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Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies requirements for support of Radio Resource Management for the FDD and TDD modes of New Radio (NR). These requirements include requirements on measurements in NR and the UE as well as requirements on node dynamical behaviour and interaction, in terms of delay and response characteristics.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[2] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[3] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[4] 3GPP TS 38.215: "NR; Physical layer measurements".

[5] 3GPP TS 38.533: "NR; User Equipment (UE) conformance specification; Radio Resource Management (RRM)".

[6] 3GPP TS 38.211: "NR; Physical channels and modulation”.

[7] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[8] 3GPP TS 38.212 "NR; Multiplexing and channel coding".

[9] 3GPP TS 38.202: "NR; Physical layer services provided by the physical layer".

[10] 3GPP TS 38.300: "NR; Overall description; Stage-2".

[11] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[12] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[13] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".

[14] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

[15] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".

[16] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC) protocol specification".

[17] 3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity", Stage 2.

[18] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[19] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[20] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[21] 3GPP TS 38.101-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements".

[22] 3GPP TS 38.305: "NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN".

[23] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation".

[24] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA); Overall description".

[25] 3GPP TS 36.101: "Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".

[26] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[27] 3GPP TS 36.355: "Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP)".

[28] Void.

[29] 3GPP TS 25.133: "Requirements for Support of Radio Resource Management (FDD)".

[30] 3GPP TS 25.302: "Services provided by the Physical Layer".

[31] 3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA), Evolved Universal Terrestrial Radio Access (E-UTRA) and Next Generation Radio Access; Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2".

[32] 3GPP TS 25.214: "Physical layer procedures (FDD)".

[33] 3GPP TS 37.213: "Physical layer procedures for shared spectrum channel access"

[34] 3GPP TS 37.355: "LTE Positioning Protocol (LPP) ".

[35] 3GPP TS 38.455 : "NG-RAN; NR Positioning Protocol A (NRPPa) ".

[36] 3GPP TS 37.106: "User Equipment (UE) requirements for shared spectrum channel access".

[37] 3GPP TS 38.355: "NR; Sidelink Positioning Protocol (SLPP) ".

[38] 3GPP TS 38.508-1: "5GS; User Equipment (UE) conformance specification; Part 1: Common test environment".

[39] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA): Physical layer procedures"

[40] 3GPP TS 38.521-2: " NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Range 2 Standalone".

[41] 3GPP TS 38.108: “NR; Satellite Access Node radio transmission and reception”.

[42] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[43] 3GPP TS 38.101-5: "NR; User Equipment (UE) radio transmission and reception; Part 5: Satellite access Radio Frequency (RF) and performance requirements".

[44] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [11] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [11].

1 Rx RedCap: RedCap UE for which requirements are derived assuming 1 Rx branch.

2 Rx RedCap: RedCap UE for which requirements are derived assuming 2 Rx branches.

Active DL BWP: Active DL bandwidth part as defined in TS 38.213 [3].

Blackbox Approach: Testing methodology, in which the UE internal implementation of certain specific UE functionality involved in the test, is unknown.

CD-SSB: Cell defining SSB as defined in TS 38.300 [10].

Control Resource Set: As defined in TS 38.213 [3].

DL BWP: DL bandwidth part as defined in TS 38.213 [3].

EN-DC: E-UTRA-NR Dual Connectivity as defined in clause 4.1.2 of TS 37.340 [17].

en-gNB: As defined in TS 37.340 [17].

eRedCap UE: A UE with reduced peak data rate, with or without reduced baseband bandwidth in FR1 as defined in clause 4.2.22 in TS 38.306 [14].

FH: As defined in TS 38.214 [26].

First SSB: SS/PBCH block as defined in clause 4.4 of TS 38.213 [3].

FR1: Frequency range 1 as defined in clause 5.1 of TS 38.104 [13].

FR2: Frequency range 2 as defined in clause 5.1 of TS 38.104 [13].

gNB: as defined in TS 38.300 [10].

IBM (Independent Beam Management): As defined in TS 38.101-2 [19].

IDC solution: As described in TS 36.300 [24] and TS 38.300 [10].

LMF: as defined in TS 38.305 [22].

Master Cell Group: As defined in TS 38.331 [2].

Multi-Radio Dual Connectivity: Dual Connectivity between E-UTRA and NR nodes, or between two NR nodes, as defined in TS 37.340 [17].

NCD-SSB: Non cell defining SSB as defined in TS 38.300 [10].

ng-eNB: As defined in TS 38.300 [10].

NE-DC: NR-E-UTRA Dual Connectivity as defined in clause 4.1.3.2 of TS 37.340 [17].

NGEN-DC: NG-RAN E-UTRA-NR Dual Connectivity as defined in clause 4.1.3.1 of TS 37.340 [17].

NR-DC: NR-NR Dual Connectivity as defined in clause 4.1.3.3 of TS 37.340 [17].

Primary Cell: As defined in TS 38.331 [2].

PRS resource instance: An instance in time of a configured PRS resource as defined in TS 38.331 [2], which may or not overlap with a measurement gap occasion.

Quasi Co-Location: As defined in TS 38.214 [26].

RedCap UE: A UE with reduced capabilities as defined in clause 4.2 in TS 38.306 [14].

RLM-RS resource: A resource out of the set of resources configured for RLM by higher layer parameter RLM-RS-List [2] as defined in TS 38.213 [3].

SA operation mode: Operation mode when the UE is configured with at least PCell and not any MR-DC.

Secondary Cell: As defined in TS 38.331 [2].

Secondary Cell Group: As defined in TS 38.331 [2].

Serving Cell: As defined in TS 38.331 [2].

SMTC: An SSB-based measurement timing configuration configured by *SSB-MeasurementTimingConfiguration* as specified in TS 38.331 [2].

Special Cell: As defined in TS 38.331 [2].

SSB: SS/PBCH block as defined in clause 7.8.3 of TS 38.211 [6].

Timing Advance Group: As defined in TS 38.331 [2].

3.2 Symbols

For the purposes of the present document, the following symbols apply:

$BW_{Channel}$	Channel bandwidth, defined in TS 38.101-1, 38.101-2 and 38.101-3 subclause 3.2
Ês	Received energy per RE (power normalized to the subcarrier spacing) during the useful part of the symbol, i.e. excluding the cyclic prefix, at the UE antenna connector or radiated interface boundary
F_C	*RF reference frequency* on the channel raster, given in table 5.4.2.2-1 in TS 38.101-1 and 38.101-2
$F_{C,low}$	The Fc of the lowest carrier, expressed in MHz
Io	The total received power density, including signal and interference, as measured at the UE antenna connector or radiated interface boundary.
Ioc	The power spectral density (integrated in a noise bandwidth equal to the chip rate and normalized to the chip rate) of a band limited noise source (simulating interference from cells, which are not defined in a test procedure) as measured at the UE antenna connector or radiated interface boundary.
Iot	The received power spectral density of the total noise and interference for a certain RE (power integrated over the RE and normalized to the subcarrier spacing) as measured at the UE antenna connector or radiated interface boundary
N_{oc}	The power spectral density of a white noise source (average power per RE normalised to the subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector or radiated interface boundary
n_{PRB}	Physical Resource Block number as defined in clause 3.2 in TS 38.211.
N_{TA}	Timing offset between uplink and downlink radio frames at the UE, as defined in clause 4.2 in TS 38.213.
$N_{TA\ offset}$	Fixed timing advance offset, as defined in clause 7.1.2 in TS 38.133.
P_{CMAX}	Configured UE transmitted power as defined in clause 6.2.4 in TS 38.101-1, 38-101-2 and 38.101-3.
$P_{CMAX,c}$	Configured UE transmitted power on a serving cell *c* as defined in clause 6.2.4 in TS 38.101-1, 38-101-2 and 38.101-3
S	Cell Selection Criterion defined in TS 38.304, subclause 5.2.3.2 for NR
SSB_RP	Received (linear) average power of the resource elements that carry NR synchronisation burst, measured at the UE antenna connector or radiated interface boundary
Srxlev	Cell selection RX level, defined in TS 38.304, subclause 5.2.3.2
Squal	Cell selection quality, defined in TS 38.304, subclause 5.2.3.2
Sintrasearch	Defined in TS 38.304 , subclause 5.2.4.7 for E-UTRAN and 38.304 subclause 5.2.4.7 for NR
Snonintrasearch	Defined in TS 38.304 , subclause 5.2.4.7
$Thresh_{x, high}$	Defined in TS 38.304 , subclause 5.2.4.7

$Thresh_{x, low}$ Defined in TS 38.304 , subclause 5.2.4.7
$Thresh_{serving, low}$ Defined in TS 38.304 , subclause 5.2.4.7
$T_{RE-ESTABLISH-REQ}$ The RRC Re-establishment delay requirement, the time between the moment when erroneous CRCs are applied, to when the UE starts to send preambles on the PRACH.
T_c Basic time unit, defined in clause 4.1 of TS 38.211 [6].
T_s Reference time unit, defined in clause 4.1 of TS 38.211 [6].
$T_{reselection}$ Defined in TS 25.304, subclause 5.2.6.1.5
$T_{reselectionRAT}$ Defined in TS 36.304 , subclause 5.2.4.7
$T_{reselectionEUTRA}$ Defined in TS 36.304 , subclause 5.2.4.7
$T_{reselectionUTRA}$ Defined in TS 36.304 , subclause 5.2.4.7
$T_{reselectionGERA}$ Defined in TS 36.304 , subclause 5.2.4
$Thresh_{x, high}$ Defined in TS 38.304 , subclause 5.2.4.7
$Thresh_{x, low}$ Defined in TS 38.304 , subclause 5.2.4.7
$Thresh_{serving, low}$ Defined in TS 38.304 , subclause 5.2.4.7
$T_{UE_re\text{-}establish_delay}$ Time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [11] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [11].

AoA Angle of Arrival
AoD Angle of Departure
ATG Air to Ground
AWGN Additive White Gaussian Noise
BFD Beam Failure Detection
BFD-RS BFD Reference Signal
BLER Block Error Rate
BM-RS Beam Management Reference Signal
BW Bandwidth
BWP Bandwidth Part
CA Carrier Aggregation
CBD Candidate Beam Detection
CBW Channel Bandwidth
CC Component Carrier
CCA Clear Channel Assessment
CCE Control Channel Element
CG-SDT Configured Grant Small Data Transmission
CHO Conditional Handover
CLI Cross Link Interference
CLTM Conditional L1/L2 triggered mobility
CMR Channel Measurement Resource
CN Core Network
CORESET Control Resource Set
CP Cyclic Prefix
CPC Conditional PSCell Change
CSI Channel-State Information
CSI-RS CSI Reference Signal
CSI-RSRP CSI Reference Signal based Reference Signal Received Power
CSI-RSRQ CSI Reference Signal based Reference Signal Received Quality
CSI-SINR CSI Reference Signal based Signal to Noise and Interference Ratio
CSI_RP Received (linear) average power of the resource elements that carry NR CSI-RS signals and channels, measured at the UE antenna connector
DAPS Dual Active Protocol Stack
DBT Discovery Burst Transmission
DC Dual Connectivity
DCI Downlink Control Information
DL Downlink
DL-AoD Downlink Angle-of-Departure

DL-TDOA	Downlink Time Difference Of Arrival
DMRS	Demodulation Reference Signal
DPC	Delta Power Class
DRX	Discontinuous Reception
E-CID	Enhanced Cell ID
eDRX	Extended DRX
E-UTRA	Evolved UTRA
E-UTRAN	Evolved UTRAN
EMP	Effective measurement periodicity
EMR	Early measurement reporting
EMW	Effective measurement window
EMWRP	Effective measurement window repetition period
EN-DC	E-UTRA-NR Dual Connectivity
FDD	Frequency Division Duplex
FH	Frequency Hopping
FR	Frequency Range
FMW	Fast measurement window
GEO	Geostationary Earth Orbit
GNSS	Global Navigation Satellite System
GSO	Geosynchronous Orbit
HARQ	Hybrid Automatic Repeat Request
HO	Handover
HST	High Speed Train
GAP	Refers to any of Measurement Gap, activated Pre-MG and NCSG
IMR	Interference Measurement Resource
kHz	Kilo Hertz
L1-RSRP	Layer 1 RSRP
L1 SL-RSRP	Layer 1 Sidelink RSRP which corresponds to PSCCH-RSRP and/or PSSCH-RSRP
LEO	Low Earth Orbit
LMF	Location Management Function
LO	LP-WUS Occasion
LPP	LTE Positioning Protocol
LP-SS	Low Power-Synchronization Signal
LP-WUR	Low Power-Wake up Receiver
LP-WUS	Low Power-Wake up Signal
LR	Low Power-Wake up Receiver
LTM	L1/L2 triggered mobility
MAC	Medium Access Control
MCG	Master Cell Group
MDT	Minimization of Drive Tests
MG	Measurement Gap
MGL	Measurement Gap Length
MGRP	Measurement Gap Repetition Period
MHz	Mega Hertz
MIB	Master Information Block
ML	Measurement Length
MN	Master Node
MR-DC	Multi-Radio Dual Connectivity
MR	Main Receiver
MUSIM	Multi-Universal Subscriber Identity Module
NCSG	Network Controlled Small Gap
NE-DC	NR-E-UTRA Dual Connectivity
NGEN-DC	NG-RAN E-UTRA-NR Dual Connectivity
NGSO	Non-Geosynchronous Orbit
NR	New Radio
NR-DC	NR-NR Dual Connectivity
NTN	Non-Terrestrial Network
OCNG	OFDMA Channel Noise Generator
OD-SIB1	On-demand SIB1
OD-SSB	On-demand SSB
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access

OTDOA	Observed Time Difference Of Arrival
PBCH	Physical Broadcast Channel
PCC	Primary Component Carrier
PCell	Primary Cell
PCI	Physical Cell Identity
PDCCH	Physical Downlink Control Channel
PDSCH	Physical Downlink Shared Channel
PLMN	Public Land Mobile Network
PRACH	Physical RACH
Pre-MG	Pre-configured Measurement Gap
ProSe	Proximity-based Service
PRB	Physical Resource Block
PRP	PRS Received Power
PRS	Positioning Reference Signal
PRS-RSRP	Positioning Reference Signal based Reference Signal Received Power
PPW	PRS Processing Window
PPWL	PRS Processing Window Length
PPWRP	PRS Processing Window Repetition Period
PSBCH	Physical Sidelink Broadcast Channel
PSBCH-RSRP	Physical Sidelink Broadcast Channel DMRS based Reference Signal Received Power
PSCCH	Physical Sidelink Control Channel
PSCCH-RSRP	Physical Sidelink Control Channel DMRS based Reference Signal Received Power
PSCell	Primary SCell
PSS	Primary Synchronization Signal
PSSCH	Physical Sidelink Shared Channel
PSSCH-RSRP	Physical Sidelink Shared Channel DMRS based Reference Signal Received Power
pTAG	Primary Timing Advance Group
PTW	Paging Time Window
PUCCH	Physical Uplink Control Channel
PUSCH	Physical Uplink Shared Channel
QCL	Quasi Co-Location
RACH	Random Access Channel
RAN	Radio Access Network
RAT	Radio Access Technology
RF	Radio Frequency
RLM	Radio Link Monitoring
RLM-RS	Reference Signal for RLM
RMC	Reference Measurement Channel
RMSI	Remaining Minimum System Information
RRC	Radio Resource Control
RRH	Remote Radio Head
RRM	Radio Resource Management
RRT	RF Retuning Time
RS	Reference Signal
RSCP	Reference Signal Carrier Phase
RSCPD	Reference Signal Carrier Phase Difference
RSSI	Received Signal Strength Indicator
RSRP	Reference Signal Received Power
RSRPP	Reference Signal Received Path Power
RSRQ	Reference Signal Received Quality
RSTD	Reference Signal Time Difference
RTD	Receive Timing Difference
RTOA	Relative Time Of Arrival
RTT	Round Trip Time
S-SSB	Sidelink Synchronization Signal Block
SSB	Synchronization Signal Block
SSB_RP	Received (linear) average power of the resource elements that carry NR SSB signals and channels, measured at the UE antenna connector or radiated interface boundary.
SA	Standalone operation mode
SAB	Satellite access band
SAN	Satellite Access Node
SBFD	Subband non-overlapping Full Duplex

SCC	Secondary Component Carrier
SCCH	Sidelink Control Channel
SCell	Secondary Cell
SCG	Secondary Cell Group
SCH	Synchronization Channel
SCS	Subcarrier Spacing
SCS_{SSB}	SSB subcarrier spacing
SDL	Supplementary Downlink
SDT	Small Data Transmission
SFN	System Frame Number
SFTD	SFN and Frame Timing Difference
SI	System Information
SIB	System Information Block
SL	Sidelink
SL AoA	Sidelink AoA
SL PRS-RSRP	Sidelink PRS-based RSRP
SL PRS-RSRPP	Sidelink PRS-based RSRPP
SL RSTD	Sidelink RSTD
SL RTOA	Sidelink RTOA
SL Rx-Tx	Sidelink Receive-Transmit time difference
SL-PRP	SL-PRS Received Power
SL-PRS	Sidelink PRS
SL-RSSI	Sidelink Received Signal Strength Indicator
SLPP	Sidelink Positioning Protocol
SLSS	Sidelink Synchronization Signal
SMTC	SSB-based Measurement Timing configuration
SpCell	Special Cell
SRS	Sounding Reference Signal
SRS-RSRP	Sounding Reference Signal based Reference Signal Received Power
SS-RSRP	Synchronization Signal based Reference Signal Received Power
SS-RSRQ	Synchronization Signal based Reference Signal Received Quality
SS-SINR	Synchronization Signal based Signal to Noise and Interference Ratio
SSB	Synchronization Signal Block
SSB_RP	Received (linear) average power of the resource elements that carry NR SSB signals and channels, measured at the UE antenna connector.
SSS	Secondary Synchronization Signal
sTAG	Secondary Timing Advance Group
SUL	Supplementary Uplink
TA	Timing Advance
TAG	Timing Advance Group
TCI	Transmission Configuration Indicator
TDCP	Time Domain Channel Properties
TDD	Time Division Duplex
TDOA	Time Difference Of Arrival
TE	Test Equipment
TN	Terrestrial Network
TRP	Transmission-Reception Point
TRS	Tracking Reference Signal
TTI	Transmission Time Interval
U2N	UE-to-Network
U2U	UE-to-UE
UE	User Equipment
UL	Uplink
UL SRS-TDCT	Uplink Sounding Reference Signal Time Domain Channel Timing
UL SRS-TDCP	Uplink Sounding Reference Signal Time Domain Channel Power
UL-WUS	Uplink Wake-up Signal
V2X	Vehicle-to-Everything service
V2X	Vehicle-to-Everything service
VIL	Visible Interruption Length
VIRP	Visible Interruption Repetition Period
VSAT	Very Small Aperture Terminal

3.4 Test tolerances

The requirements given in the present document make no allowance for measurement uncertainty. The test specification TS 38.533 [5] defines the test tolerances.

3.5 Frequency bands grouping

3.5.1 Introduction

The intention with the frequency band grouping below is to increase the readability of the specification.

The frequency bands grouping is derived based on UE REFSENS requirements specified in [18], [19], [20] and assuming 0.5 dB step between the neighbour groups. The groups are defined in the order of increasing REFSENS, i.e. the group A has the smallest REFSENS among the groups. For the same SCS and a given bandwidth, the bands within the same group have the same Io conditions in a corresponding requirement in this specification, provided the bands support this SCS. For different SCSs supported by a frequency band and the same bandwidth, different Io conditions may apply for the frequency band in the requirements, while the band group is the same, based on the lowest REFSENS requirement normalized by the number of subcarriers among its supported SCSs for this bandwidth. For the same SCS but different supported bandwidths, the group for a band is determined based on the lowest REFSENS requirement normalized by the number of subcarriers among its supported bandwidths.

3.5.2 NR operating bands in FR1

NR frequency bands grouping for FR1 is specified in table 3.5.2-1.

Table 3.5.2-1: NR frequency band groups for FR1

Group	NR FDD		NR TDD		NR SDL		NR CCA[10]	
	Band group notation	Operating bands	Band group notation	Operating bands	Band group notation	Operating bands	Band group notation	Operating bands
A	NR_FDD_FR1_A	n1, n18, n24, n70, n74[4], n91, n92, n93, n94, n100, n109, n110	NR_TDD_FR1_A	n34, n38[9], n39, n40, n50, n51, n53, n54, n101	NR_SDL_FR1_A	n67, n75, n76	NR_CCA_FR1_A	-
B	NR_FDD_FR1_B	n65, n66, n74[3]	NR_TDD_FR1_B	n38[7]	NR_SDL_FR1_B	-	NR_CCA_FR1_B	-
C	NR_FDD_FR1_C	n30	NR_TDD_FR1_C	n48, n77[1], n78, n79	NR_SDL_FR1_C	-	NR_CCA_FR1_C	-
D	NR_FDD_FR1_D	n28, n68	NR_TDD_FR1_D	n77[2]	NR_SDL_FR1_D	-	NR_CCA_FR1_D	-
E	NR_FDD_FR1_E	n2, n5, n7	NR_TDD_FR1_E	n41, n90	NR_SDL_FR1_E	-	NR_CCA_FR1_E	-
F	NR_FDD_FR1_F	n26[6]	NR_TDD_FR1_F	-	NR_SDL_FR1_F	-	NR_CCA_FR1_F	-
G	NR_FDD_FR1_G	n3, n8, n12, n13, n14[12],, n20, n71, n85, n105[11], n106	NR_TDD_FR1_G	n104	NR_SDL_FR1_G	n29	NR_CCA_FR1_G	-
H	NR_FDD_FR1_H	n25	NR_TDD_FR1_H	-	NR_SDL_FR1_H	-	NR_CCA_FR1_H	-
I	NR_FDD_FR1_I	-	NR_TDD_FR1_I		NR_SDL_FR1_I	-	NR_CCA_FR1_I	n46
J	NR_FDD_FR1_J	-	NR_TDD_FR1_J	n47[8,12]	NR_SDL_FR1_J	-	NR_CCA_FR1_J	n96, n102
K	NR_FDD_FR1_K	-	NR_TDD_FR1_K	-	NR_SDL_FR1_K	-	NR_CCA_FR1_K	-
L	NR_FDD_FR1_L	-	NR_TDD_FR1_L	-	NR_SDL_FR1_L	-	NR_CCA_FR1_L	-
M	NR_FDD_FR1_M	-	NR_TDD_FR1_M	-	NR_SDL_FR1_M	-	NR_CCA_FR1_M	-
N	NR_FDD_FR1_N	n31, n72, n87, n88	NR_TDD_FR1_N	-	NR_SDL_FR1_N	-	NR_CCA_FR1_N	-

NOTE 1: Except 3.8 GHz to 4.2 GHz.
NOTE 2: Only 3.8 GHz to 4.2 GHz.
NOTE 3: Except 1475.9 MHz to 1510.9 MHz.
NOTE 4: Only when the band is confined in 1475.9 MHz to 1510.9 MHz.
NOTE 5: These bands are used only in NR carrier aggregation with other NR bands according to NR CA band combinations specified in TS 38.101-1 [18] and TS 38.101-3 [20].
NOTE 6: The minimum Io condition is reduced by 0.5 dB when the carrier frequency of the assigned NR channel bandwidth is within 865-894 MHz.
NOTE 7: When this band is used for V2X SL service, the band is exclusively used for NR V2X in particular regions [18].
NOTE 8: This band is unlicensed band used for V2X service. There is no expected network deployment in this band. [18].
NOTE 9: When this band is only used for WAN service.
NOTE 10: Operating bands where operation on carrier frequencies with CCA is supported.
NOTE 11: The minimum Io condition is reduced by 0.5 dB when the downlink channel overlap the 612-617 MHz frequency range and the channel bandwidth is 5 MHz.
NOTE 12: This band can be used for V2X SL operation.

3.5.2A NR operating bands for satellite access in FR1

NR frequency bands grouping for satellite access in FR1 is specified in table 3.5.2A-1.

Table 3.5.2A-1: NR frequency band groups for satellite access in FR1

Group	NR FDD	
	Band group notation	Operating bands
A	NR_FDD_SAB_FR1_A	n255, n253, n251, n250
B	NR_FDD_SAB_FR1_B	n252, n254, n256
C	NR_FDD_SAB_FR1_C	
D	NR_FDD_SAB_FR1_D	
E	NR_FDD_SAB_FR1_E	
F	NR_FDD_SAB_FR1_F	
G	NR_FDD_SAB_FR1_G	
H	NR_FDD_SAB_FR1_H	
I	NR_FDD_SAB_FR1_I	
J	NR_FDD_SAB_FR1_J	

3.5.3 NR operating bands in FR2

NR frequency bands grouping for FR2 is specified in table 3.5.3-1.

Table 3.5.3-1: NR frequency band groups for FR2

Group	Band group notation	Operating bands
A	NR_TDD_FR2_A	n257[1], n258[1], n261[1]
B	NR_TDD_FR2_B	n257[4], n258[4], n261[4]
C	NR_TDD_FR2_C	
D	NR_TDD_FR2_D	
E	NR_TDD_FR2_E	
F	NR_TDD_FR2_F	n260[4]
G	NR_TDD_FR2_G	n260[1]
H	NR_TDD_FR2_H	
I	NR_TDD_FR2_I	
J	NR_TDD_FR2_J	
K	NR_TDD_FR2_K	n257[5,6], n258[5,6], n262[1], n261[6]
L	NR_TDD_FR2_L	n257[2], n258[2], n261[2]
M	NR_TDD_FR2_M	
N	NR_TDD_FR2_N	n262[4]
O	NR_TDD_FR2_O	
P	NR_TDD_FR2_P	
Q	NR_TDD_FR2_Q	n259[5]
R	NR_TDD_FR2_R	
S	NR_TDD_FR2_S	
T	NR_TDD_FR2_T	n257[3], n258[3], n261[3]
U	NR_TDD_FR2_U	
V	NR_TDD_FR2_V	
W	NR_TDD_FR2_W	n262[2]
X	NR_TDD_FR2_X	
Y	NR_TDD_FR2_Y	n260[3]
Z	NR_TDD_FR2_Z	n257[7], n258[7], n261[7]
AA	NR_TDD_FR2_AA	n259[3]
AB	NR_TDD_FR2_AB	
AC	NR_TDD_FR2_AC	
AD	NR_TDD_FR2_AD	
AE	NR_TDD_FR2_AE	n262[3]

NOTE 1: UE power class 1.
NOTE 2: UE power class 2.
NOTE 3: UE power class 3.
NOTE 4: UE power class 4.
NOTE 5: UE power class 5.
NOTE 6: UE power class 6.

Group	Band group notation	Operating bands
NOTE 7: UE power class 7.		

3.6 Applicability of requirements in this specification version

In this specification,

- ‘cell’, ‘PCell’, ‘PSCell’ and ‘SCell’ refer to NR cell, NR PCell, NR PSCell, and NR SCell,
- E-UTRA cells are referred to as ‘E-UTRA cell’, ‘E-UTRA PCell’, ‘E-UTRA PSCell’, and ‘E-UTRA SCell’,
- E-UTRA-NR dual connectivity where E-UTRA is the master is referred to as ‘E-UTRA-NR dual connectivity’ or ‘EN-DC’.
- NR-NR dual connectivity which involves two gNB acting as Master gNB and Secondary gNB is referred to as “NR-NR dual connectivity” or “NR-DC”. NR-DC in Rel-15 only includes the scenarios where all serving cells in MCG in FR1 and all serving cells in SCG in FR2.
- ‘active serving cell’ refers to PCell, PSCell and activated SCells

For UE configured with supplementary UL, the requirements in clause 7.1 and 7.3 shall also apply to uplink transmissions on supplementary UL.

Unless explicitly stated, requirements do not apply when CCA is used on serving or neighbour cells.

3.6.1 RRC connected state requirements in DRX

For the requirements in RRC connected state specified in this version of the specification, the UE shall assume that no DRX is used provided the following conditions are met:

- DRX parameters are not configured or
- DRX parameters are configured and
  - *drx-InactivityTimer* is running or
  - *drx-RetransmissionTimerDL* is running or
  - *drx-RetransmissionTimerUL* is running or
  - *ra-ContentionResolutionTimer* is running or
  - a Scheduling Request sent on PUCCH is pending or
  - a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the preamble not selected by the MAC entity.

Otherwise, the UE shall assume that DRX is used.

3.6.2 Number of serving carriers

3.6.2.1 Number of serving carriers for SA

Requirements for standalone NR with NR PCell are applicable for the UE configured with the following number of serving NR CCs:

- up to 16 NR DL CCs in total, with 1 UL (or 2 UL if SUL is configured) in PCell and up to 8 UL (or 9 UL if SUL is configured) in total for SCells.
- SUL may be configured together with one of the UL

3.6.2.2 Number of serving carriers for EN-DC

Requirements for EN-DC operation of E-UTRA and NR with E-UTRA PCell and NR PSCell are applicable for the UE configured with the following number of serving NR CCs:

- up to 9 NR DL CCs in total, with 1 UL (or 2 UL if SUL is configured) in PSCell, up to 7 UL (or 8 UL if SUL is configured) in total for SCells in the FR of PSCell and up to 1 UL (or 2 UL if SUL is configured) in SCell in different FR with PSCell.
- SUL may be configured together with one of the UL

The applicable number of E-UTRA CC for EN-DC in the MCG for both UL and DL is specified in TS 36.133 [15].

3.6.2.3 Number of serving carriers for NE-DC

Requirements for NE-DC operation of NR and E-UTRA with NR PCell and E-UTRA PSCell are applicable for the UE configured with the following number of serving NR CCs:

- up to 7 NR DL CCs in total, with 1 UL (or 2 UL if SUL is configured) in PCell and up to 1 UL (or 2 UL if SUL is configured) in SCell.
- SUL may be configured together with one of the UL

The applicable number of E-UTRA CC for NE-DC in the SCG for both UL and DL is specified in TS 36.133 [15].

3.6.2.4 Number of serving carriers for NR-DC

Requirements for NR-DC (FR1+FR1) are applicable for the UE configured with the following number of serving NR CCs:

- up to [6] NR DL CCs in total, with [1] UL in PCell, [1] UL in PSCell, [1] UL in SCell(s).

Requirements for NR-DC (FR1+FR2) are applicable for the UE configured with the following number of serving NR CCs:

- up to 2 NR DL CCs in total in FR1, up to 8 NR DL CCs in total in FR2, with 1 UL in PCell, 1 UL in PSCell, and up to 1 UL in each SCell.

3.6.3 Applicability for intra-band FR2

For the requirements in RRC connected state specified in this version of the specification, UE shall assume that the transmitted signals from the serving cells have the same downlink spatial domain transmission filter on one OFDM symbol in the same band in FR2. Otherwise, the UE is not required to satisfy any requirements for SCell.

3.6.4 Applicability for FR2 UE power classes

For the requirements of each FR2 power class specified in this version of the specification, certain UE types with specific device architectures are assumed. The UE types can be found in TS 38.101-2 [19].

3.6.5 Applicability for SDL bands

The measurements accuracy requirements for SDL bands in this version of specification in clause 10.1 shall apply for NR intra-frequency measurements on SCC (SS-RSRP, SS-RSRQ, SS-SINR, and L1-RSRP) and inter-frequency measurements (SS-RSRP, SS-RSRQ, and SS-SINR).

3.6.6 Applicability of requirements for NGEN-DC operation

All the requirements in this specification applicable for EN-DC are also applicable for NGEN-DC.

3.6.7 Applicability of QCL

For the requirements specified in this version of the specification for TCI state switching, DL TCI state switching for unified TCI or UL TCI state switching for unified TCI, a reference signal is considered to be QCLed to another reference signal if it is in the same TCI chain as the other reference signal, provided that the number of Reference Signals in the chain is no more than 4. It is assumed there is single QCL type per TCI chain.

A DL TCI chain consists of an SSB, and one or more CSI-RS resources, and the TCI state of each Reference Signal includes another Reference Signal in the same TCI chain, where the SSB can be associated with serving cell PCI or associated with a PCI different from serving cell PCI.

DMRS of PDCCH or PDSCH is QCLed with the reference signal in its active TCI state and any other reference signal that is QCLed, based on the criteria for DL TCI chain, with the reference signal in the active TCI state.

A UL TCI chain consists of an SSB, and one or more CSI-RS resources, and the TCI state of each Reference Signal includes another Reference Signal in the same TCI chain, where the SSB can be associated with serving cell PCI or associated with a PCI different from serving cell PCI.

DMRS of PUCCH or PUSCH is QCLed with the reference signal in its active TCI state and any other reference signal that is QCLed, based on the criteria for UL TCI chain, with the reference signal in the active TCI state.

3.6.8 Applicability of 2-step RA and 4-step RA in RRM requirements

Unless explicitly stated otherwise the requirements under the following clauses, where the UE transmits random access (with requirements in clause 6.2.2) to NR serving cell or NR target cell, are applicable for both 2-step RA and 4-step RA procedures [3]:

- Handover requirements in clause 6.1, except for clauses 6.1.2 and 6.1B,
- RRC connection re-establishment requirements in clause 6.2.1,
- RRC connection release with redirection to NR requirements in clause 6.2.3.2.1,
- UE transmit timing requirements in clause 7.1,
- PSCell addition delay requirements in clause 8.9.2,
- PSCell change requirements in clause 8.11 and
- Conditional PSCell change requirements in clause 8.11B.

Unless explicitly stated otherwise the requirements under the following clauses, where the UE transmits random access (with requirements in clause 6.2.2A) to NR serving cell or NR target cell subject to uplink CCA, are applicable for both 2-step RA and 4-step RA procedures [3]:

- Handover requirements with CCA in clause 6.1B,
- RRC connection re-establishment requirements with CCA in clause 6.2.1A,
- RRC connection release with redirection to NR requirements with CCA in clause 6.2.3.2.3, and
- UE transmit timing requirements with CCA in clause 7.1.

3.6.9 Applicability of requirements for scheduling availability

The scheduling availability requirements in clauses 8.1.7.3, 8.5.7.3, 8.5.8.3, 9.5.6.3 and 9.10.2.6.2 assumes that:

- The UE is not configured with simultaneous UL/DL between two FR2 bands if the UE does not have the capability of supporting *simultaneousRxTxInterBandCA*, and
- The UE is not configured with mixed numerology on two FR2 CCs if the UE does not have the capability of supporting simultaneous reception with two different numerologies between FR2 CCs in DL.

The scheduling availability requirements in clause s 8.1.7.1, 8.1.7.2, 8.5.7.1, 8.5.7.2, 8.5.8.1, 8.5.8.2, 9.5.6.1, 9.5.6.2, 9.8.6.1, and 9.8.6.2 assumes that the UE is not configured with simultaneous UL/DL between two FR1 bands if the UE does not have the capability of supporting *simultaneousRxTxInterBandCA*.

The scheduling availability requirements in clauses 8.1.7.4, 8.5.7.4, 8.5.8.4, 9.5.6.4 and 9.8.6.4 assumes that the UE is not configured with simultaneous UL/DL between FR1 and FR2 bands if the UE does not have the capability of supporting *simultaneousRxTxInterBandCA* on this band combination.

3.6.10 Applicability of requirements for measurement restrictions

The requirements for measurement restrictions in clauses 8.1.2.3, 8.1.3.3, 8.5.2.3, 8.5.3.3, 8.5.5.3, 8.5.6.3, 8.18.2.3, 8.18.3.3, 8.18.5.3, 8.18.6.3, 9.5.5, 9.8.5 and 9.13.5 are not applicable if the following condition is met:

- The network configures mixed numerology on two CCs if the UE does not have the capability of supporting simultaneous reception with different numerologies between the two CCs in DL.

3.6.11 Applicability of requirements for Redcap UEs

3.6.11.1 RRC connected state requirements in DRX

The requirements in clause 3.6.1 shall apply.

3.6.11.2 Applicability for FR2 Redcap UE power classes

The requirements in clause 3.6.4 shall apply.

3.6.11.3 Applicability of QCL

The requirements in clause 3.6.7 shall apply.

3.6.12 Applicability of requirements for Satellite Access

The requirements for Satellite Access defined in clauses with suffix ‘C’ apply provided that UE indicates *nonTerrestrialNetwork* and is accessing a cell served by a Satellite Access Node (SAN). The requirements apply provided that serving and all neighbour satellites on the same layer are of same satellite type (LEO or GEO).

Unless otherwise stated, the requirements defined for FR2-NTN apply for VSAT operating in cells with FR1-NTN numerology.

For all the requirements that are defined based on SMTC periodicity, when 2 SMTC periodicities are configured for a single frequency layer and UE supports *twoSMTC-Periodicities-r19*, the requirements apply provided that the SMTC periodicity is no smaller than the actual SSB periodicities of the cells associated with the SMTC.

3.6.13 Applicability of requirements for FR2

Unless stated otherwise, the requirements for FR2 are applicable to both FR2-1 and FR2-2, except for the following cases:

- SFTD measurement requirements in clauses 9.2.5.4, 9.3.8, 10.1.21 for FR2 are only applicable for FR2-1,
- CGI identification requirements in clause 9.11 for FR2 are only applicable for FR2-1,
- Inter-band CA requirements in all corresponding clauses for FR2 are only applicable for FR2-1.
- L1-RSRP measurements for a cell with different PCI from serving cell in clause 9.13 for FR2 are only applicable for FR2-1.
- LTM requirements in all corresponding clauses for FR2 are only applicable for FR2-1.

3.6.14 Applicability of requirements for FR2 Power Class 6

For Rel-17 FR2 power class 6 for the UE type of high speed train roof-mounted UE, UE shall only be in NR SA operation.

Measurement and evaluation period requirements with *highSpeedMeasFlagFR2-r17* configured in clause 4.2.2.3, 8.1.2.2, 8.5.2.2, 9.2.5, 9.2.6, 9.5.4, 9.8.4, delay requirements in clause 6.2.1.2.1, 8.10.3A, and UL timing adjustment in clause 7.1.2.3, are only applicable when any two SSBs from non-collocated adjacent RRHs are not on the same or consecutive symbols.

L1-SINR accuracy requirements for FR2 configured in clause 10.1.28 and intra-frequency SS-SINR accuracy requirements configured in clause 10.1.13 are not applicable to Rel-17 HST FR2 power class 6 UEs.

3.6.15 Applicability of requirements for per-FR gap

Requirements for per-FR gap are applicable for the UE indicating one of the following capabilities:

- Rel-15 capability “independentGapConfig”;
- Rel-17 capability “independentGapConfig-maxCC-r17,” and the number of configured serving cells is less than or equal to the indicated parameters “fr1-Only,” “fr2-Only,” and “fr1And2,” as specified in TS 38.306 [14].

3.6.16 Applicability of requirements for ATG

The requirements in ATG specific clauses apply to an ATG UE operating in FR1 NR SA including co-located intra-band contiguous DL CA and co-located inter-band DL CA operation mode with single SCell at an altitude of at-least 3km.

3.6.17 Applicability of requirements for MUSIM gaps

No requirements are defined in this version of specification when MUSIM gaps collide with Pre-MG and/or NCSG.

3.6.18 Applicability of requirements for a UE operating on a cell with less than 5 MHz BW

For a UE operating on a cell with less than 5 MHz BW in FR1 FDD bands, the requirements corresponding to NR single carrier operation are applicable unless specific requirements corresponding to reduced BW are specified.

3.6.19 Applicability of requirements for multi-Rx operation in FR2-1

The requirements related to the support of *fastBeamSweepingMultiRx-r18* or *schedulingMeasurementRelaxation-r18* are applicable to a PCell, PSCell, or SCell, provided the UE is configured with a single serving cell (PCell, PSCell, or SCell) in FR2-1.

The requirements related to the support of *fastBeamSweepingMultiRx-r18* are applicable when the network configures the UE with a CSI report containing *groupBasedBeamReporting-v1710.*

3.6.20 Applicability of requirements for RedCap UE with satellite access

The requirements for RedCap UEs with satellite access apply provided that UE indicates *whether the UE supports (e)RedCap UE with FR1-NTN* and is accessing a cell served by a Satellite Access Node (SAN) and operating in FR1-NTN bands. The requirements apply provided that serving and all neighbour satellites on the same layer are of same satellite type (LEO or GEO). The applicability defined for RedCap UEs in clause 3.6.11 is also applicable to RedCap UEs with satellite access except for FR2 related requirements.

In addition, the requirements for UE supporting *160 ms SSB periodicity assumed during initial access* do not apply for RedCap UEs operating in FR1-NTN bands

3.6.21 Applicability of requirements for UE supporting L3 fast beam sweeping operation in FR2-1

The requirements related to the support of *Rel-19 L3 fast Rx beam sweeping* are applicable when

- For intra-frequency measurements, the carrier configured for L3 SSB measurement in a FR2-1 band is the serving carrier, and
- For inter-frequency measurements, in addition to the serving carrier, at most one carrier in the same or another FR2-1 band is configured for L3 SSB measurement, and
- UE is not configured with CA or DC, and
- L3 fast Rx beam sweeping operation is activated.

L3 fast Rx beam sweeping operation is activated for intra-frequency measurements and inter-frequency measurements with measurement gap provided that

- UE is configured with triggering conditions indicated by *fbs-ThresholdP-r19* and/or *fbs-ThresholdQ-r19*, and the configured triggering conditions are satisfied, and
- The time since L3 fast Rx beam sweeping operation is activated is not larger than 90 s.

L3 fast Rx beam sweeping operation is activated when UE is indicated to perform handover or RRC Connection Release with Redirection to NR cell procedure.

3.6.22 Applicability of requirements for UE with LP-WUR

The requirements for LP-WUR and LP-WUS apply under the assumption that the LR and the MR are operating on the same carrier frequency.

3.6.23 Applicability of requirements for SBFD

If UE supports *supportSBFD* and SBFD is configured by network, in all applicable requirements hereafter the term “UL slot” includes UL slot or SBFD slot in which UE performs transmission, and the term “DL slot” includes DL slot or SBFD slot in which UE performs reception.

4 SA: RRC_IDLE state mobility

4.1 Cell Selection

After a UE has switched on and a PLMN has been selected, the Cell selection process takes place, as described in TS 38.304 [1]. This process allows the UE to select a suitable cell where to camp on in order to access available services. In this process, the UE can use stored information (*Stored information cell selection*) or not (*Initial cell selection*).

The 1 Rx RedCap UE for the cell selection procedure [1] applies:

- *Qrxlevmin* as the signaled value of *Qrxlevmin* [2] -1 dB.
- *Qqualmin* as the signaled value of *Qqualmin* [2] -1 dB.

The above offset for *Qrxlevmin* and *Qqualmin* is also applicable to RedCap UEs with satellite access.

4.2 Cell Re-selection

4.2.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in either *Camped Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity. For inter-frequency cell re-selection, when NTN carrier is not configured, requirements specified in clause 4.2.2.4 apply and when NTN carrier is configured, requirements specified in clause 4.2.2.12 shall be applied.

In the requirements of clause 4.2, the exceptions for side conditions apply as follows:

- for the UE capable of CA, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.1, B.3.2.3, or B.3.2.5 for UE supporting CA in FR1, CA in FR2 and CA between FR1 and FR2, respectively;
- for the UE capable of SUL, the applicable exceptions for side conditions are specified in Annex B, clause B.3.4.1 for UE supporting SUL in FR1.

4.2.2 Requirements

4.2.2.1 UE measurement capability

For idle mode cell re-selection purposes, and for UE supporting *idleInactiveNR-MeasReport-r16*, *idleInactiveEUTRA-MeasReport-r16* or *idleInactiveNR-MeasReport-r17*, for NR CA and MR-DC measurement purpose, the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and
- Depending on UE capability, 7 NR inter-frequency carriers, and
- Depending on UE capability, 7 FDD E-UTRA inter-RAT carriers, and
- Depending on UE capability, 7 TDD E-UTRA inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC_IDLE state shall be capable of monitoring a total of at least 14 carrier frequency layers, which includes serving layers, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD and NR layers.

4.2.2.2 Measurement and evaluation of serving cell

The UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1*N1 DRX cycle; where:

- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and DRX cycle ≤ 0.64 second,
- otherwise M1=1.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least eDRX_IDLE cycle/2, if the UE is configured with eDRX cycle ≤ 10.24 s; otherwise DRX cycle/2.

For UE not configured with *highSpeedMeasFlagFR2-r17*, N_{serv} is specified in table 4.2.2.2-1. For FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*, N_{serv} is specified in table 4.2.2.2-4.

If the UE is not configured with eDRX_IDLE cycle and the UE has evaluated according to table 4.2.2.2-1 or table 4.2.2.2-4 in N_{serv} consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE is configured with eDRX_IDLE cycle ≤ 10.24 s and the UE has evaluated according to table 4.2.2.2-2 or table 4.2.2.2-3 in N_{serv} consecutive eDRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE is configured with eDRX_IDLE cycle > 10.24 s and the UE has evaluated according to table 4.2.2.2-2 or table 4.2.2.2-3 in N_{serv} consecutive DRX cycles within a single PTW that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE in RRC_IDLE has not found any suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information during the time T, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1], where

- T= 10s if the UE is not configured with eDRX_IDLE cycle, or
- T= MAX (10s, one eDRX_IDLE cycle) if the UE is configured with eDRX_IDLE cycle in FR1, or
- T= MAX (10s, N1* eDRX_IDLE cycle) if the UE is configured with eDRX_IDLE cycle less than 20.48s in FR2,
- Otherwise, T= MAX (10s, one eDRX_IDLE cycle) if the UE is configured with eDRX_IDLE cycle no less than 20.48 s in FR2

Table 4.2.2.2-1: N_{serv}

DRX cycle length [s]	Scaling Factor (N1)			N_{serv} [number of DRX cycles]
	FR1	FR2-1 Note1	FR2-2 Note2	
0.32	1	8	12	M1*N1*4
0.64		5	8	M1*N1*4
1.28		4	6	N1*2
2.56		3	5	N1*2
NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length. NOTE 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.				

Table 4.2.2.2-2: N_{serv} for UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1)	N_{serv} [number of DRX or eDRX cycles Note 3]
2.56	N/A	N/A	1	N1*2
5.12	N/A	N/A		N1*2
10.24	N/A	N/A		N1*2
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥[1.28] (1)		N1*M1*2
	0.64	≥ 1.28 (1) (M1=1) or ≥ 2.56 (2) (M1=2)		N1*M1*2
	1.28	≥2.56 (2)		N1*2
	2.56	≥5.12 (4)		N1*2
NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008[42]. NOTE 3: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles. NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Nserv * DRX_cycle}{1.28} \right\rceil * 1.28$.				

Table 4.2.2.2-3: N_{serv} for UE configured with eDRX_IDLE cycle (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	N_{serv} [number of DRX or eDRX cycles Note 4]
2.56	N/A	N/A	3	N1*2
5.12	N/A	N/A	3	N1*2
10.24	N/A	N/A	3	N1*2
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥5.12 (4)	8	N1*2
	0.64	≥6.4 (5)	5	N1*2
	1.28	≥10.24 (8)	4	N1*2
	2.56	≥15.36 (12)	3	N1*2

NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles.
NOTE 5: The lower bound of PTW length is derived based on $\left\lceil \frac{Nserv * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 6: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

Table 4.2.2.2-4: N_{serv} for UE configured with *highSpeedMeasFlagFR2-r17* (Frequency range FR2)

DRX cycle length [s]	Scaling Factor (N1)	N_{serv} [number of DRX cycles]
0.32	N2 Note1	M1*N1*4
0.64	5	M1*N1*4
1.28	4	N1*2
2.56	3	N1*2

NOTE 1: N2 = 2 when *highSpeedMeasFlagFR2-r17* = [set1]; N2 = 6 when *highSpeedMeasFlagFR2-r17* = set2.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX_IDLE, changing eDRX_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

4.2.2.3 Measurements of intra-frequency NR cells

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP and SS-RSRQ measurements of the identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS 38.304 [1] within T_{detect,NR_Intra} when that $T_{reselection}$= 0. An intra frequency cell is considered to be detectable according to the conditions defined in Annex B.1.2 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every $T_{measure,NR_Intra}$ (see table 4.2.2.3-1, table 4.2.2.3-2, table 4.2.2.3-3, table 4.2.2.3-4 or table 4.2.2.3-5) for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Intra}/2$.

The UE shall not consider an NR neighbour cell for cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined in TS 38.304 [1] within $T_{evaluate,NR_Intra}$ when $T_{reselection} = 0$ as specified in table 4.2.2.3-1, table 4.2.2.3-2, table 4.2.2.3-3, table 4.2.2.3-4 or table 4.2.2.3-5 provided that:

when *rangeToBestCell* is not configured:

- the cell is at least 3 dB better ranked in FR1 or 4.5 dB better ranked in FR2.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
    - if there are multiple such cells, the cell has the highest rank among them.
        - the cell is at least 3 dB better ranked in FR1 or 4.5 dB better ranked in FR2 if the current serving cell is among them.

When evaluating cells for reselection, the SSB side conditions apply to both serving and non-serving intra-frequency cells.

If the $T_{reselection}$ timer has a non-zero value and an intra-frequency cell satisfies the reselection criteria defined in TS 38.304 [1], the UE shall evaluate this intra-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect to this cell.

For UE neither configured with *highSpeedMeasFlag-r16* nor *highSpeedMeasFlagFR2-r17*, T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,\ NR_intra}$ are specified in table 4.2.2.3-1. For UE configured with *highSpeedMeasFlag-r16*, T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_intra}$ are specified in table 4.2.2.3-2.

For a UE configured with *highSpeedMeasFlag-r16*, and configured with relaxed measurement criterion (*lowMobilityEvaluation* or both *lowMobilityEvaluation* and *cellEdgeEvaluation*),

- if the relaxed measurement criteria in section 4.2.2.9.2 are fulfilled, it is up to UE implementation whether to apply the relaxed measurements requirements specified in clause 4.2.2.9.2 or high speed requirements specified in this clause
- otherwise, high speed requirements specified in this clause shall be applied.

For FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*, T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,\ NR_intra}$ are specified in table 4.2.2.3-3.

For UE not configured with eDRX_IDLE cycle, T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ are specified in table 4.2.2.3-1, 4.2.2.3-2 and 4.2.2.3-3.

For UE configured with eDRX_IDLE cycle, T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ are specified in table 4.2.2.3-4 and table 4.2.2.3-5 for FR1 and FR2 respectively, where the requirements apply provided that the serving cell is configured with eDRX_IDLE and the DRX cycle length is same in all PTWs during any of T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ when multiple PTWs are used.

The requirements in table 4.2.2.3-2 apply only when the UE supports *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16*. For UE neither supporting *measurementEnhancement-r16* nor *intraNR-MeasurementEnhancement-r16*, the UE is not required to meet the requirements specified in table 4.2.2.3-2.

Table 4.2.2.3-1: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$

DRX cycle length [s]	Scaling Factor (N1)			T_{detect,NR_Intra} [s] (number of DRX cycles)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles)
	FR1	FR2-1 Note1	FR2-2 Note2			
0.32	1	8	12	11.52 x N1 x M2 (36 x N1 x M2)	1.28 x N1 x M2 (4 x N1 x M2)	5.12 x N1 x M2 (16 x N1 x M2)
0.64		5	8	17.92 x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28		4	6	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)

2.56		3	5	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)

NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.
NOTE 3: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer T_{detect, NR_intra} is expected.

Table 4.2.2.3-2: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with *highSpeedMeasFlag-r16* (Frequency range FR1)

DRX cycle length [s]	T_{detect,NR_Intra} [s] (number of DRX cycles)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles)
0.32	2.56 x M2 (8 x M2)	0.32 x M3 (1 x M3)	0.96 x M4 (3 x M4)
0.64	5.12 (8)	0.64 (1)	1.92 (3)
1.28	8.96 (7)	1.28 (1)	3.84 (3)
2.56	58.88 (23)	2.56 (1)	7.68 (3)

NOTE 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2
NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16.*

Table 4.2.2.3-3: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with *highSpeedMeasFlagFR2-r17* (Frequency range FR2)

DRX cycle length [s]	Scaling Factor (N1)	T_{detect,NR_Intra} [s] (number of DRX cycles)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles)
0.32	$N2^{Note2}$	2.56 x N1 x M2 (8 x N1 x M2)	0.32 x N1 x M3 (1 x N1 x M3)	0.96 x N1 x M4 (3 x N1 x M4)
0.64	5	17.92 x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28	4	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
2.56	3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)

NOTE 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2
NOTE 2: N2 = 2 when *highSpeedMeasFlagFR2-r17* = set1; N2 = 6 when *highSpeedMeasFlagFR2-r17* = set2.

Table 4.2.2.3-4: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	T_{detect,NR_Intra} [s] (number of DRX cycles or eDRX cycles Note 3)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles or eDRX cycles Note 3)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles or eDRX cycles Note 3)
2.56	-	-	58.88 (23)	2.56 (1)	7.68 (3)
5.12	-	-	117.76 (23)	5.12 (1)	10.24 (2)
10.24	-	-	235.52 (23)	10.24 (1)	20.48 (2)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥1.28 (1)	$eDRX_cycle_length \times \lceil \frac{23}{PTW/DRX_cycle_length} \rceil$ (23)	0.32 x M2 (1 x M2)	0.64 x M2 (2 x M2)
	0.64	≥1.28 (1)		0.64 (1)	1.28 (2)
	1.28	≥2.56 (2)		1.28 (1)	2.56 (2)
	2.56	≥5.12 (4)		2.56 (1)	5.12 (2)

NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured.
NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 3: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles.
NOTE 4: The lower bound of PTW length is derived based on $\lceil \frac{Tevaluate,NR_Intra*DRX_cycle}{1.28} \rceil * 1.28$.

NOTE 5: M2 = 2 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.

Table 4.2.2.3-5: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	T_{detect,NR_Intra} [s] (number of DRX cycles or eDRX cycles Note 4)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles or eDRX cycles Note 4)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles or eDRX cycles Note 4)
2.56	-	-	3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
5.12	-	-	3	117.76 x N1 (23 x N1)	5.12 x N1 (1 x N1)	10.24 x N1 (2 x N1)
10.24	-	-	3	235.52 x N1 (23 x N1)	10.24 x N1 (1 x N1)	20.48 x N1 (2 x N1)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥5.12 (4)	8	$eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1)	0.32 x N1 (1 x N1)	0.64 x N1 (2 x N1)
	0.64	≥6.4 (5)	5		0.64 x N1 (1 x N1)	1.28 x N1 (2 x N1)
	1.28	≥10.24 (8)	4		1.28 x N1 (1 x N1)	2.56 x N1 (2 x N1)
	2.56	≥15.36 (12)	3		2.56 x N1 (1 x N1)	5.12 x N1 (2 x N1)

NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles.
NOTE 5: The lower bound of PTW length is derived based on $\left\lceil \frac{\text{Tevaluate,NR_Intra} * \text{DRX_cycle}}{1.28} \right\rceil * 1.28$.
NOTE 6: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX_IDLE, changing eDRX_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

4.2.2.4 Measurements of inter-frequency NR cells

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP or SS-RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

For a UE configured with *highSpeedMeasInterFreq-r17*, and configured with relaxed measurement criterion (*lowMobilityEvaluation* or both *lowMobilityEvaluation* and *cellEdgeEvaluation*),

- if the relaxed measurement criteria in section 4.2.2.9.2 are fulfilled, it is up to UE implementation whether to apply the relaxed measurements requirements specified in clause 4.2.2.10.2 or high speed requirements specified in this clause

- otherwise, high speed requirements specified in this clause shall be applied

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{carrier} * T_{detect,NR_Inter} + K_{carrier_HST} * T_{detect,NR_Inter_HST}$ if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection} = 0$ provided that the reselection criteria is met by a margin of at least 5 dB in FR1 or 6.5dB in FR2 for reselections based on ranking or 6dB in FR1 or 7.5dB in FR2 for SS-RSRP reselections based on absolute priorities or 4dB in FR1 and 4dB in FR2 for SS-RSRQ reselections based on absolute priorities.

The parameter $K_{carrier}$ is the number of NR inter-frequency carriers which are not configured with *highSpeedMeasInterFreq-r17* for FR1 or *highSpeedMeasFlagFR2-r17* for FR2 indicated by the serving cell. The parameter $K_{carrier_HST}$ is the number of NR inter-frequency carriers which are configured with *highSpeedMeasInterFreq-r17* for FR1 or*highSpeedMeasFlagFR2-r17* for FR2 indicated by the serving cell. The parameter $K_{carrier}$ for a UE configured with idle mode CA/DC measurements (while T331 is running), is the combined number of NR inter-frequency carriers indicated by the serving cell and the number of NR inter-frequency carriers configured for idle mode CA/DC measurements which are not configured with *highSpeedMeasInterFreq-r17* for FR1 or *highSpeedMeasFlagFR2-r17* for FR2. The parameter $K_{carrier_HST}$ for a UE configured with idle mode CA/DC measurements (while T331 is running), is the combined number of NR inter-frequency carriers indicated by the serving cell and the number of NR inter-frequency carriers configured for idle mode CA/DC measurements which are configured with *highSpeedMeasInterFreq-r17* for FR1 or *highSpeedMeasFlagFR2-r17* for FR2.

Note: Combined total number means that if a carrier is an inter-frequency carrier indicated by the serving cell for mobility and additionally a carrier configured for idle mode CA measurements, it only counts as one carrier.

An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.3 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,NR_Inter}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

A UE not configured with eDRX_IDLE cycle shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier} * T_{measure,NR_Inter} + K_{carrier_HST} * T_{measure,NR_Inter_HST}$ (see table 4.2.2.4-1, table 4.2.2.4-2 if UE declares support of idle mode inter-frequency measurement enhancement when configured with *highSpeedMeasInterFreq-r17* in FR1; or table 4.2.2.4-2a if UE declares support of idle mode inter-frequency measurement enhancement when configured with *highSpeedMeasFlagFR2-r17* in FR2; else see Table 4.2.2.4-1) for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

A UE not configured with eDRX_IDLE cycle shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Inter}/2$ for carriers which are not configured with *highSpeedMeasInterFreq-r17* for FR1 or *highSpeedMeasFlagFR2-r17* for FR2 or $T_{measure,NR_Inter_HST}/2$ for carriers which are configured with *highSpeedMeasInterFreq-r17* for FR1 and *highSpeedMeasFlagFR2-r17* for FR2.

A UE configured with eDRX_IDLE cycle shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier} * T_{measure,NR_Inter}$ (see table 4.2.2.4-3 and table 4.2.2.4-4) for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

A UE configured with eDRX_IDLE cycle shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Inter}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE not configured with eDRX_IDLE cycle shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within $K_{carrier} * T_{evaluate,NR_Inter} + K_{carrier_HST} * T_{evaluate,NR_Inter_HST}$ when $T_{reselection} = 0$ (as specified in table 4.2.2.4-1, table 4.2.2.4-2 if UE declares support of idle mode inter-frequency measurement enhancement when configured with *highSpeedMeasInterFreq-r17* in FR1; or table 4.2.2.4-2a if UE declares support of idle mode inter-frequency measurement enhancement when configured with *highSpeedMeasFlagFR2-r17* in FR2; else in table 4.2.2.4-1), provided that the reselection criteria is met by

- the condition when performing equal priority reselection and
  - when *rangeToBestCell* is not configured:
    - the cell is at least 5 dB better ranked in FR1 or 6.5 dB better ranked in FR2 or.
  - when *rangeToBestCell* is configured:
    - the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
      - if there are multiple such cells, the cell has the highest rank among them
      - the cell is at least 5 dB better ranked in FR1 or 6.5 dB better ranked in FR2 if the current serving cell is among them. or
- 6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or
- 4 dB in FR1 or 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE configured with eDRX_IDLE cycle shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within $K_{carrier} * T_{evaluate,NR_Inter}$ when $T_{reselection} = 0$ as specified in table 4.2.2.4-3 and table 4.2.2.4-4, provided that the reselection criteria is met by

- the condition when performing equal priority reselection and
  - when *rangeToBestCell* is not configured:
    - the cell is at least 5 dB better ranked in FR1 or 6.5 dB better ranked in FR2 or.
  - when *rangeToBestCell* is configured:
    - the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
      - if there are multiple such cells, the cell has the highest rank among them
      - the cell is at least 5 dB better ranked in FR1 or 6.5 dB better ranked in FR2 if the current serving cell is among them. or
- 6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or
- 4 dB in FR1 or 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If the $T_{reselection}$ timer has a non-zero value and the inter-frequency cell satisfies the reselection criteria, the UE shall evaluate this inter-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect to this cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in table 4.2.2.4-1 and table 4.2.2.4-2 under the following conditions:

- $T_{SMTC_intra} = T_{SMTC_inter} = 160$ ms; where

- T_{SMTC_intra} is the periodicity of the SMTC configured for the intra-frequency carrier if no identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier; T_{SMTC_intra} is the periodicity of the *smtc2-LP* configured for the intra-frequency carrier if at least one identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed for T_{SMTC_intra}. If the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer T_{detect, NR_intra} is expected.

- T_{SMTC_inter} is the actual SMTC periodicity used by the inter-frequency cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the inter-frequency carrier is assumed for T_{SMTC_inter}. If the actual SSB transmission periodicity is greater than the SMTC configured for the inter-frequency carrier, longer T_{detect, NR_inter} is expected.

- SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and

- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion in TS 38.304 [1].

For UE not configured with eDRX_IDLE cycle, T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ are specified in Table 4.2.2.4.1-1 and 4.2.2.4.1-2.

For UE configured with eDRX_IDLE cycle, T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ are specified in table 4.2.2.4-3 and table 4.2.2.4-4 for FR1 and FR2 respectively. The requirements apply provided that the serving cell is configured with eDRX_IDLE and the DRX cycle length is the same in all PTWs during any of T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ when multiple PTWs are used.

Table 4.2.2.4-1: T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$

DRX cycle length [s]	Scaling Factor (N1)			T_{detect,NR_Inter} [s] (number of DRX cycles)	$T_{measure,NR_Inter}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter}$ [s] (number of DRX cycles)
	FR1	FR2-1 Note1	FR2-2 Note2			
0.32	1	8	12	11.52 x N1 x 1.5 (36 x N1 x 1.5)	1.28 x N1 x 1.5 (4 x N1 x 1.5)	5.12 x N1 x 1.5 (16 x N1 x 1.5)
0.64		5	8	17.92x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28		4	6	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
2.56		3	5	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length. NOTE 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.						

Table 4.2.2.4-2: T_{detect,NR_Inter_HST}, $T_{measure,NR_Inter_HST}$ and $T_{evaluate,NR_Inter_HST}$ for FR1 configured with *highSpeedMeasInterFreq-r17* note2

DRX cycle length [s]	T_{detect,NR_Inter_HST} [s] (number of DRX cycles)	$T_{measure,NR_Inter_HST}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_HST}$ [s] (number of DRX cycles)
0.32	3.2 x M2 (10 x M2) Note 1	0.32 x M3 ([1] x M3) Note 1	0.96 x M4 (3 x M4) Note 1
0.64	6.4 (10)	0.64 (1)	1.92 (3)
1.28	10.24 (8)	1.28 (1)	3.84 (3)
2.56	58.88 (23)	2.56 (1)	7.68 (3)
NOTE 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2 NOTE 2: The support of HST Idle mode inter-frequency measurement enhancement is optional without capability signalling. The requirements apply to UE that declares support of IDLE mode inter-frequency measurement enhancement for HST in FR1, otherwise table 4.2.2.4-1 shall be used.			

Table 4.2.2.4-2a: T_{detect,NR_Inter_HST}, $T_{measure,\ NR_Inter_HST}$ and $T_{evaluate,\ NR_Inter_HST}$ for FR2 configured with *highSpeedMeasFlagFR2-r17*[note2, note4]

DRX cycle length [s]	Scaling Factor (N1)	T_{detect,NR_Inter_HST} [s] (number of DRX cycles)	$T_{measure,\ NR_Inter_HST}$ [s] (number of DRX cycles)	$T_{evaluate,\ NR_Inter_HST}$ [s] (number of DRX cycles)
0.32	N1[Note3]	2.56 x N1 x M2 (8 x N1 x M2) [Note1]	0.32 x N1 x M3 (1 x N1 x M3) [Note1]	0.96 x N1 x M4 (3 x N1 x M4) [Note1]
0.64	5	17.92 x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28	4	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
2.56	3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)

NOTE 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2
NOTE 2: The requirements apply to UE that declares support of idle mode inter-frequency measurement enhancement for HST in FR2, otherwise table 4.2.2.4-1 shall be used.
NOTE 3: N1 = 2 when *highSpeedMeasFlagFR2-r17*= set1, N1 = 6 when *highSpeedMeasFlagFR2-r17*= set2.
NOTE 4: The requirements apply for the HST Idle mode inter-frequency measurement enhancement only if highSpeedMeasFlagFR2-r17 is signalled in SIB1.

Table 4.2.2.4-3: T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ for UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	T_{detect,NR_Inter} [s] (number of DRX cycles or eDRX cycles [Note 3])	$T_{measure,NR_Inter}$ [s] (number of DRX cycles or eDRX cycles [Note 3])	$T_{evaluate,NR_Inter}$ [s] (number of DRX cycles or eDRX cycles [Note 3])
2.56	-	-	58.88 (23)	2.56 (1)	7.68 (3)
5.12	-	-	117.76 (23)	5.12 (1)	10.24 (2)
10.24	-	-	235.52 (23)	10.24 (1)	20.48 (2)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥1.28 (1)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ (23)	0.32 x 1.5 (1 x 1.5)	0.64 x 1.5 (2 x 1.5)
	0.64	≥1.28 (1)		0.64 (1)	1.28 (2)
	1.28	≥2.56 (2)		1.28 (1)	2.56 (2)
	2.56	≥5.12 (4)		2.56 (1)	5.12 (2)

NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured.
NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 3: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles.
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter * DRX_cycle}{1.28} \right\rceil * 1.28$.

Table 4.2.2.4-4: T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ for UE configured with eDRX_IDLE cycle (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) [Note1]	T_{detect,NR_Inter} [s] (number of DRX cycles or eDRX cycles [Note 3])	$T_{measure,NR_Inter}$ [s] (number of DRX cycles or eDRX cycles [Note 3])	$T_{evaluate,NR_Inter}$ [s] (number of DRX cycles or eDRX cycles [Note 3])
2.56	-	-	3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
5.12	-	-	3	117.76 x N1 (23 x N1)	5.12 x N1 (1 x N1)	10.24 x N1 (2 x N1)
10.24	-	-	3	235.52 x N1 (23 x N1)	10.24 x N1 (1 x N1)	20.48 x N1 (2 x N1)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥5.12 (4)	8	$eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1)	0.32 x N1 (1 x N1)	0.64 x N1 (2 x N1)
	0.64	≥6.4 (5)	5		0.64 x N1 (1 x N1)	1.28 x N1 (2 x N1)
	1.28	≥10.24 (8)	4		1.28 x N1 (1 x N1)	2.56 x N1 (2 x N1)

	2.56	≥15.36 (12)	3		2.56 x N1 (1 x N1)	5.12 x N1 (2 x N1)

NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles.
NOTE 5: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 6: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX_IDLE, changing eDRX_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

4.2.2.5 Measurements of inter-RAT E-UTRAN cells

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-RAT E-UTRAN layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the UE shall search for and measure inter-RAT E-UTRAN layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority inter-RAT E-UTRAN layers shall be the same as that defined below for lower priority RATs.

The requirements in this clause apply to inter-RAT E-UTRAN FDD measurements and E-UTRA TDD measurements. When the measurement rules indicate that inter-RAT E-UTRAN cells are to be measured, the UE shall measure RSRP and RSRQ of detected E-UTRA cells in the neighbour frequency list at the minimum measurement rate specified in this clause.

The parameter $N_{EUTRA_carrier}$ is the total number of configured E-UTRA carriers indicated to meet non high speed requirements in the neighbour frequency list. The parameter $N_{EUTRA_carrier_HST}$ is the total number of configured E-UTRA carriers indicated to meet high speed requirements in the neighbour frequency list. If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, an inter-RAT E-UTRAN layer is indicated to meet high speed requirements if *highSpeedMeasFlag-r16* is configured and the carrier to be measured is configured with *highSpeedEUTRACarrier-r16* and UE supports the enhanced inter-RAT E-UTRAN measurement requirements. If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, UE is required to meet non high speed requirements no matter whether *highSpeedMeasFlag-r16* or *highSpeedEUTRACarrier-r16* is configured or not.

For a UE configured with *highSpeedMeasFlag-r16*, and configured with relaxed measurement criterion (*lowMobilityEvaluation* or both *lowMobilityEvaluation* and *cellEdgeEvaluation*),

- if the relaxed measurement criteria in section 4.2.2.9.2 are fulfilled, it is up to UE implementation whether to apply the relaxed measurements requirements specified in clause 4.2.2.11.2 or high speed requirements specified in this clause

- otherwise, high speed requirements specified in this clause shall apply

The parameter $N_{EUTRA_carrier}$ for a UE configured with idle mode DC measurements (while T331 is running), is the combined number of configured E-UTRA carriers in the neighbour frequency list and E-UTRA carriers configured for idle mode DC measurements, excluding the configured E-UTRA carriers indicated to meet high speed requirements in the neighbour frequency list.

NOTE: combined total number means that if a carrier is an E-UTRA carrier indicated by the serving cell for mobility and additionally a carrier configured for idle mode DC measurements, it only counts as one carrier.

The UE shall filter RSRP and RSRQ measurements of each measured E-UTRA cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least half the minimum specified measurement period.

An inter-RAT E-UTRA cell is considered to be detectable provided the following conditions are fulfilled:

- the same conditions as for inter-frequency RSRP measurements specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band, and
- the same conditions as for inter-frequency RSRQ measurements specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band.
- SCH conditions specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band

The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS 38.304 [1] within $N_{EUTRA_carrier_HST} * T_{detect,EUTRAN_HST} + N_{EUTRA_carrier} * T_{detect,EUTRAN}$ when $Srxlev \leq S_{nonIntraSearchP}$ or $Squal \leq S_{nonIntraSearchQ}$ when $T_{reselection} = 0$ provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

Cells which have been detected shall be measured at least every $N_{EUTRA_carrier_HST} * T_{measure,EUTRAN_HST} + N_{EUTRA_carrier} * T_{measure,EUTRAN}$ when $Srxlev \leq S_{nonIntraSearchP}$ or $Squal \leq S_{nonIntraSearchQ}$.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,EUTRAN}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE detects, on an inter-RAT E-UTRAN carrier, a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall not consider an inter-RAT E-UTRA cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For a cell that has been already detected, but has not been reselected to, the filtering shall be such that a UE not configured with eDRX_IDLE cycle shall be capable of evaluating that an already identified inter-RAT E-UTRA cell has met reselection criterion defined in TS 38.304 [1] within $N_{EUTRA_carrier_HST} * T_{evaluate,EUTRAN_HST} + N_{EUTRA_carrier} * T_{evaluate,EUTRAN}$ when $T_{reselection} = 0$ as specified in table 4.2.2.5-1 and 4.2.2.5-2 provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

For a cell that has been already detected, but that has not been reselected to, the filtering shall be such that a UE configured with eDRX_IDLE cycle shall be capable of evaluating that an already identified inter-RAT E-UTRA cell has met reselection criterion defined in TS 38.304 [1] within $N_{EUTRA_carrier} * T_{evaluate,EUTRAN}$ when $T_{reselection} = 0$ as specified in table 4.2.2.5-3 provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

If the $T_{reselection}$ timer has a non-zero value and an inter-RAT E-UTRA cell satisfies the reselection criteria defined in TS 38.304 [1], the UE shall evaluate this E-UTRA cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect to this cell.

For UE not configured with eDRX_IDLE cycle, $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$ and $T_{evaluate,\ E\text{-}UTRAN}$ are specified in tables 4.2.2.5-1 and 4.2.2.5-2.

For UE configured with eDRX_IDLE cycle, $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$ and $T_{evaluate,\ E\text{-}UTRAN}$ are specified in table 4.2.2.5-3, where the requirements apply provided that the serving cell is configured with eDRX_IDLE and the DRX cycle length is the same in all PTWs during any of $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$ and $T_{evaluate,\ E\text{-}UTRAN}$ when multiple PTWs are used.

Table 4.2.2.5-1: $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$, and $T_{evaluate,EUTRAN}$

DRX cycle length [s]	$T_{detect,EUTRAN}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN}$ [s] (number of DRX cycles)
0.32	11.52 (36)	1.28 (4)	5.12 (16)

0.64	17.92 (28)	1.28 (2)	5.12 (8)
1.28	32(25)	1.28 (1)	6.4 (5)
2.56	58.88 (23)	2.56 (1)	7.68 (3)

Table 4.2.2.5-2: $T_{detect,EUTRAN_HST}$, $T_{measure,EUTRAN_HST}$, and $T_{evaluate,EUTRAN_HST}$ for UE configured with highSpeedMeasFlag-r16

DRX cycle length [s]	$T_{detect,EURAN_HST}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN_HST}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN_HST}$ [s] (number of DRX cycles)
0.32	4.16 (13)	0.64 (2)	0.96 (3)
0.64	7.68 (12)	1.28 (2)	1.92 (3)
1.28	8.96 (7)	1.28 (1)	3.84 (3)
2.56	58.88 (23)	2.56 (1)	7.68 (3)
NOTE 1: When highSpeedMeasFlag-r16 is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[interRAT-MeasurementEnhancement-r16]*.			

The requirements in table 4.2.2.5-2 apply only when the UE supports *measurementEnhancement-r16* or *interRAT-MeasurementEnhancement-r16*. For UE not supporting either *measurementEnhancement-r16* or *interRAT-MeasurementEnhancement-r16*, the UE is not required to meet the requirements specified in table 4.2.2.5-2.

Table 4.2.2.5-3: $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$, and $T_{evaluate,EUTRAN}$ for UE configured with eDRX_IDLE cycle

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,EUTRAN}$ [s] (number of DRX or eDRX cycles [Note 3])	$T_{measure,EUTRAN}$ [s] (number of DRX or eDRX cycles [Note 3])	$T_{evaluate,E-UTRAN}$ [s] (number of DRX or eDRX cycles [Note 3])
2.56	N/A	N/A	58.88 (23)	2.56 (1)	7.68 (3)
5.12	N/A	N/A	117.76 (23)	5.12 (1)	10.24 (2)
10.24	N/A	N/A	235.52 (23)	10.24 (1)	20.48 (2)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥1.28 (1)	$eDRX_cycle_length \times \left\lceil \frac{23}{\lceil PTW / DRX_cycle_length \rceil} \right\rceil$ (23)	0.32 (1)	0.64 (2)
	0.64	≥1.28 (1)		0.64 (1)	1.28 (2)
	1.28	≥2.56 (2)		1.28 (1)	2.56 (2)
	2.56	≥5.12 (4)		2.56 (1)	5.12 (2)
NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s, or 10.24 s; number of DRX cycles otherwise. NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,E-UTRAN*DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 5: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.					

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX_IDLE, changing eDRX_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

4.2.2.6 Maximum interruption in paging reception

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. In addition, when the UE is configured with eDRX_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed T_{SI-NR} + 2*$T_{target_cell_SMTC_period}$ ms. $T_{target_cell_SMTC_period}$ is the periodicity of the SMTC occasions configured for the target NR cell. If the target cell is in the PCI list of *smtc2-LP*, the SMTC periodicity follows *smtc2-LP*; otherwise, the SMTC periodicity follows *smtc*. The interruption time could be longer due to on demand SIB1 acquisition if the target NR cell is an NES cell and UE is capable of on-demand SIB1 acquisition.

At inter-RAT cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels for paging reception of the target inter-RAT cell. For NR to E-UTRAN cell re-selection the interruption time must not exceed $T_{SI-EUTRA}$ + 55 ms.

T_{SI-NR} is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for an NR cell. If the target NR cell is an NES cell and UE is capable of on-demand SIB1 acquisition, T_{SI-NR} could be longer due to UL WUS transmission and RAR reception for on-demand SIB1 acquisition of NES cell.

$T_{SI-EUTRA}$ is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [16] for an E-UTRAN cell. These requirements assume sufficient radio conditions, so that decoding of system information can be made without errors and does not take into account cell re-selection failure.

4.2.2.7 General requirements

When configured with eDRX_IDLE, the UE shall search every layer of higher priority at least every $T_{higher_priority_search}$, where $T_{higher_priority_search}$ is defined as follows:

- $T_{higher_priority_search}$ = max(60, 15*eDRX_IDLE cycle length) * N_{layers} seconds if eDRX_IDLE cycle ≤ 10.24 s,
- $T_{higher_priority_search}$ = max(60, ceil (15/$N_{DRX-PTW}$)*eDRX_IDLE cycle length) * N_{layers} seconds if eDRX_IDLE cycle > 10.24 s, where $N_{DRX-PTW}$ is the number of DRX cycles within a single PTW.

Otherwise, if the UE is not configured with eDRX_IDLE cycle, the UE shall search every layer of higher priority at least every $T_{higher_priority_search}$ = (60 * N_{layers}) seconds.

N_{layers} is the total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information.

For a UE configured with early measurement reporting, while T331 is running, N_{layers} is the combined total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information and carriers configured for idle mode CA/DC measurements.

NOTE: Combined total number means that if a carrier is a high priority carrier and additionally a carrier configured for idle mode CA/DC measurements, it only counts as one carrier.

4.2.2.8 Minimum requirement at transitions

When switching from low mobility scenario or not-at-cell-edge scenario to low mobility and not-at-cell-edge scenario during cell-reselection period, the UE shall fulfill the requirements corresponding to low mobility scenario or not-at-cell-edge scenario over measurement period ($T_{relaxed}$) and thereafter switch to requirements corresponding to low mobility and not-at-cell-edge scenario. The measurement period, $T_{relaxed}$, is any of:

- $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra,}$ defined in section 4.2.2.9 for intra-frequency measurements on NR cells,
- $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ defined in section 4.2.2.10 for inter-frequency measurements on NR cells and
- $T_{measure,EUTRAN}$ and $T_{evaluate,EUTRAN}$ defined in sections 4.2.2.11 for inter-RAT E-UTRAN measurements.

When switching from low mobility and not-at-cell-edge scenario to low mobility scenario or not-at-cell-edge scenario during cell-reselection period, the UE shall fulfill the requirements corresponding to low mobility scenario or not-at-cell-edge scenario upon fulfilling the switching criteria.

When switching from normal mode to low mobility scenario or not-at-cell-edge scenario or low mobility and not-at-cell-edge scenario during cell-reselection period, the UE shall fulfill the requirements corresponding to normal mode over measurement period (T_{normal}) and thereafter switch to requirements corresponding to low mobility scenario or not-at-cell-edge scenario or low mobility and not-at-cell-edge scenario. The measurement period, T_{normal}, is any of:

- $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra,}$ defined in section 4.2.2.3 for intra-frequency measurements on NR cells,
- $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ defined in section 4.2.2.4 for inter-frequency measurements on NR cells and
- $T_{measure,EUTRAN}$ and $T_{evaluate,EUTRAN}$ defined in sections 4.2.2.5 for inter-RAT E-UTRAN measurements.

When switching from low mobility scenario or not-at-cell-edge scenario or low mobility and not-at-cell-edge scenario to normal mode during cell-reselection period, the UE shall fulfill the requirements corresponding to normal mode upon fulfilling the switching criteria.

No requirement is defined for multiple transitions of scenarios within one measurement period.

4.2.2.9 Measurements of intra-frequency NR cells for UE configured with relaxed measurement criterion

4.2.2.9.1 Introduction

This clause contains the requirements for measurements on intra-frequency NR cells when Srxlev $\leq S_{IntraSearchP}$ or Squal $\leq S_{IntraSearchQ}$ and when the UE is configured any of the following relaxed measurement criteria:

- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],
- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4.9.2 in [1],
- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4.9.1 and 5.2.4.9.2 in [1] respectively.

4.2.2.9.2 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is only configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvaluation* [2] criterion, or
- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

The requirements defined in clause 4.2.2.3 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ are as specified in table 4.2.2.9.2-1.
- For a UE configured with eDRX_IDLE cycle up to 10.24 s, T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ are as specified in table 4.2.2.9.2-2 and table 4.2.2.9.2-3 for FR1 and FR2, respectively.
- For a UE configured with eDRX_IDLE cycle greater than 10.24 s, T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ are as specified in table 4.2.2.9.2-4 and table 4.2.2.9.2-5 for FR1 and FR2, respectively, provided eDRX cycle is $\leq$ [163.84] sec and evaluation/measurement period with relaxation on one carrier is not greater than single PTW length.

Table 4.2.2.9.2-1: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$

DRX cycle length [s]	Scaling Factor (N1)		$T_{measure,NR_Intra}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra}$

	FR1	FR2-1 Note1	FR2-2 Note2	T_{detect,NR_Intra} [s] (number of DRX cycles)		[s] (number of DRX cycles)
0.32	1	8	12	11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1)	1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1)	5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1)
0.64		5	8	17.92 x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	6	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	5	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)

NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.
NOTE 3: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If high layer signalling *smtc2-LP-r16* is configured, for cells indicated in the *pci-List* parameter in *smtc2-LP-r16*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2-LP-r16*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc*.
NOTE 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.

Table 4.2.2.9.2-2: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle (Frequency range FR1) for eDRX_IDLE cycle up to 10.24s

eDRX_IDLE cycle length [s]	T_{detect,NR_Intra} [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Intra}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Intra}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x K1 (2 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x K1 (2 x K1)

NOTE 1: Void.
NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.

Table 4.2.2.9.2-3: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle (Frequency range FR2-1) for eDRX_IDLE cycle up to 10.24s

eDRX_IDLE cycle length [s]	T_{detect,NR_Intra} [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Intra}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Intra}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
5.12	117.76 x N1 x K1 (23 x N1 x K1)	5.12 x N1 x K1 (1 x N1 x K1)	10.24 x N1 x K1 (2 x N1 x K1)
10.24	235.52 x N1 x K1 (23 x N1 x K1)	10.24 x N1 x K1 (1 x N1 x K1)	20.48 x N1 x K1 (2 x N1 x K1)

NOTE 1: For UE supporting FR2-1 power class 2&3&4, N1 = 3. For UE supporting FR2-1 power class 1 or 5, N1 = 8.
NOTE 2: Void.
NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.

Table 4.2.2.9.2-4: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle greater than 10.24s (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	T_{detect,NR_Intra} [s] (number of DRX cycles Note 3)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles Note 3)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥3.84 (3)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1 (23 x K1)	0.32 x M2 x K1 (1 x M2 x K1)	0.64 x M2 x K1 (2 x M2 x K1)
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)

	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)
	2.56	≥15.36 (12)		2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)

NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs.
NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{T_{evaluate,NR_Intra} * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.
NOTE 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.

Table 4.2.2.9.2-5: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle greater than 10.24s (Frequency range FR2-1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	T_{detect,NR_Intra} [s] (number of DRX cycles Note 3)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles Note 3)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥15.36 (12)	8	K1 x $eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1 x K1)	0.32 x N1 x K1 (1 x N1 x K1)	0.64 x N1 x K1 (2 x N1 x K1)
	0.64	≥19.2 (15)	5		0.64 x N1 x K1 (1 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)
	1.28	≥30.72 (24)	4		1.28 x N1 x K1 (1 x N1 x K1)	2.56 x N1 x K1 (2 x N1 x K1)
	2.56	40.96 (32)	3		20.48	40.96

NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{T_{evaluate,NR_Intra} * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 5: The measurement shall not be performed across PTW's. In this case the measurement is performed in the next available PTW.
NOTE 6: The evaluation shall not be performed across PTW's.
NOTE 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation criterion* [2].

4.2.2.9.3 Measurements for UE fulfilling not-at-cell edge criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is only configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled the *cellEdgeEvaluation* [2] criterion, or
- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

The requirements defined in clause 4.2.2.3 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ are as specified in table 4.2.2.9.3-1.
- For a UE configured with eDRX_IDLE cycle up to 10.24s, T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ are as specified in $T_{measure,NR_Intra}$ as specified in table 4.2.2.9.3-2 and table 4.2.2.9.3-3 for FR1 and FR2, respectively.
- For a UE configured with eDRX_IDLE cycle greater than 10.24s, T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ are as specified in table 4.2.2.9.3-4 and table 4.2.2.9.3-5 for FR1 and FR2, respectively, provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement period with relaxation on one carrier is not greater than single PTW length.

Table 4.2.2.9.3-1: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$

DRX cycle length [s]	Scaling Factor (N1)			T_{detect,NR_Intra} [s] (number of DRX cycles)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles)
	FR1	FR2-1 Note1	FR2-2 Note2			
0.32	1	8	12	11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1)	1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1)	5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1)
0.64		5	8	17.92 x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	6	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	5	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)

NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.
NOTE 3: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If high layer signalling *smtc2-LP-r16* is configured, for cells indicated in the *pci-List* parameter in *smtc2-LP-r16*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2-LP-r16*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc*.
NOTE 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 4.2.2.9.3-2: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle (Frequency range FR1) for eDRX_IDLE cycle up to 10.24 s

eDRX_IDLE cycle length [s]	T_{detect,NR_Intra} [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Intra}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Intra}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x K1 (2 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x K1 (2 x K1)

NOTE 1: Void
NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 4.2.2.9.3-3: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle (Frequency range FR2) for eDRX_IDLE cycle up to 10.24 s

eDRX_IDLE cycle length [s]	T_{detect,NR_Intra} [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Intra}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Intra}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
5.12	117.76 x N1 x K1 (23 x N1 x K1)	5.12 x N1 x K1 (1 x N1 x K1)	10.24 x N1 x K1 (2 x N1 x K1)
10.24	235.52 x N1 x K1 (23 x N1 x K1)	10.24 x N1 x K1 (1 x N1 x K1)	20.48 x N1 x K1 (2 x N1 x K1)

NOTE 1: For UE supporting FR2-1 power class 2&3&4, N1 = 3. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: Void
NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 4.2.2.9.3-4: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	T_{detect,NR_Intra} [s] (number of DRX cycles Note 3)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles Note 3)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles Note 3)

20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥3.84 (3)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1 (23 x K1)	0.32 x M2 x K1 (1 x M2 x K1)	0.64 x M2 x K1 (2 x M2 x K1)
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)
	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)
	2.56	≥15.36 (12)		2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)
NOTE 1: The number of DRX cycles in this table correspond to the DRX cycles within PTWs. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra*DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.					

Table 4.2.2.9.3-5: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	T_{detect,NR_Intra} [s] (number of DRX cycles Note 3)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles Note 3)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥15.36 (12)	8	K1 x $eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1 x K1)	0.32 x N1 x K1 (1 x N1 x K1)	0.64 x N1 x K1 (2 x N1 x K1)
	0.64	≥19.2 (15)	5		0.64 x N1 x K1 (1 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)
	1.28	≥30.72 (24)	4		1.28 x N1 x K1 (1 x N1 x K1)	2.56 x N1 x K1 (2 x N1 x K1)
	2.56	40.96 (32)	3		20.48	40.96
NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length. NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs. NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra*DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 5: The measurement shall not be performed across PTW's. In this case the measurement is performed in the next available PTW. NOTE 6: The evaluation shall not be performed across PTW's. NOTE 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation criterion* [2].						

4.2.2.9.4 Measurements for UE fulfilling low mobility and not-at-cell edge criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and
- both *lowMobilityEvaluation* [2] and *cellEdgeEvaluation* [2] criteria are fulfilled, and
- less than 1 hour have passed since measurements for cell reselection were last performed

In this case the UE is not required to meet T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ as defined in table 4.2.2.3-1 or table 4.2.2.3-4 or table 4.2.2.3-5.

4.2.2.10 Measurements of inter-frequency NR cells for UE configured with relaxed measurement criterion

4.2.2.10.1 Introduction

This clause contains the requirements for measurements on inter-frequency NR cells when the UE is configured with any of following relaxed measurement criteria:

- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],
- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4.9.2 in [1],
- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4. 9.1 and 5.2.4.9.2 in [1] respectively.

4.2.2.10.2 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is only configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvaluation* [2] criterion, or
- UE is configured with both *lowMobilityEvaluation* [2] and *cellEdgeEvaluation* [2] criteria and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

The UE shall not relax measurements on NR inter-frequency carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

When Srxlev $\leq S_{nonIntraSearchP}$ or Squal $\leq S_{nonIntraSearchQ}$ then the requirements are defined as follows:

- The UE shall be able to evaluate whether a newly detectable inter-frequency NR cell meets the reselection criteria defined in TS 38.304 [1] within $N_{carrier_Relax} * T_{detect,NR_Inter_Relax} + N_{carrier_Non_relax} * T_{detect,NR_Inter}$. Cells which have been detected shall be measured at least every $N_{carrier_Relax} * T_{measure,NR_Inter_Relax} + N_{carrier_Non_relax} * T_{measure,NR_Inter.}$ The UE shall be able to evaluate that an already identified inter-frequency NR cell has met reselection criterion defined in TS 38.304 [1] within $N_{carrier_Relax} * T_{evaluate,NR_Inter_Relax} + N_{carrier_Non_relax} * T_{evaluate,NR_Inter}$.
- When T331 is running,
  - The parameter $N_{carrier_Relax}$ is the total number of NR inter-frequency carriers not configured for idle mode CA/DC measurements.
  - The parameter $N_{carrier_Non_relax}$ is the total number of NR inter-frequency carriers configured for idle mode CA/DC measurements.
- When T331 is not running,
  - The parameter $N_{carrier_Relax}$ is the total number of inter-frequency carriers configured for mobility measurements only and the number of inter-frequency carriers configured for both mobility measurement and idle mode CA/DC measurements.
  - The parameter $N_{carrier_Non_relax}$ =0.
- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ are as specified in table 4.2.2.10.2-1 and $T_{detect,NR_Inter,}$ $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ are as specified in table 4.2.2.4.1-1.
- For a UE configured with eDRX_IDLE, T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ are as specified in table 4.2.2.4-3 and table 4.2.2.4-4 for FR1 and FR2 respectively.
- For a UE configured with eDRX_IDLE cycle up to 10.24 s, $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ are as specified in table 4.2.2.10.2-2 and table 4.2.2.10.2-3 for FR1 and FR2, respectively.
- For a UE configured with eDRX_IDLE cycle greater than 10.24 s, $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ are as specified in table 4.2.2.10.2-4 and table 4.2.2.10.2-5 for FR1 and FR2, respectively, provided eDRX cycle is $\leq$ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW length.

When UE is only configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvaluation* [2] criterion, and Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ,}$

- if the UE is configured with *highPriorityMeasRelax* [2] then the UE shall search for inter-frequency layers of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and, K2 = 60

- otherwise, the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7.

Table 4.2.2.10.2-1: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$

DRX cycle length [s]	Scaling Factor (N1)			$T_{detect,NR_Inter_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of DRX cycles)
	FR1	FR2-1 Note1	FR2-2 Note2			
0.32	1	8	12	11.52 x N1 x K1 x 1.5 (36 x N1 x K1 x 1.5)	1.28 x N1 x K1x 1.5 (4 x N1 x K1 x 1.5)	5.12 x N1 x K1x 1.5 (16 x N1 x K1 x 1.5)
0.64		5	8	17.92x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	6	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	5	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)

NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.
NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling *lowMobilityEvaluation* [2] criterion.

Table 4.2.2.10.2-2: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x K1 (2 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x K1 (2 x K1)

NOTE 1: Void
NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.

Table 4.2.2.10.2-3: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ for UE configured with eDRX_IDLE cycle upto 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
5.12	117.76 x N1 x K1 (23 x N1 x K1)	5.12 x N1 x K1 (1 x N1 x K1)	10.24 x N1 x K1 (2 x N1 x K1)
10.24	235.52 x N1 x K1 (23 x N1 x K1)	10.24 x N1 x K1 (1 x N1 x K1)	20.48 x N1 x K1 (2 x N1 x K1)

NOTE 1: For UE supporting FR2-1 power class 2&3&4, N1=3. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: Void
NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.

Table 4.2.2.10.2-4: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)	$T_{measure,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)
20.48 ≤ eDRX_IDLE	0.32	≥3.84 (3)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1	0.32 x 1.5 x K1 (1 x M2 x K1)	0.64 x 1.5 x K1 (2 x M2 x K1)

cycle length ≤[163.84]			(23 x K1)		
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)
	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)
	2.56	≥15.36 (12)		2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)
NOTE 1: The number of DRX cycles in this table correspond to the DRX cycles within PTWs. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{T_{evaluate,NR_Inter_Relax} * DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.					

Table 4.2.2.10.2-5: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)	$T_{measure,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥15.36 (12)	8	K1 x $eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1 x K1)	0.32 x N1 x K1 (1 x N1 x K1)	0.64 x N1 x K1 (2 x N1 x K1)
	0.64	≥19.2 (15)	5		0.64 x N1 x K1 (1 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)
	1.28	≥30.72 (24)	4		1.28 x N1 x K1 (1 x N1 x K1)	2.56 x N1 x K1 (2 x N1 x K1)
	2.56	40.96 (32)	3		20.48	40.96
NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length. NOTE 2: The number of DRX cycles in this table correspond to the DRX cycles within PTWs. NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{T_{evaluate,NR_Inter_relax} * DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 5: The measurement shall not be performed across PTW's. In this case the measurement is performed in the next available PTW. NOTE 6: The evaluation shall not be performed across PTW's. NOTE 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation criterion* [2].						

4.2.2.10.3 Measurements for UE fulfilling not-at-cell edge criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is only configured with *cellEdgeEvaluation* [2] criterion, and UE has fulfilled the *cellEdgeEvaluation* [2] criterion or
- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

The UE shall not relax measurements on NR inter-frequency carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2.2.4 apply for this clause except that:

- The UE shall be able to evaluate whether a newly detectable inter-frequency NR cell meets the reselection criteria defined in TS 38.304 [1] within $N_{carrier_Relax} * T_{detect,NR_Inter_Relax} + N_{carrier_Non_relax} * T_{detect,NR_Inter}$. Cells which have been detected shall be measured at least every $N_{carrier_Relax} * T_{measure,NR_Inter_Relax} + N_{carrier_Non_relax} * T_{measure,NR_Inter}$. The UE shall be able to evaluate that an already identified inter-frequency NR cell has met reselection criterion defined in TS 38.304 [1] within $N_{carrier_Relax} * T_{evaluate,NR_Inter_Relax} + N_{carrier_Non_relax} * T_{evaluate,NR_Inter}$.
- When T331 is running,

- The parameter $N_{carrier_Relax}$ is the total number of NR inter-frequency carriers not configured for idle mode CA/DC measurements.

- The parameter $N_{carrier_Non_relax}$ is the total number of NR inter-frequency carriers configured for idle mode CA/DC measurements.

- When T331 is not running,

  - The parameter $N_{carrier_Relax}$ is the total number of inter-frequency carriers configured for mobility measurements only and the number of inter-frequency carriers configured for both mobility measurement and idle mode CA/DC measurements.

  - The parameter $N_{carrier_Non_relax}$ =0.

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ are as specified in table 4.2.2.10.3-1 and T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ are as specified in table 4.2.2.4.1-1.

- For a UE configured with eDRX_IDLE, T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ are as specified in table 4.2.2.4-3 and table 4.2.2.4-4 for FR1 and FR2 respectively.

- For a UE configured with eDRX_IDLE cycle up to 10.24 s, $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ are as specified in table 4.2.2.10.3-2 and table 4.2.2.10.3-3 for FR1 and FR2, respectively.

- For a UE configured with eDRX_IDLE cycle greater than 10.24 s, $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ are as specified in table 4.2.2.10.3-4 and table 4.2.2.10.3-5 for FR1 and FR2, respectively, provided eDRX cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW length.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, then regardless of whether the UE is configured with *highPriorityMeasRelax* [2] or not, the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7.

Table 4.2.2.10.3-1: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$

DRX cycle length [s]	Scaling Factor (N1)			$T_{detect,NR_Inter_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of DRX cycles)
	FR1	FR2-1 Note1	FR2-2 Note2			
0.32	1	8	12	11.52 x N1 x K1 x 1.5 (36 x N1 x K1 x 1.5)	1.28 x N1 x K1 x 1.5 (4 x N1 x K1 x 1.5)	5.12 x N1 x K1 x 1.5 (16 x N1 x K1 x 1.5)
0.64		5	8	17.92x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	6	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	5	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.						
NOTE 2: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.						
NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.						

Table 4.2.2.10.3-2: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ for UE configured with eDRX_IDLE cycle (Frequency range FR1) for eDRX_IDLE cycle up to 10.24 s

eDRX_IDLE cycle length [s]	$T_{detect,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x K1 (2 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x K1 (2 x K1)
NOTE 1: Void.			
NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.			

Table 4.2.2.10.3-3: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ for UE configured with eDRX_IDLE cycle (Frequency range FR2) for eDRX_IDLE cycle up to 10.24 s

eDRX_IDLE cycle length [s]	$T_{detect,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
5.12	117.76 x N1 x K1 (23 x N1 x K1)	5.12 x N1 x K1 (1 x N1 x K1)	10.24 x N1 x K1 (2 x N1 x K1)
10.24	235.52 x N1 x K1 (23 x N1 x K1)	10.24 x N1 x K1 (1 x N1 x K1)	20.48 x N1 x K1 (2 x N1 x K1)

NOTE 1: For UE supporting FR2-1 power class 2&3&4, N1=3. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: Void.
NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 4.2.2.10.3-4: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s(Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)	$T_{measure,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥3.84 (3)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1 (23 x K1)	0.32 x M2 x K1 (1 x M2 x K1)	0.64 x M2 x K1 (2 x M2 x K1)
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)
	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)
	2.56	≥15.36 (12)		2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)

NOTE 1: The number of DRX cycles in this table correspond to the DRX cycles within PTWs.
NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter_Relax * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer $T_{detect,\ NR_intra}$ is expected.
NOTE 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 4.2.2.10.3-5: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)	$T_{measure,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥15.36 (12)	8	K1 x $eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1 x K1)	0.32 x N1 x K1 (1 x N1 x K1)	0.64 x N1 x K1 (2 x N1 x K1)
	0.64	≥19.2 (15)	5		0.64 x N1 x K1 (1 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)
	1.28	≥30.72 (24)	4		1.28 x N1 x K1 (1 x N1 x K1)	2.56 x N1 x K1 (2 x N1 x K1)
	2.56	40.96 (32)	3		20.48	40.96

NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: The number of DRX cycles in this table correspond to the DRX cycles within PTWs.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].

NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter_Relax*DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 5: The measurement shall not be performed across PTW's. In this case the measurement is performed in the next available PTW.
NOTE 6: The evaluation shall not be performed across PTW's.
NOTE 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation criterion* [2].

4.2.2.10.4 Measurements for UE fulfilling low mobility and not-at-cell edge criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- T331 timer is not running for EMR measurements on inter-frequency NR carrier, and
- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and
- both *lowMobilityEvaluation* [2] and *cellEdgeEvaluation* [2] criteria are fulfilled.

In this case the UE is not required to meet T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ as defined in table 4.2.2.4-1 or table 4.2.2.4-3 or table 4.2.2.4-4.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, the UE shall search for, measure and evaluate inter-frequency layers of higher, equal or lower priority at least every 1 hour.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE shall search for inter-frequency layers of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and K2=60.

4.2.2.11 Measurements of inter-RAT E-UTRAN cells for UE configured with relaxed measurement criterion

4.2.2.11.1 Introduction

This clause contains the requirements for measurements on inter-RAT E-UTRAN cells when the UE is configured with any of following relaxed measurement critera:

- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],
- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4.9.2 in [1],
- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4.9.1 and 5.2.4.9.2 in [1] respectively.

4.2.2.11.2 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is only configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvaluation* [2] criterion, or
- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and
- UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

The UE shall not relax measurements on inter-RAT E-UTRAN carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2.2.5 apply for this clause except that:

- The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS 38.304 [1] within $N_{EUTRAN\ carrier_Relax}$ * $T_{detect,EUTRAN_Relax}$ + $N_{EUTRAN\ carrier_Non_relax}$ * $T_{detect,EUTRAN}$. Cells which have been detected shall be measured at least every $N_{EUTRAN\ carrier_Relax}$ * $T_{measure,EUTRAN_Relax}$ + $N_{EUTRAN\ carrier_Non_relax}$ * $T_{measure,EUTRAN}$. The UE shall be able to evaluate that an already

identified inter-RAT E-UTRAN cell has met reselection criterion defined in TS 38.304 [1] within $N_{EUTRAN\ carrier_Relax} * T_{evaluate,EUTRAN_Relax} + N_{EUTRAN\ carrier_Non_relax} * T_{evaluate,EUTRAN}$.

- When T331 is running,
  - The parameter $N_{EUTRAN\ carrier_Relax}$ is the total number of inter-RAT E-UTRAN carriers not configured for idle mode CA/DC measurements.
  - The parameter $N_{EUTRAN\ carrier_Non_relax}$ is the total number of inter-RAT E-UTRAN carriers configured for idle mode CA/DC measurements.
- When T331 is not running,
  - The parameter $N_{EUTRAN\ carrier_Relax}$ is the total number of inter-RAT E-UTRAN carriers configured for mobility measurements only and the number of inter-RAT E-UTRAN carriers configured for both mobility measurement and idle mode CA/DC measurements.
  - The parameter $N_{EUTRAN\ carrier_Non_relax}$ =0.
- For a UE not configured with eDRX_IDLE, $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$ and $T_{evaluate,EUTRAN_Relax}$ are as specified in table 4.2.2.11.2-1 and $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$ and $T_{evaluate,EUTRAN}$ are as specified in table 4.2.2.5-1.
- For a UE configured with eDRX_IDLE, $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$ and $T_{evaluate,EUTRAN}$ are as specified in table 4.2.2.5-3.
- For a UE configured with eDRX_IDLE cycle up to 10.24 s, $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$ and $T_{evaluate,EUTRAN_Relax}$ are as specified in table 4.2.2.11.2-2.
- For a UE configured with eDRX_IDLE cycle greater than 10.24 s, $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$ and $T_{evaluate,EUTRAN_Relax}$ are as specified in table 4.2.2.11.2-3, provided eDRX cycle is $\leq$ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW length.

When UE is only configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvaluation* [2] criterion, and Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$,

- if the UE is configured with *highPriorityMeasRelax* [2] then the UE shall search for E-UTRA inter-RAT frequency layers of higher priority at least every $K2*T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and, K2 = 60
- otherwise, the UE is not configured with *highPriorityMeasRelax* [2] then the UE shall search for E-UTRA inter-RAT frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7.

Table 4.2.2.11.2-1: $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$, and $T_{evaluate,EUTRAN_Relax}$

DRX cycle length [s]	$T_{detect,EUTRAN_Relax}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x K1 (36 x K1)	1.28 x K1 (4 x K1)	5.12 x K1 (16 x K1)
0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
NOTE 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.			

Table 4.2.2.11.2-2: $T_{detect,\ EUTRAN_Relax}$, $T_{measure,\ EUTRAN_Relax}$ and $T_{evaluate,\ EUTRAN_Relax}$ for UE configured with eDRX_IDLE cycle upto 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	$T_{detect,\ EUTRAN_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,\ EUTRAN_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,\ EUTRAN_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x K1 (2 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x K1 (2 x K1)
NOTE 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.			

Table 4.2.2.11.2-3: $T_{detect, EUTRAN_Relax}$, $T_{measure, EUTRAN_Relax}$ and $T_{evaluate, EUTRAN_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect, EUTRAN_Relax}$ [s] (number of DRX cycles Note 3)	$T_{measure, EUTRAN_Relax}$ [s] (number of DRX cycles Note 3)	$T_{evaluate, EUTRAN_Relax}$ [s] (number of DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥3.84 (3)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1 (23 x K1)	0.32 x K1 (1 x K1)	0.64 x K1 (2 x K1)
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)
	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)
	2.56	≥15.36 (12)		2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)
NOTE 1: The number of DRX cycles in this table correspond to the DRX cycles within PTWs. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,EUTRAN_Relax*DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.					

4.2.2.11.3 Measurements for UE fulfilling with not-at-cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is only configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled the *cellEdgeEvaluation* [2] criterion, or
- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

The UE shall not relax measurements on inter-RAT E-UTRAN carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2.2.5 apply for this clause except that:

- The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS 38.304 [1] within $N_{EUTRAN\ carrier_Relax} * T_{detect,EUTRAN_Relax} + N_{EUTRAN\ carrier_Non_relax} * T_{detect,EUTRAN}$. Cells which have been detected shall be measured at least every $N_{EUTRAN\ carrier_Relax} * T_{measure,EUTRAN_Relax} + N_{EUTRAN\ carrier_Non_relax} * T_{measure,EUTRAN}$. The UE shall be able to evaluate that an already identified inter-RAT E-UTRAN cell has met reselection criterion defined in TS 38.304 [1] within $N_{EUTRAN\ carrier_Relax} * T_{evaluate,EUTRAN_Relax} + N_{EUTRAN\ carrier_Non_relax} * T_{evaluate,EUTRAN}$.
- When T331 is running,
  - The parameter $N_{EUTRAN\ carrier_Relax}$ is the total number of inter-RAT E-UTRAN carriers not configured for idle mode CA/DC measurements.
  - The parameter $N_{EUTRAN\ carrier_Non_relax}$ is the total number of inter-RAT E-UTRAN carriers configured for idle mode CA/DC measurements.
- When T331 is not running,
  - The parameter $N_{EUTRAN\ carrier_Relax}$ is the total number of inter-RAT E-UTRAN carriers configured for mobility measurements only and the number of inter-RAT E-UTRAN carriers configured for both mobility measurement and idle mode CA/DC measurements.
  - The parameter $N_{EUTRAN\ carrier_Non_relax}$ =0.

- For a UE not configured with eDRX_IDLE, $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$ and $T_{evaluate,EUTRAN_Relax}$ are as specified in table 4.2.2.11.3-1 and $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$ and $T_{evaluate,EUTRAN}$ are as specified in table 4.2.2.5-1.

- For a UE configured with eDRX_IDLE, $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$ and $T_{evaluate,EUTRAN}$ are as specified in table 4.2.2.5-3.

- For a UE configured with eDRX_IDLE cycle up to 10.24 s, $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$ and $T_{evaluate,EUTRAN_Relax}$ are as specified in table 4.2.2.11.3-2.

- For a UE configured with eDRX_IDLE cycle greater than 10.24 s, $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$ and $T_{evaluate,EUTRAN_Relax}$ are as specified in table 4.2.2.11.3-3, provided eDRX cycle is $\leq$ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW length.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ and regardless of whether the UE is configured with *highPriorityMeasRelax* [2] or not, the UE shall search for inter-RAT E-UTRAN frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7.

Table 4.2.2.11.3-1: $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$, and $T_{evaluate,EUTRAN_Relax}$

DRX cycle length [s]	$T_{detect,EUTRAN_Relax}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x K1 (36 x K1)	1.28 x K1 (4 x K1)	5.12 x K1 (16 x K1)
0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
NOTE 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.			

Table 4.2.2.11.3-2: $T_{detect,\ EUTRAN_Relax}$, $T_{measure,\ EUTRAN_Relax}$ and $T_{evaluate,\ EUTRAN_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	$T_{detect,\ EUTRAN_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,\ EUTRAN_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,\ EUTRAN_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x K1 (2 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x K1 (2 x K1)
NOTE 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.			

Table 4.2.2.11.3-3: $T_{detect,\ EUTRAN_Relax}$, $T_{measure,\ EUTRAN_Relax}$ and $T_{evaluate,\ EUTRAN_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,\ EUTRAN_Relax}$ [s] (number of DRX cycles Note 3)	$T_{measure,EUTRAN_Relax}$ [s] (number of DRX cycles Note 3)	$T_{evaluate,EUTRAN_Relax}$ [s] (number of DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥3.84 (3)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1 (23 x K1)	0.32 x K1 (1 x M2 x K1)	0.64 x K1 (2 x M2 x K1)
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)
	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)
	2.56	≥15.36 (12)		2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)
NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,EUTRAN_Relax*DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.					

4.2.2.11.4 Measurements for UE fulfilling low mobility and not-at-cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- T331 timer is not running for EMR measurements on inter-RAT E-UTRAN, and
- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and
- both *lowMobilityEvaluation* [2] and *cellEdgeEvaluation* [2] criteria are fulfilled.

In this case the UE is not required to meet $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$ and $T_{evaluate,EUTRAN}$ as defined in table 4.2.2.5-1 or table 4.2.2.5-3.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, the UE shall search for, measure and evaluate inter-RAT E-UTRAN layers of higher or lower priority at least every 1 hour.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE shall search for inter-RAT E-UTRAN of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and K2=60.

4.2.2.12 Measurements of inter-frequency NR cells with NTN carrier

This clause applies for the inter-frequency cell reselection for NTN carriers in FR1 NTN, and TN carriers if configured. The requirements in clause 4.2.2.12 apply provided that network provides SIB19 and UE is configured with one or more NTN carrier. UE is not required to ensure having a valid version of SIB19 and the exact time of reacquiring SIB19 is up to UE implementation.

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP or SS-RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{carrier_TN}$* T_{detect,NR_Inter_TN} + $\sum_{i=1}^{K_{carrier_NTN}} K_{multi_SMTC,i} * T_{detect,NR_Inter_NTN}$+T_GNSS if the UE does not support Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within $K_{carrier_TN}$* T_{detect,NR_Inter_TN} + $\sum_{i=1}^{K_{carrier_NTN}} K_{multi_SMTC,i} * T_{detect,NR_Inter_NTN_enh}$+T_GNSS if the UE supports Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection}$ = 0 provided that the reselection criteria is met by a margin of at least [5]dB in FR1 for reselections based on ranking or [6]dB in FR1 for SS-RSRP reselections based on absolute priorities or [4]dB in FR1 for SS-RSRQ reselections based on absolute priorities. The parameter $K_{carrier_TN}$ is the number of NR TN inter-frequency carriers and the parameter $K_{carrier_NTN}$ is the number of NR NTN inter-frequency carriers indicated by the serving cell.

The parameter $K_{multi_SMTC,i}$ is the scaling factor for measurement of multiple SMTCs or multiple satellites

- If SMTCs do not overlap with each other,
  - $K_{multi_{SMTC},i} = 1$, if GEO satellites are measured on the carrier;
  - $K_{multi_{SMTC},i} = \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if LEO satellites are measured on the carrier;
- If SMTCs partially overlap with each other,
  - $K_{multi_{SMTC},i} = N_{SMTC,overlap}$, if only GEO satellites are measured on the carrier;
  - $K_{multi_{SMTC},i} = \sum_{i=1}^{N_{SMTC,overlap}} \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if only LEO satellites are measured on the carrier;

where

$N_{LEO,i}$ is the number of LEO satellites to be measured within *i*-th SMTC,

$N_{LEO,simul}$ is the number of LEO satellites that UE can measure in parallel within an SMTC,$N_{SMTC,overlap}$ is the number of SMTCs that partially overlap with each other.

NOTE: for deriving $K_{multi_SMTC,i}$ for T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ of frequency layer *i*, two SMTCs are considered as overlapping if they overlap in one or more occasions during a single T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ or $T_{evaluate,NR_Inter}$.

$T_{detecet,NR_Inter_TN}$, $T_{measure,NR_Inter_TN}$ and $T_{evaluate,NR_Inter_TN}$ are the NR TN inter-frequency cell re-selection requirement defined in table 4.2.2.4-1 in TS 38.133.

T_{detect,NR_Inter_NTN}, $T_{measure,NR_Inter_NTN}$ and $T_{evaluate,NR_Inter_NTN}$ are the NR NTN inter-frequency cell re-selection requirement defined in table 4.2C.2.4-1 in TS 38.133.

$T_{detect,NR_Inter_NTN_enh}$, $T_{measure,NR_Inter_NTN_enh}$ and $T_{evaluate,NR_Inter_NTN_enh}$ are the NR NTN inter-frequency cell re-selection requirement defined in table 4.2C.2.4-2 in TS 38.133.

T_{GNSS} is TTFF (Time To First Fix) of which value is left undefined in RRM spec. If UE GNSS has been switched ON, T_{GNSS} can be assumed zero.

NOTE: The above requirement does not assume UE always performs NTN cell detection/measurement as well as TN cells.

An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.7 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,NR_Inter}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier_TN}$* $T_{measure,NR_Inter_TN}$ + $\sum_{i=1}^{K_{carrier_NTN}} K_{multi_SMTC,i} * T_{measure,NR_Inter_NTN}$+T_GNSS (see table 4.2C.2.4-1) if the UE does not support Enhanced RRM requirements for measurements in IDLE and INACTIVE mdoes defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or every $K_{carrier_TN}$* $T_{measure,NR_Inter_TN}$ + $\sum_{i=1}^{K_{carrier_NTN}} K_{multi_SMTC,i} * T_{measure,NR_Inter_NTN_enh}$+T_GNSS (see table 4.2C.2.4-2) if the UE supports Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Inter}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within $K_{carrier_TN}$* $T_{evaluate,NR_Inter_TN}$ + $\sum_{i=1}^{K_{carrier_NTN}} K_{multi_SMTC,i} * T_{evaluste,NR_Inter_NTN}$+T_GNSS if the UE does not support Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] or if the *enhanceddMeasurementLEO-r17* is not enabled, or within $K_{carrier_TN}$* $T_{evaluate,NR_Inter_TN}$ + $\sum_{i=1}^{K_{carrier_NTN}} K_{multi_SMTC,i} * T_{evaluste,NR_Inter_NTN_enh}$+T_GNSS if the UE supports Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, when $T_{reselection}$ = 0 as specified in table 4.2C.2.4-1 provided that the reselection criteria is met by

- the condition when performing equal priority reselection and

when *rangeToBestCell* is not configured:

- the cell is at least [5]dB better ranked in FR1 or.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
  - if there are multiple such cells, the cell has the highest rank among them
  - the cell is at least [5]dB better ranked in FR1 if the current serving cell is among them. or

- [6]dB in FR1 for SS-RSRP reselections based on absolute priorities or
- [4]dB in FR1 for SS-RSRQ reselections based on absolute priorities.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If $T_{reselection}$ timer has a non-zero value and the inter-frequency cell is satisfied with the reselection criteria, the UE shall evaluate this inter-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in table 4.2C.2.4-1 under the following conditions:

- $T_{SMTC_intra} = T_{SMTC_inter} = 160$ ms; where
  - T_{SMTC_intra} is the periodicity of the SMTC configured for the intra-frequency carrier if no identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier; T_{SMTC_intra} is the periodicity of the *smtc2-LP* configured for the intra-frequency carrier if at least one identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed for T_{SMTC_intra}. If the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer T_{detect, NR_intra} is expected.
  - T_{SMTC_inter} is the actual SMTC periodicity used by the inter-frequency cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the inter-frequency carrier is assumed for T_{SMTC_inter}. If the actual SSB transmission periodicity is greater than the SMTC configured for the inter-frequency carrier, longer Tdetect, NR_inter is expected.
  - SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and
  - SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion in TS 38.304 [1].

The requirements in this clause apply provided that the number of SMTCs for any inter-frequency carrier does not exceed the value indicated by *parallelSMTC-r17*, otherwise UE may select one or subset of all the configured SMTCs sequentially until all of the SMTCs can be measured, the selection of SMTCs to be used is up to UE implementation, and longer measurement delay than the corresponding measurement period specified in table 4.2C.2.4-1 and table 4.2C.2.4-2 is expected.

The requirements in this clause apply provided that the valid information for the satellite serving the target cell has been provided by the serving cell.

The requirements in this clause apply provided that SSB of neighbour cells are within the time shifted SMTC.

4.2A Cell Re-selection when subject to CCA

4.2A.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it. The requirements in clauses 4.2A.2.3, 4.2A.2.4, and 4.2A.2.6, apply when at least the target cell is on a carrier frequency subject to CCA, and the

requirements in clauses 4.2A.2.2, and 4.2A.2.5 apply when at least the camping cell is on a carrier frequency subject to CCA.

When the UE is in either *Camped Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity.

In the requirements of clause 4.2A, the exceptions for side conditions apply as follows:

- for the UE capable of CA, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2 for UE supporting CA in FR1.

In the requirements of clause 4.2A.2, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but *N* candidate SSB positions for the same SS/PBCH block index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding detection, measurement, or evaluation period, where:

- For the cell detection procedure: *N* is at least one candidate SSB position (NOTE: the one candidate SSB position for the cell detection shall not be impacted by the set of candidate SSB positions which are already being measured by the UE within the current measurement period of the on-going measurements), and

- For other procedures in clause 4.2A.2: *N* are the first two successive candidate SSB positions when two or more candidate SSB positions are configured for this SSB index in one discovery burst transmission window, otherwise N is one candidate SSB position;

Otherwise, the SMTC occasion is considered as available at the UE.

4.2A.2 Requirements

4.2A.2.1 UE measurement capability

For idle mode cell re-selection purposes, the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and

- Depending on UE capability, 7 NR inter-frequency carriers, and

- Depending on UE capability, 7 FDD E-UTRA inter-RAT carriers, and

- Depending on UE capability, 7 TDD E-UTRA inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC_IDLE state shall be capable of monitoring a total of at least 14 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD and NR layers. The inter-frequency carriers include carriers on unlicensed band and/or licensed band.

4.2A.2.2 Measurement and evaluation when subject to CCA on the serving cell

The UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every $(1+M_n)*M1*N1$ DRX cycles in N_{serv_CCA} consecutive DRX cycles; where:

- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and DRX cycle $\leq$ 0.64 second,

- otherwise M1=1.

- $N1*M_n$ is the maximum separation in DRX cycles between two measurements that are used for filtering.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2 but not separated in time by more than $N1*M_n$, where $M_n=2$.

If the UE has evaluated according to table 4.2A.2.2-1 in N_{serv_CCA} consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure on the serving cell for at least $N1*M_p$ consecutive number of DRX cycles each with at least one SMTC occasion not available at the UE, where M_p=4 when DRX cycle length <1.28 s, M_p=2 when DRX cycle length ≥1.28 s.

UE shall initiate the measurements on neighbour cells of any intra-frequency or inter-frequency if it is unable to measure on serving cell during at least consecutive $N1*M_q$ number of DRX cycles each with at least one SMTC occasion not available at the UE, regardless of any condition of $S_{nonIntraSearchP}$ and $S_{nonIntraSearchQ}$, where M_q=8 when DRX cycle length <1.28 s, M_q=4 when DRX cycle length ≥1.28 s.

If the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information for 10 s, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1].

Table 4.2A.2.2-1: N_{serv_CCA}

DRX cycle length [s]	Scaling Factor (N1)		N_{serv_CCA} [number of DRX cycles]
	FR1	FR2-2 Note 3	
0.32	1	12	N1*M1*(4+ M_s)
0.64		8	N1*M1*(4+ M_s)
1.28		6	N1*(2+M_s)
2.56		5	N1*(2+M_s)
Note 1: Ms is the number of groups of consecutive N1 DRX cycles each group with at least one SMTC occasion not available at the UE during N_{serv_CCA}, and M_s< $M_{s,max}$ Note 2: $M_{s,max}$=8 for DRX cycle length < 1.28 s, $M_{s,max}$= 4 for DRX cycle length ≥ 1.28 s. Note 3: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.			

The UE shall restart the measurements used for serving cell evaluation if M_s exceeds $M_{s,max}$.

4.2A.2.3 Measurements of intra-frequency NR cells when subject to CCA on the serving cell and target cell

The UE shall be able to identify new intra-frequency cells with CCA and perform SS-RSRP and SS-RSRQ measurements of the identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

When the intra-frequency measurement is performed on a neighbour cell in FR2-2 with shared spectrum channel access, UE shall determine the CCA mode of the neighbour cell according to *channelAccessMode2-r17*of the cell configured in *SIB3*. If *channelAccessMode2-r17* of the cell is enabled, UE shall assume that CCA applies to the cell and perform measurement accordingly, and the requirements in clause 4.2A.2.3 shall apply; otherwise, UE shall assume that CCA does not apply to the cell and perform measurement accordingly, and requirements in clause 4.2.2.3 shall apply.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS 38.304 [1] within T_{detect,NR_Intra_CCA} when that $T_{reselection}$= 0 . An intra frequency cell is considered to be detectable according to the conditions defined in annex B.1.2A for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every $T_{measure,NR_Intra_CCA}$ (see table 4.2A.2.3-1) for intra-frequency cells that are identified and measured according to the measurement rules. For a cell that is already identified, after 2 unsuccessful measurement attempts due to exceeding the maximum number of SMTC occasions not available at the UE, the UE shall detect cells on any of the configured serving- and/or non-serving carriers.

The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Intra_CCA}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined [1] within $T_{evaluate,NR_Intra_CCA}$ when $T_{reselection} = 0$ as specified in table 4.2A.2.3-1 provided that:

when *rangeToBestCell* is not configured:

- the cell is at least 3 dB better ranked in FR1 or 4.5 dB better ranked in FR2-2.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
  - if there are multiple such cells, the cell has the highest rank among them.
    - the cell is at least 3 dB better ranked in FR1 or 4.5 dB better ranked in FR2-2 if the current serving cell is among them.

When evaluating cells for reselection, the SSB side conditions apply to both serving and non-serving intra-frequency cells.

If $T_{reselection}$ timer has a non-zero value and the intra-frequency cell is satisfied with the reselection criteria, which are defined in TS 38.304 [1], the UE shall evaluate this intra-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

Table 4.2A.2.3-1: T_{detect,NR_Intra_CCA}, $T_{measure,NR_Intra_CCA}$ and $T_{evaluate,NR_Intra_CCA}$

DRX cycle length [s]	Scaling Factor (N1)		T_{detect,NR_Intra_CCA} [s] (number of DRX cycles)	$T_{measure,NR_Intra_CCA}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_CCA}$ [s] (number of DRX cycles)
	FR1	FR2-2 Note 5			
0.32	1	12	0.32xN1x(36+M_d)xM2 {(36+M_d)xN1xM2}	0.32xN1x(4+M_m)xM2 {(4+M_m)xN1 xM2	0.32xN1x(16+M_e) x M2 {(16+M_e)xN1xM2}
0.64		8	0.64xN1x(28+M_d) {(28+M_d)xN1 }	0.64xN1x(2+M_m) {(2+M_m)xN1 }	0.64xN1x(8+M_e) {(8+M_e)xN1 }
1.28		6	1.28xN1x(25+M_d) {(25+M_d)xN1 }	1.28xN1x(1+M_m) {(1+M_m)xN1 }	1.28xN1x(5+M_e) {(5+M_e)xN1 }
2.56		5	2.56xN1x(23+M_d) {(23+M_d)xN1 }	2.56xN1x(1+M_m) {(1+M_m)xN1 }	2.56xN1x(3+M_e) {(3+M_e)xN1 }

NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.
NOTE 2: Md, Mm, Me are the number of groups of consecutive N1 DRX cycles each group with at least one SMTC occasion not available during the T_{detect,NR_Intra_CCA}, $T_{measure,NR_Intra_CCA}$ and $T_{evaluate,NR_Intra_CCA}$, and $M_m \le M_{m,max}$, $M_d \le M_{d,max}$ and $M_e \le M_{e,max}$
NOTE 3: $M_{m,max}$ = 16 for DRX cycle length = 0.32 s; $M_{m,max}$ = 8 for DRX cycle length = 0.64 s; $M_{m,max}$ = 4 for DRX cycle length = 1.28 s; $M_{m,max}$ = 4 for DRX cycle length = 2.56 s.
NOTE 4: $M_{d,max} = 4*M_{m,max}$, $M_{e,max} = 2*M_{m,max}$.
NOTE 5: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.

The UE shall restart the measurements upon exceeding $M_{m,max}$, $M_{d,max}$, or $M_{e,max}$.

4.2A.2.4 Measurements of inter-frequency NR cells when subject to CCA on the target cell

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP or SS-RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

When the inter-frequency measurement is performed on a neighbour cell in FR2-2 with shared spectrum channel access, UE shall determine the CCA mode of the neighbour cell according to *channelAccessMode2-r17*of the cell configured in *SIB4*. If *channelAccessMode2-r17* of the cell is enabled, UE shall assume that CCA applies to the cell and perform measurement accordingly, and the requirements in clause 4.2A.2.4 shall apply; otherwise, UE shall assume that CCA does not apply to the cell and perform measurement accordingly, and requirements in clause 4.2.2.4 shall apply.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2A.2.7.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{carrier} * T_{detect,NR_Inter} + K_{carrier_CCA} * T_{detect,NR_Inter_CCA}$ if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection} = 0$ provided that the reselection criteria is met by a margin of at least 5 dB in FR1 or 6.5dB in FR2-2 for reselections based on ranking or 6dB in FR1 or 7.5 dB in FR2-2 for SS-RSRP reselections based on absolute priorities or 4dB in FR1 and 4 dB in FR2-2 for SS-RSRQ reselections based on absolute priorities. The parameter $K_{carrier}$ is the number of NR inter-frequency carriers on licensed band and $K_{carrier_CCA}$ is the number of NR inter-frequency carriers on unlicensed band indicated by the serving cell. An inter-frequency cell is considered to be detectable according to the conditions defined in annex B.1.3A for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,NR_Inter_CCA}$. If after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier} * T_{measure,NR_Inter} + K_{carrier_CCA} * T_{measure,NR_Inter_CCA}$ for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

For a cell that is already identified, after 2 unsuccessful measurement attempts due to exceeding the maximum number of SMTC occasions not available at the UE, the UE shall detect cells on any of the configured serving- and/or non-serving carriers.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Inter_CCA}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within $K_{carrier} * T_{evaluate,NR_Inter} + K_{carrier_CCA} * T_{evaluate,NR_Inter_CCA}$ when $T_{reselection} = 0$ as specified in table 4.2A.2.4-1 provided that the reselection criteria is met by

- the condition when performing equal priority reselection and

  when *rangeToBestCell* is not configured:

  - the cell is at least 5 dB better ranked in FR1 or 6.5 dB better ranked in FR2-2 or.

  when *rangeToBestCell* is configured:

  - the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

    - if there are multiple such cells, the cell has the highest rank among them

  - the cell is at least 5 dB better ranked in FR1 or 6.5 dB better ranked in FR2-2 if the current serving cell is among them. or

- 6 dB in FR1 or 7.5 dB in FR2-2 for SS-RSRP reselections based on absolute priorities or

- 4 dB in FR1 or 4 dB in FR2-2 for SS-RSRQ reselections based on absolute priorities.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If $T_{reselection}$ timer has a non-zero value and the inter-frequency cell is satisfied with the reselection criteria, the UE shall evaluate this inter-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in table 4.2A.2.4-1 under the following conditions:

- $T_{SMTC_intra} = T_{SMTC_inter} = 160$ ms; where T_{SMTC_intra} and T_{SMTC_inter} are periodicities of the SMTC occasions configured for the intra-frequency carrier and the inter-frequency carrier respectively, and
- SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and
- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion [1].

Table 4.2A.2.4-1: T_{detect,NR_Inter_CCA}, $T_{measure,NR_Inter_CCA}$ and $T_{evaluate,NR_Inter_CCA}$

DRX cycle length [s]	Scaling Factor (N1)		T_{detect,NR_Inter_CCA} [s] (number of DRX cycles)	$T_{measure,NR_Inter_CCA}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_CCA}$ [s] (number of DRX cycles)
	FR1	FR2-2[Note 5]			
0.32	1	12	0.32xN1x(36+M_d)xM2 {(36+M_d)xN1xM2}	0.32xN1x(4+M_m) xM2 {(4+M_m)xN1xM2}	0.32xN1x(16+M_e) x M2 {(16+M_e)xN1 xM2}
0.64		8	0.64xN1x(28+M_d) {(28+M_d)xN1 }	0.64xN1x(2+M_m) {(2+M_m)xN1 }	0.64xN1x(8+M_e) {(8+M_e)xN1 }
1.28		6	1.28xN1x(25+M_d) {(25+M_d)xN1 }	1.28xN1x(1+M_m) {(1+M_m)xN1 }	1.28xN1x(5+M_e) {(5+M_e)xN1}
2.56		5	2.56xN1x(23+M_d) {(23+M_d)xN1 }	2.56xN1x(1+M_m) {(1+M_m)xN1 }	2.56xN1x(3+M_e) {(3+M_e)xN1}

Note 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.
Note 2: Md, Mm, Me are the number of groups of consecutive N1 DRX cycles each group with at least one SMTC occasion not available at the UE during T_{detect,NR_Inter_CCA}, $T_{measure,NR_Inter_CCA}$ and $T_{evaluate,NR_Inter_CCA}$, and $M_m \le M_{m,max}$, $M_d \le M_{d,max}$ and $M_e \le M_{e,max}$
Note 3: $M_{m,max}$ = 16 for DRX cycle length = 0.32s;
$M_{m,max}$ = 8 for DRX cycle length = 0.64s;
$M_{m,max}$ = 4 for DRX cycle length = 1.28s;
$M_{m,max}$ = 4 for DRX cycle length = 2.56s
Note 4: $M_{d,max} = 4*M_{m,max}$, $M_{e,max} = 2*M_{m,max}$.
Note 5: Applies for UE supporting FR2-2 power class 2&3. For UE supporting FR2-2 power class 1, N1 = 12 for all DRX cycle length.

The UE shall restart the measurements upon exceeding $M_{m,max}$, $M_{d,max}$, or $M_{e,max}$.

4.2A.2.5 Measurements of inter-RAT E-UTRAN cells when subject to CCA on the serving cell

The requirements in clause 4.2.2.5 shall apply.

4.2A.2.6 Maximum interruption in paging reception when subject to CCA on the target cell

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed $T_{SI,CCA} + 2*T_{target_cell_SMTC_period}$.

At inter-RAT cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels for paging reception of the target inter-RAT cell. For NR to E-UTRAN cell re-selection the interruption time shall not exceed $T_{SI-EUTRA}$ + 55 ms.

T_{SI_CCA} is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for an NR cell.

$T_{SI-EUTRA}$ is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [16] for an E-UTRAN cell.

These requirements assume sufficient radio conditions, so that decoding of system information can be made without errors and does not take into account cell re-selection failure.

4.2A.2.7 General requirements

The requirements in clause 4.2.2.7 shall apply.

4.2B Cell Re-selection for RedCap

4.2B.1 Introduction

The terms SSB and SMTC in this clause apply to CD-SSB only if not specified otherwise.

The 1 Rx RedCap UE for performing the cell reselection procedure [1] applies:

- *Qrxlevmin* as the signaled value of *Qrxlevmin* [2] -1 dB.
- *Qqualmin* as the signaled value of *Qqualmin* [2] -1 dB.

4.2B.2 Requirements

4.2B.2.1 UE measurement capability for RedCap

4.2B.2.1.1 UE measurement capability for 1 Rx RedCap

For idle mode cell re-selection purposes, and for UE supporting *IdleInactiveMeasurements-r16* or *idleInactiveEUTRA-MeasReport-r16*, the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and
- Depending on UE capability, 6 NR inter-frequency carriers, and
- Depending on UE capability, 6 FDD E-UTRA inter-RAT carriers, and
- Depending on UE capability, 6 TDD E-UTRA inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC_IDLE state shall be capable of monitoring a total of at least 11 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD and NR layers.

4.2B.2.1.2 UE measurement capability for 2 Rx RedCap

The capability defined in section 4.2.2.1 apply for this section.

4.2B.2.2 Measurement and evaluation of serving cell for RedCap UE

The UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1*N1 DRX cycle; where:

- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and DRX cycle ≤ 0.64 second,

- otherwise M1=1.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least eDRX_IDLE cycle/2, if the UE is configured with eDRX cycle ≤ 10.24 s; otherwise DRX cycle/2.

If the UE is not configured with eDRX_IDLE cycle and the UE has evaluated according to table 4.2B.2.2-1 for both 1Rx RedCap and 2Rx RedCap in N_{serv_RedCap} consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities. In this case the UE shall not relax measurements on any of the neighbour cells even if UE has fulfilled the criteria for meeting the relaxed measurement requirements defined clauses 4.2B.2.9.3, 4.2B.2.9.5, 4.2B.2.9.6, 4.2B.2.9.7, 4.2B.2.10.3, 4.2B.2.10.5, 4.2B.2.10.6, 4.2B.2.10.7, 4.2B.2.11.3, 4.2B.2.11.5, 4.2B.2.11.6, and 4.2B.2.11.7.

If the UE is configured with eDRX_IDLE cycle and has evaluated according to table 4.2B.2.2-2 or table 4.2B.2.2-3, in N_{serv_RedCap} consecutive eDRX cycles if eDRX_IDLE cycle ≤ 10.24 s, otherwise N_{serv_RedCap} consecutive DRX cycles within a single PTW that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities. In this case the UE shall not relax measurements on any of the neighbour cells even if UE has fulfilled the criteria for meeting the relaxed measurement requirements defined clauses 4.2B.2.9.3, 4.2B.2.9.5, 4.2B.2.9.6, 4.2B.2.9.7, 4.2B.2.10.3, 4.2B.2.10.5, 4.2B.2.10.6, 4.2B.2.10.7, 4.2B.2.11.3, 4.2B.2.11.5, 4.2B.2.11.6, and 4.2B.2.11.7.

For the UE configured with eDRX_IDLE cycle, N_{serv_RedCap} is specified in table 4.2B.2.2-2 for 1 Rx RedCap and 2 Rx RedCap in FR1 and in table 4.2B.2.2-3 for FR2 for 2 Rx RedCap.

If the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information during the time T, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1], where

- T= 10 s if the UE is not configured with eDRX_IDLE cycle, or
- T= MAX (10 s, one eDRX_IDLE cycle) if the UE is configured with eDRX_IDLE cycle in FR1, or
- T= MAX (10 s, N1* eDRX_IDLE cycle) if the UE is configured with eDRX_IDLE cycle less than 20.48 s in FR2,
- Otherwise, T= MAX (10 s, one eDRX_IDLE cycle) if the UE is configured with eDRX_IDLE cycle no less than 20.48 s in FR2

Table 4.2B.2.2-1: N_{serv_RedCap}

DRX cycle length [s]	Scaling Factor (N1)		N_{serv_RedCap} [number of DRX cycles]
	FR1	FR2[Note1]	
0.32	1	8	M1*N1*4
0.64		5	M1*N1*4
1.28		4	N1*2
2.56		3	N1*2
NOTE 1: Applies for RedCap UE of all FR2 power class.			

Table 4.2B.2.2-2: N_{serv_RedCap} for UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1)	N_{serv_RedCap} [number of DRX or eDRX cycles [Note 3]]
2.56	N/A	N/A	1	N1*2
5.12	N/A	N/A		N1*2
10.24	N/A	N/A		N1*2
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥[1.28] (1)		N1*M1*2
	0.64	≥ 1.28 (1) (M1=1) or ≥ 2.56 (2) (M1=2)		N1*M1*2
	1.28	≥2.56 (2)		N1*2
	2.56	≥5.12 (4)		N1*2

NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured.
NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 3: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles.
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Nserv_RedCap * DRX_cycle}{1.28} \right\rceil * 1.28$.

Table 4.2B.2.2-3: N_{serv_RedCap} for UE configured with eDRX_IDLE cycle (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	N_{serv_RedCap} [number of DRX or eDRX cycles Note 4]
2.56	N/A	N/A	3	N1*2
5.12	N/A	N/A	3	N1*2
10.24	N/A	N/A	3	N1*2
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥5.12 (4)	8	N1*2
	0.64	≥6.4 (5)	5	N1*2
	1.28	≥10.24 (8)	4	N1*2
	2.56	≥15.36 (12)	3	N1*2

NOTE 1: Applies for RedCap UE of all FR2 power class.
NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles.
NOTE 5: The lower bound of PTW length is derived based on $\left\lceil \frac{Nserv_RedCap * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 6: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX_IDLE, changing eDRX_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

4.2B.2.3 Measurements of intra-frequency NR cells for RedCap UE

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP and SS-RSRQ measurements of the identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $T_{detect,NR_Intra_RedCap}$ when that $T_{reselection} = 0$. An intra frequency cell is considered to be detectable according to the conditions defined in Annex B.1.4 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every $T_{measure,NR_Intra_RedCap}$ for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Intra_RedCap}/2$.

The UE shall not consider an NR neighbour cell for cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined in TS 38.304 [1] within $T_{evaluate,NR_Intra_RedCap}$ when $T_{reselection} = 0$ provided that:

when *rangeToBestCell* is not configured:

- the cell is at least 3 dB better ranked in FR1 or 4.5 dB better ranked in FR2 for 2 Rx RedCap.

- the cell is at least 4 dB better ranked in FR1 for 1 Rx RedCap.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
  - if there are multiple such cells, the cell has the highest rank among them.
    - the cell is at least 3 dB better ranked in FR1 or 4.5 dB better ranked in FR2 if the current serving cell is among them for 2 Rx RedCap.
    - the cell is at least 4 dB better ranked in FR1 if the current serving cell is among them for 1 Rx RedCap.

The 1 Rx RedCap UE applies *absThreshSS-BlocksConsolidation* as the signalled value of *absThreshSS-BlocksConsolidation* [2] + 1 dB.

When evaluating cells for reselection, the SSB side conditions apply to both serving and non-serving intra-frequency cells.

If the $T_{reselection}$ timer has a non-zero value and an intra-frequency cell satisfies the reselection criteria defined in TS 38.304 [1], the UE shall evaluate this intra-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect this cell.

For both 1Rx RedCap and 2Rx RedCap not configured with eDRX_IDLE cycle, $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ are specified in table 4.2B.2.3-1

For 1 Rx RedCap and 2 Rx RedCap configured with eDRX_IDLE cycle, $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ are specified in table 4.2B.2.3-2 and table 4.2B.2.3-3 for FR1 and FR2 respectively, where the requirements apply provided that the serving cell is configured with eDRX_IDLE and the DRX cycle length is same in all PTWs during any of $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ when multiple PTWs are used.

Table 4.2B.2.3-1: $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$

DRX cycle length [s]	Scaling Factor (N1)		$T_{detect,NR_Intra_RedCap}$ [s] (number of DRX cycles)	$T_{measure,NR_Intra_RedCap}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_RedCap}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			
0.32	1	8	11.52 x N1 x M2 (36 x N1 x M2)	1.28 x N1 x M2 (4 x N1 x M2)	5.12 x N1 x M2 (16 x N1 x M2)
0.64		5	17.92 x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28		4	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
2.56		3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)

NOTE 1: Applies for RedCap UE of all FR2 power class.
NOTE 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer $T_{detect, NR_intra_RedCap}$ is expected.

Table 4.2B.2.3-2: $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ for UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Intra_RedCap}$ [s] (number of DRX cycles or eDRX cycles [Note 3])	$T_{measure,NR_Intra_RedCap}$ [s] (number of DRX cycles or eDRX cycles [Note 3])	$T_{evaluate,NR_Intra_RedCap}$ [s] (number of DRX cycles or eDRX cycles [Note 3])
2.56	-	-	58.88 (23)	2.56 (1)	7.68 (3)
5.12	-	-	117.76 (23)	5.12 (1)	10.24 (2)
10.24	-	-	235.52 (23)	10.24 (1)	20.48 (2)
20.48 ≤ eDRX_IDLE	0.32	≥1.28 (1)		0.32 x M2 (1 x M2)	0.64 x M2 (2 x M2)
	0.64	≥1.28 (1)		0.64 (1)	1.28 (2)
	1.28	≥2.56 (2)		1.28 (1)	2.56 (2)

cycle length ≤10485.76	2.56	≥5.12 (4)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ (23)	2.56 (1)	5.12 (2)
NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles. NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra_RedCap*DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 5: M2 = 2 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.					

Table 4.2B.2.3-3: $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ for UE configured with eDRX_IDLE cycle (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Intra_RedCap}$ [s] (number of DRX cycles or eDRX cycles Note 4)	$T_{measure,NR_Intra_RedCap}$ [s] (number of DRX cycles or eDRX cycles Note 4)	$T_{evaluate,NR_Intra_RedCap}$ [s] (number of DRX cycles or eDRX cycles Note 4)
2.56	-	-	3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
5.12	-	-	3	117.76 x N1 (23 x N1)	5.12 x N1 (1 x N1)	10.24 x N1 (2 x N1)
10.24	-	-	3	235.52 x N1 (23 x N1)	10.24 x N1 (1 x N1)	20.48 x N1 (2 x N1)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥5.12 (4)	8	$eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1)	0.32 x N1 (1 x N1)	0.64 x N1 (2 x N1)
	0.64	≥6.4 (5)	5		0.64 x N1 (1 x N1)	1.28 x N1 (2 x N1)
	1.28	≥10.24 (8)	4		1.28 x N1 (1 x N1)	2.56 x N1 (2 x N1)
	2.56	≥15.36 (12)	3		2.56 x N1 (1 x N1)	5.12 x N1 (2 x N1)
NOTE 1: Applies for RedCap UE of all power class. NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured. NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 4: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles. NOTE 5: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra_RedCap*DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 6: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.						

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX_IDLE, changing eDRX_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

4.2B.2.4 Measurements of inter-frequency NR cells for RedCap UE

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP or SS-RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the UE shall search for and measure inter-frequency layers of higher, equal, or lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{carrier_RedCap}$ * $T_{detect,NR_Inter_RedCap}$ if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection}$ = 0 provided that the reselection criteria is met

For 2 Rx RedCap by a margin of at least

5 dB in FR1 or 6.5 dB in FR2 for reselections based on ranking or

6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities or

4 dB in FR1 and 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities

For 1 Rx RedCap by a margin of at least

6 dB in FR1 for reselections based on ranking or

7 dB in FR1 for SS-RSRP reselections based on absolute priorities or

5 dB in FR1 for SS-RSRQ reselections based on absolute priorities.

The parameter $K_{carrier_RedCap}$ is the number of NR inter-frequency carriers indicated by the serving cell. An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.5 for a corresponding Band. When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,NR_Inter_RedCap}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier_RedCap} * T_{measure,NR_Inter_RedCap}$ for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Inter}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within $K_{carrier} * T_{evaluate,NR_Inter_RedCap}$ when $T_{reselection} = 0$ provided that the reselection criteria is met by

- the condition when performing equal priority reselection and
  - when *rangeToBestCell* is not configured:
    - the cell is at least 5 dB better ranked in FR1 or 6.5 dB better ranked in FR2 for 2 Rx RedCap.
    - the cell is at least 6 dB better ranked in FR1 for 1 Rx RedCap.
  - when *rangeToBestCell* is configured:
    - the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value defined in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
      - if there are multiple such cells, the cell has the highest rank among them
      - the cell is at least 5 dB better ranked in FR1 or 6.5 dB better ranked in FR2 if the current serving cell is among them, or 6 dB in FR1 or 7.5 dB in FR2 for SS-RSRP reselections based on absolute priorities for 2 Rx RedCap or 4 dB in FR1 or 4 dB in FR2 for SS-RSRQ reselections based on absolute priorities for 2 Rx RedCap.
      - the cell is at least 6 dB better ranked in FR1 if the current serving cell is among them, or 7 dB in FR1 for SS-RSRP reselections based on absolute priorities or 5 dB in FR1 for SS-RSRQ reselections based on absolute priorities for 1 Rx RedCap.

The 1 Rx RedCap UE applies *absThreshSS-BlocksConsolidation* as the signalled value of *absThreshSS-BlocksConsolidation* [2] + 1 dB.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If the $T_{reselection}$ timer has a non-zero value and the inter-frequency cell satisfies the reselection criteria, the UE shall evaluate this inter-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect this cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in table 4.2B.2.4-1 for both 1Rx RedCap and 2Rx RedCap under the following conditions:

- $T_{SMTC_intra} = T_{SMTC_inter} = 160$ ms; where T_{SMTC_intra} and T_{SMTC_inter} are periodicities of the SMTC occasions configured for the intra-frequency carrier and the inter-frequency carrier respectively, and
- SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and
- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion defined in TS 38.304 [1].

For 1 Rx RedCap and 2 Rx RedCap not configured with eDRX_IDLE cycle, $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ are specified in table 4.2B.2.4.1-1.

For 1 Rx RedCap and 2 Rx RedCap configured with eDRX_IDLE cycle, $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ are specified in table 4.2B.2.4-2 and table 4.2B.2.4-3 for FR1 and FR2 respectively. The requirements apply provided that the serving cell is configured with eDRX_IDLE and the DRX cycle length is same in all PTWs during any of $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ when multiple PTWs are used.

Table 4.2B.2.4-1: $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$

DRX cycle length [s]	Scaling Factor (N1)		$T_{detect,NR_Inter_RedCap}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_RedCap}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_RedCap}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			
0.32	1	8	11.52 x N1 x 1.5 (36 x N1 x 1.5)	1.28 x N1 x 1.5 (4 x N1 x 1.5)	5.12 x N1 x 1.5 (16 x N1 x 1.5)
0.64		5	17.92x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28		4	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
2.56		3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
NOTE 1: Applies for RedCap UE of all FR2 power class.					

Table 4.2B.2.4-2: $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ for UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Inter_RedCap}$ [s] (number of DRX cycles or eDRX cycles [Note 3])	$T_{measure,NR_Inter_RedCap}$ [s] (number of DRX cycles or eDRX cycles [Note 3])	$T_{evaluate,NR_Inter_RedCap}$ [s] (number of DRX cycles or eDRX cycles [Note 3])
2.56	-	-	58.88 (23)	2.56 (1)	7.68 (3)
5.12	-	-	117.76 (23)	5.12 (1)	10.24 (2)
10.24	-	-	235.52 (23)	10.24 (1)	20.48 (2)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥1.28 (1)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ (23)	0.32 x 1.5 (1 x 1.5)	0.64 x 1.5 (2 x 1.5)
	0.64	≥1.28 (1)		0.64 (1)	1.28 (2)
	1.28	≥2.56 (2)		1.28 (1)	2.56 (2)
	2.56	≥5.12 (4)		2.56 (1)	5.12 (2)
NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles. NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter_RedCap * DRX_cycle}{1.28} \right\rceil * 1.28$.					

Table 4.2B.2.4-3: $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ for UE configured with eDRX_IDLE cycle (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Inter_RedCap}$ [s] (number of DRX cycles or eDRX cycles Note 3)	$T_{measure,NR_Inter_RedCap}$ [s] (number of DRX cycles or eDRX cycles Note 3)	$T_{evaluate,NR_Inter_RedCap}$ [s] (number of DRX cycles or eDRX cycles Note 3)
2.56	-	-	3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
5.12	-	-	3	117.76 x N1 (23 x N1)	5.12 x N1 (1 x N1)	10.24 x N1 (2 x N1)
10.24	-	-	3	235.52 x N1 (23 x N1)	10.24 x N1 (1 x N1)	20.48 x N1 (2 x N1)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥5.12 (4)	8	$eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1)	0.32 x N1 (1 x N1)	0.64 x N1 (2 x N1)
	0.64	≥6.4 (5)	5		0.64 x N1 (1 x N1)	1.28 x N1 (2 x N1)
	1.28	≥10.24 (8)	4		1.28 x N1 (1 x N1)	2.56 x N1 (2 x N1)
	2.56	≥15.36 (12)	3		2.56 x N1 (1 x N1)	5.12 x N1 (2 x N1)

NOTE 1: Applies for RedCap UE of all power class.
NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, when PTW is configured.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56 s, 5.12 s and 10.24 s. Otherwise, number of DRX cycles.
NOTE 5: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter_RedCap * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 6: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX_IDLE, changing eDRX_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

4.2B.2.5 Measurements of inter-RAT E-UTRAN cells for RedCap UE

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-RAT E-UTRAN layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2B.2.7.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the UE shall search for and measure inter-RAT E-UTRAN layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority inter-RAT E-UTRAN layers shall be the same as that defined below for lower priority RATs.

The requirements in this clause apply to inter-RAT E-UTRAN FDD measurements and E-UTRA TDD measurements. When the measurement rules indicate that inter-RAT E-UTRAN cells are to be measured, the UE shall measure RSRP and RSRQ of detected E-UTRA cells in the neighbour frequency list at the minimum measurement rate specified in this clause.

The parameter $N_{EUTRA_carrier_RedCap}$ is the total number of configured E-UTRA carriers in the neighbour frequency list. The UE shall filter RSRP and RSRQ measurements of each measured E-UTRA cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,EUTRAN_RedCap}/2$.

An inter-RAT E-UTRA cell is considered to be detectable provided the following conditions are fulfilled:

- the same conditions as for inter-frequency RSRP measurements specified in TS 36.133 [15], annex B.1.2, are fulfilled for a corresponding Band, and

- the same conditions as for inter-frequency RSRQ measurements specified in TS 36.133 [15], annex B.1.2, are fulfilled for a corresponding Band.

- SCH conditions specified in TS 36.133 [15], annex B.1.2, are fulfilled for a corresponding Band

The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS 38.304 [1] within ($N_{EUTRA_carrier_RedCap}$) * $T_{detect,EUTRAN_RedCap}$ when Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ when $T_{reselection}$ = 0 provided that the reselection criteria are met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities for 2 Rx RedCap and at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities for 1 Rx RedCap.

Cells which have been detected shall be measured at least every ($N_{EUTRA_carrier_RedCap}$) * $T_{measure,EUTRAN_RedCap}$ when Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,EUTRAN_RedCap}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE detects on an inter-RAT E-UTRAN carrier, a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall not consider an inter-RAT E-UTRA cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For a cell that has been already detected, but has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that an already identified inter-RAT E-UTRA cell has met reselection criterion defined in TS 38.304 [1] within ($N_{EUTRA_carrier_RedCap}$) * $T_{evaluate,EUTRAN_RedCap}$ when $T_{reselection}$ = 0 provided that the reselection criteria are met by a margin of at least 6 dB for RSRP reselections based on absolute priorities or 4 dB for RSRQ reselections based on absolute priorities for 2 Rx RedCap and at least 6 dB for RSRP reselections based on absolute priorities or 4 dB for RSRQ reselections based on absolute priorities for 1 Rx RedCap.

If the $T_{reselection}$ timer has a non-zero value and the inter-RAT E-UTRA cell satisfies the reselection criteria defined in TS 38.304 [1], the UE shall evaluate this E-UTRA cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect this cell.

For 1 Rx RedCap and 2 Rx RedCap not configured with eDRX_IDLE cycle, $T_{detect,EUTRAN_RedCap}$, $T_{measure,EUTRAN_RedCap}$ and $T_{evaluate,\ E\text{-}UTRAN_RedCap}$ are specified in table 4.2B.2.5-1.

For 1 Rx RedCap and 2 Rx RedCap configured with eDRX_IDLE cycle, $T_{detect,EUTRAN_RedCap}$, $T_{measure,EUTRAN_RedCap}$ and $T_{evaluate,\ E\text{-}UTRAN_RedCap}$ are specified in table 4.2B.2.5-2, where the requirements apply provided that the serving cell is configured with eDRX_IDLE and the DRX cycle length is the same in all PTWs during any of $T_{detect,EUTRAN_RedCap}$, $T_{measure,EUTRAN_RedCap}$ and $T_{evaluate,\ E\text{-}UTRAN_RedCap}$ when multiple PTWs are used.

Table 4.2B.2.5-1: $T_{detect,EUTRAN_RedCap}$, $T_{measure,EUTRAN_RedCap}$, and $T_{evaluate,EUTRAN_RedCap}$

DRX cycle length [s]	$T_{detect,EUTRAN_RedCap}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN_RedCap}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN_RedCap}$ [s] (number of DRX cycles)
0.32	11.52 (36)	1.28 (4)	5.12 (16)
0.64	17.92 (28)	1.28 (2)	5.12 (8)
1.28	32(25)	1.28 (1)	6.4 (5)
2.56	58.88 (23)	2.56 (1)	7.68 (3)

Table 4.2B.2.5-2: $T_{detect,EUTRAN_RedCap}$, $T_{measure,EUTRAN_RedCap}$, and $T_{evaluate,EUTRAN_RedCap}$ for UE configured with eDRX_IDLE cycle

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,EUTRAN_RedCap}$ [s] (number of DRX or eDRX cycles Note 3)	$T_{measure,EUTRAN_RedCap}$ [s] (number of DRX or eDRX cycles Note 3)	$T_{evaluate,E-UTRAN_RedCap}$ [s] (number of DRX or eDRX cycles Note 3)
2.56	N/A	N/A	58.88 (23)	2.56 (1)	7.68 (3)
5.12	N/A	N/A	117.76 (23)	5.12 (1)	10.24 (2)
10.24	N/A	N/A	235.52 (23)	10.24 (1)	20.48 (2)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥1.28 (1)	$eDRX_cycle_length \times \left\lceil \frac{23}{\lceil PTW / DRX_cycle_length \rceil} \right\rceil$ (23)	0.32 (1)	0.64 (2)
	0.64	≥1.28 (1)		0.64 (1)	1.28 (2)
	1.28	≥2.56 (2)		1.28 (1)	2.56 (2)
	2.56	≥5.12 (4)		2.56 (1)	5.12 (2)

NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs, if PTW is configured.
NOTE 2: The eDRX_IDLE cycle lengths are as specified in Section 10.5.5.32 of TS 24.008 [42].
NOTE 3: Number of eDRX cycles when eDRX_IDLE cycle length equals 2.56s, 5.12s, or 10.24s; number of DRX cycles otherwise.
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,E-UTRAN_RedCap*DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 5: When eDRX=20.48s and DRX=0.32s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX_IDLE, changing eDRX_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

4.2B.2.6 Maximum interruption in paging reception for RedCap

The FDD, HD-FDD and TDD RedCap UE shall meet all applicable requirements specified in clause 4.2.2.6. In addition, when the UE is configured with eDRX_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

The 1 Rx RedCap in HD-FDD shall meet all applicable requirements specified in clause 4.2.2.6 under the following conditions

- at least 1 SSB is available at the UE in the serving cell during the last 160 ms duration.

4.2B.2.7 General requirements for RedCap

The requirements defined in section 4.2.2.7 apply for this section.

4.2B.2.8 Minimum requirement at transitions

When switching from:

low mobility scenario to stationary scenario, or

from low mobility scenario to stationary and not-at-cell-edge scenario,

the UE shall fulfill the requirements corresponding to low mobility scenario over measurement period ($T_{relaxed}$) and thereafter switch to requirements corresponding to stationary scenario, or stationary and not-at-cell-edge scenario. The measurement period, $T_{relaxed}$, is any of:

- $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$, defined in section 4.2B.2.9 for intra-frequency measurements on NR cells,
- $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ defined in section 4.2B.2.10 for inter-frequency measurements on NR cells and
- $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ defined in sections 4.2B.2.11 for inter-RAT E-UTRAN measurements.

When switching from:

stationary scenario to low mobility scenario, or

stationary and not-at-cell-edge scenario to low mobility scenario,

the UE shall fulfill the requirements corresponding to low mobility scenario upon fulfilling the switching criteria.

When switching from normal mode to low mobility scenario, stationary scenario or stationary and not-at-cell edge scenario during cell-reselection period, the UE shall fulfill the requirements corresponding to normal mode over measurement period (T_{normal}) and thereafter switch to requirements corresponding to low mobility scenario, stationary scenario or stationary and not-at-cell edge scenario. The measurement period, T_{normal}, is any of:

- $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$, defined in section 4.2B.2.3 for intra-frequency measurements on NR cells,
- $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ defined in section 4.2B.2.4 for inter-frequency measurements on NR cells and
- $T_{measure,EUTRAN_RedCap}$ and $T_{evaluate,EUTRAN_RedCap}$ defined in sections 4.2B.2.5 for inter-RAT E-UTRAN measurements.

When switching from:

low mobility scenario to normal mode, or

stationary scenario to normal mode, or

stationary and not-at-cell-edge scenario to normal mode

the UE shall fulfill the requirements corresponding to normal mode upon fulfilling the switching criteria.

No requirement is defined for multiple transitions of scenarios within one measurement period.

4.2B.2.9 Measurements of intra-frequency NR cells for UE configured with relaxed measurement criterion for RedCap

4.2B.2.9.1 Introduction

This clause contains the requirements for measurements on intra-frequency NR cells when Srxlev $\leq S_{IntraSearchP}$ or Squal $\leq S_{IntraSearchQ}$ and when the UE is configured any of the following relaxed measurement criteria:

- Relaxed measurement criterion for a stationary UE defined in clause 5.2.4.9.3 in [1],
- Relaxed measurement criteria for a stationary UE and not-at-cell edge defined in clause 5.2.4.9.4 in [1],
- Both low mobility criterion and stationary criterion as defined in clauses 5.2.4.9.1 and 5.2.4.9.3 or 5.2.4.9.4 in [1] respectively.
- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],
- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4.9.2 in [1],

- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4.9.1 and 5.2.4.9.2 in [1] respectively.

4.2B.2.9.2 Measurements for UE fulfilling stationary criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and UE is not configured with *cellEdgeEvaluationWhileStationary* [2] criterion and UE has fulfilled the *stationaryMobilityEvaluation* [2] criterion, or

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled only the *stationaryMobilityEvaluation* [2] criterion

The requirements defined in clause 4.2B.2.3 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.2-1 and table 4.2B.2.9.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE up-to 10.24 s, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.2-3 and table 4.2B.2.9.2-4 for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE greater than 10.24 s, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.2-5 and table 4.2B.2.9.2-6 for 1 Rx RedCap and 2 Rx RedCap respectively, provided eDRX_IDLE cycle is $\leq$ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

Table 4.2B.2.9.2-1: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UEs fulfilling stationary criterion for 1 Rx RedCap UE

DRX cycle length [s]	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x M2 x K3 (36 x M2 x K3)	1.28 x M2 x K3 (4 x M2 x K3)	5.12 x M2 x K3 (16 x M2 x K3)
0.64	17.92 x K3 (28 x K3)	1.28 x K3 (2 x K3)	5.12 x K3 (8 x K3)
1.28	32 x K3 (25 x K3)	1.28x K3 (1 x K3)	6.4 x K3 (5 x K3)
2.56	58.88 x K3 (23 x K3)	2.56 x K3 (1 x K3)	7.68 x K3 (3 x K3)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer $T_{detect, NR_Intra_RedCap_Relax}$ is expected.			
NOTE 2: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion.			

Table 4.2B.2.9.2-2: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UEs fulfilling stationary criterion for 2 Rx RedCap UE

DRX cycle length [s]	Scaling Factor (N1)		$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			
0.32	1	8	11.52 x N1 x M2 x K3 (36 x N1 x M2 x K3)	1.28 x N1 x M2 x K3 (4 x N1 x M2 x K3)	5.12 x N1 x M2 x K3 (16 x N1 x M2 x K3)
0.64		5	17.92 x N1 x K3 (28 x N1 x K3)	1.28 x N1 x K3 (2 x N1 x K3)	5.12 x N1 x K3 (8 x N1 x K3)
1.28		4	32 x N1 x K3 (25 x N1 x K3)	1.28 x N1 x K3 (1 x N1 x K3)	6.4 x N1 x K3 (5 x N1 x K3)
2.56		3	58.88 x N1 x K3 (23 x N1 x K3)	2.56 x N1 x K3 (1 x N1 x K3)	7.68 x N1 x K3 (3 x N1 x K3)

NOTE 1: Applies for RedCap UE of all supporting FR2 power classes.
NOTE 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer $T_{detect, NR_Intra_RedCap_Relax}$ is expected.
NOTE 3: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion.

Table 4.2B.2.9.2-3: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K3 (23 x K3)	2.56 x K3 (1 x K3)	7.68 x K3 (3 x K3)
5.12	117.76 x K3 (23 x K3)	5.12 x K3 (1 x K3)	10.24 x K3 (2 x K3)
10.24	235.52 x K3 (23 x K3)	10.24 x K3 (1 x K3)	20.48 x K3 (2 x K3)

NOTE 1: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion.

Table 4.2B.2.9.2-4: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x N1 x K3 (23 x N1 x K3)	2.56 x N1 x K3 (1 x N1 x K3)	7.68 x N1 x K3 (3 x N1 x K3)
5.12	117.76 x N1 x K3 (23 x N1 x K3)	5.12 x N1 x K3 (1 x N1 x K3)	10.24 x N1 x K3 (2 x N1 x K3)
10.24	235.52 x N1 x K3 (23 x N1 x K3)	10.24 x N1 x K3 (1 x N1 x K3)	20.48 x N1 x K3 (2 x N1 x K3)

NOTE 1: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion.

Table 4.2B.2.9.2-5: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles or eDRX cycles Note 3)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles or eDRX cycles Note 3)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles or eDRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥6.4 (5)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K3 (23 x K3)	0.32 x M2 x K3 (1 x M2 x K3)	0.64 x M2 x K3 (2 x M2 x K3)
	0.64	≥12.8 (10)		0.64 x K3 (1 x K3)	1.28 x K3 (2 x K3)
	1.28	≥15.36 (12)		1.28 x K3 (1 x K3)	2.56 x K3 (2 x K3)
	2.56	≥30.72 (24)		2.56 x K3 (1 x K3)	5.12 x K3 (2 x K3)

NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs.
NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra_RedCap_Relax * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer $T_{detect, NR_intra_RedCap_Relax}$ is expected.
NOTE 5: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion.

Table 4.2B.2.9.2-6: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles or eDRX cycles Note 3)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles or eDRX cycles Note 3)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles or eDRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥30.72 (24)	8	K3 x $eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1 x K3)	0.32 x N1 x K3 (1 x N1 x K3)	0.64 x N1 x K3 (2 x N1 x K3)
	0.64	≥38.4 (30)	5		0.64 x N1 x K3 (1 x N1 x K3)	1.28 x N1 x K3 (2 x N1 x K3)
	1.28	40.96 (32)	4		1.28 x N1 x K3 (1 x N1 x K3)	2.56 x N1 x K3 (2 x N1 x K3)
	2.56	40.96 (32)	3		20.48 (8)	40.96 (16)

NOTE 1: Applies for RedCap UE of all supporting FR2 power classes.
NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra_RedCap_Relax * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 5: The measurement shall not be performed across PTW's. In this case the measurement is performed in the next available PTW.
NOTE 6: The evaluation shall not be performed across PTW's. In this case the evaluation is performed in the next available PTW.
NOTE 7: For DRX cycle length is 0.32 s, 0.64 s, and 2.56 s, K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion. For DRX cycle length is 1.28 s, K3 = 4 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion.

4.2B.2.9.3 Measurements for a UE fulfilling not-at-cell edge while stationary criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and
- both criteria are fulfilled, and,
- less than 4 hours have passed since measurements for cell reselection were last performed

The requirements defined in this clause apply regardless of eDRX_IDLE configurations.

In this case the UE is not required to meet $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ as defined in clause 4.2B.2.3.

4.2B.2.9.3A Measurements for a UE fulfilling stationary and not-at-cell-edge criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and has also fulfilled both criteria, or
- UE is configured with *cellEdgeEvaluation* [2] criterion, *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] is not configured, and UE has fulfilled *cellEdgeEvaluation* and *stationaryMobilityEvaluation* [2] criteria

The requirements defined in clause 4.2B.2.3 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.2-1 and table 4.2B.2.9.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.
- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.2-3 and table 4.2B.2.9.2-4 for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE greater than 10.24 s, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.2-5 and table 4.2B.2.9.2-6 for 1 Rx RedCap and 2 Rx RedCap respectively, provided eDRX_IDLE cycle is $\leq$ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

4.2B.2.9.4 Measurements for a UE fulfilling low mobility and stationary criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with *lowMobilityEvaluation* [2] criterion and *stationaryMobilityEvaluation* [2] criterion, and has also fulfilled both criteria, or,

- UE is configured with *lowMobilityEvaluation* [2] criterion, *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] is not configured, and UE has fulfilled *lowMobilityEvaluation* and *stationaryMobilityEvaluation* [2] criteria

The requirements defined in clause 4.2B.2.9.2 apply for this clause.

4.2B.2.9.5 Measurements for a UE fulfilling low mobility and not-at-cell-edge while stationary criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled this criterion, and

- UE is configured with *stationaryMobilityEvaluation* [2] and *cellEdgeEvaluationWhileStationary* [2] criterion, and UE has fulfilled both criteria

The requirements defined in clause 4.2B.2.9.3 apply for this clause.

4.2B.2.9.6 Measurements for a UE fulfilling not-at-cell edge and not-at-cell edge while stationary criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled that criterion, and

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and has fulfilled both criteria.

The requirements defined in clause 4.2B.2.9.3 apply for this clause.

4.2B.2.9.7 Measurements for a UE fulfilling low mobility and not-at-cell edge criteria and not-at-cell-edge while stationary criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and has fulfilled both criteria, and

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and has fulfilled both criteria

The requirements defined in clause 4.2B.2.9.3 apply for this clause.

4.2B.2.9.8 Measurements for a UE fulfilling low mobility, not-at-cell edge and stationary criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and has fulfilled both criteria, and

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and has also fulfilled that criterion, or UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] is not configured, and UE has fulfilled *stationaryMobilityEvaluation* [2] criteria

The requirements defined in clause 4.2.2.9.4 apply for this clause.

4.2B.2.9.9 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

UE is configured with *lowMobilityEvaluation* [2] criterion and UE is not configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvaluation* [2] criterion, or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

The requirements defined in clause 4.2B.2.3 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.9-1 and table 4.2B.2.9.9-2 for 1 Rx RedCap and 2 Rx RedCap respectively.
- For a UE configured with eDRX_IDLE up-to 10.24 s, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.9-3 and table 4.2B.2.9.9-4 for 1 Rx RedCap and 2 Rx RedCap respectively.
- For a UE configured with eDRX_IDLE greater than 10.24 s, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.9-5 and table 4.2B.2.9.9-6 for 1 Rx RedCap and 2 Rx RedCap respectively, provided eDRX_IDLE cycle is $\leq$ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

Table 4.2B.2.9.9-1: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UEs fulfilling low mobility criterion for 1 Rx RedCap UE

DRX cycle length [s]	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x M2 x K1 (36 x M2 x K1)	1.28 x M2 x K1 (4 x M2 x K1)	5.12 x M2 x K1 (16 x M2 x K1)
0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.			
NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.			

Table 4.2B.2.9.9-2: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UEs fulfilling low mobility criterion for 2 Rx RedCap UE

DRX cycle length [s]	Scaling Factor (N1)		$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			
0.32	1	8	11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1)	1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1)	5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1)
0.64		5	17.92 x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)

NOTE 1: Applies for RedCap UE of all supporting FR2 power classes.
NOTE 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.
NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.

Table 4.2B.2.9.9-3: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x K1 (2 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x K1 (2 x K1)

NOTE 1: Void.
NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.

Table 4.2B.2.9.9-4: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
5.12	117.76 x N1 x K1 (23 x N1 x K1)	5.12 x N1 x K1 (1 x N1 x K1)	10.24 x N1 x K1 (2 x N1 x K1)
10.24	235.52 x N1 x K1 (23 x N1 x K1)	10.24 x N1 x K1 (1 x N1 x K1)	20.48 x N1 x K1 (2 x N1 x K1)

NOTE 1: Applies for RedCap UE of all supporting FR2 power classes.
NOTE 2: N1 = 3.
NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.

Table 4.2B.2.9.9-5: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods) Note 3	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥3.84 (3)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1 (23 x K1)	0.32 x M2 x K1 (1 x M2 x K1)	0.64 x M2 x K1 (2 x M2 x K1)
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)
	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)
	2.56	≥15.36 (12)		2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)

NOTE 1: The number of DRX cycles in this table is given for the DRX cycles within PTWs.
NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra_RedCap * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.
NOTE 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.

Table 4.2B.2.9.9-6: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s] Note 3	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods) Note 4	Scaling Factor (N1) Note1	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles or eDRX cycles Note 2)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles Note 2)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles Note 2)
20.48 ≤ eDRX_IDLE cycle length ≤ [163.84]	0.32	≥15.36 (12)	8	K1 x $eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1 x K1)	0.32 x N1 x K1 (1 x N1 x K1)	0.64 x N1 x K1 (2 x N1 x K1)
	0.64	≥19.2 (15)	5		0.64 x N1 x K1 (1 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)
	1.28	≥30.72 (24)	4		1.28 x N1 x K1 (1 x N1 x K1)	2.56 x N1 x K1 (2 x N1 x K1)
	2.56	40.96 (32)	3		20.48 (8)	40.96 (16)

NOTE 1: Applies for RedCap UE of all supporting FR2 power classes.
NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra_RedCap_Relax * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 5: The measurement shall not be performed across PTW's. In this case the measurement is performed in the next available PTW.
NOTE 6: The evaluation shall not be performed across PTW's.
NOTE 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation criterion* [2].

4.2B.2.9.10 Measurements for UE fulfilling not-at-cell edge criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

UE is configured with *cellEdgeEvaluation* [2] criterion and UE is not configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled the *cellEdgeEvaluation* [2] criterion, or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criteria and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

The requirements defined in clause 4.2B.2.3 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.10-1 and table 4.2B.2.9.10-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.10-3 and table 4.2B.2.9.10-4 for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE greater than 10.24 s, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ are as specified in table 4.2B.2.9.10-5 and table 4.2B.2.9.10-6 for 1 Rx RedCap and 2 Rx RedCap respectively, provided eDRX_IDLE cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

Table 4.2B.2.9.10-1: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UEs fulfilling not-at-cell edge criterion for 1 Rx RedCap UE

DRX cycle length [s]	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x M2 x K1 (36 x M2 x K1)	1.28 x M2 x K1 (4 x M2 x K1)	5.12 x M2 x K1 (16 x M2 x K1)
0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)

NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.
NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 4.2B.2.9.10-2: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UEs fulfilling not-at-cell edge criterion for 2 Rx RedCap UE

DRX cycle length [s]	Scaling Factor (N1)		$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			
0.32	1	8	11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1)	1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1)	5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1)
0.64		5	17.92 x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)

NOTE 1: Applies for RedCap UE of all supporting FR2 power classes.
NOTE 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.
NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 4.2B.2.9.10-3: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x K1 (2 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x K1 (2 x K1)

NOTE 1: Void.
NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 4.2B.2.9.10-4: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
5.12	117.76 x N1 x K1 (23 x N1 x K1)	5.12 x N1 x K1 (1 x N1 x K1)	10.24 x N1 x K1 (2 x N1 x K1)
10.24	235.52 x N1 x K1 (23 x N1 x K1)	10.24 x N1 x K1 (1 x N1 x K1)	20.48 x N1 x K1 (2 x N1 x K1)

NOTE 1: Void.
NOTE 2: N1 = 3 for RedCap UE of all supporting FR2 power classes.
NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 4.2B.2.9.10-5: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_elax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)

20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥3.84 (3)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1 (23 x K1)	0.32 x M2 x K1 (1 x M2 x K1)	0.64 x M2 x K1 (2 x M2 x K1)
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)
	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)
	2.56	≥15.36 (12)		2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)
NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{T_{evaluate,NR_Intra_RedCap_Relax} * DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.					

Table 4.2B.2.9.10-6: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX cycles)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥15.36 (12)	8	K1 x $eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1 x K1)	0.32 x N1 x K1 (1 x N1 x K1)	0.64 x N1 x K1 (2 x N1 x K1)
	0.64	≥19.2 (15)	5		0.64 x N1 x K1 (1 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)
	1.28	≥30.72 (24)	4		1.28 x N1 x K1 (1 x N1 x K1)	2.56 x N1 x K1 (2 x N1 x K1)
	2.56	40.96 (32)	3		20.48	40.96
NOTE 1: Applies for RedCap UE of all supporting FR2 power classes. NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs. NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{T_{evaluate,NR_Intra_RedCap_Relax} * DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 5: The measurement shall not be performed across PTW's. In this case the measurement is performed in the next available PTW. NOTE 6: The evaluation shall not be performed across PTW's. NOTE 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation criterion* [2].						

4.2B.2.9.11 Measurements for UE fulfilling low mobility and not-at-cell edge criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and
- both criteria are fulfilled, and
- less than 1 hour have passed since measurements for cell reselection were performed

In this case the UE is not required to meet $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ as defined in table 4.2B.2.3.

4.2B.2.10 Measurements of inter-frequency NR cells for UE configured with relaxed measurement criterion

4.2B.2.10.1 Introduction

This clause contains the requirements for measurements on inter-frequency NR cells when Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ and when the UE is configured any of the following relaxed measurement criteria:

- Relaxed measurement criterion for a stationary UE defined in clause 5.2.4.9.3 in [1],
- Relaxed measurement criterion for a stationary UE not at cell edge defined in clause 5.2.4.9.4 in [1],
- Both low mobility criterion and stationary criterion as defined in clause 5.2.4.9.1 and 5.2.4.9.3 or 5.2.4.9.4 in [1] respectively.
- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],
- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4. 9.2 in [1],
- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4. 9.1 and 5.2.4.9.2 in [1] respectively.

4.2B.2.10.2 Measurements for UE fulfilling stationary criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and UE is not configured with *cellEdgeEvaluationWhileStationary* [2] criterion and UE has fulfilled the *stationaryMobilityEvaluation* [2] criterion, or
- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] is not configured, and UE has fulfilled only the *stationaryMobilityEvaluation* [2] criterion.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2B.2.4 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ are as specified in table 4.2B.2.10.2-1 and table 4.2B.2.10.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.
- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ are as specified in table 4.2B.2.10.2-3 and table 4.2B.2.10.2-4 for 1 Rx RedCap and 2 Rx RedCap respectively.
- For a UE configured with eDRX_IDLE greater than 10.24 s, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ are as specified in table 4.2B.2.10.2-5 and table 4.2B.2.10.2-6 for 1 Rx RedCap and 2 Rx RedCap respectively, provided eDRX_IDLE cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-frequency layers of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and, K2 = 240.

Table 4.2B.2.10.2-1: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for 1 Rx RedCap UE

DRX cycle length [s]	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x 1.5 x K3(36 x 1.5 x K3)	1.28 x 1.5 x K3 (4 x 1.5 x K3)	5.12 x 1.5 x K3 (16 x 1.5 x K3)
0.64	17.92 x K3 (28 x K3)	1.28x K3 (2 x K3)	5.12 x K3 (8 x K3)
1.28	32 x K3 (25 x K3)	1.28x K3 (1 x K3)	6.4 x K3 (5 x K3)
2.56	58.88 x K3 (23 x K3)	2.56 x K3 (1 x K3)	7.68 x K3 (3 x K3)
NOTE 1: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion.			

Table 4.2B.2.10.2-2: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for 2 Rx RedCap UE

DRX cycle length [s]	Scaling Factor (N1)		$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			

0.32	1	8	11.52 x N1 x 1.5 x K3 (36 x N1 x 1.5 x K3)	1.28 x N1 x 1.5 x K3 (4 x N1 x 1.5 x K3)	5.12 x N1 x 1.5 x K3 (16 x N1 x 1.5 x K3)
0.64		5	17.92x N1 x K3 (28 x N1 x K3)	1.28 x N1 x K3 (2 x N1 x K3)	5.12 x N1 x K3 (8 x N1 x K3)
1.28		4	32 x N1 x K3 (25 x N1 x K3)	1.28 x N1 x K3 (1 x N1 x K3)	6.4 x N1 x K3 (5 x N1 x K3)
2.56		3	58.88 x N1 x K3 (23 x N1 x K3)	2.56 x N1 x K3 (1 x N1 x K3)	7.68 x N1 x K3 (3 x N1 x K3)
NOTE 1: Applies for RedCap UE of all supporting power class. NOTE 2: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion.					

Table 4.2B.2.10.2-3: $T_{detect,\ NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,\ NR_Inter_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle upto 10.24s (Frequency range FR1)

eDRX_IDLE cycle length [s]	$T_{detect,\ NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,\ NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,\ NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)
2.56	58.88 x K3 (23 x K3)	2.56 x K3 (1 x K3)	5.12 x K3 (2 x K3)
5.12	117.76 x K3 (23 x K3)	5.12 x K3 (1 x K3)	10.24 x K3 (2 x K3)
10.24	235.52 x K3 (23 x K3)	10.24 x K3 (1 x K3)	20.48 x K3 (2 x K3)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer $T_{detect,\ NR_Inter_RedCap_Relax}$ is expected. NOTE 2: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion.			

Table 4.2B.2.10.2-4: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of eDRX cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of eDRX cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of eDRX cycles)
2.56	58.88 x N1 x K3 (23 x N1 x K3)	2.56 x N1 x K3 (1 x N1 x K3)	7.68 x N1 x K3 (3 x N1 x K3)
5.12	117.76 x N1 x K3 (23 x N1 x K3)	5.12 x N1 x K3 (1 x N1 x K3)	10.24 x N1 x K3 (2 x N1 x K3)
10.24	235.52 x N1 x K3 (23 x N1 x K3)	10.24 x N1 x K3 (1 x N1 x K3)	20.48 x N1 x K3 (2 x N1 x K3)
NOTE 1: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion.			

Table 4.2B.2.10.2-5: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_\ Inter\ _RedCap_Relax}$ and $T_{evaluate,NR_\ Inter\ _RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s(Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥6.4 (5)	$K3 \times eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ (23 x K3)	0.32 x M2 x K3 (1 x M2 x K3)	0.64 x M2 x K3 (2 x M2 x K3)
	0.64	≥12.8 (10)		0.64 x K3 (1 x K3)	1.28 x K3 (2 x K3)
	1.28	≥15.36 (12)		1.28 x K3 (1 x K3)	2.56 x K3 (2 x K3)
	2.56	≥30.72 (4)		2.56 x K3 (1 x K3)	5.12 x K3 (2 x K3)
NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].					

NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{T_{evaluate,NR_Inter_RedCap_Relax} * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 4: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion.

Table 4.2B.2.10.2-6: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle (Frequency range FR2) for eDRX_IDLE cycle larger than 10.24 s

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles or eDRX cycles Note 3)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles or eDRX cycles Note 3)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles or eDRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥30.72 (24)	8	K3 x $eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1 x K3)	0.32 x N1 x K3 (1 x N1 x K3)	0.64 x N1 x K3 (2 x N1 x K3)
	0.64	≥38.4 (30)	5		0.64 x N1 x K3 (1 x N1 x K3)	1.28 x N1 x K3 (2 x N1 x K3)
	1.28	40.96 (32)	4		1.28 x N1 x K3 (1 x N1 x K3)	2.56 x N1 x K3 (2 x N1 x K3)
	2.56	40.96 (32)	3		20.48 (8)	40.96 (16)

NOTE 1: Applies for RedCap UE of all supporting FR2 power classes.
NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within PTWs.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{T_{evaluate,NR_Inter_RedCap_Relax} * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 5: For DRX cycle length is 0.32 s, 0.64 s and 2.56 s, K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion. For DRX cycle length is 1.28 s, K3 = 4 is the measurement relaxation factor applicable for UE fulfilling the stationaryMobilityEvaluation [2] criterion.

4.2B.2.10.3 Measurements for a UE fulfilling not-at-cell edge while stationary criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and
- both criteria are fulfilled, and
- less than 4 hours have passed since measurements for cell reselection were performed.

In this case the UE is not required to meet $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ as defined in clause 4.2B.2.4.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, the UE shall search for, measure and evaluate inter-frequency layers of higher, equal or lower priority at least every 4 hours.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE shall search for inter-frequency layers of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and K2=240.

The requirements defined in this clause apply regardless of eDRX_IDLE configurations.

4.2B.2.10.3A Measurements for a UE fulfilling stationary and not-at-cell-edge criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, has also fulfilled both criteria, or
- UE is configured with *cellEdgeEvaluation* [2] criterion and with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] is not configured, and UE has fulfilled *cellEdgeEvaluation* and *stationaryMobilityEvaluation* [2] criteria

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2B.2.4 apply for this clause except that:

- $T_{detect,NR_Inter_RedCap_Relax}$ as specified in table 4.2B.2.10.2-1 and table 4.2B.2.10.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- $T_{measure,NR_Inter_RedCap_Relax}$ as specified in table 4.2B.2.10.2-1 and table 4.2B.2.10.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- $T_{evaluate,NR_Inter_RedCap_Relax}$ as specified in table 4.2B.2.10.2-1 and table 4.2B.2.10.2-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

If the UE is configured with eDRX_IDLE cycle then the requirements in table 4.2B.2.10.2-3 and table 4.2B.2.10.2-4 are applicable for eDRX cycle up to 10.24 s in FR1 and FR2 respectively.

If the UE is configured with eDRX_IDLE cycle greater than 10.24 s in FR1 and FR2, then the requirements in table 4.2B.2.10.2-5 and table 4.2B.2.10.2-6 respectively apply provided that eDRX cycle is $\leq$ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-frequency layers of higher priority at least every $K2*T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and, K2 = 240.

4.2B.2.10.4 Measurements for a UE fulfilling low mobility and stationary criteria

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with *lowMobilityEvaluation* [2] criterion and *stationaryMobilityEvaluation* [2] criterion, and has also fulfilled both criteria, or,

- UE is configured with *lowMobilityEvaluation* [2] criterion and with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] not configured, and UE has fulfilled *lowMobilityEvaluation* and *stationaryMobilityEvaluation* [2] criteria

The requirements defined in clause 4.2B.2.10.2 apply for this clause.

4.2B.2.10.5 Measurements for a UE fulfilling low mobility and not-at-cell-edge while stationary criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled this criterion, and

- UE is configured with *stationaryMobilityEvaluation* [2] and *cellEdgeEvaluationWhileStationary* [2] criterion, and UE has fulfilled both criteria

The requirements defined in clause 4.2B.2.10.3 apply for this clause.

4.2B.2.10.6 Measurements for a UE fulfilling not-at-cell edge and not-at-cell edge while stationary criteria

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled that criterion, and

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and has fulfilled both criteria

The requirements defined in clause 4.2B.2.10.3 apply for this clause.

4.2B.2.10.7 Measurements for a UE fulfilling low mobility and not-at-cell edge criteria and not-at-cell-edge while stationary criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and has fulfilled both criteria, and

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and has fulfilled both criteria

The requirements defined in clause 4.2B.2.10.3 apply for this clause.

4.2B.2.10.8 Measurements for a UE fulfilling low mobility, not-at-cell edge and stationary criteria

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and has fulfilled both criteria, and

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and has also fulfilled that criterion, or UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] is not configured, and UE has fulfilled *stationaryMobilityEvaluation* [2] criterion.

In this case the UE is not required to meet $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ as defined in clause 4.2B.2.4.

When $S_{rxlev} \leq S_{nonIntraSearchP}$ or $S_{qual} \leq S_{nonIntraSearchQ}$, the requirements of Srxlev $\leq S_{nonIntraSearchP}$ or Squal $\leq S_{nonIntraSearchQ}$ defined in clause 4.2.2.10.4 apply for this clause.

When $S_{rxlev} > S_{nonIntraSearchP}$ and $S_{qual} > S_{nonIntraSearchQ}$, the UE the requirements of Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ defined in clause 4.2B.2.10.2 apply for this clause.

4.2B.2.10.9 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with *lowMobilityEvaluation* [2] criterion and UE is not configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvaluation* [2] criterion, or

- UE is configured with both *lowMobilityEvaluation* [2] and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

When Srxlev $\leq S_{nonIntraSearchP}$ or Squal $\leq S_{nonIntraSearchQ}$ then the requirements are defined as follows:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ are as specified in table 4.2B.2.10.9-1 and table 4.2B.2.10.9-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ are as specified in table 4.2B.2.10.9-3 and table 4.2B.2.10.9-4 for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE greater than 10.24 s, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ are as specified in table 4.2B.2.10.9-5 and table 4.2B.2.10.9-6 for 1 Rx RedCap and 2 Rx RedCap respectively, provided eDRX_IDLE cycle is $\leq$ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ and the UE is configured with *highPriorityMeasRelax* [2] then the UE shall search for inter-frequency layers of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2B.2.7 and, K2 = 60. Otherwise, if the UE is not configured with *highPriorityMeasRelax* [2] then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2B.2.7.

Table 4.2B.2.10.9-1: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter\ RedCap_Relax}$ and $T_{evaluate,NR_Inter\ RedCap_Relax}$ for UEs fulfilling low mobility criterion for 1 Rx RedCap UE

DRX cycle length [s]	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x M2 x K1 (36 x M2 x K1)	1.28 x M2 x K1 (4 x M2 x K1)	5.12 x M2 x K1 (16 x M2 x K1)
0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.			

Table 4.2B.2.10.9-2: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter\ RedCap_Relax}$ and $T_{evaluate,NR_Inter\ RedCap_Relax}$ for UEs fulfilling low mobility criterion for 2 Rx RedCap UE

DRX cycle length [s]	Scaling Factor (N1)		$T_{detect,NR_Inter\ RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter\ RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter\ RedCap_Relax}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			
0.32	1	8	11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1)	1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1)	5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1)
0.64		5	17.92 x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
NOTE 1: Applies for RedCap UE of all supporting FR2 power classes. NOTE 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.					

Table 4.2B.2.10.9-3: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x K1 (2 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x K1 (2 x K1)
NOTE 1: Void. NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.			

Table 4.2B.2.10.9-4: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
5.12	117.76 x N1 x K1 (23 x N1 x K1)	5.12 x N1 x K1 (1 x N1 x K1)	10.24 x N1 x K1 (2 x N1 x K1)
10.24	235.52 x N1 x K1 (23 x N1 x K1)	10.24 x N1 x K1 (1 x N1 x K1)	20.48 x N1 x K1 (2 x N1 x K1)
NOTE 1: Void. NOTE 2: N1 = 3 for RedCap UE of all supporting FR2 power classes. NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.			

Table 4.2B.2.10.9-5: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s(Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥3.84 (3)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1 (23 x K1)	0.32 x 1.5 x K1 (1 x M2 x K1)	0.64 x 1.5 x K1 (2 x M2 x K1)
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)
	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)
	2.56	≥15.36 (12)		2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)

NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs.
NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra_RedCap_Relax * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.

Table 4.2B.2.10.9-6: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s(Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥15.36 (12)	8	K1 x $eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1 x K1)	0.32 x N1 x K1 (1 x N1 x K1)	0.64 x N1 x K1 (2 x N1 x K1)
	0.64	≥19.2 (15)	5		0.64 x N1 x K1 (1 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)
	1.28	≥30.72 (24)	4		1.28 x N1 x K1 (1 x N1 x K1)	2.56 x N1 x K1 (2 x N1 x K1)
	2.56	40.96 (32)	3		20.48 (8)	40.96 (16)

NOTE 1: Applies for RedCap UE of all supporting FR2 power classes.
NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter_RedCap_Relax * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 5: The measurement shall not be performed across PTW's. In this case the measurement is performed in the next available PTW.
NOTE 6: The evaluation shall not be performed across PTW's.
NOTE 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation criterion* [2].

4.2B.2.10.10 Measurements for UE fulfilling not-at-cell edge criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with *cellEdgeEvaluation* [2] criterion, and UE is not configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled the *cellEdgeEvaluation* [2] criterion or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2B.2.4 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ are as specified in table 4.2B.2.10.10-1 and table 4.2B.2.10.10-2 for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ are as specified in table 4.2B.2.10.10-3 and table 4.2B.2.10.10-4 for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE greater than 10.24 s, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ are as specified in table 4.2B.2.10.10-5 and table 4.2B.2.10.10-6 for 1 Rx RedCap and 2 Rx RedCap respectively, provided eDRX_IDLE cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ and regardless of whether the UE is configured with *highPriorityMeasRelax* [2] or not, the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2B.2.7.

Table 4.2B.2.10.10-1: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter\ RedCap_Relax}$ and $T_{evaluate,NR_Inter\ RedCap_Relax}$ for UEs fulfilling low mobility criterion for 1 Rx RedCap UE

DRX cycle length [s]	$T_{detect,NR_Inter\ RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter\ RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter\ RedCap_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x 1.5 x K1 (36 x 1.5 x K1)	1.28 x 1.5 x K1 (4 x 1.5 x K1)	5.12 x 1.5 x K1 (16 x 1.5 x K1)
0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
NOTE 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.			

Table 4.2B.2.10.10-2: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter\ RedCap_Relax}$ and $T_{evaluate,NR_Inter\ RedCap_Relax}$ for UEs fulfilling low mobility criterion for 2 Rx RedCap UE

DRX cycle length [s]	Scaling Factor (N1)		$T_{detect,NR_Inter\ RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter\ RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter\ RedCap_Relax}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			
0.32	1	8	11.52 x N1 x 1.5 x K1 (36 x N1 x 1.5 x K1)	1.28 x N1 x 1.5 x K1 (4 x N1 x 1.5 x K1)	5.12 x N1 x 1.5 x K1 (16 x N1 x 1.5 x K1)
0.64		5	17.92 x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
NOTE 1: Applies for RedCap UE of all supporting FR2 power classes. NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.					

Table 4.2B.2.10.10-3: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x N1 x K1 (2 x N1 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x N1 x K1 (2 x N1 x K1)
NOTE 1: Void. NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.			

Table 4.2B.2.10.10-4: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s (Frequency range FR2)

eDRX_IDLE cycle length [s]	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
5.12	117.76 x N1 x K1 (23 x N1 x K1)	5.12 x N1 x K1 (1 x N1 x K1)	10.24 x N1 x K1 (2 x N1 x K1)
10.24	235.52 x N1 x K1 (23 x N1 x K1)	10.24 x N1 x K1 (1 x N1 x K1)	20.48 x N1 x K1 (2 x N1 x K1)

NOTE 1: Void.
NOTE 2: N1 = 3 for RedCap UE of all supporting FR2 power classes.
NOTE 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 4.2B.2.10.10-5: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥3.84 (3)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1 (23 x K1)	0.32 x M2 x K1 (1 x M2 x K1)	0.64 x M2 x K1 (2 x M2 x K1)
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)
	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)
	2.56	≥15.36 (12)		2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)

NOTE 1: The number of DRX cycles in this table correspond to the DRX cycles within PTWs.
NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra_RedCap_Relax * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 4: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer $T_{detect, NR_intra_RedCap_Relax}$ is expected.
NOTE 5: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 4.2B.2.10.10-6: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s(Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX cycles)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥15.36 (12)	8	K1 x $eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1 x K1)	0.32 x N1 x K1 (1 x N1 x K1)	0.64 x N1 x K1 (2 x N1 x K1)
	0.64	≥19.2 (15)	5		0.64 x N1 x K1 (1 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)
	1.28	≥30.72 (24)	4		1.28 x N1 x K1 (1 x N1 x K1)	2.56 x N1 x K1 (2 x N1 x K1)
	2.56	40.96 (32)	3		20.48 (8)	40.96 (16)

NOTE 1: Applies for RedCap UE of all supporting FR2 power classes.
NOTE 2: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs.
NOTE 3: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter_RedCap_Relax * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 5: The measurement shall not be performed across PTW's. In this case the measurement is performed in the next available PTW.
NOTE 6: The evaluation shall not be performed across PTW's.
NOTE 7: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation criterion* [2].

4.2B.2.10.11 Measurements for UE fulfilling low mobility and not-at-cell edge criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and has fulfilled both criteria, and
- less than 1 hour have passed since measurements for cell reselection were last performed

In this case the UE is not required to meet $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ as defined in clause 4.2B.2.4.

When Srxlev $\leq S_{nonIntraSearchP}$ or Squal $\leq S_{nonIntraSearchQ}$, the UE shall search for, measure and evaluate inter-frequency layers of higher, equal or lower priority at least every 1 hour.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE shall search for inter-frequency layers of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and K2=60.

The requirements defined in this clause apply regardless of eDRX_IDLE configurations.

4.2B.2.11 Measurements of inter-RAT E-UTRAN cells for UE configured with relaxed measurement criterion

4.2B.2.11.1 Introduction

This clause contains the requirements for measurements on inter-RAT E-UTRAN cells when the UE is configured with any of the following relaxed measurement criteria:

- Relaxed measurement criterion for a stationary UE defined in clause 5.2.4.9.3 in [1],
- Relaxed measurement criterion for a stationary UE not at cell edge defined in clause 5.2.4.9.4 in [1],
- Both low mobility criterion and stationary criterion as defined in clause 5.2.4.9.1 and 5.2.4.9.3 in [1] respectively.
- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],
- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4.9.2 in [1],
- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4.9.1 and 5.2.4.9.2 in [1] respectively.

4.2B.2.11.2 Measurements for UE fulfilling stationary criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with *stationaryMobilityEvaluation* [2] criterion and UE is not configured with *cellEdgeEvaluationWhileStationary* [2] criterion and UE has fulfilled the *stationaryMobilityEvaluation* [2] criterion, or
- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] is not configured, and UE has fulfilled only the *stationaryMobilityEvaluation* [2] criterion

When Srxlev $\leq S_{nonIntraSearchP}$ or Squal $\leq S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2B.2.5 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.2-1.
- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.2-3.

- For a UE configured with eDRX_IDLE greater than 10.24 s, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.2-4, provided eDRX_IDLE cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for E-UTRA inter-RAT frequency layers of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and, K2 = 240.

Table 4.2B.2.11.2-1: $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$, and $T_{evaluate,EUTRAN_RedCap_Relax}$

DRX cycle length [s]	$T_{detect,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x K3 (36 x K3)	1.28 x K3 (4 x K3)	5.12 x K3 (16 x K3)
0.64	17.92 x K3 (28 x K3)	1.28 x K3 (2 x K3)	5.12 x K3 (8 x K3)
1.28	32 x K3 (25 x K3)	1.28 x K3 (1 x K3)	6.4 x K3 (5 x K3)
2.56	58.88 x K3 (23 x K3)	2.56 x K3 (1 x K3)	7.68 x K3 (3 x K3)
NOTE 1: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion.			

Table 4.2B.2.11.2-2: Void

Table 4.2B.2.11.2-3: $T_{detect,E\text{-}UTRAN_RedCap_Relax}$, $T_{measure,E\text{-}UTRAN_RedCap_Relax}$ and $T_{evaluate,E\text{-}UTRAN_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s

eDRX_IDLE cycle length [s]	$T_{detect,E\text{-}UTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,E\text{-}UTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,E\text{-}UTRAN_RedCap_Relax}$ [s] (number of DRX cycles)
2.56	58.88 x K3 (23 x K3)	2.56 x K3 (1 x K3)	7.68 x K3 (3 x K3)
5.12	117.76 x K3 (23 x K3)	5.12 x K3 (1 x K3)	10.24 x K3 (2 x K3)
10.24	235.52 x K3 (23 x K3)	10.24 x K3 (1 x K3)	20.48 x K3 (2 x K3)
NOTE 1: Void NOTE 2: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion.			

Table 4.2B.2.11.2-4: $T_{detect,E\text{-}UTRAN_RedCap_Relax}$, $T_{measure,E\text{-}UTRAN_RedCap_Relax}$ and $T_{evaluate,E\text{-}UTRAN_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,E\text{-}UTRAN_RedCap_Relax}$ [s] (number of DRX cycles)
10.24 ≤ eDRX_IDLE cycle length ≤ [163.84]	0.32	≥6.4 (5)	$eDRX_cycle_length \times \left\lceil \frac{23}{\lceil PTW/DRX_cycle_length \rceil} \right\rceil$ (23 x K3)	0.32 x K3 (1 x K3)	0.64 x K3 (2 x K3)
	0.64	≥12.8 (10)		0.64 x K3 (1 x K3)	1.28 x K3 (2 x K3)
	1.28	≥15.36 (12)		1.28 x K3 (1 x K3)	2.56 x K3 (2 x K3)
	2.56	≥30.72 (4)		2.56 x K3 (1 x K3)	5.12 x K3 (2 x K3)
NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: Void. NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,E-UTRAN_RedCap_Relax*DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 5: K3 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion.					

4.2B.2.11.3 Measurements for a UE fulfilling not-at-cell edge while stationary criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and

  has fulfilled both criteria, and

- less than 4 hours have passed since measurements for cell reselection were last performed.

In this case the UE is not required to meet $T_{detect,EUTRAN_RedCap}$, $T_{measure,EUTRAN_RedCap}$ and $T_{evaluate,EUTRAN_RedCap}$ as defined in clause 4.2B.2.5.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, the UE shall search for, measure and evaluate inter-RAT E-UTRAN layers of higher or lower priority at least every 4 hours.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE shall search for inter-RAT E-UTRAN of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and K2=240.

The requirements defined in this clause apply regardless of eDRX_IDLE configurations.

4.2B.2.11.3A Measurements for a UE fulfilling stationary and not-at-cell-edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and has fulfilled both criteria, or,

- UE is configured with *cellEdgeEvaluation* [2] criterion, *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] is not configured, and UE has fulfilled *cellEdgeEvaluation* and *stationaryMobilityEvaluation* [2] criterion.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2B.2.5 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.2-1.

- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.2-2.

- For a UE configured with eDRX_IDLE greater than 10.24 s, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.2-3, provided eDRX_IDLE cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE shall search for inter-RAT E-UTRAN of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and K2=240.

4.2B.2.11.4 Measurements for a UE fulfilling low mobility and stationary criteria

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with *lowMobilityEvaluation* [2] criterion and *stationaryMobilityEvaluation* [2] criterion, and has also fulfilled both criteria, or,

- UE is configured with *lowMobilityEvaluation* [2] criterion and with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] is not configured, and UE has fulfilled *lowMobilityEvaluation* and *stationaryMobilityEvaluation* [2] criteria

The requirements defined in clause 4.2B.2.11.2 apply for this clause.

4.2B.2.11.5 Measurements for a UE fulfilling low mobility and not-at-cell-edge while stationary criteria

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled this criterion, and
- UE is configured with *stationaryMobilityEvaluation* [2] and *cellEdgeEvaluationWhileStationary* [2] criterion, and UE has fulfilled both criteria

The requirements defined in clause 4.2B.2.11.3 apply for this clause.

4.2B.2.11.6 Measurements for a UE fulfilling not-at-cell edge and not-at-cell edge while stationary criteria

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with cellEdgeEvaluation [2] criterion and UE has fulfilled that criterion, and
- UE is configured with *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and has fulfilled both criteria

The requirements defined in clause 4.2B.2.11.3 apply for this clause.

4.2B.2.11.7 Measurements for a UE fulfilling low mobility and not-at-cell edge criteria and not-at-cell-edge while stationary criteria

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and has fulfilled both criteria, and
- UE is configured with *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion, and has also fulfilled both criteria

The requirements defined in clause 4.2B.2.11.3 apply for this clause.

4.2B.2.11.8 Measurements for a UE fulfilling low mobility, not-at-cell edge and stationary criteria

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and has fulfilled both criteria, and
- UE is configured with *stationaryMobilityEvaluation* [2] criterion and has also fulfilled that criterion, or UE is configured with both *stationaryMobilityEvaluation* [2] criterion and *cellEdgeEvaluationWhileStationary* [2] criterion and *combineRelaxedMeasCondition2* [2] is not configured, and UE has fulfilled *stationaryMobilityEvaluation* [2] criteria.

In this case the UE is not required to meet $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ as defined in clause 4.2B.2.5.

When Srxlev $\leq S_{nonIntraSearchP}$ or Squal $\leq S_{nonIntraSearchQ}$, the requirements of Srxlev $\leq S_{nonIntraSearchP}$ or Squal $\leq S_{nonIntraSearchQ}$ defined in clause 4.2.2.11.4 apply for this clause.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE the requirements of Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ defined in clause 4.2B.2.11.2 apply for this clause.

4.2B.2.11.9 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with *lowMobilityEvalutation* [2] criterion and UE is not configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvalutation* [2] criterion, or

- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and

- UE has fulfilled only the *lowMobilityEvalutation* [2] criterion.

When Srxlev ≤ $S_{nonIntraSearchP}$ and Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2B.2.5 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.9-1.

- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.9-2.

- For a UE configured with eDRX_IDLE greater than 10.24 s, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.9-3, provided eDRX_IDLE cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ and the UE is configured with *highPriorityMeasRelax* [2] then the UE shall search for E-UTRA inter-RAT frequency layers of higher priority at least every K2*$T_{higher_priority_search}$ seconds where $T_{higher_priority_search}$ is described in clause 4.2B.2.7 and, K2 = 60. Otherwise, if the UE is not configured with *highPriorityMeasRelax* [2] then the UE shall search for E-UTRA inter-RAT frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2B.2.7.

Table 4.2B.2.11.9-1: $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$, and $T_{evaluate,EUTRAN_RedCap_Relax}$

DRX cycle length [s]	$T_{detect,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x K1 (36 x K1)	1.28 x K1 (4 x K1)	5.12 x K1 (16 x K1)
0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
2.56	58.88 x K1 (23 x K1)	2.56 (1 x K1)	7.68 x K1 (3 x K1)
NOTE 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvalutation* [2] criterion.			

Table 4.2B.2.11.9-2: $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,\ EUTRAN_RedCap_Relax}$ and $T_{evaluate,\ EUTRAN_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle upto 10.24s

eDRX_IDLE cycle length [s]	$T_{detect,\ EUTRAN_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,\ EUTRAN_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,\ EUTRAN_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 (1 x K1)	7.68 x K1 (3 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x K1 (2 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x K1 (2 x K1)
NOTE 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.			

Table 4.2B.2.11.9-3: $T_{detect,\ EUTRAN_RedCap_Relax}$, $T_{measure,\ EUTRAN_RedCap_Relax}$ and $T_{evaluate,\ EUTRAN_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,\ EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN_RedCap_Rela\ x}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN_RedCap_Rela\ x}$ [s] (number of DRX cycles)
20.48 ≤ eDRX_IDLE	0.32	≥3.84 (3)		0.32 x K1 (1 x K1)	0.64 x K1 (2 x K1)
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)
	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)

cycle length ≤[163.84]	2.56	≥15.36 (12)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1 (23 x K1)	2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)
NOTE 1: The number of DRX cycles in this table corresponds to the DRX cycles within PTWs.					
NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].					
NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,EUTRAN_RedCap_Relax * DRX_cycle}{1.28} \right\rceil * 1.28$.					
NOTE 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion.					

4.2B.2.11.10 Measurements for UE fulfilling with not-at-cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with *cellEdgeEvaluation* [2] criterion and UE is not configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled the *cellEdgeEvaluation* [2] criterion, or
- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and
- UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

When Srxlev ≤ $S_{nonIntraSearchP}$ and Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2B.2.5 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.10-1.
- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.10-2.
- For a UE configured with eDRX_IDLE greater than 10.24 s, $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$ and $T_{evaluate,EUTRAN_RedCap_Relax}$ are as specified in table 4.2B.2.11.10-3, provided eDRX_IDLE cycle is ≤ [163.84] sec and evaluation/measurement time with relaxation on one carrier is not greater than single PTW window length.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, then regardless of whether the UE is configured with *highPriorityMeasRelax* [2] or not, the UE shall search for inter-RAT E-UTRAN frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2B.2.7.

Table 4.2B.2.11.10-1: $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$, and $T_{evaluate,EUTRAN_RedCap_Relax}$

DRX cycle length [s]	$T_{detect,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x K1 (36 x K1)	1.28 x K1 (4 x K1)	5.12 x K1 (16 x K1)
0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
NOTE 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.			

Table 4.2B.2.11.10-2: $T_{detect,\ EUTRAN_RedCap_Relax}$, $T_{measure,\ EUTRAN_RedCap_Relax}$ and $T_{evaluate,\ EUTRAN_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle up to 10.24 s

eDRX_IDLE cycle length [s]	$T_{detect,\ EUTRAN_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{measure,\ EUTRAN_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)	$T_{evaluate,\ EUTRAN_RedCap_Relax}$ [s] (number of eDRX IDLE cycles)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	10.24 x K1 (2 x K1)
10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	20.48 x K1 (2 x K1)
NOTE 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.			

Table 4.2B.2.11.10-3: $T_{detect, EUTRAN_RedCap_Relax}$, $T_{measure, EUTRAN_RedCap_Relax}$ and $T_{evaluate, EUTRAN_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle greater than 10.24 s

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect, EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN_RedCap_Relax}$ [s] (number of DRX cycles)
20.48 ≤ eDRX_IDLE cycle length ≤[163.84]	0.32	≥3.84 (3)	$eDRX_cycle_length$ $\times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ x K1 (23 x K1)	0.32 x K1 (1 x M2 x K1)	0.64 x K1 (2 x M2 x K1)
	0.64	≥3.84 (3)		0.64 x K1 (1 x K1)	1.28 x K1 (2 x K1)
	1.28	≥7.68 (6)		1.28 x K1 (1 x K1)	2.56 x K1 (2 x K1)
	2.56	≥15.36 (12)		2.56 x K1 (1 x K1)	5.12 x K1 (2 x K1)
NOTE 1: The number of DRX cycles in this table correspond to the DRX cycles within PTWs. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra_RedCap_Relax*DRX_cycle}{1.28} \right\rceil * 1.28$. NOTE 4: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.					

4.2B.2.11.11 Measurements for UE fulfilling low mobility and not-at-cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and both criteria are fulfilled, and
- less than 1 hour have passed since measurements for cell reselection were last performed,

In this case the UE is not required to meet $T_{detect,EUTRAN_RedCap}$, $T_{measure,EUTRAN_RedCap}$ and $T_{evaluate,EUTRAN_RedCap}$ as defined in clause 4.2B.2.5.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, the UE shall search for, measure and evaluate inter-RAT E-UTRAN layers of higher, equal or lower priority at least every 1 hour.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE shall search for inter-RAT E-UTRAN layers of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and K2=60.

The requirements defined in this clause apply regardless of eDRX_IDLE configurations.

4.2C Cell Re-selection for NR UE for Satellite Access

4.2C.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in either *Camped Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency , inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency ,inter-frequency and inter-RAT cells, the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity.

For intra-frequency cell re-selection, requirements in 4.2C.2.3 apply.

For inter-frequency cell re-selection, when TN carrier is not configured, requirements specified in clause 4.2C.2.4 apply and when NTN carrier is configured, requirements specified in clause 4.2C.2.10 apply.

For inter-RAT cell re-selection, requirements in 4.2C.2.11 apply.

The requirements specified in clause 4.2C shall apply for the quasi-earth fixed cell and the earth moving cell.

The requirements specified in clause 4.2C apply to FR1-NTN and FR2-NTN as defined in TS 38.101-5 [43].

The requirements specified in clause 4.2C apply to FR2-NTN with the following assumption:

- no inter-satellite measurement is configured;
- single SAN Tx beam per radio cell in DL;
- same UE Rx beam is used for both serving and neighbouring cells which belong to the same satellite.

4.2C.2 Requirements

4.2C.2.1 UE measurement capability

For idle mode cell re-selection purposes, the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and
- Depending on UE capability, 7 NR inter-frequency carriers,and
- Depending on UE capability, 7 FDD E-UTRA inter-RAT carriers, and
- Depending on UE capability, 7 TDD E-UTRA inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC_IDLE state shall be capable of monitoring a total of at least 14 carrier frequency layers, which includes serving layers, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD and NR layers.

4.2C.2.2 Measurement and evaluation of serving cell

The UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1*N1 DRX cycle; where:

- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and DRX cycle ≤ 0.64 second and N_{SMTC} =1, upon one SMTC configured at the UE,
- M1=2.5 if SMTC periodicity (T_{SMTC}) > 20 ms and DRX cycle ≤ 0.64 second and 1<N_{SMTC} ≤ 4,
- otherwise M1=1.

Where, N_{SMTC} is the number of SMTCs configured by SAN.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2.

If the UE has evaluated according to table 4.2C.2.2-1 in N_{serv} consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

Additionally, if the UE is configured with '*t-service*' [2], the UE shall start measurements of the neighbour cells indicated by the serving cell before '*t-service*' is reached according to the requirements provided in clauses 4.2C.2.3 and 4.2C.2.4.

Also,

- if *distanceThresh* and *referenceLocation* are configured by the network [2] and the UE supports location-based measurement initiation and has obtained its location information, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell if the distance between UE and the serving cell reference location – *referenceLocation* – is larger than *distanceThresh.* The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of 50 m.
- if *distanceThresh* and *movingReferenceLocation* are configured by the network [2] and the UE supports location-based measurement initiation and has obtained its location information, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell if the distance between UE and the serving cell moving reference location – *movingReferenceLocation* – is larger than *distanceThresh.* The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of 80 m.

If the UE is not configured with'*t-Service*' [2] in the serving cell and if the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information for 10 s, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1].

If the UE is configured with '*t-Service*' in the serving cell then the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1] when any of the following conditions is fulfilled:

- If the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information within 10 s since time instance T1 provided that '*t-Service*' > T1 or
- If the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information within 10 s since the time instance '*t-Service*'.
- Where, T1 is the time instance in seconds when the UE has determined that the serving cell does not fulfil the cell selection criterion S.

Table 4.2C.2.2-1: N_{serv}

DRX cycle length [s]	Scaling Factor (N1) FR1-NTN and FR2-NTN	N_{serv} [number of DRX cycles]
0.32	1	M1*N1*4
0.64		M1*N1*4
1.28		N1*2
2.56		N1*2
NOTE 1: The UE is not required to meet the requirements for 2.56 s DRX cycle length for earth-moving LEO deployment.		

4.2C.2.3 Measurements of intra-frequency NR cells

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP and SS-RSRQ measurements of the identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

If Srxlev > $S_{IntraSearchP}$ and Squal > $S_{IntraSearchQ}$, and the distance between UE and serving cell reference location or serving cell moving reference location is smaller than *distanceThresh* if the *distanceThresh* is configured (see TS 38.304[1]) and UE has location information, then the UE is not required to perform measurement of intra-frequency.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{multi_SMTC} * T_{detect,NR_Intra}$ when that $T_{reselection}$= 0 if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within $K_{multi_SMTC} * T_{detect,NR_Intra_enh}$ if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled. An intra frequency cell is considered to be detectable according to the conditions defined in annex B.1.6 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every $K_{multi_SMTC} * T_{measure,NR_Intra}$ (see table 4.2C.2.3-1) if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or every $K_{multi_SMTC} * T_{measure,NR_Intra_enh}$ (see table 4.2C.2.3-2) if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Intra}/2$.

For UE in FR1-NTN-NTN:

If SMTCs do not overlap with each other,

- $K_{multi_SMTC} = 1$, if GEO satellites are measured on the carrier;
- $K_{multi_SMTC} = \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if LEO satellites are measured on the carrier;

- If SMTCs partially overlap with each other,
  - $K_{multi_SMTC} = N_{SMTC,overlap}$, if only GEO satellites are measured on the carrier;
  - $K_{multi_SMTC} = \sum_{i=1}^{N_{SMTC,overlap}} \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if only LEO satellites are measured on the carrier;

  Where

  - $N_{LEO,i}$ Is the number of LEO satellites to be measured within i-th SMTC,
  - $N_{LEO,simul}$ Is the number of LEO satellites that UE can measure in parallel within an SMTC,
  - $N_{SMTC,overlap}$ Is the number of SMTCs that partially overlap with each other.

  Note: for deriving K_{multi_SMTC} for T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$, two SMTCs are considered as overlapping if they overlap in one or more occasions during a single T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ or $T_{evaluate,NR_Intra}$.

For UE in FR2-NTN, $K_{multi_SMTC} = 1$.

The parameter K_{multi_SMTC} is the scaling factor for measurements of multiple SMTCs which correspond to different satellites.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined in TS 38.304 [1] within $K_{multi_SMTC} * T_{evaluate,NR_Intra}$ if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within $K_{multi_SMTC} * T_{evaluate,NR_Intra_enh}$ if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, when $T_{reselection} = 0$ as specified in table 4.2C.2.3-1 or table 4.2C.2.3-2 provided that:

- when *rangeToBestCell* is not configured:
- the cell is at least 3 dB better ranked in FR1-NTN or 4.5 dB better ranked in FR2.
- when *rangeToBestCell* is configured:
- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
  - if there are multiple such cells, the cell has the highest rank among them.
    - the cell is at least 3 dB better ranked in FR1-NTN or 4.5 dB better ranked in FR2 if the current serving cell is among them.

When evaluating cells for reselection, the SSB side conditions apply to both serving and non-serving intra-frequency cells.

If $T_{reselection}$ timer has a nonzero value and the intra-frequency cell is satisfied with the reselection criteria which are defined in TS 38.304 [1], the UE shall evaluate this intra-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

Table 4.2C.2.3-1: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$

DRX cycle length [s]	Scaling Factor (N1)	T_{detect,NR_Intra} [s] (number of DRX cycles)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles)
	FR1-NTN and FR2-NTN			
0.32	1	11.52 x N1 x M2 (36 x N1 x M2)	1.28 x N1 x M2 (4 x N1 x M2)	5.12 x N1 x M2 (16 x N1 x M2)
0.64		17.92 x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28		32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
2.56		58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)

NOTE 1: M2 = 2 if SMTC periodicity of measured intra-frequency cell > 20 ms and $1<N_{SMTC} \leq 4$ upon more than 1 SMTC configured at the UE; M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms and $N_{SMTC}=1$ upon 1 SMTC configured at the UE; otherwise M2=1. Where, N_{SMTC} is the number of SMTCs configured by SAN If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer T_{detect, NR_intra} is expected.

NOTE 2: The UE is not required to meet the requirements for 2.56 s DRX cycle length for earth-moving LEO deployment.

Table 4.2C.2.3-2: T_{detect,NR_Intra_enh}, $T_{measure,NR_Intra_enh}$ and $T_{evaluate,NR_Intra_enh}$

DRX cycle length [s]	T_{detect,NR_Intra_enh} [s] (number of DRX cycles)	$T_{measure,NR_Intra_enh}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_enh}$ [s] (number of DRX cycles)
0.32	2.56 x M2 (8 x M2) Note 1	0.32 x M3 (1 x M3) Note 1	0.96 x M4 (3 x M4) Note 1
0.64	5.12 (8)	0.64 (1)	1.92 (3)
1.28	8.96 (7)	1.28 (1)	3.84 (3)
2.56	58.88 (23)	2.56 (1)	7.68 (3)

NOTE 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 2, M3 = M4 = 2.5

If '*t-Service*' is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before the serving cell stops serving the area regardless of whether the distance condition based on serving cell reference location or serving cell moving reference location is met or the legacy Srxlev/Squal condition are met, and when to start the detection, measurement and evaluation on neighbour cells is up to UE implementation. This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for t-Service is acquired by the UE for the first time to the first slot when the cell is scheduled to stop serving the area according to the broadcasted information is less than $T_{trigger}$.

$$T_{trigger} = \max(K_{multi_SMTC} * T_{detect,NR_Intra}, K_{multi_SMTC} * K_{carrier} * T_{detect,NR_Inter}),$$

where

- $K_{carrier}$ is the number of NR inter-frequency carriers indicated by the serving cell,
- T_{detect,NR_Intra} refers to intra-frequency cell detection delay in IDLE/INACTIVE mode defined in table 4.2C.2.3-2,
- T_{detect,NR_Inter} refers to inter-frequency cell detection delay in IDLE/INACTIVE mode defined in table 4.2C.2.4-2.

The requirements in this clause apply provided that the number of SMTCs for intra-frequency carrier does not exceed the *parallelSMTC-r17*, otherwise UE may select one or subset of all the configured SMTCs sequentially for performing the measurements until all of the SMTCs can be measured. The selection of SMTCs to be used is up to UE implementation, and in this case, measurement period longer than the corresponding measurement period specified in table 4.2C.2.3-1 and table 4.2C.2.3-2 is expected.

4.2C.2.4 Measurements of inter-frequency NR cells

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP or SS-RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, and the distance between UE and serving cell reference location or serving cell moving reference location is smaller than *distanceThresh* if *distanceThresh* is configured and UE has location information, then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2C.2.9.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, or the distance between UE and serving cell reference location or serving cell moving reference location is larger than *distanceThresh* if *distanceThresh* is configured and UE has location information, then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of 50 m when *referenceLocation* is configured by the network or 80 m when *movingReferenceLocation* is configured by the network. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{carrier} * K_{multi_SMTC} * T_{detect,NR_Inter}$ if the UE does not support t *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within $K_{carrier} * K_{multi_SMTC} * T_{detect,NR_Inter_enh}$ if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection}$ = 0 provided that the reselection criteria is met by a margin of at least [5]dB in FR1-NTN for reselections based on ranking or [6]dB in FR1-NTN for SS-RSRP reselections based on absolute priorities or [4]dB in FR1-NTN for SS-RSRQ reselections based on absolute priorities. The parameter $K_{carrier}$ is the number of NR inter-frequency carriers indicated by the serving cell.

The parameter K_{multi_SMTC} is the scaling factor for measurement of multiple SMTCs or multiple satellites.

For FR2-NTN, K_{multi_SMTC} = 1.

For UE in FR1-NTN:

- If SMTCs do not overlap with each other,
  - $K_{multi_{SMTC}} = 1$, if GEO satellites are measured on the carrier;
  - $K_{multi_{SMTC}} = \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if LEO satellites are measured on the carrier;
- If SMTCs partially overlap with each other,
  - $K_{multi_{SMTC}} = N_{SMTC,overlap}$, if only GEO satellites are measured on the carrier;
  - $K_{multi_{SMTC}} = \sum_{i=1}^{N_{SMTC,overlap}} \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if only LEO satellites are measured on the carrier;

  where

  $N_{LEO,i}$ is the number of LEO satellites to be measured within i-th SMTC,

  $N_{LEO,simul}$ is the number of LEO satellites that UE can measure in parallel within an SMTC,$N_{SMTC,overlap}$ is the number of SMTCs that partially overlap with each other.

NOTE: For deriving K_{multi_SMTC} for T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ of frequency layer *j*, two SMTCs are considered as overlapping if they overlap in one or more occasions during a single T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ or $T_{evaluate,NR_Inter}$.

An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.7 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,NR_Inter}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier} * K_{multi_SMTC} * T_{measure,NR_Inter}$ (see table 4.2C.2.4-1) if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or every $K_{carrier} * K_{multi_SMTC} * T_{measure,NR_Inter_enh}$ (see table 4.2C.2.4-2) if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Inter}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within $K_{carrier} * K_{multi_SMTC} * T_{evaluate,NR_Inter}$ if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within $K_{carrier} * K_{multi_SMTC} * T_{evaluate,NR_Inter_enh}$ if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, when $T_{reselection} = 0$ as specified in table 4.2C.2.4-1 provided that the reselection criteria is met by

- the condition when performing equal priority reselection and

  when *rangeToBestCell* is not configured:

  - the cell is at least [5]dB better ranked in FR1-NTN or.

  when *rangeToBestCell* is configured:

  - the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

    - if there are multiple such cells, the cell has the highest rank among them

    - the cell is at least [5]dB better ranked in FR1-NTN if the current serving cell is among them. or

- [6]dB in FR1-NTN for SS-RSRP reselections based on absolute priorities or

- [4]dB in FR1-NTN for SS-RSRQ reselections based on absolute priorities.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If $T_{reselection}$ timer has a non-zero value and the inter-frequency cell is satisfied with the reselection criteria, the UE shall evaluate this inter-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in table 4.2C.2.4-1 under the following conditions:

- $T_{SMTC_intra} = T_{SMTC_inter} = 160$ ms; where

  - T_{SMTC_intra} is the periodicity of the SMTC configured for the intra-frequency carrier if no identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier; T_{SMTC_intra} is the periodicity of the *smtc2-LP* configured for the intra-frequency carrier if at least one identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed for T_{SMTC_intra}. If the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer T_{detect, NR_intra} is expected.

  - T_{SMTC_inter} is the actual SMTC periodicity used by the inter-frequency cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the inter-frequency carrier is assumed for

T_{SMTC_inter}. If the actual SSB transmission periodicity is greater than the SMTC configured for the inter-frequency carrier, longer T_{detect, NR_inter} is expected.

- SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and
- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion in TS 38.304 [1].

Table 4.2C.2.4-1: T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$

DRX cycle length [s]	Scaling Factor (N1) FR1-NTN and FR2-NTN	T_{detect,NR_Inter} [s] (number of DRX cycles)	$T_{measure,NR_Inter}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter}$ [s] (number of DRX cycles)
0.32	1	11.52 x N1 x 1.5 (36 x N1 x 1.5)	1.28 x N1 x 1.5 (4 x N1 x 1.5)	5.12 x N1 x 1.5 (16 x N1 x 1.5)
0.64		17.92x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28		32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
2.56		58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
NOTE 1: UE is not required to fulfil the requirements for 2.56 s DRX cycle length for earth-moving LEO deployment.				

Table 4.2C.2.4-2: T_{detect,NR_Inter_enh}, $T_{measure,NR_Inter_enh}$ and $T_{evaluate,NR_Inter_enh}$

DRX cycle length [s]	T_{detect,NR_Inter_enh} [s] (number of DRX cycles)	$T_{measure,NR_Inter_enh}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_enh}$ [s] (number of DRX cycles)
0.32	[3.2 x M2 (10 x M2)] Note 1	[0.32 x M3 ([1] x M3)] Note 1	0.96 x M4 (3 x M4) Note 1
0.64	[6.4 (10)]	[0.64 (1)]	1.92 (3)
1.28	[10.24 (8)]	1.28 (1)	3.84 (3)
2.56	58.88 (23)	2.56 (1)	7.68 (3)
NOTE 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2			

If *t-Service* is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before the serving cell stops serving the area regardless of whether the distance condition based on serving cell reference location or serving cell moving reference location or the legacy Srxlev/Squal condition are met, and when to start detection, measurement, and evaluation is up to UE implementation. This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for t-Service is acquired by the UE for the first time to the first slot when the cell is scheduled to stop serving the area according to the broadcasted information is less than $T_{trigger}$, and $T_{trigger} = \max(K_{multi_SMTC} * T_{detect,NR_Intra}, K_{multi_SMTC} * K_{carrier} * T_{detect,NR_Inter})$ when serving cell is below the search threshold, and $T_{trigger} = \max(K_{multi_SMTC} * T_{detect,NR_Intra}, N_{layer} * [60\ s])$ when serving cell is above the search threshold, where

- $K_{carrier}$ is the number of NR inter-frequency carriers indicated by the serving cell,
- N_{layer} is the total number of higher priority NR carrier frequencies broadcasted in system information,
- T_{detect,NR_Intra} refers to HST intra-frequency cell detection delay in IDLE/INACTIVE mode defined table 4.2.2.3-2,
- T_{detect,NR_Inter} refers to HST inter-frequency cell detection delay in IDLE/INACTIVE mode defined table 4.2.2.4-2.

The requirements in this clause apply provided that the number of SMTCs for any inter-frequency carrier does not exceed the values indicated by *parallelSMTC-r17*, otherwise UE may select one or subset of all the configured SMTCs sequentially until all of the SMTCs can be measured, the selection of SMTCs to be used is up to UE implementation, and longer measurement delay than the corresponding measurement period specified in table 4.2C.2.4-1 and table 4.2C.2.4-2 is expected.

The requirements in this clause apply provided that the valid information for the satellite serving the target cell has been provided by the serving cell.

The requirements in this clause apply provided that SSB of neighbour cells are within the time shifted SMTC.

4.2C.2.5 Maximum interruption in paging reception

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed $T_{SI-NR} + K*T_{target_cell_SMTC_period}$ ms.

At inter-frequency cell re-selection with TN carrier, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target inter-frequency cell for paging reception. The interruption time shall not exceed $T_{SI-NR} + K*T_{target_cell_SMTC_period}$ ms.

At inter-RAT cell re-selection with TN carrier, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels for paging reception of the target inter-RAT cell. The interruption time must not exceed $T_{SI-EUTRA}$ + 55 ms.

Where,

If the target cell belongs to the same satellite as the current one, and if the target cell is known, then K = 2.

If the target cell belongs to a different satellite than the current one and the target cell's satellite is GEO, and if the target cell is known, then K = 2.

If the target cell belongs to a different satellite than the current one and the target cell's satellite is non-GEO, then K = 5 if the target cell is known.

If the target cell is NR cell with TN carrier, then K = 2.

$T_{target_cell_SMTC_period}$ is the periodicity of the SMTC occasions configured for the target NR cell. The SMTC periodicity is according to the physical cell ID of the target cell. If the target cell is in the PCI list of *smtc2-LP*, the SMTC periodicity follows *smtc2-LP*; otherwise, the SMTC periodicity follows *smtc*.

T_{SI-NR} is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for an NR cell.

$T_{SI-EUTRA}$ is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [16] for an E-UTRAN cell.

The target cell is considered as known if it has been detectable during T_{detect,NR_Intra} or T_{detect,NR_Inter}, and the time span between SIB broadcasting cell stop time and the cell stop time is not less than Ttrigger. Otherwise, the target cell is considered as unknown, where T_{detect,NR_Intra}, T_{detect,NR_Inter} and Ttrigger are defined in clauses 4.2C.2.3 and 4.2C.2.4. A longer interruption can be expected if the target cell is unknown.

These requirements assume sufficient radio conditions, so that decoding of system information can be made without errors and does not take into account cell re-selection failure.

4.2C.2.6 Minimum requirement at transitions

The requirements in clause 4.2.2.8 apply provided that target cell's satellite is GEO.

4.2C.2.7 Measurements of intra-frequency NR cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2.2.9 apply provided that target cell's satellite is GEO.

4.2C.2.8 Measurements of inter-frequency NR cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2.2.10 apply provided that target cell's satellite is GEO.

4.2C.2.9 General requirements

The UE shall search every layer of higher priority at least every $T_{higher_priority_search}$ = (60 * N_{layers}) seconds, where N_{layers} is the total number of higher priority NR carrier frequencies broadcasted in system information.

4.2C.2.10 Measurements of inter-frequency NR cells with TN carrier

This clause applies for the inter-frequency cell re-selection for TN carriers, and NTN carriers if configured. The requirements in clause 4.2C.2.10 apply provided that network provides SIB19 and UE is configured with and one or more TN carriers.

UE is allowed to skip TN neighbour cells measurement in an area where there is no coverage of the frequency based on the provided TN cell coverage information and UE GNSS position information. Otherwise, UE shall perform TN measurement if its estimated distance to *tn-ReferenceLocation* is smaller than *tn-DistanceRadius*. The requirements apply provided that the actual distance between UE to *tn-ReferenceLocation* is smaller than *tn-DistanceRadius* – 50m.This clause considers the inter-frequency cell reselection from NTN to TN in FR1-NTN.

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP or SS-RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, and the distance between UE and serving cell reference location is smaller than *distanceThresh* if *distanceThresh* is configured and UE has location information, then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2C.2.9.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, or the distance between UE and serving cell reference location is larger than *distanceThresh* if *distanceThresh* is configured and UE has location information, then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of 50 m. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{carrier_TN}$ * T_{detect,NR_Inter_TN} + $K_{carrier} * K_{multi_SMTC} * T_{detect,NR_Inter_NTN}$ if the UE does not support Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within$K_{carrier_TN}$ * T_{detect,NR_Inter_TN} + $K_{carrier} * K_{multi_SMTC} * T_{detect,NR_Inter_NTN_enh}$ if the UE supports Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection}$ = 0 provided that the reselection criteria is met by a margin of at least [5]dB in FR1-NTN for reselections based on ranking or [6]dB in FR1-NTN for SS-RSRP reselections based on absolute priorities or [4]dB in FR1-NTN for SS-RSRQ reselections based on absolute priorities.

The parameter K_{multi_SMTC} is the scaling factor for measurement of multiple SMTCs or multiple satellites

- If SMTCs do not overlap with each other,
  - $K_{multi_{SMTC}} = 1$, if GEO satellites are measured on the carrier;
  - $K_{multi_{SMTC}} = \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if LEO satellites are measured on the carrier;
- If SMTCs partially overlap with each other,
  - $K_{multi_{SMTC}} = N_{SMTC,overlap}$, if only GEO satellites are measured on the carrier;
  - $K_{multi_{SMTC}} = \sum_{i=1}^{N_{SMTC,overlap}} \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if only LEO satellites are measured on the carrier;

where

$N_{LEO,i}$ is the number of LEO satellites to be measured within i-th SMTC,

$N_{LEO,simul}$ is the number of LEO satellites that UE can measure in parallel within an SMTC,$N_{SMTC,overlap}$ is the number of SMTCs that partially overlap with each other.

NOTE: For deriving K_{multi_SMTC} for T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ of frequency layer *j*, two SMTCs are considered as overlapping if they overlap in one or more occasions during a single T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ or $T_{evaluate,NR_Inter}$.

The parameter $K_{carrier_TN}$ is the number of NR TN inter-frequency carriers indicated by the serving cell, except for the frequency carrier where there is no coverage of that frequency based on the provide TN cell coverage information and UE GNSS position information.

T_{detect,NR_Inter_TN} ,$T_{measure,NR_Inter_TN}$ and $T_{evaluate,NR_Inter_TN}$ are the NR TN inter-frequency cell re-selection requirement defined in table 4.2.2.4-1 in TS 38.133

T_{detect,NR_Inter_NTN} ,$T_{measure,NR_Inter_NTN}$ and $T_{evaluate,NR_Inter_NTN}$ are the NR NTN inter-frequency cell re-selection requirement defined in table 4.2C.2.4-1 in TS 38.133.

$T_{detect,NR_Inter_NTN_enh}$, $T_{measure,NR_Inter_NTN_enh}$ and $T_{evaluate,NR_Inter_NTN_enh}$ are the NR NTN inter-frequency cell re-selection requirement defined in table 4.2C.2.4-2 in TS 38.133.

An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.7 for a corresponding band.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,NR_Inter}$. If, after detecting a cell in a higher priority search, it is determined that re-selection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of re-selection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier_TN} * T_{measure,NR_Inter_TN} + K_{carrier} * K_{multi_SMTC} * T_{measure,NR_Inter_NTN}$ (see table 4.2C.2.4-1) if the UE does not support Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or every $K_{carrier_TN} * T_{measure,NR_Inter_TN} + K_{carrier} * K_{multi_SMTC} * T_{measure,NR_Inter_NTN_enh}$ (see table 4.2C.2.4-2) if the UE supports Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Inter}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within $K_{carrier_TN} * T_{evaluate,NR_Inter_TN} + K_{carrier} * K_{multi_SMTC} * T_{evaluate,NR_Inter_NTN}$ if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within $K_{carrier_TN} * T_{evaluate,NR_Inter_TN} + K_{carrier} * K_{multi_SMTC} * T_{evaluate,NR_Inter_NTN_enh}$ if the UE supportsEnhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, when $T_{reselection} = 0$ as specified in table 4.2C.2.4-1 provided that the reselection criteria is met by

- the condition when performing equal priority reselection and

  when *rangeToBestCell* is not configured:

  - the cell is at least [5]dB better ranked in FR1-NTN or.

  when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

  - if there are multiple such cells, the cell has the highest rank among them

  - the cell is at least [5]dB better ranked in FR1-NTN if the current serving cell is among them. or

- [6]dB in FR1-NTN for SS-RSRP reselections based on absolute priorities or

- [4]dB in FR1-NTN for SS-RSRQ reselections based on absolute priorities.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If $T_{reselection}$ timer has a non-zero value and the inter-frequency cell is satisfied with the reselection criteria, the UE shall evaluate this inter-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in table 4.2C.2.4-1 under the following conditions:

$T_{SMTC_intra} = T_{SMTC_inter} = 160$ ms; where

- T_{SMTC_intra} is the periodicity of the SMTC configured for the intra-frequency carrier if no identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier; T_{SMTC_intra} is the periodicity of the *smtc2-LP* configured for the intra-frequency carrier if at least one identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed for T_{SMTC_intra}. If the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer T_{detect, NR_intra} is expected.

- T_{SMTC_inter} is the actual SMTC periodicity used by the inter-frequency cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the inter-frequency carrier is assumed for T_{SMTC_inter}. If the actual SSB transmission periodicity is greater than the SMTC configured for the inter-frequency carrier, longer T_{detect, NR_inter} is expected.

- SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and

- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion in TS 38.304 [1].

If *t-Service* is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before the serving cell stops serving the area regardless of whether the distance condition based on serving cell reference location or the legacy Srxlev/Squal condition are met, and when to start detection, measurement, and evaluation is up to UE implementation. This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for t-Service is acquired by the UE for the first time to the first slot when the cell is scheduled to stop serving the area according to the broadcasted information is less than $T_{trigger}$, and $T_{trigger} = \max(T_{detect,NR_Intra}, K_{carrier} * T_{detect,NR_Inter})$ when serving cell is below the search threshold, and $T_{trigger} = \max(T_{detect,NR_Intra}, N_{layer} * [60s])$ when serving cell is above the search threshold, where

- $K_{carrier}$ is the number of NR inter-frequency carriers indicated by the serving cell,

- N_{layer} is the total number of higher priority NR carrier frequencies broadcasted in system information,

- T_{detect,NR_Intra} refers to HST intra-frequency cell detection delay in IDLE/INACTIVE mode defined table 4.2.2.3-2,

- T_{detect,NR_Inter} refers to HST inter-frequency cell detection delay in IDLE/INACTIVE mode defined table 4.2.2.4-2.

The requirements in this clause apply provided that the number of SMTCs for any inter-frequency carrier does not exceed the values indicated by *parallelSMTC-r17*, otherwise UE may select one or subset of all the configured SMTCs sequentially until all of the SMTCs can be measured, the selection of SMTCs to be used is up to UE implementation, and longer measurement delay than the corresponding measurement period specified in table 4.2C.2.4-1 and table 4.2C.2.4-2 is expected.

The requirements in this clause apply provided that the valid information for the satellite serving the target cell has been provided by the serving cell.

The requirements in this clause apply provided that SSB of neighbour cells are within the time shifted SMTC.

4.2C.2.11 Measurements of inter-RAT E-UTRAN cells with TN carrier

This clause applies for the inter-RAT cell re-selection for TN carriers. The requirements in clause 4.2C.2.11 apply provided that network provides SIB19 and UE is configured with and one or more TN carriers.

UE is allowed to skip TN neighbour cells measurement in an area where there is no coverage of the frequency based on the provided TN cell coverage information and UE GNSS position information. Otherwise, UE shall perform TN measurement if its estimated distance to tn-ReferenceLocation is smaller than tn-DistanceRadius. The requirements apply provided that the actual distance between UE to tn-ReferenceLocation is smaller than tn-DistanceRadius – 50m.This clause considers the inter-RAT cell reselection from NTN to E-UTRAN TN in FR1-NTN.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-RAT E-UTRAN layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the UE shall search for and measure inter-RAT E-UTRAN layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority inter-RAT E-UTRAN layers shall be the same as that defined below for lower priority RATs.

The requirements in this clause apply to inter-RAT E-UTRAN FDD measurements and E-UTRA TDD measurements. When the measurement rules indicate that inter-RAT E-UTRAN cells are to be measured, the UE shall measure RSRP and RSRQ of detected E-UTRA cells in the neighbour frequency list at the minimum measurement rate specified in this clause.

The parameter $N_{EUTRA_carrier}$ is the number of EUTRA TN carriers indicated by the serving cell, except for the frequency carrier where there is no coverage of that frequency based on the provide TN cell coverage information and UE GNSS position information. The UE shall filter RSRP and RSRQ measurements of each measured E-UTRA cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least half the minimum specified measurement period.

An inter-RAT E-UTRA cell is considered to be detectable provided the following conditions are fulfilled:

- the same conditions as for inter-frequency RSRP measurements specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band, and
- the same conditions as for inter-frequency RSRQ measurements specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band.
- SCH conditions specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band

The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS 38.304 [1] within $N_{EUTRA_carrier}$ * $T_{detect,EUTRAN}$ when Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ when $T_{reselection}$ = 0 provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

Cells which have been detected shall be measured at least every $N_{EUTRA_carrier}$ * $T_{measure,EUTRAN}$ when Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,EUTRAN}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE detects, on an inter-RAT E-UTRAN carrier, a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall not consider an inter-RAT E-UTRA cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For a cell that has been already detected, but has not been reselected to, the filtering shall be such that a UE shall be capable of evaluating that an already identified inter-RAT E-UTRA cell has met reselection criterion defined in TS 38.304 [1] within $N_{EUTRA_carrier} * T_{evaluate,EUTRAN}$ when $T_{reselection} = 0$ as specified in table 4.2.2.5-1 provided that the reselection criteria is met by a margin of at least 6 dB for RSRP reselections based on absolute priorities or 4 dB for RSRQ reselections based on absolute priorities.

If the $T_{reselection}$ timer has a non-zero value and an inter-RAT E-UTRA cell satisfies the reselection criteria defined in TS 38.304 [1], the UE shall evaluate this E-UTRA cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect to this cell.

When the distance between the UE and tn-ReferenceLocation is larger than tn-DistanceRadius +50m, the UE is allowed to not perform measurements on the TN frequency in the corresponding area.

$T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$ and $T_{evaluate, E-UTRAN}$ are specified in table 4.2.2.5-1.

4.2C.3 Void

4.2C.4 Void

4.2D Cell Re-selection for ATG

4.2D.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in either *Camped Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency and inter-frequency cells indicated by the serving cell. For intra-frequency and inter-frequency cells, the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity.

In the requirements of clause 4.2D, the exceptions for side conditions apply as follows:

- for the UE capable of CA, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.1, for UE supporting CA in FR1.

4.2D.2 Requirements

4.2D.2.1 UE measurement capability

For idle mode cell re-selection purposes, the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and
- Depending on UE capability, 7 NR inter-frequency carriers

4.2D.2.2 Measurement and evaluation of serving cell

The UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1*N1 DRX cycle; where:

- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and DRX cycle ≤ 0.64 second,
- otherwise M1=1.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2.

If the UE has evaluated according to table 4.2D.2.2-1 in N_{serv} consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency and inter-frequency information indicated in the system information for 10 s, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1].

Table 4.2D.2.2-1: N_{serv}

DRX cycle length [s]	Scaling Factor (N1)	N_{serv} [number of DRX cycles]
	FR1	
0.32	N1 Note 1	M1*N1*4
0.64		M1*N1*4
1.28		N1*2
2.56		N1*2
NOTE 1: For ATG UEs capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.		

4.2D.2.3 Measurements of intra-frequency NR cells

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP and SS-RSRQ measurements of the identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS 38.304 [1] within T_{detect,NR_Intra} when that $T_{reselection}= 0$. An intra-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.2 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every $T_{measure,NR_Intra}$ (see table 4.2D.2.3-1) for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Intra}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined in TS 38.304 [1] within $T_{evaluate,NR_Intra}$ when $T_{reselection} = 0$ as specified in table 4.2D.2.3-1 provided that:

when *rangeToBestCell* is not configured:

- the cell is at least 3 dB better ranked in FR1.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
    - if there are multiple such cells, the cell has the highest rank among them.
        - the cell is at least 3 dB better ranked in FR1 if the current serving cell is among them.

When evaluating cells for reselection, the SSB side conditions apply to both serving and non-serving intra-frequency cells.

If $T_{reselection}$ timer has a non-zero value and the intra-frequency cell is satisfied with the reselection criteria which are defined in TS 38.304 [1], the UE shall evaluate this intra-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,\ NR_intra}$ are specified in table 4.2D.2.3-1. The requirements in this clause apply provided that SSB of neighbour cells are within SMTC window duration.

Table 4.2D.2.3-1: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$

DRX cycle length [s]	Scaling Factor (N1)	T_{detect,NR_Intra} [s] (number of DRX cycles)	$T_{measure,NR_Intra}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra}$ [s] (number of DRX cycles)
	FR1			
0.32	N1 Note 1	11.52 x N1 x M2 (36 x N1 x M2)	1.28 x N1 x M2 (4 x N1 x M2)	5.12 x N1 x M2 (16 x N1 x M2)
0.64		17.92 x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28		32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
2.56		58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)

NOTE 1: For ATG UEs capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4.
Otherwise, N1 = 1.

NOTE 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer $T_{detect,\ NR_intra}$ is expected.

4.2D.2.4 Measurements of inter-frequency NR cells

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP or SS-RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2D.2.6.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

If at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection}$ = 0 provided that the reselection criteria is met by a margin of at least 5 dB in FR1 for reselections based on ranking or 6 dB in FR1 for SS-RSRP reselections based on absolute priorities or 4 dB in FR1 for SS-RSRQ reselections based on absolute priorities, the UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{carrier}$ * T_{detect,NR_Inter_enh} as specified in table 4.2D.2.4-2 if UE indicates support of *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes for ATG* and is configured with *hs-ATG-cellReselectionSet-r18* for FR1, otherwise the UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{carrier}$ * T_{detect,NR_Inter} as specified in table 4.2D.2.4-1. The parameter $K_{carrier}$ is the number of NR inter-frequency carriers indicated by the serving cell.

An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.3 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,NR_Inter}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier}$ * $T_{measure,NR_Inter}$ for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Inter}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within $K_{carrier}$ * $T_{evaluate,NR_Inter}$ when $T_{reselection}$ = 0 as specified in table 4.2D.2.4-1, provided that the reselection criteria is met by

- the condition when performing equal priority reselection and
- when *rangeToBestCell* is not configured:
  - the cell is at least 5 dB better ranked in FR1 or.

  when *rangeToBestCell* is configured:
  - the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
    - if there are multiple such cells, the cell has the highest rank among them
    - the cell is at least 5 dB better ranked in FR1 if the current serving cell is among them. or
- 6 dB in FR1 for SS-RSRP reselections based on absolute priorities or
- 4 dB in FR1 for SS-RSRQ reselections based on absolute priorities.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If $T_{reselection}$ timer has a non-zero value and the inter-frequency cell is satisfied with the reselection criteria, the UE shall evaluate this inter-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in table 4.2D.2.4-1 and table 4.2D.2.4-2 under the following conditions:

- T_{SMTC_intra} = T_{SMTC_inter} = 160 ms; where
  - T_{SMTC_intra} is the periodicity of the SMTC configured for the intra-frequency carrier if no identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier; T_{SMTC_intra} is the periodicity of the *smtc2-LP* configured for the intra-frequency carrier if at least one identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed for T_{SMTC_intra}. If the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer T_{detect, NR_intra} is expected.
  - T_{SMTC_inter} is the actual SMTC periodicity used by the inter-frequency cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the inter-frequency carrier is assumed for T_{SMTC_inter}. If the actual SSB transmission periodicity is greater than the SMTC configured for the inter-frequency carrier, longer T_{detect, NR_inter} is expected.
- SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and
- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion in TS 38.304 [1].

The requirements in this clause apply provided that SSB of neighbour cells are within SMTC window duration.

Table 4.2D.2.4-1: T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$

DRX cycle length [s]	Scaling Factor (N1) FR1	T_{detect,NR_Inter} [s] (number of DRX cycles)	$T_{measure,NR_Inter}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter}$ [s] (number of DRX cycles)
0.32	N1 Note 1	11.52 x N1 x 1.5 (36 x N1 x 1.5)	1.28 x N1 x 1.5 (4 x N1 x 1.5)	5.12 x N1 x 1.5 (16 x N1 x 1.5)
0.64		17.92x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28		32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
2.56		58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)

NOTE 1: For ATG UEs capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4.
Otherwise, N1 = 1.

Table 4.2D.2.4-2: T_{detect,NR_Inter_enh}, for FR1 configured with *hs-ATG-cellReselectionSet-r18*

DRX cycle length [s]	Scaling Factor (N1)	T_{detect,NR_Inter_enh} [s] (number of DRX cycles)
0.32	N1 Note 1	3.2 x N1 x M2 (10 x N1 x M2) Note 2
0.64		6.4 x N1 (10 x N1)
1.28		10.24 x N1 (8 x N1)
2.56		58.88 x N1 (23 x N1)

NOTE 1: For ATG UEs capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4.
Otherwise, N1 = 1.
NOTE 2: When SMTC < = 40 ms, M2 = 1; and when SMTC > 40 ms, M2 = 1.5.

4.2D.2.5 Maximum interruption in paging reception

The requirements in clause 4.2.2.6 shall apply without considering inter-RAT cell re-selection.

4.2D.2.6 General requirements

The UE shall search every layer of higher priority at least every $T_{higher_priority_search} = (60 * N_{layers})$ seconds, where N_{layers} is the total number of higher priority NR carrier frequencies broadcasted in system information.

4.2E Cell Re-selection for NR RedCap UE with Satellite Access

4.2E.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the RedCap UE is in either *Camped Normally* state or *Camped on Any Cell* state on a cell, the RedCap UE shall attempt to detect, synchronize, and monitor intra-frequency , inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency, inter-frequency and inter-RAT cells, the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. RedCap UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the RedCap UE to limit its measurement activity.

For intra-frequency cell re-selection, requirements defined in clause 4.2E.2.3 apply.

For inter-frequency cell re-selection, when TN carrier is not configured, requirements specified in clause 4.2E.2.4 apply and when NTN carrier is configured, requirements specified in clause 4.2E.2.10 apply.

For inter-RAT cell re-selection, requirements defined in clause 4.2E.2.11 apply.

The requirements specified in clause 4.2E shall apply for the quasi-earth fixed cell and the earth moving cell.

The requirements specified in clause 4.2E apply to FR1-NTN as defined in TS 38.101-5 [43].

The terms SSB and SMTC in this clause apply to CD-SSB only if not specified otherwise.

The 1 Rx RedCap UE for performing the cell reselection procedure [1] applies:

- *Qrxlevmin* as the signaled value of *Qrxlevmin* [2] -1 dB.
- *Qqualmin* as the signaled value of *Qqualmin* [2] -1 dB.

4.2E.2 Requirements for RedCap UE with Satellite Access

4.2E.2.1 UE measurement capability for RedCap with Satellite Access

4.2E.2.1.1 UE measurement capability for 1Rx RedCap UEs

For idle mode cell re-selection purposes, the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and
- Depending on UE capability, 6 NR inter-frequency carriers, and
- Depending on UE capability, 6 FDD E-UTRAN inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC_IDLE state shall be capable of monitoring a total of at least 11 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD and NR layers.

4.2E.2.1.2 UE measurement capability for 2Rx RedCap UEs

The capability defined in section 4.2C.2.1 shall apply.

4.2E.2.2 Measurement and evaluation of serving cell for RedCap UEs

The RedCap UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1*N1 DRX cycle; where:

- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and DRX cycle ≤ 0.64 second and N_{SMTC} =1, upon one SMTC configured at the UE,
- M1=2.5 if SMTC periodicity (T_{SMTC}) > 20 ms and DRX cycle ≤ 0.64 second and 1<N_{SMTC} ≤ 4,
- otherwise M1=1.

Where, N_{SMTC} is the number of SMTCs configured by SAN.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least eDRX_IDLE cycle/2, when the RedCap UE is configured with eDRX cycle ≤10.24s; otherwise, DRX cycle/2.

If the UE is not configured with eDRX_IDLE cycle and the UE has evaluated according to table 4.2C.2.2-1 (only FR1) for both 1Rx RedCap and 2Rx RedCap in N_{serv_RedCap} consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities. In this case the UE shall not relax measurements on any of the neighbour cells even if UE has fulfilled the criteria for meeting the relaxed measurement requirements defined clauses 4.2E.2.7 and 4.2E.2.8.

If the UE is configured with eDRX_IDLE cycle and has evaluated according to table 4.2E.2.2-1, in N_{serv_RedCap} consecutive eDRX cycles, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities. In this case the UE shall not relax measurements on any of the neighbour cells even if UE has fulfilled the criteria for meeting the relaxed measurement requirements defined clauses 4.2E.2.7 and 4.2E.2.8.

For the UE configured with eDRX_IDLE cycle, N_{serv_RedCap} is specified in table 4.2E.2.2-1 for 1 Rx RedCap and 2 Rx RedCap in FR1.Additionally, if the UE is configured with '*t-service*' [2], the UE shall start measurements of the

neighbour cells indicated by the serving cell before '*t-service*' is reached according to the requirements provided in clauses 4.2E.2.3 and 4.2E.2.4.
Also,

- if *distanceThresh* and *referenceLocation* are configured by the network [2] and the UE supports location-based measurement initiation and has obtained its location information, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell if the distance between UE and the serving cell reference location – *referenceLocation* – is larger than *distanceThresh.* The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of 50 m.

- if *distanceThresh* and *movingReferenceLocation* are configured by the network [2] and the UE supports location-based measurement initiation and has obtained its location information, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell if the distance between UE and the serving cell moving reference location – *movingReferenceLocation* – is larger than *distanceThresh.* The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of 80 m.

If the UE is not configured with'*t-Service*' [2] in the serving cell and if the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information during the time T, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1], where

- T= 10 s if the UE is not configured with eDRX_IDLE cycle, or

- T= MAX (10 s, one eDRX_IDLE cycle) if the UE is configured with eDRX_IDLE cycle in FR1

If the UE is configured with '*t-Service*' in the serving cell then the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1] when any of the following conditions is fulfilled:

- If the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information within T since time instance T1 provided that '*t-Service*' > T1 or

- If the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information within T since the time instance '*t-Service*'.

- Where, T1 is the time instance in seconds when the UE has determined that the serving cell does not fulfil the cell selection criterion S.

Table 4.2E.2.2-1: N_{serv_RedCap} for UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1)	N_{serv_RedCap} [number of eDRX cycles]
2.56	N/A	N/A	1	N1*2
5.12	N/A	N/A		N1*2
10.24	N/A	N/A		N1*2
NOTE 1: Void. NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: Void. NOTE 4: Void				

4.2E.2.3 Measurements of intra-frequency NR cells for RedCap UE

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP and SS-RSRQ measurements of the identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

If Srxlev > $S_{IntraSearchP}$ and Squal > $S_{IntraSearchQ}$, and the distance between UE and serving cell reference location or serving cell moving reference location is smaller than *distanceThresh* if the *distanceThresh* is configured (see TS 38.304[1]) and UE has location information, then the UE is not required to perform measurement of intra-frequency.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS 38.304 [1] within K_{multi_SMTC} * T_{detect,NR_Intra} when that $T_{reselection}$= 0 if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within K_{multi_SMTC} * T_{detect,NR_Intra_enh} if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled. An intra-frequency cell is considered to be detectable according to the conditions defined in annex B.1.6 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every K_{multi_SMTC} * $T_{measure,NR_Intra}$ if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or every K_{multi_SMTC} * $T_{measure,NR_Intra_enh}$ if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, for intra-frequency cells that are identified and measured according to the measurement rules.The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Intra}$/2. The UE shall not consider an NR neighbour cell for cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

The parameter K_{multi_SMTC} is the scaling factor for measurements of multiple SMTCs or multiple satellites, which refers to clause 4.2C.2.3.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined in TS 38.304 [1] within K_{multi_SMTC} * $T_{evaluate,NR_Intra}$ if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within K_{multi_SMTC} * $T_{evaluate,NR_Intra_enh}$ if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17* is enabled, when $T_{reselection}$ = 0 as specified in table 4.2C.2.3-1(with FR1), table 4.2E.2.3-1 or table 4.2E.2.3-2 provided that:

- when *rangeToBestCell* is not configured:
- the cell is at least 3 dB better ranked in FR1 for 2Rx RedCap, or
- the cell is at least 4 dB better ranked in FR1 for 1Rx RedCap.
- when *rangeToBestCell* is configured:
- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
    - if there are multiple such cells, the cell has the highest rank among them.
        - the cell is at least 3 dB better ranked in FR1 if the current serving cell is among them for 2 Rx RedCap.
        - the cell is at least 4 dB better ranked in FR1 if the current serving cell is among them for 1 Rx RedCap.

The 1 Rx RedCap UE applies *absThreshSS-BlocksConsolidation* as the signalled value of *absThreshSS-BlocksConsolidation* [2] + 1 dB.

When evaluating cells for reselection, the SSB side conditions apply to both serving and non-serving intra-frequency cells.

If $T_{reselection}$ timer has a nonzero value and the intra-frequency cell is satisfied with the reselection criteria which are defined in TS 38.304 [1], the UE shall evaluate this intra-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

For both 1Rx RedCap and 2Rx RedCap not configured with eDRX_IDLE cycle, $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ are specified in table 4.2C.2.3-1.

For 1 Rx RedCap and 2 Rx RedCap configured with eDRX_IDLE cycle, $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ are specified in table 4.2E.2.3-1 for FR1, where the requirements apply provided that the serving cell is configured with eDRX_IDLE.

For both 1Rx RedCap and 2Rx RedCap, $T_{detect,NR_Intra_enh_RedCap}$,$T_{measure,NR_Intra_enh_RedCap}$ and $T_{evaluate,NR_Intra_enh_RedCap}$ are defined in table 4.2E.2.3-2.

Table 4.2E.2.3-1: $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ for UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Intra_RedCap}$ [s] (number of eDRX cycles)	$T_{measure,NR_Intra_RedCap}$ [s] (number of eDRX cycles)	$T_{evaluate,NR_Intra_RedCap}$ [s] (number of eDRX cycles)
2.56	-	-	58.88 (23)	2.56 (1)	7.68 (3)
5.12	-	-	117.76 (23)	5.12 (1)	10.24 (2)
10.24	-	-	235.52 (23)	10.24 (1)	20.48 (2)
NOTE 1: Void NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: Void NOTE 4: Void NOTE 5: Void					

Table 4.2E.2.3-2: $T_{detect,NR_Intra_enh_RedCap}$, $T_{measure,NR_Intra_enh_RedCap}$ and $T_{evaluate,NR_Intra_enh_RedCap}$

DRX cycle length [s]	$T_{detect,NR_Intra_enh_RedCap}$ [s] (number of DRX cycles)	$T_{measure,NR_Intra_enh_RedCap}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Intra_enh_RedCap}$ [s] (number of DRX cycles)
0.32	3.2 x M2 (10 x M2) Note 1	0.32 x M3 (1 x M3) Note 1	0.96 x M4 (3 x M4) Note 1
0.64	6.4 (10)	0.64 (1)	1.92 (3)
1.28	11.52 (9)	1.28 (1)	3.84 (3)
2.56	64 (25)	2.56 (1)	7.68 (3)
NOTE 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 2, M3 = M4 = 2.5			

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX_IDLE, changing eDRX_IDLE cycle length, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

If '*t-Service*' is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before the serving cell stops serving the area regardless of whether the distance condition based on serving cell reference location or serving cell moving reference location is met or the legacy Srxlev/Squal condition are met, and when to start the detection, measurement and evaluation on neighbour cells is up to UE implementation. This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for t-Service is acquired by the UE for the first time to the first slot when the cell is scheduled to stop serving the area according to the broadcasted information is less than $T_{trigger}$.

$$T_{trigger} = \max(K_{multi_SMTC} * T_{detect,NR_Intra}, K_{multi_SMTC} * K_{carrier} * T_{detect,NR_Inter}),$$

where

- $K_{carrier}$ is the number of NR inter-frequency carriers indicated by the serving cell,
- $T_{detect,NR_Intra_RedCap}$ refers to intra-frequency cell detection delay in IDLE/INACTIVE mode defined in tables 4.2C.2.3-1(with FR1) and 4.2E.2.3-1,
- $T_{detect,NR_Inter_RedCap}$ refers to inter-frequency cell detection delay in IDLE/INACTIVE mode defined in table 4.2C.2.4-1(with FR1) and 4.2E.2.4-1.

The requirements in this clause apply provided that the number of SMTCs for intra-frequency carrier does not exceed the *parallelSMTC-r17*, otherwise UE may select one or subset of all the configured SMTCs sequentially for performing the measurements until all of the SMTCs can be measured. The selection of SMTCs to be used is up to UE implementation, and in this case, measurement period longer than the corresponding measurement period specified in tables 4.2C.2.3-1 (with FR1), 4.2E.2.3-1 and table 4.2E.2.3-2 is expected.

4.2E.2.4 Measurements of inter-frequency NR cells for RedCap UE

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP or SS-RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, and the distance between UE and serving cell reference location or serving cell moving reference location is smaller than *distanceThresh* if *distanceThresh* is configured and UE has location information, then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2E.2.9.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, or the distance between UE and serving cell reference location or serving cell moving reference location is larger than *distanceThresh* if *distanceThresh* is configured and UE has location information, then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of 50 m when *referenceLocation* is configured by the network or 80 m when *movingReferenceLocation* is configured by the network. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{carrier} * K_{multi_SMTC} * T_{detect,NR_{Inter_RedCap}}$ if the UE does not support t *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasuremenNGSO-r17*is not enabled, or within $K_{carrier} * K_{multi_SMTC} * T_{detect,NR_Inter_RedCap_enh}$ if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17*is enabled, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection}$ = 0 provided that the reselection criteria is met:

For 2 Rx RedCap by a margin of at least

5 dB in FR1 for reselections based on ranking or

6 dB in FR1 for SS-RSRP reselections based on absolute priorities or

4 dB in FR1 for SS-RSRQ reselections based on absolute priorities

For 1 Rx RedCap by a margin of at least

6 dB in FR1 for reselections based on ranking or

7 dB in FR1 for SS-RSRP reselections based on absolute priorities or

5 dB in FR1 for SS-RSRQ reselections based on absolute priorities.

The parameter $K_{carrier}$ is the number of NR inter-frequency carriers indicated by the serving cell.

The parameter K_{multi_SMTC} is the scaling factor for measurement of multiple SMTCs or multiple satellites, which refers to clause 4.2C.2.4.

An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.7 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,NR_Inter}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier} * K_{multi_SMTC} * T_{measure,NR_Inter_RedCap}$ if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17*is not enabled, or every $K_{carrier} * K_{multi_SMTC} * T_{measure,NR_Inter_RedCap_enh}$ if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17*is enabled, for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Inter_RedCap}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within $K_{carrier} * K_{multi_SMTC} * T_{evaluate,NR_Inter_RedCap}$ if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within $K_{carrier} * K_{multi_SMTC} * T_{evaluate,NR_Inter_RedCap_enh}$ if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17*is enabled, when $T_{reselection} = 0$ as specified in tables 4.2C.2.4-1(with FR1) and 4.2E.2.4-1 provided that the reselection criteria is met by

- the condition when performing equal priority reselection and
  - when *rangeToBestCell* is not configured:
    - the cell is at least 5 dB better ranked in FR1 for 2 Rx RedCap.
    - the cell is at least 6 dB better ranked in FR1 for 1 Rx RedCap.
  - when *rangeToBestCell* is configured:
    - the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value defined in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
      - if there are multiple such cells, the cell has the highest rank among them
      - the cell is at least 5 dB better ranked in FR1 if the current serving cell is among them, or 6 dB in FR1 for SS-RSRP reselections based on absolute priorities for 2 Rx RedCap or 4 dB in FR1 for SS-RSRQ reselections based on absolute priorities for 2 Rx RedCap.
      - the cell is at least 6 dB better ranked in FR1 if the current serving cell is among them, or 7 dB in FR1 for SS-RSRP reselections based on absolute priorities or 5 dB in FR1 for SS-RSRQ reselections based on absolute priorities for 1 Rx RedCap.

The 1 Rx RedCap UE applies *absThreshSS-BlocksConsolidation* as the signalled value of *absThreshSS-BlocksConsolidation* [2] + 1 dB.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If $T_{reselection}$ timer has a non-zero value and the inter-frequency cell is satisfied with the reselection criteria, the UE shall evaluate this inter-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in table 4.2C.2.4-1(with FR1) under the following conditions:

- $T_{SMTC_intra} = T_{SMTC_inter} = 160$ ms; where
  - T_{SMTC_intra} is the periodicity of the SMTC configured for the intra-frequency carrier if no identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier; T_{SMTC_intra} is the periodicity of the

smtc2-LP configured for the intra-frequency carrier if at least one identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed for T_{SMTC_intra}. If the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer T_{detect, NR_intra} is expected.

- T_{SMTC_inter} is the actual SMTC periodicity used by the inter-frequency cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the inter-frequency carrier is assumed for T_{SMTC_inter}. If the actual SSB transmission periodicity is greater than the SMTC configured for the inter-frequency carrier, longer T_{detect, NR_inter} is expected.
- SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and
- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion in TS 38.304 [1].

For 1 Rx RedCap and 2 Rx RedCap not configured with eDRX_IDLE cycle, $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ are specified in table 4.2C.2.4-1 (with FR1).

For 1 Rx RedCap and 2 Rx RedCap configured with eDRX_IDLE cycle, $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ are specified in table 4.2E.2.4-1 for FR1.

For both 1Rx RedCap and 2Rx RedCap, $T_{detect,NR_Inter_RedCap_enh}$,$T_{measure,NR_Intra_RedCap_enh}$ and $T_{evaluate,NR_Intra_RedCap_enh}$ refer to table 4.2E.2.4-2.

Table 4.2E.2.4-1: $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ for UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX cycle length [s]	PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Inter_RedCap}$ [s] (number of eDRX cycles)	$T_{measure,NR_Inter_RedCap}$ [s] (number of eDRX cycles)	$T_{evaluate,NR_Inter_RedCap}$ [s] (number of eDRX cycles)
2.56	-	-	58.88 (23)	2.56 (1)	7.68 (3)
5.12	-	-	117.76 (23)	5.12 (1)	10.24 (2)
10.24	-	-	235.52 (23)	10.24 (1)	20.48 (2)
NOTE 1: Void NOTE 2: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 3: Void NOTE 4: Void					

Table 4.2E.2.4-2: $T_{detect,NR_Inter_RedCap_enh}$, $T_{measure,NR_Inter_RedCap_enh}$ and $T_{evaluate,NR_Inter_RedCap_enh}$

DRX cycle length [s]	$T_{detect,NR_Inter_RedCap_enh}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_RedCap_enh}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_RedCap_enh}$ [s] (number of DRX cycles)
0.32	3.84 x M2 (12 x M2) Note 1	0.32 x M3 (1 x M3) Note 1	0.96 x M4 (3 x M4) Note 1
0.64	7.68 (12)	0.64 (1)	1.92 (3)
1.28	12.8 (10)	1.28 (1)	3.84 (3)
2.56	64 (25)	2.56 (1)	7.68 (3)
NOTE 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2			

If *t-Service* is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before the serving cell stops serving the area regardless of whether the distance condition based on serving cell reference location or serving cell moving reference location or the legacy Srxlev/Squal condition are met, and when to start detection, measurement, and evaluation is up to UE implementation. This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for t-Service is acquired by the UE for the first time to the first slot when the cell is scheduled to stop serving the area according to the broadcasted information is less than $T_{trigger}$, and $T_{trigger} = \max(K_{multi_SMTC} * T_{detect,NR_Intra}, K_{multi_SMTC} * K_{carrier} * T_{detect,NR_Inter})$ when serving cell is below the search threshold, and $T_{trigger} = \max(K_{multi_SMTC} * T_{detect,NR_Intra}, N_{layer} * 60\ s)$ when serving cell is above the search threshold, where

- $K_{carrier}$ is the number of NR inter-frequency carriers indicated by the serving cell,
- N_{layer} is the total number of higher priority NR carrier frequencies broadcasted in system information,
- T_{detect,NR_Intra} refers to enhanced intra-frequency cell detection delay in IDLE/INACTIVE mode defined table 4.2E.2.3-2,
- T_{detect,NR_Inter} refers to enhanced inter-frequency cell detection delay in IDLE/INACTIVE mode defined table 4.2E.2.4-2.

The requirements in this clause apply provided that the number of SMTCs for any inter-frequency carrier does not exceed the values indicated by *parallelSMTC-r17*, otherwise UE may select one or subset of all the configured SMTCs sequentially until all of the SMTCs can be measured, the selection of SMTCs to be used is up to UE implementation, and longer measurement delay than the corresponding measurement period specified in tables 4.2C.2.4-1 (with FR1), table 4.2E.2.4-1 and table 4.2C.2.4-2 is expected.

The requirements in this clause apply provided that the valid information for the satellite serving the target cell has been provided by the serving cell.

The requirements in this clause apply provided that SSB of neighbour cells are within the time shifted SMTC.

4.2E.2.5 Maximum interruption in paging reception

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception.

The FDD and HD-FDD RedCap UE shall meet all applicable requirements specified in clause 4.2C.2.5, except that

- 'T_{detect,NR_Intra}' is replaced with '$T_{detect,NR_Intra_RedCap}$' , and
- 'T_{detect,NR_Inter}' is replaced with $T_{detect,NR_Inter_RedCap}$, and
- clause 4.2C.2.3 is replaced with 4.2E.2.3, and
- clause 4.2C.2.4 is replaced with 4.2E.2.4.

The 1 Rx RedCap in HD-FDD shall meet all applicable requirements specified in clause 4.2C.2.5 under the following conditions

- at least 1 SSB is available at the UE in the serving cell during the last 160 ms duration.

4.2E.2.6 Minimum requirement at transitions for RedCap UE

The requirements in clause 4.2.2.8 apply provided that target cell's satellite is GEO.

4.2E.2.7 Measurements of intra-frequency NR cells for RedCap UE configured with relaxed measurement criterion

4.2E.2.7.1 Introduction

This clause contains the requirements for measurements on intra-frequency NR cells when $Srxlev \leq S_{IntraSearchP}$ or $Squal \leq S_{IntraSearchQ}$ and when the UE is configured any of the following relaxed measurement criteria:

- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],
- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4.9.2 in [1],
- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4.9.1 and 5.2.4.9.2 in [1] respectively.

4.2E.2.7.2 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

UE is configured with *lowMobilityEvaluation* [2] criterion and UE is not configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvaluation* [2] criterion, or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

The requirements defined in clause 4.2E.2.3 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ refer to table 4.2B.2.9.9-1 and table 4.2B.2.9.9-2 with FR1 only for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE up-to 10.24 s, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ refer to table 4.2B.2.9.9-3 and table 4.2B.2.9.9-4 for 1 Rx RedCap and 2 Rx RedCap respectively.

4.2E.2.7.3 Measurements for UE fulfilling not-at-cell edge criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

UE is configured with *cellEdgeEvaluation* [2] criterion and UE is not configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled the *cellEdgeEvaluation* [2] criterion, or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criteria and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

The requirements defined in clause 4.2E.2.3 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ refer to table 4.2B.2.9.10-1 and table 4.2B.2.9.10-2 with FR1 only for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ refer to table 4.2B.2.9.10-3 and table 4.2B.2.9.10-4 for 1 Rx RedCap and 2 Rx RedCap respectively.

4.2E.2.7.4 Measurements for UE fulfilling low mobility and not-at-cell edge criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and

- both criteria are fulfilled, and

- less than 1 hour have passed since measurements for cell reselection were performed

In this case the UE is not required to meet $T_{detect,NR_Intra_RedCap,}$ $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ as defined in table 4.2E.2.3.

4.2E.2.8 Measurements of inter-frequency NR cells for UE configured with relaxed measurement criterion

4.2E.2.8.1 Introduction

This clause contains the requirements for measurements on inter-frequency NR cells when $Srxlev \leq S_{nonIntraSearchP}$ or $Squal \leq S_{nonIntraSearchQ}$ and when the UE is configured any of the following relaxed measurement criteria:

- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],

- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4. 9.2 in [1],

- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4.9.1 and 5.2.4.9.2 in [1] respectively.

4.2E.2.8.2 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with *lowMobilityEvaluation* [2] criterion and UE is not configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled the *lowMobilityEvaluation* [2] criterion, or

- UE is configured with both *lowMobilityEvaluation* [2] and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *lowMobilityEvaluation* [2] criterion.

When $Srxlev \leq S_{nonIntraSearchP}$ or $Squal \leq S_{nonIntraSearchQ}$ then the requirements are defined as follows:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ refer to table 4.2B.2.10.9-1 and table 4.2B.2.10.9-2 for 1 Rx RedCap and 2 Rx RedCap respectively

- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ refer to table 4.2B.2.10.9-3 and table 4.2B.2.10.9-4 for 1 Rx RedCap and 2 Rx RedCap respectively.

When $Srxlev > S_{nonIntraSearchP}$ and $Squal > S_{nonIntraSearchQ}$ and the UE is configured with *highPriorityMeasRelax* [2] then the UE shall search for inter-frequency layers of higher priority at least every $K2*T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2B.2.7 and, K2 = 60. Otherwise, if the UE is not configured with *highPriorityMeasRelax* [2] then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2E.2.9.

4.2E.2.8.3 Measurements for UE fulfilling not-at-cell edge criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with *cellEdgeEvaluation* [2] criterion, and UE is not configured with *lowMobilityEvaluation* [2] criterion and UE has fulfilled the *cellEdgeEvaluation* [2] criterion or

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] is not configured, and UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

When $Srxlev \leq S_{nonIntraSearchP}$ or $Squal \leq S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2B.2.4 apply for this clause except that:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ are as specified in table 4.2B.2.10.10-1 and table 4.2B.2.10.10-2 with FR1 only for 1 Rx RedCap and 2 Rx RedCap respectively.

- For a UE configured with eDRX_IDLE up to 10.24s, $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ are as specified in table 4.2B.2.10.10-3 and table 4.2B.2.10.10-4 for 1 Rx RedCap and 2 Rx RedCap respectively.

When $Srxlev > S_{nonIntraSearchP}$ and $Squal > S_{nonIntraSearchQ}$ and regardless of whether the UE is configured with *highPriorityMeasRelax* [2] or not, the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2E.2.9.

4.2E.2.8.4 Measurements for UE fulfilling low mobility and not-at-cell edge criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- UE is configured with both *lowMobilityEvaluation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and has fulfilled both criteria, and

- less than 1 hour have passed since measurements for cell reselection were last performed

In this case the UE is not required to meet $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ as defined in clause 4.2E.2.4.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, the UE shall search for, measure and evaluate inter-frequency layers of higher, equal or lower priority at least every 1 hour.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE shall search for inter-frequency layers of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2E.2.9 and K2=60.

The requirements defined in this clause apply regardless of eDRX_IDLE configurations.

4.2E.2.9 General requirements

When configured with eDRX_IDLE, the UE shall search every layer of higher priority at least every $T_{higher_priority_search}$, where $T_{higher_priority_search}$ is defined as follows:

- $T_{higher_priority_search}$ = max(60, 15*eDRX_IDLE cycle length) * N_{layers} seconds if eDRX_IDLE cycle ≤ 10.24 s,

Otherwise, if the UE is not configured with eDRX_IDLE cycle, the UE shall search every layer of higher priority at least every $T_{higher_priority_search}$ = (60 * N_{layers}) seconds.

N_{layers} is the total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information.

For a UE configured with early measurement reporting, while T331 is running, N_{layers} is the combined total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information.

4.2E.2.10 Measurements of inter-frequency NR cells with TN carrier

This clause applies for the inter-frequency cell re-selection for TN carriers, and NTN carriers if configured. The requirements in clause 4.2E.2.10 apply provided that network provides SIB19 and UE is configured with and one or more TN carriers.

UE is allowed to skip TN neighbour cells measurement in an area where there is no coverage of the frequency based on the provided TN cell coverage information and UE GNSS position information. Otherwise, UE shall perform TN measurement if its estimated distance to *tn-ReferenceLocation* is smaller than *tn-DistanceRadius*. The requirements apply provided that the actual distance between UE to *tn-ReferenceLocation* is smaller than *tn-DistanceRadius* – 50m.This clause considers the inter-frequency cell reselection from NTN to TN in FR1.

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP or SS-RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, and the distance between UE and serving cell reference location is smaller than *distanceThresh* if *distanceThresh* is configured and UE has location information, then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2E.2.9.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, or the distance between UE and serving cell reference location is larger than *distanceThresh* if *distanceThresh* is configured and UE has location information, then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of 50 m. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{carrier_TN}$ * T_{detect,NR_Inter_TN} + $K_{carrier} * K_{multi_SMTC} * T_{detect,NR_Inter_NTN_RedCap}$ if the UE does not support Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17*is not enabled, or within $K_{carrier_TN}$ * T_{detect,NR_Inter_TN} + $K_{carrier} * K_{multi_SMTC} * T_{detect,NR_Inter_NTN_RedCap_enh}$ if the UE supports Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17*is enabled, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection}$ = 0 provided that the reselection criteria is met:

For 2 Rx RedCap by a margin of at least

5 dB in FR1 for reselections based on ranking or

6 dB in FR1 for SS-RSRP reselections based on absolute priorities or

4 dB in FR1 for SS-RSRQ reselections based on absolute priorities

For 1 Rx RedCap by a margin of at least

6 dB in FR1 for reselections based on ranking or

7 dB in FR1 for SS-RSRP reselections based on absolute priorities or

5 dB in FR1 for SS-RSRQ reselections based on absolute priorities.

The parameter K_{multi_SMTC} is the scaling factor for measurement of multiple SMTCs or multiple satellites

- If SMTCs do not overlap with each other,
  - $K_{multi_{SMTC}} = 1$, if GEO satellites are measured on the carrier;
  - $K_{multi_{SMTC}} = \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if LEO satellites are measured on the carrier;
- If SMTCs partially overlap with each other,
  - $K_{multi_{SMTC}} = N_{SMTC,overlap}$, if only GEO satellites are measured on the carrier;
  - $K_{multi_{SMTC}} = \sum_{i=1}^{N_{SMTC,overlap}} \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if only LEO satellites are measured on the carrier;

where

$N_{LEO,i}$ is the number of LEO satellites to be measured within i-th SMTC,

$N_{LEO,simul}$ is the number of LEO satellites that UE can measure in parallel within an SMTC, $N_{SMTC,overlap}$ is the number of SMTCs that partially overlap with each other.

NOTE: For deriving K_{multi_SMTC} for T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ of frequency layer *j*, two SMTCs are considered as overlapping if they overlap in one or more occasions during a single T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ or $T_{evaluate,NR_Inter}$.

The parameter $K_{carrier_TN}$ is the number of NR TN inter-frequency carriers indicated by the serving cell, except for the frequency carrier where there is no coverage of that frequency based on the provide TN cell coverage information and UE GNSS position information.

T_{detect,NR_Inter_TN} , $T_{measure,NR_Inter_TN}$ and $T_{evaluate,NR_Inter_TN}$ are the NR TN inter-frequency cell re-selection requirement defined in table 4.2.2.4-1 in TS 38.133

$T_{detect,NR_Inter_NTN_RedCap}$, $T_{measure,NR_Inter_NTN_RedCap}$ and $T_{evaluate,NR_Inter_NTN\text{-}RedCap}$ are the NR NTN inter-frequency cell re-selection requirement defined in tables 4.2C.2.4-1 (with FR1) and 4.2C.2.4-1 in TS 38.133.

$T_{detect,NR_Inter_NTN_RedCap_enh}$, $T_{measure,NR_Inter_NTN_RedCap_enh}$ and $T_{evaluate,NR_Inter_NTN_RedCap_enh}$ are the NR NTN inter-frequency cell re-selection requirement defined in table 4.2E.2.4-2 in TS 38.133.

An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.7 for a corresponding band.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,NR_Inter}$. If, after detecting a cell in a higher priority search, it is determined that re-selection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of re-selection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier_TN} * T_{measure,NR_Inter_TN} + K_{carrier} * K_{multi_SMTC} * T_{measure,NR_Inter_NTN_RedCap}$ if the UE does not support Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17*is not enabled, or every $K_{carrier_TN} * T_{measure,NR_Inter_TN} + K_{carrier} * K_{multi_SMTC} * T_{measure,NR_Inter_NTN_RedCap_enh}$ if the UE supports Enhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17*is enabled, for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR_Inter_NTN_RedCap_enh}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within $K_{carrier_TN} * T_{evaluate,NR_Inter_TN} + K_{carrier} * K_{multi_SMTC} * T_{evaluate,NR_Inter_NTN_RedCap}$ if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementNGSO-r17* is not enabled, or within $K_{carrier_TN} * T_{evaluate,NR_Inter_TN} + K_{carrier} * K_{multi_SMTC} * T_{evaluate,NR_Inter_NTN_RedCap_enh}$ if the UE supportsEnhanced RRM requirements for measurements in IDLE and INACTIVE modes defined in TS 38.306 [14] and the *enhancedMeasurementNGSO-r17*is enabled, when $T_{reselection} = 0$ as specified in tables 4.2C.2.4-1 (with FR1) and table 4.2E.2.3-1 provided that the reselection criteria is met by

- For 2 Rx RedCap by a margin of at least

  5 dB in FR1 for reselections based on ranking or

  6 dB in FR1 for SS-RSRP reselections based on absolute priorities or

  4 dB in FR1 for SS-RSRQ reselections based on absolute priorities

  For 1 Rx RedCap by a margin of at least

  6 dB in FR1 for reselections based on ranking or

  7 dB in FR1 for SS-RSRP reselections based on absolute priorities or

  5 dB in FR1 for SS-RSRQ reselections based on absolute priorities.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If $T_{reselection}$ timer has a non-zero value and the inter-frequency cell is satisfied with the reselection criteria, the UE shall evaluate this inter-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in table 4.2C.2.4-1 under the following conditions:

$T_{SMTC_intra} = T_{SMTC_inter} = 160$ ms; where

- T_{SMTC_intra} is the periodicity of the SMTC configured for the intra-frequency carrier if no identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier; T_{SMTC_intra} is the periodicity of the *smtc2-LP* configured for the intra-frequency carrier if at least one identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed for T_{SMTC_intra}. If the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer T_{detect, NR_intra} is expected.

- T_{SMTC_inter} is the actual SMTC periodicity used by the inter-frequency cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the inter-frequency carrier is assumed for T_{SMTC_inter}. If the actual SSB transmission periodicity is greater than the SMTC configured for the inter-frequency carrier, longer T_{detect, NR_inter} is expected.

- SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and

- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion in TS 38.304 [1].

If *t-Service* is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before the serving cell stops serving the area regardless of whether the distance condition based on serving cell reference location or the legacy Srxlev/Squal condition are met, and when to start detection, measurement, and evaluation is up to UE implementation. This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for t-Service is acquired by the UE for the first time to the first slot when the cell is scheduled to stop serving the area according to the broadcasted information is less than $T_{trigger}$, and $T_{trigger} = \max(T_{detect,NR_Intra}, K_{carrier} * T_{detect,NR_Inter})$ when serving cell is below the search threshold, and $T_{trigger} = \max(T_{detect,NR_Intra}, N_{layer} * 60s)$ when serving cell is above the search threshold, where

- $K_{carrier}$ is the number of NR inter-frequency carriers indicated by the serving cell,

- N_{layer} is the total number of higher priority NR carrier frequencies broadcasted in system information,

- T_{detect,NR_Intra} refers to HST intra-frequency cell detection delay in IDLE/INACTIVE mode defined table 4.2.2.3-2,

- T_{detect,NR_Inter} refers to HST inter-frequency cell detection delay in IDLE/INACTIVE mode defined table 4.2.2.4-2.

The requirements in this clause apply provided that the number of SMTCs for any inter-frequency carrier does not exceed the values indicated by *parallelSMTC-r17*, otherwise UE may select one or subset of all the configured SMTCs sequentially until all of the SMTCs can be measured, the selection of SMTCs to be used is up to UE implementation, and longer measurement delay than the corresponding measurement period specified in table 4.2C.2.4-1 and table 4.2E.2.4-2 is expected.

For 1 Rx RedCap and 2 Rx RedCap not configured with eDRX_IDLE cycle, $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ are specified in table 4.2C.2.4-1 with FR1.

For 1 Rx RedCap and 2 Rx RedCap configured with eDRX_IDLE cycle, $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ are specified in table 4.2E.2.4-1 for FR1.

For both 1Rx RedCap and 2Rx RedCap, $T_{detect,NR_Inter_RedCap_enh}$,$T_{measure,NR_Intra_RedCap_enh}$,$T_{evaluate,NR_Intra_RedCap_enh}$ are defined in table 4.2E.2.4-2.

4.2E.2.11 Measurements of inter-RAT E-UTRAN cells with TN carrier

This clause applies for the inter-RAT cell re-selection for TN carriers. The requirements in clause 4.2C.2.11 apply provided that network provides SIB19 and UE is configured with and one or more TN carriers.

UE is allowed to skip TN neighbour cells measurement in an area where there is no coverage of the frequency based on the provided TN cell coverage information and UE GNSS position information. Otherwise, UE shall perform TN measurement if its estimated distance to tn-ReferenceLocation is smaller than *tn-DistanceRadius*. The requirements apply provided that the actual distance between UE to *tn-ReferenceLocation* is smaller than *tn-DistanceRadius* – 50m.This clause considers the inter-RAT cell reselection from NTN to E-UTRAN TN in FR1.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-RAT E-UTRAN layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2E.2.9

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the UE shall search for and measure inter-RAT E-UTRAN layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority inter-RAT E-UTRAN layers shall be the same as that defined below for lower priority RATs.

The requirements in this clause apply to inter-RAT E-UTRAN FDD measurements and E-UTRA TDD measurements. When the measurement rules indicate that inter-RAT E-UTRAN cells are to be measured, the UE shall measure RSRP and RSRQ of detected E-UTRA cells in the neighbour frequency list at the minimum measurement rate specified in this clause.

The parameter $N_{EUTRA_carrier}$ is the number of EUTRA TN carriers indicated by the serving cell, except for the frequency carrier where there is no coverage of that frequency based on the provide TN cell coverage information and UE GNSS position information.

The UE shall filter RSRP and RSRQ measurements of each measured E-UTRA cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least half the minimum specified measurement period.

An inter-RAT E-UTRA cell is considered to be detectable provided the following conditions are fulfilled:

- the same conditions as for inter-frequency RSRP measurements specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band, and
- the same conditions as for inter-frequency RSRQ measurements specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band.
- SCH conditions specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band

The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS 38.304 [1] within $N_{EUTRA_carrier} * T_{detect,EUTRAN}$ when $Srxlev \leq S_{nonIntraSearchP}$ or $Squal \leq S_{nonIntraSearchQ}$ when $T_{reselection} = 0$ provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

Cells which have been detected shall be measured at least every $N_{EUTRA_carrier} * T_{measure,EUTRAN}$ when $Srxlev \leq S_{nonIntraSearchP}$ or $Squal \leq S_{nonIntraSearchQ}$.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,EUTRAN}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE detects, on an inter-RAT E-UTRAN carrier, a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall not consider an inter-RAT E-UTRA cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For a cell that has been already detected, but has not been reselected to, the filtering shall be such that a UE not configured with eDRX_IDLE cycle shall be capable of evaluating that an already identified inter-RAT E-UTRA cell has met reselection criterion defined in TS 38.304 [1] within $N_{EUTRA_carrier_RedCap} * T_{evaluate,EUTRAN_RedCap}$ when $T_{reselection} = 0$ as specified in table 4.2.2.5-1provided that the reselection criteria is met by a margin of at least 6 dB for RSRP reselections based on absolute priorities or 4 dB for RSRQ reselections based on absolute priorities for 2Rx RedCap and at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities for 1 Rx RedCap.

If the $T_{reselection}$ timer has a non-zero value and an inter-RAT E-UTRA cell satisfies the reselection criteria defined in TS 38.304 [1], the UE shall evaluate this E-UTRA cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect to this cell.

When the distance between the UE and *tn-ReferenceLocation* is larger than *tn-DistanceRadius* +50m, the UE is allowed to not perform measurements on the TN frequency in the corresponding area.

For 1 Rx RedCap and 2 Rx RedCap configured with eDRX_IDLE cycle, $T_{detect,EUTRAN_RedCap}$, $T_{measure,EUTRAN_RedCap}$ and $T_{evaluate,\ E\text{-}UTRAN_RedCap}$ are specified in table 4.2B.2.5-2.

For UE not configured with eDRX_IDLE cycle, $T_{detect,EUTRAN_RedCap}$, $T_{measure,EUTRAN_RedCap}$ and $T_{evaluate,\ E\text{-}UTRAN_RedCap}$ are specified in table 4.2B.2.5-1.

4.3 Minimization of Drive Tests (MDT)

4.3.1 Introduction

UE supporting minimisation of drive tests in RRC_IDLE shall be capable of:

- logging measurements in RRC_IDLE, reporting the logged measurements and meeting requirements in clause 4.3;
- logging of RRC connection establishment failure, reporting the logged failure and meeting requirements in clause 4.3;
- logging of radio link failure and handover failure, reporting the logged failure and meeting requirements in clause 4.3.

The logged MDT requirements consist of measurement requirements as specified in clause 4.3.2 and relative time stamp accuracy requirements as specified in clause 4.3.3. Both sets of requirements are applicable for intra-frequency, inter-frequency and inter-RAT cases in RRC_IDLE state. The MDT procedures are described in TS 37.320 [31].

For RRC connection establishment failure logging and reporting, the MDT requirements consist of requirements for measurements performed and logged in RRC_IDLE state specified in clause 4.3.2 and relative time stamp accuracy requirement for RRC connection establishment failure log reporting as specified in clause 4.3.4.

4.3.2 Measurement Requirements

The requirements specified in this clause apply for the following measurements performed and logged by the UE for MDT in RRC_IDLE:

- inter-RAT E-UTRA FDD and TDD RSRP,
- inter-RAT E-UTRA FDD and TDD RSRQ,
- SS-RSRP per cell,
- SS-RSRQ per cell,
- SS-RSRP per SSB index of the serving cell,
- SS-RSRQ per SSB index of the serving cell,
- best SSB index of the serving cell,
- the number of SSBs with different SSB index which are above the threshold *absThreshSS-BlocksConsolidation* for all detected cells whose cell-ranking criterion R value is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

The requirements apply for the measurements included in logged MDT reports and RRC connection establishment failure reports.

The measurement values that are used to meet

- serving cell and reselection requirements as specified in clauses 4.2.2.2–4.2.2.7
- shall also apply to values logged for MDT measurements in RRC_IDLE state.

4.3.3 Requirements for Relative Time Stamp Accuracy

The relative time stamp for a logged measurement is defined as the time from the moment the MDT configuration was received at the UE until the measurement was logged, see TS 38.331 [2].

The accuracy of the relative time stamping is such that the drift of the time stamping shall be not more than ± 2 seconds per hour.

4.3.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

Relative time stamp for RRC connection establishment failure log reporting is defined as the time elapsed from the last RRC connection establishment failure to the time when the log is included in the report TS 38.331 [2]. The UE shall report the RRC connection establishment failure log, while meeting the accuracy requirement specified in this clause.

The accuracy of the relative time stamping for RRC connection establishment failure log reporting is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. The relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RRC connection establishment failure had been detected and until the log is time-stamped.

4.3.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The UE shall report the radio link and handover failure log, while meeting the accuracy requirements specified in this clause.

Relative time stamp accuracy requirements for *timeSinceFailure* reported for MDT in a radio link failure or handover failure log are specified in this clause. *timeSinceFailure* determines the time elapsed from the last radio link failure or handover failure in NR to the time when the log is included in the report TS 38.331 [2].

The accuracy of the relative time stamping for *timeSinceFailure* is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. These relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RLF or handover failure had been detected and until the log is time-stamped.

4.3C Minimization of Drive Tests (MDT) for Satellite Access

4.3C.1 Introduction

UE supporting minimisation of drive tests in RRC_IDLE shall be capable of:

- logging measurements in RRC_IDLE, reporting the logged measurements and meeting requirements in clause 4.3C;
- logging of RRC connection establishment failure, reporting the logged failure and meeting requirements in clause 4.3C;
- logging of radio link failure and handover failure, reporting the logged failure and meeting requirements in clause 4.3C.

The logged MDT requirements consist of measurement requirements as specified in clause 4.3C.2 and relative time stamp accuracy requirements as specified in clause 4.3C.3. Both sets of requirements are applicable for intra-frequency and inter-frequency cases in RRC_IDLE state. The MDT procedures are described in TS 37.320 [31].

For RRC connection establishment failure logging and reporting, the MDT requirements consist of requirements for measurements performed and logged in RRC_IDLE state specified in clause 4.3C.2 and relative time stamp accuracy requirement for RRC connection establishment failure log reporting as specified in clause 4.3C.4.

4.3C.2 Measurement Requirements

The requirements specified in this clause apply for the following measurements performed and logged by the UE for MDT in RRC_IDLE:

- SS-RSRP per cell,

- SS-RSRQ per cell,
- SS-RSRP per SSB index of the serving cell,
- SS-RSRQ per SSB index of the serving cell,
- best SSB index of the serving cell,
- the number of SSBs with different SSB index which are above the threshold *absThreshSS-BlocksConsolidation* for all detected cells whose cell-ranking criterion R value is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

The requirements apply for the measurements included in logged MDT reports and RRC connection establishment failure reports.

The measurement values that are used to meet

- serving cell and reselection requirements as specified in clauses 4.2C.2.2–4.2C.2.11.

shall also apply to values logged for MDT measurements in RRC_IDLE state.

4.3C.3 Requirements for Relative Time Stamp Accuracy

The relative time stamp for a logged measurement is defined as the time from the moment the MDT configuration was received at the UE until the measurement was logged, see TS 38.331 [2].

The accuracy of the relative time stamping is such that the drift of the time stamping shall be not more than ± 2 seconds per hour.

4.3C.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

Relative time stamp for RRC connection establishment failure log reporting is defined as the time elapsed from the last RRC connection establishment failure to the time when the log is included in the report TS 38.331 [2]. The UE shall report the RRC connection establishment failure log, while meeting the accuracy requirement specified in this clause.

The accuracy of the relative time stamping for RRC connection establishment failure log reporting is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. The relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RRC connection establishment failure had been detected and until the log is time-stamped.

4.3C.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The UE shall report the radio link and handover failure log, while meeting the accuracy requirements specified in this clause.

Relative time stamp accuracy requirements for *timeSinceFailure* reported for MDT in a radio link failure or handover failure log are specified in this clause. *timeSinceFailure* determines the time elapsed from the last radio link failure or handover failure in NR to the time when the log is included in the report TS 38.331 [2].

The accuracy of the relative time stamping for *timeSinceFailure* is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. These relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RLF or handover failure had been detected and until the log is time-stamped.

4.3D Minimization of Drive Tests (MDT) for NR RedCap UE with Satellite Access

4.3D.1 Introduction

The requirements in clause 4.3C.1 shall apply except that:

- clause 4.3C is replaced with clause 4.3D, and
- clause 4.3C.2 is replaced with clause 4.3D.2, and
- clause 4.3C.3 is replaced with clause 4.3D.3, and
- clause 4.3C.4 is replaced with clause 4.3D.4.

4.3D.2 Measurement Requirements

The requirements in clause 4.3C.2 shall apply except that:

The measurement values that are used to meet

- serving cell and reselection requirements as specified in clauses 4.2E.2.2–4.2E.2.11.

shall also apply to values logged for MDT measurements in RRC_IDLE state.

4.3D.3 Requirements for Relative Time Stamp Accuracy

The requirements in clause 4.3C.3 shall apply.

4.3D.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

The requirements in clause 4.3C.4 shall apply.

4.3D.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The requirements in clause 4.3C.5 shall apply.

4.4 Idle Mode CA/DC Measurements

4.4.1 Introduction

A UE supporting *idleInactiveNR-MeasReport-r16* or *idleInactiveEUTRA-MeasReport-r16* shall perform the idle mode measurement on the inter-frequency CA and DC candidate frequencies/cells and E-UTRAN inter-RAT DC candidate frequencies/cells indicated by higher layers and meet the requirement specified in this clause. The UE shall perform idle mode measurements provided that the serving cell support early measurement and is within the validity area. The idle mode measurement requirements apply to a configured carrier frequency and the serving cell are among the supported band combination of the UE.

4.4.2 Measurement Requirements

For a UE which supports *idleInactiveNR-MeasReport-r16* or *idleInactiveEUTRA-MeasReport-r16* the UE shall support the idle mode CA/DC measurements on the serving cell, and carriers configured for idle mode CA/DC measurement reporting provided T331 has not expired, the serving cell is supporting idle mode CA/DC measurement reporting and the serving cell is in the validity area.

4.4.2.1 Detected cell requirement during state transition and Idle mode

This subclause defines the requirements for the detected cell status for the idle mode CA/DC measurement when UE transitions from RRC Connected mode to Idle mode and after UE has entered Idle mode. The requirements are applicable to an NE-DC and NR carrier aggregation capable UE which has been configured with one or more of following, one or more SCells, one E-UTRAN PSCell or one or more downlink E-UTRAN SCells during the Connected mode and which supports *idleInactiveNR-MeasReport-r16* or *idleInactiveEUTRA-MeasReport-r16.* The requirements are applicable for SCell(s) and E-UTRAN FDD and TDD PSCell and SCells.

Upon releasing the connection and if the UE has been configured with idle mode CA/DC measurement reporting, following requirements apply concerning the detected cells in Connected mode upon state transitioning to Idle mode and during Idle mode:

- A cell which is detected cell in Connected mode prior to connection release, shall remain detected after UE has entered Idle mode and during Idle mode, provided that the following conditions are met:
  - The UE has been provided with a list of cells and/or carrier frequencies for early measurement reporting by dedicated RRC signalling and
  - The detected cell is among the list of cells or on a carrier frequency provided for early measurement reporting, and
  - The UE is provided with a valid timer T331 by dedicated RRC signalling, and
  - The detected cell and SSBs remains detectable until UE reconnect to the network and transmits the early measurement reporting, and
  - The carrier frequency of the detected cell and the carrier frequency of the serving cell are among the supported band combination of the UE.

An inter-RAT E-UTRAN cell is considered detectable according to RSRP, RSRP Ês/Iot, SCH_RP and SCH Ês/Iot defined in Annex B.1.1 and Annex B.1.2 in [15] for a corresponding Band. An inter-frequency cell is considered detectable according to the conditions in Annex B.1.2 and B.1.3 for a corresponding band. An SSB of an inter-frequency cell is considered detectable according to SSB_RP and SSB Ês/Iot defined in Annex B.1.2 and B.1.3 for a corresponding Band.

4.4.2.2 Measurements of inter-frequency CA/DC candidate cells

While T331 is running, the UE shall perform measurement on the configured inter-frequency carriers for idle mode CA/DC measurement reporting according to the UE measurement capability.

A UE which supports *idleInactiveNR-MeasReport-r16* shall support idle mode CA/DC measurements of:

- at least 7 inter-frequency carriers which are also configured for inter-frequency mobility measurements, and
- at least 7 inter-frequency carriers which are not configured for inter-frequency mobility measurements.

The UE shall be capable of monitoring a total of at least 7 inter-frequency carriers for idle mode CA/DC measurements comprising of carriers configured for inter-frequency mobility measurements and carriers not configured for inter-frequency mobility measurements.

For inter-frequency carriers configured for idle mode CA/DC measurements, if $Srxlev \leq S_{nonIntraSearchP}$ or $Squal \leq S_{nonIntraSearchQ}$ the inter-frequency measurement requirements in clause 4.2.2.4 shall apply, where UE shall search for and measure inter-frequency layers configured for idle mode CA/DC measurements in preparation for possible reporting. If $Srxlev > S_{nonIntraSearchP}$ and $Squal > S_{nonIntraSearchQ}$ the UE shall search for inter-frequency layers configured for idle mode CA/DC measurements at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7, where UE shall search for and measure inter-frequency layers configured for idle mode CA/DC measurements in preparation for possible reporting.

For UE supporting *idleInactiveNR-MeasBeamReport-r16*, if the UE is configured with *beamMeasConfigIdle-r16* for idle mode CA/DC measurement, the UE shall be capable of performing SS-RSRP, SS-RSRQ for at least

- 7 SSBs with different SSB index and/or PCI on an inter-frequency layer in FR1,
- 10 SSBs with different SSB index and/or PCI on an inter-frequency layer in FR2.

For UE supporting *idleInactiveNR-MeasBeamReport-r16*, if the UE is configured with *beamMeasConfigIdle-r16* on one or more carrier for idle mode CA/DC measurement, the UE, on each carrier, shall be able to:

- detect a newly detectable inter-frequency NR cell and perform RSRP/RSRQ measurement in preparation for reporting, and
- acquire the SSB index for a newly detectable inter-frequency NR cell if *beamMeasConfigIdle-r16* is configured on this carrier and perform RSRP/RSRQ measurement in preparation for reporting,

within the requirements defined in clause 4.2.2.4 plus k* T_{SSB_index,NR_Inter}, where k is the number of carriers configured for idle mode CA/DC measurement with *beamMeasConfigIdle-r16*, and T_{SSB_index,NR_Inter} is the additional time period used to acquire the index of the SSB being measured as defined in table 4.4.2.2-1.

Table 4.4.2.2-1: T_{SSB_index,NR_Inter}

DRX cycle length [s]	Scaling Factor (N1)		T_{SSB_index,NR_Inter} [s] (number of DRX cycles)
	FR1	FR2[Note1]	
0.32	1	8	N2 x 1.28 x N1 x 1.5 (N2 x 4 x N1 x 1.5)
0.64		5	N2 x 1.28 x N1 (N2 x 2 x N1)
1.28		4	N2 x 1.28 x N1 (N2 x 1 x N1)
2.56		3	N2 x 2.56 x N1 (N2 x 1 x N1)
NOTE 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length.			
NOTE 2: N2 = 3 if the NR inter-frequency carrier for idle mode CA/DC measurement reporting is in FR1, N2=6 if the NR inter-frequency carrier for idle mode CA/DC measurement reporting is in FR1 and UE operating on a target cell with 12 PRB, and N2 = 5 if the NR inter-frequency carrier for idle mode CA/DC measurement reporting is in FR2.			

In the absence or expiration of T331, it is up to UE implementation to perform the idle mode CA/DC measurement.

For inter-frequency carriers configured for idle mode CA/DC measurements, the UE shall be capable of performing SS-RSRP and SS-RSRQ measurements of the carriers, and the UE physical layer shall be capable of reporting SS-RSRP and SS-RSRQ measurements of the carriers configured for idle mode CA/DC measurements to higher layers, with measurement accuracy as specified in clauses 10.1.4B and 10.1.5B and 10.1.9B and 10.1.10B, respectively.

The UE shall be able to report idle mode CA/DC measurements when idle mode CA/DC measurement reporting is requested by the network.

4.4.2.3 Measurements on serving cell

The UE shall measure the RSRP and RSRQ level of the serving cell and evaluate the cell selection criterion S defined in clause 4.2.2.2 and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements of the serving cell to higher layers, with measurement accuracy as specified in 10.1.2B, 10.1.3B, 10.1.7B and 10.1.8B.

4.4.2.4 Measurements of E-UTRAN inter-RAT DC candidate cells

While T331 is running, the UE shall perform measurement on the configured inter-RAT carriers for idle mode DC measurement reporting according to the UE measurement capability.

A UE which supports *idleInactiveEUTRA-MeasReport-r16* shall support idle mode DC measurements of:

- at least 7 E-UTRAN inter-RAT carriers which are also configured for E-UTRAN inter-RAT mobility measurements, and
- at least 1 E-UTRAN inter-RAT carrier which is not configured for E-UTRAN inter-RAT mobility measurements.

The UE shall be capable of monitoring a total of at least 7 inter-RAT carriers for idle mode DC measurements comprising of carriers configured for inter-RAT mobility measurements and carriers not configured for inter-RAT mobility measurements.

For inter-RAT carriers configured for idle mode DC measurements, if Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ the inter-RAT measurement requirements in clause 4.2.2.5 shall apply, where UE shall search for and measure inter-RAT layers configured for idle mode DC measurements in preparation for possible reporting. If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ the UE shall search for inter-RAT layers configured for idle mode DC measurements at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2, where UE shall search for and measure inter-RAT layers configured for idle mode /DC measurements in preparation for possible reporting.

For overlapping inter-RAT carriers configured for idle mode DC measurements, the UE shall be capable of performing RSRP and RSRQ measurements of the carriers, and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements of the carriers configured for idle mode DC measurements to higher layers, with measurement accuracy as specified in clauses 9.1.3B.2 and 9.1.6B.2 [15], respectively.

The UE shall be able to report idle mode DC measurements when idle mode DC measurement reporting is requested by the network.

4.5 NR measurements for positioning

4.5.1 Introduction

This clause contains requirements for UE capable of performing NR positioning measurements defined in TS 38.215 [4], including RSTD, PRS-RSRP, PRS-RSRPP, and RSCPD with RSTD measurements in RRC_IDLE state.

The requirements in clauses 4.5.2, 4.5.3, 4.5.4, and 4.5.5 are applicable to PRS resources that do not collide with other DL signals/channels which include SSB, SIB1, CORESET0, MSG2/MSGB, paging and DL SDT. In addition, a UE is not expected to receive PRS resources that collide with a time interval starting at symbol *m* and ending at symbol *m* + N_2, where symbol *m* is the last symbol in which the UE is configured to receive PDCCH and N_2 is defined in clause 6.4 of TS 38.214 [26] for the subcarrier spacing μ of the DL PRS.

If a PRS resource is outside or partially overlapped with the initial DL BWP, a PRS resource instance collides with another DL signals/channels if any portion of the other DL signal/channel overlaps with the time interval starting X symbols before the PRS instance and ending X symbols after the PRS instance, taking into account *nr-DL- PRS-ExpectedRSTD-Uncertainty* and *nr-DL-PRS-ExpectedRSTD*, where X is defined in table 5.6.1-1.

All measurement requirements specified in clauses 4.5.2, 4.5.3, 4.5.4, and 4.5.5 shall apply for DRX and eDRX configurations specified in TS 38.331 [2] for RRC_IDLE state.

The requirements in clauses 4.5.2, 4.5.3, 4.5.4 and 4.5.5 are applicable provided that the cell selection procedure for the selected PLMN defined in TS 38.304 [1] is not triggered during PRS measurement period.

The requirements in clauses 4.5.2, 4.5.3, and 4.5.4 apply provided that all PRS resources within a PFL are within up to 2 separate windows within $T_{PRS,i}$ for each positioning frequency layer *i*, where each window is up to 10ms and $T_{PRS,i}$ is defined in clauses 4.5.2, 4.5.3, and 4.5.4.

The UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

When the UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

4.5.2 RSTD measurements

4.5.2.1 Introduction

The requirements in clause 4.5.2 shall apply provided the UE has received *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34] requesting the UE to measure and report DL RSTD measurements defined in TS 38.215 [4].

4.5.2.2 Requirements Applicability

The requirements in clause 4.5.2 apply for periodic and triggered RSTD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23.2 for FR1 and FR2 are fulfilled, for a corresponding band.

4.5.2.3 Measurement Capability

The UE PRS RSTD measurement capability in RRC_IDLE state is as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355 [34].

4.5.2.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. The UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For RSTD measurements performed by a UE in RRC_IDLE state, the measurement reporting delay excludes all of the following:

- additional delay caused other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH, equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by unavailability of UL resources to transmit the measurement report,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.23.3.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2, for each measured DL PRS resource.

4.5.2.5 Measurements Period Requirements

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 4.5.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined as:

$$\mathrm{T_{RSTD,Total}} = \sum_{i=1}^{L} \mathrm{T_{RSTD,i}} + (\mathrm{L}-1) * \max\left(\mathrm{T_{effect,i}}\right)$$

Where:

- i is the index of positioning frequency layer,
- L is total number of positioning frequency layers, and
- $\mathrm{T_{effect},i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i

$\mathrm{T_{RSTD,i}}$ is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

$$\mathrm{T_{RSTD,i}} = \left(K_{\mathrm{carrier_PRS}} * N_{Rx,TEG,i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil * \left\lfloor \frac{L_{available_PRS,i}}{N} \right\rfloor * N_{sample} - 1\right) * \mathrm{T_{effect,i}} + \mathrm{T_{last,i}}\ ,$$

Where:

- $N_{RxBeam,i}$ is the UE Rx beam sweeping factor:
  - $N_{RxBeam,i}$ = 1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2

- $N_{RxBeam,i}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation* .
- $N_{RxBeam,i}$ equals to 8, otherwise.

- $K_{\text{carrier_PRS}}$ is a scaling factor for PRS-based NR positioning measurements in RRC_IDLE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{\text{carrier_PRS}}$ = 1; otherwise,
- If Srxlev ≤ $S_{\text{nonIntraSearchP}}$ or Squal ≤ $S_{\text{nonIntraSearchQ}}$, $K_{\text{carrier_PRS}} = K_{\text{carrier}} + 1$, where K_{carrier} is defined in clause 4.2.2.4
- If Srxlev > $S_{\text{nonIntraSearchP}}$ and Squal > $S_{\text{nonIntraSearchQ}}$, $K_{\text{carrier_PRS}} = N_{\text{layers}} + 1$, where N_{layers} is defined in clause 4.2.2.7.
- $N_{Rx,TEG,i}$ is the Rx TEG specific scaling factor:
  - $N_{Rx,TEG,i}$ =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].
  - $N_{Rx,TEG,i}$ is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:
    - $N_{Rx,TEG,i} = P$, if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case 'n0' is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.
    - $N_{Rx,TEG,i} = \left\lceil \frac{P}{Q} \right\rceil$, if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where Q is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].
- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.
- $L_{available_PRS,\text{i}}$ is the time duration of available PRS in positioning frequency layer *i* to be measured $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,\text{i}}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.
- N_{sample} is the number of PRS RSTD samples, where
  - N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive-r17* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
    - PRS bandwidth is within the initial BWP and
    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.
  - N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive-r17* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
    - PRS bandwidth is within the initial BWP and
    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.
  - N_{sample} = 4 otherwise.

- $T_{last,i}$ is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time, $T_{\text{last,i}} = T_{\text{i}} + T_{available_PRS,\text{i}}$,

- $T_{\text{effect},i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

$$T_{\text{effect,i}} = \left\lceil \frac{T_{\text{i}}}{T_{available_PRS,\text{i}}} \right\rceil * T_{available_PRS,\text{i}}$$

Where:

- T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- $T_{available_PRS,\text{i}} = LCM\left(T_{PRS,\text{i}}, T_{DRX}\right)$, the least common multiple between $T_{PRS,\text{i}}$ and T_{DRX}, where T_{DRX} is the DRX cycle of the UE, defined in TS 38.304 [1], clause 7.1.

- $T_{PRS,\text{i}}$ is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the positioning frequency layer is used to derive $T_{PRS,\text{i}}$, where,

- $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource,

- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where

- T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

- $\{N, T\}$ is the UE capability combination per band for RRC_IDLE state where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34], T (ms) corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34], for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- N' is UE capability for number of DL PRS resources that it can process in a slot in RRC_IDLE state as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* specified in TS 37.355 [34].

If the following conditions are met, the time $T_{\text{RSTD,Total}}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24 s, and

- periodic PRS measurement reporting is configured, and

- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].When the UE is configured with periodic reporting, as defined in TS 23.273, clause 4.1a.5.1,

If the UE operates in eDRX and eDRX is configured by higher layers [1], and the eDRX cycle $T_{\text{eDRX, CN}}$ is smaller than or equal to the configured PRS measurement reporting periodicity given by *reportingInterval* in TS 37.355 [34], and $T_{\text{eDRX, CN}}$ > 10.24 s, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) instances in the assistance data contained inside a Paging Time Window (PTW) after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34]. Otherwise, the time $T_{RSTD,Total}$ starts from the first DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

When the UE is not configured with periodic reporting, the time $T_{RSTD,Total}$ starts from the first DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the UE DRX cycle T_{DRX} changes during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 4.5.1.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If $K_{\text{carrier_PRS}}$ changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,\text{i}}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 4.5.2 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC_IDLE to RRC_CONNECTED state during the RSTD measurement period, then the UE shall continue the RSTD measurement in the RRC_CONNECTED state. The RSTD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2.

4.5.2.6 Measurements Period Requirements with Bandwidth Aggregation

The requirements in this clause apply provided that UE receives requests from LMF to perform PRS measurement on aggregated positioning frequency layers (PFLs) via *nr-DL-PRS-JointMeasurementRequestedPFL-List* in *NR-DL-TDOA-RequestLocationInformation*.

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 4.5.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined as:

$$\mathrm{T_{RSTD,total}} = \mathrm{T_{RSTD,aggr}} + \mathrm{T_{RSTD,non-aggr}} + \mathrm{T_{margin}}$$

Where:

- $\mathrm{T_{RSTD,aggr}}$ is the total measurement period for aggregated measurements, and
- $\mathrm{T_{RSTD,non-aggr}}$ is the total measurement period for non-aggregated measurements as defined in this clause, and

- When both $T_{RSTD,aggr}$ and $T_{RSTD,non-aggr}$ are non-zero, then $T_{margin} = T'_{margin}$; otherwise $T_{margin} = 0$, where $T'_{margin} = \max(T_{effect,j})$, and the maximum $T_{effect,j}$ is across all the PFL combination(s) and non-aggregated PFL(s) configured for positioning measurements.

$T_{RSTD,non-aggr}$ is zero if every resource set on every PFL is linked for aggregation to at least one other resource set on another PFL. Otherwise, $T_{RSTD,non-aggr}$ is as defined in clause 4.5.2.5 with the following exceptions,

- only PFLs containing resource set(s) not linked to any other resource set(s) are considered in L,
- on each PFL i, only resource set(s) not linked to any other resource set(s) are considered in $T_{available_PRS,i}$, $N_{PRS,i}^{slot}$ and $L_{available_PRS,i}$,
- N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-Inactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,
- $(L-1) * \max(T_{effect,i})$ is replace by $(L-1) * T'_{margin}$.

$T_{RSTD,aggr}$ is zero if no resource sets on any PFL are linked for aggregation with other resource sets on other PFLs. Otherwise, $T_{RSTD,aggr}$ is defined as

$$T_{RSTD,aggr} = \sum_{m=1}^{M} T_{RSTD,aggr,m} + (M-1) * T'_{margin}$$

where:

- m is the index of PFL combination,
- M is total number of PFL combinations,
- $T_{effect,aggr,m}$ is the periodicity of the PRS measurement in PFL combination m as defined in this clause,
- $T_{RSTD,aggr,m}$ is the measurement period for PRS RSTD measurement in PFL combination m as specified below.

$$T_{RSTD,aggr,m} = \left(K_{carrier,aggr} * N_{Rx,TEG,aggr,m} * N_{RxBeam,aggr,m} * \left\lceil \frac{N_{PRS,aggr,m}^{slot}}{N'_{aggr,m}} \right\rceil * \left\lceil \frac{L_{available_{PRS},aggr,m}}{N_{aggr,m}} \right\rceil * N_{sample} - 1\right) * T_{effect,aggr,m} + T_{last,aggr,m}$$

where:

- $K_{carrier,aggr}$ is a scaling factor for PRS measurements in RRC_IDLE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier_PRS}$ = 1. Otherwise,
  - If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, $K_{carrier_PRS}$ equals to the sum of $K_{carrier}$ in clause 4.2.2.4 and one positioning layer.
  - If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier_PRS}$ equals to the sum of N_{layer} in clause 4.2.2.7 and one positioning layer.
- $N_{Rx,TEG,m}$ is the Rx TEG specific scaling factor:
  - $N_{Rx,TEG,m}$ =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].
  - $N_{Rx,TEG,m}$ is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:

- $N_{Rx,TEG,m} = P$, if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case 'n0' is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- $N_{Rx,TEG,m} = \left\lfloor \frac{P}{Q} \right\rfloor$, if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where Q is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].

- $N_{RxBeam,aggr,m}$ is a scaling factor for PRS measurements with multiple Rx beams, and is defined as

  - $N_{RxBeam,aggr,m}$ = 1 if PFL combination *m* is in FR1,

  - $N_{RxBeam,aggr,m}$ is defined as follows if PFL combination *m* is in FR2

    - $N_{RxBeam,aggr,m}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing PFL combination *m*, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*,

    - $N_{RxBeam,aggr,m}$ equals to 8 otherwise

  - $N^{slot}_{PRS,aggr,m}$ is the maximum number of DL PRS resources in PFL combination *m* configured in a slot, and only the PRS resources in resource set(s) linked to other resource set in PFL combination *m* are counted

  - $N'_{aggr,m}$ is the UE capability on maximum number of DL PRS resources that can be processed in a slot for PFL combination *m* as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot* specified in TS 37.355 [34].

  - $L_{available_{PRS},aggr,m}$ is the time duration of available PRS resources in PFL combination *m* to be measured during $T_{PRS,aggr,m}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_{PRS},aggr,m}$, only unmuted PRS resources in resource set(s) linked to other resource set in PFL combination *m* and that are not fully overlapped with other higher-priority DL signals/channels are considered.

  - $N_{aggr,m}$ is the UE capability on duration of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN* specified in TS 37.355 [34].

  - N_{sample} is number of PRS measurement samples,

    - N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,

    - N_{sample} = 4 otherwise.

  - $T_{effect,aggr,m}$ is the periodicity of the PRS measurement in PFL combination *m*,

$$T_{effect,aggr,m} = \left\lceil \frac{T_{aggr,m}}{T_{available,PRS,aggr,m}} \right\rceil * T_{available,PRS,aggr,m}$$

    - $T_{aggr,m}$ is the UE capability on time for processing of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* specified in TS 37.355 [34].

    - $T_{available,PRS,aggr,m} = LCM(T_{PRS,aggr,m}, T_{DRX})$, the least common multiple between $T_{PRS,aggr,m}$ and the DRX cycle length T_{DRX}, defined in TS 38.304 [1], clause 7.1.

    - $T_{PRS,aggr,m}$ is the periodicity of DL PRS resource with muting on PFL combination *m*

- If more than one PRS periodicities are configured in PFL combination m, the least common multiple of PRS periodicities $T_{per}^{\text{PRS with muting}}$ among all DL PRS resource sets that are linked to other resource set in PFL combination m, is used to derive $T_{PRS,aggr,m}$, and for each applicable PRS resource set,
  - $T_{per}^{\text{PRS with muting}} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource, and
  - T_{per}^{PRS} is the periodicity of PRS resource set given by the higher-layer parameter *DL-PRS-Periodicity*, and
  - N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

- $T_{last,aggr,m}$ is the measurement duration for the last PRS sample in PFL combination m, including the sampling time and processing time, $T_{last,aggr,m} = T_{aggr,m} + T_{available,PRS,aggr,m}$.

If the following conditions are met, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24 s, and
- periodic PRS measurement reporting is configured, and
- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and
- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements satisfy all the conditions specified in clause 5.1.6.5.3 in TS 38.214 [26].

NOTE: No separate requirement on non-aggregated measurement based on $T_{RSTD,non-aggr}$ or on aggregated measurement based on $T_{RSTD,aggr}$ is applied when both $T_{RSTD,aggr}$ and $T_{RSTD,non-aggr}$ are non-zero.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is also reported by UE together with RSTD measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRP are performed over the measurement period defined in clause 4.5.2.6.

When PRS-RSRPP is also reported by UE together with RSTD measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRPP are performed over the measurement period defined in clause 4.5.2.6.

Longer RSTD measurement period is expected when there are collisions between PRS resources in any of the PFLs configured for aggregation and other higher-priority DL signals/channels.

If $K_{carrier_PRS}$ changes for any PFL or any PFL combination during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 4.5.2.6 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-*

TDOA-ProvideCapabilities, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC_IDLE to RRC_CONNECTED state during the RSTD measurement period then the UE shall continue the RSTD measurement in the RRC_CONNECTED state. The RSTD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23A.2.

4.5.3 PRS-RSRP measurements

4.5.3.1 Introduction

The requirements in clause 4.5.3 shall apply provided the UE has received a message from LMF via LPP [34] requesting the UE to measure and report PRS-RSRP measurements defined in TS 38.215 [4]. The UE is supposed to transition to RRC_CONNECTED state to report the measurements.

4.5.3.2 Requirements applicability

The requirements in clause 4.5.3 apply for periodic and triggered PRS-RSRP measurements, provided:

- PRS-RSRP related side conditions given in clause 10.1.24.2 are met for a corresponding Band.

4.5.3.3 Measurement Capability

UE PRS-RSRP measurement capability in RRC_IDLE state is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

4.5.3.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. The UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For PRS-RSRP measurements performed by the UE in RRC_IDLE state, the measurement reporting delay excludes all of the following:

- any delay caused other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH which is equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by no UL resources for UE to send the measurement report,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported PRS-RSRP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.24.3.

The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1.24.2.

4.5.3.5 Measurement Period Requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 4.5.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within $T_{PRS-RSRP,total}$ ms.

$$T_{PRS-RSRP,Total} = \sum_{i=1}^{L} T_{PRS-RSRP,i} + (L-1) * \max(T_{effect,i})$$

Where:

- *i* is the index of positioning frequency layer,
- L is total number of positioning frequency layers,
- $T_{effect,i}$ is the periodicity of the PRS-RSRP measurement in positioning frequency layer *i*.

$$T_{PRS-RSRP,i} = \left(K_{carrier_PRS_i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last}$$

Where:

- $K_{carrier_PRS}$ is a scaling factor for PRS-based NR positioning measurements in RRC_IDLE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier_PRS}$= 1. Otherwise,
- If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, $K_{carrier_PRS}$ equals to the sum of $K_{carrier}$ in clause 4.2.2.4 and one positioning layer.
- If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier_PRS}$ equals to the sum of N_{layer} in clause 4.2.2.7 and one positioning layer.
- $N_{RxBeam,i}$ is the scaling factor for Rx beam sweeping:
  - $N_{RxBeam,i}$=1 if positioning frequency layer *i* is in FR1, and
  - If positioning frequency layer *i* is in FR2
    - $N_{RxBeam,i}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-AoD-RequestLocationInformation*.
    - $N_{RxBeam,i}$ equals to 8, otherwise.
- $L_{available_PRS,i}$ is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.
- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,
- {N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],
- N' is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* in clause 6.4.3 of TS 37.355 [34],
- N_{sample} is the number of PRS-RSRP measurement samples and
  - N_{sample}= 1, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are met:
    - PRS bandwidth is within the initial BWP and
    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.
  - N_{sample}= 2, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are not met:

- PRS bandwidth is within the initial BWP and
- Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

- N_{sample} = 4 otherwise

$T_{last,i} = T_i + T_{available_PRS,i}$ is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time,

- $T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$ is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,
- T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],
- $T_{available_PRS,i} = LCM(T_{PRS,i}, T_{DRX})$ is the least common multiple between $T_{PRS,i}$ and T_{DRX}.
- $T_{PRS,i}$ is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,
- T_{DRX} is the DRX cycle length if UE is not configured with eDRX_IDLE cycle, and T_{DRX} is defined as T in TS 38.304[1] if UE is configured with eDRX_IDLE cycle.

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among the DL PRS resource sets is used to derive $T_{PRS,i}$, where:

- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.
- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

If the following conditions are met, the time $T_{PRS-RSRP,Total}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24 s, and
- periodic PRS measurement reporting is configured, and
- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and
- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{PRS-RSRP,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 4.5.2.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or
- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

Longer PRS-RSRP measurement period is expected when there is collision/overlap between other DL signals/channels and PRS resources in RRC_IDLE state.

The requirements in clause 4.5.3 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If the DRX cycle is reconfigured during the PRS-RSRP measurement period then the PRS-RSRP measurement period can be longer.

If cell reselection occurs while PRS-RSRPP measurement is being performed, then the UE shall continue and complete the on-going PRS-RSRP measurement after the cell selection is completed. The PRS-RSRP measurement period can be longer.

If the UE's RRC state changes from the RRC_IDLE to RRC_CONNECTED during the PRS-RSRP measurement period, then the UE shall continue the PRS-RSRP measurement in the RRC_CONNECTED state. The PRS-RSRP measurement period can be longer.

The UE shall meet the PRS-RSRP measurement accuracy requirements in clause 10.1.24.2.

4.5.4 PRS-RSRPP measurements

4.5.4.1 Introduction

The requirements in clause 4.5.4 shall apply provided the UE has received a message from LMF via LPP requesting the UE to measure and report PRS-RSRPP measurements defined in TS 38.215 [4]. The UE is supposed to transition to RRC_CONNECTED state to report the measurements.

4.5.4.2 Requirements Applicability

The requirements in clause 4.5.4 apply for periodic and triggered PRS-RSRPP measurements, provided:

- PRS-RSRPP related side conditions given in clause 10.1.38.2 are met for a corresponding Band.

4.5.4.3 Measurement Capability

UE PRS-RSRPP measurement capability in RRC_IDLE state is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

4.5.4.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. The UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For PRS-RSRPP measurements performed by the UE in RRC_IDLE state, the measurement reporting delay excludes all of the following:

- any delay caused other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH which is equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by no UL resources for UE to send the measurement report,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported PRS-RSRPP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.38.3.

The PRS-RSRPP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1.38.2.

4.5.4.5 Measurement Period Requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], and the PRS-RSRPP measurement is performed in RRC_IDLE state, measurement period requirements for PRS-RSRP defined in clause 4.5.3.5 is re-used for PRS-RSRPP measurement.

4.5.5 Measurement requirements for DL RSCPD reported with RSTD

4.5.5.1 Introduction

The requirements in clause 4.5.5 shall apply provided the UE has received *NR-DL-TDOA-RequestLocationInformation* message with *dl-PRS-RSCPD-Request-r18* from the LMF via LPP [34] requesting the UE to measure and report DL RSCPD with DL RSTD measurements defined in TS 38.215 [4].

4.5.5.2 Requirements Applicability

The requirements in clause 4.5.5 apply for periodic and triggered RSTD and DL RSCPD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23.2 for FR1 and FR2 are fulfilled, for a corresponding Band.
- DL RSCPD related side conditions given in clause 10.1.43.2 for FR1 and FR2 are fulfilled, for a corresponding Band.

4.5.5.3 Measurement Capability

The UE PRS RSTD and DL-RSCPD measurement capabilities in RRC_IDLE state are as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355 [34].

4.5.5.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. The UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For RSTD and DL RSCPD measurements performed by the UE in RRC_IDLE state, the measurement reporting delay excludes all of the following:

- additional delay caused by other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH, equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by unavailability of UL resources to transmit the measurement report,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.23.3. The reported DL RSCPD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.43.3.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2, for each measured DL PRS resource. The DL RSCPD measurements performed and reported according to this section shall meet the DL RSCPD measurement accuracy requirements in clause 10.1.43.2, for each measured DL PRS resource.

4.5.5.5 Measurements Period Requirements

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34] with *dl-PRS-RSCPD-Request-r18*, the UE shall be able to measure multiple (up to the UE capability specified in clause 4.5.5.3) DL RSTD and DL RSCPD measurements, defined in TS 38.215 [4].

When LMF does not configure measurement time window(s):

- When a single PFL is configured, requirements in clause 4.5.2.5 apply to both DL RSTD and DL RSCPD.
- When multiple PFLs are configured, the UE performs DL RSCPD measurement on a single PFL that is common between the reference TRP and the target TRP, and requirements in clause 4.5.2.5 apply to both DL RSTD and DL RSCPD.

When LMF configures measurement time window(s), but UE does not support RSCPD measurement inside time window as indicated in *supportOfMeasurementsInTimeWindow*:

- The UE performs DL RSCPD measurement on the indicated PFL by the network. The requirements in clause 4.5.2.5 apply to both DL RSTD and DL RSCPD measurements.

When LMF configures measurement time window(s), and UE supports RSCPD measurement inside time window as indicated in *supportOfMeasurementsInTimeWindow* but does not support RSTD measurement inside time window as indicated in *supportOfMeasurementsInTimeWindow*:

- The requirements in the clause 4.5.2.5 apply to DL RSTD measurement.
- The requirements in clause 4.5.5.5 apply to DL RSCPD measurement for the PRS resource(s) that have occasions only within the measurement time window.

When LMF configures measurement time window(s), and UE supports RSTD and RSCPD measurements inside time window as indicated in *supportOfMeasurementsInTimeWindow*:

- The requirements in clause 4.5.5.5 apply to DL RSTD measurement and DL RSCPD measurement.

If a one-shot time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in clause 4.5.5.3) DL RSTD and DL RSCPD measurements, defined in TS 38.215 [4], based on the indicated PRS resource sets occurring inside the one-shot time window during the measurement period $T_{RSCPD\ with\ RSTD,Total}$ defined as:

$$T_{RSCPD\ with\ RSTD,Total} = \min(L_{window}, 10\ \text{ms}) + T_i,$$

and the UE shall be able to measure multiple DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total,with\ one\ shot\ window}$ defined as:

$$T_{RSTD,Total,with\ one\ shot\ window} = T_{RSCPD\ with\ RSTD,Total} + max\left(T_{effect,i}\right) + T_{RSTD,Total}$$

Where:

- the start of the measurement is the start of the one-shot time window, and
- L_{window} is the length of the one-shot window, and
- $T_{effect,i}$ and T_i are defined in the following of this clause, and
- $T_{RSTD,Total}$ is defined in clause 4.5.2.5.

The requirements with one-shot window assume scaling factors equal to 1 for the PFLs, for which the one-shot time window is configured.

If a periodic time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in clause 4.5.5.3) DL RSTD and DL RSCPD measurements, defined in TS 38.215 [4], based on the indicated PRS resource sets occurring inside the time window during the measurement period $T_{RSCPD\ with\ RSTD,Total}$ defined as:

$$T_{RSCPD\ with\ RSTD,Total} = \sum_{i=1}^{L} T_{RSCPD\ with\ RSTD,i} + (L-1) * \max\left(T_{effect,i}\right)$$

Where:

- i is the index of positioning frequency layer,
- L is total number of positioning frequency layers, and
- $T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i

$T_{RSCPD\ with\ RSTD,i}$ is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

$$T_{RSCPD\ with\ RSTD,i} = \left(K_{carrier_PRS} * N_{Rx,TEG,i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil * \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last,i},$$

Where:

- $N_{RxBeam,i}$ is the UE Rx beam sweeping factor:
  - $N_{RxBeam,i}$ = 1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2
    - $N_{RxBeam,i}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*.
  - $N_{RxBeam,i}$ equals to 8, otherwise.
- $K_{carrier_PRS}$ is a scaling factor for PRS-based NR positioning measurements in RRC_IDLE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier_PRS}$ = 1; otherwise,
- If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, $K_{carrier_PRS} = K_{carrier} + 1$, where $K_{carrier}$ is defined in clause 4.2.2.4
- If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier_PRS} = N_{layers} + 1$, where N_{layers} is defined in clause 4.2.2.7.
- $N_{Rx,TEG,i}$ is the Rx TEG specific scaling factor:
  - $N_{Rx,TEG,i}$ =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].
  - $N_{Rx,TEG,i}$ is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:
    - $N_{Rx,TEG,i} = P$, if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case 'n0' is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.
    - $N_{Rx,TEG,i} = \left\lceil \frac{P}{Q} \right\rceil$, if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where Q is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].
- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.
- $L_{available_PRS,i}$ is the time duration of available PRS in positioning frequency layer *i* to be measured $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only the unmuted PRS resources in the indicated resources sets that are not fully overlapped with other higher-priority DL signals/channels and overlapped the time window(s) are considered if PFL *i* is associated with the time window are considered, otherwise only the unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.
- N_{sample} is the number of PRS RSTD samples, where

- N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
  - PRS bandwidth is within the initial BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.
- N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
  - PRS bandwidth is within the initial BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.
- N_{sample} = 4 otherwise.

- $T_{last,i}$ is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time, $T_{\text{last,i}} = T_{\text{i}} + T_{available_PRS,\text{i}}$,
- $T_{\text{effect},i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

$$T_{\text{effect,i}} = \left\lceil \frac{T_{\text{i}}}{T_{available_PRS,\text{i}}} \right\rceil * T_{available_PRS,\text{i}}$$

Where:

- T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],
- $T_{available_PRS,\text{i}} = LCM\left(T_{PRS,\text{i}}, T_{DRX}, T_{window}\right)$, the least common multiple between the time window periodicity T_{window} $T_{PRS,\text{i}}$, and the DRX cycle length T_{DRX}, defined in TS 38.304 [1], clause 7.1, if PFL *i* is associated with the time window, otherwise $T_{available_PRS,\text{i}} = LCM\left(T_{PRS,\text{i}}, T_{DRX}\right)$,
- $T_{PRS,\text{i}}$ is the periodicity of DL PRS resource with muting on positioning frequency layer *i*, and when calculating $T_{PRS,\text{i}}$, only the PRS resources in the indicated resources sets and overlapped with the indicated time window(s) are considered if PFL *i* is associated with the time window,
- T_{window} is the maximum periodicity of the indicated time window(s).

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the positioning frequency layer is used to derive $T_{PRS,\text{i}}$, where,

- $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource,
- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.
- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where
- T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.
- $\{N, T\}$ is the UE capability combination per band for RRC_IDLE state where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34], T (ms) corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34], and T-N>0 is the time required to process duration N of DL PRS symbols already buffered in memory, for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],
- N' is UE capability for number of DL PRS resources that it can process in a slot in RRC_IDLE state as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* specified in TS 37.355 [34].

If the following conditions are met, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24 s, and
- periodic PRS measurement reporting is configured, and
- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and
- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the DRX cycle is reconfigured during the RSCPD with RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA with a request to perform RSCPD measurement with RSTD measurement, RSCPD with RSTD and PRS-RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA with a request to perform RSCPD measurement with RSTD measurement, RSCPD with RSTD and PRS-RSRPP are performed over the same measurement period.The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 5.6.1.

Longer RSCPD with RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If $K_{\text{carrier_PRS}}$ changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 4.5.5 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If cell re-selection occurs while RSTD and DL RSCPD measurements are being performed, then the UE shall continue and complete the on-going RSTD and DL RSCPD measurements after the cell selection is completed. The RSTD and DL RSCPD measurement period can be longer.

If the RRC state transition occurs from RRC_IDLE to RRC_CONNECTED state during the measurement period then the UE shall continue the RSTD and DL RSCPD measurement in the RRC_CONNECTED state. The RSTD and DL RSCPD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2.

The UE shall meet the DL-RSCPD measurement accuracy requirements in clause 10.1.43.2.

4.5A Reporting Delay Requirements for DL AI/ML Positioning

4.5A.1 Introduction

The reporting delay requirements in clause 4.5A shall apply provided the UE supports DL AI/ML positioning specified in TS 38.305 [22] as indicated in *NR-DL-AIML-ProvideCapabilities*, and has received *NR-DL-AIML-RequestLocationInformation* message from LMF via LPP requesting UE to report its location based on DL AI/ML positioning [34].

The position reporting delay is the sum of measurement delay, inference delay, and the time needed until the UE is ready to send the position report to LMF and is defined as the time between the moment when the position report is triggered and the moment when the UE is ready to start to transmit the position report over the air interface. The UE shall be able to send the positioning response within

$$T_{position_reporting_delay} = T_{measurement_delay} + T_{inference_delay},$$

where $T_{measurement_delay}$ is either the measurement period defined in clause 4.5A.2 or the measurement period with bandwidth aggregation as defined in clause 4.5A.3, and the inference delay, $T_{inference_delay}$, is the summation of inference delay across the number of configured PFLs where inference delay per PFL is reported by UE for FG 59-3 and indicated to LMF. For bandwidth aggregation, the inference delay is the sum of inference delays across all effective PFLs where the UE performs aggregated measurements, with inference delay per effective PFL is equal to each per-PFL inference delay reported by the UE for FG 59-3 and indicated to the LMF.When performing measurements in RRC_IDLE state, the UE will transition to RRC_CONNECTED state prior to transmitting the positioning report. Therefore, the positioning reporting delay in RRC_IDLE state excludes all of the following:

- additional delay caused other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH, equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by unavailability of UL resources to transmit the measurement report,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

4.5A.2 Measurements Period Requirements

After receiving both *NR-DL-AIML-ProvideAssistanceData message and NR-DL-AIML-RequestLocationInformation* message from the LMF via LPP [34], the UE shall be able to measure PRS resources within the measurement period $T_{measurement_delay}$ to produce inputs for its AI/ML model to infer its location for reporting. The measurement delay when UE performs PRS measurement within the measurement gap is defined as:

$$T_{measurement_delay} = \sum_{i=1}^{L} T_{measure,i} + (L-1) * \max\left(T_{effect,i}\right)$$

Where:

- i is the index of positioning frequency layer,
- L is total number of positioning frequency layers, and
- $T_{effect,i}$ is the periodicity of the PRS measurement in positioning frequency layer i

$T_{measure,i}$ is the measurement period for PRS measurement in positioning frequency layer *i* as specified below:

$$T_{measure,i} = \left(K_{carrier_PRS} * N_{Rx,TEG,i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil * \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last,i},$$

Where:

- $N_{RxBeam,i}$ is the UE Rx beam sweeping factor:

- $N_{RxBeam,i}$ = 1 if positioning frequency layer *i* is in FR1. If positioning frequency layer *i* is in FR2, $N_{RxBeam,i}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-AIML-RequestLocationInformation* .

- $N_{RxBeam,i}$ equals to 8, otherwise.

- $K_{\text{carrier_PRS}}$ is a scaling factor for PRS-based NR positioning measurements in RRC_IDLE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{\text{carrier_PRS}}$ = 1; otherwise,

- If Srxlev ≤ $S_{\text{nonIntraSearchP}}$ or Squal ≤ $S_{\text{nonIntraSearchQ}}$, $K_{\text{carrier_PRS}} = K_{\text{carrier}} + 1$, where K_{carrier} is defined in clause 4.2.2.4

- If Srxlev > $S_{\text{nonIntraSearchP}}$ and Squal > $S_{\text{nonIntraSearchQ}}$, $K_{\text{carrier_PRS}} = N_{\text{layers}} + 1$, where N_{layers} is defined in clause 4.2.2.7.

- $N_{Rx,TEG,i}$ is the Rx TEG specific scaling factor:

- $N_{Rx,TEG,i}$ = P, where P is the number of UE Rx TEGs configured by LMF for PRS measurement depending on the UE capability regarding the number of UE-RxTEG(s) that is supported by UE and reported for FG 59-6-
  $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

- $L_{available_PRS,\text{i}}$ is the time duration of available PRS in positioning frequency layer *i* to be measured $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,\text{i}}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- N_{sample} is the number of PRS measurement samples, where

  - N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive-r17* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

    - PRS bandwidth is within the initial BWP and

    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

  - N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive-r17* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

    - PRS bandwidth is within the initial BWP and

    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

  - N_{sample} = 4 otherwise.

- $T_{last,i}$ is the measurement duration for the last PRS measurement sample in positioning frequency layer *i*, including the sampling time and processing time, $T_{\text{last,i}} = T_{\text{i}} + T_{available_PRS,\text{i}}$,

- $T_{\text{effect},i}$ is the periodicity of the PRS measurement in positioning frequency layer i defined as:

$$T_{\text{effect,i}} = \left\lceil \frac{T_{\text{i}}}{T_{available_PRS,\text{i}}} \right\rceil * T_{available_PRS,\text{i}}$$

Where:

- T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- $T_{available_PRS,\text{i}} = LCM\left(T_{PRS,\text{i}}, T_{DRX}\right)$, the least common multiple between $T_{PRS,\text{i}}$ and T_{DRX}, where T_{DRX} is the DRX cycle of the UE, defined in TS 38.304 [1], clause 7.1.

- $T_{PRS,\text{i}}$ is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the positioning frequency layer is used to derive $T_{PRS,\mathrm{i}}$, where,

- $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource,
- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.
- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where
- T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.
- $\{N, T\}$ is the UE capability combination per band for RRC_IDLE state where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34], T (ms) corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34], for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],
- N' is UE capability for number of DL PRS resources that it can process in a slot in RRC_IDLE state as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* specified in TS 37.355 [34].

If the following conditions are met, the time $\mathrm{T}_{\mathrm{measurement_delay}}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24 s, and
- periodic PRS measurement reporting is configured, and
- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and
- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{\mathrm{measurement_delay},Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].When the UE is configured with periodic reporting, as defined in TS 23.273, clause 4.1a.5.1,

If the UE operates in eDRX and eDRX is configured by higher layers [1], and the eDRX cycle $\mathrm{T}_{\mathrm{eDRX,\ CN}}$ is smaller than or equal to the configured PRS measurement reporting periodicity given by *reportingInterval* in TS 37.355 [34], and $\mathrm{T}_{\mathrm{eDRX,\ CN}}$ > 10.24 s, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) instances in the assistance data contained inside a Paging Time Window (PTW) after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34]. Otherwise, the time $T_{\mathrm{measurement_delay},Total}$ starts from the first DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

When the UE is not configured with periodic reporting, the time $T_{\mathrm{measurement_delay},Total}$ starts from the first DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the UE DRX cycle T_{DRX} changes during the measurement period, then the measurement period can be longer.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels.

Longer measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If $K_{\mathrm{carrier_PRS}}$ changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 4.5A.2 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AIML-ProvideCapabilities*.

If cell re-selection occurs while measurements are being performed, then the UE shall continue and complete the on-going measurements after the cell selection is completed. The measurement period can be longer.

If the RRC state transition occurs from RRC_IDLE to RRC_CONNECTED state during the measurement period, then the UE shall continue the measurement in the RRC_CONNECTED state. The measurement period can be longer.

4.5A.3 Measurements Period Requirements with Bandwidth Aggregation

When UE physical layer receives last of *NR-DL-AIML-ProvideAssistanceData* message, *NR-DL-AIML-RequestLocationInformation* message from LMF via LPP [34] with an indication of PRS resources in multiple PFLs that can be aggregated in *nr-DL-PRS-AggregationInfo*, the UE shall be able to measure PRS resources within the measurement period $T_{measurement_delay}$ to produce inputs for its AI/ML model to infer its location for reporting. The measurement delay when UE performs PRS measurement by aggregating PRS resources in multiple PFLs is defined as:

$$T_{measurement_delay} = T_{measurement_delay,aggr} + T_{measurement_delay,non-aggr} + T_{margin}$$

Where:

- $T_{measurement_delay,aggr}$ is the total measurement period for aggregated measurements, and
- $T_{measurement_delay,non-aggr}$ is the total measurement period for non-aggregated measurements as defined in this clause, and
- When both $T_{measurement_delay,aggr}$ and $T_{measurement_delay,non-aggr}$ are non-zero, then $T_{margin} = T'_{margin}$; otherwise $T_{margin} = 0$, where $T'_{margin} = \max(T_{effect,j})$, and the maximum $T_{effect,j}$ is across all the PFL combination(s) and non-aggregated PFL(s) configured for positioning measurements.

$T_{measurement_delay,non-aggr}$ is zero if every resource set on every PFL is linked for aggregation to at least one other resource set on another PFL. Otherwise, $T_{measurement_delay,non-aggr}$ is as defined in clause 4.5A.2 with the following exceptions,

- only PFLs containing resource set(s) not linked to any other resource set(s) are considered in L,
- on each PFL i, only resource set(s) not linked to any other resource set(s) are considered in $T_{available_PRS,i}$, $N^{slot}_{PRS,i}$ and $L_{available_PRS,i}$,
- $N_{sample} = 2$ if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-Inactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,
- $(L-1) * \max(T_{effect,i})$ is replace by $(L-1) * T'_{margin}$.

$T_{measurement_delay,aggr}$ is zero if no resource sets on any PFL are linked for aggregation with other resource sets on other PFLs. Otherwise, $T_{measurement_delay,aggr}$ is defined as

$$T_{measurement_delay,aggr} = \sum_{m=1}^{M} T_{measurement_delay,aggr,m} + (M-1) * T'_{margin}$$

where:

- m is the index of PFL combination,

- M is total number of PFL combinations,
- $T_{effect,aggr,m}$ is the periodicity of the PRS measurement in PFL combination m as defined in this clause,
- $T_{measurement_delay,aggr,m}$ is the measurement period for PRS measurement in PFL combination m as specified below.

$$T_{measurement_delay,aggr,m} = \left(K_{carrier,aggr} * N_{Rx,TEG,aggr,m} * N_{RxBeam,aggr,m} * \left\lceil \frac{N_{PRS,aggr,m}^{slot}}{N'_{aggr,m}} \right\rceil * \left\lceil \frac{L_{available_{PRS},aggr,m}}{N_{aggr,m}} \right\rceil * N_{sample} - 1 \right) * T_{effect,aggr,m} + T_{last,aggr,m}$$

where:

- $K_{carrier,aggr}$ is a scaling factor for PRS measurements in RRC_IDLE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier_PRS} = 1$. Otherwise,
  - If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, $K_{carrier_PRS}$ equals to the sum of $K_{carrier}$ in clause 4.2.2.4 and one positioning layer.
  - If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier_PRS}$ equals to the sum of N_{layer} in clause 4.2.2.7 and one positioning layer.
- $N_{Rx,TEG,m}$ is the Rx TEG specific scaling factor:
- $N_{Rx,TEG,m}$ = P, where P is the number of UE Rx TEGs configured by LMF for PRS measurement depending on the UE capability regarding the number of UE-RxTEG(s) that is supported by UE and reported for FG 59-6.
- $N_{RxBeam,aggr,m}$ is a scaling factor for PRS measurements with multiple Rx beams, and is defined as
  - $N_{RxBeam,aggr,m}$ = 1 if PFL combination *m* is in FR1,
  - $N_{RxBeam,aggr,m}$ equals to 8 otherwise if PFL combination *m* is in FR2, unless specified otherwise.
  - $N_{PRS,aggr,m}^{slot}$ is the maximum number of DL PRS resources in PFL combination *m* configured in a slot, and only the PRS resources in resource set(s) linked to other resource set in PFL combination *m* are counted
  - $N'_{aggr,m}$ is the UE capability on maximum number of DL PRS resources that can be processed in a slot for PFL combination *m* as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot* specified in TS 37.355 [34].
  - $L_{available_{PRS},aggr,m}$ is the time duration of available PRS resources in PFL combination *m* to be measured during $T_{PRS,aggr,m}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_{PRS},aggr,m}$, only unmuted PRS resources in resource set(s) linked to other resource set in PFL combination *m* and that are not fully overlapped with other higher-priority DL signals/channels are considered.
  - $N_{aggr,m}$ is the UE capability on duration of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN* specified in TS 37.355 [34].
  - N_{sample} is number of PRS measurement samples,
    - N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,
    - N_{sample} = 4 otherwise.
  - $T_{effect,aggr,m}$ is the periodicity of the PRS measurement in PFL combination m,

$$T_{effect,aggr,m} = \left\lceil \frac{T_{aggr,m}}{T_{available,PRS,aggr,m}} \right\rceil * T_{available,PRS,aggr,m}$$

- $T_{aggr,m}$ is the UE capability on time for processing of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* specified in TS 37.355 [34].

- $T_{available,PRS,aggr,m} = LCM(T_{PRS,aggr,m}, T_{DRX})$, the least common multiple between $T_{PRS,aggr,m}$ and the DRX cycle length T_{DRX}, defined in TS 38.304 [1], clause 7.1.

- $T_{PRS,aggr,m}$ is the periodicity of DL PRS resource with muting on PFL combination m

  - If more than one PRS periodicities are configured in PFL combination m, the least common multiple of PRS periodicities $T_{per}^{\text{PRS with muting}}$ among all DL PRS resource sets that are linked to other resource set in PFL combination m, is used to derive $T_{PRS,aggr,m}$, and for each applicable PRS resource set,

    - $T_{per}^{\text{PRS with muting}} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource, and

    - T_{per}^{PRS} is the periodicity of PRS resource set given by the higher-layer parameter *DL-PRS-Periodicity*, and

    - N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

- $T_{last,aggr,m}$ is the measurement duration for the last PRS sample in PFL combination m, including the sampling time and processing time, $T_{last,aggr,m} = T_{aggr,m} + T_{available,PRS,aggr,m}$.

If the following conditions are met, the time $T_{measurement_delay,Total}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24 s, and

- periodic PRS measurement reporting is configured, and

- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements satisfy all the conditions specified in clause 5.1.6.5.3 in TS 38.214 [26].

NOTE: No separate requirement on non-aggregated measurement based on $T_{measurement_delay,non-aggr}$ or on aggregated measurement based on $T_{measurement_delay,aggr}$ is applied when both $T_{measurement_delay,aggr}$ and $T_{measurement_delay,non-aggr}$ are non-zero.

If the DRX cycle is reconfigured during the measurement period, then the measurement period can be longer.

Longer measurement period is expected when there are collisions between PRS resources in any of the PFLs configured for aggregation and other higher-priority DL signals/channels.

If $K_{carrier_PRS}$ changes for any PFL or any PFL combination during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 4.5.2.6 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AIML-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If cell re-selection occurs while measurements are being performed, then the UE shall continue and complete the on-going measurements after the cell selection is completed. The measurement period can be longer.

4.6 NR measurements for positioning for RedCap

4.6.1 Introduction

This clause contains requirements for RedCap UE capable of performing NR positioning measurements defined in TS 38.215 [4], including RSTD, PRS-RSRP, and PRS-RSRPP, in RRC_IDLE state.

The requirements in clauses 4.6.2, 4.6.3, and 4.6.4 are applicable to PRS resources that do not collide with other DL signals/channels which include SSB, SIB1, CORESET0, MSG2/MSGB, paging and DL SDT. In addition, a UE is not expected to receive PRS resources that collide with a time interval starting at symbol *m* and ending at symbol $m + N_2$, where symbol *m* is the last symbol in which the UE is configured to receive PDCCH and N_2 is defined in clause 6.4 of TS 38.214 [26] for the subcarrier spacing μ of the DL PRS.

If a PRS resource is outside or partially overlapped with the initial DL BWP, a PRS resource instance collides with another DL signals/channels if any portion of the other DL signal/channel overlaps with the time interval starting X symbols before the PRS instance and ending X symbols after the PRS instance, taking into account *nr-DL- PRS-ExpectedRSTD-Uncertainty* and *nr-DL-PRS-ExpectedRSTD*. Where X is defined in table 5.6.1-1.

All measurement requirements specified in clauses 4.6.2, 4.6.3, and 4.6.4 shall apply for DRX and eDRX configurations specified in TS 38.331 [2] for RRC_IDLE state.

The requirements in clauses 4.6.2, 4.6.3, and 4.6.4 are applicable provided that the cell selection procedure for the selected PLMN defined in TS 38.304 [1] is not triggered during PRS measurement period.

The requirements in clauses 4.6.2, 4.6.3, and 4.6.4 apply provided that all PRS resources within a PFL are within up to 2 separate windows within $T_{PRS,i}$ for each positioning frequency layer *i*, where each window is up to 10 ms and $T_{PRS,i}$ is defined in in clauses 4.6.2, 4.6.3, and 4.6.4.

The UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

When the UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

4.6.2 RSTD measurements for RedCap

4.6.2.1 Introduction

The requirements in clause 4.6.2 shall apply provided the RedCap UE performing PRS measurement with Rx FH or without RX FH in RRC_IDLE state has received *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34] requesting the UE to measure and report DL RSTD measurements defined in TS 38.215 [4].

4.6.2.2 Requirements Applicability

The requirements in clause 4.6.2 apply for periodic and triggered RSTD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23.2 for FR1 are fulfilled, for a corresponding Band, for 1 Rx RedCap UE.

- PRS-RSTD related side conditions given in clause 10.1.23.2 for FR1 and FR2 are fulfilled, for a corresponding Band, for 2 Rx RedCap UE.

4.6.2.3 Measurement Capability

The UE PRS RSTD measurement capability in RRC_IDLE state is as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355 [34].

4.6.2.4 Measurement Reporting Requirements

The measurement reporting delay shall satisfy the requirements defined in clause 4.5.2.4, with the exception of the applicable measurement accuracy requirements, which are specified below.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1A.16.2.1, for each measured DL PRS resource by 1 Rx RedCap UE without RX FH.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2, for each measured DL PRS resource by 2 Rx RedCap UE without RX FH.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1A.16.2.2, for each measured DL PRS resource by 2 Rx RedCap UE with RX FH.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1A.16.2.2, for each measured DL PRS resource by 1 Rx RedCap UE with RX FH.

4.6.2.5 Measurements Period Requirements without RX FH

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34], and UE is not configured to perform DL RSTD measurement with RX FH, the UE shall be able to measure multiple (up to the UE capability specified in clause 4.6.2.3) DL RSTD measurements without RX FH, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined in 4.5.2.5.

If the following conditions are met, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24 s, and

- periodic PRS measurement reporting is configured, and

- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 4.6.2.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If $K_{\text{carrier_PRS}}$ changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,\text{i}}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 4.6.2.5 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC_IDLE to RRC_CONNECTED state during the RSTD measurement period then the UE shall continue the RSTD measurement in the RRC_CONNECTED state. The RSTD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2.

4.6.2.6 Measurement Period Requirements with RX FH

The requirements in this clause apply when a RedCap UE is requested by the LMF to perform measurements with FH, and UE reports measurement based on multiple hops.

The requirements in clause 4.5.2.5 shall apply with the following modifications.

- N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.
- A measurement sample with FH is defined as a PRS measurement over multiple hops within a single time window.
- $L_{available_PRS,i} = \sum_{j=1}^{J} N_{hop,i,j} * L_{per-hop,i,j}$, where
  - $N_{hop,i,j}$ is the number of hops that UE can do within a time window occasion *j* as defined in the following, and
  - $L_{per-hop,i,j}$ is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured in time window occasion *j* during $T_{available_PRS,\text{i}}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{per-hop,i,j}$, only the PRS resources unmuted and fully or partially overlapped with the sampling duration in each hop are considered;
  - *J* is the number of time window occasions during $T_{available_PRS,\text{i}}$.

The sampling window per hop is the first $T_{sample,hop}$ symbols in each hop, where $T_{sample,hop} = T_{hop} - RRT_{FH}$, T_{hop} is the applicable length per hop as defined in table 4.6.2.6-1, and RRT_{FH} is the retuning time between Rx hops as reported by UE in *rf-RxRetuneTimeFR1* or *rf-RxRetuneTimeFR2* via *NR-DL-PRS-ProcessingCapability* [34]. The first hop within a time window instance starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the time window instance considering the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table 4.6.2.6-1: Applicable number of hops per slot and applicable length of each hop

RRT_{FH}	(comb size, Number of PRS symbols)	Applicable number of hops per slot (N_{hops}^{slot})	Applicable length per hop (T_{hop}) in number of symbols
$RRT_{FH} \leq 2$ symbols	(2, 12) with SCS 15 kHz, 30 kHz, 60 kHz in FR2, 120 kHz	2	7
	All others	1	14
2 symbols $< RRT_{FH}$ ≤ 6 symbols	(≤ 6, any)	1	14
	(12, 12)	½	28
$RRT_{FH} > 6$ symbols	Any combination	½	28

The number of hops within a single time window occasion $N_{hop,i,j}$ is defined as

$$N_{hop,i,j} = min\left(N_{hops,effect,i,j}, \left\lfloor \frac{N3_i}{L_{per-hop,i,j}} \right\rfloor, N_{hop,max,i}\right),$$

where

- $N_{hop,max,i}$ is the maximum number of Rx hops signaled as reported by UE in *maximumFH-Hops* via *NR-DL-PRS-ProcessingCapability* as specified in [34] for positioning frequency layer *i*,
- $N_{hops,effect,i,j}$ is the effective number of Rx hops within a single time window occasion *j*,
  - $N_{hops,effect,i,j} = 2 * N_{rep}^{PRS}$, if $N_{hops}^{slot} = 2$,
  - $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1$,
  - $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} > 1$,
  - $N_{hops,effect,i,j} = \left\lfloor \frac{\left(N_{rep}^{PRS}-1\right)}{2} \right\rfloor + 1$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} = 1$,

    where N_{rep}^{PRS} is the number of PRS repetitions within the time window occasion, which are unmuted and fully or partially overlapped with the sampling duration within each hop. M_{rep}^{PRS} is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap* and N_{hops}^{slot} is the applicable number of hops per slot as defined in table 4.6.2.6-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions $\left(N_{rep}^{PRS}\right)$ within a time window instance and the same PRS repetition interval $\left(M_{rep}^{PRS}\right)$, otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of BW_{total} defined as

$$BW_{total} = min\left(BW_{PRS}, N_{hop,i,j} * BW_{per-hop} - \left(N_{hop,i,j} - 1\right) * BW_{overlap}\right),$$

where

BW_{PRS} is the minimum among:

- configured PRS BW, and
- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18* as specified in [34], and
- total BW of all hops requested by LMF via *nr-DL-PRS-RxHoppingTotalBandwidth-r18* as specified in [34],

$N_{hop,i,j}$ is number of hops within a single time window as define above,

$BW_{per-hop}$ is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16* as specified in [34].

$BW_{overlap}$ is the UE capability on BW of the overlapping RB indicated via *numOfOverlappingPRB-r18* as specified in [34].

4.6.3 PRS-RSRP measurements for RedCap

4.6.3.1 Introduction

The requirements in clause 4.6.3 shall apply provided the RedCap UE has received a message from LMF via LPP [34] requesting the RedCap UE to measure and report PRS-RSRP measurements defined in TS 38.215 [4]. And the RedCap UE is capable of supporting the PRS-RSRP measurement in RRC IDLE state.

4.6.3.2 Requirements applicability

The requirements in clause 4.6.3 apply for periodic and triggered PRS-RSRP measurements, provided:

- PRS-RSRP related side conditions given in clause 10.1.23.2 for FR1 are met for a corresponding Band for 1 Rx RedCap UE.
- PRS-RSRP related side conditions given in clause 10.1.23.2 for FR1 and FR2 are met for a corresponding Band for 2 Rx RedCap UE.

4.6.3.3 Measurement Capability

UE PRS-RSRP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

4.6.3.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. The UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For PRS-RSRP measurements performed by the UE in RRC_IDLE state, the measurement reporting delay excludes all of the following:

- any delay caused by other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH which is equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by no UL resources for UE to send the measurement report,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported PRS-RSRP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.24.3.

The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1.24.2 for FR1 for 1 Rx RedCap UE.

The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1.24.2 for FR1 and FR2 for 2 Rx RedCap UE.

4.6.3.5 Measurement Period Requirements without RX FH

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], and UE is not configured to perform measurement with RX FH, the UE shall be able to measure multiple (up to the UE capability specified in clause 4.6.3.3) PRS-RSRP

measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within $T_{PRS-RSRP,total}$.

$$T_{PRS-RSRP,\ total} = \sum_{i=1}^{L} T_{PRS-RSRP,i} + (L-1) * \max\left(T_{effect,i}\right)$$

Where:

- i is the index of positioning frequency layer,
- L is total number of positioning frequency layers,
- $T_{effect,i}$ is the periodicity of the PRS-RSRP measurement in positioning frequency layer i.

$$T_{PRS-RSRP,i} = \left(K_{carrier_PRS_RedCap_i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last}$$

Where:

- $K_{carrier_PRS_RedCap_i}$ is a scaling factor for PRS-based NR positioning measurements in RRC_IDLE. If the UE can perform RRM measurement and PRS measurement in parallel to each other, $K_{carrier_PRS_RedCap_i} = 1$. Otherwise,
- If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, $K_{carrier_PRS_RedCap} = K_{carrier_RedCap} + 1$, where $K_{carrier_RedCap}$ is defined in clause 4.2B.2.4.
- If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier_PRS_RedCap} = N_{layers} + 1$, where N_{layer} is defined in clause 4.2.2.7.
- $N_{RxBeam,i}$ is the scaling factor for Rx beam sweeping:
  - $N_{RxBeam,i}$=1 if positioning frequency layer i is in FR1 or UE has only 1 Rx branch, and if positioning frequency layer i is in FR2 or UE has 2 Rx branches
    - $N_{RxBeam,i}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-AoD-RequestLocationInformation*.
    - $N_{RxBeam,i}$ equals to 8, otherwise.
- $L_{available_PRS,i}$ is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.
- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,
- {N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17*in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],
- N′ is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* in clause 6.4.3 of TS 37.355 [34],
- N_{sample} is the number of PRS-RSRP measurement samples and
  - N_{sample} = 1, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are met:
    - PRS bandwidth is within the initial BWP and
    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

- N_{sample} = 2, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are not met:
  - PRS bandwidth is within the initial BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.
- N_{sample} = 4 otherwise

$T_{last,i} = T_i + T_{available_PRS,i}$ is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time,

- $T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$ is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,
- T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],
- $T_{available_PRS,i} = LCM(T_{PRS,i}, T_{DRX})$, the least common multiple between $T_{PRS,i}$ and T_{DRX}.
- $T_{PRS,i}$ is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,
- T_{DRX} is the DRX cycle length if UE is not configured with eDRX. Otherwise, T_{DRX} is defined as T in TS 38.304 [1].

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among the DL PRS resource sets is used to derive $T_{PRS,i}$, where:

- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.
- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

If the following conditions are met, the time $T_{PRS-RSRP,Total}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* messages are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24 s, and
- periodic PRS measurement reporting is configured, and
- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and
- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{PRS-RSRP,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-TDOAProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* messages are delivered from LMF to the UE via LPP [34].

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 4.6.2.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

Longer PRS-RSRP measurement period is expected when there is collision/overlap between other DL signals/channels and PRS resources in RRC_IDLE state.

The requirements in clause 4.6.3 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If the DRX cycle is reconfigured during the PRS-RSRP measurement period, then the PRS-RSRP measurement period can be longer.

If cell reselection occurs while PRS-RSRP measurement is being performed, then the UE shall continue and complete the on-going PRS-RSRP measurement after the cell selection is completed. The PRS-RSRP measurement period can be longer.

If the UE's RRC state changes from the RRC_IDLE to RRC_CONNECTED during the PRS-RSRP measurement period, then the UE shall continue the PRS-RSRP measurement in the RRC_CONNECTED state. The PRS-RSRP measurement period can be longer.

4.6.3.6 Measurement Period Requirements with RX FH

When physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], and UE is configured to perform PRS-RSRP measurement with RX FH via *nr-DL-PRS-RxHoppingRequest-r18* as defined in TS 37.355 [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 4.6.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], during the measurement period $T_{PRS-RSRP,Total}$ defined in clause 4.6.3.5 with using the following definition for N_{sample} and $L_{available_PRS,i}$.

N_{sample} is the number of PRS-RSRP measurement samples, where

- N_{sample} = 2 if the RedCap UE supports *reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.
- N_{sample} = 4 otherwise.

A measurement sample under RX FH is defined as a PRS measurement over multiple hops.

$L_{available_PRS,i}$ is the time duration of available PRS in the positioning frequency layer *i* to be measured, and is calculated by:

$$L_{available_PRS,i} = \sum_{j=1}^{J} N_{hop,i,j} * L_{per-hop,i,j} ,$$

where,

- $N_{hop,i,j}$ is the number of hops that UE can perform within a time window occasion *j* as defined in the following, and
- $L_{per-hop,i,j}$ is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured in time window occasion *j* during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{per-hop,i,j}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered;
- *J* is the number of time window occasions during $T_{available_PRS,i}$.

The sampling duration per hop is the first $T_{sample,hop}$ symbols in each hop, where $T_{sample,hop} = T_{hop} - RRT_{FH}$, T_{hop} is the applicable length per hop as defined in table 4.6.3.6-1, and RRT_{FH} is the retuning time between Rx hops indicated by UE in *rf-RxRetuneTimeFR1* or *rf-RxRetuneTimeFR2* via *NR-DL-PRS-ProcessingCapability* [34]. The first hop starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the measurement time window, defined in clause 4.6.1, taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table 4.6.3.6-1: Applicable number of hops per slot and applicable length of each hop

RRT_{FH}	(comb size, Number of PRS symbols)	Applicable number of hops per slot (N_{hops}^{slot})	Applicable length per hop ($T_{per-hop}$) in number of symbols
$RRT_{FH} \leq 2$ symbols	(2, 12) with SCS 15 kHz, 30 kHz in FR1, and 60 kHz, 120 kHz in FR2	2	7
	All others	1	14
2 symbols $< RRT_{FH}$ ≤ 6 symbols	(≤ 6, any)	1	14
	(12, 12)	½	28
$RRT_{FH} > 6$ symbols	Any combination	½	28

The number of hops within a single time window N_{hop} is defined as

$$N_{hop,i,j} = min\left(N_{hops,effect,i,j}, \left\lfloor \frac{N3_i}{L_{per-hop,i,j}} \right\rfloor, N_{hop,max,i}\right) \quad ,$$

where

- $N_{hop,max,i}$ is the maximum number of Rx hops signaled by UE in *maximumFH-Hops* via *NR-DL-PRS-ProcessingCapability* for positioning frequency layer *i* as specified in [34].
- $N3_i$ is indicated via UE capability *processingPRS-SymbolsDurationN3-r18* for positioning frequency layer *i.*
- $N_{hops,effect,i,j}$ is the effective number of Rx hops within a single time window occasion *j*,
  - $N_{hops,effect,i,j} = 2 * N_{rep}^{PRS}$, if $N_{hops}^{slot} = 2$,
  - $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1$,
  - $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} > 1$,
  - $N_{hops,effect,i,j} = \left\lfloor \frac{(N_{rep}^{PRS}-1)}{2} \right\rfloor + 1$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} = 1$,
  - where N_{rep}^{PRS} is the number of inter-slot PRS repetitions within a single time window, which are unmuted and fully or partially overlapped with the sampling duration within each hop. M_{rep}^{PRS} is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap*, N_{hops}^{slot} is the applicable number of hops per slot as defined in table 4.6.3.6-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions (N_{rep}^{PRS}) within a time window instance and the same PRS repetition interval (M_{rep}^{PRS}), otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of BW_{total} defined as

$$BW_{total} = min\left(BW_{PRS}, N_{hop,i,j} * BW_{per-hop} - \left(N_{hop,i,j} - 1\right) * BW_{overlap}\right) \quad ,$$

where

BW_{PRS} is the minimum among:

- configured PRS BW, and
- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18* as specified in [34], and
- total BW of all hops requested by LMF via *nr-DL-PRS-RxHoppingTotalBandwidth-r18* as specified in [34].

$N_{hop,i,j}$ is number of hops within a single time window as defined above.

$BW_{per-hop}$ is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16* as specified in [34].

$BW_{overlap}$ is the UE capability on BW of the overlapping PRB indicated via *numOfOverlappingPRB-r18* as specified in [34].

4.6.4 PRS-RSRPP measurements for RedCap

4.6.4.1 Introduction

The requirements in clause 4.6.4 shall apply provided the UE has received a message from LMF via LPP requesting the UE to measure and report PRS-RSRPP measurements defined in TS 38.215 [4] and the UE can support the PRS-RSRPP measurement in RRC_IDLE state.

4.6.4.2 Requirements Applicability

The requirements in clause 4.6.4 apply for periodic and triggered PRS-RSRPP measurements, provided:

- PRS-RSRPP related side conditions given in clause 10.1.24.2 for FR1 are met for a corresponding Band for 1Rx RedCap UE.
- PRS-RSRPP related side conditions given in clause 10.1.24.2 for FR1 and FR2 are met for a corresponding Band for 2Rx RedCap UE.

4.6.4.3 Measurement Capability

UE PRS-RSRPP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

4.6.4.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. The UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For PRS-RSRPP measurements performed by the UE in RRC_IDLE state, the measurement reporting delay excludes all of the following:

- any delay caused by other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH which is equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by no UL resources for UE to send the measurement report,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported PRS-RSRPP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.38.3.

The PRS-RSRPP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1.38.2 for FR1 for 1 Rx RedCap UE.

The PRS-RSRPP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1.38.2 for FR1 and FR2 for 2 Rx RedCap UE.

4.6.4.5 Measurement Period Requirements without RX FH

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], and the PRS-RSRPP measurement is performed in RRC_IDLE state, measurement period requirements for PRS-RSRP defined in clause 4.6.3.5 is re-used for PRS-RSRPP measurement.

4.6.4.6 Measurement Period Requirements with RX FH

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], requesting RedCap UE to measure DL PRS-RSRPP measurement with FH via *nr-DL-PRS-RxHoppingRequest-r18*, measurement period requirements defined in clause 4.6.3.6 apply.

4.7 Measurement report for fast CA/DC setup

4.7.1 Introduction

The requirements of measurement report for fast CA/DC setup apply in this clause for:

- UE supporting *measValidationReportEMR-r18* and configured with *measIdleCarrierListNR-r16* and/or *measIdleCarrierListEUTRA-r16* by higher layers.
- UE supporting *measValidationReportReselectionMeasurements-r18* and configured with *measReselectionCarrierListNR-r18* by higher layers.

A UE supporting *measValidationReportEMR-r18* and *idleInactiveNR-MeasReport-r16* or *idleInactiveEUTRA-MeasReport-r16* shall report the results of the idle mode measurement which is specified in clause 4.4, and according to the measurement reporting requirements specified in clause 4.7.3**.**

A UE supporting *measValidationReportReselectionMeasurements-r18* shall report the results of the idle mode measurement specified in the clause 4.2.2, and according to the measurement reporting requirements specified in the clause 4.7.3.

UE is not required to report for fast CA/DC setup from any measurements during IDLE mode for carriers which are not configured by higher layers.

4.7.2 Void

4.7.3 Measurement Report Requirements

A UE shall perform validity check and report valid measurement results:

- if the UE supports *measValidationReportEMR-r18* and *measIdleValidityDuration-r18* is configured for carriers in *measIdleCarrierListNR-r16* or *measIdleCarrierListEUTRA-r16*,
- if the UEsupports *measValidationReportReselectionMeasurements-r18* and *measReselectionValidityDuration-r18* is configured for carriers in *measReselectionCarrierListNR-r18*

The measurement results are considered valid if the following conditions are met for the validity check:

- the measurements are performed before msg1 transmission for RRC resume/setup request within the last:
- measIdleValidityDuration-r18 seconds for carriers configured in measIdleCarrierListNR-r16 or measIdleCarrierListEUTRA-r16, and/or
- *measReselectionValidityDuration-r18* seconds for carriers configured in *measReselectionCarrierListNR-r18*,
- the measurement results satisfy measurement accuracy requirement at the measurement instance.

Otherwise, the measurement results are considered invalid. The UE shall not report invalid measurement results when *measIdleValidityDuration-r18* and/or *measReselectionValidityDuration-r18* is configured.

If the *measIdleValidityDuration-r18* is not configured, the UE is not required to perform validity check for carriers in *measIdleCarrierListNR-r16* and *measIdleCarrierListEUTRA-r16*, and the UE may report measurement results given the measurement results satisfy measurement accuracy requirement at the measurement instance.

If the *measReselectionValidityDuration-r18* is not configured, the UE is not required to perform validity check for carriers configured in *measReselectionCarrierListNR-r18*, and the UE may report measurement results given the measurement results satisfy measurement accuracy requirement at the measurement instance.

RSRP, RSRQ measurements contained in the measurement reports shall meet the corresponding accuracy requirements at the measurement instance specified in the clauses 10.1.2B, 10.1.3B, 10.1.4B, 10.1.5B, 10.1.7B, 10.1.8B, 10.1.9B, 10.1.10B.

4.8 IDLE mode measurement for LP-WUS operation

4.8.1 Introduction

The UE supporting *LP-WUS capability* in RRC_IDLE shall be capable of:

- performing serving cell measurement based on LP-SS or SSB by LR.
- monitoring LP-WUS signal when monitoring criteria defined in [1] is met, and
- performing serving cell measurement offloading when serving cell measurement offloading criteria defined in [1] is met, or performing serving cell and neighbour cell measurement relaxation when relaxed measurement criteria defined in [1] is met by MR together with LP-SS or SSB based serving cell measurement by LR.

4.8.2 Requirements

4.8.2.1 UE Measurement Capability

4.8.2.1.1 LP-WUR measurement capability

UE LP-WUR shall be capable of monitoring at least the serving cell.

4.8.2.1.2 MR measurement capability with LP-WUR

For the UE measurement capability, the requirements in clause 4.2.2.1 apply.

For the Redcap UE measurement capability, the requirements in clause 4.2B.2.1 apply.

4.8.2.2 LP-WUR Serving cell measurement and evaluation requirement

4.8.2.2.1 General description

This sub-clause specifies the serving cell measurements and evaluation requirements for a UE with LP-WUR in RRC_IDLE State.

The requirements apply for to a UE supporting *FG-62-1* or *FG-62-1a* and when the corresponding evaluation thresholds are configured by higher layers.

The requirements in this clause 4.8.2 apply when the LP-WUR is in ON state.

Before entering LP-WUS monitoring, RRM offloading or RRM relaxation mode and after exiting LP-WUS monitoring, RRM offloading and RRM relaxation mode, it is up to UE implementation when and how to turn the LP-WUR to ON state for serving cell measurement.

When LP-WUR is in the ON state, the UE may perform serving cell measurements based on LP-SS or PSS/SSS, where the requirements for LP-SS based measurements and evaluations in the clause 4.8.2 apply only if the LP-SS is configured and transmitted on the same carrier frequency as the serving cell.

The requirements in section 4.2 apply when the network has not configured thresholds for RRM measurement offloading or RRM measurement relaxation, or when the corresponding conditions are not fulfilled. If the UE applies RRM measurement offloading or RRM measurement relaxation, it shall perform measurements based on PSS/SSS or LP-SS following the requirements specified in section 4.8.2.2.2 or 4.8.2.2.3.

The requirements in this clause apply for Redcap UE supporting FG-62-1 or, FG-62-1a.

LP-WUR evaluation requirements specified in 4.8.2.2.2 and 4.8.2.2.3 apply to LP-WUR entry and exit criteria evaluation.

Prior to performing LP-WUR evaluation specified in 4.x.2.2 or 4.x.2.3, if configured, the UE shall meet the corresponding LR entry criteria, if configured, at least once for:

- entry condition for LP-WUS monitoring
- entry condition for RRM relaxation
- entry condition for RRM offloading

4.8.2.2.2 LP-WUR measurement and evaluation requirements for PSS/SSS

Upon meeting the entry conditions for LP-WUS monitoring, RRM offloading or RRM relaxation, the UE shall measure the SS-RSRP and SS-RSRQ level once every LO cycle and evaluate whether one or more of the following conditions defined in TS 38.304 [1], if configured, are met within $T_{evaluate\text{-}LP\text{-}WUR\text{-}PSS/SSS}$

- exit condition for LP-WUS monitoring
- exit condition for RRM offloading
- exit condition for RRM relaxation

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurement samples. Within the set of measurements used for the filtering, at least two measurement samples shall be spaced by *LO-periodicity*/2.

Table 4.8.2.2-1: $T_{evaluate\text{-}LP\text{-}WUR\text{-}PSS/SSS}$ for FR1 and FR2

LO periodicity [s] Note 1	Scaling Factor ($N_{LP\text{-}WUS}$)		$T_{evaluate\text{-}LP\text{-}WUR\text{-}PSS/SSS}$ (number of LO Cycles [s])
	FR1	FR2	
0.32	1	8	0.32 x 4 x $N_{LP\text{-}WUS}$ (1.28s x $N_{LP\text{-}WUS}$)
0.64		5	0.64 x 4 x $N_{LP\text{-}WUS}$ (2.56s x $N_{LP\text{-}WUS}$)
1.28		4	1.28 x 4 x $N_{LP\text{-}WUS}$ (5.12s x $N_{LP\text{-}WUS}$)
2.56		3	2.56 x 4 x $N_{LP\text{-}WUS}$ (10.24s x $N_{LP\text{-}WUS}$)
Note 1: The LO periodicity is the same as the configured DRX cycle length			

The UE shall evaluate and consider an *entry* or *exit* criteria is fulfilled within $T_{evaluate\text{-}LP\text{-}WUR\text{-}PSS/SSS,}$ provided that the corresponding criteria is met by a margin of 6 dB for SS-RSRP and/or 3.5 dB for SS-RSRQ in FR1 and by a margin of 7.5 dB for SS-RSRP and/or 3.5 dB for SS-RSRQ in FR2 when SSB $\hat{E}s/Iot \geq -3dB$

Upon fulfilling a configured entry or exit condition, the UE shall perform corresponding actions as defined in clause 5.2.4.12 in TS 38.304 [1].

The requirements in this clause apply for UE which supports FG 62-1a and measures PSS/SSS.

4.8.2.2.3 LP-WUR measurement and evaluation requirements for LP-SS

Upon meeting the entry conditions for LP-WUS monitoring, RRM offloading or RRM relaxation, the UE shall measure the LP-RSRP and LP-RSRQ level once every LP-SS cycle and evaluate whether one or more of the following conditions defined in TS 38.304 [1] are met within $T_{evaluate\text{-}LP\text{-}WUR\text{-}LP\text{-}SS}$

- exit condition for LP-WUS monitoring
- exit condition for RRM offloading
- exit condition for RRM relaxation

The UE shall filter the LP-SS measurements of the serving cell using at least 2 measurement samples.

Table 4.8.2.3-1: $T_{evaluate\text{-}LP\text{-}WUR\text{-}LP\text{-}SS}$

LP-SS periodicity [s]	$T_{evaluate\text{-}LP\text{-}WUR\text{-}LP\text{-}SS}$ (number of LP-SS Cycles [s])
0.16	0.16 x 6 (0.96s)
0.32	0.32 x 6 (1.92s)

The UE shall evaluate and consider an *entry* or *exit* criteria is fulfilled within $T_{evaluate\text{-}LP\text{-}WUR\text{-}LP\text{-}SS,}$ provided that the criteria is met by a margin of 6 dB for LP-RSRP and/or 3.5 dB for LP-RSRQ in FR1 when LP-SS $\hat{E}s/Iot \geq$ -3dB

Upon fulfilling a configured entry or exit condition, the UE shall perform corresponding actions as defined in clause 5.2 in TS 38.304 [1].

The requirements in this clause apply for UE which supports FG 62-1, or UE which supports FG 62-1a-LP-SS and measures only LP-SS.

Note: Higher margin may be required for UE to consider an entry or exit criteria fulfilled when LP-RSRP and LP-RSRQ thresholds are configured, if the serving cell and neighbour cell are using opposite binary sequences for LP-SS, and LP-SS are transmitted on the same time and frequency resource in the two cells.

4.8.2.3 Measurement and evaluation of serving cell by MR

The requirements in this clause apply for UE measurement and evaluation of serving cell using MR, when LP-WUS UE is not in serving cell offloading mode as defined in [1].

4.8.2.3.1 Requirements for evaluation of cell selection criterion

When LP-WUS UE is not in relaxed measurement mode as defined in [1], the requirements in clause 4.2.2.2 shall apply.

When UE is in relaxed measurement mode as defined in TS 38.304 [1], the UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every N1*16 DRX cycle.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by 8 DRX cycles.

If the UE has evaluated according to table 4.8.2.3.1-1 in $16*N_{serv}$ consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information during the time T, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1], where T= 10s.

Table 4.8.2.3.1-1: N_{serv}

DRX cycle length [s]	Scaling Factor (N1)		N_{serv} [number of 16*DRX cycles]
	FR1	FR2-1[Note1]	
0.32	1	8	N1*4
0.64		5	N1*4

1.28		4	N1*2
2.56		3	N1*2
NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.			

4.8.2.3.2 Requirements for evaluation of LP-WUS related conditions

When UE is in relaxed measurement mode as defined in [1], the UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the following LP-WUR related conditions defined in TS 38.304 [1], if configured, for the serving cell at least once every N1*16 DRX cycle.

- exit condition for relaxed measurement mode

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by 8 DRX cycles.

If the UE has evaluated according to table 4.8.2.3.2-1 in $16*N_{serv}$ consecutive DRX cycles that the serving cell fulfils the exit condition for relaxed measurement mode, the UE shall perform corresponding actions as defined in clause 5.2.4.12 in [1].

Table 4.8.2.3.2-1: N_{serv} when UE is in relaxed measurement mode

DRX cycle length [s]	Scaling Factor (N1)		N_{serv} [number of 16*DRX cycles]
	FR1	FR2-1[Note1]	
0.32	1	8	N1*4
0.64		5	N1*4
1.28		4	N1*2
2.56		3	N1*2
NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.			

4.8.2.3A Measurement and evaluation of serving cell by RedCap UE

The requirements in this clause apply for RedCap UE measurement and evaluation of serving cell using MR, when the RedCap UE is not in serving cell measurement offloading mode as defined in [1].

Requirements defined in clause 4.2B.1 shall apply.

4.8.2.3A.1 Requirements for evaluation of cell selection criterion for RedCap UE

Requirements in clause 4.8.2.3.1 shall apply, except that clause 4.2.2.2 is replaced with 4.2B.2.2.

4.8.2.3A.2 Requirements for evaluation of LP-WUS related conditions for RedCap UE

Requirements defined in clause 4.8.2.3.2 shall apply.

4.8.2.4 Measurements of intra-frequency NR cells for UE with LP-WUR

For a UE supporting LP-WUR capability and not configured with eDRX_IDLE cycle, the requirements in clause 4.2.2.3 for FR1 and FR2-1 apply except for the requirements specified in this clause when the relaxed measurement criterion defined in 5.2.4.12.2 in TS 38.304 [1] is fulfilled.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS 38.304 [1] within $K_{LPW} * T_{detect,NR_Intra}$ when that $T_{reselection}= 0$, where $K_{LPW} = 16$.

The UE shall measure SS-RSRP and SS-RSRQ at least every $K_{LPW} * T_{measure,NR_Intra}$ for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $K_{LPW} * T_{measure,NR_Intra}/2$.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined in TS 38.304 [1] within K_{LPW} * $T_{evaluate,NR_Intra}$ when $T_{reselection}$ = 0, provided that:

when *rangeToBestCell* is not configured:

- the cell is at least 3 dB better ranked in FR1.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
    - if there are multiple such cells, the cell has the highest rank among them.
        - the cell is at least 3 dB better ranked in FR1 if the current serving cell is among them.

$T_{detect,NR_Intra,}$ $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ are specified in table 4.2.2.3-1 for FR1 and FR2-1.

4.8.2.4A Measurements of intra-frequency NR cells for RedCap UE with LP-WUR

For a Redcap UE supporting LP-WUR capability and not configured with eDRX_IDLE cycle, the requirements in clause 4.2B.2.3 apply except for the requirements specified in this clause when the relaxed measurement criterion defined in 5.2.4.12.2 in TS 38.304 [1] is fulfilled.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS 38.304 [1] within K_{LPW} * $T_{detect,NR_Intra_RedCap}$ when that Treselection= 0, where K_{LPW} = 16.

The UE shall measure SS-RSRP and SS-RSRQ at least every K_{LPW} x $T_{measure,NR_Intra_RedCap}$ for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least K_{LPW} * $T_{measure,NR_Intra_RedCap}$ /2.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined in TS 38.304 [1] within K_{LPW} * $T_{evaluate,NR_Intra_RedCap}$ when $T_{reselection}$ = 0, provided that:

when rangeToBestCell is not configured:

- the cell is at least 3 dB better ranked in FR1 or 4.5 dB better ranked in FR2 for 2 Rx RedCap.
- the cell is at least 4 dB better ranked in FR1 for 1 Rx RedCap.

when rangeToBestCell is configured:

- the cell has the highest number of beams above the threshold absThreshSS-BlocksConsolidation among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within rangeToBestCell of the cell-ranking criterion R value of the highest ranked cell.
- if there are multiple such cells, the cell has the highest rank among them.
    - the cell is at least 3 dB better ranked in FR1 or 4.5 dB better ranked in FR2 if the current serving cell is among them for 2 Rx RedCap.
    - the cell is at least 4 dB better ranked in FR1 if the current serving cell is among them for 1 Rx RedCap.

$T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ are specified in table 4.2B.2.3-1.

4.8.2.5 Measurements of inter-frequency NR cells for UE with LP-WUR

4.8.2.5.1 Introduction

This clause contains the requirements for measurements on inter-frequency NR cells for UE with LP-WUR when the UE is configured with any of following measurement criteria and when any one or both of the follow critera are met:

- Relaxed measurement criterion for UE with LP-WUR defined in TS 38.304 [1],
- Serving cell measurement offloading criterion for UE with LP-WUR defined in TS 38.304 [1],

4.8.2.5.2 Measurements for UE with LP-WUR fulfilling relaxed measurement criterion

The requirements for measurements on inter-frequency NR cells specified in this clause apply provided that:

- UE is configured with relaxed measurement [2] criterion and UE has fulfilled the relaxed measurement [2] criterion.

The UE shall not relax measurements on NR inter-frequency carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

The requirements defined in clause 4.2.2.4 apply for this clause except that:

When Srxlev $\leq S_{nonIntraSearchP}$ or Squal $\leq S_{nonIntraSearchQ}$ then:

- When T331 is running, for a UE not configured with eDRX_IDLE, T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ apply for NR inter-frequency layers configured and not configured for idle mode CA/DC measurements specified in Table 4.2.2.4-1.
- When T331 is not running, for a UE not configured with eDRX_IDLE, $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ apply for NR inter-frequency layers not configured for idle mode CA/DC measurements and NR inter-frequency layers configured for idle mode CA/DC measurements and mobility measurement are as specified in table 4.8.2.5.2-1.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$,

- When T331 is running, the UE shall search for NR inter-frequency layers configured for idle mode CA/DC measurements and inter-frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is specified in clause 4.2.2.7.
- When T331 is not running, the UE shall search for inter-frequency layers of higher priority at least every K2*$T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and, K2 = 60

Table 4.8.2.5.2-1: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$

DRX cycle length [s]	Scaling Factor (N1)		$T_{detect,NR_Inter_Relax}$ [s] (number of DRX cycles)	$T_{measure,NR_Inter_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of DRX cycles)
	FR1	FR2-1[Note1]			
0.32	1	8	11.52 x N1 x K_{LPW} x 1.5 (36 x N1 x K_{LPW} x 1.5)	1.28 x N1 x K_{LPW} 1.5 (4 x N1 x K_{LPW} x 1.5)	5.12 x N1 x K_{LPW} 1.5 (16 x N1 x K_{LPW} x 1.5)
0.64		5	17.92x N1 x K_{LPW} (28 x N1 x K_{LPW})	1.28 x N1 x K_{LPW} (2 x N1 x K_{LPW})	5.12 x N1 x K_{LPW} (8 x N1 x K_{LPW})
1.28		4	32 x N1 x K_{LPW} (25 x N1 x K_{LPW})	1.28 x N1 x K_{LPW} (1 x N1 x K_{LPW})	6.4 x N1 x K_{LPW} (5 x N1 x K_{LPW})
2.56		3	58.88 x N1 x K_{LPW} (23 x N1 x K_{LPW})	2.56 x N1 x K_{LPW} (1 x N1 x K_{LPW})	7.68 x N1 x K_{LPW} (3 x N1 x K_{LPW})

NOTE 1: Applies for UE supporting FR2-1 power class 2&3&4. For UE supporting FR2-1 power class 1 or 5, N1 = 8 for all DRX cycle length.
NOTE 2: K_{LPW} = 16 is the measurement relaxation factor applicable for UE with LP-WUR fulfilling relaxed measurement criterion.

4.8.2.5.3 Measurements for UE with LP-WUR fulfilling serving cell measurement offloading criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- Entry conditions for serving cell measurement offloading for UE with LP-WUR defined in clause 5.2.4.8.4 in 38.304 [1] are fulfilled.
- UE is configured with Rel-19 LP-WUR and UE has fulfilled serving cell measurement offloading criterion.

The UE shall not relax measurements on NR inter-frequency carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

The requirements defined in clause 4.2.2.4 apply for this clause except that:

- When T331 is not running, the UE shall search for inter-frequency layers of higher priority at least every $K2*T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7 and, K2 = 60
- When T331 is running, the UE shall search for inter-frequency layers of higher priority and inter-frequency NR layers configured for idle mode DC measurements at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is described in clause 4.2.2.7.

4.8.2.5A Measurements of inter-frequency NR cells for Redcap with LP-WUR

4.8.2.5A.1 Introduction

This clause contains the requirements for measurements on inter-frequency NR cells for Redcap with LP-WUR when the UE is configured with any of following relaxed measurement criteria and when any one or both of the follow critera are met:

- Relaxed measurement criterion for UE with LP-WUR defined in clause 5.2.4.12.2 in [1],
- Serving cell measurement offloading criterion for UE with LP-WUR defined in clause 5.2.4.12.4 in [1],

4.8.2.5A.2 Measurements for UE with LP-WUR fulfilling relaxed measurement criterion

The requirements for measurements on inter-frequency NR cells specified in this clause apply provided that:

- UE is configured with relaxed measurement [2] criterion and UE has fulfilled the relaxed measurement [2] criterion.

The requirements defined in clause 4.2B.2.4 apply for this clause except that:

When $Srxlev \leq S_{nonIntraSearchP}$ or $Squal \leq S_{nonIntraSearchQ}$:

- For a UE not configured with eDRX_IDLE, $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ are as specified in table 4.8.2.5.2-1.

When $Srxlev > S_{nonIntraSearchP}$ and $Squal > S_{nonIntraSearchQ}$:

- The UE shall search for inter-frequency layers of higher priority at least every $K2*T_{higher_priority_search}$ where $T_{higher_priority_search}$ is specified in clause 4.2.2.7 and, K2 = 60

4.8.2.5A.3 Measurements for UE with LP-WUR fulfilling serving cell measurement offloading criterion

The requirements for measurements on inter-frequency NR cells specified in this clause apply provided that:

- UE is configured with serving cell measurement offloading [1] criterion and UE has fulfilled the serving cell measurement offloading [1] criterion.

The requirements defined in clause 4.2B.2.4 apply for this clause except that:

- The UE shall search for inter-frequency layers of higher priority at least every $K2*T_{higher_priority_search}$ where $T_{higher_priority_search}$ is specified in clause 4.2.2.7 and, K2 = 60

4.8.2.6 Measurements of inter-RAT E-UTRAN cells for UE with LP-WUR

4.8.2.6.1 Introduction

This clause specifies the requirements for measurements on inter-RAT E-UTRAN cells performed by MR when the UE with LP-WUR is configured with any of the following relaxed measurement criteria and when any one or both of the follow critera are met:

- Relaxed measurement criteria for UE with LP-WUR defined in clause 5.2.4.12.2 in TS 38.304 [1],
- Serving cell measurement offloading criteria for UE with LP-WUR defined in clause 5.2.4.12.4 in TS 38.304 [1].

4.8.2.6.2 Measurements for UE fulfilling relaxed measurement criteria

The requirements for measurements on inter-RAT E-UTRAN cells specified in this clause apply provided that:

- Relaxed measurement criteria for UE with LP-WUR defined in clause 5.2.4.12.2 in TS 38.304 [1] are fulfilled.

The UE shall not relax measurements on inter-RAT E-UTRAN carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

The requirements defined in clause 4.2.2.5 apply for this clause except that:

- When Srxlev $\leq S_{nonIntraSearchP}$ or Squal $\leq S_{nonIntraSearchQ}$, then

  - When T331 is running, for a UE not configured with eDRX_IDLE, $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$ and $T_{evaluate,EUTRAN_Relax}$ apply for inter-RAT E-UTRAN carriers configure and not configured for idle mode CA/DC measurements are specified in Table 4.2.2.5-1.

  - When T331 is not running, for a UE not configured with eDRX_IDLE, $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$ and $T_{evaluate,EUTRAN_Relax}$ apply for inter-RAT E-UTRAN layers not configured for idle mode CA/DC measurements and inter-RAT E-UTRAN configured for idle mode CA/DC measurements and mobility measurement are as specified in table 4.X.2.6.2-1.

- When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ the requirements are defined as follows:

  - When T331 is running, the UE shall search for inter-RAT E-UTRAN configured for idle mode CA/DC measurements and inter-RAT E-UTRAN frequency layers of higher priority at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is specified in clause 4.2.2.7.

  - When T331 is not running, the UE shall search for inter-RAT E-UTRAN frequency layers of higher priority at least every $K2*T_{higher_priority_search}$ where $T_{higher_priority_search}$ is specified in clause 4.2.2.7 and, K2 = 60.

Table 4.8.2.6.2-1: $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$, and $T_{evaluate,EUTRAN_Relax}$ for UE with LP-WUR

DRX cycle length [s]	$T_{detect,EUTRAN_Relax}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN_Relax}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN_Relax}$ [s] (number of DRX cycles)
0.32	11.52 x K_{LPW} (36 x K_{LPW})	1.28 x K_{LPW} (4 x K_{LPW})	5.12 x K_{LPW} (16 x K_{LPW})
0.64	17.92 x K_{LPW} (28 x K_{LPW})	1.28 x K_{LPW} (2 x K_{LPW})	5.12 x K_{LPW} (8 x K_{LPW})
1.28	32 x K_{LPW} (25 x K_{LPW})	1.28 x K_{LPW} (1 x K_{LPW})	6.4 x K_{LPW} (5 x K_{LPW})
2.56	58.88 x K_{LPW} (23 x K_{LPW})	2.56 x K_{LPW} (1 x K_{LPW})	7.68 x K_{LPW} (3 x K_{LPW})
NOTE 1: K_{LPW} = 16 is the measurement relaxation factor applicable for UE with LP-WUR fulfilling relaxed measurement criterion.			

4.8.2.6.3 Measurements for UE fulfilling serving cell measurement offloading entry criteria

The requirements for measurements on inter-RAT E-UTRAN cells specified in this clause apply provided that:

- Entry conditions for serving cell measurement offloading for UE with LP-WUR defined in clause 5.2.4.12.4 in TS 38.304 [1] are fulfilled.

The UE shall not relax measurements on inter-RAT E-UTRAN carriers configured for idle mode CA/DC measurements (defined in clause 4.4) while T331 is running.

The requirements defined in clause 4.2.2.5 apply for this clause except that:

- When T331 is not running, the UE shall search for inter-RAT E-UTRAN layers of higher priority at least every $K2*T_{higher_priority_search}$ where $T_{higher_priority_search}$ is specified in clause 4.2.2.7 and, K2 = 60.
- When T331 is running, the UE shall search for inter-RAT E-UTRAN layers of higher priority and inter-RAT E-UTRAN layers configured for idle mode DC measurements at least every $T_{higher_priority_search}$ where $T_{higher_priority_search}$ is specified in clause 4.2.2.7.

Note: It is assumed that Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ is always met when the entry conditions for serving cell measurement offloading are met.

4.8.2.6A Measurements of inter-RAT E-UTRAN cells for RedCap with LP-WUR

4.8.2.6A.1 Introduction

This clause contains the requirements for measurements on inter-RAT E-UTRAN cells performed by RedCap UE when the UE with LP-WUR is configured with any of the following relaxed measurement criteria and when any one or both of the follow critera are met:

- Relaxed measurement criteria for UE with LP-WUR defined in clause 5.2.4.12.2 in TS 38.304 [1],
- Serving cell measurement offloading criteria for UE with LP-WUR defined in clause 5.2.4.12.4 in TS 38.304 [1].

4.8.2.6A.2 Measurements for UE fulfilling relaxed measurement criteria

The requirements for measurements on inter-RAT E-UTRAN cells specified in this clause apply provided that:

- Relaxed measurement criteria for UE with LP-WUR defined in clause 5.2.4.12.2 in TS 38.304 [1] are fulfilled:

The requirements defined in clause 4.2B.2.5 apply for this clause except:

- When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$:
  - For a UE not configured with eDRX_IDLE, $T_{detect,EUTRAN_Relax}$, $T_{measure,EUTRAN_Relax}$ and $T_{evaluate,EUTRAN_Relax}$ are specified in Table 4.2B.2.5-1.
- When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ the requirements are defined as follows
  - The UE shall search for inter-RAT E-UTRAN frequency layers of higher priority at least every $K2*T_{higher_priority_search}$ where $T_{higher_priority_search}$ is specified in clause 4.2.2.7 and, K2 = 60.

4.8.2.6A.3 Measurements for UE fulfilling serving cell measurement offloading entry criteria

The requirements for measurements on inter-RAT E-UTRAN cells specified in this clause apply provided that:

- Entry conditions for serving cell measurement offloading for UE with LP-WUR defined in clause 5.2.4.12.4 in TS 38.304 [1] are fulfilled.

The requirements defined in clause 4.2B.2.5 apply for this clause except that:

- The UE shall search for inter-RAT E-UTRAN layers of higher priority at least every $K2*T_{higher_priority_search}$ where $T_{higher_priority_search}$ is specified in clause 4.2.2.7 and, K2 = 60.

Note: It is assumed that Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ is always met when the entry conditions for serving cell measurement offloading are met.

5 SA: RRC_INACTIVE state mobility

5.1 Cell Re-selection

5.1.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in *Camped Normally* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity. For inter-frequency cell re-selection, when NTN carrier is not configured, requirements in clause 5.1.2.4 apply and when NTN carrier is configured, requirements in clause 5.1.2.8 shall be applied.

5.1.2 Requirements

5.1.2.1 UE measurement capability

The requirements in clause 4.2.2.1 shall apply.

5.1.2.2 Measurement and evaluation of serving cell

The requirements in this clause apply when UE is configured with eDRX_IDLE, otherwise the requirements in clause 4.2.2.2 shall apply.

When UE is configured with eDRX_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1* T for FR1 and N1*T for FR2; where:

- T is determined according to clause 7.1 in [1],
- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and T $\leq$ 0.64 second, otherwise M1=1.

When UE is configured with eDRX_IDLE and eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, within a single eDRX INACTIVE PTW, the UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1* T for FR1 and N1*T for FR2; where:

- T is determined according to clause 7.1 in [1],
- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and T $\leq$ 0.64 second, otherwise M1=1.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least T/2.

If UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1 and the UE has evaluated according to table 5.1.2.2-1 or table 5.1.2.2-2 in N_{serv} consecutive T cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

If UE is configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1 and the UE has evaluated according to table 5.1.2.2-3 or table 5.1.2.2-4 in N_{serv} consecutive T within a single eDRX INACTIVE PTW that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

Table 5.1.2.2-1: N_{serv} for UE configured with eDRX_IDLE cycle, (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length[s]	T [s]	N_{serv} [number of T]
2.56 ≤eDRX_IDLE cycle length ≤10485.76	0.32 ≤DRX_Inactive cycle length ≤2.56; or 2.56 ≤eDRX_Inactive cycle length ≤10.24 if inactive eDRX is configured	0.32	4*M1
		0.64	4*M1
		1.28	2
		2.56	2
		5.12	2
		10.24	2
NOTE1: T is determined according to clause 7.1 in [1].			

Table 5.1.2.2-2: N_{serv} for UE configured with eDRX_IDLE cycle, (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length[s]	T [s]	Scaling Factor (N1)	N_{serv} [number of T]
2.56 ≤eDRX_IDLE cycle length ≤10485.76	0.32 ≤DRX_Inactive cycle length ≤2.56; or 2.56 ≤eDRX_Inactive cycle length ≤10.24 if inactive eDRX is configured	0.32	8	4* N1
		0.64	5	4* N1
		1.28	4	2* N1
		2.56	3	2* N1
		5.12	3	2* N1
		10.24	3	2* N1
NOTE1: T is determined according to clause 7.1 in [1].				

Table 5.1.2.2-3: N_{serv} for UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle, (Frequency range FR1)

eDRX_IDLE cycle and eDRX INACTIVE cycle length [s]	T [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	N_{serv} [number of T Note 3]
20.48 ≤ eDRX_IDLE cycle length ≤10485.76 20.48 ≤ eDRX_INACTIVE cycle length ≤10485.76	0.32	≥ 1.28 (1)	M1*2
	0.64	≥ 1.28 (1) (M1=1) or ≥ 2.56 (2) (M1=2)	M1*2
	1.28	≥2.56 (2)	2
	2.56	≥5.12 (4)	2
NOTE 1: eDRX INACTIVE PTW in this table is RAN configured PTW. NOTE 2: N_{serv} requirements are only defined within a single eDRX INACTIVE PTW duration. NOTE 3: T is determined according to clause 7.1 in [1]. NOTE 4: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42]. NOTE 5: The lower bound of PTW length is derived based on $\left\lceil \frac{Nserv * DRX_cycle}{1.28} \right\rceil * 1.28$.			

Table 5.1.2.2-4: N_{serv} for UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle, (Frequency range FR2)

eDRX_IDLE cycle and eDRX INACTIVE cycle length [s]	T [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1)	N_{serv} [number of T Note 3]
20.48 ≤ eDRX_IDLE cycle length ≤10485.76 20.48 ≤ eDRX_INACTIVE cycle length ≤10485.76	0.32	≥5.12 (4)	8	N1*2
	0.64	≥6.4 (5)	5	N1*2
	1.28	≥10.24 (8)	4	N1*2
	2.56	≥15.36 (12)	3	N1*2

NOTE 1: Applies for UE of all FR2 power class.
NOTE 2: eDRX INACTIVE PTW in this table is RAN configured PTW.
NOTE 3: N_{serv} requirements are only defined within a single eDRX INACTIVE PTW duration.
NOTE 4: T is determined according to clause 7.1 in [1].
NOTE 5: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 6: The lower bound of PTW length is derived based on $\left\lceil \frac{Nserv * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 7: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

If UE is not configured with eDRX_INACTIVE ≥ 20.48 s, when UE transitions from measurements within eDRX_IDLE PTW to measurements outside eDRX_IDLE PTW or vice versa during one measurement period, the UE measurement requirements apply based on the longer measurement period requirements before or after the transition.

When the UE transitions between any two states when changing eDRX_IDLE cycle length, eDRX_INACTIVE cycle length, INACTIVE RAN DRX length or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

If the UE in RRC_INACTIVE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information during the time T', the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1], where:

- T'= 10 s, if the UE is not configured with eDRX_INACTIVE cycle, or
- T'= MAX (10 s, one eDRX_INACTIVE cycle) if the UE is configured with eDRX_INACTIVE cycle for FR1, or
- T'= MAX (10 s, N1* eDRX_INACTIVE cycle) if the UE is configured with eDRX_INACTIVE cycle for FR2.

5.1.2.3 Measurements of intra-frequency NR cells

The requirements in this clause apply when UE is configured with eDRX_IDLE, otherwise the requirements in clause 4.2.2.3 shall apply. The requirements in clause 4.2.2.9 apply for UE configured with relaxed measurement criterion when UE is not configured with eDRX_IDLE.

When UE is configured with eDRX_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the requirements defined in section 4.2.2.3 shall apply with T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ defined in table 5.1.2.3-1 and table 5.1.2.3-2.

When UE is configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, the requirements defined in section 4.2.2.3 shall apply with T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ defined in table 5.1.2.3-3 and table 5.1.2.3-4.

Table 5.1.2.3-1: T_{detect, NR_Intra}, $T_{measure, NR_Intra}$ and $T_{evaluate, NR_Intra}$ for UE configured with eDRX_IDLE cycle, (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	T_{detect,NR_Intra} [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Intra}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Intra}$ [s] (number of DRX or INACTIVE eDRX cycles)
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	11.52 x M2 (36 x M2)	1.28 x M2 (4 x M2)	5.12 x M2 (16 x M2)
	0.64	17.92 (28)	1.28 (2)	5.12 (8)
	1.28	32 (25)	1.28 (1)	6.4 (5)
	2.56	58.88 (23)	2.56 (1)	7.68 (3)
	5.12	117.76 (23)	5.12 (1)	15.36 (3)
	10.24	235.52 (23)	10.24 (1)	30.72 (3)
NOTE1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.				

Table 5.1.2.3-2: T_{detect,NR_Intra}, $T_{measure,\ NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle, (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	Scaling Factor (N1)	T_{detect,NR_Intra} [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Intra}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Intra}$ [s] (number of DRX or eDRX INACTIVE cycles)
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	8	11.52 x N1 x M2 (36 x N1 x M2)	1.28 x N1 x M2 (4 x N1 x M2)	5.12 x N1 x M2 (16 x N1 x M2)
	0.64	5	17.92x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
	1.28	4	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
	2.56	3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
	5.12	3	117.76 x N1 (23 x N1)	5.12 x N1 (1 x N1)	15.36 x N1 (3 x N1)
	10.24	3	235.52 x N1 (23 x N1)	10.24 x N1 (1 x N1)	30.72 x N1 (3 x N1)
NOTE1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.					

Table 5.1.2.3-3: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle, (Frequency range FR1)

eDRX_IDLE cycle and eDRX INACTIVE cycle length [s]	RANDRX cycle length [s]	eDRX INACTIVEPTW length [s] (number of 1.28 s periods)	T_{detect,NR_Intra} [s] (number of RAN DRX cycles)	$T_{measure,NR_Intra}$ [s] (number of RAN DRX cycles Note 3)	$T_{evaluate,NR_Intra}$ [s] (number of RAN DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76	0.32	≥[1.28] ([1])	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ (23)	0.32 x M2 (1 x M2)	0.64 x M2 (2 x M2)
	0.64	≥[1.28] ([1])		0.64 (1)	1.28 (2)
20.48 ≤ eDRX_INACTIVE cycle length ≤10485.76	1.28	≥[2.56] ([2])		1.28 (1)	2.56 (2)
	2.56	≥[5.12] ([4])		2.56 (1)	5.12 (2)
NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].					
NOTE 2: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.					
NOTE 3: eDRX INACTIVE PTW in this table is RAN configured PTW.					
NOTE 4: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].					
NOTE 5: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra*DRX_cycle}{1.28} \right\rceil * 1.28$.					
NOTE 6: M2 = 2 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.					

Table 5.1.2.3-4: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ for UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle, (Frequency range FR2)

eDRX_IDLE cycle and eDRX INACTIVE cycle length [s]	RAN DRX length [s]	eDRX INACTIVEPTW length [s] (number of 1.28 s periods)	Scaling Factor (N1)	T_{detect,NR_Intra} [s] (number of RAN DRX cycles)	$T_{measure,NR_Intra}$ [s] (number of RAN DRX cycles Note 5)	$T_{evaluate,NR_Intra}$ [s] (number of RAN DRX cycles Note 5)
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	≥5.12 (4)	8	$eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1)	0.32 x N1 (1 x N1)	0.64 x N1 (2 x N1)
	0.64	≥6.4 (5)	5		0.64 x N1 (1 x N1)	1.28 x N1 (2 x N1)
20.48 ≤ eDRX_INACTIVE cycle length ≤10485.76	1.28	≥10.24 (8)	4		1.28 x N1 (1 x N1)	2.56 x N1 (2 x N1)
	2.56	≥15.36 (12)	3		2.56 x N1 (1 x N1)	5.12 x N1 (2 x N1)

NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 2: Applies for UE of all power class.
NOTE 3: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 4: eDRX INACTIVE PTW in this table is RAN configured PTW.
NOTE 5: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 6: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Intra*DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 7: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

When the UE transitions between any two states when changing eDRX_IDLE cycle length, eDRX_INACTIVE cycle length, INACTIVE RAN DRX length or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

5.1.2.4 Measurements of inter-frequency NR cells

When UE is configured with eDRX_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the requirements defined in section 4.2.2.4 shall apply with T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ defined in table 5.1.2.4-1 and table 5.1.2.4-2, and with $K_{carrier}$ defined as follows.

When UE is configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, the requirements defined in section 4.2.2.4 shall apply with T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ defined in table 5.1.2.4-3 and table 5.1.2.4-4.

Table 5.1.2.4-1: T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ for UE configured with eDRX_IDLE cycle, (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	T_{detect,NR_Inter} [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter}$ [s] (number of DRX or eDRX INACTIVE cycles)
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	11.52 x 1.5 (36 x 1.5)	1.28 x 1.5 (4 x 1.5)	5.12 x 1.5 (16 x 1.5)
	0.64	17.92 (28)	1.28 (2)	5.12 (8)
	1.28	32 (25)	1.28 (1)	6.4 (5)
	2.56	58.88 (23)	2.56 (1)	7.68 (3)
	5.12	117.76 (23)	5.12 (1)	15.36 (3)
	10.24	235.52(23)	10.24 (1)	30.72 (3)

Table 5.1.2.4-2: T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ for UE configured with eDRX_IDLE cycle, (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	Scaling Factor (N1)	T_{detect,NR_Inter} [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter}$ [s] (number of DRX or eDRX INACTIVE cycles)
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	8	11.52 x N1 x 1.5 (36 x N1 x 1.5)	1.28 x N1 x 1.5 (4 x N1 x 1.5)	5.12 x N1 x 1.5 (16 x N1 x 1.5)
	0.64	5	17.92x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
	1.28	4	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
	2.56	3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
	5.12	3	117.76 x N1 (23 x N1)	5.12 x N1 (1 x N1)	15.36 x N1 (3 x N1)
	10.24	3	235.52 x N1 (23 x N1)	10.24 x N1 (1 x N1)	30.72 x N1 (3 x N1)

Table 5.1.2.4-3: T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ for UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle (Frequency range FR1)

eDRX_IDLE cycle and eDRX_INACTIVE cycle length [s]	RAN DRX cycle length [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	T_{detect,NR_Inter} [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter}$ [s] (number of DRX or eDRX INACTIVE cycles)
20.48≤eDRX_IDLE cycle length ≤ 10485.76 20.48 ≤eDRX_INACTIVE cycle length ≤ 10485.76	0.32	≥1.28 (1)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ (23)	0.32 x 1.5 (1 x 1.5)	0.64 x 1.5 (2 x 1.5)
	0.64	≥1.28 (1)		0.64 (1)	1.28 (2)
	1.28	≥2.56 (2)		1.28 (1)	2.56 (2)
	2.56	≥5.12 (4)		2.56 (1)	5.12 (2)

NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 2: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 3: eDRX INACTIVE PTW in this table is RAN configured PTW [1].
NOTE 4: The number of DRX cycles in this table is given for the DRX cycles within RAN PTWs.
NOTE 5: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 6: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter * DRX_cycle}{1.28} \right\rceil * 1.28$.

Table 5.1.2.4-4: T_{detect,NR_Inter}, $T_{measure,NR_Inter}$ and $T_{evaluate,NR_Inter}$ for UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle (Frequency range FR2)

eDRX_IDLE cycle and eDRX_INACTIVE cycle length [s]	RAN DRX cycle length [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	T_{detect,NR_Inter} [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter}$ [s] (number of DRX or eDRX INACTIVE cycles)
20.48≤eDRX_IDLE cycle length ≤ 10485.76 20.48 ≤eDRX_INACTIVE cycle length ≤ 10485.76	0.32	≥5.12 (4)	8	$eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1)	0.32 x N1 (1 x N1)	0.64 x N1 (2 x N1)
	0.64	≥6.4 (5)	5		0.64 x N1 (1 x N1)	1.28 x N1 (2 x N1)
	1.28	≥10.24 (8)	4		1.28 x N1 (1 x N1)	2.56 x N1 (2 x N1)
	2.56	≥15.36 (12)	3		2.56 x N1 (1 x N1)	5.12 x N1 (2 x N1)

NOTE 1: Applies for UE of all power class.
NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within RAN PTWs.
NOTE 3: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 5: When eDRX_INACTIVE=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX _INACTIVE cycles.
NOTE 6: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 7: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 8: eDRX INACTIVE PTW in this table is RAN configured PTW [1].

When the UE transitions between any two states when being configured with eDRX_INACTIVE, being configured with eDRX_INACTIVE cycle, changing eDRX_INACTIVE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

If UE is not configured to perform PRS measurement, or if UE is configured to perform PRS measurement and supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier}$ in clause 4.2.2.4 shall apply regardless of whether the serving cell is subject to CCA or not.

If UE is configured to perform PRS measurement but does not support *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier}$ is replaced with $K_{carrier}$ + 1, regardless of whether the serving cell is subject to CCA or not.

If UE is not configured to perform PRS measurement, or if UE is configured to perform PRS measurement and supports *parallelPRS-MeasRRC-Inactive-r17*, the requirements in clause 4.2.2.10 shall apply regardless of whether the serving cell is subject to CCA or not for UE configured with relaxed measurement criterion.

If UE is configured to perform PRS measurement but does not support *parallelPRS-MeasRRC-Inactive-r17*, the requirements in clause 4.2.2.10 shall apply with $K_{carrier}$ being replaced with $K_{carrier}$ + 1, regardless of whether the serving cell is subject to CCA or not for UE configured with relaxed measurement criterion.

5.1.2.5 Measurements of inter-RAT E-UTRAN cells

When UE is configured with eDRX_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the requirements defined in section 4.2.2.5 shall apply with $T_{detect, EUTRAN}$, $T_{measure, EUTRAN}$ and $T_{evaluate, EUTRAN}$ defined in table 5.1.2.5-1.

When UE is configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, the requirements defined in section 4.2B.2.5 shall apply with $T_{detect, EUTRAN}$, $T_{measure, EUTRAN}$ and $T_{evaluate, EUTRAN}$ defined in table 5.1.2.5-2.

Table 5.1.2.5-1: $T_{detect, EUTRAN}$, $T_{measure, EUTRAN}$ and $T_{evaluate, EUTRAN}$ for inactive UE configured with eDRX_IDLE cycle, (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect, EUTRAN}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure, EUTRAN}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate, EUTRAN}$ [s] (number of DRX or eDRX INACTIVE cycles)
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	11.52 x 1.5 (36 x 1.5)	1.28 x 1.5 (4 x 1.5)	5.12 x 1.5 (16 x 1.5)
	0.64	17.92 (28)	1.28 (2)	5.12 (8)
	1.28	32 (25)	1.28 (1)	6.4 (5)
	2.56	58.88 (23)	2.56 (1)	7.68 (3)
	5.12	117.76 (23)	5.12 (1)	15.36 (3)
	10.24	235.52(23)	10.24 (1)	30.72 (3)

Table 5.1.2.5-2: $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$, and $T_{evaluate,EUTRAN}$ for UE configured with eDRX_IDLE cycle and eDRX_INACTIVE ≥ 20.48 s, (Frequency range FR1)

eDRX_IDLE cycle and eDRX_Inactive cycle length [s]	RAN DRX cycle length [s]	eDRX Inactive PTW length [s] (number of 1.28 s periods)	$T_{detect,EUTRAN}$ [s] (number of RAN DRX cycles Note 3)	$T_{measure,EUTRAN}$ [s] (number of RAN DRX cycles Note 3)	$T_{evaluate,E-UTRAN}$ [s] (number of RAN DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76 20.48 ≤ eDRX_INACTIVE cycle length ≤10485.76	0.32	≥1.28 (1)	$eDRX_cycle_length \times \left\lceil \frac{23}{\lfloor PTW/DRX_cycle_length \rfloor} \right\rceil$ (23)	0.32 (1)	0.64 (2)
	0.64	≥1.28 (1)		0.64 (1)	1.28 (2)
	1.28	≥2.56 (2)		1.28 (1)	2.56 (2)
	2.56	≥5.12 (4)		2.56 (1)	5.12 (2)

NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 2: The number of RAN DRX cycles in this table is given for the RAN DRX cycles within RAN configured PTWs.
NOTE 3: eDRX Inactive PTW in this table is RAN configured PTW [1].
NOTE 4: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 5: The eDRX_INACTIVE cycle lengths are *ran-ExtendedPagingCycleConfig-r18* as specified in [2]
NOTE 6: The lower bound of PTW length is derived based on $\left\lceil \frac{\text{Tevaluate,E-UTRAN} * \text{DRX_cycle}}{1.28} \right\rceil * 1.28$.
NOTE 7: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

When the UE transitions between any two states when changing eDRX_IDLE cycle length, eDRX_INACTIVE cycle length, INACTIVE RAN DRX length or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

5.1.2.6 Maximum interruption in paging reception

The requirements in clause 4.2.2.6 shall apply.

5.1.2.7 General requirements

When configured with eDRX_INACTIVE, the UE shall search every layer of higher priority at least every $T_{higher_priority_search}$, where $T_{higher_priority_search}$ is defined as follows:

- $T_{higher_priority_search}$ = max(60, 15*eDRX_INACTIVE cycle length) * N_{layers} seconds if eDRX_INACTIVE cycle ≤ 10.24 s,

- $T_{higher_priority_search}$ = max(60, ceil (15/$N_{DRX\text{-}PTW}$)*eDRX_INACTIVE cycle length) * N_{layers} seconds if eDRX_INACTIVE cycle > 10.24 s, where $N_{DRX\text{-}PTW}$ is the number of RAN DRX cycles within a single RAN configured PTW.

Otherwise, if the UE is not configured with eDRX_INACTIVE cycle, the UE shall search every layer of higher priority at least every $T_{higher_priority_search}$ = (60 * N_{layers}) seconds.

N_{layers} is the total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information. For a UE configured with early measurement reporting, while T331 is running, N_{layers} is the combined total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information and carriers configured for idle mode CA measurements.

NOTE: Combined total number means that if a carrier is a high priority carrier and additionally a carrier configured for idle mode CA measurements, it only counts as one carrier.

If UE is not configured to perform PRS measurement, or if UE is configured to perform PRS measurement and supports *parallelPRS-MeasRRC-Inactive-r17*, the requirements in this clause shall apply.

If UE is configured to perform PRS measurement but does not support *parallelPRS-MeasRRC-Inactive-r17*, the requirements in this clause shall apply with N_{layers} being replaced with N_{layers} + 1.

5.1.2.8 Measurement of inter-frequency NR cells with NTN carrier

This clause applies for the inter-frequency cell re-selection from TN to NTN only in FR1-NTN. The requirements in clause 4.2.2.12 shall apply.

5.1.2.9 Minimum requirement at transitions

The requirements in sub-clause 4.2.2.8 shall apply.

5.1.2.10 Measurements of intra-frequency NR cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2.2.9 apply for UE configured with relaxed measurement criterion except when UE is configured with eDRX_IDLE cycle greater than 10.24 s and UE has fulfilled low mobility criterion or not-at-cell edge criterion.

If the UE is configured with eDRX_IDLE cycle greater than 10.24 s in FR1 and FR2, and UE has fulfilled low mobility criterion or not-at-cell edge criterion, then the requirements in table 5.1.2.10-1 and table 5.1.2.10-2 respectively apply provided that eDRX cycle is ≤ [10485.76] sec.

Table 5.1.2.10-1: $T_{detect,NR_Intra_Relax}$, $T_{measure,NR_Intra_Relax}$ and $T_{evaluate,NR_Intra_Relax}$ for inactive UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect,NR_Intra_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Intra_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Intra_Relax}$ [s] (number of DRX or INACTIVE eDRX cycles)
20.48 ≤eDRX_IDLE	0.32	11.52 x M2 x K1 (36 x M2 x K1)	1.28 x M2 x K1 (4 x M2 x K1)	5.12 x M2 x K1 (16 x M2 x K1)

cycle length ≤10485.76	0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
	1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
	2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
	5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	15.36 x K1 (3 x K1)
	10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	30.72 x K1 (3 x K1)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.				

Table 5.1.2.10-2: $T_{detect,NR_Intra_Relax}$, $T_{measure,NR_Intra_Relax}$ and $T_{evaluate,NR_Intra_Relax}$ for inactive UE configured with eDRX_IDLE cycle, (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	Scaling Factor (N1)	$T_{detect,NR_Intra_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Intra_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Intra_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)
20.48 ≤eDRX_IDLE cycle length ≤10485.76	0.32	8	11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1)	1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1)	5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1)
	0.64	5	17.92x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
	1.28	4	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
	2.56	3	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
	5.12	3	117.76 x N1 x K1 (23 x N1 x K1)	5.12 x N1 x K1 (1 x N1 x K1)	15.36 x N1 x K1 (3 x N1 x K1)
	10.24	3	235.52 x N1 x K1 (23 x N1 x K1)	10.24 x N1 x K1 (1 x N1 x K1)	30.72 x N1 x K1 (3 x N1 x K1)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.					

5.1.2.11 Measurements of inter-frequency NR cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2.2.10 apply for UE configured with relaxed measurement criterion except when UE is configured with eDRX_IDLE cycle greater than 10.24 s and UE has fulfilled or low mobility criterion or not-at-cell edge criterion.

If the UE is configured with eDRX_IDLE cycle greater than 10.24 s in FR1 and FR2, and UE has fulfilled low mobility criterion or not-at-cell edge criterion, then the requirements in table 5.1.2.11-1 and table 5.1.2.11-2 respectively apply provided that eDRX cycle is $\leq$ [10485.76] sec.

Table 5.1.2.11-1: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ for inactive UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect,NR_Inter_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of DRX or INACTIVE eDRX cycles)
20.48 ≤eDRX_IDLE cycle length ≤10485.76	0.32	11.52 x M2 x K1 (36 x M2 x K1)	1.28 x M2 x K1 (4 x M2 x K1)	5.12 x M2 x K1 (16 x M2 x K1)
	0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
	1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
	2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
	5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	15.36 x K1 (3 x K1)
	10.24	235.52 x K1 (23)	10.24 x K1 (1 x K1)	30.72 x K1 (3 x K1)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.				

Table 5.1.2.11-2: $T_{detect,NR_Inter_Relax}$, $T_{measure,NR_Inter_Relax}$ and $T_{evaluate,NR_Inter_Relax}$ for inactive UE configured with eDRX_IDLE cycle, (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	Scaling Factor (N1)	$T_{detect,NR_Inter_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)
20.48 ≤eDRX_IDLE cycle length ≤10485.76	0.32	8	11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1)	1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1)	5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1)
	0.64	5	17.92x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
	1.28	4	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
	2.56	3	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
	5.12	3	117.76 x N1 x K1 (23 x N1 x K1)	5.12 x N1 x K1 (1 x N1 x K1)	15.36 x N1 x K1 (3 x N1 x K1)
	10.24	3	235.52 x N1 x K1 (23 x N1 x K1)	10.24 x N1 x K1 (1 x N1 x K1)	30.72 x N1 x K1 (3 x N1 x K1)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.					

5.1.2.12 Measurements of inter-RAT E-UTRAN cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2.2.11 apply for UE configured with relaxed measurement criterion except when UE is configured with eDRX_IDLE cycle greater than 10.24 s and UE has fulfilled low mobility criterion or not-at-cell edge criterion.

If the UE is configured with eDRX_IDLE cycle greater than 10.24 s in FR1 and FR2, and UE has fulfilled low mobility criterion or not-at-cell edge criterion, then the requirements in table 5.1.2.12-1 apply provided that eDRX cycle is ≤ [10485.76] sec.

Table 5.1.2.12-1: $T_{detect,\ EUTRAN_Relax}$, $T_{measure,\ EUTRAN_Relax}$ and $T_{evaluate,\ EUTRAN_Relax}$ for inactive UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect,\ EUTRAN_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,\ EUTRAN_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,\ EUTRAN_Relax}$ [s] (number of DRX or INACTIVE eDRX cycles)
20.48 ≤eDRX_IDLE cycle length ≤10485.76	0.32	11.52 x M2 x K1 (36 x M2 x K1)	1.28 x M2 x K1 (4 x M2 x K1)	5.12 x M2 x K1 (16 x M2 x K1)
	0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
	1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
	2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
	5.12	117.76 x K1 (23 x K1)	5.12 x K1 (1 x K1)	15.36 x K1 (3 x K1)
	10.24	235.52 x K1 (23 x K1)	10.24 x K1 (1 x K1)	30.72 x K1 (3 x K1)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.				

5.1A Cell Re-selection with CCA

5.1A.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it. The requirements in subclauses 5.1A.2.3, 5.1A.2.4, and 5.1A.2.6 apply when at least the target cell is on a carrier frequency with CCA, and the requirements in subclauses 5.1A.2.2 and 5.1A.2.5 apply when at least the camping cell is on a carrier frequency with CCA.

When the UE is in *Camped Normally* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity.

5.1A.2 Requirements

5.1A.2.1 UE measurement capability

The requirements in clause 4.2A.2.1 shall apply.

5.1A.2.2 Measurement and evaluation when CCA is used on the serving cell

The requirements in clause 4.2A.2.2 shall apply.

5.1A.2.3 Measurements of intra-frequency NR cells when CCA is used on the serving cell and target cell

The requirements in clause 4.2A.2.3 shall apply.

5.1A.2.4 Measurements of inter-frequency NR cells when CCA is used on the target cell

The requirements in clause 4.2A.2.4 shall apply.

5.1A.2.5 Measurements of inter-RAT E-UTRAN cells when CCA is used on the serving cell

The requirements in clause 4.2.2.5 shall apply.

5.1A.2.6 Maximum interruption in paging reception when CCA is used on the target cell

The requirements in clause 4.2A.2.6 shall apply.

5.1A.2.7 General requirements

The requirements in clause 4.2.2.7 shall apply.

5.1B Cell Re-selection for RedCap

5.1B.1 Introduction

5.1B.2 Requirements

5.1B.2.1 UE measurement capability

The requirements in clause 4.2B.2.1 shall apply.

5.1B.2.2 Measurement and evaluation of serving cell

The requirements in clause 4.2B.2.2 shall apply when UE is not configured with eDRX_IDLE.

When UE is configured with eDRX_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1* T for FR1 and N1*T for FR2; where:

- T is determined according to clause 7.1 in [1],
- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and T $\leq$ 0.64 second, otherwise M1=1.

When UE is configured with eDRX_IDLE and eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, within a single eDRX INACTIVE PTW, the UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1* T for FR1 and N1*T for FR2; where:

- T is determined according to clause 7.1 in [1],
- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and T $\leq$ 0.64 second, otherwise M1=1.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least T/2.

If UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1 and the UE has evaluated according to table 5.1B.2.2-1or table 5.1B.2.2-2 in N_{serv_RedCap} consecutive T that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

If UE is configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1 and the UE has evaluated according to table 5.1B.2.2-3 or table 5.1B.2.2-4 in N_{serv_RedCap} consecutive T within a single eDRX INACTIVE PTW that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

Table 5.1B.2.2-1: N_{serv_RedCap} for inactive Redcap UE configured with eDRX_IDLE cycle, (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length[s]	T [s]	N_{serv_RedCap} [number of T]
2.56 ≤eDRX_IDLE cycle length ≤10485.76	0.32 ≤DRX_Inactive cycle length ≤2.56; or 2.56 ≤eDRX_Inactive cycle length ≤10.24 if inactive eDRX is configured	0.32	4*M1
		0.64	4*M1
		1.28	2
		2.56	2
		5.12	2
		10.24	2
NOTE 1: T is determined according to clause 7.1 in [1]. NOTE 2: M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and T≤ 0.64 second, otherwise M1=1.			

Table 5.1B.2.2-2: N_{serv_RedCap} for inactive Redcap UE configured with eDRX_IDLE cycle, (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length[s]	T [s]	Scaling Factor (N1)	N_{serv_RedCap} [number of T]
2.56 ≤eDRX_IDLE cycle length ≤10485.76	0.32 ≤DRX_Inactive cycle length ≤2.56; or 2.56 ≤eDRX_Inactive cycle length ≤10.24 if inactive eDRX is configured	0.32	8	4* N1
		0.64	5	4* N1
		1.28	4	2* N1
		2.56	3	2* N1
		5.12	3	2* N1
		10.24	3	2* N1
NOTE 1: T is determined according to clause 7.1 in [1].				

Table 5.1B.2.2-3: N_{serv_RedCap} for inactive Redcap UE, (Frequency range FR1)

eDRX_IDLE cycle and eDRX INACTIVE cycle length [s]	T [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	N_{serv_RedCap} [number of T Note 3]
20.48 ≤ eDRX_IDLE cycle length ≤10485.76 20.48 ≤ eDRX_ INACTIVE cycle length ≤10485.76	0.32	≥ 1.28 (1)	M1*2
	0.64	≥ 1.28 (1) (M1=1) or ≥ 2.56 (2) (M1=2)	M1*2
	1.28	≥2.56 (2)	2
	2.56	≥5.12 (4)	2

NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 2: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 3: eDRX INACTIVE PTW in this table is RAN configured PTW.
NOTE 4: N_{serv_RedCap} requirements are only defined within a single eDRX INACTIVE PTW duration.
NOTE 5: T is determined according to clause 7.1 in [1].
NOTE 6: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 7: The lower bound of PTW length is derived based on $\left\lceil \frac{Nserv_RedCap * DRX_cycle}{1.28} \right\rceil * 1.28$.

Table 5.1B.2.2-4: N_{serv_RedCap} for inactive Redcap UE, (Frequency range FR2)

eDRX_IDLE cycle and eDRX INACTIVE cycle length [s]	T [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1)	N_{serv_RedCap} [number of T Note 3]
20.48 ≤ eDRX_IDLE cycle length ≤10485.76 20.48 ≤ eDRX_ INACTIVE cycle length ≤10485.76	0.32	≥5.12 (4)	8	N1*2
	0.64	≥6.4 (5)	5	N1*2
	1.28	≥10.24 (8)	4	N1*2
	2.56	≥15.36 (12)	3	N1*2

NOTE 1: Applies for RedCap UE of all FR2 power class.
NOTE 2: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 3: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 4: eDRX INACTIVE PTW in this table is RAN configured PTW.
NOTE 5: N_{serv_RedCap} requirements are only defined within a single eDRX INACTIVE PTW duration.
NOTE 6: T is determined according to clause 7.1 in [1].
NOTE 7: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 8: The lower bound of PTW length is derived based on $\left\lceil \frac{Nserv_RedCap * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 9: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

If UE is not configured with eDRX_INACTIVE ≥ 20.48 s, when UE transitions from measurements within eDRX_IDLE PTW and to measurements outside eDRX_IDLE PTW or vice versa during one measurement period, the UE measurement requirements apply based on the longer measurement period requirements before or after the transition.

When the UE transitions between any two states when changing eDRX_IDLE cycle length, eDRX_INACTIVE cycle length, INACTIVE RAN DRX length or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

If the UE in RRC_INACTIVE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information during the time T', the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1], where

- T'= 10 s, if the UE is not configured with eDRX_INACTIVE cycle, or

- T'= MAX (10 s, one eDRX_INACTIVE cycle) if the UE is configured with eDRX_INACTIVE cycle for FR1, or

- T'= MAX (10 s, N1* eDRX_INACTIVE cycle) if the UE is configured with eDRX_INACTIVE cycle for FR2.

5.1B.2.3 Measurements of intra-frequency NR cells

The requirements in clause 4.2B.2.3 shall apply when UE is not configured with eDRX_IDLE. When UE is configured with eDRX_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the requirements defined in section 4.2B.2.3 shall apply with $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ defined in table 5.1B.2.3-1 and table 5.1B.2.3-2.

When UE is configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, the requirements defined in section 4.2B.2.3 shall apply with $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ defined in table 5.1B.2.3-3 and table 5.1B.2.3-4.

Table 5.1B.2.3-1: $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ for Redcap UE configured with eDRX_IDLE cycle, (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect,NR_Intra_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Intra_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Intra_RedCap}$ [s] (number of DRX or INACTIVE eDRX cycles)
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	11.52 x M2 (36 x M2)	1.28 x M2 (4 x M2)	5.12 x M2 (16 x M2)
	0.64	17.92 (28)	1.28 (2)	5.12 (8)
	1.28	32 (25)	1.28 (1)	6.4 (5)
	2.56	58.88 (23)	2.56 (1)	7.68 (3)
	5.12	117.76 (23)	5.12 (1)	15.36 (3)
	10.24	235.52 (23)	10.24 (1)	30.72 (3)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.				

Table 5.1B.2.3-2: $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ for Redcap UE configured with eDRX_IDLE cycle, (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	Scaling Factor (N1)	$T_{detect,NR_Intra_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Intra_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Intra_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	8	11.52 x N1 x M2 (36 x N1 x M2)	1.28 x N1 x M2 (4 x N1 x M2)	5.12 x N1 x M2 (16 x N1 x M2)
	0.64	5	17.92x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
	1.28	4	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
	2.56	3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
	5.12	3	117.76 x N1 (23 x N1)	5.12 x N1 (1 x N1)	15.36 x N1 (3 x N1)
	10.24	3	235.52 x N1 (23 x N1)	10.24 x N1 (1 x N1)	30.72 x N1 (3 x N1)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.					

Table 5.1B.2.3-3: $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ for Redcap UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle, (Frequency range FR1)

eDRX_IDLE cycle and eDRX INACTIVE cycle length [s]	RANDRX cycle length [s]	eDRX INACTIVEPTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Intra_RedCap}$ [s] (number of RAN DRX cycles)	$T_{measure,NR_Intra_RedCap}$ [s] (number of RAN DRX cycles Note 3)	$T_{evaluate,NR_Intra_RedCap}$ [s] (number of RAN DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76 20.48 ≤eDRX_INACTIVE cycle length ≤ 10485.76	0.32	≥[1.28] ([1])	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ (23)	0.32 x M2 (1 x M2)	0.64 x M2 (2 x M2)

	0.64	≥[1.28] ([1])		0.64 (1)	1.28 (2)
	1.28	≥[2.56] ([2])		1.28 (1)	2.56 (2)
	2.56	≥[5.12] ([4])		2.56 (1)	5.12 (2)

NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 2: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 3: eDRX INACTIVE PTW in this table is RAN configured PTW.
NOTE 4: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 5: The lower bound of PTW length is derived based on $\left\lceil \frac{T_{evaluate,NR_Intra_RedCap} * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 6: M2 = 2 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.

Table 5.1B.2.3-4: $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ for Redcap UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle, (Frequency range FR2)

eDRX_IDLE cycle and eDRX INACTIVE cycle length [s]	RAN DRX length [s]	eDRX INACTIVEPTW length [s] (number of 1.28 s periods)	Scaling Factor (N1)	$T_{detect,NR_Intra_RedCap}$ [s] (number of RAN DRX cycles)	$T_{measure,NR_Intra_RedCap}$ [s] (number of RAN DRX cycles Note 5)	$T_{evaluate,NR_Intra_RedCap}$ [s] (number of RAN DRX cycles Note 5)
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76 20.48 ≤eDRX_INACTIVE cycle length ≤10485.76	0.32	≥5.12 (4)	8	$eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1)	0.32 x N1 (1 x N1)	0.64 x N1 (2 x N1)
	0.64	≥6.4 (5)	5		0.64 x N1 (1 x N1)	1.28 x N1 (2 x N1)
	1.28	≥10.24 (8)	4		1.28 x N1 (1 x N1)	2.56 x N1 (2 x N1)
	2.56	≥15.36 (12)	3		2.56 x N1 (1 x N1)	5.12 x N1 (2 x N1)

NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 2: Applies for RedCap UE of all power class.
NOTE 3: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 4: eDRX INACTIVE PTW in this table is RAN configured PTW.
NOTE 5: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 6: The lower bound of PTW length is derived based on $\left\lceil \frac{T_{evaluate,NR_Intra_RedCap} * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 7: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

When the UE transitions between any two states when changing eDRX_IDLE cycle length, eDRX_INACTIVE cycle length, INACTIVE RAN DRX length or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

5.1B.2.4 Measurements of inter-frequency NR cells

The requirements in clause 4.2B.2.4 shall apply when UE is not configured with eDRX_IDLE. When UE is configured with eDRX_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the requirements defined in section 4.2B.2.4 shall apply with $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ defined in table 5.1B.2.4-1 and table 5.1B.2.4-2.

When UE is configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, the requirements defined in section 4.2B.2.4 shall apply with $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ defined in table 5.1B.2.4-3 and table 5.1B.2.4-4.

Table 5.1B.2.4-1: $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ for Redcap UE configured with eDRX_IDLE cycle, (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)

2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	11.52 x 1.5 (36 x 1.5)	1.28 x 1.5 (4 x 1.5)	5.12 x 1.5 (16 x 1.5)
	0.64	17.92 (28)	1.28 (2)	5.12 (8)
	1.28	32 (25)	1.28 (1)	6.4 (5)
	2.56	58.88 (23)	2.56 (1)	7.68 (3)
	5.12	117.76 (23)	5.12 (1)	15.36 (3)
	10.24	235.52(23)	10.24 (1)	30.72 (3)

Table 5.1B.2.4-2: $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ for Redcap UE configured with eDRX_IDLE cycle, (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	Scaling Factor (N1)	$T_{detect,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	8	11.52 x N1 x 1.5 (36 x N1 x 1.5)	1.28 x N1 x 1.5 (4 x N1 x 1.5)	5.12 x N1 x 1.5 (16 x N1 x 1.5)
	0.64	5	17.92x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
	1.28	4	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
	2.56	3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
	5.12	3	117.76 x N1 (23 x N1)	5.12 x N1 (1 x N1)	15.36 x N1 (3 x N1)
	10.24	3	235.52 x N1 (23 x N1)	10.24 x N1 (1 x N1)	30.72 x N1 (3 x N1)

Table 5.1B.2.4-3: $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ for Redcap UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle (Frequency range FR1)

eDRX_IDLE cycle and eDRX_INACTIVE cycle length [s]	RAN DRX cycle length [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)
20.48≤eDRX_IDLE cycle length ≤ 10485.76 20.48 ≤eDRX_INACTIVE cycle length ≤ 10485.76	0.32	≥1.28 (1)	$eDRX_cycle_length \times \left\lceil \frac{23}{PTW/DRX_cycle_length} \right\rceil$ (23)	0.32 x 1.5 (1 x 1.5)	0.64 x 1.5 (2 x 1.5)
	0.64	≥1.28 (1)		0.64 (1)	1.28 (2)
	1.28	≥2.56 (2)		1.28 (1)	2.56 (2)
	2.56	≥5.12 (4)		2.56 (1)	5.12 (2)

NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 2: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 3: eDRX INACTIVE PTW in this table is RAN configured PTW [1].
NOTE 4: The number of DRX cycles in this table is given for the DRX cycles within RAN PTWs.
NOTE 5: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 6: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter_RedCap * DRX_cycle}{1.28} \right\rceil * 1.28$.

Table 5.1B.2.4-4: $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ for Redcap UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle (Frequency range FR2)

eDRX_IDLE cycle and eDRX_INACTIVE cycle length [s]	RAN DRX cycle length [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)
20.48≤eDRX_IDLE cycle length ≤ 10485.76 20.48 ≤eDRX_INACTIVE cycle length ≤ 10485.76	0.32	≥5.12 (4)	8	$eDRX_cycle_length \times \left\lceil \frac{23 \times N1}{PTW/DRX_cycle_length} \right\rceil$ (23 x N1)	0.32 x N1 (1 x N1)	0.64 x N1 (2 x N1)
	0.64	≥6.4 (5)	5		0.64 x N1 (1 x N1)	1.28 x N1 (2 x N1)
	1.28	≥10.24 (8)	4		1.28 x N1 (1 x N1)	2.56 x N1 (2 x N1)
	2.56	≥15.36 (12)	3		2.56 x N1 (1 x N1)	5.12 x N1 (2 x N1)

NOTE 1: Applies for RedCap UE of all power class.
NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within RAN PTWs.
NOTE 3: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,NR_Inter_RedCap * DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 5: When eDRX_INACTIVE=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX_INACTIVE cycles.
NOTE 6: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 7: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 8: eDRX INACTIVE PTW in this table is RAN configured PTW [1].

When the UE transitions between any two states when changing eDRX_IDLE cycle length, eDRX_INACTIVE cycle length, INACTIVE RAN DRX length or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

5.1B.2.5 Measurements of inter-RAT E-UTRAN cells

The requirements in clause 4.2B.2.5 shall apply when UE is not configured with eDRX_IDLE. When UE is configured with eDRX_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the requirements defined in section 4.2B.2.5 shall apply with $T_{detect,\ EUTRAN_RedCap}$, $T_{measure,\ EUTRAN\ _RedCap}$ and $T_{evaluate,\ EUTRAN\ _RedCap}$ defined in table 5.1B.2.5-1.

Table 5.1B.2.5-1: $T_{detect,\ EUTRAN_RedCap}$, $T_{measure,\ EUTRAN\ _RedCap}$ and $T_{evaluate,\ EUTRAN\ _RedCap}$ for inactive Redcap UE configured with eDRX_IDLE cycle, (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect,\ EUTRAN_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,\ EUTRAN\ _RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,\ EUTRAN\ _RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	11.52 x 1.5 (36 x 1.5)	1.28 x 1.5 (4 x 1.5)	5.12 x 1.5 (16 x 1.5)
	0.64	17.92 (28)	1.28 (2)	5.12 (8)
	1.28	32 (25)	1.28 (1)	6.4 (5)
	2.56	58.88 (23)	2.56 (1)	7.68 (3)
	5.12	117.76 (23)	5.12 (1)	15.36 (3)
	10.24	235.52(23)	10.24 (1)	30.72 (3)

When UE is configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, the requirements defined in section 4.2B.2.5 shall apply with $T_{detect,\ EUTRAN_RedCap}$, $T_{measure,\ EUTRAN\ _RedCap}$ and $T_{evaluate,\ EUTRAN\ _RedCap}$ defined in table 5.1B.2.5-2.

Table 5.1B.2.5-2: $T_{detect,EUTRAN_RedCap}$, $T_{measure,EUTRAN_RedCap}$, and $T_{evaluate,EUTRAN_RedCap}$ for UE configured with eDRX_IDLE cycle and eDRX_INACTIVE ≥ 20.48 s, (Frequency range FR1)

eDRX_IDLE cycle and eDRX_Inactive cycle length [s]	RAN DRX cycle length [s]	eDRX Inactive PTW length [s] (number of 1.28 s periods)	$T_{detect,EUTRAN_RedCap}$ [s] (number of RAN DRX cycles Note 3)	$T_{measure,EUTRAN_RedCap}$ [s] (number of RAN DRX cycles Note 3)	$T_{evaluate,E-UTRAN_RedCap}$ [s] (number of RAN DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤10485.76 20.48 ≤ eDRX_INACTIVE cycle length ≤10485.76	0.32	≥1.28 (1)	$eDRX_cycle_length \times \left\lceil \frac{23}{\lceil PTW/DRX_cycle_length \rceil} \right\rceil$ (23)	0.32 (1)	0.64 (2)
	0.64	≥1.28 (1)		0.64 (1)	1.28 (2)
	1.28	≥2.56 (2)		1.28 (1)	2.56 (2)
	2.56	≥5.12 (4)		2.56 (1)	5.12 (2)

NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 2: The number of RAN DRX cycles in this table is given for the RAN DRX cycles within RAN configured PTWs.
NOTE 3: eDRX Inactive PTW in this table is RAN configured PTW [1].
NOTE 4: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 5: The eDRX_INACITVE cycle lengths are *ran-ExtendedPagingCycleConfig-r18* as specified in [2]
NOTE 6: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,E-UTRAN_RedCap*DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 7: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.

When the UE transitions between any two states when changing eDRX_IDLE cycle length, eDRX_INACTIVE cycle length, INACTIVE RAN DRX length or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

5.1B.2.6 Maximum interruption in paging reception

The requirements in clause 4.2B.2.6 shall apply for RedCap UEs.

For RedCap UE in HD-FDD mode, if paging occasions partially overlap with CG-SDT transmission, the UE is only required to monitor for SI change indication in any paging occasion at least once per modification period [2] during SDT if the initial downlink BWP on which the SDT procedure is ongoing is associated with a CD-SSB.

5.1B.2.7 General requirements

The requirements in sub-clause 5.1.2.7 shall apply.

5.1B.2.8 Minimum requirement at transitions

The requirements in sub-clause 4.2B.2.8 shall apply.

5.1B.2.9 Measurements of intra-frequency NR cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2B.2.9 apply for UE configured with relaxed measurement criterion except when UE is configured with eDRX_IDLE cycle greater than 10.24 s and UE has fulfilled stationary criterion or low mobility criterion or not-at-cell edge criterion.

If the UE is configured with eDRX_IDLE cycle greater than 10.24 s in FR1 and FR2, and UE has fulfilled stationary criterion or low mobility criterion or not-at-cell edge criterion, and

- when UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, then the requirements in table 5.1B.2.9-1 and table 5.1B.2.9-2 respectively apply provided that eDRX_IDLE cycle is ≤ 10485.76 sec, or

- when UE is configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, the requirements defined in section 4.2B.2.9 shall apply with $T_{detect,\ NR_intra_RedCap_Relax}$, $T_{measure,\ NR_intra_RedCap_Relax}$ and $T_{evaluate,\ NR_intra_RedCap_Relax}$ defined in table 5.1B.2.9-3 and table 5.1B.2.9-4.

Table 5.1B.2.9-1: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for inactive Redcap UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX or INACTIVE eDRX cycles)
20.48 ≤eDRX_IDLE cycle length ≤10485.76	0.32	11.52 x M2 x K4 (36 x M2 x K4)	1.28 x M2 x K4 (4 x M2 x K4)	5.12 x M2 x K4 (16 x M2 x K4)
	0.64	17.92 x K4 (28 x K4)	1.28 x K4 (2 x K4)	5.12 x K4 (8 x K4)
	1.28	32 x K4 (25 x K4)	1.28 x K4 (1 x K4)	6.4 x K4 (5 x K4)
	2.56	58.88 x K4 (23 x K4)	2.56 x K4 (1 x K4)	7.68 x K4 (3 x K4)
	5.12	117.76 x K4 (23 x K4)	5.12 x K4 (1 x K4)	15.36 x K4 (3 x K4)
	10.24	235.52 x K4 (23 x K4)	10.24 x K4 (1 x K4)	30.72 x K4 (3 x K4)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 2: K4 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. K4 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.				

Table 5.1B.2.9-2: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for inactive Redcap UE configured with eDRX_IDLE cycle, (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	Scaling Factor (N1)	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)
20.48 ≤eDRX_IDLE cycle length ≤10485.76	0.32	8	11.52 x N1 x M2 x K4 (36 x N1 x M2 x K4)	1.28 x N1 x M2 x K4 (4 x N1 x M2 x K4)	5.12 x N1 x M2 x K4 (16 x N1 x M2 x K4)
	0.64	5	17.92x N1 x K4 (28 x N1 x K4)	1.28 x N1 x K4 (2 x N1 x K4)	5.12 x N1 x K4 (8 x N1 x K4)
	1.28	4	32 x N1 x K4 (25 x N1 x K4)	1.28 x N1 x K4 (1 x N1 x K4)	6.4 x N1 x K4 (5 x N1 x K4)
	2.56	3	58.88 x N1 x K4 (23 x N1 x K4)	2.56 x N1 x K4 (1 x N1 x K4)	7.68 x N1 x K4 (3 x N1 x K4)
	5.12	3	117.76 x N1 x K4 (23 x N1 x K4)	5.12 x N1 x K4 (1 x N1 x K4)	15.36 x N1 x K4 (3 x N1 x K4)
	10.24	3	235.52 x N1 x K4 (23 x N1 x K4)	10.24 x N1 x K4 (1 x N1 x K4)	30.72 x N1 x K4 (3 x N1 x K4)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 2: K4 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. K4 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.					

Table 5.1B.2.9-3: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for Redcap UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle (Frequency range FR1)

eDRX_IDLE cycle and eDRX_INACTIVE cycle length [s]	RAN DRX cycle length [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)
	0.32	≥1.28 (1)		0.32 x M2 x Kx (1 x 1.5 x Kx)	0.64 x M2 x Kx (2 x 1.5)

20.48≤eDRX_IDLE cycle length ≤163.84 20.48 ≤eDRX_INACTIVE cycle length ≤ 163.84	0.64	≥1.28 (1)	$eDRX_{cycle_{length}} \times \left\lceil \frac{23}{\frac{PTW}{DRX_{cycle_{length}}}} \right\rceil \times Kx$ (23 x Kx)	0.64 x Kx (1 x Kx)	1.28 x Kx (2 x Kx)
	1.28	≥2.56 (2)		1.28 x Kx (1 x Kx)	2.56 x Kx (2 x Kx)
	2.56	≥5.12 (4)		2.56 x Kx (1 x Kx)	5.12 x Kx (2 x Kx)

NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 2: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 3: eDRX INACTIVE PTW in this table is RAN configured PTW [1].
NOTE 4: The number of DRX cycles in this table is given for the DRX cycles within RAN PTWs.
NOTE 5: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 6: The lower bound of PTW length is derived based on $\left\lceil \frac{\text{Tevaluate,NR_Inter_RedCap} * \text{DRX_cycle}}{1.28} \right\rceil * 1.28$.
NOTE 7: Kx = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. Kx = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.
NOTE 8: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.

Table 5.1B.2.9-4: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for Redcap UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle (Frequency range FR2)

eDRX_IDLE cycle and eDRX_INACTIVE cycle length [s]	RAN DRX cycle length [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Intra_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Intra_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Intra_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)
20.48≤eDRX_IDLE cycle length ≤163.84 20.48 ≤eDRX_INACTIVE cycle length ≤163.84	0.32	≥5.12 (4)	8	$eDRX_{cycle_{length}} \times \left\lceil \frac{23 \times N1}{\frac{PTW}{DRX_{cycle_{length}}}} \right\rceil$ x Kx (23 x N1 x Kx)	0.32 x N1 x Kx (1 x N1 x Kx)	0.64 x N1 x Kx (2 x N1 x Kx)
	0.64	≥6.4 (5)	5		0.64 x N1 x Kx (1 x N1 x Kx)	1.28 x N1 x Kx (2 x N1 x Kx)
	1.28	≥10.24 (8)	4		1.28 x N1 x Kx (1 x N1 x Kx)	2.56 x N1 x Kx (2 x N1 x Kx)
	2.56	≥15.36 (12)	3		2.56 x N1 x Kx (1 x N1 x Kx)	5.12 x N1 x Kx (2 x N1 x Kx)

NOTE 1: Applies for RedCap UE of all power class.
NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within RAN PTWs.
NOTE 3: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{\text{Tevaluate,NR_Inter_RedCap} * \text{DRX_cycle}}{1.28} \right\rceil * 1.28$.
NOTE 5: When eDRX_INACTIVE=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX_INACTIVE cycles.
NOTE 6: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 7: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 8: eDRX INACTIVE PTW in this table is RAN configured PTW [1].
NOTE 9: Kx = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. Kx = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.

5.1B.2.10 Measurements of inter-frequency NR cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2B.2.10 apply for UE configured with relaxed measurement criterion except when UE is configured with eDRX_IDLE cycle greater than 10.24 s and UE has fulfilled stationary criterion or low mobility criterion or not-at-cell edge criterion.

If the UE is configured with eDRX_IDLE cycle greater than 10.24 s in FR1 and FR2, and UE has fulfilled stationary criterion or low mobility criterion or not-at-cell edge criterion, and

- when UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, then the requirements in table 5.1B.2.10-1 and table 5.1B.2.10-2 respectively apply provided that eDRX_IDLE cycle is ≤ 10485.76 sec, or

- when UE is configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, the requirements defined in section 4.2B.2.10 shall apply with $T_{detect, NR_inter_RedCap_Relax}$, $T_{measure, NR_inter_RedCap_Relax}$ and $T_{evaluate, NR_inter_RedCap_Relax}$ defined in table 5.1B.2.10-3 and table 5.1B.2.10-4.

Table 5.1B.2.10-1: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for inactive Redcap UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX or INACTIVE eDRX cycles)
20.48 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	11.52 x M2 x K4 (36 x M2 x K4)	1.28 x M2 x K4 (4 x M2 x K4)	5.12 x M2 x K4 (16 x M2 x K4)
	0.64	17.92 x K4 (28 x K4)	1.28 x K4 (2 x K4)	5.12 x K4 (8 x K4)
	1.28	32 x K4 (25 x K4)	1.28 x K4 (1 x K4)	6.4 x K4 (5 x K4)
	2.56	58.88 x K4 (23 x K4)	2.56 x K4 (1 x K4)	7.68 x K4 (3 x K4)
	5.12	117.76 x K4 (23 x K4)	5.12 x K4 (1 x K4)	15.36 x K4 (3 x K4)
	10.24	235.52 x K4 (23)	10.24 x K4 (1 x K4)	30.72 x K4 (3 x K4)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 2: K4 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. K4 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.				

Table 5.1B.2.10-2: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for inactive Redcap UE configured with eDRX_IDLE cycle, (Frequency range FR2)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	Scaling Factor (N1)	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)
20.48 ≤eDRX_IDLE cycle length ≤10485.76	0.32	8	11.52 x N1 x M2 x K4 (36 x N1 x M2 x K4)	1.28 x N1 x M2 x K4 (4 x N1 x M2 x K4)	5.12 x N1 x M2 x K4 (16 x N1 x M2 x K4)
	0.64	5	17.92x N1 x K4 (28 x N1 x K4)	1.28 x N1 x K4 (2 x N1 x K4)	5.12 x N1 x K4 (8 x N1 x K4)
	1.28	4	32 x N1 x K4 (25 x N1 x K4)	1.28 x N1 x K4 (1 x N1 x K4)	6.4 x N1 x K4 (5 x N1 x K4)
	2.56	3	58.88 x N1 x K4 (23 x N1 x K4)	2.56 x N1 x K4 (1 x N1 x K4)	7.68 x N1 x K4 (3 x N1 x K4)
	5.12	3	117.76 x N1 x K4 (23 x N1 x K4)	5.12 x N1 x K4 (1 x N1 x K4)	15.36 x N1 x K4 (3 x N1 x K4)
	10.24	3	235.52 x N1 x K4 (23 x N1 x K4)	10.24 x N1 x K4 (1 x N1 x K4)	30.72 x N1 x K4 (3 x N1 x K4)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. NOTE 2: K4 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. K4 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.					

Table 5.1B.2.10-3: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for Redcap UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle (Frequency range FR1)

eDRX_IDLE cycle and eDRX_INACTIVE cycle length [s]	RAN DRX cycle length [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)
20.48≤eDRX_IDLE cycle length ≤163.84	0.32	≥1.28 (1)		0.32 x 1.5 x Kx (1 x 1.5 x Kx)	0.64 x 1.5 x Kx (2 x 1.5)
	0.64	≥1.28 (1)		0.64 x Kx (1 x Kx)	1.28 x Kx (2 x Kx)
	1.28	≥2.56 (2)		1.28 x Kx (1 x Kx)	2.56 x Kx (2 x Kx)

20.48 ≤eDRX_INACTIVE cycle length ≤ 163.84	2.56	≥5.12 (4)	$eDRX_{cycle_{length}} \times \left\lceil \frac{23}{\frac{PTW}{DRX_{cycle_{length}}}} \right\rceil \times Kx$ (23 x Kx)	2.56 x Kx (1 x Kx)	5.12 x Kx (2 x Kx)

NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 2: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 3: eDRX INACTIVE PTW in this table is RAN configured PTW [1].
NOTE 4: The number of DRX cycles in this table is given for the DRX cycles within RAN PTWs.
NOTE 5: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 6: The lower bound of PTW length is derived based on $\left\lceil \frac{\text{Tevaluate,NR_Inter_RedCap} * \text{DRX_cycle}}{1.28} \right\rceil * 1.28$.
NOTE 7: Kx = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. Kx = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 5.1B.2.10-4: $T_{detect,NR_Inter_RedCap_Relax}$, $T_{measure,NR_Inter_RedCap_Relax}$ and $T_{evaluate,NR_Inter_RedCap_Relax}$ for Redcap UE configured with eDRX_IDLE cycle and eDRX_INACTIVE cycle (Frequency range FR2)

eDRX_IDLE cycle and eDRX_INACTIVE cycle length [s]	RAN DRX cycle length [s]	eDRX INACTIVE PTW length [s] (number of 1.28 s periods)	Scaling Factor (N1) Note1	$T_{detect,NR_Inter_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)
20.48≤eDRX_IDLE cycle length ≤163.84 20.48 ≤eDRX_INACTIVE cycle length ≤163.84	0.32	≥5.12 (4)	8	$eDRX_{cycle_{length}} \times \left\lceil \frac{23 \times N1}{\frac{PTW}{DRX_{cycle_{length}}}} \right\rceil$ x Kx (23 x N1 x Kx)	0.32 x N1 x Kx (1 x N1 x Kx)	0.64 x N1 x Kx (2 x N1 x Kx)
	0.64	≥6.4 (5)	5		0.64 x N1 x Kx (1 x N1 x Kx)	1.28 x N1 x Kx (2 x N1 x Kx)
	1.28	≥10.24 (8)	4		1.28 x N1 x Kx (1 x N1 x Kx)	2.56 x N1 x Kx (2 x N1 x Kx)
	2.56	≥15.36 (12)	3		2.56 x N1 x Kx (1 x N1 x Kx)	5.12 x N1 x Kx (2 x N1 x Kx)

NOTE 1: Applies for RedCap UE of all power class.
NOTE 2: The number of DRX cycles in this table is given for the DRX cycles within RAN PTWs.
NOTE 3: The eDRX_INACTIVE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 4: The lower bound of PTW length is derived based on $\left\lceil \frac{\text{Tevaluate,NR_Inter_RedCap} * \text{DRX_cycle}}{1.28} \right\rceil * 1.28$.
NOTE 5: When eDRX_INACTIVE=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX _INACTIVE cycles.
NOTE 6: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 7: The number of RAN DRX cycles in this table is given for the DRX cycles within RAN configured PTWs.
NOTE 8: eDRX INACTIVE PTW in this table is RAN configured PTW [1].
NOTE 9: Kx = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. Kx = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.

5.1B.2.11 Measurements of inter-RAT E-UTRAN cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2B.2.11 apply for UE configured with relaxed measurement criterion except when UE is configured with eDRX_IDLE cycle greater than 10.24 s and UE has fulfilled stationary criterion or low mobility criterion or not-at-cell edge criterion.

If the UE is configured with eDRX_IDLE cycle greater than 10.24 s in FR1 and FR2, and UE has fulfilled stationary criterion or low mobility criterion or not-at-cell edge criterion, and

- when UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, then the requirements in table 5.1B.2.11-1 apply provided that eDRX_IDLE cycle is ≤ 10485.76 sec, or

- when UE is configured with eDRX by*ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, the requirements defined in section 4.2B.2.11 shall apply with $T_{detect,\ EUTRAN_RedCap_Relax}$, $T_{measure,\ EUTRAN\ _RedCap_Relax}$ and $T_{evaluate,\ EUTRAN\ _RedCap_Relax}$ defined in table 5.1B.2.11-2.

Table 5.1B.2.11-1: $T_{detect,NR_Intra_RedCap_Relax}$, $T_{measure,NR_Intra_RedCap_Relax}$ and $T_{evaluate,NR_Intra_RedCap_Relax}$ for inactive Redcap UE configured with eDRX_IDLE cycle (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect,\ EUTRAN_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,\ EUTRAN_RedCap_Relax}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,\ EUTRAN_RedCap_Relax}$ [s] (number of DRX or INACTIVE eDRX cycles)
20.48 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32	11.52 x M2 x K4 (36 x M2 x K4)	1.28 x M2 x K4 (4 x M2 x K4)	5.12 x M2 x K4 (16 x M2 x K4)
	0.64	17.92 x K4 (28 x K4)	1.28 x K4 (2 x K4)	5.12 x K4 (8 x K4)
	1.28	32 x K4 (25 x K4)	1.28 x K4 (1 x K4)	6.4 x K4 (5 x K4)
	2.56	58.88 x K4 (23 x K4)	2.56 x K4 (1 x K4)	7.68 x K4 (3 x K4)
	5.12	117.76 x K4 (23 x K4)	5.12 x K4 (1 x K4)	15.36 x K4 (3 x K4)
	10.24	235.52 x K4 (23 x K4)	10.24 x K4 (1 x K4)	30.72 x K4 (3 x K4)

NOTE1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.
NOTE 2: K4 = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. K4 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.

Table 5.1B.2.11-2: $T_{detect,EUTRAN_RedCap_Relax}$, $T_{measure,EUTRAN_RedCap_Relax}$, and $T_{evaluate,EUTRAN_RedCap_Relax}$ for UE configured with eDRX_IDLE cycle and eDRX_INACTIVE ≥ 20.48 s, (Frequency range FR1)

eDRX_IDLE cycle and eDRX_Inactive cycle length [s]	RAN DRX cycle length [s]	eDRX Inactive PTW length [s] (number of 1.28 s periods)	$T_{detect,EUTRAN_RedCap_Relax}$ [s] (number of RAN DRX cycles Note 3)	$T_{measure,EUTRAN_RedCap_Relax}$ [s] (number of RAN DRX cycles Note 3)	$T_{evaluate,E-UTRAN_RedCap_Relax}$ [s] (number of RAN DRX cycles Note 3)
20.48 ≤ eDRX_IDLE cycle length ≤ 163.84 20.48 ≤ eDRX_INACTIVE cycle length ≤ 163.84	0.32	≥1.28 (1)	$eDRX_cycle_length \times \left\lceil \frac{23}{\lfloor PTW/DRX_cycle_length \rfloor} \right\rceil$ x Kx (23 x Kx)	0.32 x Kx (1 x Kx)	0.64 x Kx (2 x Kx)
	0.64	≥1.28 (1)		0.64 x Kx (1 x Kx)	1.28 x Kx (2 x Kx)
	1.28	≥2.56 (2)		1.28 x Kx (1 x Kx)	2.56 x Kx (2 x Kx)
	2.56	≥5.12 (4)		2.56 x Kx (1 x Kx)	5.12 x Kx (2 x Kx)

NOTE 1: RAN DRX cycle in this table is UE specific DRX value configured by RRC specified in [1].
NOTE 2: The number of RAN DRX cycles in this table is given for the RAN DRX cycles within RAN configured PTWs.
NOTE 3: eDRX Inactive PTW in this table is RAN configured PTW [1].
NOTE 4: The eDRX_IDLE cycle lengths are as specified in section 10.5.5.32 of TS 24.008 [42].
NOTE 5: The eDRX_INACITVE cycle lengths are *ran-ExtendedPagingCycleConfig-r18* as specified in [2]
NOTE 6: The lower bound of PTW length is derived based on $\left\lceil \frac{Tevaluate,E-UTRAN_RedCap*DRX_cycle}{1.28} \right\rceil * 1.28$.
NOTE 7: When eDRX=20.48 s and DRX=0.32 s, UE is allowed to perform cell evaluation within PTW in every 2 eDRX cycles.
NOTE 8: Kx = 6 is the measurement relaxation factor applicable for UE fulfilling the *stationaryMobilityEvaluation* [2] criterion. Kx = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvaluation* [2] criterion or fulfilling the *cellEdgeEvaluation* [2] criterion.

5.1C Cell Re-selection for Satellite Access

5.1C.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in *Camped Normally* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency, inter-frequency and

inter-RAT cells the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity. The requirements in this clause shall apply for the quasi-earth_fixed cell and the earth_moving cell.

5.1C.2 Requirements

5.1C.2.1 UE measurement capability

The requirements in clause 4.2C.2.1 shall apply.

5.1C.2.2 Measurement and evaluation of serving cell

The requirements in clause 4.2C.2.2 shall apply.

5.1C.2.3 Measurements of intra-frequency NR cells

The requirements in clause 4.2C.2.3 shall apply. The requirements in clause 4.2C.2.7 apply for UE configured with relaxed measurement criterion.

5.1C.2.4 Measurements of inter-frequency NR cells

The requirements in clause 4.2C.2.4 shall apply. The requirements in clause 4.2C.2.8 apply for UE configured with relaxed measurement criterion.

5.1C.2.5 Maximum interruption in paging reception

The requirements in clause 4.2C.2.5 shall apply.

5.1C.2.6 General requirements

The requirements in clause 4.2C.2.9 shall apply.

5.1C.2.7 Measurements of inter-frequency NR cells with TN carrier

The requirements in clause 4.2C.2.10 shall apply.

5.1C.2.8 Measurements of inter-RAT E-UTRAN cells with TN carrier

The requirements in clause 4.2C.2.11 shall apply.

5.1C.3 Void

5.1C.4 Void

5.1D Cell Re-selection for ATG

5.1D.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in *Camped Normally* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency and inter-frequency cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. UE

measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity.

5.1D.2 Requirements

5.1D.2.1 UE measurement capability

The requirements in clause 4.2D.2.1 shall apply.

5.1D.2.2 Measurement and evaluation of serving cell

The requirements in clause 4.2D.2.2 shall apply.

5.1D.2.3 Measurements of intra-frequency NR cells

The requirements in clause 4.2D.2.3 shall apply.

5.1D.2.4 Measurements of inter-frequency NR cells

The requirements in clause 4.2D.2.4 shall apply.

5.1D.2.5 Maximum interruption in paging reception

The requirements in clause 4.2D.2.5 shall apply.

5.1D.2.6 General requirements

The requirements in clause 4.2D.2.6 shall apply.

5.1E Cell Re-selection for RedCap UE with Satellite Access

5.1E.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in *Camped Normally* state on a cell, the UE shall attempt to detect, synchroniZe, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency, inter-frequency and inter-RAT cells the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity. The requirements in this clause shall apply for the quasi-earth_fixed cell and the earth_moving cell.

The 1 Rx RedCap UE for performing the cell reselection procedure [1] applies:

- *Qrxlevmin* as the signaled value of *Qrxlevmin* [2] -1 dB.
- *Qqualmin* as the signaled value of *Qqualmin* [2] -1 dB.

5.1E.2 Requirements

5.1E.2.1 UE measurement capability

The requirements in clause 4.2E.2.1 shall apply.

5.1E.2.2 Measurement and evaluation of serving cell

The requirements in clause 4.2E.2.2 shall apply when UE is not configured with eDRX_IDLE.

When UE is configured with eDRX_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1* T for FR1; where:

- T is determined according to clause 7.1 in [1],
- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and T $\leq$ 0.64 second, otherwise M1=1.

When UE is configured with eDRX_IDLE and eDRX by *ran-ExtendedPagingCycleConfig-r18* and *eDRX-AllowedInactive-r18* is signalled in SIB1, within a single eDRX INACTIVE PTW, the UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1* T for FR1; where:

- T is determined according to clause 7.1 in [1],
- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and T $\leq$ 0.64 second, otherwise M1=1.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least T/2.

If UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1 and the UE has evaluated according to table 5.1E.2.2-1 in N_{serv_RedCap} consecutive T that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

Table 5.1E.2.2-1: N_{serv_RedCap} for inactive RedCap UE configured with eDRX_IDLE cycle, (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length[s]	T [s]	N_{serv_RedCap} [number of T]
2.56 ≤eDRX_IDLE cycle length ≤10.24	0.32 ≤DRX_Inactive cycle length ≤2.56; or 2.56 ≤eDRX_Inactive cycle length ≤10.24 if inactive eDRX is configured	0.32	4*M1
		0.64	4*M1
		1.28	2
		2.56	2
		5.12	2
		10.24	2
NOTE 1: T is determined according to clause 7.1 in [1]. NOTE 2: M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and T≤ 0.64 second, otherwise M1=1.			

When the UE transitions between any two states when changing eDRX_IDLE cycle length, eDRX_INACTIVE cycle length, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

If the UE in RRC_INACTIVE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information during the time T', the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1], where

- T'= 10 s, if the UE is not configured with eDRX_INACTIVE cycle, or
- T'= MAX (10 s, one eDRX_INACTIVE cycle) if the UE is configured with eDRX_INACTIVE cycle for FR1

5.1E.2.3 Measurements of intra-frequency NR cells

The requirements in clause 4.2E.2.3 shall apply when UE is not configured with eDRX_IDLE. When UE is configured with eDRX_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the requirements defined in section 4.2E.2.3 shall apply with $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ defined in table 5.1E.2.3-1.

Table 5.1E.2.3-1: $T_{detect,NR_Intra_RedCap}$, $T_{measure,NR_Intra_RedCap}$ and $T_{evaluate,NR_Intra_RedCap}$ for RedCap UE configured with eDRX_IDLE cycle, (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect,NR_Intra_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Intra_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Intra_RedCap}$ [s] (number of DRX or INACTIVE eDRX cycles)
2.56 ≤eDRX_IDLE cycle length ≤ 10.24	0.32	11.52 x M2 (36 x M2)	1.28 x M2 (4 x M2)	5.12 x M2 (16 x M2)
	0.64	17.92 (28)	1.28 (2)	5.12 (8)
	1.28	32 (25)	1.28 (1)	6.4 (5)
	2.56	58.88 (23)	2.56 (1)	7.68 (3)
	5.12	117.76 (23)	5.12 (1)	15.36 (3)
	10.24	235.52 (23)	10.24 (1)	30.72 (3)
NOTE 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.				

When the UE transitions between any two states when changing eDRX_IDLE cycle length, eDRX_INACTIVE cycle length, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

5.1E.2.4 Measurements of inter-frequency NR cells

The requirements in clause 4.2E.2.4 shall apply when UE is not configured with eDRX_IDLE. When UE is configured with eDRX_IDLE and UE is not configured with eDRX by *ran-ExtendedPagingCycleConfig-r18* or *eDRX-AllowedInactive-r18* is not signalled in SIB1, the requirements defined in section 4.2E.2.4 shall apply with $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ defined in table 5.1E.2.4-1.

Table 5.1E.2.4-1: $T_{detect,NR_Inter_RedCap}$, $T_{measure,NR_Inter_RedCap}$ and $T_{evaluate,NR_Inter_RedCap}$ for RedCap UE configured with eDRX_IDLE cycle, (Frequency range FR1)

eDRX_IDLE cycle length [s]	DRX or eDRX INACTIVE cycle length [s]	$T_{detect,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{measure,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)	$T_{evaluate,NR_Inter_RedCap}$ [s] (number of DRX or eDRX INACTIVE cycles)
2.56 ≤eDRX_IDLE cycle length ≤ 10.24	0.32	11.52 x 1.5 (36 x 1.5)	1.28 x 1.5 (4 x 1.5)	5.12 x 1.5 (16 x 1.5)
	0.64	17.92 (28)	1.28 (2)	5.12 (8)
	1.28	32 (25)	1.28 (1)	6.4 (5)
	2.56	58.88 (23)	2.56 (1)	7.68 (3)
	5.12	117.76 (23)	5.12 (1)	15.36 (3)
	10.24	235.52(23)	10.24 (1)	30.72 (3)

When the UE transitions between any two states when changing eDRX_IDLE cycle length, eDRX_INACTIVE cycle length, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

5.1E.2.5 Maximum interruption in paging reception

The requirements in clause 4.2E.2.5 shall apply for RedCap UEs.

For RedCap UE in HD-FDD mode, if paging occasions partially overlap with CG-SDT transmission, the UE is only required to monitor for SI change indication in any paging occasion at least once per modification period [2] during SDT if the initial downlink BWP on which the SDT procedure is ongoing is associated with a CD-SSB.

5.1E.2.6 General requirements

When configured with eDRX_INACTIVE, the UE shall search every layer of higher priority at least every $T_{higher_priority_search}$, where $T_{higher_priority_search}$ is defined as follows:

- $T_{higher_priority_search}$ = max(60, 15*eDRX_INACTIVE cycle length) * N_{layers} seconds if eDRX_INACTIVE cycle ≤ 10.24 s,

Otherwise, if the UE is not configured with eDRX_INACTIVE cycle, the UE shall search every layer of higher priority at least every $T_{higher_priority_search}$ = (60 * N_{layers}) seconds.

N_{layers} is the total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information. For a UE configured with early measurement reporting, while T331 is running, N_{layers} is the combined total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information.

5.1E.2.7 Minimum requirement at transitions

The requirements in sub-clause 4.2E.2.6 shall apply.

5.1E.2.8 Measurements of inter-frequency NR cells with TN carrier

The requirements in sub-clause 4.2E.2.10 shall apply.

5.1E.2.9 Measurements of inter-RAT E-UTRAN cells with TN carrier

The requirements in clause 4.2E.2.11 shall apply.

5.2 Void

5.2B Configured Grant based Small Data Transmissions (CG-SDT) for RedCap

5.2B.1 Introduction

This section contains the requirements for Small Data Transmissions (SDT) for 1 Rx RedCap and 2 Rx RedCap.

The 1 Rx RedCap UE for determining whether to perform SDT procedure defined in clause 5.27 [7] applies:

- sdt-RSRP-Threshold-r17 as the signaled value of sdt-RSRP-Threshold-r17 [2] + 1 dB.

5.2B.2 Requirements on UE synchronization for small data transmissions for RedCap

The requirements in this clause are applicable for the RedCap UE performing small data transmissions using configured resources as TS 38.331 [2].

The UE is allowed to transmit using the configured uplink resources provided that the UE is synchronized towards (i.e. using the timing derived using the latest available N_{TA} value as specified in subclause 7.1A.2) the serving cell prior to transmission. If the UE is not able to obtain the synchronization towards the serving cell then the UE shall drop the small data transmission. The UE determines the small data transmission occasion according to the received CG-SDT configuration TS 38.331 [2].

5.2B.2.1 Void

5.2B.3 TA validation requirements for RedCap

When *cg-SDT-RSRP-ChangeThreshold* TS 38.331 [2] is configured for TA validation based on the RSRP change criterion according to clause 5.8.2 in TS 38.321 [7], the UE is allowed to transmit using CG-SDT using the timing derived using the latest available N_{TA} value as specified in subclause 7.1 provided that

- the first RSRP ($RSRP_1$) measurement and the second RSRP ($RSRP_2$) measurements used in the TA validation are valid measurements and,
- timing alignment validation for transmission using CG-SDT is valid according to the validation criteria in clause 5.8.2 in TS 38.321 [7].

$RSRP_1$ and $RSRP_2$ are considered valid provided that the conditions in table5.2B.3-1 are met for FR1 when UE is not configured with any eDRX cycle by serving gNB or core network.

$RSRP_1$ and $RSRP_2$ are considered valid provided that the conditions in table 5.2B.3-2 are met for FR2 regardless of whether the UE is configured with eDRX cycle by serving gNB or core network (AMF).

$RSRP_1$ and $RSRP_2$ are considered valid provided that the conditions in table 5.2B.3-3 are met for FR1 when UE is configured:

- only with CN eDRX cycle ($T_{eDRX-CN}$) by core network (AMF), or
- with both RAN eDRX cycle ($T_{eDRX-RAN}$) by serving gNB and $T_{eDRX-CN}$ by the core network (AMF) and $T_{eDRX-RAN}$ $\leq$10.24s.

$RSRP_1$ and $RSRP_2$ are considered valid provided that the conditions in table 5.2B.3-1 are met for FR1 when UE is configured with both $T_{eDRX-RAN}$ by serving gNB and CN eDRX cycle ($T_{eDRX-CN}$) by the core network (AMF) and $T_{eDRX-RAN}$ >10.24s.

Table 5.2B.3-1 Valid measurement for FR1 without eDRX cycle

Measurement	FR1
$RSRP_1$	(T1 – min(640 ms, M1*T_{DRX})) ≤ T1' ≤ (T1 + min(640 ms, M1*T_{DRX}))
$RSRP_2$	(T2 – min(640 ms, M1*T_{DRX})) ≤ T2' ≤ T2

Table 5.2B.3-2 Valid measurement for FR2

Measurement	FR2
$RSRP_1$	(T1 – max{480 ms, 8*SMTC periodicity}) ≤ T1' ≤ (T1 + max{480 ms, 8*SMTC periodicity})
$RSRP_2$	(T2 – max{480 ms, 8*SMTC periodicity}) ≤ T2' ≤ T2

Table 5.2B.3-3 Valid measurement for FR1 when RAN eDRX cycle is not configured or RAN eDRX cycle≤10.24s

Measurement	FR1
$RSRP_1$	(T1 – min(640 ms, M1* T)) ≤ T1' ≤ (T1 + min(640 ms, M1* T))
$RSRP_2$	(T2 – min(640 ms, M1* T)) ≤ T2' ≤ T2
NOTE 1: T is determined according to clause 7.1 in [1].	

If at least one of $RSRP_1$ and $RSRP_2$ is considered to be invalid based on the above conditions, then the UE shall not validate the CG-SDT using $RSRP_1$ and $RSRP_2$ and shall not transmit using CG-SDT. Additionally for the initial CG-SDT transmission, the UE shall not transmit in an CG-SDT occasion that occurs more than 640 ms after T2.

Where:

- T1 is the time when the latest $N_{TA}$was obtained by the UE via:
  - *RRCRelease* with CG-SDT configuration (TS 38.331 [2]) is received, or

- the latest TA is received if TA is received while in RRC_INACITVE state.
- T1' is the time when the UE has completed $RSRP_1$.
- T2 is the time when the UE performs TA validation as defined in clause 5.8.2.x in [7] for transmission using CG-SDT.
- T2' is the time when the UE has completed $RSRP_2$.
- T_{DRX} is the DRX cycle length in ms.
- M1 the scaling factor as defined in clause 4.2.2.2.

5.2B.3.1 Void

5.2B.3.2 Void

5.2B.4 Scheduling restriction

The requirements in clause 5.5.4 shall apply for RedCap UEs.

5.2B.5 Applicability conditions for CG-SDT for RedCap

The UE is not required to meet the following measurement requirements during subsequent SDT transmissions:

- Measurements of inter-frequency NR cells in clause 5.1B.2.4
- Measurements of inter-RAT E-UTRAN cells in clause 5.1B.2.5

5.3 Minimization of Drive Tests (MDT)

5.3.1 Introduction

UE supporting minimisation of drive tests in RRC_INACTIVE shall be capable of:

- logging measurements in RRC_INACTIVE, reporting the logged measurements and meeting requirements in clause 5.3.1;
- logging of RRC connection establishment failure, reporting the logged failure and meeting requirements in clause 5.3.1;
- logging of radio link failure and handover failure, reporting the logged failure and meeting requirements in clause 5.3.1.

The logged MDT requirements consist of measurement requirements as specified in clause 5.3.2 and relative time stamp accuracy requirements as specified in clause 5.3.3. Both sets of requirements are applicable for intra-frequency, inter-frequency and inter-RAT cases in RRC_INACTIVE state. The MDT procedures are described in TS 37.320 [31].

For RRC connection establishment failure logging and reporting, the MDT requirements consist of requirements for measurements performed and logged in RRC_INACTIVE state specified in clause 5.3.2 and relative time stamp accuracy requirement for RRC connection establishment failure log reporting as specified in clause 5.3.4.

5.3.2 Measurement Requirements

The measurements and measurement requirements applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3.2.

5.3.3 Requirements for Relative Time Stamp Accuracy

The requirements for relative time stamp accuracy applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3.3.

5.3.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

The requirements for relative time stamp accuracy for RRC connection establishment failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3.4.

5.3.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The requirements for relative time stamp accuracy for RRC link failure and handover failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3.5.

5.3.6 Requirements for Relative Time Stamp Accuracy for RRC Resume Failure Log Reporting

The requirements for relative time stamp accuracy for RRC resume failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3.4.

5.3C Minimization of Drive Tests (MDT) for Satellite Access

5.3C.1 Introduction

UE supporting minimisation of drive tests in RRC_INACTIVE shall be capable of:

- logging measurements in RRC_INACTIVE, reporting the logged measurements and meeting requirements in clause 5.3C;
- logging of RRC connection establishment failure, reporting the logged failure and meeting requirements in clause 5.3C;
- logging of radio link failure and handover failure, reporting the logged failure and meeting requirements in clause 5.3C.

The logged MDT requirements consist of measurement requirements as specified in clause 5.3C.2 and relative time stamp accuracy requirements as specified in clause 5.3C.3. Both sets of requirements are applicable for intra-frequency and inter-frequency cases in RRC_INACTIVE state. The MDT procedures are described in TS 37.320 [31].

For RRC connection establishment failure logging and reporting, the MDT requirements consist of requirements for measurements performed and logged in RRC_INACTIVE state specified in clause 5.3C.2 and relative time stamp accuracy requirement for RRC connection establishment failure log reporting as specified in clause 5.3C.4.

5.3C.2 Measurement Requirements

The measurements and measurement requirements applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3C.2.

5.3C.3 Requirements for Relative Time Stamp Accuracy

The requirements for relative time stamp accuracy applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3C.3.

5.3C.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

The requirements for relative time stamp accuracy for RRC connection establishment failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3C.4.

5.3C.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The requirements for relative time stamp accuracy for RRC link failure and handover failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3C.5.

5.3C.6 Requirements for Relative Time Stamp Accuracy for RRC Resume Failure Log Reporting

The requirements for relative time stamp accuracy for RRC resume failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3C.4.

5.3D Minimization of Drive Tests (MDT) for NR RedCap UE with Satellite Access

5.3D.1 Introduction

The requirements in clause 5.3D.1 shall apply except that:

- clause 5.3C is replaced with clause 5.3D, and
- clause 5.3C.2 is replaced with clause 5.3D.2, and
- clause 5.3C.3 is replaced with clause 5.3D.3, and
- clause 5.3C.4 is replaced with clause 5.3D.4.

5.3D.2 Measurement Requirements

The measurements and measurement requirements applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3D.2.

5.3D.3 Requirements for Relative Time Stamp Accuracy

The requirements for relative time stamp accuracy applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3D.3.

5.3D.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

The requirements for relative time stamp accuracy for RRC connection establishment failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3D.4.

5.3D.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The requirements for relative time stamp accuracy for RRC link failure and handover failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3D.5.

5.3D.6 Requirements for Relative Time Stamp Accuracy for RRC Resume Failure Log Reporting

The requirements for relative time stamp accuracy for RRC resume failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3D.4.

5.4 Inactive Mode CA/DC Measurements

5.4.1 Introduction

A UE supporting *idleInactiveNR-MeasReport-r16*, *idleInactiveEUTRA-MeasReport-r16* or *idleInactiveNR-MeasReport-r17* shall perform the inactive mode measurement on the inter-frequency CA and DC candidate frequencies/cells and E-UTRAN inter-RAT DC candidate frequencies/cells indicated by higher layers and meet the requirement specified in this clause. The UE shall perform inactive mode measurements provided that the serving cell support early measurement and is within the validity area. The inactive mode measurement requirements apply to a configured carrier frequency and the serving cell are among the supported band combination of the UE.

5.4.2 Measurement Requirements

The requirements in clause 4.4.2 shall apply.

5.4.2.1 Detected cell requirement during state transition and inactive mode

The requirements in clause 4.4.2.1 shall apply.

5.4.2.2 Measurements of inter-frequency CA/DC candidate cells

The requirements in clause 4.4.2.2 shall apply.

5.4.2.3 Measurements on serving cell

The requirements in clause 4.4.2.3 shall apply.

5.4.2.4 Measurements on E-UTRAN inter-RAT DC candidate cells

The requirements in clause 4.4.2.4 shall apply.

5.5 Configured Grant based Small Data Transmissions (CG-SDT)

5.5.1 Introduction

The requirements in this clause are applicable when the UE is configured with timing alignment (TA) validation using *cg-SDT-RSRP-ChangeThreshold* for transmitting in uplink using CG-SDT as specified in TS 38.331 [2].

5.5.2 Requirements on UE synchronization for small data transmissions

The requirements in this clause are applicable for the UE performing small data transmissions using configured resources as TS 38.331 [2].

The UE is allowed to transmit using the configured uplink resources provided that the UE is synchronized towards (i.e. using the timing derived using the latest available N_{TA} value as specified in subclause 7.1.2) the serving cell prior to transmission. If the UE is not able to obtain the synchronization towards the serving cell, then the UE shall drop the small data transmission. The UE determines the small data transmission occasion according to the received CG-SDT configuration [2].

5.5.3 TA validation requirements

When *cg-SDT-RSRP-ChangeThreshold* [2] is configured for TA validation based on the RSRP change criterion according to clause 5.8.2 in TS 38.331 [7], the UE is allowed to transmit using CG-SDT using the timing derived using the latest available N_{TA} value as specified in subclause 7.1 provided that

- the first RSRP ($RSRP_1$) measurement and the second RSRP ($RSRP_2$) measurements used in the TA validation are valid measurements and,
- timing alignment validation for transmission using CG-SDT is valid according to the validation criteria in clause 5.8.2 in TS 38.321 [7].

$RSRP_1$ and $RSRP_2$ are considered valid provided that the conditions in table 5.5.3-1 are met for FR1 when UE is not configured with any eDRX cycle by serving gNB or core network.

$RSRP_1$ and $RSRP_2$ are considered valid provided that the conditions in table 5.5.3-2 are met for FR2-1 regardless of whether the UE is configured with eDRX cycle by serving gNB or core network (AMF).

$RSRP_1$ and $RSRP_2$ are considered valid provided that the conditions in table 5.5.3-3 are met for FR1 when UE is configured:

- only with CN eDRX cycle ($T_{eDRX-CN}$) by the core network (AMF), or
- with both RAN eDRX cycle ($T_{eDRX-RAN}$) by serving gNB and CN eDRX cycle ($T_{eDRX-CN}$) by the core network (AMF) and $T_{eDRX-RAN} \leq 10.24$s.

$RSRP_1$ and $RSRP_2$ are considered valid provided that the conditions in table 5.5.3-1 are met for FR1 when UE is configured with both RAN eDRX cycle ($T_{eDRX-RAN}$) by serving gNB and CN eDRX cycle ($T_{eDRX-CN}$) by the core network (AMF) and $T_{eDRX-RAN} > 10.24$s.

Table 5.5.3-1 Valid measurement for FR1 for UE not configured with eDRX cycle

Measurement	FR1
$RSRP_1$	$(T1 - \min(640\text{ ms}, M1*T_{DRX})) \leq T1' \leq (T1 + \min(640\text{ ms}, M1*T_{DRX}))$
$RSRP_2$	$(T2 - \min(640\text{ ms}, M1*T_{DRX})) \leq T2' \leq T2$

Table 5.5.3-2 Valid measurement for FR2-1

Measurement	FR2-1
$RSRP_1$	$(T1 - \max(480\text{ ms}, 8*\text{SMTC periodicity})) \leq T1' \leq (T1 + \max(480\text{ ms}, 8*\text{SMTC periodicity}))$
$RSRP_2$	$(T2 - \max(480\text{ ms}, 8*\text{SMTC periodicity})) \leq T2' \leq T2$

Table 5.5.3-3 Valid measurement for FR1 for UE configured when RAN eDRX_cycle is not configured or RAN eDRX cycle ≤ 10.24s

Measurement	FR1
$RSRP_1$	$(T1 - \min(640\text{ ms}, M1*T)) \leq T1' \leq (T1 + \min(640\text{ ms}, M1*T))$
$RSRP_2$	$(T2 - \min(640\text{ ms}, M1*T)) \leq T2' \leq T2$
NOTE 1: T is determined according to clause 7.1 in [1].	

If at least one of $RSRP_1$ and $RSRP_2$ is considered to be invalid based on the above conditions, then the UE shall not validate the CG-SDT using $RSRP_1$ and $RSRP_2$ and shall not transmit using CG-SDT. Additionally, for the initial CG-SDT transmission, the UE shall not transmit in an CG-SDT occasion that occurs more than 640 ms after T2.

Where:

- T1 is the time when
  - *RRCRelease* with CG-SDT configuration (TS 38.331 [2]) is received, or
  - the latest TA is received if TA is received while in RRC_INACITVE state.

- T1' is the time when the UE has completed $RSRP_1$.
- T2 is the time when the UE performs TA validation as defined in clause 5.27.2 in (TS 38.321 [7]) for transmission using CG-SDT.
- T2' is the time when the UE has completed $RSRP_2$.
- T_{DRX} is the DRX cycle length in ms.
- M1 the scaling factor as defined in clause 4.2.2.2.

5.5.4 Scheduling restriction

5.5.4.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRP measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

5.5.4.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ measurement

- If *deriveSSB_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.
- If *deriveSSB_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH on all symbols within SMTC window duration.

For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to measurement of serving cell.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/ on SSB symbols of the serving cell.

5.5.4.3 Scheduling availability of UE performing measurements on FR2

The following scheduling restriction applies due to SS-RSRP measurement on an FR2 intra-frequency cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration (The signalling *deriveSSB_IndexFromCell* is always enabled for FR2).

The following scheduling restriction applies to SS-RSRQ measurement on an FR2 intra-frequency cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/ on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI

symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration (The signalling *deriveSSB_IndexFromCellc* is always enabled for FR2).

The following scheduling restriction applies to measurement on an FR2 serving cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/ on SSB symbols of the serving cell.

5.5.5 Applicability conditions for SDT

The UE is not required to meet the following measurement requirements during subsequent SDT transmissions:

- Measurements of inter-frequency NR cells in clause 5.1.2.4
- Measurements of inter-RAT E-UTRAN cells in clause 5.1.2.5
- Inactive Mode CA/DC Measurements in clause 5.4

The UE is allowed to delay the reception of PRS resources on the positioning frequency layer until the SDT session is completed if the measurement using PRS resource overlaps with the SDT resources.

5.5D Configured Grant based Small Data Transmissions (CG-SDT) for ATG

The requirements in clause 5.5 shall apply only for FR1.

5.5E Configured Grant based Small Data Transmissions (CG-SDT) for RedCap UEs with NTN

5.5E.1 Introduction

The requirements in this clause are applicable for 1 Rx (e)RedCap and 2 Rx (e)RedCap UEs with FR1-NTN when the UE is configured with timing alignment (TA) validation for transmitting in uplink using CG-SDT as specified in TS 38.331 [2].

The 1 Rx (e)RedCap UE for determining whether to perform SDT procedure defined in clause 5.27 [7] applies:

- *sdt-RSRP-Threshold-r17* as the signaled value of *sdt-RSRP-Threshold-r17* [2] + 1 dB.

5.5E.2 Requirements on UE synchronization for small data transmissions

The requirements in this clause are applicable for the UE performing small data transmissions using configured resources as TS 38.331 [2].

The UE is allowed to transmit using the configured uplink resources provided that the UE is synchronized towards (i.e. using the timing derived using the latest available N_{TA}, $N_{\mathrm{TA,adj}}^{\mathrm{common}}$, and $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$ values as specified in subclause 7.1E.2) the serving cell prior to transmission. If the UE is not able to obtain the synchronization towards the serving cell, then the UE shall drop the small data transmission. The UE determines the small data transmission occasion according to the received CG-SDT configuration [2].

5.5E.3 TA validation requirements

The UE is allowed to transmit using CG-SDT using the timing derived using the latest available N_{TA}, $N_{TA,adj}^{common}$, and $N_{TA,adj}^{UE}$ values as specified in subclause 7.1C before CG-SDT transmission provided that

- timing alignment validation for transmission using CG-SDT is valid according to the validation criteria in clause 5.8.2 in TS 38.321 [7], and
- either *cg-SDT-TimeAlignmentTimer* is not configured or *cg-SDT-TimeAlignmentTimer* is running as confirmed by lower layers, as defined in clause 5.27.2 in TS 38.321 [7] with UE expected to not perform any threshold comparison against *cg-SDT-RSRP-ChangeThreshold*.

Additionally, for the initial CG-SDT transmission, the UE shall not transmit in an CG-SDT occasion that occurs more than 640ms after T2, where T2 is the time when the UE performs TA validation as defined in clause 5.27.2 in (TS 38.321 [7]) for transmission using CG-SDT.

5.5E.4 Scheduling restriction

The requirements in clause 5.5.4 shall apply for (e)RedCap UEs with FR1-NTN.

5.5E.5 Applicability conditions for SDT

The UE is not required to meet the following measurement requirements during subsequent SDT transmissions:

- Measurements of inter-frequency NR cells in clause 5.1E.2.4
- Measurements of inter-frequency NR cells in clause 5.1E.2.9

5.6 NR measurements for positioning

5.6.1 Introduction

This clause contains requirements for UE capable of performing NR positioning measurements defined in TS 38.215 [4], including RSTD, PRS-RSRP, UE Rx-Tx time difference, PRS-RSRPP, RSCPD and RSCP in RRC_INACTIVE state. For RSTD and UE Rx-Tx time difference, measurement requirements are specified both with and without aggregation of PRS resources from multiple PFLs. Requirements for RSCPD are specified only for measurements reported together with RSTD. Requirements for RSCP are specified only for measurements reported together with UE Rx-Tx time difference measurement.

The requirements in clauses 5.6.2, 5.6.3, 5.6.4, 5.6.5, 5.6.7, and 5.6.8 are applicable to PRS resources that do not collide with other DL signals/channels which include SSB, SIB1, CORESET0, MSG2/MSGB, paging and DL SDT. In addition, a UE is not expected to receive PRS resources that collide with a time interval starting at symbol *m* and ending at symbol $m + N_2$, where symbol *m* is the last symbol in which the UE is configured to receive PDCCH and N_2 is defined in clause 6.4 of TS 38.214 [26] for the subcarrier spacing μ of the DL PRS.

If a PRS resource is outside or partially overlapped with the initial DL BWP, a PRS resource instance collides with another DL signal/channel if any portion of the other DL signal/channel overlaps with the time interval starting X symbols before the PRS instance and ending X symbols after the PRS instance, taking into account *nr-DL- PRS-ExpectedRSTD-Uncertainty* and *nr-DL-PRS-ExpectedRSTD,* where X is defined in table 5.6.1-1.

Table 5.6.1-1: Value of X number of symbols

FR	μ	NR Slot length (ms)	X symbols
FR1	0	1	7
	1	0.5	14
	2	0.25	28
FR2	2	0.25	14
	3	0.125	28

NOTE 1: The FR1 value applies if one or both of the serving cell and the positioning frequency layer are in FR1. FR2 value applies if both of the serving cell and the positioning frequency layer are in FR2.

Measurement requirements specified in clauses 5.6.2, 5.6.3, 5.6.4, 5.6.5, 5.6.7, and 5.6.8 shall apply for any DRX and eDRX configuration specified in TS 38.331 [2].

The requirements in clauses 5.6.2, 5.6.3, 5.6.4, 5.6.5, 5.6.7, and 5.6.8 are applicable provided that the cell selection procedure for the selected PLMN defined in TS 38.304 [1] is not triggered during PRS measurement period.

The requirements in clauses 5.6.2, 5.6.3, 5.6.4, 5.6.5, 5.6.7, and 5.6.8 apply provided that:

- all PRS resources within a PFL are within up to 2 separate windows within $T_{PRS,i}$ for each positioning frequency layer *i* as defined in clauses 5.6.2, 5.6.3, 5.6.4 and 5.6.5, where each window is up to 10 ms.

The UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

When the UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

5.6.1A Cell re-selection for positioning

The requirements in this clause apply when UE is configured to perform SRS transmission for positioning.

The requirements in clause 5.1.2 shall apply in the following conditions.

- UE is not configured with eDRX_IDLE, or
- UE is configured with eDRX_IDLE but without eDRX_INACTIVE, or
- UE is configured with both eDRX_IDLE and eDRX_INACTIVE, and eDRX_INACTIVE cycle is smaller or equal to T_{POS},

where T_{POS} is

- SRS transmission periodicity, if UE is configured to only perform SRS transmission for positioning, or if UE is configured to both perform PRS measurements without periodic reporting and to perform SRS transmission for positioning,
- the minimum of PRS measurement reporting periodicity and SRS transmission periodicity, if UE is configured to both perform PRS measurements with periodic reporting and to perform SRS transmission for positioning.

NOTE: PRS measurement reporting periodicity is the configured *reportingInterval* in *RequestLocationInformation as defined in [34]*.

When UE is configured with both eDRX_IDLE and eDRX_INACTIVE, and eDRX_INACTIVE cycle is larger than T_{POS}, the requirements in clause 5.1.2 except clauses 5.1.2.2 and 5.1.2.3 shall apply, and the requirements in clause 5.6.1A.1 apply for measurement and evaluation of serving cell, and the requirements in clause 5.6.1A.2 apply for measurements of intra-frequency NR cells.

5.6.1A.1 Measurement and evaluation of serving cell

When UE is configured with both eDRX_IDLE and eDRX_INACTIVE, and eDRX_INACTIVE cycle is larger than T_{POS}, the UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every $M1*T_{serv}$ for FR1 and $N1* T_{serv}$ for FR2; where:

- T_{serv} is defined as $\max(T_{DRX}, T_{POS})$, where
  - T_{DRX} is defined as T in clause 7.1 TS 38.304 [1] when RAN eDRX <= 10.24s and CN eDRX <= 10.24s

- T_{DRX} is the maximum of the T inside and outside of the CN PTW, where T inside and outside of the CN PTW are defined in clause 7.1 TS 38.304 [1], when RAN eDRX <= 10.24s and CN eDRX > 10.24s

- T_{DRX} is the maximum of the DRX cycles within the CN PTW and the RAN PTW when RAN eDRX > 10.24 s

- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and $T_{serv} \leq 0.64$ second, otherwise M1=1.

- The serving cell measurement is not limited to PTW.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least $T_{serv}/2$.

If the UE has evaluated according to table 5.6.1A.1-1 or table 5.6.1A.1-2 in N_{serv} consecutive T_{serv} that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

Table 5.6.1A.1-1: N_{serv} for UE configured with eDRX INACTIVE cycle ≥ T_{POS} (FR1)

eDRX_IDLE cycle length [s]	eDRX INACTIVE cycle length[s]	T_{serv} [s]	N_{serv} [number of T_{serv}]
2.56 ≤eDRX_IDLE cycle length ≤10485.76	eDRX INACTIVE cycle length ≥ T_{POS}	0.32 ≤ T_{serv} < 1.28	4*M1
		1.28 ≤ T_{serv}	2

Table 5.6.1A.1-2: N_{serv} for UE configured with eDRX INACTIVE cycle ≥ T_{POS} (FR2-1)

eDRX_IDLE cycle length [s]	eDRX INACTIVE cycle length[s]	T_{serv} [s]	Scaling Factor (N1)	N_{serv} [number of T_{serv}]
2.56 ≤eDRX_IDLE cycle length ≤10485.76	eDRX INACTIVE cycle length ≥ T_{POS}	0.32 ≤ T_{serv} < 0.64	8	4*M1*N1
		0.64 ≤ T_{serv} < 1.28	5	4*M1*N1
		1.28 ≤ T_{serv} < 2.56	4	2*N1
		2.56 ≤ T_{serv}	3	2*N1

If the UE in RRC_INACTIVE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information during the time T', the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1], where

- T' = MAX (10 s, one eDRX_INACTIVE cycle) for FR1, or

- T'= MAX (10 s, N1* eDRX_INACTIVE cycle) for FR2.

5.6.1A.2 Measurements of intra-frequency NR cells

When UE is configured with both eDRX_IDLE and eDRX_INACTIVE, and eDRX_INACTIVE cycle is larger than T_{POS}, the requirements defined in section 5.1.2.3 shall apply with T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ defined in table 5.6.1A.2-1 and table 5.6.1A.2-2, where

- T_{serv} is defined as max(T_{DRX}, T_{POS}), where

  - T_{DRX} is defined as T in clause 7.1 TS 38.304 [1] when RAN eDRX <= 10.24s and CN eDRX <= 10.24s

  - T_{DRX} is the maximum of the T inside and outside of the CN PTW, where T inside and outside of the CN PTW are defined in clause 7.1 TS 38.304 [1], when RAN eDRX <= 10.24s and CN eDRX > 10.24s

  - T_{DRX} is the maximum of the DRX cycles within the CN PTW and the RAN PTW when RAN eDRX > 10.24 s

- M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.

- The detection, measurement and evaluation of intra-frequency neighbour cells are not limited to PTW.

Table 5.6.1A.2-1: T_{detect}, $T_{measure}$ and $T_{evaluate}$ for UE configured with eDRX INACTIVE cycle > T_{POS} (FR1)

eDRX_IDLE cycle length [s]	T_{serv} [s]	T_{detect,NR_Intra} (number of T_{serv})	$T_{measure,NR_Intra}$ (number of T_{serv})	$T_{evaluate,NR_Intra}$ (number of T_{serv})
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	$0.32 \leq T_{serv} < 0.64$	36 x M2	4 x M2	16 x M2
	$0.64 \leq T_{serv} < 1.28$	28	2	8
	$1.28 \leq T_{serv} < 2.56$	25	1	5
	$2.56 \leq T_{serv}$	23	1	3
NOTE 1: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ in seconds depend on the number *N* of T_{serv} and are calculated as N * T_{serv}.				

Table 5.6.1A.2-2: T_{detect}, $T_{measure}$ and $T_{evaluate}$ for UE configured with eDRX INACTIVE cycle > T_{POS} (FR2-1)

eDRX_IDLE cycle length [s]	T_{serv} [s]	Scaling Factor (N1)	T_{detect,NR_Intra} (number of T_{serv})	$T_{measure,NR_Intra}$ (number of T_{serv})	$T_{evaluate,NR_Intra}$ (number of T_{serv})
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	$0.32 \leq T_{serv} < 0.64$	8	36 x N1 x M2	4 x N1 x M2	16 x N1 x M2
	$0.64 \leq T_{serv} < 1.28$	5	28 x N1	2 x N1	8 x N1
	$1.28 \leq T_{serv} < 2.56$	4	25 x N1	1 x N1	5 x N1
	$2.56 \leq T_{serv}$	3	23 x N1	1 x N1	3 x N1
NOTE 1: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ in seconds depend on the number *N* of T_{serv} and are calculated as N * T_{serv}.					

5.6.2 RSTD measurements

5.6.2.1 Introduction

The requirements in clause 5.6.2 shall apply provided the UE has received *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34] requesting the UE to measure and report DL RSTD measurements defined in TS 38.215 [4].

5.6.2.2 Requirements Applicability

The requirements in clause 5.6.2 apply for periodic and triggered RSTD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23.2 for FR1 and FR2 are fulfilled, for a corresponding Band.

5.6.2.3 Measurement Capability

The UE PRS RSTD measurement capability in RRC_INACTIVE state is as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355 [34].

5.6.2.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. If the UE supports reporting of NR positioning measurements via SDT, the UE may be able to report the measurements while it remains in RRC_INACTIVE state; otherwise, the UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For RSTD measurements performed by the UE in RRC_INACTIVE state, the measurement reporting delay excludes all of the following:

- additional delay caused by other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH, equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,

- any delay caused by unavailability of UL resources to transmit the measurement report,
- any transmission delay needed by SDT,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.23.3.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2, for each measured DL PRS resource.

5.6.2.5 Measurements Period Requirements

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined as:

$$T_{RSTD,Total} = \sum_{i=1}^{L} T_{RSTD,i} + (L-1) * \max(T_{effect,i})$$

Where:

- i is the index of positioning frequency layer,
- L is total number of positioning frequency layers, and
- $T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i

$T_{RSTD,i}$ is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

$$T_{RSTD,i} = \left(K_{carrier_PRS} * N_{Rx,TEG,i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil * \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last,i} ,$$

Where:

- $N_{RxBeam,i}$ is the UE Rx beam sweeping factor:
  - $N_{RxBeam,i}$ = 1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2
    - $N_{RxBeam,i}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation* .
  - $N_{RxBeam,i}$ equals to 8, otherwise.
- $K_{carrier_PRS}$ is a scaling factor for PRS-based NR positioning measurements in RRC_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier_PRS}$ = 1; otherwise,
- If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, $K_{carrier_PRS} = K_{carrier} + 1$, where $K_{carrier}$ is defined in clause 4.2.2.4
- If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier_PRS} = N_{layers} + 1$, where N_{layers} is defined in clause 4.2.2.7.
- $N_{Rx,TEG,i}$ is the Rx TEG specific scaling factor:
  - $N_{Rx,TEG,i}$ =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].
  - $N_{Rx,TEG,i}$ is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:

- $N_{Rx,TEG,i} = P$, if the UE is not capable of measuring same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case 'n0' is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- $N_{Rx,TEG,i} = \left\lceil \frac{P}{Q} \right\rceil$, if the UE is capable of measuring the same DL PRS resource simultaneously from multiple Rx TEGs, where Q is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].

- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

- $L_{available_PRS,\mathrm{i}}$ is the time duration of available PRS in positioning frequency layer *i* to be measured within $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,\mathrm{i}}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- N_{sample} is the number of PRS RSTD samples, where

  - N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

    - PRS bandwidth is within the initial BWP and

    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

  - N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

    - PRS bandwidth is within the initial BWP and

    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

  - N_{sample} = 4 otherwise.

- $T_{last,i}$ is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time, $T_{\mathrm{last,i}} = T_{\mathrm{i}} + T_{available_PRS,\mathrm{i}}$,

- $T_{\mathrm{effect},i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

$$T_{\mathrm{effect,i}} = \left\lceil \frac{T_{\mathrm{i}}}{T_{available_PRS,\mathrm{i}}} \right\rceil * T_{available_PRS,\mathrm{i}}$$

Where:

- T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- $T_{available_PRS,\mathrm{i}} = LCM\left(T_{PRS,\mathrm{i}}, T_{DRX}\right)$, the least common multiple between $T_{PRS,\mathrm{i}}$ and T_{DRX}

- T_{DRX} is defined as following:

  - T_{DRX} is DRX cycle length, defined in clause 7.1 TS 38.304, when no extended DRX (eDRX) cycle is configured

  - T_{DRX} is defined as T in clause 7.1 TS 38.304 when RAN eDRX <= 10.24 s and CN eDRX <= 10.24 s

  - T_{DRX} is the maximum of the T inside and outside of the CN PTW, where T inside and outside of the CN PTW are defined in clause 7.1 TS 38.304, when RAN eDRX <= 10.24 s and CN eDRX > 10.24 s

- T_{DRX} is the maximum of the DRX cycles within the CN PTW and the RAN PTW when RAN eDRX > 10.24 s
- $T_{PRS,\mathrm{i}}$ is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the positioning frequency layer is used to derive $T_{PRS,\mathrm{i}}$, where,

- $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource,
- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.
- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where
- T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.
- $\{N, T\}$ is the UE capability combination per band for RRC_INACTIVE state where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34], T (ms) corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34], for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],
- N' is UE capability for number of DL PRS resources that it can process in a slot in RRC_INACTIVE state as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* specified in TS 37.355 [34].

If the following conditions are met, the time $\mathrm{T_{RSTD,Total}}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with RAN eDRX > 10.24 s, and
- periodic PRS measurement reporting is configured, and
- RAN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and
- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE 1: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 5.6.1.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If $K_{\mathrm{carrier_PRS}}$ changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,\mathrm{i}}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 5.6.2 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC_INACTIVE to RRC_CONNECTED state during the RSTD measurement period then the UE shall continue the RSTD measurement in the RRC_CONNECTED state. The RSTD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2

5.6.2.6 Measurements Period Requirements with Bandwidth Aggregation

The requirements in this clause apply provided that UE receives requests from LMF to perform PRS measurement on aggregated positioning frequency layers (PFLs) via *nr-DL-PRS-JointMeasurementRequestedPFL-List [34]*.

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined as:

$$\mathrm{T_{RSTD,total}} = \mathrm{T_{RSTD,aggr}} + \mathrm{T_{RSTD,non-aggr}} + \mathrm{T_{margin}}$$

Where:

- $\mathrm{T_{RSTD,aggr}}$ is the total measurement period for aggregated measurements as defined in this clause, and
- $\mathrm{T_{RSTD,non-aggr}}$ is the total measurement period for non-aggregated measurements as defined in this clause, and
- When both $\mathrm{T_{RSTD,aggr}}$ and $\mathrm{T_{RSTD,non-aggr}}$ are non-zero, then $\mathrm{T_{margin}} = \mathrm{T'_{margin}}$; otherwise $\mathrm{T_{margin}} = 0$, where $\mathrm{T'_{margin}} = \max\left(\mathrm{T_{effect,j}}\right)$, andthe maximum $\mathrm{T_{effect,j}}$ is across all the PFL combination(s) and non-aggregated PFL(s) configured for positioning measurements.

$\mathrm{T_{RSTD,non-aggr}}$ is zero if every resource set on every PFL is linked for aggregation to at least one other resource set on another PFL. Otherwise, $\mathrm{T_{RSTD,non-aggr}}$ is as defined in clause 5.6.2.5 with the following exceptions,

- only PFLs containing resource set(s) not linked to any other resource set(s) are considered in L,
- on each PFL i, only resource set(s) not linked to any other resource set(s) are considered in $T_{available_PRS,\mathrm{i}}$, $N_{PRS,\mathrm{i}}^{slot}$ and $L_{available_PRS,\mathrm{i}}$,
- $N_{sample} = 2$ if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-Inactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,
- $(\mathrm{L}-1) * \max\left(\mathrm{T_{effect,i}}\right)$ is replace by $(\mathrm{L}-1) * \mathrm{T'_{margin}}$.

$\mathrm{T_{RSTD,aggr}}$ is zero if no resource sets on any PFL are linked for aggregation with other resource sets on other PFLs. Otherwise, $\mathrm{T_{RSTD,aggr}}$ is defined as

$$\mathrm{T_{RSTD,aggr}} = \sum_{m=1}^{M} \mathrm{T_{RSTD,aggr,m}} + (\mathrm{M}-1) * \mathrm{T'_{margin}} \quad ,$$

where:

- m is the index of PFL combination,

- M is total number of PFL combinations,
- $T_{effect,aggr,m}$ is the periodicity of the PRS measurement in PFL combination m as defined in this clause,
- $T_{RSTD,aggr,m}$ is the measurement period for PRS RSTD measurement in PFL combination m as specified below.

$$T_{RSTD,aggr,m} = \left(K_{carrier,aggr} * N_{Rx,TEG,aggr,m} * N_{RxBeam,aggr,m} * \left\lceil \frac{N^{slot}_{PRS,aggr,m}}{N'_{aggr,m}} \right\rceil * \left\lceil \frac{L_{available_{PRS},aggr,m}}{N_{aggr,m}} \right\rceil * N_{sample} - 1\right) * T_{effect,aggr,m} + T_{last,aggr,m},$$

where:

- $K_{carrier,aggr}$ is a scaling factor for PRS measurements in RRC_INACTIVE,
  - $K_{carrier,aggr} = 1$ if the UE supports *parallelPRS-MeasRRC-Inactive-r17*,
  - Otherwise,
    - If Srxlev $\leq S_{nonIntraSearchP}$ or Squal $\leq S_{nonIntraSearchQ}$, $K_{carrier,aggr} = K_{carrier} + 1$, where $K_{carrier}$ is defined in clause 4.2.2.4
    - If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier,aggr} = N_{layers} + 1$, where N_{layers} is defined in clause 4.2.2.7.
  - $N_{Rx,TEG,aggr,m}$ is a scaling factor for PRS measurements with multiple Rx TEGs
    - $N_{Rx,TEG,aggr,m}$ =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].
    - $N_{Rx,TEG,aggr,m}$ is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:
      - $N_{Rx,TEG,i} = P$, if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case 'n0' is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.
      - $N_{Rx,TEG,i} = \left\lceil \frac{P}{Q} \right\rceil$, if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where Q is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].
  - $N_{RxBeam,aggr,m}$ is a scaling factor for PRS measurements with multiple Rx beams, and is defined as
    - $N_{RxBeam,aggr,m}$ = 1 if PFL combination m is in FR1,
    - $N_{RxBeam,aggr,m}$ is defined as follows if PFL combination m is in FR2
      - $N_{RxBeam,aggr,m}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing PFL combination m, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*,
      - $N_{RxBeam,aggr,m}$ equals to 8 otherwise
  - $N^{slot}_{PRS,aggr,m}$ is the maximum number of DL PRS resources in PFL combination m configured in a slot, and only the PRS resources in resource set(s) linked to other resource set in PFL combination m are counted
  - $N'_{aggr,m}$ is the UE capability on maximum number of DL PRS resources that can be processed in a slot for PFL combination m as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18* for FR1 and *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18* for FR2 specified in TS 37.355 [34].

- $L_{available_{PRS},aggr,m}$ is the time duration of available PRS resources in PFL combination *m* to be measured during $T_{PRS,aggr,m}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_{PRS},aggr,m}$, only unmuted PRS resources in resource set(s) linked to other resource set in PFL combination *m* and that are not fully overlapped with other higher-priority DL signals/channels are considered.

- $N_{aggr,m}$ is the UE capability on duration of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r18* specified in TS 37.355 [34].

- N_{sample} is number of PRS measurement samples,

  - N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,

  - N_{sample} = 4 otherwise.

- $T_{effect,aggr,m}$ is the periodicity of the PRS measurement in PFL combination m,

$$T_{effect,aggr,m} = \left\lceil \frac{T_{aggr,m}}{T_{available,PRS,aggr,m}} \right\rceil * T_{available,PRS,aggr,m}$$

  - $T_{aggr,m}$ is the UE capability on time for processing of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* specified in TS 37.355 [34].

  - $T_{available,PRS,aggr,m} = LCM(T_{PRS,aggr,m}, T_{DRX})$, the least common multiple between $T_{PRS,aggr,m}$ and the DRX cycle length T_{DRX}, where $T_{PRS,aggr,m}$ is the periodicity of DL PRS resource with muting on PFL combination m.

    - If more than one PRS periodicities are configured in PFL combination m, the least common multiple of PRS periodicities $T_{per}^{\text{PRS with muting}}$ among all DL PRS resource sets that are linked to other resource set in PFL combination m, is used to derive $T_{PRS,aggr,m}$, and for each applicable PRS resource set,

      - $T_{per}^{\text{PRS with muting}} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource, and

      - T_{per}^{PRS} is the periodicity of PRS resource set given by the higher-layer parameter *DL-PRS-Periodicity*, and

      - N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

- $T_{last,aggr,m}$ is the measurement duration for the last PRS sample in PFL combination m, including the sampling time and processing time, $T_{last,aggr,m} = T_{aggr,m} + T_{available,PRS,aggr,m}$.

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements are transmitted by the TRP using single Tx chain as defined in clause 5.1.6.5.3 in TS 38.214 [26].

If PRS resources in one or more of the aggregated PFLs in PFL combination m are dropped because of collision with other signals, $T_{RSTD,aggr,m}$ can be longer than specified above.

The time $T_{RSTD,Total}$ starts from the first DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE: No separate requirement on non-aggregated measurement based on $T_{RSTD,non-aggr}$ or on aggregated measurement based on $T_{RSTD,aggr}$ is applied when both $T_{RSTD,aggr}$ and $T_{RSTD,non-aggr}$ are non-zero.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period. When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 5.6.1.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If $K_{\text{carrier_PRS}}$ changes for any PFL or any PFL combination during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 5.6.2 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC_INACTIVE to RRC_CONNECTED state during the RSTD measurement period, then the UE shall continue the RSTD measurement in the RRC_CONNECTED state. The RSTD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23A.2.

5.6.3 PRS-RSRP measurements

5.6.3.1 Introduction

The requirements in clause 5.6.3 shall apply provided the UE has received a message from LMF via LPP [34] requesting the UE to measure and report PRS-RSRP measurements defined in TS 38.215 [4] and the UE is capable of supporting the PRS-RSRP measurement in RRC INACTIVE state.

5.6.3.2 Requirements applicability

The requirements in clause 5.6.3 apply for periodic and triggered PRS-RSRP measurements, provided:

- PRS-RSRP related side conditions given in clause 10.1.24.2 are met for a corresponding Band.

5.6.3.3 Measurement Capability

UE PRS-RSRP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

5.6.3.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. If the UE supports reporting of NR positioning measurements via SDT, the UE may be able to report the measurements while it remains in RRC_INACTIVE state; otherwise, the UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For PRS-RSRP measurements performed by the UE in RRC_INACTIVE state, the measurement reporting delay excludes all of the following:

- any delay caused by other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH which is equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by no UL resources for UE to send the measurement report,
- any transmission delay needed by SDT,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported PRS-RSRP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.24.3.

The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1.24.2.

5.6.3.5 Measurement Period Requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within $T_{PRS-RSRP,total}$ ms.

$$T_{PRS-RSRP,\,total} = \sum_{i=1}^{L} T_{PRS-RSRP,i} + (L-1) \times \max\left(T_{effect,i}\right)$$

Where:

- i is the index of positioning frequency layer,
- L is total number of positioning frequency layers,
- $T_{effect,i}$ is the periodicity of the PRS-RSRP measurement in positioning frequency layer i.

$$T_{PRS-RSRP,i} = \left(K_{carrier_PRS_i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last}$$

Where:

- $K_{carrier_PRS}$ is a scaling factor for PRS-based NR positioning measurements in RRC_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier_PRS} = 1$. Otherwise,
- If $Srxlev \leq S_{nonIntraSearchP}$ or $Squal \leq S_{nonIntraSearchQ}$, $K_{carrier_PRS}$ equals to the sum of $K_{carrier}$ in clause 4.2.2.4 and one positioning layer.
- If $Srxlev > S_{nonIntraSearchP}$ and $Squal > S_{nonIntraSearchQ}$, $K_{carrier_PRS}$ equals to the sum of N_{layer} in clause 4.2.2.7 and one positioning layer.
- $N_{RxBeam,i}$ is the scaling factor for Rx beam sweeping:
  - $N_{RxBeam,i}$=1 if positioning frequency layer i is in FR1, and if positioning frequency layer i is in FR2
    - $N_{RxBeam,i}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-AoD-RequestLocationInformation*.
    - $N_{RxBeam,i}$ equals to 8, otherwise.

- $L_{available_PRS,i}$ is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

- {N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17*in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- N′ is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* in clause 6.4.3 of TS 37.355 [34],

- N_{sample} is the number of PRS-RSRP measurement samples and

  - N_{sample} = 1, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are met:

    - PRS bandwidth is within the initial BWP and

    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

  - N_{sample} = 2, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are not met:

    - PRS bandwidth is within the initial BWP and

    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

  - N_{sample} = 4 otherwise

  $T_{last,i} = T_i + T_{available_PRS,i}$ is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time,

  - $T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$ is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,

  - T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

  - $T_{available_PRS,i} = LCM(T_{PRS,i}, T_{DRX})$ is the least common multiple between $T_{PRS,i}$ and T_{DRX},

  - $T_{PRS,i}$ is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,

  - T_{DRX} is defined as following:

    - T_{DRX} is DRX cycle length when no extended DRX (eDRX) cycle is configured

    - T_{DRX} is defined as T in clause 7.1 TS 38.304 [1] when RAN eDRX <= 10.24 s and CN eDRX <= 10.24 s

    - T_{DRX} is the maximum of the T inside and outside of the CN PTW, where T inside and outside of the CN PTW are defined in clause 7.1 TS 38.304 [1], when RAN eDRX <= 10.24 s and CN eDRX > 10.24 s

    - T_{DRX} is the maximum of the DRX cycles within the CN PTW and the RAN PTW when RAN eDRX > 10.24 s

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among the DL PRS resource sets is used to derive $T_{PRS,i}$, where:

- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.
- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

If the following conditions are met, the time $T_{PRS-RSRP,Total}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with RAN eDRX > 10.24 s, and
- periodic PRS measurement reporting is configured, and
- RAN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and
- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{PRS-RSRP,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE 1: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 5.6.2.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement then the PRS-RSRP measurement shall meet the UE Rx-Tx time difference measurement requirements defined in clause 5.6.4.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or
- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

Longer PRS-RSRP measurement period is expected when there is collision/overlap between other DL signals/channels and PRS resources in RRC_INACTIVE state.

The requirements in clause 5.6.3 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If the DRX cycle is reconfigured during the PRS-RSRP measurement period then the PRS-RSRP measurement period can be longer.

If cell reselection occurs while PRS-RSRP measurement is being performed, then the UE shall continue and complete the on-going PRS-RSRP measurement after the cell selection is completed. The PRS-RSRP measurement period can be longer.

If the UE's RRC state changes from the RRC_INACTIVE to RRC_CONNECTED during the PRS-RSRP measurement period, then the UE shall continue the PRS-RSRP measurement in the RRC_CONNECTED state. The PRS-RSRP measurement period can be longer.

5.6.4 UE Rx-Tx time difference measurements

5.6.4.1 Introduction

The requirements in this clause shall apply, provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4].

5.6.4.2 Requirements Applicability

The requirements in clause 5.6.4 apply for periodic and triggered UE Rx-Tx time difference measurements, provided:

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25.2 are met for a corresponding band.
- SRS is configured on the PCell.
- UE has valid SRS configuration in the current camping cell.

5.6.4.3 Measurement Capability

UE Rx-Tx time difference measurement capability is as indicated by the UE in *NR-Multi-RTT-ProvideCapabilities*, according to TS 37.355 [34].

5.6.4.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

This measurement reporting delay excludes the delay caused by any of the following:

- delay caused by other LPP signalling on the DCCH.
- delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.
- delay caused due to lack of UL resources for UE to send the measurement report.
- delay required by SDT for reporting the measurement using SDT resources.
- delay required for transition to RRC_CONNECTED state for report the measurement in RRC_CONNECTED.

The UE Rx-Tx time difference measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.25.3.

The UE Rx-Tx time difference measurement accuracy for all measured DL PRS resources shall be fulfilled according to the accuracy requirements specified in clause 10.1.25.2.

5.6.4.5 Measurement Period Requirements

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34], UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.4.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] in configured positioning frequency layers within the measurement period $T_{UERxTx,Total}$ ms.

$$T_{UERxTx,\ Total} = \sum_{i=1}^{L} T_{UERxTx,i} + (L-1) * \max\left(T_{effect,i}\right)$$

Where:

- i is the index of positioning frequency layer,

- $T_{UERxTx,i}$ is the measurement period for UE Rx-Tx time difference measurements in positioning frequency layer *i* as further defined in this clause,

- L is total number of positioning frequency layers,

- $T_{effect,i}$ is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer *i* as defined further in this clause.

$$T_{UERxTx,i} = \left(K_{carrier_PRS} * N_{RxTx,TEG,i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1 \right) * T_{effect,i} + T_{last,i}$$

Where:

- $K_{carrier_PRS}$=1 if the UE is capable of *parallelPRS-MeasRRC-Inactive-r17* defined in [34].

- $K_{carrier_PRS} = N_{layer} + 1$ if the UE is not capable of *parallelPRS-MeasRRC-Inactive-r17* defined in [34] and if Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$; where N_{layer} is defined in clause 4.2.2.7.

- $K_{carrier_PRS} = K_{carrier} + 1$ if the UE is not capable of *parallelPRS-MeasRRC-Inactive-r17* defined in [34] and if Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$; where $K_{carrier}$ is defined in clause 4.2.2.4.

- $N_{RxBeam,i}$ is the scaling factor for UE Rx beam sweeping:

  - $N_{RxBeam,i}$=1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2.

    - $N_{RxBeam,i}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-Multi-RTT -RequestLocationInformation*.

    - $N_{RxBeam,i}$ equals to 8, otherwise.

  $N_{RxTx,TEG,i}$ is the Rx TEG specific scaling factor:

    - $N_{RxTx,TEG,i}$ = 1 if UE is not configured by LMF with *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].

    Otherwise,

    - $N_{RxTx,TEG,i} = N_{TEG,i}$, if UE is not capable of measuring same DL PRS resource simultaneously from multiple Rx TEGs, where $N_{TEG,i}$ is the number of Rx TEGs or RxTx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34], and in case 'n0' is indicated, $N_{TEG,i}$ is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

    - $N_{RxTx,TEG,i} = \left\lceil \frac{N_{TEG,i}}{k_{TEG,simul,i}} \right\rceil$, if UE is capable of measuring same DL PRS resource simultaneously from multiple Rx TEGs, where $k_{TEG,simul,i}$ is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

- $L_{available_PRS,i}$ is the time duration of available PRS resources in the positioning frequency layer *i*, to be measured during $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

- {N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in clause 4.2.7.2 of TS 37.355 [34],

- N' is UE capability for number of DL PRS resources that it can process in a slot corresponding to *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* as specified in clause 6.4.3 of TS 37.355 [34],

- N_{sample} is the number of UE Rx-Tx time difference measurement samples:

  - N_{sample} = 4 if the UE is not capable of *supportedDL-PRS-ProcessingSamples-RRC-Inactive* defined in [34] or not configured to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples-r17* [34].

  - N_{sample} = 1 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-Inactive* defined in [34] and LMF requests the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples-r17* [34] and the following conditions are met:

    - PRS bandwidth is within the initial BWP and

    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

  - N_{sample} = 2 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-Inactive* defined in [34] and the LMF requests the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples-r17* [34] but the following conditions are not met:

    - PRS bandwidth is within the initial BWP and

    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

  - $T_{last,i}$ is the measurement duration for the last UE Rx-Tx time difference measurement sample in the positioning layer i, including the sampling time and processing time, $T_{last,i} = T_i + T_{available_PRS,i}$,

- $T_{effect,i}$ is periodicity of UE Rx-Tx time difference measurement in positioning frequency layer *i*:

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$$

Where:

- T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- $T_{available_PRS,i} = LCM(T_{PRS,i}, T_{DRX})$, the least common multiple between $T_{PRS,i}$ and T_{DRX}.

  - When UE is configured with RAN eDRX ≤ 10.24 s:

    - T_{DRX} is defined as T in TS 38.304 [1] when CN eDRX ≤ 10.24 s.

    - T_{DRX} is the maximum of the T inside and outside of the CN PTW when CN eDRX > 10.24 s, where T inside and outside of the CN PTW are defined in TS 38.304 [1].

  - When UE is configured with RAN eDRX > 10.24 s:

    - T_{DRX} is the maximum of the DRX cycles within the CN PTW and the RAN PTW.

- Otherwise, T_{DRX} is the DRX cycle of the UE in the serving cell.

- $T_{PRS,i}$ is the PRS resource periodicity in positioning frequency layer *i*. If the positioning frequency layer *i* has more than one DL PRS resource sets with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among DL PRS resource sets is used to derive $T_{PRS,i}$, where:

  - T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$

If the following conditions are met, the time $T_{UE\,Rx\,Tx,\,Total}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with RAN eDRX > 10.24 s, and
- periodic PRS measurement reporting is configured, and
- RAN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and
- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{UE\,Rx\,Tx,\,Total}$ starts from the first DL PRS resource(s) after both the *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE 1: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the RRC state transition occurs from RRC_INACTIVE to RRC_CONNECTED state during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the serving cell.

If cell reselection occurs during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the new serving cell.

If cell reselection occurs, and UE reselects to a cell out of the positioning validity area or if UE performs autonomous TA adjustment at reselection, then UE shall restart the measurement.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,\mathrm{i}}$ or
- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If the DRX cycle is reconfigured during the UE Rx-Tx time difference measurement period then the UE Rx-Tx time difference measurement period can be longer.

If during UE Rx-Tx time difference measurement period PRS resources overlap with other DL signals/channels then the UE Rx-Tx time difference measurement period can be longer.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

When PRS-RSRPP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRPP measurements are performed over the same measurement period.

The requirements in clause 5.6.4 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the N_{TA_offset} defined in table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

5.6.4.6 Measurement Period Requirements with Bandwidth Aggregation

The requirements in this clause apply provided that UE receives requests from LMF to perform PRS measurement on aggregated positioning frequency layers (PFLs) via *nr-DL-PRS-JointMeasurementRequestedPFL-List* [34].

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.4.3) UE Rx-Tx time difference measurements, defined in TS 38.215 [4], during the measurement period $T_{UERxTx,Total}$ defined as:

$$T_{UERxTx,total} = T_{UERxTx,aggr} + T_{UERxTx,non-aggr} + T_{margin}$$

Where:

- $T_{UERxTx,aggr}$ is the total measurement period for aggregated measurements as defined in this clause, and
- $T_{UERxTx,non-aggr}$ is the total measurement period for non-aggregates measurements as defined in this clause, and
- $T_{margin} = T'_{margin}$ is $\max(T_{effect,j})$, if both $T_{UERxTx,aggr}$ and $T_{UERxTx,non-aggr}$ are non-zero, and $T_{margin} = 0$ otherwise, where $T'_{margin} = \max(T_{effect,j})$ and $T_{effect,j}$ is the T_{effect} from both PFL combination(s) and non-aggregated PFL(s) which are configured for positioning measurement.

$T_{UERxTx,non-aggr}$ is zero if every resource set on every PFL is linked for aggregation with at least one other resource set on another PFL. Otherwise, $T_{UERxTx,non-aggr}$ is as defined in clause 5.6.4.5 with the following exceptions,

- only PFLs containing resource set(s) not linked to any other resource set(s) are considered in L
- on each PFL i, only resource set(s) not linked to any other resource set(s) are considered in $T_{available_PRS,i}$, $N^{slot}_{PRS,i}$ and $L_{available_PRS,i}$
- N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-Inactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,
- $(L-1) * \max(T_{effect,i})$ is replace by $(L-1) * T'_{margin}$.

$T_{UERxTx,aggr}$ is zero if no resourse sets on any PFL are linked for aggregation with other resource sets on other PFLs. Otherwise, $T_{UERxTx,aggr}$ is defined as

$$T_{UERxTx,aggr} = \sum_{m=1}^{M} T_{UERxTx,aggr,m} + (M-1) * T'_{margin} \quad ,$$

where:

- m is the index of PFL combination,
- M is total number of PFL combinations,
- $T_{effect,aggr,m}$ is the periodicity of the PRS measurement in PFL combination m as defined in this clause,
- $T_{UERxTx,aggr,m}$ is the measurement period for UE Rx-Tx time difference measurement in PFL combination m as specified below.

$$T_{UERxTx,aggr,m} = \left(K_{carrier,aggr} * N_{Rx,TEG,aggr,m} * N_{RxBeam,aggr,m} * \left\lceil \frac{N^{slot}_{PRS,aggr,m}}{N'_{aggr,m}} \right\rceil * \left\lceil \frac{L_{available_{PRS},aggr,m}}{N_{aggr,m}} \right\rceil * N_{sample} - 1 \right) * T_{effect,aggr,m} + T_{last,aggr,m}$$

where:

- $K_{carrier,aggr}$ is a scaling factor for PRS measurements in RRC_INACTIVE, and is defined as:
  - $K_{carrier,aggr} = 1$ if the UE supports *parallelPRS-MeasRRC-Inactive-r17*,
  - Otherwise,
    - If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, $K_{carrier,aggr} = K_{carrier} + 1$, where $K_{carrier}$ is defined in clause 4.2.2.4
    - If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier,aggr} = N_{layers} + 1$, where N_{layers} is defined in clause 4.2.2.7.
- $N_{Rx,TEG,aggr,m}$ is a scaling factor for PRS measurements with multiple Rx TEGs, and is defined as:
  - $N_{Rx,TEG,aggr,m}$ =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].
  - $N_{Rx,TEG,aggr,m}$ is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:
    - $N_{Rx,TEG,i} = P$, if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case 'n0' is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.
    - $N_{Rx,TEG,i} = \left\lceil \frac{P}{Q} \right\rceil$, if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where Q is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].
- $N_{RxBeam,aggr,m}$ is a scaling factor for PRS measurements with multiple Rx beams, and is defined as
  - $N_{RxBeam,aggr,m}$ = 1 if PFL combination *m* is in FR1,
  - $N_{RxBeam,aggr,m}$ is defined as follows if PFL combination *m* is in FR2
    - $N_{RxBeam,aggr,m}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing PFL combination *m*, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*,
    - $N_{RxBeam,aggr,m}$ equals to 8 otherwise
- $N^{slot}_{PRS,aggr,m}$ is the maximum number of DL PRS resources in PFL combination *m* configured in a slot, and only the PRS resources in resource set(s) linked to other resource set in PFL combination *m* are counted
- $N'_{aggr,m}$ is the UE capability on maximum number of DL PRS resources that can be processed in a slot for PFL combination *m* as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18* for FR1 and *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18* for FR2 specified in TS 37.355 [34].
- $L_{available_{PRS},aggr,m}$ is the time duration of available PRS resources in PFL combination *m* to be measured during $T_{PRS,aggr,m}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_{PRS},aggr,m}$, only unmuted PRS resources in resource set(s) linked to other resource set in PFL combination *m* and that are not fully overlapped with other higher-priority DL signals/channels are considered.
- $N_{aggr,m}$ is the UE capability on duration of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r18* specified in TS 37.355 [34].

- N_{sample} is number of PRS measurement samples,
  - N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,
  - N_{sample} = 4 otherwise.
- $T_{effect,aggr,m}$ is the periodicity of the PRS measurement in PFL combination m,

$$T_{effect,aggr,m} = \left\lceil \frac{T_{aggr,m}}{T_{available,PRS,aggr,m}} \right\rceil * T_{available,PRS,aggr,m}$$

  - $T_{aggr,m}$ is the UE capability on time for processing of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* specified in TS 37.355 [34].
  - $T_{available,PRS,aggr,m} = LCM(T_{PRS,aggr,m}, T_{DRX})$, the least common multiple between $T_{PRS,aggr,m}$ and the DRX cycle length T_{DRX}, where $T_{PRS,aggr,m}$ is the periodicity of DL PRS resource with muting on PFL combination m.
    - If more than one PRS periodicities are configured in PFL combination m, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets that are linked to other resource set in PFL combination m, is used to derive $T_{PRS,aggr,m}$, and for each applicable PRS resource set,
      - $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource, and
      - T_{per}^{PRS} is the periodicity of PRS resource set given by the higher-layer parameter *DL-PRS-Periodicity*, and
      - N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.
- $T_{last,aggr,m}$ is the measurement duration for the last PRS sample in PFL combination m, including the sampling time and processing time, $T_{last,aggr,m} = T_{aggr,m} + T_{available,PRS,aggr,m}$.

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements are transmitted by the TRP using single Tx chain as defined in clause 5.1.6.5.3 in TS 38.214 [26].

If PRS resources in one or more of the aggregated PFLs in PFL combination m are dropped because of collision with other signals, $T_{RSTD,aggr,m}$ can be longer than specified above.

The time $T_{UERxTx,total}$ starts from the first DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message are delivered from LMF to the UE via LPP [34].

NOTE: No separate requirement on non-aggregated measurement based on $T_{UERxTx,non-aggr}$ or on aggregated measurement based on $T_{UERxTx,aggr}$ is applied when both $T_{UERxTx,aggr}$ and $T_{UERxTx,non-aggr}$ are non-zero.

If the RRC state transition occurs from RRC_INACTIVE to RRC_CONNECTED state during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the serving cell.

If cell reselection occurs during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the new serving cell.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or
- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If the DRX cycle is reconfigured during the UE Rx-Tx time difference measurement period then the UE Rx-Tx time difference measurement period can be longer.

If $K_{\text{carrier_PRS}}$ changes for any PFL or any PFL combination during the measurement period, the measurement period could be longer.

If during UE Rx-Tx time difference measurement period PRS resources overlap with other DL signals/channels then the UE Rx-Tx time difference measurement period can be longer.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period. When PRS-RSRPP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRPP are performed over the same measurement period.

The requirements in clause 5.6.4 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the N_{TA_offset} defined in table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

The UE shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1.25A.2.

5.6.5 PRS-RSRPP measurements

5.6.5.1 Introduction

The requirements in clause 5.6.5 shall apply provided the UE has received a message from LMF via LPP requesting the UE to measure and report PRS-RSRPP measurements defined in TS 38.215 [4]. And the UE is capable of supporting the PRS-RSRPP measurement in RRC INACTIVE state.

5.6.5.2 Requirements Applicability

The requirements in clause 5.6.5 apply for periodic and triggered PRS-RSRPP measurements, provided:

- PRS-RSRPP related side conditions given in clause 10.1.38 are met for a corresponding Band.

5.6.5.3 Measurement Capability

UE PRS-RSRPP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

5.6.5.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. If the UE supports reporting of NR positioning measurements via SDT, the UE may be able to report the measurements while it remains in RRC_INACTIVE state; otherwise, the UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For PRS-RSRPP measurements performed by the UE in RRC_INACTIVE state, the measurement reporting delay excludes all of the following:

- any delay caused by other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH which is equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by no UL resources for UE to send the measurement report,
- any transmission delay needed by SDT,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported PRS-RSRPP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.38.3.

The PRS-RSRPP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1.38.2.

5.6.5.5 Measurement Period Requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message in RRC_INACTIVE state, measurement period requirements for PRS-RSRP defined in clause 5.6.3.5 is re-used for PRS-RSRPP measurement.

5.6.6 TA validation requirements for positioning

5.6.6.1 Introduction

The requirements in clause 5.6.6 shall apply when the UE is configured with the SRS transmission on the PCell and with *inactivePosSRS-RSRP-ChangeThreshold* for the time alignment (TA) validation before the SRS transmission [2].

5.6.6.2 TA validation requirements

When *inactivePosSRS-RSRP-ChangeThreshold* [2] is configured for TA validation based on the RSRP change criterion according to clause 5.26.2 in [7], the UE is allowed to transmit the SRS using the timing derived using the latest available N_{TA} value as specified in subclause 7.1 provided that the following conditions are met:

- the first RSRP ($RSRP_1$) measurement and the second RSRP ($RSRP_2$) measurements used in the TA validation are valid measurements and,
- TA for the SRS transmission is valid according to the TA validation criteria in clause 5.26.2 in [7].

$RSRP_1$ and $RSRP_2$ are considered valid provided that the conditions in table 5.6.6.2-1 and table 5.6.6.2-2 are met for FR1 and FR2-1 respectively.

Table 5.6.6.2-1 Valid measurement for FR1

Measurement	FR1
$RSRP_1$	$(T1 - \min(640\ ms, M1*T_{DRX})) \le T1' \le (T1 + \min(640\ ms, M1*T_{DRX}))$
$RSRP_2$	$(T2 - \min(640\ ms, M1*T_{DRX})) \le T2' \le T2$

Table 5.6.6.2-2 Valid measurement for FR2-1

Measurement	FR2-1
$RSRP_1$	$(T1 - \max(480\ ms, 8*SMTC\ periodicity)) \le T1' \le (T1 + \max(480\ ms, 8*SMTC\ periodicity))$
$RSRP_2$	$(T2 - \max(480\ ms, 8*SMTC\ periodicity)) \le T2' \le T2$

If at least one of $RSRP_1$ and $RSRP_2$ is invalid based on the above conditions, then the UE shall not validate the SRS transmission using $RSRP_1$ and $RSRP_2$ and shall not transmit the SRS. The UE shall not transmit in an SRS resource that occurs more than 640 ms after T2.

Where:

- T1 is the time when:
  - *RRCRelease* with *SRS-PosRRC-InactiveConfig* [2] is received by the UE, or
  - the latest TA is received by the UE while the UE is in RRC_INACTIVE state.
- T1' is the time when the UE has completed $RSRP_1$.
- T2 is the time when the UE performs TA validation as defined in clause 5.26.2 in [7] for the SRS transmission.
- T2' is the time when the UE has completed $RSRP_2$.
- T_{DRX} is the DRX cycle length in ms.
- M1 the scaling factor as defined in clause 4.2.2.2.

5.6.6.3 TA validation requirements when configured with validity area

The requirement in this section shall apply when the UE is configured with:

- *inactivePosSRS-ValidityAreaRSRP* [2] for TA validation based on the RSRP change criterion according to clause 5.26.2 in [7] and
- *SRS-PosRRC-InactiveValidityAreaConfig* [2] for SRS for positioning configuration which is valid during RRC_INACTIVE state across the cells included in *srs-PosRRC-InactiveValidityArea area* [2].

The UE is allowed to transmit the SRS using the timing derived using the latest available N_{TA} value as specified in subclause 7.1 and is allowed to perform the cell reselection to a cell included in *srs-PosRRC-InactiveValidityArea area* [2], provided that the following conditions are met:

the first RSRP ($RSRP_1$) measurement and the second RSRP ($RSRP_2$) measurements used in the TA validation are valid measurements and,

TA for the SRS transmission is valid according to the TA validation criteria defined in clause 5.26.2 in [7].

$RSRP_1$ and $RSRP_2$ are measured by the UE from the same camped cell. $RSRP_1$ and $RSRP_2$ are considered valid provided that the conditions in table 5.6.6.3-1 and table 5.6.6.3-2 are met for FR1 and FR2-1 respectively.

Table 5.6.6.3-1 Valid measurement for FR1

Measurement	FR1
$RSRP_1$	$(T1 - \min(640\ ms, M1*T_{DRX})) \le T1' \le (T1 + \min(640\ ms, M1*T_{DRX}))$
$RSRP_2$	$(T2 - \min(640\ ms, M1*T_{DRX})) \le T2' \le T2$

Table 5.6.6.3-2 Valid measurement for FR2-1

Measurement	FR2-1
$RSRP_1$	$(T1 - \max(480\ ms, 8*SMTC\ periodicity)) \le T1' \le (T1 + \max(480\ ms, 8*SMTC\ periodicity))$
$RSRP_2$	$(T2 - \max(480\ ms, 8*SMTC\ periodicity)) \le T2' \le T2$

If at least one of $RSRP_1$ and $RSRP_2$ is invalid based on the above conditions, then the UE shall not validate the SRS transmission using $RSRP_1$ and $RSRP_2$ and shall not transmit the SRS. The UE shall not transmit in an SRS resource that occurs more than 640 ms after T2.

Where:

- T1 is the time when:

- *RRCRelease* with *SRS-PosRRC-InactiveConfig* [2] is received by the UE, or
- the latest TA is received by the UE while in RRC_INACTIVE state, or
- according to clause 7.1.2.4, the UE while in RRC_INACTIVE state has autonomously adjusted the TA during the cell reselection to a cell included in *srs-PosRRC-InactiveValidityArea area* [2].

- T1' is the time when the UE has completed $RSRP_1$.
- T2 is the time when the UE performs TA validation as defined in clause 5.26.2 in [7] for the SRS transmission.
- T2' is the time when the UE has completed $RSRP_2$.
- T_{DRX} is the DRX cycle length in ms.
- M1 the scaling factor as defined in clause 4.2.2.2.

5.6.7 Measurement requirements for DL RSCPD reported with RSTD

5.6.7.1 Introduction

The requirements in clause 5.6.7 shall apply provided the UE has received *NR-DL-TDOA-RequestLocationInformation* message with *dl-PRS-RSCPD-Request-r18* from the LMF via LPP [34] requesting the UE to measure and report RSCPD measurement together with DL RSTD measurements defined in TS 38.215 [4].

5.6.7.2 Requirements Applicability

The requirements in clause 5.6.7 apply for periodic and triggered reporting of RSCPD with RSTD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23.2 for FR1 and FR2 are fulfilled, for a corresponding Band.
- RSCPD related side conditions given in clause 10.1.43.2 for FR1 and FR2 are fulfilled, for a corresponding Band.

5.6.7.3 Measurement Capability

The UE PRS RSTD and DL-RSCPD measurement measurement capabilities in RRC_INACTIVE state are as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355 [34].

5.6.7.4 Measurement Reporting Requirements

The measurement reporting delay shall satisfy the requirements defined in clause 5.6.2.4, and the applicable measurement report mapping and measurement accuracy requirements are specified below.

The reported RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.23.3.

The reported RSCPD measurement values contained in the measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.1.43.3.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2, for each measured DL PRS resource.

The RSCPD measurements performed and reported according to this section shall meet the RSCPD measurement accuracy requirements in clause 10.1.43.2, for the measured DL PRS resource.

5.6.7.5 Measurements Period Requirements

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message with *dl-PRS-RSCPD-Request-r18* from the LMF via LPP [34], when LMF configures measurement time window(s) for a PFL, the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.7.3) DL RSTD and RSCPD measurements, defined in TS 38.215 [4], during the time window configured to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig*.

When LMF does not configure measurement time window(s):

- When a single PFL is configured, requirements in clause 5.6.2.5 apply to both RSCPD and RSTD measurements.
- When multiple PFLs are configured for legacy measurements, the UE performs RSCPD measurement on a single PFL that is common between the reference TRP and the target TRP. The requirement in clause 5.6.2.5 apply to both RSTD and RSCPD measurements.

When LMF configures measurement time window(s), but UE does not support RSCPD measurement inside time window as indicated in *supportOfMeasurementsInTimeWindow*:

- The UE performs RSCPD measurement on the indicated PFL by the network. The requirements in clause 5.6.2.5 apply to both RSTD and RSCPD measurements.

When LMF configures measurement time window(s), but UE does not support RSTD measurement inside time window as indicated in *supportOfMeasurementsInTimeWindow* but supports RSCPD measurement inside time window as indicated in *supportOfMeasurementsInTimeWindow*:

- The requirements in the clause 5.6.2.5 apply to RSTD measurements.
- The requirements in clause 5.6.7.5 apply to RSCPD measurement for the PRS resource(s) that have occasions only within the measurement time window.

When LMF configures measurement time window(s), and UE supports RSTD and RSCPD measurements inside time window as indicated in *supportOfMeasurementsInTimeWindow*:

- The requirements in Clause 5.6.7.5 apply to DL RSTD measurement and DL RSCPD measurement.

If a one-shot time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.7.3) DL RSTD and DL RSCPD measurements, defined in TS 38.215 [4], based on the indicated PRS resource sets occurring inside the one-shot time window during the measurement period $T_{RSCPD\ with\ RSTD,Total}$ defined as:

$$T_{RSCPD\ with\ RSTD,Total} = \min(L_{window}, 10\ \text{ms}) + T_i \quad ,$$

and the UE shall be able to measure multiple DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total,with\ one\ shot\ window}$ defined as:

$$T_{RSTD,Total,with\ one\ shot\ window} = T_{RSCPD\ with\ RSTD,Total} + max(T_{effect,i}) + T_{RSTD,Total}$$

Where:

- the start of the measurement is the start of the one-shot time window, and
- L_{window} is the length of the one-shot window, and
- $T_{effect,i}$ and T_i are defined in the following of this clause, and
- $T_{RSTD,Total}$ is defined in clause 5.6.2.5.

The requirements with one-shot window assume scaling factors equal to 1 for the PFLs, for which the one-shot time window is configured.

If a periodic time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.8.3) DL RSTD and DL RSCPD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSCPD\ with\ RSTD,Total}$ defined as:

$$T_{\text{RSCPD with RSTD,Total}} = \sum_{i=1}^{L} T_{\text{RSCPD with RSTD,i}} + (L-1) * \max\left(T_{\text{effect,i}}\right)$$

Where:

- i is the index of positioning frequency layer,
- L is total number of positioning frequency layers, and
- $T_{\text{effect},i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i

$T_{\text{RSCPD with RSTD,i}}$ is the measurement period for PRS RSTD with RSCPD measurement in positioning frequency layer *i* as specified below:

$$T_{\text{RSCPD with RSTD}} = \left(K_{\text{carrier_PRS}} * N_{Rx,TEG,i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil * \left\lceil \frac{L_{available_{PRS},i}}{N} \right\rceil * N_{sample} - 1\right) * T_{\text{effect,i}} + T_{\text{last,i}},$$

where:

- $K_{\text{carrier_PRS}}$, $N_{Rx,TEG,i}$, $N_{RxBeam,i}$, $N_{PRS,i}^{slot}$, N, N', N_{sample}, $T_{\text{effect,i}}$ and $T_{last,i}$ are defined in clause 5.6.2.5
- $L_{available_{PRS},i}$ is the time duration of available PRS in the positioning frequency layer to be measured during T_{PRS}, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_{PRS},i}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.
- When periodic time window(s) are configured by the LMF and PFL *i* is associated with the configured time window, $T_{available_{PRS},i} = LCM\left(T_{PRS,i}, T_{DRX}, T_{window}\right)$, the least common multiple between $T_{\text{PRS,i}}$, the DRX cycle length T_{DRX} and T_{window} being the maximum periodicity of the indicated time window(s). $T_{PRS.i}$ is defined in clause 5.6.2.5.
- When periodic time window(s) are configured by the LMF and PFL *i* is not associated with the configured time window(s), $T_{available_{PRS},i} = LCM\left(T_{PRS,i}, T_{DRX}\right)$, the least common multiple between $T_{PRS,i}$ and the DRX cycle length T_{DRX} . $T_{PRS,i}$ is defined in clause 5.6.2.5.

- $L_{available_{PRS},i}$ and $T_{PRS,i}$ are calculated by only considering the PRS resources in the indicated resources sets overlapping with the indicated time window(s).

The time $T_{\text{RSCPD with RSTD}}$ starts from the first time window ($T_{\text{DL RSCPD}}$) configured by LMF within DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

If the DRX cycle is reconfigured during the measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOAwith a request to perform RSCPD measurement with RSTD measurement, RSCPD with RSTD and PRS-RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA with a request to perform RSCPD measurement with RSTD measurement, RSCPD with RSTD and PRS-RSRPP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 5.6.1.

Longer measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If $K_{\text{carrier_PRS}}$ changes for the PFL during the measurement period, the measurement period can be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 5.6.7 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If cell re-selection occurs while RSCPD together with RSTD measurements are being performed, then the UE shall continue and complete the on-going RSCPD and RSTD measurements after the cell re-selection is completed. The measurement period can be longer.

If the RRC state transition occurs from RRC_INACTIVE to RRC_CONNECTED state during the measurement period then the UE shall continue the RSCPD and RSTD measurements in the RRC_CONNECTED state. The measurement period can be longer.

5.6.8 Measurement requirements for DL RSCP reported with UE Rx-Tx time difference

5.6.8.1 Introduction

The requirements in this clause shall apply, provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message with *dl-PRS-RSCP-Request-r18* from LMF via LPP [34] requesting the UE to measure and report one or more DL RSCP measurements together with UE Rx-Tx time difference measurements defined in TS 38.215 [4].

5.6.8.2 Requirements Applicability

The requirements in clause 5.6.8 apply for periodic and triggered UE Rx-Tx time difference measurements, provided:

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25.2 are met for a corresponding band.
- DL RSCP related side conditions given in clause 10.1.44.2 for FR1 and FR2 are fulfilled, for a corresponding Band.
- SRS is configured on the PCell.

5.6.8.3 Measurement Capability

UE Rx-Tx time difference and DL-RSCP measurement capabilities are as indicated by the UE in *NR-Multi-RTT-ProvideCapabilities*, according to TS 37.355 [34].

5.6.8.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

This measurement reporting delay excludes the delay caused by any of the following:

- delay caused by other LPP signalling on the DCCH.
- delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.
- delay caused due to lack of UL resources for UE to send the measurement report.
- delay required by SDT for reporting the measurement using SDT resources.
- delay required for transition to RRC_CONNECTED state for report the measurement in RRC_CONNECTED.

The UE Rx-Tx time difference measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.25.3.

The DL RSCP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.44.3.

The UE Rx-Tx time difference measurement accuracy for all measured DL PRS resources shall be fulfilled according to the accuracy requirements specified in clause 10.1.25.2.

The DL RSCP measurement accuracy for all measured DL PRS resources shall be fulfilled according to the accuracy requirements specified in clause 10.1.44.2.

5.6.8.5 Measurement Period Requirements

When the physical layer receives the last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] with *dl-PRS-RSCP-Request-r18* and configuring a measurement time window via *nr-DL-PRS-MeasurementTimeWindowsConfig*, subject to UE capabilities *supportOfRSCP-MeasurementInTimeWindow* and *supportOfLegacyMeasurementInTimeWindow*, the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.8.3) UE Rx-Tx and DL RSCP measurements, defined in TS 38.215 [4], during the time window only.

When LMF does not configure measurement time window(s):

- When a single PFL is configured, requirements in clause 5.6.4.5 apply to both RSCP and UE Rx-Tx measurements.
- When multiple PFLs are configured for legacy measurements, the UE performs RSCP measurement on a single PFL that is common between the reference TRP and the target TRP. The requirement in clause 5.6.4.5 apply to both RSCP and UE Rx-Tx measurements.

When LMF configures measurement time window(s), but UE does not support DL RSCP measurement inside time window as indicated in *supportOfMeasurementsInTimeWindow*:

- The UE performs RSCP measurement on the indicated PFL by the network. The requirement in clause 5.6.4.5 apply to both UE Rx-Tx and RSCP measurements.

When LMF configures measurement time window(s), but UE does not support UE Rx-Tx measurement inside time window as indicated in *supportOfMeasurementsInTimeWindow*, but supports DL RSCP measurement inside time window as indicated in *supportOfMeasurementsInTimeWindow*:

- The requirements in the clause 5.6.4.5 apply to UE Rx-Tx measurement.
- The requirements in clause 5.6.8.5 apply to RSCP measurement for the PRS resource(s) that have occasions only within the measurement time window.

When LMF configures measurement time window(s), and UE supports DL RSCP and UE Rx-Tx time difference measurements inside time window as indicated in *supportOfMeasurementsInTimeWindow*:

- The requirements in Clause 5.6.8.5 apply to UE Rx-Tx measurement and DL RSCP measurement.

If a one-shot time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.8.3) UE Rx-Tx and DL RSCP measurements, defined in TS 38.215 [4], based on the indicated PRS resource sets occurring inside the one-shot time window during the measurement period $T_{\text{DL RSCP with UERxTx,Total}}$ defined as:

$$T_{\text{DL RSCP with UERxTx,Total}} = \min(L_{window}, 10\text{ ms}) + T_i \quad ,$$

and the UE shall be able to measure multiple UE Rx-Tx measurements, defined in TS 38.215 [4], during the measurement period $T_{UERxTx,Total,with\ one\ shot\ window}$ defined as:

$$T_{UERxTx,Total,with\ one\ shot\ window} = T_{\text{DL RSCP with UERxTx,Total}} + max(T_{effect,i}) + T_{UERxTx,Total}$$

Where:

- the start of the measurement is the start of the one-shot time window, and
- L_{window} is the length of the one-shot window, and
- $T_{\text{effect},i}$ and T_i are defined in the following of this clause, and

- $T_{UERxTx,Total}$ is defined in clause 5.6.4.5.

The requirements with one-shot window assume scaling factors equal to 1 for the PFLs, for which the one-shot time window is configured.

If a periodic time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.8.3) UE Rx-Tx and DL RSCP measurements, defined in TS 38.215 [4], during the measurement period $T_{\text{DL RSCP with UERxTx,Total}}$ defined as:

$$T_{\text{RSCP with UERxTx,Total}} = \sum_{i=1}^{L} T_{\text{DL RSCP with UERxTx,i}} + (L-1) * \max(T_{\text{effect,i}})$$

where:

- i is the index of positioning frequency layer,
- L is total number of positioning frequency layers, and
- $T_{\text{effect},i}$ is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer *i*.

$T_{\text{DL RSCP with UERxTx,i}}$ is the measurement period for DL RSCP with UE Rx-Tx measurement in positioning frequency layer *i* as specified below:

$$T_{\text{DL RSCP with UERxTx,i}} = \left(K_{\text{carrier_PRS}} * N_{RxTx,TEG,i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_{PRS,i}}}{N} \right\rceil * N_{sample} - 1\right) * T_{\text{effect,i}} + T_{\text{last,i}},$$

where:

- $K_{\text{carrier_PRS}}$, $N_{RxTx,TEG,i}$, $N_{RxBeam,i}$, $N_{PRS,i}^{slot}$, N, N', N_{sample}, $T_{\text{effect,i}}$ and $T_{\text{last,i}}$ are defined in clause 5.6.4.5.
- DL-RSCP performed during $T_{\text{DL RSCP with UERxTx}}$ is a single sample measurement where DL RSCP and UE Rx-Tx measurements are performed on the same PFL.
- $L_{available_{PRS,i}}$ is the time duration of available PRS resources in the positioning frequency layer *i*, to be measured during $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_{PRS,i}}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.
- When periodic time window(s) are configured by the LMF and PFL *i* is associated with the configured time window, $T_{available_{PRS,i}} = LCM(T_{PRS,i}, T_{DRX}, T_{window})$, the least common multiple between $T_{\text{PRS,i}}$, T_{DRX} and T_{window} being the maximum periodicity of the indicated time window(s).
- When periodic time window(s) are configured by the LMF and PFL *i* is not associated with the configured time window(s), $T_{available_{PRS,i}} = LCM(T_{PRS,i}, T_{DRX})$, the least common multiple between $T_{PRS,i}$ and the DRX cycle length T_{DRX} .
- $L_{available_{PRS,i}}$ and $T_{PRS,i}$ are calculated by only considering the PRS resources in the indicated resources sets overlapping with the indicated time window(s).

The time $T_{\text{DL RSCP with UERxTx}}$ starts from the first time window ($T_{\text{DL RSCP}}$) configured by LMF within DRX cycle containing the DL PRS resources in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

If the RRC state transition occurs from RRC_INACTIVE to RRC_CONNECTED state during the measurement period then the UE shall continue the DL RSCP measurement and shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the serving cell.

If cell reselection occurs during the measurement period then the UE shall restart the DL RSCP and UE Rx-Tx time difference measurements after it obtains SRS configuration and Timing Advance command from the new serving cell.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_{PRS,i}}$ or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If the DRX cycle is reconfigured during the measurement period, then the measurement period can be longer.

If during the measurement period, PRS resources overlap with other DL signals/channels then the measurement period can be longer.

When PRS-RSRP is configured for multi-RTT, the DL RSCP with UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

When PRS-RSRPP is configured for multi-RTT, the DL RSCP with UE Rx-Tx time difference measurements and PRS-RSRPP measurements are performed over the same measurement period.

The requirements in clause 5.6.8 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the DL RSCP with UE Rx-Tx measurement period, then the DL RSCP with UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the DL RSCP and UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the N_{TA_offset} defined in table 7.1.2-2 during the DL RSCP with UE Rx-Tx measurement period, then the DL RSCP with UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the DL RSCP and UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1.2 during the measurement period, then:

- DL RSCP and UE Rx-Tx measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in section 7.1.1) for SRS transmission.

- DL RSCP and UE Rx-Tx measurement period requirements in this clause shall not apply for a cell, which is not the downlink reference cell (defined in section 7.1.1) for SRS transmission. The DL RSCP with UE Rx-Tx time difference measurement period may be restarted in such case.

5.6A NR measurements for positioning for RedCap

5.6A.1 Introduction

This clause contains requirements for RedCap UE capable of performing NR positioning measurements defined in TS 38.215 [4], including RSTD, PRS-RSRP, UE Rx-Tx time difference and PRS-RSRPP, in RRC_INACTIVE state.

The requirements in clauses 5.6A.4, 5.6A.5, 5.6A.6 and 5.6A.7 are applicable to PRS resources that do not collide with other DL signals/channels which include SSB, SIB1, CORESET0, MSG2/MSGB, paging and DL SDT. In addition, a UE is not expected to receive PRS resources that collide with a time interval starting at symbol *m* and ending at symbol $m + N_2$, where symbol *m* is the last symbol in which the UE is configured to receive PDCCH and N_2 is defined in clause 6.4 of TS 38.214 [26] for the subcarrier spacing μ of the DL PRS.

If a PRS resource is outside or partially overlapped with the initial DL BWP, a PRS resource instance collides with another DL signals/channels if any portion of the other DL signal/channel overlaps with the time interval starting X symbols before the PRS instance and ending X symbols after the PRS instance, taking into account *nr-DL- PRS-ExpectedRSTD-Uncertainty* and *nr-DL-PRS-ExpectedRSTD*. Where X is defined in table 5.6.1-1.

All measurement requirements specified in clauses 5.6A.4, 5.6A.5, 5.6A.6 and 5.6A.7 shall apply for DRX and eDRX configuration specified in TS 38.331 [2].

The requirements in clauses 5.6A.4, 5.6A.5, 5.6A.6 and 5.6A.7 are applicable provided that the cell selection procedure for the selected PLMN defined in TS 38.304 [1] is not triggered during PRS measurement period.

The requirements in clauses 5.6A.4, 5.6A.5, 5.6A.6 and 5.6A.7 apply provided that all PRS resources within a PFL are within up to 2 separate windows within $T_{PRS,i}$ for each positioning frequency layer *i*, where each window is up to 10 ms. $T_{PRS,i}$ is defined in clauses 5.6A.4, 5.6A.5, 5.6A.6 and 5.6A.7.

The UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

When the UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

5.6A.2 Cell re-selection for positioning

The requirements in this clause apply for RedCap UE, when the UE is configured to perform SRS transmission for positioning.

The requirements in clause 5.1B.2 shall apply in the following conditions.

- UE is not configured with eDRX_IDLE, or
- UE is configured with eDRX_IDLE but without eDRX_INACTIVE, or
- UE is configured with both eDRX_IDLE and eDRX_INACTIVE, and eDRX_INACTIVE cycle is smaller or equal to T_{POS},

where T_{POS} is

- SRS transmission periodicity, if UE is configured to only perform SRS transmission for positioning, or if UE is configured to both perform PRS measurements without periodic reporting and to perform SRS transmission for positioning,
- the minimum of PRS measurement reporting periodicity and SRS transmission periodicity, if UE is configured to both perform PRS measurements with periodic reporting and to perform SRS transmission for positioning.

NOTE: PRS measurement reporting periodicity is the configured *reportingInterval* in *RequestLocationInformation as defined in [34]*.

When UE is configured with both eDRX_IDLE and eDRX_INACTIVE, and eDRX_INACTIVE cycle is larger than T_{POS}, the requirements in clause 5.1B.2 except clause 5.1B.2.2 and 5.1.2B.3 shall apply, and the requirements in clause 5.6A.2.1 apply for measurement and evaluation of serving cell, and the requirements in clause 5.6A.2.2 apply for measurements of intra-frequency NR cells.

5.6A.2.1 Measurement and evaluation of serving cell

When a RedCap UE is configured with both eDRX_IDLE and eDRX_INACTIVE, and eDRX_INACTIVE cycle is larger than T_{POS}, the UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1*T_{serv} for FR1 and N1* T_{serv} for FR2; where:

- T_{serv} is defined as max(T_{DRX}, T_{POS}), where
  - T_{DRX} is defined as T in clause 7.1 TS 38.304 [1] when RAN eDRX <= 10.24s and CN eDRX <= 10.24s
  - T_{DRX} is the maximum of the T inside and outside of the CN PTW, where T inside and outside of the CN PTW are defined in clause 7.1 TS 38.304 [1], when RAN eDRX <= 10.24s and CN eDRX > 10.24s
  - T_{DRX} is the maximum of the DRX cycles within the CN PTW and the RAN PTW when RAN eDRX > 10.24 s
- M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and $T_{serv} \leq 0.64$ second, otherwise M1=1.
- The serving cell measurement is not limited to PTW.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least $T_{serv}/2$.

If the UE has evaluated according to table 5.6A.2.1-1 or table 5.6A.2.1-2 in N_{serv} consecutive T_{serv} that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

Table 5.6A.2.1-1: N_{serv} for UE configured with eDRX INACTIVE cycle > T_{POS} (FR1)

eDRX_IDLE cycle length [s]	eDRX INACTIVE cycle length[s]	T_{serv} [s]	N_{serv} [number of T_{serv}]
2.56 ≤eDRX_IDLE cycle length ≤10485.76	eDRX INACTIVE cycle length ≥ T_{POS}	0.32 ≤ T_{serv} < 1.28	[4*M1]
		1.28 ≤ T_{serv}	[2]

Table 5.6A.2.1-2: N_{serv} for UE configured with eDRX INACTIVE cycle > T_{POS} (FR2-1)

eDRX_IDLE cycle length [s]	eDRX INACTIVE cycle length[s]	T_{serv} [s]	Scaling Factor (N1)	N_{serv} [number of T_{serv}]
2.56 ≤eDRX_IDLE cycle length ≤10485.76	eDRX INACTIVE cycle length ≥ T_{POS}	0.32 ≤ T_{serv} < 0.64	8	[4* M1*N1]
		0.64 ≤ T_{serv} < 1.28	5	[4* M1*N1
		1.28 ≤ T_{serv} < 2.56	4	[2*N1]
		2.56 ≤ T_{serv}	3	[2*N1]

If the UE in RRC_INACTIVE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information during the time T', the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1], where

- T' = MAX (10 s, one eDRX_INACTIVE cycle) for FR1, or
- T'= MAX (10 s, N1* eDRX_INACTIVE cycle) for FR2.

5.6A.2.2 Measurements of intra-frequency NR cells

When a RedCap UE is configured with both eDRX_IDLE and eDRX_INACTIVE, and eDRX_INACTIVE cycle is larger than T_{POS}, the requirements defined in section 5.1B.2.3 shall apply with T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ defined in table 5.6A.2.2-1 and table 5.6A.2.2-2, where

- T_{serv} is defined as max(T_{DRX}, T_{POS}), where
  - T_{DRX} is defined as T in clause 7.1 TS 38.304 [1] when RAN eDRX <= 10.24s and CN eDRX <= 10.24s
  - T_{DRX} is the maximum of the T inside and outside of the CN PTW, where T inside and outside of the CN PTW are defined in clause 7.1 TS 38.304 [1], when RAN eDRX <= 10.24s and CN eDRX > 10.24s
  - T_{DRX} is the maximum of the DRX cycles within the CN PTW and the RAN PTW when RAN eDRX > 10.24 s
- M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.
- The detection, measurement and evaluation of intra-frequency neighbour cells are not limited to PTW.

Table 5.6A.2.2-1: T_{detect}, $T_{measure}$ and $T_{evaluate}$ for UE configured with eDRX INACTIVE cycle > T_{POS} (FR1)

eDRX_IDLE cycle length [s]	T_{serv} [s]	T_{detect,NR_Intra} (number of T_{serv})	$T_{measure,NR_Intra}$ (number of T_{serv})	$T_{evaluate,NR_Intra}$ (number of T_{serv})
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32 ≤ T_{serv} < 0.64	[36 x M2]	[4 x M2]	[16 x M2]
	0.64 ≤ T_{serv} < 1.28	[28]	[2]	[8]
	1.28 ≤ T_{serv} < 2.56	[25]	[1]	[5]
	2.56 ≤ T_{serv}	[23]	[1]	[3]
NOTE 1: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ in seconds depend on the number *N* of T_{serv} and are calculated as N * T_{serv}.				

Table 5.6A.2.2-2: T_{detect}, $T_{measure}$ and $T_{evaluate}$ for UE configured with eDRX INACTIVE cycle > T_{POS} (FR2-1)

eDRX_IDLE cycle length [s]	T_{serv} [s]	Scaling Factor (N1)	T_{detect,NR_Intra} (number of T_{serv})	$T_{measure,NR_Intra}$ (number of T_{serv})	$T_{evaluate,NR_Intra}$ (number of T_{serv})
2.56 ≤eDRX_IDLE cycle length ≤ 10485.76	0.32 ≤ T_{serv} < 0.64	8	[36 x N1 x M2]	[4 x N1 x M2]	[16 x N1 x M2]
	0.64 ≤ T_{serv} < 1.28	5	[28 x N1]	[2 x N1]	[8 x N1]
	1.28 ≤ T_{serv} < 2.56	4	[25 x N1]	[1 x N1]	[5 x N1]
	2.56 ≤ T_{serv}	3	[23 x N1]	[1 x N1]	[3 x N1]
NOTE 1: T_{detect,NR_Intra}, $T_{measure,NR_Intra}$ and $T_{evaluate,NR_Intra}$ in seconds depend on the number *N* of T_{serv} and are calculated as N * T_{serv}.					

5.6A.3 TA validation requirements for positioning SRS

5.6A.3.1 Introduction

The requirements in clause 5.6A.3 shall apply when the UE is configured with the SRS transmission on the PCell and with *inactivePosSRS-RSRP-ChangeThreshold* for the time alignment (TA) validation before the SRS transmission [2]. The requirements in clause 5.6A.3 are applicable for both 1 Rx RedCap UE and 2 Rx RedCap UE.

5.6A.3.2 TA validation requirements

The requirements in clause 5.6.6.2 shall apply when the UE is configured with *inactivePosSRS-RSRP-ChangeThreshold* [2] for TA validation based on the RSRP change criterion according to clause 5.26.2 in [7].

5.6A.3.3 TA validation requirements when configured with validity area

The requirements in clause 5.6.6.3 shall apply when the UE is configured with:

- inactivePosSRS-RSRP-ChangeThreshold [2] for TA validation based on the RSRP change criterion according to clause 5.26.2 in [7] and

SRS-PosRRC-InactiveValidityAreaConfig [2] for SRS for positioning configuration which is valid during RRC_INACTIVE state across the cells included in *srs-PosRRC-InactiveValidityArea area* [2].

5.6A.4 RSTD measurements for RedCap

5.6A.4.1 Introduction

The requirements in clause 5.6A.4.5 shall apply provided the RedCap UE has received *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34] requesting the RedCap UE to measure and report DL RSTD measurements defined in TS 38.215 [4] without FH via *nr-DL-PRS-RxHoppingRequest*.

The requirements in clause 5.6A.4.6 shall apply provided the RedCap UE has received *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34] requesting the UE to measure and report DL RSTD measurements defined in TS 38.215 [4] with FH via *nr-DL-PRS-RxHoppingRequest*.

5.6A.4.2 Requirements applicability

The requirement in clause 5.6A.4.5 apply for periodic and triggered RSTD measurements, provided:

PRS-RSTD related side conditions given in clause 10.1A.16.2.1 for FR1 are fulfilled, for a corresponding band, for 1 Rx RedCap UE.

PRS-RSTD related side conditions given in clause 10.1.23.2 for FR1 and FR2 are fulfilled, for a corresponding band, for 2 Rx RedCap UE.

The requirement in clause 5.6A.4.6 apply for periodic and triggered RSTD measurements, provided:

PRS-RSTD related side conditions given in clause 10.1A.16.2.2 for FR1 are fulfilled, for a corresponding band, for 1 Rx RedCap UE.

PRS-RSTD related side conditions given in clause 10.1A.16.2.2 for FR1 and FR2 are fulfilled, for a corresponding band, for 2 Rx RedCap UE.

5.6A.4.3 Measurement Capability

The UE PRS RSTD measurement capability in RRC_INACTIVE state is as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355 [34].

5.6A.4.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. If the UE supports reporting of NR positioning measurements via SDT, the UE may be able to report the measurements while it remains in RRC_INACTIVE state; otherwise, the UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For RSTD measurements performed by the UE in RRC_INACTIVE state, with and without FH, the measurement reporting delay excludes all of the following:

- additional delay caused other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH, equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by unavailability of UL resources to transmit the measurement report,
- any transmission delay needed by SDT,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.23.3.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1A.16.2.1, for each measured DL PRS resource by 1 Rx RedCap UE without FH.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1A.16.2.2, for each measured DL PRS resource by 1 Rx RedCap UE with FH.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1A.16.2.1, for each measured DL PRS resource by 2 Rx RedCap UE without FH.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1A.16.2.2, for each measured DL PRS resource by 2 Rx RedCap UE with FH.

5.6A.4.5 Measurement Period Requirement without RX FH

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34], and UE is not configured to perform measurement with RX FH, the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6A.4.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined as:

$$\mathrm{T_{RSTD,Total}} = \sum_{i=1}^{L} \mathrm{T_{RSTD,i}} + \ (\mathrm{L}-1) \times \max\left(\mathrm{T_{effect,i}}\right)$$

Where:

- i is the index of positioning frequency layer,

- L is total number of positioning frequency layers, and
- $T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i

$T_{RSTD,i}$ is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

$$T_{RSTD,i} = \left(K_{carrier_PRS_RedCap} \times N_{Rx,TEG,i} \times N_{RxBeam,i} \times \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \times \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil \times N_{sample} - 1\right) \times T_{effect,i} + T_{last,i},$$

Where:

- $N_{RxBeam,i}$ is the UE Rx beam sweeping factor:
  - $N_{RxBeam,i}$ = 1 if positioning frequency layer *i* is in FR1 or UE has only 1Rx branch,
  - $N_{RxBeam,i}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2*, if positioning frequency layer *i* is in FR2 or the UE has 2Rx branches, and the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*.
  - $N_{RxBeam,i}$ equals to 8, otherwise.
- $K_{carrier_PRS_RedCap}$ is a scaling factor for PRS-based NR positioning measurements in RRC_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier_PRS_RedCap}$ = 1; otherwise,
  - If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, $K_{carrier_PRS_RedCap} = K_{carrier_RedCap} + 1$, where $K_{carrier_RedCap}$ is defined in clause 4.2B.2.4
  - If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier_PRS_RedCap} = N_{layers} + 1$, where N_{layers} is defined in clause 4.2.2.7.
- $N_{Rx,TEG,i}$ is the Rx TEG specific scaling factor:
  - $N_{Rx,TEG,i}$ =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].
  - $N_{Rx,TEG,i}$ is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:
    - $N_{Rx,TEG,i} = P$, if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case 'n0' is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.
    - $N_{Rx,TEG,i} = \left\lceil \frac{P}{Q} \right\rceil$, if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where Q is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].
- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.
- $L_{available_PRS,i}$ is the time duration of available PRS in positioning frequency layer *i* to be measured $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.
- N_{sample} is the number of PRS RSTD samples, where
  - N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
    - PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

- N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

  - PRS bandwidth is within the initial BWP and

  - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

- N_{sample} = 4 otherwise.

- $T_{last,i}$ is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time, $T_{\text{last,i}} = T_{\text{i}} + T_{available_PRS,\text{i}}$,

- $T_{\text{effect},i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

$$T_{\text{effect,i}} = \left\lceil \frac{T_{\text{i}}}{T_{available_PRS,\text{i}}} \right\rceil \times T_{available_PRS,\text{i}}$$

where:

- T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- $T_{available_PRS,\text{i}} = LCM\left(T_{PRS,\text{i}}, T_{DRX}\right)$, the least common multiple between $T_{PRS,\text{i}}$ and the DRX cycle length T_{DRX}

  - When UE is configured with RAN eDRX_INACTIVE ≤ 10.24 s:

    T_{DRX} is calculated as T defined in TS 38.304 [1] when CN eDRX_INACTIVE ≤ 10.24 s.

    T_{DRX} is calculated as max(T_{inside}, $T_{outside}$), where T_{inside} and $T_{outside}$ of the CN PTW as defined in TS 38.304 [1].

  - When UE is configured with RAN eDRX_INACTIVE > 10.24 s:

    T_{DRX} is calculated as max(T_{DRX_RAN}, T_{DRX_CN}), T_{DRX_RAN} and T_{DRX_CN} are DRX cycles with the RAN PTW and CN PTW defined in TS 38.304 [1].

  Otherwise, T_{DRX} is the DRX cycle of the UE in the serving cell.

- $T_{PRS,\text{i}}$ is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the positioning frequency layer is used to derive $T_{PRS,\text{i}}$, where,

- $T_{per}^{PRS\ with\ muting} = N_{muting} \times T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource,

- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} \times L_{muting}$, where

- T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

- $\{N, T\}$ is the UE capability combination per band for RRC_INACTIVE state where N is the duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34], T (ms) corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34], and T-N (>0) is the time required to process duration N of DL PRS symbols already buffered in memory, for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34] .

- N' is UE capability for number of DL PRS resources that it can process in a slot in RRC_INACTIVE state as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* specified in TS 37.355 [34].

If the following conditions are met, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with RAN eDRX > 10.24 s, and
- periodic PRS measurement reporting is configured, and
- RAN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and
- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-TDOAProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

If eDRX_INACTIVE cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 5.6A.1.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If $K_{\text{carrier_PRS_RedCap}}$ changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 5.6A.4.5 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC_INACTIVE to RRC_CONNECTED state during the RSTD measurement period, then the UE shall continue the RSTD measurement in the RRC_CONNECTED state. The RSTD measurement period can be longer.

5.6A.4.6 Measurement Period Requirement with RX FH

When physical layer receives last of *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message from LMF via LPP [34], requesting RedCap UE to measure DL RSTD measurement with RX FH via *nr-DL-PRS-RxHoppingRequest-r18* as defined in TS 37.355 [34], the RedCap UE shall be able to measure multiple (up to the RedCap UE capability specified in clause 5.6A.4.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined in clause 5.6A.4.5 with using the following definition for N_{sample} and $L_{available_PRS,\mathrm{i}}$.

N_{sample} is the number of PRS RSTD measurement samples, where

- N_{sample} = 2 if the RedCap UE supports *reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.
- N_{sample} = 4 otherwise.

A measurement sample under RX FH is defined as a PRS measurement over multiple hops.

$L_{available_PRS,\mathrm{i}}$ is the time duration of available PRS in the positioning frequency layer i to be measured, and is calculated by:

$$L_{available_PRS,i} = \sum_{j=1}^{J} N_{hop,i,j} * L_{per-hop,i,j} \quad ,$$

where

- $N_{hop,i,j}$ is the number of hops that UE can perform within a time window occasion *j* as defined in the following, and
- $L_{per-hop,i,j}$ is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured in time window occasion *j* during $T_{available_PRS,\mathrm{i}}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{per-hop,i,j}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered;
- *J* is the number of time window occasions during $T_{available_PRS,\mathrm{i}}$.

The sampling duration per hop is the first $T_{sample,hop}$ symbols in each hop, where $T_{sample,hop} = T_{hop} - RRT_{FH}$, T_{hop} is the applicable length per hop as defined in table 5.6A.4.6-1, and RRT_{FH} is the RF retuning time between Rx hops indicated by UE in *rf-RxRetuneTimeFR1* or *rf-RxRetuneTimeFR2* via *NR-DL-PRS-ProcessingCapability* [34]. The first hop starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the measurement time window, defined in clause 5.6A.1, taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table5.6A.4.6-1: Applicable number of hops per slot and applicable length of each hop

RRT_{FH}	(comb size, Number of PRS symbols)	Applicable number of hops per slot (N_{hops}^{slot})	Applicable length per hop ($T_{per-hop}$) in number of symbols
$RRT_{FH} \leq 2$ symbols	(2, 12) with SCS 15 kHz, 30 kHz in FR1, and 60 kHz, 120 kHz in FR2	2	7
	All others	1	14
2 symbols $< RRT_{FH} \leq 6$ symbols	(≤ 6, any)	1	14
	(12, 12)	½	28
$RRT_{FH} > 6$ symbols	Any combination	½	28

The number of hops within a single time window $N_{hop,i,j}$ is defined as

$$N_{hop,i,j} = min\left(N_{hops,effect,i,j}, \left\lfloor \frac{N3_i}{L_{per-hop,i,j}} \right\rfloor, N_{hop,max,i}\right)$$

where

- $N_{hop,max,i}$ is the maximum number of Rx hops as reported by UE in *maximumFH-Hops* via *NR-DL-PRS-ProcessingCapability* as specified in [34] for positioning frequency layer *i* ,
- $N3_i$ is indicated via UE capability *processingPRS-SymbolsDurationN3-r18* for positioning frequency layer *i*,
- $N_{hops,effect,i,j}$ is the effective number of Rx hops within a single time window occasion *j*,
  - $N_{hops,effect,i,j} = 2 * N_{rep}^{PRS}$, if $N_{hops}^{slot} = 2$,
  - $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1$,
  - $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} > 1$,
  - $N_{hops,effect,i,j} = \left\lfloor \frac{(N_{rep}^{PRS}-1)}{2} \right\rfloor + 1$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} = 1$,

  where N_{rep}^{PRS} is the number of inter-slot PRS repetitions within a single time window, which are unmuted and fully or partially overlapped with the sampling duration within each hop. M_{rep}^{PRS} is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap*, N_{hops}^{slot} is the applicable number of hops per slot as defined in table 5.6A.4.6-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions $\left(N_{rep}^{PRS}\right)$ within a time window instance and the same PRS repetition interval $\left(M_{rep}^{PRS}\right)$, otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of BW_{total} defined as

$$BW_{total} = min\left(BW_{PRS}, N_{hop,i,j} * BW_{per-hop} - \left(N_{hop,i,j} - 1\right) * BW_{overlap}\right),$$

where

BW_{PRS} is the minimum among:

- configured PRS BW, and
- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18* as specified in [34], and
- total BW of all hops requested by LMF via *nr-DL-PRS-RxHoppingTotalBandwidth-r18*.as specified in [34],

$N_{hop,i,j}$ is number of hops within a single time window as define above,

$BW_{per-hop}$ is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16* as specified in [34].

$BW_{overlap}$ is the UE capability on BW of the overlapping RB indicated via *numOfOverlappingPRB-r18* as specified in [34].

5.6A.5 PRS-RSRP measurements for RedCap

5.6A.5.1 Introduction

The requirements in clause 5.6A.5.5 shall apply provided the RedCap UE has received *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report PRS-RSRP measurements defined in TS 38.215 [4] without FH via *nr-DL-PRS-RxHoppingRequest*. And the UE is capable of supporting the PRS-RSRP measurement in RRC_INACTIVE state.

The requirements in clause 5.6A.5.6 shall apply provided the RedCap UE has received *NR-DL-AoD-RequestLocationInformation* message from the LMF via LPP [34] requesting the UE to measure and report PRS-RSRP

measurements defined in TS 38.215 [4] with FH via *nr-DL-PRS-RxHoppingRequest*. And the UE is capable of supporting the PRS-RSRP measurement in RRC_INACTIVE state.

5.6A.5.2 Requirements applicability

The requirements in clause 5.6A.5.5 apply for periodic and triggered PRS-RSRP measurements, provided:

- PRS-RSRP related side conditions given in clause 10.1A.17.2 for FR1 are fulfilled, for a corresponding band, for 1 Rx RedCap UE.
- PRS-RSRP related side conditions given in clause 10.1.24.2 are met for a corresponding Band, for 2Rx RedCap UE.

The requirements in clause 5.6A.5.6 apply for periodic and triggered PRS-RSRP measurements, provided:

- PRS-RSRP related side conditions given in clause 10.1A.17.2 for FR1 are fulfilled, for a corresponding band, for 1 Rx RedCap UE.
- PRS-RSRP related side conditions given in clause 10.1.24.2 are met for a corresponding Band, for 2Rx RedCap UE.

5.6A.5.3 Measurement Capability

UE PRS-RSRP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

5.6A.5.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. If the UE supports reporting of NR positioning measurements via SDT, the UE may be able to report the measurements while it remains in RRC_INACTIVE state; otherwise, the UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For PRS-RSRP measurements performed by the UE in RRC_INACTIVE state, the measurement reporting delay excludes all of the following:

- any delay caused other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH which is equal to $2 \times TTI_{DCCH}$ where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by no UL resources for UE to send the measurement report,
- any transmission delay needed by SDT,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported PRS-RSRP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.24.3.

The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1A.17.2, for each measured DL PRS resource by 1 Rx RedCap UE without FH.

The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1A.17.2, for each measured DL PRS resource by 1 Rx RedCap UE with FH.

The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1A.17.2, for each measured DL PRS resource by 2 Rx RedCap UE without FH.

The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1A.17.2, for each measured DL PRS resource by 2 Rx RedCap UE with FH.

5.6A.5.5 Measurement Period Requirements without RX FH

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], and UE is not configured to perform measurement with RX FH, the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6A.5.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within $T_{PRS-RSRP,total}$.

$$T_{PRS-RSRP,\ total} = \sum_{i=1}^{L} T_{PRS-RSRP,i} + (L-1) \times \max\left(T_{effect,i}\right)$$

Where:

- i is the index of positioning frequency layer,
- L is total number of positioning frequency layers,
- $T_{effect,i}$ is the periodicity of the PRS-RSRP measurement in positioning frequency layer i.

$$T_{PRS-RSRP,i} = \left(K_{carrier_PRS_RedCap} \times N_{RxBeam,i} \times \left\lfloor \frac{N_{PRS,i}^{slot}}{N'} \right\rfloor \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil \times N_{sample} - 1\right) \times T_{effect,i} + T_{last,i}$$Where:

- $K_{carrier_PRS_RedCap}$ is a scaling factor for PRS-based NR positioning measurements in RRC_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier_PRS} = 1$; otherwise,
  - If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, $K_{carrier_PRS_RedCap} = K_{carrier_RedCap} + 1$, where $K_{carrier_RedCap}$ is defined in clause 4.2B.2.4
  - If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier_PRS_RedCap} = N_{layers} + 1$, where N_{layers} is defined in clause 4.2.2.7.
- $N_{RxBeam,i}$ is the UE Rx beam sweeping factor:
  - $N_{RxBeam,i}$ = 1 if positioning frequency layer i is in FR1 or UE has only 1Rx branch,
  - $N_{RxBeam,i}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2*, if positioning frequency layer i is in FR2 or the UE has 2Rx branches, and the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*.
- $N_{RxBeam,i}$ equals to 8, otherwise.
- $L_{available_PRS,i}$ is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.
- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,
- {N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],
- N′ is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* in clause 6.4.3 of TS 37.355 [34],
- N_{sample} is the number of PRS-RSRP measurement samples and
  - N_{sample} = 1, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamplesrequestedDL-PRS-ProcessingSamples* [34], and the following conditions are met:
    - PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

- N_{sample} = 2, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are not met:

  - PRS bandwidth is within the initial BWP and

  - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

- N_{sample} = 4 otherwise

- $T_{last,i} = T_i + T_{available_PRS,i}$ is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time,

- $T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil \times T_{available_PRS,i}$ is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,

- T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- $T_{available_PRS,i} = LCM(T_{PRS,i}, T_{DRX})$, the least common multiple between $T_{PRS,i}$ and the DRX cycle length T_{DRX}

  - When UE is configured with RAN eDRX_INACTIVE ≤ 10.24 s:

  T_{DRX} is calculated as T defined in TS 38.304 [1] when CN eDRX_INACTIVE ≤ 10.24 s.

  T_{DRX} is calculated as max(T_{inside}, $T_{outside}$), where T_{inside} and $T_{outside}$ of the CN PTW as defined in TS 38.304 [1].

  When UE is configured with RAN eDRX_INACTIVE > 10.24 s:

  T_{DRX} is calculated as max(T_{DRX_RAN}, T_{DRX_CN}), T_{DRX_RAN} and T_{DRX_CN} are DRX cycles with the RAN PTW and CN PTW defined in TS 38.304 [1].

  Otherwise, T_{DRX} is the DRX cycle of the UE in the serving cell.

  - $T_{PRS,i}$ is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,

  - T_{DRX} is the DRX cycle length.

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} \times T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among the DL PRS resource sets is used to derive $T_{PRS,i}$, where:

- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} \times L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

When UE is configured with DRX_cycle, the time $T_{PRS-RSRP,total}$ starts from the first DRX cycle containing the DL PRS resources in the assistance data after both the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

If the following conditions are met, the time $T_{PRS-RSRP,\ total}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* messages are delivered from LMF to the UE via LPP [34].

- UE is configured with RAN eDRX > 10.24 s, and

- periodic PRS measurement reporting is configured, and

- RAN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{RSTD,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-TDOAProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* messages are delivered from LMF to the UE via LPP [34].

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 5.6A.4.5.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement then the PRS-RSRP measurement shall meet the UE Rx-Tx time difference measurement requirements defined in clause 5.6A.6.5.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,\mathrm{i}}$ or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

Longer PRS-RSRP measurement period is expected when there is collision/overlap between other DL signals/channels and PRS resources in RRC_INACTIVE state.

The requirements in clause 5.6A.5.5 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If the DRX cycle is reconfigured during the PRS-RSRP measurement period, then the PRS-RSRP measurement period can be longer.

If the eDRX_INACTIVE cycle is reconfigured during the PRS-RSRP measurement period, then the PRS-RSRP measurement period can be longer.

If cell reselection occurs while PRS-RSRPP measurement is being performed, then the UE shall continue and complete the on-going PRS-RSRP measurement after the cell selection is completed. The PRS-RSRP measurement period can be longer.

If the UE's RRC state changes from the RRC_INACTIVE to RRC_CONNECTED during the PRS-RSRP measurement period, then the UE shall continue the PRS-RSRP measurement in the RRC_CONNECTED state. The PRS-RSRP measurement period can be longer.

5.6A.5.6 Measurement Period Requirement with RX FH

When physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], and UE is configured to perform PRS-RSRP measurement with RX FH via *nr-DL-PRS-RxHoppingRequest-r18* as defined in TS 37.355 [34], the UE shall be able to measure multiple (up to the UE capability specified in 5.6A.5.3) PRS-RSRP measurements, defined in TS 38.215 [4], during the measurement period $T_{PRS-RSRP,Total}$ defined in clause 5.6A.5.5 with using the following definition for N_{sample} and $L_{available_PRS,\mathrm{i}}$.

N_{sample} is the number of PRS-RSRP measurement samples, where

- N_{sample} = 2 if the RedCap UE supports *reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

- N_{sample} = 4 otherwise.

A measurement sample under RX FH is defined as a PRS measurement over multiple hops.

$L_{available_PRS,i}$ is the time duration of available PRS in the positioning frequency layer i to be measured, and is calculated by:

$$L_{available_PRS,i} = \sum_{j=1}^{J} N_{hop,i,j} * L_{per-hop,i,j} ,$$

where,

- $N_{hop,i,j}$ is the number of hops that UE can perform within a time window occasion *j* as defined in the following, and
- $L_{per-hop,i,j}$ is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured in a time window occasion *j* during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{per-hop,i,j}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered;
- *J* is the number of time window occasions during $T_{available_PRS,i}$.

The sampling duration per hop is the first $T_{sample,hop}$ symbols in each hop, where $T_{sample,hop} = T_{hop} - RRT_{FH}$, T_{hop} is the applicable length per hop as defined in table 5.6A.5.6-1, and RRT_{FH} is the retuning time between Rx hops indicated by UE in *rf-RxRetuneTimeFR1* or *rf-RxRetuneTimeFR2* via *NR-DL-PRS-ProcessingCapability* [34]. The first hop starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the measurement time window, defined in clause 5.6A.1, taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table5.6A.5.6-1: Applicable number of hops per slot and applicable length of each hop

RRT_{FH}	**(comb size, Number of PRS symbols)**	**Applicable number of hops per slot (N_{hops}^{slot})**	**Applicable length per hop ($T_{per-hop}$) in number of symbols**
$RRT_{FH} \leq 2$ symbols	(2, 12) with SCS 15 kHz, 30 kHz in FR1, and 60 kHz, 120 kHz in FR2	2	7
	All others	1	14
2 symbols $< RRT_{FH} \leq 6$ symbols	(≤ 6, any)	1	14
	(12, 12)	½	28
$RRT_{FH} > 6$ symbols	Any combination	½	28

The number of hops within a single time window $N_{hop,i,j}$ is defined as

$$N_{hop,i,j} = min\left(N_{hops,effect,i,j}, \left\lfloor \frac{N3_i}{L_{per-hop,i,j}} \right\rfloor, N_{hop,max,i}\right),$$

where

- $N_{hop,max,i}$ is the maximum number of Rx hops as reported by UE in *maximumFH-Hops* via *NR-DL-PRS-ProcessingCapability* for positioning frequency layer *i* as specified in [34],
- $N3_i$ is indicated via UE capability *processingPRS-SymbolsDurationN3-r18* for positioning frequency layer *i*,
- $N_{hops,effect,i,j}$ is the effective number of Rx hops within a single time window occasion *j*,
  - $N_{hops,effect,i,j} = 2 * N_{rep}^{PRS}$, if $N_{hops}^{slot} = 2$,
  - $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1$,
  - $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} > 1$,
  - $N_{hops,effect,i,j} = \left\lfloor \frac{(N_{rep}^{PRS}-1)}{2} \right\rfloor + 1$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} = 1$,
  - where N_{rep}^{PRS} is the number of inter-slot PRS repetitions within a single time window, which are unmuted and fully or partially overlapped with the sampling duration within each hop. M_{rep}^{PRS} is the PRS repetition interval

configured by *dl-PRS-ResourceTimeGap*, N_{hops}^{slot} is the applicable number of hops per slot as defined in table 5.6A.5.6-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions $\left(N_{rep}^{PRS}\right)$ within a time window instance and the same PRS repetition interval $\left(M_{rep}^{PRS}\right)$, otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of BW_{total} defined as

$$BW_{total} = min\left(BW_{PRS}, N_{hop,i,j} * BW_{per-hop} - \left(N_{hop,i,j} - 1\right) * BW_{overlap}\right),$$

where

BW_{PRS} is the minimum among:

- configured PRS BW, and
- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18* as specified in [34], and
- total BW of all hops requested by LMF via *nr-DL-PRS-RxHoppingTotalBandwidth-r18* as specified in [34],

$N_{hop,i,j}$ is number of hops within a single time window as define above,

$BW_{per-hop}$ is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16* as specified in [34],

$BW_{overlap}$ is the UE capability on BW of the overlapping RB indicated via *numOfOverlappingPRB-r18* as specified in [34].

5.6A.6 UE Rx-Tx time difference measurements for RedCap

5.6A.6.1 Introduction

The requirements in clause 5.6A.6.5 shall apply, provided the RedCap UE has received *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4] without FH via *nr-DL-PRS-RxHoppingRequest*.

The requirements in clause 5.6A.6.6 shall apply, provided the RedCap UE has received *nr-Multi-RTT-ReqstLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4] with FH via *nr-DL-PRS-RxHoppingRequest*.

5.6A.6.2 Requirements Applicability

The requirements in clause 5.6A.6.5 apply for periodic and triggered UE Rx-Tx time difference measurements, provided:

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1A.18.2.2 for FR1 are fulfilled, for a corresponding band, for 1 Rx RedCap UE.
- UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25.2 are met for a corresponding band, for 2Rx RedCap UE.
- SRS is configured on the PCell.

The requirements in clause 5.6A.6.6 apply for periodic and triggered UE Rx-Tx time difference measurements, provided:

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1A.18.2.4 for FR1 are fulfilled, for a corresponding band, for 1 Rx RedCap UE.

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1A.18.2.3 are met for a corresponding band, for 2RX RedCap UE.

- SRS is configured on the PCell.

5.6A.6.3 Measurement Capability

UE Rx-Tx time difference measurement capability is as indicated by the UE in *NR-Multi-RTT-ProvideCapabilities*, according to TS 37.355 [34].

5.6A.6.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

This measurement reporting delay excludes the delay caused by any of the following:

- delay caused by other LPP signalling on the DCCH.

- delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.

- delay caused due to lack of UL resources for UE to send the measurement report.

- delay required by SDT for reporting the measurement using SDT resources.

- delay required for transition to RRC_CONNECTED state for report the measurement in RRC_CONNECTED.

The UE Rx-Tx time difference measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1A.18.2.2.

The UE Rx-Tx time difference measurement performed and reported according to this section shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1A.18.2.1, for each measured DL PRS resource by 1 Rx RedCap UE without FH.

The UE Rx-Tx time difference measurement performed and reported according to this section shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1A.18.2.4, for each measured DL PRS resource by 2 Rx RedCap UE without FH.

The UE Rx-Tx time difference measurement performed and reported according to this section shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1A.18.2.3, for each measured DL PRS resource by 1 Rx RedCap UE with FH.

The UE Rx-Tx time difference measurement performed and reported according to this section shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1A.25.x.x.z, for each measured DL PRS resource by 2 Rx RedCap UE with FH.

5.6A.6.5 Measurement Period Requirements without RX FH

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34], and UE is not configured to perform measurement with RX FH, UE shall be able to measure multiple (up to the UE capability specified in clause 5.6A.6.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] in configured positioning frequency layers within the measurement period $T_{UERxTx,Total}$ defined in 5.6.4.5.

If the RRC state transion occurs from RRC_INACTIVE to RRC_CONNECTED state during the UE Rx-Tx time difference measurement period, then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the serving cell.

If cell reselection occurs during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the new serving cell.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or
- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If the DRX cycle is reconfigured during the UE Rx-Tx time difference measurement period then the UE Rx-Tx time difference measurement period can be longer.

If during UE Rx-Tx time difference measurement period PRS resources overlap with other DL signals/channels then the UE Rx-Tx time difference measurement period can be longer.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

When PRS-RSRPP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRPP measurements are performed over the same measurement period.

The requirements in clause 5.6.4 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the N_{TA_offset} defined in table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

The UE shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1.25.2.

5.6A.6.6 Measurement Period Requirements with RX FH

When physical layer receives *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34], and UE is configured to perform PRS-RSRP measurement with RX FH via *nr-DL-PRS-RxHoppingRequest-r18* as defined in TS 37.355 [34], the RedCap UE shall be able to measure multiple (up to the RedCap UE capability specified in clause 5.6A.6.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4], during the measurement period $T_{UE\ RxTx,Total}$ defined in clause 5.6.4.5 with using the following definition for N_{sample} and $L_{available_PRS,i}$:

N_{sample} is the number of PRS RSTD measurement samples, where

- N_{sample} = 2 if the RedCap UE supports *reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.
- N_{sample} = 4 otherwise.

A measurement sample under RX FH is defined as a PRS measurement over multiple hops.

$L_{available_PRS,i}$ is the time duration of available PRS in the positioning frequency layer i to be measured, and is calculated by:
$L_{available_PRS,i}$ is the time duration of available PRS in the positioning frequency layer i to be measured, and is calculated by:

$$L_{available_PRS,i} = \sum_{j=1}^{J} N_{hop,i,j} * L_{per-hop,i,j} \quad ,$$

where

- $N_{hop,i,j}$ is the number of hops that UE can perform within a time window occasion *j* as defined in the following, and

- $L_{per-hop,i,j}$ is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured in time window occasion *j* during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{per-hop,i}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered;

- *J* is the number of time window occasions during $T_{available_PRS,i}$.

The sampling duration per hop is the first $T_{sample,hop}$ symbols in each hop, where $T_{sample,hop} = T_{hop} - RRT_{FH}$, T_{hop} is the applicable length per hop as defined in table 5.6A.6.6-1, and RRT_{FH} is the retuning time between Rx hops indicated by UE in *rf-RxRetuneTimeFR1* or *rf-RxRetuneTimeFR2* via *NR-DL-PRS-ProcessingCapability* [34]. The first hop starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the measurement time window, defined in clause 5.6A.1, taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table5.6A.6.6-1: Applicable number of hops per slot and applicable length of each hop

RRT_{FH}	(comb size, Number of PRS symbols)	Applicable number of hops per slot (N_{hops}^{slot})	Applicable length per hop ($T_{per-hop}$) in number of symbols
$RRT_{FH} \leq 2$ symbols	(2, 12) with SCS 15kHz, 30kHz in FR1, and 60kHz, 120kHz in FR2	2	7
	All others	1	14
2 symbols $< RRT_{FH} \leq 6$ symbols	(≤ 6, any)	1	14
	(12, 12)	½	28
$RRT_{FH} > 6$ symbols	Any combination	½	28

The number of hops within a single time window $N_{hop,i,j}$ is defined as

$$N_{hop,i,j} = min\left(N_{hops,effect,i,j}, \left\lfloor \frac{N3_i}{L_{per-hop,i,j}} \right\rfloor, N_{hop,max,i}\right),$$

where

- $N_{hop,max,i}$ is the maximum number of Rx hops as reported by UE in *maximumFH-Hops* via *NR-DL-PRS-ProcessingCapability* as specified in [34] for positioning frequency layer *i* ,

- $N3_i$ is indicated via UE capability *processingPRS-SymbolsDurationN3-r18* for positioning frequency layer *i*,

- $N_{hops,effect,i,j}$ is the effective number of Rx hops within a single time window occasion *j*,

  - $N_{hops,effect,i,j} = 2 * N_{rep}^{PRS}$, if $N_{hops}^{slot} = 2$,

  - $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1$,

  - $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} > 1$,

  - $N_{hops,effect,i,j} = \left\lfloor \frac{(N_{rep}^{PRS}-1)}{2} \right\rfloor + 1$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} = 1$,

  - where N_{rep}^{PRS} is the number of inter-slot PRS repetitions within a single time window, which are unmuted and fully or partially overlapped with the sampling duration within each hop. M_{rep}^{PRS} is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap*, N_{hops}^{slot} is the applicable number of hops per slot as defined in table 5.6A.6.6-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions $\left(N_{rep}^{PRS}\right)$ within a time window instance and the same PRS repetition interval $\left(M_{rep}^{PRS}\right)$, otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of BW_{total} defined as

$$BW_{total} = min\left(BW_{PRS}, N_{hop,i,j} * BW_{per-hop} - \left(N_{hop,i,j} - 1\right) * BW_{overlap}\right),$$

where

BW_{PRS} is the minimum among:

- configured PRS BW, and
- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18* as specified in [34], and
- total BW of all hops requested by LMF via *nr-DL-PRS-RxHoppingTotalBandwidth-r18* as specified in [34],

$N_{hop,i,j}$ is number of hops within a single time window as define above,

$BW_{per-hop}$ is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16* as specified in [34],

$BW_{overlap}$ is the UE capability on BW of the overlapping RB indicated via *numOfOverlappingPRB-r18* as specified in [34].

5.6A.7 PRS-RSRPP measurements for RedCap

5.6A.7.1 Introduction

The requirements in clause 5.6A.7.5 shall apply provided the UE has received a message from LMF via LPP [34] requesting the UE to measure and report PRS-RSRPP measurements defined in TS 38.215 [4]. And the UE is capable of supporting the PRS-RSRPP measurement in RRC INACTIVE state.

The requirements in clause 5.6A.7.6 shall apply provided the RedCap UE has received *NR-DL-AoD-RequestLocationInformation* message from the LMF via LPP [34] requesting the UE to measure and report DL RSRPP measurements defined in TS 38.215 [4] with FH via *nr-DL-PRS-RxHopping-Request*.

5.6A.7.2 Requirements applicability

The requirements in clause 5.6A.7.5 apply for periodic and triggered PRS-RSRPP measurements, provided:

- PRS-RSRPP related side conditions given in clause 10.1A.19.2 for FR1 are fulfilled, for a corresponding band, for 1 Rx RedCap UE.
- PRS-RSRPP related side conditions given in clause 10.1.38.2 are met for a corresponding Band, for 2Rx RedCap UE.

The requirements in clause 5.6A.7.6 apply for periodic and triggered PRS-RSRPP measurements, provided:

- PRS-RSRPP related side conditions given in clause 10.1A.19.2 for FR1 are fulfilled, for a corresponding band, for 1 Rx RedCap UE.
- PRS-RSRPP related side conditions given in clause 10.1A.38.2 are met for a corresponding Band, for 2Rx RedCap UE.

5.6A.7.3 Measurement Capability

UE PRS-RSRPP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

5.6A.7.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. If the UE supports reporting of NR positioning measurements via SDT, the UE may be able to report the measurements while it remains in RRC_INACTIVE state; otherwise, the UE will transition to RRC_CONNECTED state prior to transmitting the measurement report.

For PRS-RSRPP measurements performed by the UE in RRC_INACTIVE state, the measurement reporting delay excludes all of the following:

- any delay caused other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH which is equal to $2 \times TTI_{DCCH}$ where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by no UL resources for UE to send the measurement report,
- any transmission delay needed by SDT,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

The reported PRS-RSRPP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.38.3.

The PRS-RSRPP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1.38.2 for FR1 for 1 Rx RedCap UE.

The PRS-RSRPP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requirements specified in the clause 10.1.38.2 for FR1 and FR2 for 2 Rx RedCap UE.

5.6A.7.5 Measurement Period Requirements without FH

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message in RRC_INACTIVE state, the measurement period requirements for PRS-RSRP in clause 5.6A.5.5 applies.

5.6A.7.6 Measurement period requirement with FH

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message in RRC_INACTIVE state, the measurement period requirements for PRS-RSRP in clause 5.6A.5.6 applies.

5.6B Reporting Delay Requirements for DL AI/ML Positioning

5.6B.1 Introduction

The reporting delay requirements in clause 5.6B shall apply provided the UE supports DL AI/ML positioning specified in TS 38.305 [22] as indicated in *NR-DL-AIML-ProvideCapabilities*, and has received *NR-DL-AIML-RequestLocationInformation* message from LMF via LPP requesting UE to report its location based on DL AI/ML positioning [34].

The position reporting delay is the sum of measurement delay, inference delay, and the time needed until the UE is ready to send the position report to LMF and is defined as the time between the moment when the position report is triggered and the moment when the UE is ready to start to transmit the position report over the air interface. The UE shall be able to send the positioning response within

$$T_{position_reporting_delay} = T_{measurement_delay} + T_{inference_delay},$$

where $T_{measurement_delay}$ is either the measurement period defined in clause 5.6B.2 or the measurement period with bandwidth aggregation as defined in clause 5.6B.3, and the inference delay, $T_{inference_delay}$, is the summation of inference delay across the number of configured PFLs where inference delay per PFL is reported by UE for FG 59-3 and indicated to LMF. For bandwidth aggregation, the inference delay is the sum of inference delays across all effective PFLs where the UE performs aggregated measurements, with inference delay per effective PFL is equal to each per-PFL inference delay reported by the UE for FG 59-3 and indicated to the LMF.

When performing measurements in RRC_INACTIVE state, if the UE supports reporting of NR positioning location information via SDT, the UE may be able to report the positioning while it remains in RRC_INACTIVE state;

otherwise, the UE will transition to RRC_CONNECTED state prior to transmitting the positioning report. Therefore, the positioning reporting delay in RRC_INACTIVE state excludes all of the following:

- additional delay caused by other LPP signalling on the DCCH,
- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH, equal to 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration,
- any delay caused by unavailability of UL resources to transmit the measurement report,
- any transmission delay needed by SDT,
- the time needed to transition to RRC_CONNECTED state to report the measurements.

5.6B.2 Measurements Period Requirements

After receiving both *NR-DL-AIML-ProvideAssistanceData message and NR-DL-AIML-RequestLocationInformation* message from the LMF via LPP [34], the UE shall be able to measure PRS resources within the measurement period $T_{measurement_delay}$ to produce inputs for its AI/ML model to infer its location for reporting. The measurement delay when UE performs PRS measurement within the measurement gap is defined as:

$$T_{measurement_delay,Total} = \sum_{i=1}^{L} T_{measurement_delay,i} + (L-1) * \max(T_{effect,i})$$

Where:

- i is the index of positioning frequency layer,
- L is total number of positioning frequency layers, and
- $T_{effect,i}$ is the periodicity of the PRS measurement in positioning frequency layer i

$T_{measurement_delay,i}$ is the measurement period for PRS measurement in positioning frequency layer *i* as specified below:

$$T_{measurement_delay,i} = \left(K_{carrier_PRS} * N_{Rx,TEG,i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil * \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last,i}$$

,

Where:

- $N_{RxBeam,i}$ is the UE Rx beam sweeping factor:
  - $N_{RxBeam,i}$ = 1 if positioning frequency layer *i* is in FR1. If positioning frequency layer *i* is in FR2, $N_{RxBeam,i}$ equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-AIML-RequestLocationInformation*.
  - $N_{RxBeam,i}$ equals to 8, otherwise.
- $K_{carrier_PRS}$ is a scaling factor for PRS-based NR positioning measurements in RRC_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier_PRS}$ = 1; otherwise,
- If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, $K_{carrier_PRS} = K_{carrier} + 1$, where $K_{carrier}$ is defined in clause 4.2.2.4
- If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier_PRS} = N_{layers} + 1$, where N_{layers} is defined in clause 4.2.2.7.
- $N_{Rx,TEG,i}$ is the Rx TEG specific scaling factor:
  - $N_{Rx,TEG,i}$ = P, where P is the number of UE Rx TEGs configured by LMF for PRS measurement depending on the UE capability regarding the number of UE-RxTEG(s) that is supported by UE and reported for FG 59-6

- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

- $L_{available_PRS,\mathrm{i}}$ is the time duration of available PRS in positioning frequency layer *i* to be measured within $T_{PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,\mathrm{i}}$, only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- N_{sample} is the number of PRS samples, where

  - N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

    - PRS bandwidth is within the initial BWP and

    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

  - N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

    - PRS bandwidth is within the initial BWP and

    - Magnitude of difference between the serving cell's SS-RSRP and the neighbour cell's PRS-RSRP is within 6 dB.

  - N_{sample} = 4 otherwise.

- $T_{last,i}$ is the measurement duration for the last PRS sample in positioning frequency layer *i*, including the sampling time and processing time, $\mathrm{T_{last,i}} = T_{\mathrm{i}} + T_{available_PRS,\mathrm{i}}$,

- $\mathrm{T_{effect},i}$ is the periodicity of the PRS measurement in positioning frequency layer i defined as:

$$T_{\mathrm{effect,i}} = \left\lceil \frac{T_{\mathrm{i}}}{T_{available_PRS,\mathrm{i}}} \right\rceil * T_{available_PRS,\mathrm{i}} ,$$

where:

- T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- $T_{available_PRS,\mathrm{i}} = LCM\left(T_{PRS,\mathrm{i}}, T_{DRX}\right)$, the least common multiple between $T_{PRS,\mathrm{i}}$ and T_{DRX}

- T_{DRX} is defined as following:

  - T_{DRX} is DRX cycle length, defined in clause 7.1 TS 38.304, when no extended DRX (eDRX) cycle is configured

  - T_{DRX} is defined as T in clause 7.1 TS 38.304 when RAN eDRX <= 10.24 s and CN eDRX <= 10.24 s

  - T_{DRX} is the maximum of the T inside and outside of the CN PTW, where T inside and outside of the CN PTW are defined in clause 7.1 TS 38.304, when RAN eDRX <= 10.24 s and CN eDRX > 10.24 s

- T_{DRX} is the maximum of the DRX cycles within the CN PTW and the RAN PTW when RAN eDRX > 10.24 s

- $T_{PRS,\mathrm{i}}$ is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the positioning frequency layer is used to derive $T_{PRS,\mathrm{i}}$, where,

- $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource,

- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where

- T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

- $\{N, T\}$ is the UE capability combination per band for RRC_INACTIVE state where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34], T (ms) corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34], for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- N' is UE capability for number of DL PRS resources that it can process in a slot in RRC_INACTIVE state as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* specified in TS 37.355 [34].

If the following conditions are met, the time $T_{measurement_delay,Total}$ starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with RAN eDRX > 10.24 s, and

- periodic PRS measurement reporting is configured, and

- RAN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the time $T_{measurement_delay,Total}$ starts from the first DL PRS resource(s) after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE 1: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the DRX cycle is reconfigured during the measurement period, then the measurement period can be longer.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels.

Longer measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If $K_{\text{carrier_PRS}}$ changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 5.6B.2 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AIML-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If cell re-selection occurs while measurements are being performed, then the UE shall continue and complete the on-going measurements after the cell selection is completed. The measurement period can be longer.

If the RRC state transition occurs from RRC_INACTIVE to RRC_CONNECTED state during the measurement period then the UE shall continue the measurement in the RRC_CONNECTED state. The measurement period can be longer.

5.6B.3 Measurements Period Requirements with Bandwidth Aggregation

When UE physical layer receives last of NR-DL-AIML-ProvideAssistanceData message, *NR-DL-AIML-RequestLocationInformation* message from LMF via LPP [34] with an indication of PRS resources in multiple PFLs that can be aggregated in *nr-DL-PRS-AggregationInfo*, the UE shall be able to measure PRS resources within the measurement period $T_{measurement_delay}$ to produce inputs for its AI/ML model to infer its location for reporting. The measurement delay when UE performs PRS measurement by aggregating PRS resources in multiple PFLs is defined as:

$$T_{measurement_delay} = T_{measurement_delay,aggr} + T_{measurement_delay,non-aggr} + T_{margin}$$

where:

- $T_{measurement_delay,aggr}$ is the total measurement period for aggregated measurements as defined in this clause, and
- $T_{measurement_delay,non-aggr}$ is the total measurement period for non-aggregated measurements as defined in this clause, and
- When both $T_{measurement_delay,aggr}$ and $T_{measurement_delay,non-aggr}$ are non-zero, then $T_{margin} = T'_{margin}$; otherwise $T_{margin} = 0$, where $T'_{margin} = \max(T_{effect,j})$, and the maximum $T_{effect,j}$ is across all the PFL combination(s) and non-aggregated PFL(s) configured for positioning measurements.

$T_{measurement_delay,non-aggr}$ is zero if every resource set on every PFL is linked for aggregation to at least one other resource set on another PFL. Otherwise, $T_{measurement_delay,non-aggr}$ is as defined in clause 5.6B.2 with the following exceptions,

- only PFLs containing resource set(s) not linked to any other resource set(s) are considered in L,
- on each PFL i, only resource set(s) not linked to any other resource set(s) are considered in $T_{available_PRS,i}$, $N^{slot}_{PRS,i}$ and $L_{available_PRS,i}$,
- N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-Inactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,
- $(L-1) * \max(T_{effect,i})$ is replace by $(L-1) * T'_{margin}$.

$T_{measurement_delay,aggr}$ is zero if no resource sets on any PFL are linked for aggregation with other resource sets on other PFLs. Otherwise, $T_{measurement_delay,aggr}$ is defined as

$$T_{measurement_delay,aggr} = \sum_{m=1}^{M} T_{measurement_delay,aggr,m} + (M-1) * T'_{margin}$$

where:

- m is the index of PFL combination,
- M is total number of PFL combinations,
- $T_{effect,aggr,m}$ is the periodicity of the PRS measurement in PFL combination m as defined in this clause,
- $T_{measurement_delay,aggr,m}$ is the measurement period for PRS measurement in PFL combination m as specified below.

$$T_{measurement_delay,aggr,m} = \left(K_{carrier,aggr} * N_{Rx,TEG,aggr,m} * N_{RxBeam,aggr,m} * \left\lceil \frac{N^{slot}_{PRS,aggr,m}}{N'_{aggr,m}} \right\rceil * \left\lceil \frac{L_{available_{PRS},aggr,m}}{N_{aggr,m}} \right\rceil * N_{sample} - 1\right) * T_{effect,aggr,m} + T_{last,aggr,m},$$

where:

- $K_{carrier,aggr}$ is a scaling factor for PRS measurements in RRC_INACTIVE,

- $K_{carrier,aggr} = 1$ if the UE supports *parallelPRS-MeasRRC-Inactive-r17*,
- Otherwise,
  - If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, $K_{carrier,aggr} = K_{carrier} + 1$, where $K_{carrier}$ is defined in clause 4.2.2.4
  - If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, $K_{carrier,aggr} = N_{layers} + 1$, where N_{layers} is defined in clause 4.2.2.7.
- $N_{Rx,TEG,aggr,m}$ is the scaling factor for PRS measurement with multiple Rx TEGs.
  - $N_{Rx,TEG,aggr,m}$ = P, where P is the number of UE Rx TEGs configured by LMF for PRS measurement depending on the UE capability regarding the number of UE-RxTEG(s) that is supported by UE and reported for FG 59-6
- $N_{RxBeam,aggr,m}$ is a scaling factor for PRS measurements with multiple Rx beams, and is defined as
  - $N_{RxBeam,aggr,m}$ = 1 if PFL combination *m* is in FR1,
  - $N_{RxBeam,aggr,m}$ equals to 8 if PFL combination *m* is in FR2 unless specified otherwise.
- $N_{PRS,aggr,m}^{slot}$ is the maximum number of DL PRS resources in PFL combination *m* configured in a slot, and only the PRS resources in resource set(s) linked to other resource set in PFL combination *m* are counted
- $N'_{aggr,m}$ is the UE capability on maximum number of DL PRS resources that can be processed in a slot for PFL combination *m* as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18* for FR1 and *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18* for FR2 specified in TS 37.355 [34].
- $L_{available_{PRS},aggr,m}$ is the time duration of available PRS resources in PFL combination *m* to be measured during $T_{PRS,aggr,m}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_{PRS},aggr,m}$, only unmuted PRS resources in resource set(s) linked to other resource set in PFL combination *m* and that are not fully overlapped with other higher-priority DL signals/channels are considered.
- $N_{aggr,m}$ is the UE capability on duration of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r18* specified in TS 37.355 [34].
- N_{sample} is number of PRS measurement samples,
  - N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,
  - N_{sample} = 4 otherwise.
- $T_{effect,aggr,m}$ is the periodicity of the PRS measurement in PFL combination m,

$$T_{effect,aggr,m} = \left\lceil \frac{T_{aggr,m}}{T_{available,PRS,aggr,m}} \right\rceil * T_{available,PRS,aggr,m}$$

  - $T_{aggr,m}$ is the UE capability on time for processing of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* specified in TS 37.355 [34].
  - $T_{available,PRS,aggr,m} = LCM(T_{PRS,aggr,m}, T_{DRX})$, the least common multiple between $T_{PRS,aggr,m}$ and the DRX cycle length T_{DRX}, where $T_{PRS,aggr,m}$ is the periodicity of DL PRS resource with muting on PFL combination m.

- If more than one PRS periodicities are configured in PFL combination m, the least common multiple of PRS periodicities $T_{per}^{\text{PRS with muting}}$ among all DL PRS resource sets that are linked to other resource set in PFL combination m, is used to derive $T_{PRS,aggr,m}$, and for each applicable PRS resource set,
  - $T_{per}^{\text{PRS with muting}} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource, and
  - T_{per}^{PRS} is the periodicity of PRS resource set given by the higher-layer parameter *DL-PRS-Periodicity*, and
  - N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

- $T_{last,aggr,m}$ is the measurement duration for the last PRS sample in PFL combination m, including the sampling time and processing time, $T_{last,aggr,m} = T_{aggr,m} + T_{available,PRS,aggr,m}$.

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements are transmitted by the TRP using single Tx chain as defined in clause 5.1.6.5.3 in TS 38.214 [26].

If PRS resources in one or more of the aggregated PFLs in PFL combination m are dropped because of collision with other signals, $T_{measurement_delay,aggr,m}$ can be longer than specified above.

The time $T_{measurement_delay,Total}$ starts from the first DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

NOTE: No separate requirement on non-aggregated measurement based on $T_{measurement_delay,non-aggr}$ or on aggregated measurement based on $T_{measurement_delay,aggr}$ is applied when both $T_{measurement_delay,aggr}$ and $T_{measurement_delay,non-aggr}$ are non-zero.

If the DRX cycle is reconfigured during the measurement period, then the measurement period can be longer.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels.

Longer measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If $K_{carrier_PRS}$ changes for any PFL or any PFL combination during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 5.6B.3 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AIML-ProvideCapabilities*.

If cell re-selection occurs while measurements are being performed, then the UE shall continue and complete the on-going measurements after the cell selection is completed. The measurement period can be longer.

If the RRC state transition occurs from RRC_INACTIVE to RRC_CONNECTED state during the measurement period, then the UE shall continue the measurement in the RRC_CONNECTED state. The measurement period can be longer.

5.7 Random access based Small Data Transmissions (RA-SDT)

5.7.1 Introduction

The requirements in this clause are applicable for the UE performing small data transmissions using 2-step RA or 4-step RA procedures [3].

5.7.2 Requirements for small data transmissions based on 2-step RA

The requirements in clause 6.2.2.3 shall apply.

5.7.3 Requirements for small data transmissions based on 4-step RA

The requirements in clause 6.2.2.2 shall apply.

5.7.4 Applicability conditions for SDT

The UE is not required to meet the following measurement requirements during subsequent SDT transmissions:

- Measurements of inter-frequency NR cells in clause 5.1.2.4
- Measurements of inter-RAT E-UTRAN cells in clause 5.1.2.5
- Idle Mode CA/DC Measurements in clause 5.4

The UE is allowed to delay the reception of PRS resources on the positioning frequency layer until the SDT session is completed if the measurement using PRS resource overlaps with the SDT resources.

5.7B Random access based Small Data Transmissions (RA-SDT) for RedCap

5.7B.1 Introduction

The requirements in this clause are applicable for the UE performing small data transmissions 1 Rx RedCap and 2 Rx RedCap UE using 2-step RA or 4-step RA procedures [3].

The 1 Rx RedCap UE for determining whether to perform SDT procedure defined in clause 5.27 [7] applies:

- sdt-RSRP-Threshold-r17 as the signaled value of sdt-RSRP-Threshold-r17 [2] + 1 dB.

5.7B.2 Requirements for small data transmissions based on 2-step RA

The requirements in clause 6.2.2.3 shall apply.

5.7B.3 Requirements for small data transmissions based on 4-step RA

The requirements in clause 6.2.2.2 shall apply.

5.7B.4 Applicability conditions for RA-SDT for RedCap

The UE is not required to meet the following measurement requirements during SDT transmissions:

- Measurements of inter-frequency NR cells in clause 5.1B.2.4
- Measurements of inter-RAT E-UTRAN cells in clause 5.1B.2.5

5.7D Random access based Small Data Transmissions (RA-SDT) for ATG

The requirements in clause 5.7 shall apply.

5.7E Random access based Small Data Transmissions (RA-SDT) for RedCap UEs with NTN

5.7E.1 Introduction

The requirements in this clause are applicable for the 1 Rx (e)RedCap and 2 Rx (e)RedCap UE with FR1-NTN performing small data transmissions using 2-step RA or 4-step RA procedures [3].

The 1 Rx (e)RedCap UE for determining whether to perform SDT procedure defined in clause 5.27 [7] applies:

- sdt-RSRP-Threshold-r17 as the signaled value of sdt-RSRP-Threshold-r17 [2] + 1 dB.

5.7E.2 Requirements for small data transmissions based on 2-step RA

The requirements in clause 6.2C.2.3 shall apply.

5.7E.3 Requirements for small data transmissions based on 4-step RA

The requirements in clause 6.2C.2.2 shall apply.

5.7E.4 Applicability conditions for RA-SDT

The UE is not required to meet the following measurement requirements during subsequent SDT transmissions:

- Measurements of inter-frequency NR cells in clause 5.1E.2.4
- Measurements of inter-RAT E-UTRAN cells in clause 5.1E.2.5

5.8 Measurement report for fast CA/DC setup

5.8.1 Introduction

The requirements of measurement report for fast CA/DC setup apply in this clause for:

- UE supporting *measValidationReportEMR-r18* and configured with *measIdleCarrierListNR-r16* and/or *measIdleCarrierListEUTRA-r16* by higher layers.
- UE supporting *measValidationReportReselectionMeasurements-r18* and configured with *measReselectionCarrierListNR-r18* higher layers.

A UE supporting *measValidationReportEMR-r18* and *idleInactiveNR-MeasReport-r16* or *idleInactiveEUTRA-MeasReport-r16* shall report the results of the inactive mode measurement specified in the clause 5.4, and according to the measurement reporting requirements specified in the clause 5.8.3.

A UE supporting *measValidationReportReselectionMeasurements-r18* shall report the results of the inactive-mode cell re-selection requirements specified in clause 5.1.2, and according to the measurement reporting requirements specified in the clause 5.8.3.

UE is not required to report for fast CA/DC setup from any measurements during INACTIVE mode for carriers which are not configured by higher layers.

5.8.2 Void

5.8.3 Measurement Report Requirements

The requirements in clause 4.7.3 shall apply.

5.9 INACTIVE mode measurement for LP-WUS operation

5.9.1 Introduction

The UE supporting *LP-WUS capability* in RRC_IDLE shall be capable of:

- performing serving cell measurement based on LP-SS or SSB by LR.
- Monitoring LP-WUS signal when monitoring criteria defined in [1] is met, and
- performing serving cell offloading when serving cell measurement offloading criteria defined in [1] is met, or performing serving cell and neighbour cell measurement relaxation when relaxed measurement criteria defined in [1] is met by MR together with LP-SS or SSB based serving cell measurement by LR.

5.9.2 Requirements

5.9.2.1 UE measurement capability

5.9.2.1.1 LP-WUR measurement capability

The requirements in clause 4.8.2.1.1 could be applied.

5.9.2.1.2 MR measurement capability with LP-WUR

The requirements in clause 4.8.2.1.2 could be applied.

5.9.2.2 LP-WUR serving cell measurement and evaluation requirements

The requirements in clause 4.8.2.2 shall apply.

5.9.2.3 Measurement and evaluation of serving cell by MR

The requirements in clause 4.8.2.3 shall apply.

5.9.2.3A Measurement and evaluation of serving cell by Redcap

The requirements in clause 4.8.2.3A shall apply.5.9.2.4 Measurements of intra-frequency NR cells for UE with LP-WUR

The requirements in clause 4.8.2.4 shall apply.

5.9.2.4A Measurements of intra-frequency NR cells for RedCap UE with LP-WUR

The requirements in clause 4.8A.2.4 shall apply.

5.9.2.5 Measurements of inter-frequency NR cells for UE with LP-WUR

The requirements in clause 4.8.2.5 shall apply when UE with LP-WUR is not configured with eDRX_IDLE and has fulfilled the relaxed measurement criterion.

If UE is not configured to perform PRS measurement, or if UE is configured to perform PRS measurement and supports *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier}$ in clause 4.8.2.5 shall apply regardless of whether the serving cell is subject to CCA or not.

If UE is configured to perform PRS measurement but does not support *parallelPRS-MeasRRC-Inactive-r17*, $K_{carrier}$ is replaced with $K_{carrier}$ + 1, regardless of whether the serving cell is subject to CCA or not.

5.9.2.5A Measurements of inter-frequency NR cells for Redcap with LP-WUR

The requirements in clause 4.8.2.5A shall apply when UE with LP-WUR is not configured with eDRX_IDLE and has fulfilled the relaxed measurement criterion.

5.9.2.6 Measurements of inter-RAT E-UTRAN cells for UE with LP-WUR

The requirements in clause 4.8.2.6 shall apply when UE with LP-WUR is not configured with eDRX_IDLE and has fulfilled the relaxed measurement criterion.

5.9.2.6A Measurements of inter-RAT E-UTRAN cells for Redcap with LP-WUR

The requirements in clause 4.8.2.6A shall apply when UE with LP-WUR is not configured with eDRX_IDLE and has fulfilled the relaxed measurement criterion.

6 RRC_CONNECTED state mobility

6.1 Handover

6.1.1 NR Handover

6.1.1.1 Introduction

The purpose of NR handover is to change the NR PCell to another NR cell. The requirements in this clause are applicable to SA NR, NE-DC and NR-DC.

Handover is defined as intra-frequency handover if the center frequency and subcarrier spacing (SCS) of the reference SSB of the serving cell is same as the center frequency and SCS of the reference SSB of the target cell, where:

- The reference SSB of the serving cell is the SSB in the active DL BWP of serving cell
- The reference SSB of the target cell is the SSB in the first active DL BWP of the target cell upon reconfiguration.

The requirements in this clause apply for the following handover scenarios:

- Handover to the first active DL BWP of the target cell associated with CD-SSB;
- Handover to the first active DL BWP of the target cell associated with NCD-SSB if the UE supports *ncd-SSB-BWP-Wor-r18*.

6.1.1.2 NR FR1 - NR FR1 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR1 cell to NR FR1 cell, and to inter-frequency handover from NR FR1 cell in a carrier frequency with CCA to NR FR1 cell.

6.1.1.2.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ msec from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.2.2.

6.1.1.2.2 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

- If the target cell is a known intra-frequency cell, then T_{search} = 0 ms.
- If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then $T_{search} = T_{rs}$ ms.
- If the target cell is a known inter-frequency cell, then
  - For a UE supporting *ncd-SSB-BWP-Wor-r18*:
    - if the measured SSB is the target SSB for handover of the target cell, T_{search} = 0 ms;
    - if the measured SSB and the target SSB for handover belong to the same NR target cell and are not the same SSB, $T_{search} = T_{rs}$ ms provided one of the following conditions is satisfied:
      - The measured SSB is the CD-SSB in the target cell and the HO target SSB is the NCD-SSB in the first active DL BWP, or
      - The measured SSB is the NCD-SSB in the target cell and the HO target SSB is the CD-SSB in the first active DL BWP, or
      - The measured SSB is the NCD-SSB in the target cell and the HO target SSB is the NCD-SSB and they are within different DL BWPs
    - For a UE not supporting *ncd-SSB-BWP-Wor-r18,* then T_{search} = 0 ms.
  - If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, $T_{search} = 3 * T_{rs}$ ms.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell.

$T_{\Delta} = T_{rs}$ for both known and unknown target cells operating with 20 PRB SSB BW.

$T_{\Delta} = 3*T_{rs}$ for both known and unknown target cells operating with 12 PRB SSB BW.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, T_{rs} is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5

ms. There is no requirement if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in clause 9.2.5 for intra-frequency handover and clause 9.3.4 for inter-frequency handover.

6.1.1.3 NR FR2- NR FR1 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR2 cell to NR FR1 cell.

6.1.1.3.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ ms from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.3.2.

6.1.1.3.2 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

- If the target cell is a known intra-frequency cell, then T_{search} = 0 ms.
- If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then $T_{search} = T_{rs}$ ms.
- If the target cell is a known inter-frequency cell, then
  - For a UE supporting *ncd-SSB-BWP-Wor-r18*:
    - if the measured SSB is the target SSB for handover of the target cell, T_{search} = 0 ms;
    - if the measured SSB and the target SSB for handover belong to the same NR target cell and are not the same SSB, $T_{search} = T_{rs}$ ms provided one of the following conditions is satisfied:
      - The measured SSB is the CD-SSB in the target cell and the HO target SSB is the NCD-SSB in the first active DL BWP, or
      - The measured SSB is the NCD-SSB in the target cell and the HO target SSB is the CD-SSB in the first active DL BWP, or
      - The measured SSB is the NCD-SSB in the target cell and the HO target SSB is the NCD-SSB and they are within different DL BWPs
  - For a UE not supporting *ncd-SSB-BWP-Wor-r18*, then T_{search} = 0 ms.
- If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, $T_{search} = 3 * T_{rs}$ ms.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell.

T_{Δ} = T_{rs} for both known and unknown target cells operating with 20 PRB SSB BW.

T_{Δ} = 3*T_{rs} for both known and unknown target cells operating with 12 PRB SSB BW.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 40 ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If such measObjectNRs configured by MN and SN have different SMTC, T_{rs} is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in clause 9.2.5 for intra-frequency handover and clause 9.3.4 for inter-frequency handover.

6.1.1.4 NR FR2- NR FR2 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR2 cell to NR FR2 cell.

6.1.1.4.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ ms from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.4.2.

6.1.1.4.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the handover command is received by the UE. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

- If the target cell is a known intra-frequency cell, then T_{search} = 0 ms.
- If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then T_{search} = N* T_{rs} ms.
- If the target cell is a known inter-frequency cell, then
  - For a UE supporting *ncd-SSB-BWP-Wor-r18*:
    - if the measured SSB is the target SSB for handover of the target cell, T_{search} = 0 ms;
    - if the measured SSB and the target SSB for handover belong to the same NR target cell and are not the same SSB, T_{search} = T_{rs} ms provided one of the following conditions is satisfied:

- The measured SSB is the CD-SSB in the target cell and the HO target SSB is the NCD-SSB in the first active DL BWP, or
- The measured SSB is the NCD-SSB in the target cell and the HO target SSB is the CD-SSB in the first active DL BWP, or
- The measured SSB is the NCD-SSB in the target cell and the HO target SSB is the NCD-SSB and they are within different DL BWPs

- For a UE not supporting *ncd-SSB-BWP-Wor-r18*, then T_{search} = 0 ms.
- If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, T_{search} = N*3* T_{rs} ms.

Where

N = *reduced beam sweeping factor* when the UE supports *Rel-19 L3 fast Rx beam sweeping* and the conditions in clause 3.6.21 are fulfilled, otherwise N = 8 when the target cell is in FR2-1, and N = 12 when the target cell is in FR2-2.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. T_{Δ} = T_{rs} for both known and unknown target cell.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If such measObjectNRs configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

In FR2, the target cell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the handover command:
  - the UE has sent a valid measurement report for the target cell and
  - One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell,
- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell.

otherwise, it is unknown.

6.1.1.5 NR FR1- NR FR2 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR2 cell.

6.1.1.5.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ ms from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.5.2.

6.1.1.5.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When in inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the handover command is received by the UE. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

- If the target cell is a known intra-frequency cell, then T_{search} = 0 ms.
- If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then T_{search} = N* T_{rs} ms.
- If the target cell is a known inter-frequency cell, then
  - For a UE supporting *ncd-SSB-BWP-Wor-r18*:
    - if the measured SSB is the target SSB for handover of the target cell, T_{search} = 0 ms;
    - if the measured SSB and the target SSB for handover belong to the same NR target cell and are not the same SSB, T_{search} = T_{rs} ms provided one of the following conditions is satisfied:
      - The measured SSB is the CD-SSB in the target cell and the HO target SSB is the NCD-SSB in the first active DL BWP, or
      - The measured SSB is the NCD-SSB in the target cell and the HO target SSB is the CD-SSB in the first active DL BWP, or
      - The measured SSB is the NCD-SSB in the target cell and the HO target SSB is the NCD-SSB and they are within different DL BWPs
- For a UE not supporting *ncd-SSB-BWP-Wor-r18*, then T_{search} = 0 ms.
- If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, T_{search} = N*3* T_{rs} ms.

Where N = *reduced beam sweeping factor* when the UE supports *Rel-19 L3 fast Rx beam sweeping* and the conditions in clause 3.6.21 are fulfilled, otherwise N = 8 when the target cell is in FR2-1, and N = 12 when the target cell is in FR2-2.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up 40 ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. T_{Δ} = T_{rs} for both known and unknown target cell.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If such measObjectNRs configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

In FR2, the target cell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the handover command:
  - the UE has sent a valid measurement report for the target cell and
  - One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.3,
- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in clause 9.3.

otherwise, it is unknown.

6.1.2 NR Handover to other RATs

6.1.2.1 NR – E-UTRAN Handover

6.1.2.1.1 Introduction

The purpose of inter-RAT handover from NR to E-UTRAN is to change the radio access mode of PCell from NR to E-UTRAN. The handover procedure is initiated from NR with a RRC message that implies a handover as described in TS 38.331 [2]. The requirements in this clause are applicable to SA NR, NE-DC and NR-DC, and to handover from SA NR cell in a carrier frequency with CCA to E-UTRAN.

6.1.2.1.2 Handover delay

When the UE receives a RRC message implying handover to E-UTRAN the UE shall be ready to start the transmission of the uplink PRACH channel in E-UTRA within $D_{handover}$ ms from the end of the last TTI containing the RRC command. $D_{handover}$ is defined as

$$D_{handover} = T_{RRC_procedure_delay} + T_{interrupt}$$

Where:

$T_{RRC_procedure_delay}$: it is the RRC procedure delay, which is 50 ms

$T_{interrupt}$: it is the time between end of the last TTI containing the RRC command on the NR PDSCH and the time the UE starts transmission of the PRACH in E-UTRAN, excluding $T_{RRC_procedure_delay}$. $T_{interrupt}$ is defined in clause 6.1.2.1.3.

6.1.2.1.3 Interruption time

When the inter-RAT handover to E-UTRAN is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + 20 \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then T_{search} = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then T_{search} = 80 ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to 30 ms. If PRACH occasion is configured in radio frames with even SFN and the relative time difference between radio frame *i* in the current cell and the target cell is larger than or equal to 153600·Ts, the UE is allowed an additional MIB reception delay of 50ms.

NOTE: The actual value of T_{IU} shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant E-UTRAN cell identification requirements are described in clause 9.4.1.

6.1.2.2 NR – UTRAN Handover

6.1.2.2.1 Introduction

The purpose of inter-RAT handover from NR to UTRAN is to change the radio access mode from NR to UTRAN. The handover procedure is initiated from NR with a RRC message that implies a hard handover as described in TS 38.331 [2].

6.1.2.2.2 Handover delay

When the UE receives a RRC message implying handover to UTRAN the UE shall be ready to start the transmission of the new UTRA uplink DPCCH within $D_{handover}$ msfrom the end of the last NR TTI containing the RRC *MobilityfromNRCommand* command.

where:

- $D_{handover}$ equals the RRC procedure delay, which is 50 ms plus the interruption time stated in clause 6.1.2.2.3.

6.1.2.2.3 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the NR PDSCH and the time the UE starts transmission on the uplink DPCCH in UTRAN, excluding the RRC procedure delay. The interruption time depends on whether the target cell is known to the UE or not.

The target cell is known if it has been measured by the UE during the last 5 seconds otherwise it is unknown. The UE shall always perform a UTRA synchronisation procedure as part of the handover procedure.

If the target cell is known the interruption time shall be less than $T_{interrupt1}$

$$T_{interrupt1} = T_{IU}+T_{sync}+50+ 10*F_{max} + T_{MC} \text{ ms}$$

If the target cell is unknown the interruption time shall be less than $T_{interrupt2}$

$$T_{interrupt2} = T_{IU}+T_{sync}+150 + 10*F_{max} + T_{MC} \text{ ms}$$

This requirement shall be met, if there is one target cell in the *MobilityfromNRCommand* command. Performance requirements for E-UTRA to UTRA soft handover are not specified. When UE is connected to an NR cell, UTRA SFN timing measurements are not reported. This implies that the timing of the DPCH of the UTRA target cells in the active set cannot be configured by UTRAN to guarantee that all target cells fall within the UE reception window of T_0 +/- 148 chips.

Where:

- T_{IU} is the interruption uncertainty when changing the timing from the NR to the new UTRAN cell. T_{IU} can be up to one UTRA frame (10 ms).

- F_{max} denotes the maximum number of radio frames within the transmission time intervals of all transport channels that are multiplexed into the same CCTrCH on the UTRA target cell. If HS-PDSCH is configured in the UTRA target cell, F_{max} is 4 radio frames.

- T_{sync} is the time required for measuring the downlink DPCCH channel as stated in TS 25.214 [32], clause 4.3.1.2. In case higher layers indicate the usage of a post-verification period T_{sync}=0 ms. Otherwise T_{sync}=40 ms.

- T_{MC} is 0 ms if a single UTRA cell is configured as the handover target, otherwise 20 ms if handover to UTRA with 1, 2 or 3 UTRA carriers with secondary HS-PDSCH is configured.

The phase reference is the primary CPICH.

The requirements in this clause assume that N312 has the smallest possible value i.e. only one insync is required.

6.1.3 NR DAPS Handover

6.1.3.1 Introduction

The requirements in this clause are applicable to DAPS handover to change the NR PCell to another NR cell.

NOTE: requirements only apply if

- the UE indicates 'no-gap' via *intraFreq-needForGap* for intra-frequency measurement of source cell and intra-frequency measurement of target cell, or
- the SSB of source cell is completely contained in the active DL BWP of the source cell, and the SSB of target cell is completely contained in the active DL BWP of the target cell, or
- the initial DL and UL BWP of source cell is confined within the active DL and UL BWP of the source cell respectively, and the initial DL and UL BWP of target cell is confined within the active DL and UL BWP of the target cell respectively.

6.1.3.2 NR FR1 - NR FR1 DAPS Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR1 cell to NR FR1 cell. A DAPS handover is intra-frequency if the centre frequency of the SSB of the source cell and the centre frequency of the SSB of the target cell are the same, and the subcarrier spacing of the two SSBs are also the same.

NOTE: For intra-frequency DAPS handover, no requirement applies if active DL and UL BWP of target cell is not confined within the active DL and UL BWP of the source cell respectively.

NOTE: For inter-frequency DAPS handover, no requirement applies if the BWP of target cell is overlapped with the BWP of source cell in frequency domain.

An FR1 DAPS handover is synchronous if it meets the conditions in table 6.1.3.2-1, otherwise it is asynchronous

Table 6.1.3.2-1: Sync conditions for FR1 DAPS handover

Type of handover	Maximum receive timing difference between source and target cell (μs) for sync DAPS handover	Maximum transmit timing difference between source and target cell (μs) for sync DAPS handover
Intra-frequency Note 1,2,3	6μs	7.6 μs
Intra-band inter-frequency Note 1,2,3	6μs	7.6 μs
Inter-band inter-frequency	33 μs	34.6 μs

NOTE 1: For synchronous DAPS handover, if the receive time difference exceeds the cyclic prefix length of that SCS, demodulation performance degradation is expected for the first symbol of the slot. For asynchronous DAPS handover, if the receive time difference exceeds the cyclic prefix length of that SCS, interruptions may occur depending on UE implementation. The duration and frequency of occurrence of such interruptions is not specified.

NOTE 2: For DAPS handover on a TDD band, after starting RACH procedure, a UE is not required to transmit in the uplink to any of source and target cells earlier than N_{RX-TX} after the end of the last received downlink symbol from any of source and target cells in the same TDD band where N_{RX-TX}=25600Tc.

NOTE 3: For DAPS handover on a TDD band, after starting RACH procedure, a UE is not required to receive in the downlink from any of source and target cells earlier than N_{TX-RX} after the end of the last transmitted uplink symbol to any of source and target cells in the same TDD band where N_{TX-RX}=25600Tc.

6.1.3.2.1 DAPS handover delay

Procedure delays for the procedure that can command a DAPS handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover1}$ seconds from the end of the last TTI containing the RRC command when UE is configured with dual active protocol stack handover.

$$D_{handover1} = T_{RRC_procedure} + T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

$T_{RRC_procedure}$ is the maximum RRC procedure delay as specified in clause 12 in TS 38.331 [2].

T_{search}, T_{IU}, $T_{processing}$, T_{Δ} and T_{margin} are defined in clause 6.1.1.2.2.

After successful RACH procedure of the target cell, when the UE receives an RRC message implying source cell release command, the UE shall accomplish the release actions specified in TS 38.331 [2] within $D_{handover2}$.

$D_{handover2} = T_{RRC_procedure} + T_{interrupt2}$

Where:

$T_{RRC_procedure}$ is the RRC procedure delay as specified in clause 12 in TS 38.331 [2].

$T_{interrupt2}$ is defined in clause 6.1.3.2.2.

6.1.3.2.2 Interruption time

During $D_{handover1}$, the UE is allowed an interruption of up to $T_{interrupt1}$ on source cell.

For FR1-to-FR1 intra-frequency handover, $T_{interrupt1}$ is specified in table 6.1.3.2.2-1.

Table 6.1.3.2.2-1: $T_{interrupt1}$ for FR1-to-FR1 intra-frequency DAPS HO

μ	NR Slot length (ms)	Interruption length $T_{interrupt1}$ (slots[Note 1]), synchronous DAPS HO	Interruption length $T_{interrupt1}$ (slots[Note 1]), asynchronous DAPS HO
0	1	1	2
1	0.5	2	3
2	0.25	4	5
NOTE 1: The same SCS of source cell and target cell is assumed. NOTE 2: It is assumed that the BWP of target cell is not larger than the BWP of source cell. It is assumed that the CBW of target cell is not larger than the CBW of source cell NOTE 3: Void			

For FR1-to-FR1 intra-band inter-frequency handover, $T_{interrupt1}$ is specified in table 6.1.3.2.2-2.

Table 6.1.3.2.2-2: $T_{interrupt1}$ for FR1-to-FR1 intra-band inter-frequency DAPS HO

μ	NR Slot length (ms)	$T_{interrupt1}$ (slots[Note 1]), synchronous DAPS HO	$T_{interrupt1}$ (slots[Note 1]), asynchronous DAPS HO
0	1	$1 + T_{SMTC_duration} * N_{slot}^{subframe,\mu}$	$2+ T_{SMTC_duration} * N_{slot}^{subframe,\mu}$
1	0.5	$2 + T_{SMTC_duration} * N_{slot}^{subframe,\mu}$	$3+ T_{SMTC_duration} * N_{slot}^{subframe,\mu}$
2	0.25	$4 + T_{SMTC_duration} * N_{slot}^{subframe,\mu}$	$5+ T_{SMTC_duration} * N_{slot}^{subframe,\mu}$
NOTE 1: The same SCS of source cell and target cell is assumed. NOTE 2: $T_{SMTC_duration}$ measured in subframes is the longest SMTC duration between source cell and target cell. NOTE 3: Void NOTE 4: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].			

For FR1-to-FR1 inter-band handover, $T_{interrupt1}$ is specified in table 6.1.3.2.2-3.

Table 6.1.3.2.2-3: $T_{interrupt1}$ for FR1-to-FR1 inter-band DAPS HO

μ	NR Slot length (ms) of source cell	$T_{interrupt1}$ (slots)	
		Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	5

For FR1-to-FR1 intra-frequency handover, $T_{interrupt2}$ is specified in table 6.1.3.2.2-4 when the BWP of target cell is smaller than the BWP of source cell, and $T_{interrupt2}$ is specified in table 6.1.3.2.2-5 when the same BWP is used for target cell and source cell.

Table 6.1.3.2.2-4: $T_{interrupt2}$ for FR1-to-FR1 intra-frequency DAPS HO

μ	NR Slot length (ms)	Interruption length X (slots[Note 1])	$T_{interrupt2}$ (slots[Note 1]) for asynchronous DAPS HO
0	1	2	3
1	0.5	4	5
2	0.25	8	9
NOTE 1: The same SCS of source cell and target cell is assumed. NOTE 2: It is assumed that the BWP of target cell is smaller than the BWP of source cell.			

Table 6.1.3.2.2-5: $T_{interrupt2}$ for FR1-to-FR1 intra-frequency DAPS HO

μ	NR Slot length (ms)	Interruption length X (slots[Note 1])	$T_{interrupt2}$ (slots[Note 1]) for asynchronous DAPS HO
0	1	1	2
1	0.5	2	3
2	0.25	4	5
NOTE 1: The same SCS of source cell and target cell is assumed. NOTE 2: It is assumed that the BWP of target cell is the same as the BWP of source cell. NOTE 3: Void			

For FR1-to-FR1 intra-band inter-frequency handover, $T_{interrupt2}$ is specified in table 6.1.3.2.2-6.

Table 6.1.3.2.2-6: $T_{interrupt2}$ for FR1-to-FR1 intra-band inter-frequency DAPS HO

μ	NR Slot length (ms)	$T_{interrupt2}$ (slots[Note 1]) for synchronous DAPS HO	$T_{interrupt2}$ (slots[Note 1]) for asynchronous DAPS HO
0	1	$1 + T_{SMTC_duration} * N_{slot}^{subframe,\mu}$	$2+ T_{SMTC_duration} * N_{slot}^{subframe,\mu}$
1	0.5	$2 + T_{SMTC_duration} * N_{slot}^{subframe,\mu}$	$3+ T_{SMTC_duration} * N_{slot}^{subframe,\mu}$
2	0.25	$4 + T_{SMTC_duration} * N_{slot}^{subframe,\mu}$	$5+ T_{SMTC_duration} * N_{slot}^{subframe,\mu}$
NOTE 1: The same SCS of source cell and target cell is assumed. NOTE 2: $T_{SMTC_duration}$ measured in subframes is the longest SMTC duration between source cell and target cell. NOTE 3: Void. NOTE 4: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].			

For FR1-to-FR1 inter-band handover, $T_{interrupt2}$ is specified in table 6.1.3.2.2-7.

Table 6.1.3.2.2-7: $T_{interrupt2}$ for FR1-to-FR1 inter-band DAPS HO

μ	NR slot length (ms) of target cell	$T_{interrupt2}$ (slots)	
		Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	5

6.1.3.3 NR FR2- NR FR1 DAPS Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR2 cell to NR FR1 cell.

An FR2-FR1 DAPS handover is synchronous if it meets the conditions in table 6.1.3.3-1, otherwise it is asynchronous

Table 6.1.3.3-1: Sync condition for FR2-FR1 DAPS handover

Frequency Range of the pair of carriers	Maximum receive timing difference between source and tagettarget cell (μs) for sync DAPS handover	Maximum transmit timing difference between source and tagettarget cell (μs) for sync DAPS handover
Between FR1 and FR2	25	26.1

6.1.3.3.1 DAPS handover delay

Procedure delays for the procedure that can command a DAPS handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover1}$ ms from the end of the last TTI containing the RRC command when UE is configured with dual active protocol stack handover.

$$D_{handover1} = T_{RRC_procedure} + T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

$T_{RRC_procedure}$ is the maximum RRC procedure delay as specified in clause 12 in TS 38.331 [2].

T_{search}, T_{IU}, $T_{processing}$, T_{Δ} and T_{margin} are defined in clause 6.1.1.3.2.

After successful RACH procedure of the target cell, when the UE receives an RRC message implying source cell release command, the UE shall accomplish the release actions specified in TS 38.331 [2] within $D_{handover2}$.

$$D_{handover2} = T_{RRC_procedure} + T_{interrupt2}$$

Where:

$T_{RRC_procedure}$ is the RRC procedure delay as specified in clause 12 in TS 38.331 [2].

$T_{interrupt2}$ is defined in clause 6.1.3.3.2.

6.1.3.3.2 Interruption time

During $D_{handover1}$, the UE is allowed an interruption of up to $T_{interrupt1}$ on source cell.

For FR2-to-FR1 inter-band handover, $T_{interrupt1}$ is specified in table 6.1.3.3.2-1.

Table 6.1.3.3.2-1: $T_{interrupt1}$ for FR2-to-FR1 inter-band DAPS HO

μ	NR slot length (ms) of source cell	$T_{interrupt1}$ (slots)	
		Sync	Async
2	0.25	5	5
3	0.125	9	9

During $D_{handover2}$, the UE is allowed an interruption of up to $T_{interrupt2}$ on target cell.

For FR2-to-FR1 inter-band handover, $T_{interrupt2}$ is specified in table 6.1.3.3.2-2.

Table 6.1.3.3.2-2: $T_{interrupt2}$ for FR2-to-FR1 inter-band DAPS HO

μ	NR slot length (ms) of target cell	$T_{interrupt2}$ (slots)	
		Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	5

6.1.3.4 NR FR1- NR FR2 DAPS Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR2 cell.

An FR1-FR2 DAPS handover is synchronous if it meets the conditions in table 6.1.3.4-1, otherwise it is asynchronous

Table 6.1.3.4-1: Sync condition for FR1-FR2 DAPS handover

Frequency Range of the pair of carriers	Maximum receive timing difference between source and tagettarget cell (μs) for sync DAPS handover	Maximum transmit timing difference between source and tagettarget cell (μs)Note 1 sync DAPS handover
Between FR1 and FR2	25	26.1

6.1.3.4.1 DAPS handover delay

Procedure delays for the procedure that can command a DAPS handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover1}$ ms from the end of the last TTI containing the RRC command when UE is configured with dual active protocol stack handover.

$$D_{handover1} = T_{RRC_procedure} + T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

$T_{RRC_procedure}$ is the maximum RRC procedure delay as specified in clause 12 in TS 38.331 [2].

T_{search}, T_{IU}, $T_{processing}$, T_{Δ} and T_{margin} are defined in clause 6.1.1.5.2.

After successful RACH procedure of the target cell, when the UE receives an RRC message implying source cell release command, the UE shall accomplish the release actions specified in TS 38.331 [2] within $D_{handover2}$.

$D_{handover2} = T_{RRC_procedure} + T_{interrupt2}$

Where:

$T_{RRC_procedure}$ is the RRC procedure delay as specified in clause 12 in TS 38.331 [2].

$T_{interrupt2}$ is defined in clause 6.1.3.4.2.

6.1.3.4.2 Interruption time

During $D_{handover1}$, the UE is allowed an interruption of up to $T_{interrupt1}$ on source cell.

For FR1-to-FR2 inter-band handover, $T_{interrupt1}$ is specified in table 6.1.3.4.2-1.

Table 6.1.3.4.2-1: $T_{interrupt1}$ for FR1-to-FR2 inter-band DAPS HO

μ	NR slot length (ms) of source cell	$T_{interrupt1}$ (slots)	
		Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	5

During $D_{handover2}$, the UE is allowed an interruption of up to $T_{interrupt2}$ on target cell.

For FR1-to-FR2 inter-band handover, $T_{interrupt2}$ is specified in table 6.1.3.4.2-2.

Table 6.1.3.4.2-2: $T_{interrupt2}$ for FR1-to-FR2 inter-band DAPS HO

μ	NR slot length (ms) of target cell	$T_{interrupt2}$ (slots)	
		Sync	Async
2	0.25	5	5
3	0.125	9	9

6.1.4 NR Conditional Handover

6.1.4.1 Introduction

The requirements in this clause are applicable to conditional handover to change the NR PCell to another NR cell.

6.1.4.2 NR FR1 – NR FR1 conditional handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handover from NR FR1 cell to NR FR1 cell.

6.1.4.2.1 Handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel within D_{CHO} seconds from the end of the last TTI containing the RRC command.

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{CHO_execution} + T_{interrupt}$$

Where:

T_{RRC} is the RRC procedure delay defined in clause 12 in TS 38.331 [2].

T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until

- a condition exists at the measurement reference point which will trigger the conditional handover, or
- a condition exists at the measurement reference point which will trigger the NES-based conditional handover

$T_{measure}$ is the time for the UE to measure and realize the condition for CHO is fulfilled. $T_{measure}$ equals to the measurements time stated in clause 6.1.4.2.2.

$T_{CHO_execution}$ is the conditional execution preparation time in clause 6.1.4.2.3.

$T_{interrupt}$ is the interruption time stated in clause 6.1.4.2.4.

The NES-based conditional handover delay requirements shall apply if UE receives a RRC message implying NES-based conditional handover before receiving the NES indication in DCI 2-9 command.

UE is not expected to receive a NES indication in DCI 2-9 command before receiving a RRC message implying NES-based conditional handover. When UE receives a RRC message implying NES-based conditional handover but no NES indication in DCI 2-9 command no NES-based conditional handover requirement is applied. The NES indication is specified in clause 5.5.4 in TS 38.331[2].

6.1.4.2.2 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE starts handover execution preparation ($T_{CHO_execution}$) to a target cell.

For conditional intra-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify_intra_without_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2.

For conditional inter-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_inter_with_index}$ or $T_{identify_inter_without_index}$ defined in clause 9.3.4 or clause 9.3.9.

For NES-based conditional intra-frequency handover:

- If UE successfully decodes DCI 2-9 command earlier than the time at the end of $T_{Event_DU} + T_{identify_intra_with_index}$ or $T_{Event_DU} + T_{identify_intra_without_index}$, then the measurement time delay equal to $T_{identify_intra_with_index}$ or $T_{identify_intra_without_index}$

- If UE successfully decodes DCI 2-9 command later than the time at the end of $T_{Event_DU} + T_{identify_intra_with_index}$ or $T_{Event_DU} + T_{identify_intra_without_index}$, and the condition of NES-based CHO keeps existing till UE receiving the DCI 2-9 command, then the measurement time delay equals to the time from the end of T_{Event_DU} until UE successfully decodes DCI 2-9 command.

- If UE successfully decodes DCI 2-9 command later than the time at the end of $T_{Event_DU} + T_{identify_intra_with_index}$ or $T_{Event_DU} + T_{identify_intra_without_index}$, and the condition of NES-based CHO is not met when receiving the DCI 2-9 command, then the measurement time delay equals to the time span from the end of T_{Event_DU} until a condition keeps existing for $T_{SSB\ measurement\ period_intra}$ which will immediately trigger the NES-based conditional handover after DCI 2-9.

For NES-based conditional inter-frequency handover:

- If UE successfully decodes DCI 2-9 command earlier than the time at the end of $T_{Event_DU} + T_{identify_inter_with_index}$ or $T_{Event_DU} + T_{identify_inter_without_index}$, and the condition of NES-based CHO keeps existing till UE receiving the DCI 2-9 command, then the measurement time delay equal to $T_{identify_inter_with_index}$ or $T_{identify_inter_without_index}$

- If UE successfully decodes DCI 2-9 command later than the time at the end of $T_{Event_DU} + T_{identify_inter_with_index}$ or $T_{Event_DU} + T_{identify_inter_without_index}$, then the measurement time delay equals to the time from the end of T_{Event_DU} until UE successfully decodes DCI 2-9 command.

- If UE successfully decodes DCI 2-9 command later than the time at the end of $T_{Event_DU} + T_{identify_inter_with_index}$ or $T_{Event_DU} + T_{identify_inter_without_index}$, and the condition of NES-based CHO is not met when receiving the DCI 2-9 command, then the measurement time delay equals to the time span from the end of T_{Event_DU} until a condition keeps existing for $T_{SSB\ measurement\ period_inter}$ which will immediately trigger the NES-based conditional handover after DCI 2-9.

When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency handover or $T_{identify_inter_without_index}$ for inter-frequency handover. If a cell which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency handover or $T_{identify_inter_without_index}$ for inter-frequency handover becomes undetectable for a period and then the cell becomes detectable again and triggers a handover, the measurement time delay shall be less than $T_{SSB_measurement_period_intra}$ or $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

6.1.4.2.3 Preparation time

$T_{CHO_execution}$ is the UE execution preparation time for conditional handover. $T_{CHO_execution}$ can be up to 10ms.

For conditional handover, it starts after UE realizes the condition of CHO is fulfilled and identity of the target cell is determined.

For NES-based conditional handover,

- It starts after UE realizes the condition of CHO is met and identity of the target cell is determined provided that UE has already successfully decoded DCI 2-9.

- Otherwise, it starts after UE successfully decodes DCI 2-9.

6.1.4.2.4 Interruption time

The interruption time is the time between when the UE starts to execute the conditional handover to the target cell and the time the UE starts transmission of the new PRACH.

For intra-frequency or inter-frequency conditional handover, the interruption time shall be less than

$$T_{interrupt} = T_{processing} + T_{IU} + T_{\Delta} + T_{margin}\ \text{ms}$$

Where:

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3]

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of T_{IU} shall depend upon the PRACH configuration used in the target cell.

6.1.4.3 NR FR2 – NR FR1 conditional handover

The requirements in this clause are applicable to inter-frequency conditional handover from NR FR2 cell to NR FR1 cell.

The requirements defined in clause 6.1.4.2 applies assuming inter-frequency handover and:

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 40 ms.

6.1.4.4 NR FR2 – NR FR2 conditional handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handover from NR FR2 cell to NR FR2 cell.

6.1.4.4.1 Handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel within D_{CHO} seconds from the end of the last TTI containing the RRC command.

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{CHO_execution} + T_{interrupt}$$

Where:

T_{RRC} is the RRC procedure delay defined in clause 12 in TS 38.331 [2].

T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until

- a condition exists at the measurement reference point which will trigger the conditional handover, or
- a condition exists at the measurement reference point which will trigger the NES-based conditional handover if NES-based conditional handover applies

$T_{measure}$ is the time for the UE to measure and realize the condition for CHO is fulfilled. $T_{measure}$ equals to the measurements time stated in clause 6.1.4.4.2.

$T_{CHO_execution}$ is the conditional execution preparation time in clause 6.1.4.4.3.

$T_{interrupt}$ is the interruption time stated in clause 6.1.4.4.4.

The NES-based conditional handover delay requirements shall apply if UE receives a RRC message implying NES-based conditional handover before receiving the NES indication in DCI 2-9 command.

UE is not expected to receive a NES indication in DCI 2-9 command before receiving a RRC message implying NES-based conditional handover. When UE receives a RRC message implying NES-based conditional handover but no NES indication in DCI 2-9 command, no NES-based conditional handover requirement is applied. The NES indication is specified in clause 5.5.4 in TS 38.331[2].

6.1.4.4.2 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE starts handover execution preparation ($T_{CHO_execution}$) to a target cell.

For conditional intra-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify_intra_without_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2.

For conditional inter-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_inter_with_index}$ or $T_{identify_inter_without_index}$ defined in clause 9.3.4 or clause 9.3.9.

For NES-based conditional intra-frequency handover:

- If UE successfully decodes DCI 2-9 command occurs earlier than the time at the end of T_{Event_DU} + $T_{identify_intra_with_index}$ or T_{Event_DU} + $T_{identify_intra_without_index}$, then the measurement time delay equal to $T_{identify_intra_with_index}$ or $T_{identify_intra_without_index}$
- If UE successfully decodes DCI 2-9 command occurs later than the time at the end of T_{Event_DU} + $T_{identify_intra_with_index}$ or T_{Event_DU} + $T_{identify_intra_without_index}$, and the condition of NES-based CHO keeps existing till UE receiving the DCI 2-9 command, then the measurement time delay equals to the time from the end of T_{Event_DU} until UE successfully decodes DCI 2-9 command.
- If UE successfully decodes DCI 2-9 command later than the time at the end of T_{Event_DU} + $T_{identify_intra_with_index}$ or T_{Event_DU} + $T_{identify_intra_without_index}$, and the condition of NES-based CHO is not met when receiving the DCI 2-9 command, then the measurement time delay equals to the time span from the end of T_{Event_DU} until a condition keeps existing for $T_{SSB\ measurement\ period_intra}$ which will immediately trigger the NES-based conditional handover after DCI 2-9.

For NES-based conditional inter-frequency handover:

- If UE successfully decodes DCI 2-9 command occurs earlier than the time at the end of T_{Event_DU} + $T_{identify_inter_with_index}$ or T_{Event_DU} + $T_{identify_inter_without_index}$, then the measurement time delay equal to $T_{identify_inter_with_index}$ or $T_{identify_inter_without_index}$
- If UE successfully decodes DCI 2-9 command occurs later than the time at the end of T_{Event_DU} + $T_{identify_inter_with_index}$ or T_{Event_DU} + $T_{identify_inter_without_index}$, and the condition of NES-based CHO keeps existing till UE receiving the DCI 2-9 command, then the measurement time delay equals to the time from the end of T_{Event_DU} until UE successfully decodes DCI 2-9 command.
- If UE successfully decodes DCI 2-9 command later than the time at the end of T_{Event_DU} + $T_{identify_inter_with_index}$ or T_{Event_DU} + $T_{identify_inter_without_index}$, and the condition of NES-based CHO is not met when receiving the DCI 2-9 command, then the measurement time delay equals to the time span from the end of T_{Event_DU} until a condition keeps existing for $T_{SSB\ measurement\ period_inter}$ which will immediately trigger the NES-based conditional handover after DCI 2-9.

When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency handover or $T_{identify_inter_without_index}$ for inter-frequency handover. If a cell which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency handover or $T_{identify_inter_without_index}$ for inter-frequency handover becomes undetectable for a period and then the cell becomes detectable again and triggers a handover, the measurement time delay shall be less than $T_{SSB_measurement_period_intra}$ or $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

6.1.4.4.3 Preparation time

$T_{CHO_execution}$ is the UE execution preparation time for conditional handover.

For conditional handover, it starts after UE realizes the condition of CHO is fulfilled and identity of the target cell is determined.

For NES-based conditional handover,

- It starts after UE realizes the condition of CHO is met and identity of the target cell is determined provided that UE has already successfully decoded DCI 2-9.
- Otherwise, it starts after UE successfully decodes DCI 2-9.

And $T_{CHO_execution}$ can be up to 10ms.

6.1.4.4.4 Interruption time

The interruption time is the time between when the UE starts to execute the conditional handover to the target cell and the time the UE starts transmission of the new PRACH.

For intra-frequency or inter-frequency conditional handover, the interruption time shall be less than

$$T_{interrupt} = T_{processing} + T_{IU} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3]

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of T_{IU} shall depend upon the PRACH configuration used in the target cell.

6.1.4.5 NR FR1 – NR FR2 conditional handover

The requirements in this clause are applicable to inter-frequency conditional handover from NR FR1 cell to NR FR2 cell.

The requirements defined in clause 6.1.4.4 applies assuming inter-frequency handover and:

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 40 ms.

6.1.5 NR Handover with PSCell

6.1.5.1 Introduction

The purpose of NR handover with PSCell is to change the NR PCell to another NR cell or E-UTRA cell and add or change the PSCell along with PCell handover. The requirements in this clause are applicable to:

- Handover with PSCell from NR SA to EN-DC
- Handover with PSCell from NR-DC to NR-DC
- Handover with PSCell from NE-DC to NE-DC
  - Requirements in this clause only applies to NE-DC with FR1 PCell

6.1.5.2 Handover with PSCell from NR SA to EN-DC

The requirements in this clause are applicable to inter-RAT handover from NR to E-UTRAN and FR1/FR2 PSCell addition.

When the UE receives a RRC message implying handover with PSCell, the UE shall be ready to start the transmission of the new uplink PRACH channel on target E-UTRA PCell within $D_{HOwithPSCell_PCell}$ msec from the end of the last TTI containing the RRC command, and the UE shall be ready to start the transmission of the new uplink PRACH channel on target PSCell within $D_{HOwithPSCell_PSCell}$ msec from the end of the last TTI containing the RRC command.

Where:

- $D_{HOwithPSCell_PCell}$ equals the applicable RRC procedure delay (i.e. 50 ms) plus the interruption time stated in clause 6.1.5.2.1.
- $D_{HOwithPSCell_PSCell}$ equals the PSCell addition delay stated in clause 6.1.5.2.2.

6.1.5.2.1 Interruption time for inter-RAT HO from NR to E-UTRAN

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay

When handover with PSCell from NR SA to EN-DC is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search_HO} + T_{IU} + T_{processing}$$

Where:

- T_{search_HO} is same as the T_{search} defined in section 6.1.2.1.3.
- T_{IU} is same as the one defined in section 6.1.2.1.3.
- $T_{processing}$ is the SW processing time needed by UE, including RF warm up period. When target PSCell is unknown and SMTC configuration of target unknown PSCell is present in *RRCConnectionReconfiguration* [2], $T_{processing}$ = 30ms if target PSCell is in FR1, $T_{processing}$ = 50ms if target PSCell is in FR2; otherwise, $T_{processing}$ = 25ms if target PSCell is in FR1, $T_{processing}$ = 45ms if target PSCell is in FR2.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant E-UTRA cell identification requirements are described in clause 9.4.1.

6.1.5.2.2 PSCell addition in HO with PSCell for NR SA to EN-DC

The requirements in this section shall apply for PSCell addition during handover with PSCell from NR SA to EN-DC.

When handover with PSCell from NR SA to EN-DC is commanded, the PSCell addition time shall be less than $D_{HOwithPSCell_PSCell}$:

- $D_{HOwithPSCell_PSCell} = T_{RRC_delay} + T_{processing} + T_{search_PCell} + T_{search_PSCell} + T_{\Delta} + T_{PSCell_DU} + 2$ ms

Where:

- T_{RRC_delay} is the RRC procedure delay. T_{RRC_delay} = 50 ms.
- $T_{processing}$ is as defined in section 6.1.5.2.1.

- T_{search_PCell} is the time for obtaining the timing reference of target PCell. $T_{search_PCell} = T_{search_HO}$ which is as defined in section 6.1.5.2.1 if target PSCell is unknown and SMTC configuration of target unknown PSCell is configured in *RRCConnectionReconfiguration* of *targetRAT-MessageContainer* [2]. Otherwise, $T_{search_PCell} = 0$.

- T_{search_PSCell} is same as T_{search} in section 7.31.2 of TS 36.133[15], and T_{Δ} and T_{PSCell_DU} is same as the one defined in section 7.31.2 of TS 36.133[15]. The Trs definition from section 7.31.2 of TS 36.133[15] is modified as following for requirement in this section:

- T_{rs} is the SMTC periodicity of the target NR cell if target PSCell is unknown and SMTC configuration of target unknown PSCell is present in *RRCConnectionReconfiguration* [2], otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

PSCell known and unknown condition is as defined in section 7.31.2 of TS 36.133[15].

6.1.5.3 HO with PSCell from NE-DC to NE-DC

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR PCell to NR PCell on FR1, and the PSCell addition is on LTE.

6.1.5.3.1 Handover delay

When the UE receives a RRC message implying PCell handover with PSCell change, the UE shall be ready to start the transmission of the new uplink PRACH channel on target NR PCell within $D_{HOwithPSCell_PCell}$ from the end of the last TTI containing the RRC command, and UE shall be ready to start the transmission of the new uplink PRACH channel on target E-UTRA PSCell within $D_{HOwithPSCell_PSCell}$ from the end of the last TTI containing the RRC command.

The PCell handover delay, $D_{HOwithPSCell_PCell}$, equals to the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the PCell interruption time ($T_{interrupt}$) defined in clause 6.1.5.3.2.

PSCell addition/change delay, $D_{HOwithPSCell_PSCell}$ is defined in clause 6.1.5.3.3.

6.1.5.3.2 HO with PSCell - PCell Interruption time

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search_PCell} + T_{\Delta_PCell} + T_{margin_PCell} + T_{IU_PCell} + T_{processing} \text{ ms}$$

Where:

- If the source cell is in FR1 and target cell is in FR1, T_{search_PCell}, T_{Δ_PCell}, T_{margin_PCell} is same as the T_{search}, T_{Δ}, T_{margin} defined in section 6.1.1.2.2 respectively.

- $T_{processing}$ is UE software processing and RF warmup delay for PCell HO and for this case $T_{processing}$ can be up to 25 ms.

- T_{IU_PCell} can be up to the summation of SSB to PRACH occasion association period and 10 ms if there is no collision between PCell RACH and PSCell RACH occasion or UE can perform PCell RACH and PSCell RACH occasion simultaneously as defined in TS 38.213[39] section 7.6.1A; otherwise, longer T_{IU_PCell} is expected to include the uncertainty in acquiring the next available RACH occasion for PCell RACH transmission.

6.1.5.3.3 PSCell addition/change in NE-DC to NE-DC HO with PSCell

When HO with PSCell addition is commanded, the PSCell addition/change time shall be less than $D_{HOwithPSCell_PSCell}$.

- $D_{HOwithPSCell_PSCell} = T_{config_EUTRAN\text{-}PSCell} + T_{processing_margin}$.

where

- $T_{config_EUTRAN\text{-}PSCell}$ is defined in clause 8.8.2, and

- $T_{processing_margin}$ = 5 ms is the additional delay margin for RF warm-up and software processing in handover with PSCell.

6.1.5.4 HO with PSCell from NR-DC to NR-DC

The requirements in this clause are applicable to handover with PSCell from NR-DC to NR-DC. The requirements in this clause are applicable to

- FR1-FR1 NR-DC to FR1-FR1 NR-DC,
- FR1-FR1 NR-DC to FR1-FR2 NR-DC,
- FR1-FR2 NR-DC to FR1-FR1 NR-DC,
- FR1-FR2 NR-DC to FR1-FR2 NR-DC.

This clause defines requirements for the delay within which the UE shall be able to handover from NR cell to NR cell and change NR PSCell in the meantime.

When the UE receives a RRC message implying handover with PSCell,

- The UE shall be ready to start the transmission of the new uplink PRACH channel of the target PCell within $D_{HOwithPSCell_PCell}$ ms from the end of the last TTI containing the RRC command, and
- The UE shall be capable of transmitting PRACH preamble towards the target PSCell no later than $D_{HOwithPSCell_PSCell}$ ms from the end of the last TTI containing the RRC command.

Where:

- $D_{HOwithPSCell_PCell}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.5.4.1.
- $D_{HOwithPSCell_PSCell}$ is the PSCell change delay stated in clause 6.1.5.4.2.

6.1.5.4.1 HO with PSCell – PCell Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When handover with PSCell from NR-DC to NR-DC is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

- T_{search}, T_{IU}, T_{Δ} and T_{margin} are the same as defined in clause 6.1.1.2.2.
- $T_{processing}$ is the SW processing time needed by UE, including RF warm up period.

  For FR1-FR1 NR-DC to FR1-FR1 NR-DC or FR1-FR2 NR-DC to FR1-FR2 NR-DC, $T_{processing}$ = 30 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, $T_{processing}$ = 25 ms.

  For FR1-FR1 NR-DC to FR1-FR2 NR-DC or FR1-FR2 NR-DC to FR1-FR1 NR-DC, $T_{processing}$ = 50 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, $T_{processing}$ = 45 ms.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in clause 9.2.5 for intra-frequency handover and clause 9.3.4 for inter-frequency handover.

6.1.5.4.2 HO with PSCell – PSCell change delay

The requirements in this section shall apply for PSCell change during handover with PSCell from NR-DC to NR-DC. In the case of NR-DC PSCell change in FR1, when the UE indicating *support3MHz-ChannelBW-Symmetric-r18* is

configured with a target PSCell that is with 12PRB SSB bandwidth, the UE shall transmit PRACH preamble towards the target PSCell no later than the delay requirements specified in clause 8.9.2.

When handover with PSCell from NR-DC to NR-DC is commanded, the PSCell change time shall be less than $D_{HOwithPSCell_PSCell}$:

- $D_{HOwithPSCell_PSCell} = T_{RRC_delay} + T_{processing} + T_{search_PCell} + T_{search_PSCell} + T_{\Delta_PSCell} + T_{PSCell_DU} + 2$ ms

Where:

- T_{RRC_delay}, T_{search_PSCell}, and T_{PSCell_DU} are the same as defined in clause 8.9.2. $T_{\Delta_PSCell} = T_{\Delta}$ which is specified in clause 8.9.2

- $T_{processing}$ is the SW processing time needed by UE, including RF warm up period.

  For FR1-FR1 NR-DC to FR1-FR1 NR-DC or FR1-FR2 NR-DC to FR1-FR2 NR-DC, $T_{processing}$ = 30 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, $T_{processing}$ = 25 ms.

  For FR1-FR1 NR-DC to FR1-FR2 NR-DC or FR1-FR2 NR-DC to FR1-FR1 NR-DC, $T_{processing}$ = 50 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, $T_{processing}$ = 45 ms.

- T_{search_PCell} is the time for obtaining the timing reference of target PCell. If SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*, $T_{search_PCell} = T_{search} + T_{\Delta} + T_{margin}$, where T_{search}, T_{Δ} and T_{margin} are specified in clause 6.1.5.4.1. Otherwise, T_{search_PCell} = 0 ms.

The T_{rs} definition from clause 8.9.2 is modified as following for requirements in this section:

- T_{rs} is the SMTC periodicity of the target NR cell if target PSCell is unknown and SMTC configuration of target unknown PSCell is present in either *targetcellSMTC-SCG-r16* or *reconfigurationWithSync*, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, T_{rs} is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

PSCell known and unknown condition is as defined in clause 8.9.2.

6.1.5.5 Handover with PSCell from NR SA to EN-DC with PSCell using CCA

6.1.5.5.1 Introduction

When the UE receives a RRC message implying handover with PSCell change, the UE shall be ready to start the transmission of the new uplink PRACH channel on target E-UTRA PCell within $D_{HOwithPSCell_PCell}$ ms from the end of the last TTI containing the RRC command, and UE shall be ready to start the transmission of the new uplink PRACH channel on a target PSCell on a carrier frequency with CCA within $D_{HOwithPSCell_PSCell}$ seconds and from the end of the last TTI containing the RRC command.

Where:

$D_{HOwithPSCell_PCell}$ equals the maximum RRC procedure delay defined in clause 11.2 in TS 36.331 [16] plus the interruption time stated in clause 6.1.5.5.2.

$D_{HOwithPSCell_PSCell}$ is the PSCell addition delay stated in clause 6.1.5.5.3

6.1.5.5.2 NR SA to EN-DC HO with PSCell- NR to E-UTRA HO Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH excluding the RRC procedure delay. This requirement applies when UE is not required to perform any synchronisation procedure before transmitting on the new PRACH or on the new PUSCH.

When Handover with PSCell is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing}\ ms$$

Where:

T_{search} is same as the T_{search} defined in section 6.1.2.1.3

T_{IU} is same as the one defined in section 6.1.2.1.3.

$T_{processing}$ is the SW processing time needed by UE, including RF warm up period. When target PSCell is unknown and SMTC configuration of target unknown PSCell is present in *RRCConnectionReconfiguration* [2], $T_{processing}$ = 30 ms, otherwise, $T_{processing}$ = 25 ms.

NOTE: The actual value of T_{IU} shall depend upon the PRACH configuration used in the target E-UTRA cell.

In the interruption requirement, a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds. Otherwise, it is unknown. Relevant E-UTRA cell identification requirements are described in clause 9.4.1.

6.1.5.5.3 NR SA to EN-DC HO with PSCell - NR PSCell Addition Delay requirements

When Handover with PSCell is commanded, the NR PSCell on a carrier frequency with CCA changing delay shall be less than $D_{HOwithPSCell_PSCell}$:

$$D_{HOwithPSCell_PSCell} = T_{RRC_delay} + T_{processing} + T_{search_PCell} + T_{search_PSCell} + T_{\Delta} + T_{IU_PSCell} + T_{margin}$$

Where:

T_{RRC_delay} is maximum RRC procedure delay defined in clause 11.2 in TS 36.331 [16].

T_{search_PCell} is the time for obtaining the timing reference of target PCell. T_{search_PCell} is same as T_{search_HO} as defined in section 6.1.5.2.1, if target PSCell is unknown and SMTC configuration of target unknown PSCell is present in *RRCConnectionReconfiguration* [2]. Otherwise, T_{search_PCell} = 0

T_{search_PSCell} is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then T_{search_PSCell} = 0 ms. If the target cell is an unknown cell and target cell Es/Iot $\geq$ [-2] dB, then $T_{search_PSCell} = (3+L_1) * T_{rs}$ ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

L_1 is the number of SMTC occasions not available at the UE during the inter-RAT detection period. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

T_{Δ} is same as $T_{\Delta_withCCA}$ in section 7.31A.2 in TS 36.133[15].

$T_{processing}$ is time for UE processing and is same as defined in clause 6.1.5.5.2.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{IU_PSCell} is the delay uncertainty due to the random-access procedure when sending PRACH to the new cell. T_{IU_PSCell} can be up to: $(1+ L_3) * T_{SSB,RO}$ + 10 ms; where $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined in table 8.1-1 of TS 38.213 [39] and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failures or RACH collision between PCell and PSCell. L_3 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [57] and when there are no RACH collisions between PCell and PSCell. When the UE is configured with both the UL BWP with PRACH occasion on the target cell and UL LBT failure detection/recovery, the interruption can be longer.

NOTE 1: The actual value of T_{IU_PSCell} shall depend upon the PRACH configuration used in the target cell.

NOTE 2: The interruption time extended by L_1, L_2, and L_3 parameters, and by the UL LBT failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is specified in TS 38.331 [2].

T_{rs} is the SMTC periodicity of the target NR cell if target PSCell is unknown and SMTC configuration of target unknown PSCell is present in *RRCConnectionReconfiguration* [2], otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

A cell on a carrier frequency with CCA is known if it has been meeting the relevant cell identification requirement during the last 5 seconds. Otherwise, it is unknown. Relevant cell identification requirements are described in clauses 8.1.2.4.21A, and 8.1.2.4.22A in TS 36.133[15].

6.1.6 NR Conditional Handover including target MCG and target SCG

6.1.6.1 Conditional handover including target MCG in FR1 and target SCG in FR1 in NR-DC

The requirements in this clause are applicable to conditional handover with target SCG from NR-DC to NR-DC. The requirements in this clause are only applicable to:

- FR1-FR1 NR-DC to FR1-FR1 NR-DC,
- FR1-FR2 NR-DC to FR1-FR1 NR-DC.

This clause defines requirements for the delay within which the UE shall be able to conditional handover from NR cell to NR cell and change NR PSCell in the meantime.

When the UE receives a RRC message implying conditional handover with PSCell,

- The UE shall be ready to start the transmission of the new uplink PRACH channel of the target PCell within $D_{CHOwithPSCell_PCell}$ ms from the end of the last TTI containing the RRC command, and
- The UE shall be capable of transmitting PRACH preamble towards the target PSCell no later than $D_{CHOwithPSCell_PSCell}$ ms from the end of the last TTI containing the RRC command.

$D_{CHOwithPSCell_PCell} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{CHO_execution} + T_{interrupt}$

$D_{CHOwithPSCell_PSCell}$ is the PSCell change delay stated in clause 6.1.6.1.2

Where:

T_{RRC} is the RRC procedure delay defined in clause 12 in TS 38.331 [2].

T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until a condition exists at the measurement reference point which will trigger the conditional handover.

$T_{measure}$ is the time for the UE to measure and realize the condition for CHO is fulfilled. $T_{measure}$ equals to the measurements time stated in clause 6.1.4.2.2.

$T_{CHO_execution}$ is the conditional execution preparation time in clause 6.1.4.2.3.

$T_{interrupt}$ is the interruption time stated in clause 6.1.6.1.1.

6.1.6.1.1 CHO with PSCell – PCell Interruption time

The interruption time is the time between when the UE starts to execute the conditional handover to the target cell and the time the UE starts transmission of the new PRACH.

For intra-frequency or inter-frequency conditional handover, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

- T_{IU}, T_{Δ} and T_{margin} are the same as defined in clause 6.1.4.2.4

- $T_{processing}$ is the SW processing time needed by UE, including RF warm up period.

  For FR1-FR1 NR-DC to FR1-FR1 NR-DC, $T_{processing}$ = 30 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, $T_{processing}$ = 25 ms.

  For FR1-FR2 NR-DC to FR1-FR1 NR-DC, $T_{processing}$ = 50 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, $T_{processing}$ = 45 ms.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in clause 9.2.5 for intra-frequency handover and clause 9.3.4 for inter-frequency handover.

6.1.6.1.2 CHO with PSCell – PSCell change delay

The requirements in this section shall apply for PSCell change during conditional handover with PSCell from NR DC to NR-DC.

When conditional handover with PSCell from NR-DC to NR-DC is commanded, the PSCell change time shall be less than $D_{CHOwithPSCell_PSCell}$:

- $D_{CHOwithPSCell_PSCell} = T_{RRC_delay} + T_{Event_DU} + T_{measure} + T_{CHO_execution} + T_{processing} + T_{search_PCell_Conditional} + T_{search_PSCell} + T_{\Delta_PSCell} + T_{PSCell_DU} + 2$ ms

Where:

- T_{RRC_delay}, T_{Event_DU}, $T_{measure}$, $T_{CHO_execution}$ are the same as defined in clause 6.1.6.1

- $T_{processing}$ is the same as defined in clause 6.1.6.1.1. T_{search_PSCell} is same as T_{search} defined in clause 8.9.2.

- $T_{search_PCell_Conditional}$ is the time for obtaining the timing reference of target PCell. If SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*, $T_{search_PCell_Conditional} = T_{\Delta} + T_{margin}$, where T_{Δ} and T_{margin} are specified in clause 6.1.6.1.1 Otherwise, $T_{search_PCell_Conditional}$ = 0 ms.

- T_{Δ_PSCell} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta_PSCell} = 3*T_{rs}$ ms for target PSCell operating with 12 PRB SSB BW. Otherwise, $T_{\Delta_PSCell} = 1*Trs$ ms.

- T_{PSCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. T_{PSCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

The T_{rs} definition from clause 8.9.2 is modified as following for requirements in this section:

- T_{rs} is the SMTC periodicity of the target NR cell if target PSCell is unknown and SMTC configuration of target unknown PSCell is present in either *targetcellSMTC-SCG-r16* or *reconfigurationWithSync*, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, T_{rs} is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

PSCell known and unknown condition is as defined in clause 8.9.2.

6.1.6.2 Conditional handover including target MCG in FR1 and target SCG in FR2 in NR-DC

The requirements in this clause are applicable to conditional handover with target SCG from NR-DC to NR-DC. The requirements in this clause are only applicable to:

- FR1-FR1 NR-DC to FR1-FR2 NR-DC,
- FR1-FR2 NR-DC to FR1-FR2 NR-DC.

This clause defines requirements for the delay within which the UE shall be able to handover from NR cell to NR cell and change NR PSCell in the meantime.

When the UE receives a RRC message implying conditional handover including target MCG in FR1 and target SCG in FR2,

- The UE shall be ready to start the transmission of the new uplink PRACH channel of the target PCell within $D_{CHOwithPSCell_PCell}$ ms from the end of the last TTI containing the RRC command, and
- The UE shall be capable of transmitting PRACH preamble towards the target PSCell no later than $D_{CHOwithPSCell_PSCell}$ ms from the end of the last TTI containing the RRC command.

Where:

- $D_{CHOwithPSCell_PCell}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.6.2.1.
- $D_{CHOwithPSCell_PSCell}$ is the PSCell change delay stated in clause 6.1.6.2.2.

6.1.6.2.1 CHO with PSCell – PCell handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel of the target PCell within $D_{CHOwithPSCell_PCell}$ seconds from the end of the last TTI containing the RRC command.

$D_{CHOwithPSCell_PCell} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{CHO_execution} + T_{processing} + T_{IU} + T_{\Delta} + T_{margin}$

Where:

T_{RRC} is the RRC procedure delay defined in clause 12 in TS 38.331 [2].

T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until a condition exists at the measurement reference point which will trigger the conditional handover.

$T_{measure}$ is the time for the UE to measure and realize the condition for CHO is fulfilled. $T_{measure}$ equals to the measurements time stated in clause 6.1.4.2.2.

$T_{processing}$ is the SW processing time needed by UE, including RF warm up period.

For FR1-FR1 NR-DC to FR1-FR2 NR-DC, $T_{processing}$ = 50 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, $T_{processing}$ = 45 ms.

For FR1-FR2 NR-DC to FR1-FR2 NR-DC, $T_{processing}$ = 30 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, $T_{processing}$ = 25 ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell stated in clause 6.1.4.2.4.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell stated in clause 6.1.4.2.4.

T_{margin} is time for SSB post-processing stated in clause 6.1.4.2.4.

$T_{CHO_execution}$ is the conditional execution preparation time in clause 6.1.4.2.3

6.1.6.2.2 CHO with PSCell – PSCell change delay

The requirements in this section shall apply for PSCell change during handover with PSCell from NR DC to NR-DC.

When handover with PSCell from NR-DC to NR-DC is commanded, the PSCell change time shall be less than $D_{HOwithPSCell_PSCell}$:

- $D_{CHOwithPSCell_PSCell} = T_{RRC_delay} + T_{Event_DU} + T_{measure} + T_{CHO_execution} + T_{processing} + T_{search_PCell_Conditional} + T_{search_PSCell} + T_{\Delta_PSCell} + T_{PSCell_DU} + 2$ ms

Where:

- T_{RRC_delay}, T_{Event_DU}, $T_{measure}$ and $T_{CHO_execution}$ are the same as defined in clause 6.1.6.2.1. T_{search_PSCell}, T_{Δ_PSCell} and T_{PSCell_DU} are the same as defined in clause 6.1.5.4.2.

- $T_{processing}$ is the SW processing time needed by UE, including RF warm up period.

  For FR1-FR1 NR-DC to FR1-FR2 NR-DC, $T_{processing}$ = 50 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, $T_{processing}$ = 45 ms.

  For FR1-FR2 NR-DC to FR1-FR2 NR-DC, $T_{processing}$ = 30 ms if SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*. Otherwise, $T_{processing}$ = 25 ms.

- $T_{search_PCell_Conditional}$ is the time for obtaining the timing reference of target PCell. If SMTC of the target unknown PSCell is configured in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*, $T_{search_PCell_Conditional} = T_{\Delta} + T_{margin}$, where T_{Δ} and T_{margin} are specified in clause 6.1.5.4.1. Otherwise, $T_{search_PCell_Conditional} = 0$ ms.

The T_{rs} definition from clause 8.9.2 is modified as following for requirements in this section:

- T_{rs} is the SMTC periodicity of the target NR cell if target PSCell is unknown and SMTC configuration of target unknown PSCell is present in either *targetcellSMTC-SCG-r16* or *reconfigurationWithSync*, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, T_{rs} is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

PSCell known and unknown condition is as defined in clause 8.9.2.

6.1.7 NR Conditional Handover including target MCG and candidate SCG

6.1.7.1 Conditional handover including target MCG and candidate SCG for CPC in FR1 NR-DC

The purpose of NR Conditional handover including target MCG and candidate SCG for CPC is to change the NR PCell to another NR cell and change the PSCell along with PCell handover. The requirements in this clause are applicable to:

- FR1-FR1 NR-DC to FR1-FR1 NR-DC,

- FR1-FR2 NR-DC to FR1-FR1 NR-DC.

When the CHO execution condition is met but no CPC execution condition is met, and the UE has an available complementary CHO-only configuration, the UE executes CHO without CPC and the delay requirements for CHO defined in section 6.1.4 apply.

When the CHO execution condition is met but no CPC execution condition is met, and the UE has Rel-17 complementary CHO with SCG configuration, the UE executes Rel-17 CHO with SCG execution and the delay requirements for CHO with SCG defined in section 6.1.6 apply.

When the UE receives a RRC message implying conditional handover including target MCG and candidate SCG for CPC,

- The UE shall be ready to start the transmission of the new uplink PRACH channel of the target PCell within $D_{CHOwithCPC_PCell}$ ms from the end of the last TTI containing the RRC command, and

- The UE shall be capable of transmitting PRACH preamble towards the target PSCell no later than $D_{CHOwithCPC_PSCell}$ ms from the end of the last TTI containing the RRC command.

Where:

- $D_{CHOwithCPC_PCell}$ is the PCell conditional handover delay stated in clause 6.1.7.1.1.
- $D_{CHOwithCPC_PSCell}$ is the PSCell conditional change delay stated in clause 6.1.7.1.2.

6.1.7.1.1 PCell conditional handover delay

$D_{CHOwithCPC_PCell} = T_{RRC_delay} + T_{Event_DU} + \max(T_{measure_PCell}, T_{measure_PSCell}) + T_{UE_preparation} + T_{processing} + T_{\Delta_PCell} + T_{PCell_DU} + 2$ ms

- T_{RRC_delay} is the RRC procedure delay defined in clause 12 in TS 38.331 [2] for processing the RRC command.
- T_{Event_DU} in PCell and PSCell handover delay requirement is the delay uncertainty which is the time from when the UE successfully decodes the RRC command for CHO including target MCG and candidate SCG for CPC until conditions exist at the measurement reference point which will trigger the CHO and CPC.
- $T_{measure_PCell}$ is the time for the UE to measure and realize the condition for CHO is fulfilled. $T_{measure_PCell}$ equals to the measurements time stated in clause 6.1.7.1.1.1.
- $T_{measure_PSCell}$ is the time for the UE to measure and realize the condition for conditional PSCell change is fulfilled. $T_{measure_PSCell}$ equals to the measurements time stated in clause 6.1.7.1.2.1.
- $T_{UE_preparation}$ is the UE preparation time for conditional handover with conditional PSCell change, and starts at simultaneous execution of PCell handover and PSCell change to a target PCell and a target PSCell respectively after UE realizes the conditions of conditional PCell handover and conditional PSCell change are met and identities of the target PCell and PSCell are determined. $T_{UE_preparation}$ is up to 10 ms.
- $T_{processing}$ is the SW processing time needed by UE, including RF warm up period.

  For FR1-FR1 NR-DC to FR1-FR1 NR-DC, $T_{processing}$ = 25 ms.

  For FR1-FR2 NR-DC to FR1-FR1 NR-DC, $T_{processing}$ = 45 ms.
- T_{Δ_PCell} is time for fine time tracking and acquiring full timing information of the target PCell. $T_{\Delta_PCell} = 1*T_{rs}$ ms.
- T_{rs} is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in handover message, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.
- T_{PCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PCell. T_{PCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

6.1.7.1.1.1 Measurement time

The measurement time delay for PCell is defined from the end of T_{Event_DU} until UE realizes the condition of PCell handover is met and the identity of new PCell is determined.

For intra-frequency PCell handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_intra\ with\ index}$ or $T_{identify_intra_without_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2.

For inter-frequency PCell handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ defined in clause 9.3.4. When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PCell handover or the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PCell handover. If a cell, which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PCell handover or the time

period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PCell handover, becomes undetectable for a period and then the cell becomes detectable again and triggers a PCell handover, the measurement time delay shall be less than $T_{SSB_measurement_period_intra}$ or $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than ± $3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

6.1.7.1.2 PSCell conditional change delay

$D_{CHOwithCPC_PSCell} = T_{RRC_delay} + T_{Event_DU} + \max(T_{measure_PCell}, T_{measure_PSCell}) + T_{UE_preparation} + T_{processing} + T_{\Delta_PSCell} + T_{PSCell_DU} + 2$ ms

- T_{RRC_delay} is the RRC procedure delay defined in clause 12 in TS 38.331 [2] for processing the RRC command.
- T_{Event_DU} in PCell and PSCell handover delay requirement is the delay uncertainty which is the time from when the UE successfully decodes the RRC command for CHO including target MCG and candidate SCG for CPC until conditions exist at the measurement reference point which will trigger the CHO and CPC.
- $T_{measure_PCell}$ is the time for the UE to measure and realize the condition for CHO is fulfilled. $T_{measure_PCell}$ equals to the measurements time stated in clause 6.1.7.1.1.1.
- $T_{measure_PSCell}$ is the time for the UE to measure and realize the condition for conditional PSCell change is fulfilled. $T_{measure_PSCell}$ equals to the measurements time stated in clause 6.1.7.1.2.1.
- $T_{UE_preparation}$ is the UE preparation time for conditional handover with conditional PSCell change, and starts at simultaneous execution of PCell handover and PSCell change to a target PCell and a target PSCell respectively after UE realizes the conditions of conditional PCell handover and conditional PSCell change are met and identities of the target PCell and PSCell are determined. $T_{UE_preparation}$ is up to 10 ms.
- $T_{processing}$ is as specified in clause 6.1.7.1.1.
- T_{Δ_PSCell} is time for fine time tracking and acquiring full timing information of the target PSCell. $T_{\Delta_PSCell} = 3*T_{rs}$ ms for target PSCell operating with 12 PRB SSB BW. Otherwise, $T_{\Delta_PSCell} = 1*Trs$ ms.
  - T_{rs} is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.
- T_{PSCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. T_{PSCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

6.1.7.1.2.1 Measurement time

The measurement time delay for PSCell is defined from the end of T_{Event_DU} until UE realizes the condition of PSCell change is met and identity of new PSCell is determined.

For intra-frequency PSCell change, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify_intra_without_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2.

For inter-frequency PSCell change, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ defined in clause 9.3.4. When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PCell handover or the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PCell handover. If a cell, which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PCell handover or the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PCell handover, becomes undetectable for a period and then the cell becomes detectable again and triggers a PCell handover, the measurement time delay shall be less than $T_{SSB_measurement_period_intra}$ or $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

6.1.7.2 Conditional handover including target MCG in FR1 and Candidate SCG for CPC in FR2 in NR-DC

The requirements in this clause are applicable to conditional handover including target MCG in FR1 and candidate SCG for CPC in FR2 NR-DC. The requirements in this clause are applicable to:

- FR1-FR1 NR-DC to FR1-FR2 NR-DC,
- FR1-FR2 NR-DC to FR1-FR2 NR-DC.

Procedure delays for all procedures that can command a conditional handover including target MCG and candidate SCG for CPC are specified in TS 38.331 [2].

When the CHO execution condition is met but no CPC execution condition is met and the UE has an available complementary CHO-only configuration the UE executes CHO without CPC and the delay requirements for CHO defined in section 6.1.4 apply.

When the CHO execution condition is met but no CPC execution condition is met and the UE has Rel-17 complementary CHO with SCG configuration the UE executes Rel-17 CHO with SCG execution and the delay requirements for CHO with SCG defined in section 6.1.6 apply.

When the UE receives a RRC message implying conditional handover including target MCG and candidate SCG for CPC

the UE shall be ready to start the transmission of the new uplink PRACH channel of the target PCell within $D_{CHOwithCPC_PCell}$ ms from the end of the last TTI containing the RRC command and

the UE shall be capable of transmitting of the new uplink PRACH channel of the target PSCell within $D_{CHOwithCPC_PSCell}$ ms from the end of the last TTI containing the RRC command.

Where:

- $D_{CHOwithCPC_PCell}$ is the PCell conditional handover delay stated in clause 6.1.7.2.1.
- $D_{CHOwithCPC_PSCell}$ is the PSCell conditional change delay stated in clause 6.1.7.2.2.

6.1.7.2.1 PCell handover delay

$D_{CHOwithCPC_PCell} = T_{RRC_delay} + T_{Event_DU} + \max(T_{measure_PCell}, T_{measure_PSCell}) + T_{UE_preparation} + T_{processing} + T_{\Delta_PCell} + T_{PCell_DU} + 2$ ms

- T_{RRC_delay} is the RRC procedure delay defined in clause 12 in TS 38.331 [2] for processing the RRC command.
- T_{Event_DU} in PCell and PSCell handover delay requirement is the delay uncertainty which is the time from when the UE successfully decodes the RRC command for CHO including target MCG and candidate SCG for CPC until conditions exist at the measurement reference point which will trigger the CHO with CPC.
- $T_{measure_PCell}$ is the time for the UE to measure and realize the condition for CHO is fulfilled. $T_{measure_PCell}$ equals to the measurements time stated in clause 6.1.7.2.1.1
- $T_{measure_PSCell}$ is the time for the UE to measure and realize the condition for conditional PSCell change is fulfilled. $T_{measure_PSCell}$ equals to the measurements time stated in clause 6.1.7.2.2.1.

- $T_{UE_preparation}$ is the UE preparation time for conditional handover with conditional PSCell change and starts at simultaneous execution of PCell handover and PSCell change to a target PCell and a target PSCell respectively after UE realizes the conditions of conditional PCell handover and conditional PSCell change are met and identities of the target PCell and PSCell are determined. $T_{UE_preparation}$ is up to 10 ms.

- $T_{processing}$ is the SW processing time needed by UE, including RF warm up period.

For FR1-FR1 NR-DC to FR1-FR2 NR-DC, $T_{processing}$ = 45 ms.

For FR1-FR2 NR-DC to FR1-FR2 NR-DC, $T_{processing}$ = 25 ms

- T_{Δ_PCell} is time for fine time tracking and acquiring full timing information of the target PCell. $T_{\Delta_PCell} = 1*T_{rs}$ ms.

- T_{rs} is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in handover message, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

- T_{PCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PCell. T_{PCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

6.1.7.2.1.1 Measurement time

The measurement time delay for PCell is defined from the end of T_{Event_DU} until UE realizes the condition of PCell handover is met and identity of new PCell is determined.

For intra-frequency PCell handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify_intra_without_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2.

For inter-frequency PCell handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ defined in clause 9.3.4. When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PCell handover or the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PCell handover. If a cell, which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PCell handover or the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PCell handover, becomes undetectable for a period and then the cell becomes detectable again and triggers a PCell handover, the measurement time delay shall be less than $T_{SSB_measurement_period_intra}$ or $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

6.1.7.2.2 PSCell conditional change delay

$D_{CHOwithCPC_PSCell} = T_{RRC_delay} + T_{Event_DU} + \max(T_{measure_PCell}, T_{measure_PSCell}) + T_{UE_preparation} + T_{processing} + T_{\Delta_PSCell} + T_{PSCell_DU} + 2$ ms

- T_{RRC_delay} is the RRC procedure delay defined in clause 12 in TS 38.331 [2] for processing the RRC command.

- T_{Event_DU} in PCell and PSCell handover delay requirement is the delay uncertainty which is the time from when the UE successfully decodes the RRC command for CHO including target MCG and candidate SCG for CPC until conditions exist at the measurement reference point which will trigger the CHO with CPC.

- $T_{measure_PCell}$ is the time for the UE to measure and realize the condition for CHO is fulfilled. $T_{measure_PCell}$ equals to the measurements time stated in clause 6.1.7.2.1.1.

- $T_{measure_PSCell}$ is the time for the UE to measure and realize the condition for conditional PSCell change is fulfilled. $T_{measure_PSCell}$ equals to the measurements time stated in clause 6.1.7.2.2.1.

- $T_{UE_preparation}$ is the UE preparation time for conditional handover with conditional PSCell change and starts at simultaneous execution of PCell handover and PSCell change to a target PCell and a target PSCell respectively

after UE realizes the conditions of conditional PCell handover and conditional PSCell change are met and identities of the target PCell and PSCell are determined. $T_{UE_preparation}$ is up to 10 ms.

- $T_{processing}$ is as specified in clause 6.1.7.2.1.
- T_{Δ_PSCell} is time for fine time tracking and acquiring full timing information of the target PSCell. $T_{\Delta_PSCell} = 1*T_{rs}$ ms.
- T_{rs} is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in PSCell change message, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.
- T_{PSCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. T_{PSCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

6.1.7.2.2.1 Measurement time

The measurement time delay for PSCell is defined from the end of T_{Event_DU} until UE realizes the condition of PSCell change is met and identity of new PSCell is determined.

For intra-frequency PSCell change, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify_intra_without_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2.

For inter-frequency PSCell change, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ defined in clause 9.3.4. When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PCell handover or the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PCell handover. If a cell, which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PCell handover or the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PCell handover, becomes undetectable for a period and then the cell becomes detectable again and triggers a PCell handover, the measurement time delay shall be less than $T_{SSB_measurement_period_intra}$ or $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

6.1A Void

6.1A.1 Void

6.1A.1.1 Void

6.1A.1.2 Void

6.1A.1.2.1 Void

6.1A.1.2.2 Void

6.1B Handover to target cell using CCA

6.1B.1 NR Handover

6.1B.1.1 Introduction

The purpose of NR handover to target cell using CCA is to change the NR PCell to a target NR cell in a carrier frequency with CCA. The requirements in this clause are applicable to NR SA.

In the requirements of clause 6.1B.1, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding detection or time tracking period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 6.1B.1, the term PRACH occasion unavailable for transmission refers to when the PRACH occasion is configured by gNB but not transmitted by the UE during the corresponding period due to UL CCA failure at the UE.

6.1B.1.2 NR FR1 - NR FR1 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR1 cell in carrier frequencies with CCA, and to both intra-frequency and inter-frequency handovers from NR FR1 cell in carrier frequencies with CCA to NR FR1 cell in carrier frequencies with CCA.

6.1B.1.2.1 Handover delay

When the UE receives an RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ ms from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay to be defined in clause12 in TS 38.331 [2] plus the interruption time stated in clause 6.1B.1.2.2.

6.1B.1.2.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then T_{search} = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then T_{search} = (1+L_1) *T_{rs}. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, then T_{search} = (3+L_1´) *T_{rs} where L_1 and L_1´ are the number of SMTC occasions not available at the UE during the intra-frequency and inter-frequency detection period, respectively. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

T_Δ is time for fine time tracking and acquiring full timing information of the target cell. T_Δ = (1+ L_2) *T_{rs} ms, where L_2 is the number of SMTC occasions not available at the UE during the time tracking period.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{IU} is the interruption uncertainty due to the random access procedure when sending PRACH to the new cell. T_{IU} can be up to: (1+ L_3)*$T_{SSB,RO}$ + 10 ms where $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined in table 8.1-1 of TS 38.213 [3] and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. L_3 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [33]. When the UE is configured with both the UL BWP with PRACH occasion on the target cell and UL CCA failure detection/recovery, the interruption can be longer.

T_{rs} is the SMTC periodicity of the target NR cell in a carrier frequency with CCA if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

NOTE 1: The interruption time considering the potential extensions caused by L_1, L_1´,L_2 , L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2].

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in clause 9.2A.5 for intra-frequency handover and clause 9.3A.4 for inter-frequency handover to a carrier frequency with CCA.

6.1B.1.3 NR FR2-2 NR FR2-2 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR2-2 cell to NR FR2-2 cell in carrier frequencies with CCA, and to both intra-frequency and inter-frequency handovers from NR FR2-2 cell in carrier frequencies with CCA to NR FR2-2 cell in carrier frequencies with CCA.

6.1B.1.3.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ ms from the end of the last TTI containing the RRC command.

Where:

- $D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1B.1.3.2.

6.1B.1.3.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_\Delta + T_{margin} \text{ ms}$$

Where:

- T_{search} is the time required to search the target cell when the handover command is received by the UE. If the target cell is a known cell, then T_{search} = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then T_{search} = (1+L_1) * N * T_{rs} ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, then T_{search} = (3+L_1´) * N * T_{rs} where L_1 and L_1´ are the number of SMTC occasion groups not available at the UE during the intra-frequency and inter-frequency detection period, respectively. An SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. N is equal to 12. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

- $T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

- T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

- T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. T_{Δ} = (1+ L_2) * T_{rs}, where L_2 is the number of SMTC occasions not available at the UE during the time tracking period.

- T_{IU} is the interruption uncertainty due to the random access procedure when sending PRACH to the new cell. T_{IU} can be up to (1+ L_3)*$T_{SSB,RO}$ + 10 ms, where $T_{SSB,RO}$ is SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3] and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. L_3 = 0 for Type 3 channel access procedure as defined in TS 37.213 [33] L_3 = 0 if *ra-ChannelAccess-r17* is not configured in FR2-2.

- T_{rs} is the SMTC periodicity of the target NR cell in a carrier frequency with CCA if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise T_{rs} is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

NOTE 1: The interruption time considering the potential extensions caused by L_1, L_1, L_2 , L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2].

In FR2-2, the target cell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the handover command:
  - the UE has sent a valid measurement report for the target cell and
  - One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.2A.5 for intra-frequency handover and clause 9.3A.4 for inter-frequency handover to a carrier frequency with CCA,
- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in clause 9.2A.5 for intra-frequency handover and clause 9.3A.4 for inter-frequency handover to a carrier frequency with CCA.

otherwise it is unknown.

6.1B.1.4 NR FR1- NR FR2-2 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR2-2 cell in carrier frequencies with CCA.

6.1B.1.4.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ ms from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1B.1.4.2.

6.1B.1.4.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the handover command is received by the UE. If the target cell is a known cell, then T_{search} = 0 ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, then $T_{search} = (3+L_1) * N * T_{rs}$, where L_1 is the number of SMTC occasion groups not available at the UE during the inter-frequency detection period. An SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. N is equal to 12. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up 40 ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = (1+ L_2) * T_{rs}$, where L_2 is the number of SMTC occasions not available at the UE during the time tracking period.

T_{IU} is the interruption uncertainty due to the random access procedure when sending PRACH to the new cell. T_{IU} can be up to $(1+ L_3)*T_{SSB,RO}$ + 10 ms, where $T_{SSB,RO}$ is SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3] and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. L_3 = 0 for Type 3 channel access procedure as defined in TS 37.213 [33] L_3 = 0 if *ra-ChannelAccess-r17* is not configured in FR2-2.

- T_{rs} is the SMTC periodicity of the target NR cell in a carrier frequency with CCA if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise T_{rs} is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

NOTE 1: The interruption time considering the potential extensions caused by L_1, L_2, L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2].

In FR2-2, the target cell is known if it has been meeting the following conditions:

During the last 5 seconds before the reception of the handover command:

- the UE has sent a valid measurement report for the target cell and

  One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.2A.5 for intra-frequency handover and clause 9.3A.4 for inter-frequency handover to a carrier frequency with CCA,

- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in clause 9.2A.5 for intra-frequency handover and clause 9.3A.4 for inter-frequency handover to a carrier frequency with CCA.

otherwise it is unknown.

6.1C Handover for SAN

6.1C.1 NR SAN Handover

6.1C.1.1 Introduction

The purpose of NR SAN handover is to change the NR SAN PCell to another NR SAN cell. The requirements in this clause are applicable to SA NR SAN.

6.1C.1.2 NR SAN FR1 – NR SAN FR1 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR SAN FR1 cell to NR SAN FR1 cell. The requirements in this clause apply provided that UE has the valid and applicable parameters of ephemeris information, common TA, DL and UL Polarization information, K_{offset}, and K_{mac} for target NR SAN cell during $D_{handover}$, otherwise interruption time may be longer than the requirements in clause 6.1C.1.2.2.1 or clause 6.1C.1.2.2.2.

6.1C.1.2.1 Handover delay

When the UE receives a RRC message implying handover to NR SAN cell, the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ msec from the end of the last TTI containing the RRC command when UE is configured with RACH-based handover.

When the UE receives a RRC message implying handover to NR SAN cell, the UE shall be ready to start the transmission of the new uplink PUSCH channel or PRACH channel within $D_{handover}$ msec from the end of the last TTI containing the RRC command when UE is configured with RACH-less handover.

Where:

- $D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1C.1.2.2.1 when UE is configured with RACH-based handover.

- $D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1C.1.2.2.2 when UE is configured with RACH-less handover.

6.1C.1.2.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH or PUSCH, excluding the RRC procedure delay.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in clause 9.2C.5 for intra-frequency handover and clause 9.3C.4 for inter-frequency handover.

6.1C.1.2.2.1 Interruption time for RACH-based handover

When intra-frequency or inter-frequency handover to NR SAN cell is commanded,

the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Otherwise, no interruption time requirement is applied.

Where:

- T_{search} is the time required to search the target NR SAN cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then T_{search} = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot ≥ -2 dB, then $T_{search} = T_{rs}$ ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot ≥ -2 dB, then $T_{search} = 3 * T_{rs}$ ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

- T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell.

  $T_{\Delta} = T_{rs}$ for both known and unknown target cells operating with 20 PRB SSB BW.

  $T_{\Delta} = 3*T_{rs}$ for both known and unknown target cells operating with 12 PRB SSB BW.

- $T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

- T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

- T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

- T_{rs} is the SMTC periodicity of the target NR SAN cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise T_{rs} is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing if UE doesn't support *twoSMTC-Periodicities-r19* or UE support *twoSMTC-Periodicities-r19* but only a single SMTC periodicity is configured or T_{rs} is the SMTC periodicity configured in the *measObjectNR* corresponding to the physical cell ID of the target cell if UE support *twoSMTC-Periodicities-r19* and more than one SMTC periodicity are configured. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

6.1C.1.2.2.2 Interruption time for RACH-less handover

When intra-frequency or inter-frequency RACH-less handover to NR SAN cell is commanded,

the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Otherwise, no interruption time requirement is applied.

Where:

- T_{search} is same as the one defined in section 6.1C.1.2.2.1.

- T_{Δ} is same as the one defined in section 6.1C.1.2.2.1.

- $T_{processing}$ is same as the one defined in section 6.1C.1.2.2.1.

- T_{margin} is same as the one defined in section 6.1C.1.2.2.1.

- T_{IU} is the interruption uncertainty in acquiring the first UL transmission resource, which can be a configured grant based PUSCH, dynamic grant based PUSCH, according to NW configuration and scheduling, or PRACH if no valid configured grant based PUSCH is selected. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

6.1C.1.3 NR SAN FR2-NTN – NR SAN FR2-NTN Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR SAN FR2-NTN cell to NR SAN FR2-NTN cell. The requirements in this clause apply provided that UE has the valid and applicable parameters of ephemeris information, common TA, DL and UL Polarization information, K_{offset}, and K_{mac} for target NR SAN cell during $D_{handover}$, otherwise interruption time may be longer than the requirements in clause 6.1C.1.3.2.

6.1C.1.3.1 Handover delay

When the UE receives a RRC message implying handover to NR SAN cell, the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ msec from the end of the last TTI containing the RRC command.

Where:

- $D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1C.1.3.2.

6.1C.1.3.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover to NR SAN cell is commanded, and if the target NR SAN cell is served by the same satellite as the serving cell, the interruption time shall be less than $T_{interrupt_intra_sat}$, where $T_{interrupt_intra_sat}$ is same as $T_{interrupt}$ defined in clause 6.1C.1.2.2.

When intra-frequency or inter-frequency handover to NR SAN cell is commanded, and if the target NR SAN cell is served by a different satellite than the serving cell, the interruption time shall be less than $T_{interrupt_inter_sat}$, where

$$T_{interrupt_inter_sat} = T_{search} + T_{IU} + T_{processing} + T_{sat_beam} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

- T_{search} is the time required to search the target NR SAN cell. If the target cell is an intra-frequency cell and the target cell Es/Iot $\geq$ -2 dB, then $T_{search} = T_{rs}$ ms. If the target cell is an inter-frequency cell and the target cell Es/Iot $\geq$ -2 dB, then $T_{search} = 3 * T_{rs}$ ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

- T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$.

- $T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

- T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

- T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

- T_{sat_beam} is additional time for UE to steer the downlink spatial domain reception filter to the target cell.

  - For UE indicating '*electronic*' via UE capability *ntn-VSAT-AntennaType-r18*, T_{sat_beam} is $3*T_{rs}$

  - For UE indicating '*mechanical*' via UE capability *ntn-VSAT-AntennaType-r18*, T_{sat_beam} is O_{angle} / 22.5 s, where O_{angle} is the angle offset observed from UE in degree between the satellite for the serving cell and the satellite for the target cell.

- T_{rs} is the SMTC periodicity of the target NR SAN cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise T_{rs} is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing if UE doesn't support *twoSMTC-Periodicities-r19* or UE support *twoSMTC-Periodicities-r19* but only a single SMTC periodicity is configured or T_{rs} is the SMTC periodicity configured in the *measObjectNR* corresponding to the physical cell ID of the target cell if UE support *twoSMTC-Periodicities-r19* and more than one SMTC periodicity are configured. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

6.1C.2 NR SAN Conditional Handover

6.1C.2.1 Introduction

The requirements in this clause are applicable to conditional handover to change the NR SAN PCell to another NR SAN cell.

6.1C.2.2 NR SAN FR1 – NR SAN FR1 conditional handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handover from NR SAN FR1 cell to NR SAN FR1 cell. The requirements in this clause apply provided that UE has the valid and applicable parameters of ephemeris information, common TA, DL and UL Polarization information, K_{offset}, and K_{mac} for target NR SAN cell during D_{CHO}, otherwise the measurement time, preparation time and interruption time may be longer than the requirements in clauses 6.1C.2.2.2, 6.1C.2.2.3 and 6.1C.2.2.4.

6.1C.2.2.1 Handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 38.331 [2]. UE shall start RRM measurement before the time or distance condition is met, the time/distance condition is defined in clause 5.5.4 in TS 38.331[2]

When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel or PUSCH channel within D_{CHO} seconds from the end of the last TTI containing the RRC command.

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{interrupt} + T_{CHO_execution}$$

Where:

- T_{RRC} is the RRC procedure delay defined in clause 12 in TS 38.331 [2].
- T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until a condition exists at the measurement reference point which will trigger the conditional handover
- $T_{measure}$ is the measurements time stated in clause 6.1C.2.2.2.
- $T_{CHO_execution}$ is the UE conditional execution preparation time for conditional handover in clause 6.1C.2.2.3.
- $T_{interrupt}$ is the interruption time stated in clause 6.1C.2.2.4.

The conditional handover delay requirements are applied if condition T1-1 is later than the end of $T_{measure}$ for time based CHO, both condition D1-1 and condition D1-2 , or both condition D2-1 and condition D2-2 are fulfilled before the end of $T_{measure}$ for location-based CHO, otherwise no CHO requirement is applied.

6.1C.2.2.2 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE executes a handover to a target cell and interruption time starts.

For intra-frequency handover, the measurement time delay for identifying a new detectable intra frequency cell measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_intra_with_index}$ or $T_{identify_intra_without_index}$, defined in clause 9.2C.5.1 and clause 9.2C.6.1.

For time-based conditional intra-frequency handover:

- If condition T1-1 occurs earlier than the time at the end of $T_{Event_DU} + T_{identify_intra_with_index}$ or $T_{Event_DU} + T_{identify_intra_without_index}$, then the measurement time delay equals to $T_{identify_intra_with_index}$ or $T_{identify_intra_without_index}$ assuming UE only performs the measurements within SMTC window of the target cell.
- If condition T1-1 occurs later than the time at the end of $T_{Event_DU} + T_{identify_intra_with_index}$ or $T_{Event_DU} + T_{identify_intra_without_index}$, then the measurement time delay equals to the time from the end of T_{Event_DU} until condition T1-1.

For location-based conditional intra-frequency handover:

- If both source cell and target cell are quasi-Earth fixed cells,
  - if both condition D1-1 and condition D1-2 are fulfilled earlier than the time at the end of $T_{Event_DU} + T_{identify_intra_with_index}$ or $T_{Event_DU} + T_{identify_intra_without_index}$, then the measurement time delay equals to $T_{identify_intra_with_index}$ or $T_{identify_intra_without_index}$ assuming UE only performs measurements within SMTC window of the target cell.

- if both condition D1-1 and condition D1-2 are fulfilled is later than the time at the end of T_{Event_DU} + $T_{identify_intra_with_index}$ or T_{Event_DU} + $T_{identify_intra_without_index}$ for intra-frequency handover, then the measurement time delay equals to the time from the end of T_{Event_DU} until the time when both condition D2-1 and condition D1-2 are fulfilled.

- if both source cell and target cell are earth moving cells,

  - if both condition D2-1 and condition D2-2 are fulfilled earlier than the time at the end of T_{Event_DU} + $T_{identify_intra_with_index}$ or T_{Event_DU} + $T_{identify_intra_without_index}$, then the measurement time delay equals to $T_{identify_intra_with_index}$ or $T_{identify_intra_without_index}$ assuming UE only performs measurements within SMTC window of the target cell.

  - if both condition D2-1 and condition D2-2 are fulfilled later than the time at the end of T_{Event_DU} plus $T_{identify_intra_with_index}$ or $T_{identify_intra_without_index}$ for intra-frequency handover, then the measurement time delay equals to the time from the end of T_{Event_DU} until the time when both condition D1-1 and condition D2-2 are fulfilled.

For inter-frequency handover, the measurement time delay for identifying a new detectable inter frequency cell measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_inter_with_index}$ or $T_{identify_inter_without_index}$, defined in clause 9.3C.7.1.

For time-based conditional inter-frequency handover:

- If condition T1-1 occurs earlier than the time at the end of T_{Event_DU} + $T_{identify_inter_with_index}$ or T_{Event_DU} + $T_{identify_inter_without_index}$, then the measurement time delay equals to $T_{identify_inter_with_index}$ or $T_{identify_inter_without_index}$ assuming that the UE uses only the SMTC window of the target inter-frequency carrier for performing the measurements. In this case $K_{satellite}$=1, $CSSF_{inter}$=1.

- If condition T1-1 occurs later than the time at the end of T_{Event_DU} + $T_{identify_inter_with_index}$ or T_{Event_DU} + $T_{identify_inter_without_index}$, then the measurement time delay equals to the time from the end of T_{Event_DU} until condition T1-1.

For location-based conditional inter-frequency handover,

- if both source cell and target cell are quasi-Earth fixed cells,

  - If both condition D1-1 and condition D1-2 are fulfilled earlier than the time at the end of T_{Event_DU} + $T_{identify_inter_with_index}$ or T_{Event_DU} + $T_{identify_inter_without_index}$, then the measurement time delay equals to $T_{identify_inter_with_index}$ or $T_{identify_inter_without_index}$, assuming that the UE uses only the SMTC window of the target inter-frequency carrier for performing the measurements. In this case $K_{satellite=}$1, $CSSF_{inter}$=1.

  - If both condition D1-1 and condition D1-2 are fulfilled later than the time at the end of T_{Event_DU}+$T_{identify_inter_with_index}$ or T_{Event_DU} + $T_{identify_inter_without_index}$, then the measurement time delay equal to the time from the end of T_{Event_DU} until the time of both condition D1-1 and condition D1-2 are fulfilled.

- if both source cell and target cell are earth moving cells,

  - if both condition D2-1 and condition D2-2 are fulfilled earlier than the time at the end of T_{Event_DU} + $T_{identify_inter_with_index}$ or T_{Event_DU} + $T_{identify_inter_without_index}$, then the measurement time delay equals to $T_{identify_inter_with_index}$ or $T_{identify_inter_without_index}$, assuming that the UE uses only the SMTC window of the target inter-frequency carrier for performing the measurements. In this case $K_{satellite=}$1, $CSSF_{inter}$=1.

  - if both condition D2-1 and condition D1-2 are fulfilled later than the time at the end of T_{Event_DU} + $T_{identify_inter_with_index}$ or T_{Event_DU} + $T_{identify_inter_without_index}$, then the measurement time delay equals to the time from the end of T_{Event_DU} until the time of both condition D2-1 and condition D2-2 are fulfilled.

When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency handover or [$T_{identify_inter_without_index}$] for inter-frequency handover.

6.1C.2.2.3 Preparation time

$T_{CHO_execution}$ is the UE execution preparation time for conditional handover, and starts after UE realizes the condition of CHO is met and identity of the target cell is determined. $T_{CHO_execution}$ can be up to 10 ms.

6.1C.2.2.4 Interruption time

The interruption time is the time between when the UE starts to execute the conditional handover to the target cell and the time the UE starts transmission of the new PRACH or PUSCH.

For intra-frequency or inter-frequency conditional handover, the measurement time shall be less than

$$T_{interrupt} = T_{processing} + T_{IU} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

- $T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.
- T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3]. For combination of RACH-less handover with time-based conditional handover, T_{IU} can be a configured grant based PUSCH, dynamic grant based PUSCH, SR on PUCCH, according to NW configuration and scheduling, or PRACH if no valid configured grant based PUSCH is selected.
- T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$ for both known and unknown target cells operating with 20 PRB SSB BW. $T_{\Delta} = 2*T_{rs}$ for both known and unknown target cells operating with 12 PRB SSB BW.
- T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.
- T_{rs} is the SMTC periodicity of the target NR SAN cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise T_{rs} is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing if UE doesn't support *twoSMTC-Periodicities-r19* or UE support *twoSMTC-Periodicities-r19* but only a single SMTC periodicity is configured or T_{rs} is the SMTC periodicity configured in the *measObjectNR* corresponding to the physical cell ID of the target cell if UE support *twoSMTC-Periodicities-r19* and more than one SMTC periodicity are configured. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of T_{IU} shall depend upon the PRACH configuration used in the target cell.

6.1C.2.3 NR SAN FR1 – NR SAN FR1 conditional handover without L3 measurement criteria

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handover from NR SAN FR1 cell to NR SAN FR1 cell without L3 measurement criteria. The requirements in this clause apply provided that UE has the valid and applicable parameters of ephemeris information, common TA, DL and UL Polarization information, K_{offset}, and K_{mac} for target NR SAN cell during D_{CHO}, otherwise preparation time and interruption time may be longer than the requirements in clauses 6.1C.2.3.2, 6.1C.2.3.3.

6.1C.2.3.1 Handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 38.331 [2]. UE is allowed to execute time-based and location-based conditional handover without RRM measurement once the time or distance condition is met, the time/distance condition is defined in clause 5.5.4 in TS 38.331[2]

When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel or PUSCH channel within D_{CHO} seconds from the end of the last TTI containing the RRC command.

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{interrupt} + T_{CHO_execution}$$

Where:

- T_{RRC} is the RRC procedure delay defined in clause 12 in TS 38.331 [2].

For time-based conditional handover:

- T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until condition T1-1 is fulfilled which will trigger the conditional handover

For location-based conditional handover:

- T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until both entering conditions are fulfilled which will trigger the conditional handover. If both source cell and target cell are quasi-Earth fixed cells, entering conditions correspond to condition D1-1 and condition D1-2. If both source cell and target cell are moving cells, entering conditions correspond to condition D2-1 and condition D2-2.

- $T_{CHO_execution}$ is the UE conditional execution preparation time for conditional handover in clause 6.1C.2.3.2.

- $T_{interrupt}$ is the interruption time stated in clause 6.1C.2.3.3.

6.1C.2.3.2 Preparation time

$T_{CHO_execution}$ is the UE execution preparation time for conditional handover, and starts after UE realizes the condition of CHO is met and identity of the target cell is determined. $T_{CHO_execution}$ can be up to 10 ms.

6.1C.2.3.3 Interruption time

The interruption time is the time between when the UE starts to execute the conditional handover to the target cell and the time the UE starts transmission of the new PRACH or PUSCH.

For intra-frequency or inter-frequency conditional handover, the measurement time shall be less than

$$T_{interrupt} = T_{processing} + T_{search} + T_{IU} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

- $T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

- T_{search} is the time required to search the target cell when the target cell is not already known when the conditional handover command is received by the UE. If the target cell is known, then $T_{search} = 0$ ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then $T_{search} = T_{rs}$ ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, then $T_{search} = 3* T_{rs}$ ms.

- T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3]. For combination of RACH-less handover with time-based conditional handover, T_{IU} can be a configured grant based PUSCH, dynamic grant based PUSCH, SR on PUCCH, according to NW configuration and scheduling, or PRACH if no valid configured grant based PUSCH is selected.

- T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$ for both known and unknown target cells operating with 20 PRB SSB BW. $T_{\Delta} = 3*T_{rs}$ for both known and unknown target cells operating with 12 PRB SSB BW.

- T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

- T_{rs} is the SMTC periodicity of the target NR SAN cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise T_{rs} is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing if UE doesn't support *twoSMTC-Periodicities-r19* or UE support *twoSMTC-Periodicities-r19* but only a single SMTC periodicity is configured or T_{rs} is the SMTC periodicity configured in the *measObjectNR* corresponding to the physical cell ID of the target cell if UE support *twoSMTC-Periodicities-r19* and more than one SMTC periodicity are configured. If the UE is not provided

SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of T_{IU} shall depend upon the PRACH configuration used in the target cell.

6.1C.2.4 NR SAN FR2-NTN – NR SAN FR2-NTN conditional handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handover from NR SAN FR2-NTN cell to NR SAN FR2-NTN cell, when the serving cell and the target cell are served by the same satellite.

The requirements in this clause apply provided that UE has the valid and applicable parameters of ephemeris information, common TA, DL and UL Polarization information, K_{offset}, and K_{mac} for target NR SAN cell during D_{CHO}, otherwise the measurement time, preparation time and interruption time may be longer than the requirements in clauses 6.1C.2.2.2, 6.1C.2.2.3 and 6.1C.2.2.4.

The requirements in this clause 6.1C.2.2 shall apply.

6.1C.3 NR SAN Satellite switching with re-synchronization

6.1C.3.1 Introduction

The purpose of NR SAN Satellite switching with re-synchronization is to switch satellite in the same SSB frequency and same gNB without PCI changing. The requirements in this clause are applicable to SA NR SAN.

6.1C.3.2 NR SAN FR1 – NR SAN FR1 Satellite switching with re-synchronization

The requirements in this clause are applicable to both hard and soft switch over quasi-earth fixed scenario from NR SAN FR1 satellite to NR SAN FR1 satellite. The requirements in this clause apply provided that UE has the valid and applicable parameters of ephemeris information, common TA, DL and UL Polarization information, K_{offset}, and K_{mac} for target NR SAN satellite during $D_{switch_unchangedPCI}$, otherwise interruption time may be longer than the requirements in clause 6.1C.3.2.2 for hard satellite switch and satellite switch delay may be longer than the requirements in clause 6.1C.3.2.3 for soft satellite switch.

Requirements for soft satellite switching are applicable for UEs that support *softSatelliteSwitchResyncNTN-r18* [14] when network configures soft satellite switching with resynchronization [2].

Requirements for hard satellite switching are applicable for UEs that support *hardSatelliteSwitchResyncNTN-r18* or *softSatelliteSwitchResyncNTN-r18* [14] when the network configures hard satellite switching with resynchronization [2]; or for UEs that support *hardSatelliteSwitchResyncNTN-r18* but do not support *softSatelliteSwitchResyncNTN-r18* when the network configures soft satellite switching with resynchronization.

6.1C.3.2.1 Satellite switching delay

When the UE receives a broadcast message implying satellite switching within re-synchronization, the UE shall be ready to start the transmission of the new uplink PRACH channel or transmission of the new uplink PUSCH channel within $D_{switch_unchangedPCI}$ msec.

Where:

- $D_{switch_unchangedPCI}$ equals to the interruption time stated in clause 6.1C.3.2.2 for hard satellite switch and satellite switch delay stated in clause 6.1C.3.2.3 for soft satellite switch.

6.1C.3.2.2 Interruption time for hard satellite switch with re-sync

The interruption time is the time between *t-service* and the time when the UE is ready to receive any DL channel/signal and transmit any UL channel/signal from/to the target satellite.

When intra-frequency hard switch to NR SAN satellite is commanded,

the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{processing} + T_{\Delta} + T_{margin}\ ms$$

Otherwise, no interruption time requirement is applied.

Where:

- T_{search} is the time required to search the target NR SAN satellite assuming the target satellite is not already known when UE starts synchronizing with target satellite. If the target satellite Es/Iot ≥ -2 dB, then $T_{search} = T_{first_SSB}$ ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target satellite search times.

- T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell.

  $T_{\Delta} = T_{rs}$ for both known and unknown target cells operating with 20 PRB SSB BW.

  $T_{\Delta} = 3*T_{rs}$ for both known and unknown target cells operating with 12 PRB SSB BW.

- $T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 10 ms.

- T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

- T_{first_SSB} is the time to the end of the first complete SSB burst of target satellite, the location of which is determined by the periodicity and location of SSB of the source satellite, and if *ssb-TimeOffset* is configured, the *ssb-TimeOffset* and the difference between propagation delay of the serving satellite and the target satellite counted from the *SSB-TimeOffset* reference point as defined in TS 38.331 [2] to UE.

UE is allowed to skip measurements for other cells and satellites than the target satellite and source satellite from *T-service* until the satellite switch completion.

6.1C.3.2.3 Satellite switch delay for soft satellite switch with re-sync

The Satellite switch delay is from *t-serviceStart* to the time instance when UE is ready to receive any DL channel/signal and transmit any UL channel/signal from/to the target satellite.

When intra-frequency soft switch to NR SAN satellite is commanded,

the satellite switch time shall be less than T_{soft_switch}

$$T_{soft_switch} = \max(t\text{-}service\text{-}t\text{-}seviceStart, T_{search} + T_{\Delta} + T_{margin}) + T_{processing}\ ms$$

Where:

- T_{search} is the time required to search the target NR SAN satellite assuming the target satellite is not already known when the handover command is received by the UE. If the target satellite Es/Iot ≥ -2 dB, then $T_{search} = T_{first_SSB}$ ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target satellite search times.

- T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell.

  $T_{\Delta} = T_{rs}$ for both known and unknown target cells operating with 20 PRB SSB BW.

  $T_{\Delta} = 3*T_{rs}$ for both known and unknown target cells operating with 12 PRB SSB BW.

- $T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 10 ms.

- T_{margin} is same as the one defined in section 6.1C.1.2.2.1.

- T_{first_SSB} is the time to the end of the first complete SSB burst of target satellite, the location of which is determined by the periodicity and location of SSB of the source satellite, the *ssb-TimeOffset* and the difference between propagation delay of the serving satellite and the target satellite counted from *SSB-TimeOffset* reference point as defined in 38.331 [2] to UE.

During the time period from *t-seviceStart* to *t-service*, scheduling restriction as defined in clause 9.2C.5.3 is allowed, with the exception that the locations of SSB symbols of target satellite where scheduling restriction applies are

determined by the periodicity and location of SSB of the source satellite, the *ssb-TimeOffset* and the difference between propagation delay of the serving satellite and the target satellite counted from the *SSB-TimeOffset* reference point as defined in TS 38.331 [2] to UE.

UE is allowed to skip measurements for other cells and satellites than the target satellite and source satellite from *t-seviceStart* to the satellite switch completion.

The requirement in this clause applies and UE is required to keep the connection (DL and UL) with the source NGSO satellite, under the following conditions:

- SSBs from the two satellites are spaced apart from each other at least by 1 OFDM symbol in the time domain at UE Rx side.

6.1C.3.3 NR SAN FR2 – NR SAN FR2 Satellite switching with re-synchronization

The requirements in this clause are applicable to both hard and soft switch over quasi-earth fixed scenario from FR2-NTN satellite to FR2-NTN satellite. The requirements in this clause apply provided that UE has the valid and applicable parameters of ephemeris information, common TA, DL and UL Polarization information, K_{offset}, and K_{mac} for target NR SAN satellite during $D_{switch_unchangedPCI}$, otherwise interruption time may be longer than the requirements in clause 6.1C.3.3.2 for hard satellite switch and satellite switch delay may be longer than the requirements in clause 6.1C.3.3.3 for soft satellite switch.

Requirements for soft satellite switching are applicable for UEs that support *softSatelliteSwitchResyncNTN-r18* [14] when network configures soft satellite switching with resynchronization [2].

Requirements for hard satellite switching are applicable for UEs that support *hardSatelliteSwitchResyncNTN-r18* or *softSatelliteSwitchResyncNTN-r18* [14] when the network configures hard satellite switching with resynchronization [2]; or for UEs that support *hardSatelliteSwitchResyncNTN-r18* but do not support *softSatelliteSwitchResyncNTN-r18* when the network configures soft satellite switching with resynchronization.

Note: UE indicating '*mechanical*' via UE capability *ntn-VSAT-AntennaType-r19* is not expected to indicate support of *softSatelliteSwitchResyncNTN-r18* [14].

6.1C.3.3.1 Satellite switching delay

The requirements in clause 6.1C.3.2.1 shall apply except that

- clause 6.1C.3.2.2 is replaced with clause 6.1C.3.3.2, and
- clause 6.1C.3.2.3 is replaced with 6.1C.3.3.3.

6.1C.3.3.2 Interruption time for hard satellite switch with re-sync

The requirements in clause 6.1C.3.2.2 shall apply except that $T_{interrupt}$ is replaced with

$$T_{interrupt} = T_{sat_beam} + T_{search} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

where:

- T_{search}, $T_{processing}$, T_{Δ} and T_{margin} are as defined in clause 6.1C.3.2.2,
- T_{sat_beam} is additional time for UE to steer the downlink spatial domain reception filter to the target satellite.
  - For UE indicating '*electronic*' via UE capability *ntn-VSAT-AntennaType-r19*, T_{sat_beam} is $3*T_{SSB}$, where T_{SSB} is the periodicity of the SSB of the source satellite.
  - For UE indicating '*mechanical*' via UE capability *ntn-VSAT-AntennaType-r19*, T_{sat_beam} is O_{angle} / 22.5 s, where O_{angle} is the angle offset observed from UE in degree between the satellite for the serving cell and the satellite for the target cell.

6.1C.3.3.3 Satellite switch delay for soft satellite switch with re-sync

The requirements in clause 6.1C.3.2.3 shall apply except that

- clause 9.2C.5.3 is replaced with clause 9.2C.7.3, and
- T_{soft_switch} is replaced with

$$T_{soft_switch} = \max(\textit{t-service-t-serviceStart}, T_{sat_beam} + T_{search} + T_{\Delta} + T_{margin}) + T_{processing}\ \text{ms}$$

where

- T_{search}, $T_{processing}$, T_{Δ} and T_{margin} are as defined in clause 6.1C.3.2.3,
- T_{sat_beam} is additional time for UE to steer the downlink spatial domain reception filter to the target satellite.
  - For UE indicating '*electronic*' via UE capability *ntn-VSAT-AntennaType-r19*, T_{sat_beam} is $3*T_{SSB}$, where T_{SSB} is the periodicity of the SSB of the source satellite.

In addition, following scheduling restriction applies during the time period from *t-serviceStart* to *t-service*,

- If *deriveSSB-IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and K_{RX_switch} data symbol before and after each consecutive SSB symbols to be measured within SMTC window duration.
- If *deriveSSB-IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration, and K_{RX_switch} data symbol before and after SMTC window duration.
- where K_{RX_switch} is for the switch period of UE to steer the downlink spatial domain reception filter toward a target cell. $K_{RX_switch} = 1$.

The requirements in this clause do not apply if the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for *t-ServiceStart-r18* and *ssb-TimeOffset* are available for the UE for the first time to the first slot corresponding to *t-ServiceStart-r18* is less than 1s.

6.1D Handover for RedCap

6.1D.1 NR Handover

6.1D.1.1 Introduction

The purpose of NR handover is to change the NR PCell to another NR cell for RedCap UE. The requirements in this clause are applicable to SA NR.

Handover for a RedCap UE is defined as intra-frequency handover if the center frequency and subcarrier spacing (SCS) of the reference SSB of the serving cell is same as the center frequency and SCS of the reference SSB of the target cell, where:

- The reference SSB of the serving cell is the SSB in the active DL BWP of serving cell
- The reference SSB of the target cell is the SSB in the first active DL BWP of the target cell upon reconfiguration.

The requirements in this clause apply for the following handover scenarios:

- Handover to a target cell's DL BWP associated with CD-SSB;
- Handover to a target cell's Redcap specific DL BWP associated with NCD-SSB with RACH on the corresponding Redcap specific UL BWP.

6.1D.1.2 NR FR1 - NR FR1 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR1 cell to NR FR1 cell.

6.1D.1.2.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ msec from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1D.1.2.2.

6.1D.1.2.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell which depends on whether the target cell is already known when the handover command is received by the UE.

- If the target cell is a known intra-frequency cell, T_{search} = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then T_{search} = 1*T_{rs} ms if UE is capable of 2 Rx antennas; T_{search} = 2*T_{rs} ms if UE is only required to support 1 Rx antenna.

- If the target cell is a known inter-frequency cell, then

  if the measured SSB is the target SSB for HO of the target cell, T_{search} = 0 ms;

  if the measured SSB and the target SSB for HO belong to the same NR target cell , T_{search} = T_{rs} ms provided one of the following conditions is fulfilled:

  - The measured SSB is the CD-SSB in the DL BWP and the target SSB for HO is the NCD-SSB in RedCap specific DL BWP, or
  - The measured SSB is the NCD-SSB in RedCap specific DL BWP and the target SSB for HO is the CD-SSB in DL BWP, or
  - The measured SSB is the NCD-SSB and the target SSB for HO is the NCD-SSB and both are within different RedCap specific DL BWPs

  If the target cell is an unknown inter-frequency celland if the target cell Es/Iot≥-2 dB, then T_{search} = 3* T_{rs} ms if the UE is operating with 2 Rx antennas; T_{search} = 5*T_{rs} ms if UE is operating with only 1 Rx antenna.

Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. T_{Δ} = T_{rs} for both known and unknown target cell.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise,

- T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing as NCD-SSB indicated by nonCellDefiningSSB-r17 if the first active DL BWP included in handover command is configured with nonCellDefiningSSB-r17, otherwise, as CD-SSB indicated by *absoluteFrequencySSB* in *frequencyInfoDL* in handover command.

- If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

For RedCap UE with HD-FDD, the handover requirements are met provided that

- SSB is available at the UE once every SMTC period during T_{search}

- One SSB is available during T_{Δ}

- One SSB is available during $T_{IU.}$

In FR1, the target cell is known if it has been meeting the following conditions:

- At least one of the SSBs measured belongs to the same NR target cell,

- During the last 5 seconds before the reception of the handover command:

  - at least one of the SSBs measured which belongs to the same NR target cell remains detectable according to the cell identification requirements as described in clause 9.2B for intra-frequency measurements and clause 9.3B for inter-frequency measurements,

- The reference SSB of the NR target cell also remains detectable during the handover delay according to the cell identification requirements are described in clause 9.2B for intra-frequency handover and clause 9.3B for inter-frequency handover.

Otherwise, it is unknown.

6.1D.1.3 NR FR2- NR FR2 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR2 cell to NR FR2 cell.

6.1D.1.3.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ msec from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1D.1.3.2.

6.1D.1.3.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}\ \text{ms}$$

Where:

T_{search} is the time required to search the target cell which depends on whether the target cell is already known when the handover command is received by the UE.

- If the target cell is a known intra-frequency cell, T_{search} = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then T_{search} = N*T_{rs} ms.
- If the target cell is a known inter-frequency cell, then

  if the measured SSB is the target SSB for HO of the target cell, T_{search} = 0 ms;

  if the measured SSB and the target SSB for HO belong to the same NR target cell, T_{search} = T_{rs} ms provided one of the following conditions is fulfilled:

  - The measured SSB is the CD-SSB in the DL BWP and the target SSB for HO is the NCD-SSB in RedCap specific DL BWP, or
  - The measured SSB is the NCD-SSB in RedCap specific DL BWP and the target SSB for HO is the CD-SSB in DL BWP, or
  - The measured SSB is the NCD-SSB and the target SSB for HO is the NCD-SSB and both are within different RedCap specific DL BWPs

- Otherwise, the target cell is an unknown inter-frequency cell. In this case, if the target cell Es/Iot≥-2 dB, then T_{search} = 3*N* T_{rs} ms.
- Where N = 8 when the target cell is in FR2-1.

Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. T_{Δ} = T_{rs} for both known and unknown target cell.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise,

- T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing as NCD-SSB indicated by *nonCellDefiningSSB-r17* if the first active DL BWP included in handover command is configured with *nonCellDefiningSSB-r17*, otherwise, as CD-SSB indicated by *absoluteFrequencySSB* in *frequencyInfoDL* in handover command.
- If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

In FR2, the target cell is known if it has been meeting the following conditions:

- At least one of the SSBs measured belongs to the same NR target cell,
- During the last 5 seconds before the reception of the handover command:
  - the UE has sent a valid measurement report for the target cell and
  - at least one of the SSBs measured which belongs to the same NR target cell remains detectable according to the cell identification requirements as described in clause 9.2B for intra-frequency measurements and clause 9.3B for inter-frequency measurements,

- The reference SSB of the NR target cell also remains detectable during the handover delay according to the cell identification requirements are described in clause 9.2B for intra-frequency handover and clause 9.3B for inter-frequency handover.

Otherwise, it is unknown.

6.1D.2 NR Handover to other RATs

6.1D.2.1 NR – E-UTRAN Handover

The purpose of inter-RAT handover from NR to E-UTRAN is to change the radio access mode of PCell from NR to E-UTRAN for RedCap UE. The handover procedure is initiated from NR with a RRC message that implies a handover as described in TS 38.331 [2]. The requirements in this clause are applicable to SA NR.

The requirements in clause 6.1.2.1 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements for category 1bis UE defined in clause 5.1.2 in [15] shall apply.

6.1E Handover for ATG

6.1E.1 NR Handover

6.1E.1.1 Introduction

The purpose of NR handover for NR ATG is to change the NR PCell to another NR cell. The requirements in this clause are applicable to SA NR ATG.

6.1E.1.2 NR FR1 - NR FR1 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR1 cell to NR FR1 cell.

6.1E.1.2.1 Handover delay

When the UE receives a RRC message implying handover to NR cell, the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ msec from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1E.1.2.2.

6.1E.1.2.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover to NR cell is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then T_{search} = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot≥-2 dB, then $T_{search} = N*T_{rs}$ ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot≥-2 dB, then $T_{search} = 3* N*T_{rs}$ ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

For ATG UE capable of *antennaArrayType-r18*,

- When network assistance on ATG cells reference location of the target cell is provided to UE, N = 2;
- Otherwise, N = 4.

- Otherwise, N=1

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$ for both known and unknown target cell.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20 ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2 ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise T_{rs} is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in clause 9.2D.5 for intra-frequency handover and clause 9.3D.4 for inter-frequency handover.

6.1E.2 NR Conditional Handover

6.1E.2.1 Introduction

The requirements in this clause are applicable to conditional handover to change the NR PCell to another NR cell for NR ATG.

6.1E.2.2 NR FR1 – NR FR1 conditional handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handover from NR FR1 cell to NR FR1 cell. When the *condEventD1* is configured to UE, the requirements in this clause apply provided that UE has the valid and applicable parameters of BS location information and K_{offset} for target NR cell during D_{CHO}, otherwise the measurement time, preparation time and interruption time may be longer than the requirements in clause 6.1E.2.2.2, 6.1E.2.2.3 and 6.1E.2.2.4.

6.1E.2.2.1 Handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 38.331 [2]. UE shall start RRM measurement before the distance condition is met if the *condEventD1* is configured to UE, the distance condition is defined in clause 5.5.4 in TS 38.331[2]. When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel within D_{CHO} seconds from the end of the last TTI containing the RRC command.

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{interrupt} + T_{CHO_execution}$$

Where:

T_{RRC} is the RRC procedure delay defined in clause 12 in TS 38.331 [2].

T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until a condition exists at the measurement reference point which will trigger the conditional handover.

$T_{measure}$ is the measurements time stated in clause 6.1E.2.2.2.

$T_{CHO_execution}$ is the conditional execution preparation time in clause 6.1E.2.2.3.

$T_{interrupt}$ is the interruption time stated in clause 6.1E.2.2.4.

The conditional handover delay requirements are applied if both condition D1-1 and condition D1-2 are fulfilled before the end of $T_{measure}$ for location-based CHO, otherwise no CHO requirement is applied.

6.1E.2.2.2 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE executes a handover to a target cell and interruption time starts.

For intra-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_intra\ with\ index}$ or $T_{identify_intra_without_index}$ defined in clause 9.2D.5.1 or clause 9.2D.6.2.

For location-based conditional intra-frequency handover:

- If both condition D1-1 and condition D1-2 are fulfilled earlier than the time at the end of T_{Event_DU} + $T_{identify_intra_with_index}$ or T_{Event_DU} + $T_{identify_intra_without_index}$, then the measurement time delay equals to $T_{identify_intra_with_index}$ or $T_{identify_intra_without_index}$ assuming UE only performs measurements within SMTC window of the target cell.
- If both condition D1-1 and condition D1-2 are fulfilled later than the time at the end of T_{Event_DU} + $T_{identify_intra_with_index}$ or T_{Event_DU} + $T_{identify_intra_without_index}$, then the measurement time delay equals to the time from the end of T_{Event_DU} until time when both condition D1-1 and condition D1-2 are fulfilled.

For inter-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_inter_with_index}$ or $T_{identify_inter_without_index}$ defined in clause 9.3D.4.

For location-based conditional inter-frequency handover:

- If both condition D1-1 and condition D1-2 are fulfilled earlier than the time at the end of T_{Event_DU} + $T_{identify_inter_with_index}$ or T_{Event_DU} + $T_{identify_inter_without_index}$, then the measurement time delay equals to $T_{identify_inter_with_index}$ or $T_{identify_inter_without_index}$, assuming that the UE uses only the SMTC window of the target inter-frequency carrier for performing the measurements.
- If both condition D1-1 and condition D1-2 are fulfilled later than the time at the end of T_{Event_DU} + $T_{identify_inter_with_index}$ or T_{Event_DU} + $T_{identify_inter_without_index}$, then the measurement time delay equals to the time from the end of T_{Event_DU} until time when condition D1-1 and condition D1-2 are fulfilled.

When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency handover or $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency handover. If a cell which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency handover or $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency handover becomes undetectable for a period and then the cell becomes detectable again and triggers a handover, the measurement time delay shall be less than $T_{SSB_measurement_period_intra}$ or $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

6.1E.2.2.3 Preparation time

The requirements in clause 6.1.4.2.3 shall apply.

6.1E.2.2.4 Interruption time

The requirements in clause 6.1.4.2.4 shall apply.

6.1F Handover for RedCap UE with satellite access

6.1F.1 NR SAN Handover

6.1F.1.1 Introduction

The purpose of NR SAN handover is to change the NR SAN PCell to another NR SAN cell for RedCap UE. The requirements in this clause are applicable to SA NR SAN.

Handover for a RedCap UE is defined as intra-frequency handover if the center frequency and subcarrier spacing (SCS) of the reference SSB of the serving cell is same as the center frequency and SCS of the reference SSB of the target cell, where:

- The reference SSB of the serving cell is the SSB in the active DL BWP of serving cell
- The reference SSB of the target cell is the SSB in the first active DL BWP of the target cell upon reconfiguration.

6.1F.1.2 NR SAN FR1 – NR SAN FR1 Handover

The applicability defined in clause 6.1F.1.2 apply for the requirements in this clause.

6.1F.1.2.1 Handover delay

The requirements in clause 6.1C.1.2.1 shall apply except that

- clause 6.1C.1.2.2.1 is replaced with 6.1F.1.2.2.1, and
- clause 6.1C.1.2.2.2 is replaced with 6.1F.1.2.2.2.

6.1F.1.2.2 Interruption time

The requirements in clause 6.1C.1.2.2 shall apply except that

- clause 9.2C.5 is replaced with 9.2E.5, and
- clause 9.3C.4 is replaced with 9.3E.4.

6.1F.1.2.2.1 Interruption time for RACH-based handover

The requirements in clause 6.1C.1.2.2.1 shall apply for RedCap UE with 2 Rx antennas.

The requirements in clause 6.1C.1.2.2.1 shall apply for RedCap UE with 1 Rx antennas except that T_{search} is defined as

- T_{search} is the time required to search the target NR SAN cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then T_{search} = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot ≥ -2 dB, then T_{search} = 2*T_{rs} ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot ≥ -2 dB, then T_{search} = 5* T_{rs} ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

6.1F.1.2.2.2 Interruption time for RACH-less handover

The requirements in clause 6.1C.1.2.2.2 shall apply except that clause 6.1F.1.2.2.1 is replaced with 6.1F.1.2.2.1.

6.1F.2 NR SAN Conditional Handover

6.1F.2.1 Introduction

The requirements in this clause are applicable to conditional handover to change the NR SAN PCell to another NR SAN cell for RedCap UE.

6.1F.2.2 NR SAN FR1 – NR SAN FR1 conditional handover

The applicability defined in clause 6.1F.2.2 apply for the the requirements in this clause except that

- clause 6.1C.2.2.2 is replaced with 6.1F.2.2.2, and
- clause 6.1C.2.2.3 is replaced with 6.1F.2.2.3, and
- clause 6.1C.2.2.4 is replaced with 6.1F.2.2.4.

6.1F.2.2.1 Handover delay

The requirements in clause 6.1C.2.2.1 shall apply except that

- clause 6.1C.2.2.2 is replaced with 6.1F.2.2.2, and
- clause 6.1C.2.2.3 is replaced with 6.1F.2.2.3, and
- clause 6.1C.2.2.4 is replaced with 6.1F.2.2.4.

6.1F.2.2.2 Measurement time

The requirements in clause 6.1C.2.2.2 shall apply except that

- clause 9.2C.5.1 is replaced with 9.2E.5.1, and
- clause 9.2C.6.1 is replaced with 9.2E.6.1, and
- clause 9.3C.7.1 is replaced with 9.3E.7.1.

6.1F.2.2.3 Preparation time

The requirements in clause 6.1C.2.2.3 shall apply.

6.1F.2.2.4 Interruption time

The requirements in clause 6.1C.2.2.4 shall apply.

6.1F.2.3 NR SAN FR1 – NR SAN FR1 conditional handover without L3 measurement criteria

The applicability defined in clause 6.1C.2.3 apply for the requirements in this clause except that

- clause 6.1C.2.3.2 is replaced with 6.1F.2.3.2, and
- clause 6.1C.2.3.3 is replaced with 6.1F.2.3.3.

6.1F.2.3.1 Handover delay

The requirements in clause 6.1C.2.3.1 shall apply except that

- clause 6.1C.2.3.2 is replaced with 6.1F.2.3.2, and
- clause 6.1C.2.3.3 is replaced with 6.1F.2.3.3.

6.1F.2.3.2 Preparation time

The requirements in clause 6.1C.2.3.2 shall apply.

6.1F.2.3.3 Interruption time

The requirements in clause 6.1C.2.3.3 shall apply for RedCap UE with 2 Rx antennas.

The requirements in clause 6.1C.2.3.3 shall apply for RedCap UE with 1 Rx antennas except that T_{search} is defined as

- T_{search} is the time required to search the target NR SAN cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then T_{search} = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot ≥ -2 dB, then T_{search} = 2*T_{rs} ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot ≥ -2 dB, then T_{search} = 5* T_{rs} ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

6.1F.3 NR SAN Satellite switching with re-synchronization

6.1F.3.1 Introduction

The purpose of NR SAN Satellite switching with re-synchronization is to switch satellite in the same SSB frequency and same gNB without PCI changing for RedCap UE. The requirements in this clause are applicable to SA NR SAN.

6.1F.3.2 NR SAN FR1 – NR SAN FR1 Satellite switching with re-synchronization

The applicability defined in clause 6.1C.3.2 apply for the the requirements in this clause except that

- clause 6.1C.3.2.2 is replaced with 6.1F.3.2.2, and
- clause 6.1C.3.2.3 is replaced with 6.1F.3.2.3.

6.1F.3.2.1 Satellite switching delay

The requirements in clause 6.1C.3.2.1 apply for the the requirements in this clause except that

- clause 6.1C.3.2.2 is replaced with 6.1F.3.2.2, and
- clause 6.1C.3.2.3 is replaced with 6.1F.3.2.3.

6.1F.3.2.2 Interruption time for hard satellite switch with re-sync

The requirements in clause 6.1C.3.2.2 shall apply for RedCap UE with 2 Rx antennas except that

- clause 6.1C.1.2.2.1 is replaced with 6.1F.1.2.2.1.

The requirements in clause 6.1C.3.2.2 shall apply for RedCap UE with 1 Rx antennas except that

- T_{search} is the time required to search the target NR SAN cell assuming the target cell is not already known when UE starts synchronizing with target satellite. If the target cell Es/Iot ≥ -2 dB, then T_{search} = T_{first_SSB} + T_{SSB} ms, where T_{SSB} is the periodicity of the SSB of the source satellite. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.
- clause 6.1C.1.2.2.1 is replaced with 6.1F.1.2.2.1.

6.1F.3.2.3 Satellite switch delay for soft satellite switch with re-sync

The requirements in clause 6.1C.3.2.3 shall apply for RedCap UE with 2 Rx antennas except that

- clause 6.1C.1.2.2.1 is replaced with 6.1F.1.2.2.1, and
- clause 9.2C.5.3 is replaced with 9.2E.5.3.

The requirements in clause 6.1C.3.2.2 shall apply for RedCap UE with 1 Rx antennas except that

- T_{search} is the time required to search the target NR SAN cell assuming the target cell is not already known when UE starts synchronizing with target satellite. If the target cell Es/Iot ≥ -2 dB, then T_{search} = T_{first_SSB} + T_{SSB} ms, where T_{SSB} is the periodicity of the SSB of the source satellite. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.
- clause 6.1C.1.2.2.1 is replaced with 6.1F.1.2.2.1, and

- clause 9.2C.5.3 is replaced with 9.2E.5.3.

6.2 RRC Connection Mobility Control

6.2.1 SA: RRC Re-establishment

6.2.1.1 Introduction

This clause contains requirements on the UE regarding RRC connection re-establishment procedure. RRC connection re-establishment is initiated when a UE in RRC_CONNECTED state on the carrier without CCA or on the carrier with CCA loses RRC connection due to any of failure cases, including radio link failure, handover failure, and RRC connection reconfiguration failure. The RRC connection re-establishment procedure is specified in clause 5.3.7 of TS 38.331 [2].

A neighbour cell for RRC re-establishment procedures for UE supporting *ncd-SSB-BWP-Wor-r18* is defined as an intra-frequency cell if the centre frequency and subcarrier spacing (SCS) of the reference SSB of the serving cell is same as the centre frequency and SCS of the reference SSB of the neighbour cell; else it is considered as inter-frequency cell, where:

- The reference SSB of the target cell is the CD-SSB of the target cell.
- The reference SSB of the serving cell is the CD-SSB of the serving cell.

The requirements in this clause are applicable for RRC connection re-establishment to NR cell.

6.2.1.2 Requirements

In RRC_CONNECTED state the UE shall be capable of sending *RRCReestablishmentRequest* message within $T_{re\text{-}establish_delay}$ seconds from the moment it detects a loss in RRC connection. The total RRC connection delay ($T_{re\text{-}establish_delay}$) shall be less than:

$$T_{re-establish_delay} = T_{UE_re-establish_delay} + T_{UL_grant}$$

T_{UL_grant}: It is the time required to acquire and process uplink grant from the target PCell. The uplink grant is required to transmit *RRCReestablishmentRequest* message.

The UE re-establishment delay ($T_{UE_re\text{-}establish_delay}$) is specified in clause 6.2.1.2.1.

6.2.1.2.1 UE Re-establishment delay requirement

The UE re-establishment delay ($T_{UE_re\text{-}establish_delay}$) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell. The UE re-establishment delay ($T_{UE_re\text{-}establish_delay}$) requirement shall be less than:

$$T_{UE_re-establish_delay} = 50\ \text{ms} + T_{identify_intra_NR} + \sum_{i=1}^{N_{freq}-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

The intra-frequency target NR cell shall be considered detectable if each relevant SSB can satisfy that:

- SS-RSRP related side conditions given in clauses 10.1.2 and 10.1.3 are fulfilled for a corresponding NR Band for FR1 and FR2, respectively, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding NR Band are fulfilled.

The inter-frequency target NR cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clauses 10.1.4 and 10.1.5 are fulfilled for a corresponding NR Band for FR1 and FR2, respectively, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding NR Band are fulfilled.

$T_{identify_intra_NR}$: It is the time to identify the target intra-frequency NR cell and it depends on whether the target NR cell is known cell or unknown cell and on the FR of the target NR cell. If the UE is not configured with intra-frequency NR carrier for RRC re-establishment then $T_{identify_intra_NR}$=0; otherwise $T_{identify_intra_NR}$ shall not exceed the values defined in table 6.2.1.2.1-1 when *highSpeedMeasFlagFR2-r17* is not configured or UE is not capable of FR2 power class 6 and table 6.2.1.2.1-3 when *highSpeedMeasFlagFR2-r17* is configured and UE is capable of FR2 power class 6.

$T_{identify_inter_NR,i}$: It is the time to identify the target inter-frequency NR cell on inter-frequency carrier *i* configured for RRC re-establishment and it depends on whether the target NR cell is known cell or unknown cell and on the FR of the target NR cell. $T_{identify_inter_NR,i}$ shall not exceed the values defined in table 6.2.1.2.1-2.

T_{SMTC}: It is the periodicity of the SMTC occasion configured for the intra-frequency carrier. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2*, T_{smtc} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

$T_{SMTC,i}$: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*. If it is not configured, the UE may assume that the target SSB periodicity is no larger than 20 ms.

T_{SI-NR}: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for the target NR cell.

T_{PRACH}: It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. T_{PRACH} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

N_{freq}: It is the total number of NR frequencies to be monitored for RRC re-establishment; N_{freq} = 1 if the target intra-frequency NR cell is known, else N_{freq} = 2 and $T_{identify_intra_NR}$ = 0 if the target inter-frequency NR cell is known.

There is no requirement if the target cell does not contain the UE context.

In the requirement defined in the below tables, the target FR1 cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown.

Table 6.2.1.2.1-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify_intra_NR}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (200 ms, 5 x T_{SMTC})	MAX (800 ms, 10 x T_{SMTC})
≥ -8	FR2-1	N/A	MAX (1000 ms, ($M1^{Note2}$ x T_{SMTC} + T_{proc}))
≥ -8	FR2-2	N/A	MAX (1000 ms, 120 x T_{SMTC}))
< -8	FR1	N/A	800^{Note1}
< -8	FR2-1	N/A	$M2^{Note1,Note3}$ + T_{proc}
< -8	FR2-2	N/A	5280^{Note1}
NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when T_{SMTC} > 20 ms and serving cell SSB Ês/Iot < -8 dB.			
NOTE 2: M1 = N*10, N = *reduced beam sweeping factor* and T_{proc} = 2 ms for the UE capable of *Rel-19 L3 fast Rx beam sweeping* and when the conditions in clause 3.6.21 are fulfilled, otherwise, M1 = 80 and T_{proc} = 0 ms.			
NOTE 3: M2 = N*440, N = *reduced beam sweeping factor* and T_{proc} = 2 ms for the UE capable of *Rel-19 L3 fast Rx beam sweeping* and when the conditions in clause 3.6.21 are fulfilled, otherwise, M2 = 3520 and T_{proc} = 0 ms.			

Table 6.2.1.2.1-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify_inter_NR,\ i}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (200 ms, 6 x $T_{SMTC,\ i}$)	MAX (800 ms, 13 x $T_{SMTC,\ i}$)
≥ -8	FR2-1	N/A	MAX (1000 ms, ($M1^{Note2}$ x $T_{SMTC,\ i}$ + T_{proc}))
≥ -8	FR2-2	N/A	MAX (1000 ms, 156 x $T_{SMTC,\ i}$))
< -8	FR1	N/A	800^{Note1}
< -8	FR2-1	N/A	$M2^{Note1,Note3}$ + T_{proc}
< -8	FR2-2	N/A	6000^{Note1}

NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when $T_{SMTC,i}$ > 20 ms and serving cell SSB Ês/Iot < -8 dB.
NOTE 2: M1 = N*13, N = *reduced beam sweeping factor* and T_{proc} = 2 ms for the UE capable of *Rel-19 L3 fast Rx beam sweeping* and when the conditions in clause 3.6.21 are fulfilled, otherwise, M1 = 104 and T_{proc} = 0 ms.
NOTE 3: M2 = N*500, N = *reduced beam sweeping factor* and T_{proc} = 2 ms for the UE capable of *Rel-19 L3 fast Rx beam sweeping* and when the conditions in clause 3.6.21 are fulfilled, otherwise, M2 = 4000 and T_{proc} = 0 ms.

Table 6.2.1.2.1-3: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell when *highSpeedMeasFlagFR2-r17* is configured (Frequency range FR2)

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify_intra_NR}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR2	N/A	MAX (1000 ms, 10 xN2 x T_{SMTC}))

NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when T_{SMTC} > 20 ms and serving cell SSB Ês/Iot < -8 dB.
NOTE 2: When SMTC <= 40 ms, N2=2 when *highSpeedMeasFlagFR2-r17* = set1; N2=6 when *highSpeedMeasFlagFR2-r17* = set2.

6.2.1A RRC Re-establishment with CCA

6.2.1A.1 Introduction

This clause contains requirements on the UE regarding RRC connection re-establishment procedure on the carrier with CCA. RRC connection re-establishment on the carrier with CCA is initiated when a UE in RRC_CONNECTED state on the carrier w/o or with CCA loses RRC connection due to any of failure cases, including radio link failure, handover failure, and RRC connection reconfiguration failure. The RRC connection re-establishment procedure is specified in clause 5.3.7 of TS 38.331 [2].

In the requirements of clause 6.2.1A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding RRC re-establishment period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 6.2.1A, the term PRACH occasion unavailable for transmission refers to when the PRACH occasion is configured by gNB but not transmitted by the UE during the corresponding period due to UL CCA failure at the UE; otherwise the PRACH occasion is considered as available for transmission.

The requirements in this clause are applicable for RRC connection re-establishment to NR cell on the carrier with CCA.

When the RRC connection re-establishment is performed on a cell in FR2-2 with shared spectrum channel access, UE shall determine the CCA mode of the neighbour cell according to *channelAccessMode2-r17* if configured. If *channelAccessMode2-r17* of the cell is enabled, UE shall assume that CCA applies to the cell and perform measurement accordingly, and the requirements in clause 6.2.1A shall apply; otherwise, UE shall assume that CCA does not apply to the cell and perform measurement accordingly, and requirements in clause 6.2.1 shall apply.

6.2.1A.2 Requirements

In RRC_CONNECTED state on the carrier w/o or with CCA the UE shall be capable of sending *RRCReestablishmentRequest* message within $T_{re\text{-}establish_delay_CCA}$ seconds from the moment it detects a loss in RRC connection. The total RRC connection delay ($T_{re\text{-}establish_delay_CCA}$) shall be less than:

$$T_{re-establish_delay_CCA} = T_{UE_re-establish_delay_CCA} + T_{UL_grant}$$

T_{UL_grant}: It is the time required to acquire and process uplink grant from the target PCell with CCA. The uplink grant is required to transmit *RRCReestablishmentRequest* message.

The UE re-establishment delay ($T_{UE_re\text{-}establish_delay_CCA}$) is specified in clause 6.2.1A.2.1.

6.2.1A.2.1 UE Re-establishment with CCA delay requirement

The UE re-establishment on the carrier with CCA delay ($T_{UE_re\text{-}establish_delay_CCA}$) is the time between the moments when any of the conditions requiring RRC re-establishment on the carrier with CCA as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell on the carrier with CCA . The UE re-establishment delay requirement ($T_{UE_re\text{-}establish_delay_CCA}$) on the carrier with CCA shall be less than:

$$T_{UE_re-establish_delay_CCA} = 50\ \text{ms} + T_{identify_intra_NR_CCA} + \sum_{i=1}^{N_{freq}-1} T_{identify_inter_NR_CCA,i} + T_{SI-NR_CCA} + T_{PRACH_CCA}$$

The intra-frequency target NR cell with CCA shall be considered detectable if each relevant SSB can satisfy that:

- SS-RSRP related side conditions given in clauses 10.1.2 and 10.1.3 are fulfilled for a corresponding NR Band for FR1 and FR2-2, respectively, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding NR Band are fulfilled.

The inter-frequency target NR cell on the carrier with CCA shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clauses 10.1.4 and 10.1.5 are fulfilled for a corresponding NR Band for FR1 and FR2-2, respectively, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding NR Band are fulfilled.

$T_{identify_intra_NR_CCA}$: If the target intra-frequency carrier is the carrier without CCA, it is the time to identify the target intra-frequency NR cell which is defined in clause 6.2.1; otherwise it is the time to identify the target intra-frequency NR cell on the carrier with CCA and it depends on whether the target NR cell on the carrier with CCA is known cell or unknown cell and on the frequency range (FR) of the target NR cell on the carrier with CCA. If the UE is not configured with intra-frequency NR carrier with CCA for RRC re-establishment then $T_{identify_intra_NR_CCA}$=0; otherwise $T_{identify_intra_NR_CCA}$ shall not exceed the values defined in table 6.2.1A.2.1-1.

$T_{identify_inter_NR_CCA,i}$: If the target inter-frequency carrier is the carrier without CCA, it is the time to identify the target inter-frequency NR cell which is defined in clause 6.2.1; otherwise it is the time to identify the target inter-frequency NR cell on inter-frequency carrier *i* with CCA configured for RRC re-establishment and it depends on whether the target NR cell on the inter-frequency carrier with CCA is known or unknown. $T_{identify_inter_NR_CCA,i}$ shall not exceed the values defined in table 6.2.1A.2.1-2.

T_{SMTC}: It is the periodicity of the SMTC occasion configured for the intra-frequency carrier. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2*, T_{smtc} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

$T_{SMTC,i}$: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*. If it is not configured, the UE may assume that the target SSB periodicity is not larger than 20 ms.

$T_{SI\text{-}NR_CCA}$: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for the target NR cell on the carrier with CCA.

T_{PRACH_CCA} is the delay uncertainty in acquiring the first available PRACH occasion in the target NR Cell on the carrier with CCA:

$T_{PRACH_CCA} = (1+ K_3)*T_{SSB,RO} + 10$ ms, where:

- $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined in table 8.1-1 of TS 38.213 [39].
- K_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. $K_3 = 0$ for Type 2C UL channel access procedure as defined in TS 37.213 [57]. $L_3 = 0$ if *ra-ChannelAccess-r17* is not configured in FR2-2.

N_{freq}: It is the total number of NR frequencies to be monitored for RRC re-establishment; $N_{freq} = 1$ if the target NR cell on the intra-frequency carrier with CCA is known, else $N_{freq} = 2$ and $T_{identify_intra_NR_CCA} = 0$ if the target NR cell on the inter-frequency carrier with CCA is known.

There is no requirement if the target cell on the carrier with CCA does not contain the UE context.

In the requirement defined in the below tables, the target FR1 cell on the carrier with CCA is known if it has been meeting the relevant cell identification requirement during the last 8 seconds otherwise it is unknown.

Table 6.2.1A.2.1-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell with CCA

Serving cell SSB Ês/Iot (dB)	Frequency range (FR) of target NR cell	$T_{identify_intra_NR_CCA}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (200 ms, (5+K_1) x T_{SMTC})	MAX (800 ms, (10+ K_1) x T_{SMTC})
≥ -8	FR2-2	N/A	MAX (1000 ms, N x (10+ K_3) x T_{SMTC})
< -8	FR1	N/A	(800+20 x K_1)Note1
< -8	FR2-2	N/A	N x (440+20 x K_3)Note1
NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer with CCA when T_{SMTC} > 20 ms and serving cell SSB Ês/Iot < -8 dB.			
NOTE 2: K_1 is the number of SMTC occasions not available at the UE during RRC re-establishment period on the carrier with CCA.			
NOTE 3: K_3 is the number of SMTC occasion groups not available at the UE during RRC re-establishment period on the carrier with CCA. An SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. N is equal to 12.			

Table 6.2.1A.2.1-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell on the carrier with CCA

Serving cell SSB Ês/Iot (dB)	Frequency range (FR) of target NR cell	$T_{identify_inter_NR_CCA,\ i}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (200 ms, ([6]+$K_{2,i}$) x $T_{SMTC,\ i}$)	MAX (800 ms, ([13]+$K_{2,i}$) x $T_{SMTC,\ i}$)
< -8	FR1	N/A	(800+20 x $K_{2,i}$) Note1
NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer with CCA when $T_{SMTC,i}$ > 20 ms and serving cell SSB Ês/Iot < -8 dB.			
NOTE 2: $K_{2,i}$ is the number of SMTC occasions not available at the UE during RRC re-establishment period on the “i” th carrier with CCA.			

6.2.1B SA: RRC Re-establishment for RedCap

6.2.1B.1 Introduction

This clause contains requirements on the RedCap UE regarding RRC connection re-establishment procedure.

A neighbour cell for RRC re-establishment procedures for a RedCap UE is defined as an intra-frequency cell if the centre frequency and subcarrier spacing (SCS) of the reference SSB of the serving cell is same as the centre frequency and SCS of the reference SSB of the neighbour cell; else it is considered as inter-frequency cell, where:

- The reference SSB of the target cell is the CD-SSB of the target cell.
- The reference SSB of the serving cell is the CD-SSB of the serving cell.

6.2.1B.2 Requirements

The requirements in clause 6.2.1 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements defined in clause 6.2.1 shall apply except that:

- $T_{identify_intra_NR}$ as specified in table 6.2.1B.2-1.
- $T_{identify_inter_NR,\ i}$ as specified in table 6.2.1B.2-2.

Table 6.2.1B.2-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify_intra_NR}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (200 ms, 6 x T_{SMTC})	MAX (800 ms, [11] x T_{SMTC})
< -8	FR1	N/A	800[Note1]
NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when T_{SMTC} > 20 ms and serving cell SSB Ês/Iot < -8 dB.			

Table 6.2.1B.2-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify_inter_NR,\ i}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (200 ms, 7 x $T_{SMTC,\ i}$)	MAX (800 ms, [14] x $T_{SMTC,\ i}$)
< -8	FR1	N/A	800[Note1]
NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when $T_{SMTC,i}$ > 20 ms and serving cell SSB Ês/Iot < -8 dB.			

When the Redcap specific initial BWP is configured for random access, $T_{UE_re-establish_delay}$ in clause 6.2.1 is extended by 6 ms.

6.2.2 Random access

6.2.2.1 Introduction

This clause contains requirements on the UE regarding random access procedure. The random access procedure is initiated to establish uplink time synchronization for a UE which either has not acquired or has lost its uplink synchronization, or to convey UE's request Other SI, or for beam failure recovery. The random access is specified in clause 8 of TS 38.213 [3] and the control of the RACH transmission is specified in clause 5.1 of TS 38.321 [7]. Two types of procedure are defined for the random access, the 4-step RA type, and the 2-step RA type [7]. The decision on which type of procedure to adopt is as described in clause 5.1.1 of TS 38.321 [7]. The requirements for the 4-step RA type procedure are described in clause 6.2.2.2, whereas the requirements for the 2-step RA type procedure are described in the clause 6.2.2.3 of this specification.

6.2.2.2 Requirements for 4-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as specified in table 6.3.4.2-1 of TS 38.101-1 [18] for FR1 and in table 6.3.4.2-1 of TS 38.101-2 [19] for FR2. The relative power applied to additional preambles shall have an accuracy as specified in table 6.3.4.3-1 of TS 38.101-1 [18] for FR1 and clause 6.3.4.3 of TS 38.101-2 [19] for FR2.

The UE shall indicate a random access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4 in TS 38.321 [7].

The requirements in this clause apply for UE in SA operation mode or any MR-DC operation mode.

6.2.2.2.1 Contention based random access

6.2.2.2.1.1 Correct behaviour when transmitting Random Access Preamble

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB

if the association between Random Access Preambles and SSB is configured, as specified in clause 5.1.2 in TS 38.321 [7].

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

For a UE supports *supportSBFD*, if either *sbfd-RACH-SingleConfig* or *sbfd-RACH-DualConfig* is configured by RRC for the Random Access procedure, the UE shall have the capability to select PRACH occasion for an RO type as specified in clause 5.1 in TS 38.321 [7].

6.2.2.2.1.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2.2.2.1.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 in TS 38.321 [7].

6.2.2.2.1.4 Correct behaviour when receiving an UL grant for msg3 retransmission

The UE shall re-transmit the msg3 upon the reception of UL grant for msg3 retransmission.

6.2.2.2.1.5 SA: Correct behaviour when receiving a message over Temporary C-RNTI

The UE shall send ACK if the Contention Resolution is successful.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

6.2.2.2.1.6 Correct behaviour when contention Resolution timer expires

The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

6.2.2.2.2 Non-Contention based random access

6.2.2.2.2.1 Correct behaviour when transmitting Random Access Preamble

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs is configured, with the UE selected CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-

RSs, UE shall have the capability to select the Random Access Preamble corresponding to the selected CSI-RS, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

For a UE supports *supportSBFD*, if either *sbfd-RACH-SingleConfig* or *sbfd-RACH-DualConfig* is configured by RRC for the Random Access procedure, the UE shall have the capability to select PRACH occasion for an RO type as specified in clause 5.1 in TS 38.321 [7].

If the random access procedure is initialized for beam failure recovery and if the contention-free Random Access Resources and the contention-free PRACH occasions for beam failure recovery request associated with any of the SSBs and/or CSI-RSs is configured, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs or the selected CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, or from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions or the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

6.2.2.2.2.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s), if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble, unless the random access procedure is initialized for Other SI request from UE.

The UE may stop monitoring for Random Access Response(s) and shall monitor the Other SI transmission if the Random Access Response only contains a Random Access Preamble identifier which is corresponding to the transmitted Random Access Preamble and the random access procedure is initialized for SI request from UE, as specified in clause 5.1.4 in TS 38.321 [7].

The UE may stop monitoring for Random Access Response(s), if the contention-free Random Access Preamble for beam failure recovery request was transmitted and if the PDCCH addressed to UE's C-RNTI is received, as specified in clause 5.1.4 in TS 38.321 [7].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2.2.2.2.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated PRACH transmission power, if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon* or if no PDCCH addressed to UE's C-RNTI is received within the RA Response window configured in *BeamFailureRecoveryConfig*, as defined in clause 5.1.4 in TS 38.321 [7].

6.2.2.2.3 UE behaviour when configured with supplementary UL

In addition to the requirements defined in clauses 6.2.2.2.1 and 6.2.2.2.2, a UE configured with supplementary UL carrier shall use RACH configuration for the supplementary UL carrier contained in RMSI and RRC dedicated signalling. If the cell for the random access procedure is configured with supplementary UL, the UE shall transmit or re-transmit PRACH preamble on the supplementary UL carrier if the SS-RSRP measured by the UE on the DL carrier is lower than the *rsrp-ThresholdSSB-SUL* as defined in TS 38.331 [2].

6.2.2.3 Requirements for 2-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate MsgA PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and the MsgA PUSCH power formula of clause 7.1.1 of TS 38.213 [3] and apply this power level at the first MsgA or additional MsgA repetitions. The absolute power applied to the first preamble shall have an accuracy as specified in table 6.3.4.2-1 of TS 38.101-1 [18] for frequency range 1 and in table 6.3.4.2-1 of TS 38.101-2 [19] for frequency range 2. The relative power applied to additional preambles shall have an accuracy as specified in table 6.3.4.3-1 of TS 38.101-1 [18] for frequency range 1 and clause 6.3.4.3 of TS 38.101-2 [19] for frequency range 2.

The UE shall switch to 4-step RA type procedure if the MsgA transmission counter has exceeded *msgA-TransMax*, if configured, as specified in clause 5.1.4a of TS 38.321 [7]. The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4a in TS 38.321 [7].

The requirements in this clause apply for UE in SA operation mode or any MR-DC operation mode.

6.2.2.3.1 Contention based random access

6.2.2.3.1.1 Correct behaviour when transmitting MsgA

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, the UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SS blocks is configured, as specified in clause 5.1.2a in TS 38.321 [7].

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, UE shall have the capability to transmit MsgA PRACH on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured.

The PRACH preamble and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE shall be able to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH occasion and preamble index as defined in clause 8.1A in TS 38.213 [3].

6.2.2.3.1.2 Correct behaviour when receiving MsgB

The UE shall stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

The UE shall send ACK if Success RAR is received in MsgB and the Contention Resolution is successful, as defined in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH and monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

6.2.2.3.1.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

6.2.2.3.2 Non-Contention based random access

6.2.2.3.2.1 Correct behaviour when transmitting MsgA

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE shall be able to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH occasion,, and preamble index as defined in clause 8.1A in TS 38.213 [3].

6.2.2.3.2.2 Correct behaviour when receiving MsgB

The UE may stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated MsgA PRACH and MsgA PUSCH transmission power if all received MsgBs contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2.2.3.2.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit MsgA with the calculated MsgA PRACH and MsgA PUSCH transmission power, if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA* and the Random Access Response Reception has not been considered as successful as defined in clause 5.1.4a in TS 38.321 [7].

6.2.2.3.3 UE behaviour when configured with supplementary UL

In addition to the requirements defined in clauses 6.2.2.3.1 and 6.2.2.3.2, a UE configured with supplementary UL carrier shall use RACH configuration for the supplementary UL carrier contained in RMSI and RRC dedicated signalling. If the cell for the random access procedure is configured with supplementary UL, the UE shall transmit or re-transmit PRACH preamble on the supplementary UL carrier if the SS-RSRP measured by the UE on the DL carrier is lower than the *rsrp-ThresholdSSB-SUL* as defined in TS 38.321 [7].

6.2.2A Random access when CCA is used on target frequency

6.2.2A.1 Introduction

This clause contains requirements on the UE regarding random access procedure when CCA is used on the target frequency. The random access procedure is initiated to establish uplink time synchronization for a UE which either has not acquired or has lost its uplink synchronization, or to convey UE's request Other SI, or for beam failure recovery. The random access is specified in clause 8 of TS 38.213 [3] and the control of the RACH transmission is specified in clause 5.1 of TS 38.321 [7]. Two types of procedure are defined for the random access, the 4-step RA type, and the 2-step RA type [7]. The decision on which type of procedure to adopt is as described in clause 5.1.1 of TS 38.321 [7]. The requirements for the 4-step RA type procedure are described in clause 6.2.2A.2, whereas the requirements for the 2-step RA type procedure are described in the clause 6.2.2A.3 of this specification.

6.2.2A.2 Requirements for 4-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as specified in table 6.3.4.2-1 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy as specified in table 6.3.4.3-1 of TS 38.101-1 [18].

The UE shall indicate a random access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4 in TS 38.321 [7].

The requirements in this clause apply for UE operating in a carrier frequency with CCA in SA operation mode or any MR-DC operation mode, in a carrier frequency with CCA.

6.2.2A.2.1 Contention based random access

6.2.2A.2.1.1 Correct behaviour when transmitting Random Access Preamble

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SSB is configured, as specified in clause 5.1.2 in TS 38.321 [7].

If the UL CCA is successful on the next available PRACH occasion, with the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If UE is configured *lbt-FailureRecoveryConfig* and is capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for random access preamble transmission, as outlined in clause 5.21.2 of TS 38.321 [7], the UE shall perform the Random Access Resource selection procedure again, as specified in clause 5.1.3 in TS 38.321 [7].

If UE is not configured *lbt-FailureRecoveryConfig* or is not capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for random access preamble transmission, as outlined in clause 5.21.2 of TS 38.321 [7], the UE shall increment PREAMBLE_TRANSMISSION_COUNTER by 1. The UE shall again perform the Random Access Resource selection procedure if PREAMBLE_TRANSMISSION_COUNTER < *preambleTransMax* + 1, as specified in clause 5.1.3 in TS 38.321 [7].

6.2.2A.2.1.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2.2A.2.1.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], if the UL CCA is successful, and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 in TS 38.321 [7].

6.2.2A.2.1.4 Correct behaviour when receiving an UL grant for msg3 retransmission

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission, if the UL CCA is successful,

6.2.2A.2.1.5 Correct behaviour when receiving a message over Temporary C-RNTI

If the UL CCA is successful, The UE shall send ACK if the Contention Resolution is successful.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires and the UL CCA is successful, unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

6.2.2A.2.1.6 Correct behaviour when contention Resolution timer expires

The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

6.2.2A.2.2 Non-Contention based random access

6.2.2A.2.2.1 Correct behaviour when transmitting Random Access Preamble

If the UL CCA is successful on the next available PRACH occasion and if the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the UL CCA is successful, and if the random access procedure is initialized for beam failure recovery and if the contention-free Random Access Resources and the contention-free PRACH occasions for beam failure recovery request associated with SSBs configured, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If UE is configured *lbt-FailureRecoveryConfig* and is capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for random access preamble transmission, as outlined in clause 5.21.2 of TS 38.321 [7], the UE shall perform the Random Access Resource selection procedure again, as specified in clause 5.1.3 in TS 38.321 [7].

If UE is not configured *lbt-FailureRecoveryConfig* or is not capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for random access preamble transmission, as outlined in clause 5.21.2 of TS 38.321 [7], the UE shall increment PREAMBLE_TRANSMISSION_COUNTER by 1. The UE shall again perform the Random Access Resource selection procedure if PREAMBLE_TRANSMISSION_COUNTER < *preambleTransMax* + 1, as specified in clause 5.1.3 in TS 38.321 [7].

6.2.2A.2.2.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s), if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble, unless the random access procedure is initialized for Other SI request from UE.

The UE may stop monitoring for Random Access Response(s) and shall monitor the Other SI transmission if the Random Access Response only contains a Random Access Preamble identifier which is corresponding to the

transmitted Random Access Preamble and the random access procedure is initialized for SI request from UE, as specified in clause 5.1.4 in TS 38.321 [7].

The UE may stop monitoring for Random Access Response(s), if the contention-free Random Access Preamble for beam failure recovery request was transmitted and if the PDCCH addressed to UE's C-RNTI is received, as specified in clause 5.1.4 in TS 38.321 [7].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion if the UL CCA is successful, and transmit the preamble with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2.2A.2.2.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion if the UL CCA is successful, and transmit the preamble with the calculated PRACH transmission power, if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon* or if no PDCCH addressed to UE's C-RNTI is received within the RA Response window configured in *BeamFailureRecoveryConfig*, as defined in clause 5.1.4 in TS 38.321 [7].

6.2.2A.3 Requirements for 2-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate MsgA PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and the MsgA PUSCH power formula of clause 7.1.1 of TS 38.213 [3] and apply this power level at the first MsgA or additional MsgA repetitions. The absolute power applied to the first preamble shall have an accuracy as specified in table 6.3.4.2-1 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy as specified in table 6.3.4.3-1 of TS 38.101-1 [18].

The UE shall switch to 4-step RA type procedure if the MsgA transmission counter has exceeded *msgA-TransMax*, if configured, as specified in clause 5.1.4a of TS 38.321 [7]. The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4a in TS 38.321 [7].

The requirements in this clause apply for UE operating in a carrier frequency with CCA in SA operation mode or any MR-DC operation mode, in a carrier frequency with CCA.

6.2.2A.3.1 Contention based random access

6.2.2A.3.1.1 Correct behaviour when transmitting MsgA

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, the UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SS blocks is configured, as specified in clause 5.1.2a in TS 38.321 [7].

If the UL CCA is successful on the next available PRACH occasion, with the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, UE shall have the capability to transmit MsgA PRACH on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured.

The PRACH preamble and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, if the UL CCA is successful, the UE shall be able to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH occasion, and preamble index as defined in clause 8.1A in TS 38.213 [3].

If UE is configured *lbt-FailureRecoveryConfig* and is capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for MsgA transmission, as outlined in clause 5.21.2 of TS 38.321 [7], the UE shall cancel the transmission of the MsgA payload on the associated PUSCH resource and perform the Random Access Resource selection procedure, as specified in clause 5.1.3a in TS 38.321 [7].

If UE is not configured *lbt-FailureRecoveryConfig* or is not capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for MsgA transmission, as outlined in clause 5.21.2 of TS 38.321 [7], the UE shall cancel the transmission of the MsgA payload on the associated PUSCH resource and increment PREAMBLE_TRANSMISSION_COUNTER by 1. The UE shall again perform the Random Access Resource selection procedure if PREAMBLE_TRANSMISSION_COUNTER < *preambleTransMax* + 1, as specified in clause 5.1.3a in TS 38.321 [7]. If the Random Access Procedure is not complete and the UE is configured with *msgA-TransMax* then, as specified in clause 5.1.3a in TS 38.321 [7], the UE shall perform the Random Access Resource selection procedure with 4-step RA type provided that PREAMBLE_TRANSMISSION_COUNTER = *msgA-TransMax* + 1.

6.2.2A.3.1.2 Correct behaviour when receiving MsgB

The UE shall stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

If the UL CCA is successful, the UE shall send ACK if Success RAR is received in MsgB and the Contention Resolution is successful, as defined in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH if the UL CCA is successful, and monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power, if the UL CCA is successful on the next available PRACH occasion, when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

6.2.2A.3.1.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and if the UL CCA is successful, transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power if the UL CCA is successful on the next available PRACH occasion when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

6.2.2A.3.2 Non-Contention based random access

6.2.2A.3.2.1 Correct behaviour when transmitting MsgA

If the UL CCA is successful, if the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE shall be able to transmit MsgA PUSCH, if the UL CCA is successful, on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH occasion, and preamble index as defined in clause 8.1A in TS 38.213 [3].

If UE is configured *lbt-FailureRecoveryConfig* and is capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for MsgA transmission, as outlined in clause 5.21.2 of TS 38.321 [7], the UE shall have cancel the transmission of the MsgA payload on the associated PUSCH resource and perform the Random Access Resource selection procedure, as specified in clause 5.1.3a in TS 38.321 [7].

If UE is not configured *lbt-FailureRecoveryConfig* or is not capable of *ul-LBT-FailureDetectionRecovery* [2] then upon detecting uplink CCA failure during the random access procedure for MsgA transmission, as outlined in clause 5.21.2 of TS 38.321 [7], the UE shall cancel the transmission of the MsgA payload on the associated PUSCH resource and increment PREAMBLE_TRANSMISSION_COUNTER by 1. The UE shall again perform the Random Access Resource selection procedure if PREAMBLE_TRANSMISSION_COUNTER < *preambleTransMax* + 1, as specified in clause 5.1.3a in TS 38.321 [7]. If the Random Access Procedure is not complete and the UE is configured with *msgA-TransMax* then, as specified in clause 5.1.3a in TS 38.321 [7], the UE shall perform the Random Access Resource selection procedure with 4-step RA type provided that PREAMBLE_TRANSMISSION_COUNTER = *msgA-TransMax* + 1.

6.2.2A.3.2.2 Correct behaviour when receiving MsgB

The UE may stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH if the UL CCA is successful, as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated MsgA PRACH and MsgA PUSCH transmission power if the UL CCA is successful, if all received MsgBs contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2.2A.3.2.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit MsgA with the calculated MsgA PRACH and MsgA PUSCH transmission power if the UL CCA is successful on the next available PRACH occasion, if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA* and the Random Access Response Reception has not been considered as successful as defined in clause 5.1.4a in TS 38.321 [7].

6.2.2B Random access for RedCap

6.2.2B.1 Introduction

This clause contains requirements on the RedCap UE regarding random access procedure. The random access procedure is initiated to establish uplink time synchronization for a UE which either has not acquired or has lost its uplink synchronization, or to convey UE's request Other SI, or for beam failure recovery. The random access is specified in clause 8 of TS 38.213 [3] and the control of the RACH transmission is specified in clause 5.1 of TS 38.321 [7]. Two types of procedure are defined for the random access, the 4-step RA type, and the 2-step RA type [7]. The decision on which type of procedure to adopt is as described in clause 5.1.1 of TS 38.321 [7].

The 1 Rx RedCap UE for performing the random access procedure defined in clause 5.1 [7] applies:

- rsrp-ThresholdSSB as the signaled value of rsrp-ThresholdSSB [2] + 1 dB.
- msgA-RSRP-ThresholdSSB as the signaled value of msgA-RSRP-ThresholdSSB [2] + 1 dB.
- msgA-RSRP-Threshold as the signaled value of msgA-RSRP-Threshold [2] + 1 dB.
- rsrp-ThresholdMsg3 as the signaled value of rsrp-ThresholdMsg3 [2] - 1 dB.

6.2.2B.2 Requirements

The requirements for the 4-step RA type procedure described in clause 6.2.2.2 and the requirements for the 2-step RA type procedure described in the clause 6.2.2.3 are applicable for TDD and FDD RedCap UEs. The 4-step and 2-step RA requirements for contention based random access defined in clause 6.2.2.2 and 6.2.2.3 respectively apply to HD-FDD UE with the following conditions:

- The RedCap UE operating in HD-FDD mode is not expected to perform PRACH transmission on a PRACH resource of a cell if UE has not received at least one SSB associated with that PRACH resource during the last Tp period in the cell, where Tp=160 ms.
- The RedCap UE operating in HD-FDD mode shall meet the PRACH requirements when performing PRACH transmission on a PRACH resource of a cell provided that the UE has received at least one SSB associated with that PRACH resource during the last Tp period before the PRACH transmission, where Tp=160 ms.

6.2.2C PDCCH ordered Random Access for LTM

6.2.2C.1 Introduction

The requirements in this clause apply for a UE capable of *rach-EarlyTA-Measurement-r18* configured to trigger RACH procedure toward target LTM candidate cell before receiving cell switch command MAC-CE.

The requirements in this clause apply if PDCCH order-based RACH on candidate cell is triggered based on L1-RSRP report or L3-RSRP beam-level report in FR1, or based on L1-RSRP report in FR2.

The requirements in this clause for PDCCH ordered-based RACH to an inter-frequency target cell is only applicable, when

- network has configured UE to perform SSB based L3 measurement with beam measurement reporting or L1 measurement for the target cell before the PDCCH order, or
- the SFN of the serving cell from which PDCCH order is received and the SFN of the target cell are the same.

6.2.2C.2 PDCCH ordered Random Access delay

UE shall complete the RACH transmission as defined in TS 38.213 [3] clause 8.1, in which T_{SSB} and $\Delta_{\mathrm{RF/BB\ preparation}}$ are defined as the following:

- T_{SSB} is the time for T/F tracking and acquiring full timing information of the target cell
  - $T_{\mathrm{SSB}} = 0$, provided:
    - L1-RSRP measurement is configured and
    - The target LTM candidate cell is on an FR1 carrier whose TCI state associated with SSB indicated in the PDCCH-order is activated, and the time between the MAC-CE activating the target TCI state and the PDCCH is larger than TCI state activation delay defined in clause 8.25.3, and
      - L1-RSRP measurement period of candidate cell is not larger than 160 ms, or
      - The time between the MAC-CE activating the target TCI state and the PDCCH is not larger than TCI state activation delay defined in clause 8.25.3 + 160ms.
  - Otherwise, $T_{\mathrm{SSB}} = T_{\mathrm{first-SSB_RACH}} + T_{\mathrm{SSB-proc}}$, where
    - $T_{\mathrm{first-SSB_RACH}}$ is the time to the first SSB occasion, after 1slot from the end of the slot of the PDCCH, when SSB is to be measured outside MG
    - $T_{\mathrm{first-SSB_RACH}}$ is the time to the first SSB occasion, overlapped with MGL after 2ms and 1slot from the end of the slot of the PDCCH if the SSB to be measured within MG.
    - $T_{\mathrm{SSB-proc}}$ = 2 ms, which is the time for SSB processing;
- $\Delta_{\mathrm{RF/BB\ preparation}}$ is the time for RF and baseband preparation. The following apply:
  - If PRACH bandwidth is outside active UL BWP of serving cell(s) but within one of configured UL BWPs of an active serving cell, the $\Delta_{\mathrm{RF/BB\ preparation}}$ is the DCI based BWP switching delay specified in clause 8.6.
  - If PRACH bandwidth is not within any of the configured UL BWPs of any active serving cell, $\Delta_{\mathrm{RF/BB\ preparation}}$ equals to capability value reported in *pdcch-RACH-PrepTimeList-r18*.

- Otherwise, $\Delta_{RF/BB\ preparation} = 0$.

6.2.3 SA: RRC Connection Release with Redirection

6.2.3.1 Introduction

This clause contains requirements on the UE regarding RRC connection release with redirection procedure. RRC connection release with redirection is initiated by the *RRCRelease* message with redirection to E-UTRAN or NR from NR specified in TS 38.331 [2]. The RRC connection release with redirection procedure is specified in clause 5.3.8 of TS 38.331 [2].

In the requirements of clause 6.2.3.2, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding identification period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 6.2.3.2, the term PRACH occasion unavailable for transmission refers to when the PRACH occasion is configured by gNB but not transmitted by the UE during the corresponding period due to UL CCA failure at the UE.

When the RRC connection release with redirection is performed on a cell in FR2-2 with shared spectrum channel access, UE shall determine the CCA mode of the neighbour cell according to *channelAccessMode2-r17* if configured. If *channelAccessMode2-r17* of the cell is enabled, UE shall assume that CCA applies to the cell and perform measurement accordingly, and the requirements in clause 6.2.3.2.3 shall apply; otherwise, UE shall assume that CCA does not apply to the cell and perform measurement accordingly, and requirements in clause 6.2.3.2.1 shall apply.

6.2.3.2 Requirements

6.2.3.2.1 RRC connection release with redirection to NR

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell within $T_{connection_release_redirect_NR}$.

The time delay ($T_{connection_release_redirect_NR}$) is the time between the end of the last slot containing the RRC command, "*RRCRelease*" (TS 38.331 [2]) on the NR PDSCH and the time the UE starts to send random access to the target NR cell. The time delay ($T_{connection_release_redirect_NR}$) shall be less than:

$$T_{connection_release_redirect_NR} = T_{RRC_procedure_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH}$$

The target NR cell shall be considered detectable when for each relevant SSB, the following side conditions are met:

- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.5 for a corresponding NR Band are fulfilled.

$T_{RRC_procedure_delay}$: It is the RRC procedure delay for processing the received message "*RRCRelease*" as defined in clause 6.2.2 of TS 38.331 [2].

$T_{identify\text{-}NR}$: It is the time to identify the target NR cell and depends on the FR of the target NR cell. It is defined in table 6.2.3.2.1-1. Note that $T_{identify\text{-}NR} = T_{PSS/SSS\text{-}sync} + T_{meas}$, in which $T_{PSS/SSS\text{-}sync}$ is the cell search time and T_{meas} is the measurement time due to cell selection criteria evaluation.

$T_{SI\text{-}NR}$: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released. $T_{RACH:}$ It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. T_{RACH} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise T_{rs} is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, T_{rs} is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided with

SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this clause is applied with T_{rs} = 20 ms if the SSB transmission periodicity is not larger than 20 ms; otherwise,

- there is no requirement if the SSB transmission periodicity is larger than 20 ms.

Table 6.2.3.2.1-1: Time to identify target NR cell for RRC connection release with redirection to NR

FR of target NR cell	$T_{identify-NR}$
FR1	MAX (680 ms, 11 x T_{rs})
FR2-1	MAX (880 ms, Nx11 x T_{rs} + T_{proc})
FR2-2	MAX (880 ms, 12x11 x T_{rs})
NOTE: If the UE has been provided with higher layer signalling of *smtc2* specified in TS 38.331 [2] prior to the redirection command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.	
NOTE2: If the UE supports *Rel-19 L3 fast Rx beam sweeping* and when the conditions in clause 3.6.21 are fulfilled, N = *reduced beam sweeping factor* indicated via UE capability and T_{proc} = 2 ms, otherwise N = 8 and T_{proc} = 0.	

6.2.3.2.2 RRC connection release with redirection to E-UTRAN

The UE shall be capable of performing the RRC connection release with redirection to the target E-UTRAN cell within $T_{connection_release_redirect_E\text{-}UTRA}$.

The time delay ($T_{connection_release_redirect_E\text{-}UTRA}$) is the time between the end of the last slot containing the RRC command, "*RRCRelease*" (TS 38.331 [2]) on the PDSCH and the time the UE starts to send random access to the target E-UTRA cell. The time delay ($T_{connection_release_redirect_E\text{-}UTRA}$) shall be less than:

$$T_{connection_release_redirect_E\text{-}UTRA} = T_{RRC_procedure_delay} + T_{identify\text{-}E\text{-}UTRA} + T_{SI\text{-}E\text{-}UTRA} + T_{RACH}$$

The target E-UTRA FDD or TDD cell shall be considered detectable provided the following conditions are fulfilled:

- the same conditions as for inter-frequency RSRP measurements specified in annex B.1.2 of TS 36.133 [15] are fulfilled for a corresponding Band, and

- the same conditions as for inter-frequency RSRQ measurements specified in annex B.1.2 of TS 36.133 [15] are fulfilled for a corresponding Band, and

- SCH conditions specified in annex B.1.2 of TS 36.133 [15] are fulfilled for a corresponding Band.

$T_{RRC_procedure_delay}$: It is the RRC procedure delay for processing the received message "*RRCRelease*" as defined in clause 6.2.2 of TS 38.331 [2].

$T_{identify\text{-}E\text{-}UTRA}$: It is the time to identify the target E-UTRA cell. It shall be less than 320 ms.

$T_{SI\text{-}E\text{-}UTRA}$: It is the time required for acquiring all the relevant system information of the target E-UTRA cell. This time depends upon whether the UE is provided with the relevant system information (SI) of the target E-UTRA cell or not by the old NR cell before the RRC connection is released.

T_{RACH}: It is the delay caused due to the random access procedure when sending random access to the target E-UTRA cell.

6.2.3.2.3 RRC connection release with redirection to NR carrier subject to CCA

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell subject to CCA within $T_{connection_release_redirect_NR_CCA}$.

The time delay ($T_{connection_release_redirect_NR_CCA}$) is the time between the end of the last slot containing the RRC command, "*RRCRelease*" (TS 38.331 [2]) on the NR PDSCH and the time the UE starts to send random access to the target NR cell. The time delay ($T_{connection_release_redirect_NR_CCA}$) shall be less than:

$$T_{connection_release_redirect_NR_CCA} = T_{RRC_procedure_delay} + T_{identify\text{-}NR_CCA} + T_{SI\text{-}NR_CCA} + T_{RACH_CCA}$$

The target NR cell shall be considered detectable when for each relevant SSB, the following side conditions are met:

- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.5 for a corresponding NR Band are fulfilled.

- $T_{RRC_procedure_delay}$: It is the RRC procedure delay for processing the received message "*RRCRelease*" as defined in clause 6.2.2 of TS 38.331 [2].

- $T_{identify\text{-}NR_CCA}$: It is the time to identify the target NR cell and is defined as:

- $T_{identify\text{-}NR_CCA} = T_{PSS/SSS\text{-}sync} + T_{meas}$; $T_{PSS/SSS\text{-}sync}$ is the cell search time and T_{meas} is the measurement time due to cell selection criteria evaluation.

- For FR1 target NR cell: $T_{identify\text{-}NR_CCA} = MAX\ (680\ ms, (L_1+11) \times T_{rs})$;

- For FR2-2 target NR cell: $T_{identify\text{-}NR_CCA} = MAX\ (880\ ms, N\times(L_1´+11) \times T_{rs})$;

  - where L_1 is the number of SMTC occasions not available at the UE due to DL CCA failures and $L_1´$ is the number of SMTC occasion groups not available at the UE due to DL CCA failures. An SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. N is equal to 12. If $L_1 > L_{1,max}$ or $L_1´ > L_{1,max}$ then the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1]; where $L_{1,max}$ is defined in table 6.2.3.2.3-1.

- $T_{SI\text{-}NR_CCA}$: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released.

- T_{RACH_CCA}: It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell:

- $T_{RACH_CCA} = (1+L_2)\times T_{SSB,RO} + 10\ ms\ T_{PRACH}$; where:

  - L_2 is the consecutive number of SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failures. $L_2 = 0$ for Type 2C UL channel access procedure as defined in TS 37.213 [33]. $L_3 = 0$ if *ra-ChannelAccess-r17* is not configured in FR2-2.

  - $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined in the table 8.1-1 of TS 38.213 [3].

  - The value of L2 is limited by *PREAMBLE_TRANSMISSION_COUNTER*, which is increased when PRACH occasion is unavailable for PRACH transmission due to UL CCA failure as specified in TS 38.321 [7]. The UE behaviour when *PREAMBLE_TRANSMISSION_COUNTER* reaches the *preambleTransMax* is specified in TS 38.321 [7].

- T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise T_{rs} is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the UE is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this clause is applied with T_{rs} = 20 ms if the SSB transmission periodicity is not larger than 20 ms;

- otherwise, there is no requirement if the SSB transmission periodicity is larger than 20 ms.

Table 6.2.3.2.3-1: Maximum allowed number of missed SMTC occasions during cell identification

SMTC periodicity (T_{rs}) [ms]	Maximum allowed number of missed SMTC occasions ($L_{1,max}$)
$T_{rs} \le 40$	8
$T_{rs} > 40$	4

6.2.3A SA: RRC Connection Release with Redirection for RedCap

6.2.3A.1 Introduction

This clause contains requirements on the RedCap UE regarding RRC connection release with redirection procedure. RRC connection release with redirection is initiated by the *RRCRelease* message with redirection to E-UTRAN or NR from NR specified in TS 38.331 [2]. The RRC connection release with redirection procedure is specified in clause 5.3.8 of TS 38.331 [2].

6.2.3A.2 Requirements

6.2.3A.2.1 RRC connection release with redirection to NR

The requirements in clause 6.2.3.2.1 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements defined in clause 6.2.3.2.1 shall apply except that:

- $T_{identify-NR}$ as specified in table 6.2.3A.2.1-1.

Table 6.2.3A.2.1-1: Time to identify target NR cell for RRC connection release with redirection to NR

FR of target NR cell	$T_{identify-NR}$
FR1	MAX (680 ms, [12] x T_{rs})
NOTE: If the UE has been provided with higher layer signalling of *smtc2* specified in TS 38.331 [2] prior to the redirection command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.	

The HD-FDD UE shall meet the RRC connection release with redirection requirements provided that SSB is available at the UE once every SMTC period during T_{search}.

When the Redcap specific initial BWP is configured for random access, $T_{connection_release_redirect_NR}$ in clause 6.2.3.2.1 is extended by 6 ms.

6.2.3A.2.2 RRC connection release with redirection to E-UTRAN

The requirements in clause 6.2.3.2.2 shall apply.

6.2C RRC Connection Mobility Control for Satellite Access

6.2C.1 SA: RRC Re-establishment for Satellite Access

6.2C.1.1 Introduction

This clause contains requirements on the UE regarding RRC connection re-establishment procedure. RRC connection re-establishment is initiated when a UE in RRC_CONNECTED state on the carrier loses RRC connection due to any of failure cases, including radio link failure, handover failure, and RRC connection reconfiguration failure. The RRC connection re-establishment procedure is specified in clause 5.3.7 of TS 38.331 [2].

The requirements in this clause are applicable for RRC connection re-establishment to NR cell, which is served by satellite access node (SAN).

6.2C.1.2 Requirements

In RRC_CONNECTED state the UE shall be capable of sending *RRCReestablishmentRequest* message within $T_{re-establish_delay}$ seconds from the moment it detects a loss in RRC connection. The total RRC connection delay ($T_{re-establish_delay}$) shall be less than:

$$T_{re-establish_delay} = T_{UE_re-establish_delay} + T_{UL_grant}$$

T_{UL_grant}: It is the time required to acquire and process uplink grant from the target PCell. The uplink grant is required to transmit *RRCReestablishmentRequest* message.

The UE re-establishment delay ($T_{UE_re\text{-}establish_delay}$) is specified in clause 6.2C.1.2.1.

6.2C.1.2.1 UE Re-establishment delay requirement

The UE re-establishment delay ($T_{UE_re\text{-}establish_delay}$) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell. The UE re-establishment delay ($T_{UE_re\text{-}establish_delay}$) requirement shall be less than:

$$T_{UE_re-establish_delay} = 50\ ms + T_{identify_intra_NR} + \sum_{i=1}^{N_{freq}-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

The intra-frequency target NR cell shall be considered detectable if each relevant SSB can satisfy that:

- SS-RSRP related side conditions given in clause 10.1.2C are fulfilled for a corresponding NR Band for FR1-NTN, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.17 for a corresponding NR Band are fulfilled.

The inter-frequency target NR cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.4C are fulfilled for a corresponding NR Band for FR1-NTN, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.18 for a corresponding NR Band are fulfilled.

$T_{identify_intra_NR}$: It is the time to identify the target intra-frequency NR cell and it depends on whether the target NR cell is known cell or unknown cell. If the UE is not configured with intra-frequency NR carrier for RRC re-establishment then $T_{identify_intra_NR}$=0; otherwise $T_{identify_intra_NR}$ shall not exceed the values defined in table 6.2C.1.2.1-1 for UE that does not support 160 ms SSB periodicity assumed during initial access, and in table 6.2C.1.2.1-1a for UE that supports 160 ms SSB periodicity assumed during initial access.

$T_{identify_inter_NR,i}$: It is the time to identify the target inter-frequency NR cell on inter-frequency carrier *i* configured for RRC re-establishment and it depends on whether the target NR cell is known cell or unknown cell. $T_{identify_inter_NR,i}$ shall not exceed the values defined in table 6.2C.1.2.1-2 for UE that does not support 160 ms SSB periodicity assumed during initial access, and in table 6.2C.1.2.1-2a for UE that supports 160 ms SSB periodicity assumed during initial access.

T_{SMTC}: It is the periodicity of the SMTC occasion configured for the intra-frequency carrier. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2*, T_{smtc} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

$T_{SMTC,i}$: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*. If it is not configured, the UE may assume that the target SSB periodicity is no larger than 20 ms.

$T_{SI\text{-}NR}$: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for the target NR cell.

T_{PRACH}: It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. T_{PRACH} can be up to the summation of SSB to PRACH occasion association period and [10] ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

N_{freq}: It is the total number of NR frequencies to be monitored for RRC re-establishment; N_{freq} = 1 if the target intra-frequency NR cell is known, else N_{freq} = 2 and $T_{identify_intra_NR}$ = 0 if the target inter-frequency NR cell is known.

T_{search}: It is the periodicity with which UE searches for the intra-frequency carrier. T_{search} equals to the periodicity of the SMTC occasion if single SMTC periodicity is configured, and equals to the maximum of the periodicities of the SMTC occasions if multiple SMTC periodicities are configured.

$T_{search,i}$: It is the periodicity with which UE searches for inter-frequency carrier *i*. $T_{search,i}$ equals to the periodicity of the SMTC occasion if single SMTC periodicity is configured, and equals to the maximum of the periodicities of the SMTC occasions if multiple SMTC periodicities are configured. If no SMTC is configured for inter-frequency carrier *i*, $T_{search,i}$ equals to 160ms.

There is no requirement if the target cell does not contain the UE context.

In the requirement defined in the below tables, the target FR1-NTN cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown.

The requirements in this clause apply provided that the ephemeris information provided by the serving cell for the target cell is valid during UE re-establishment delay ($T_{UE_re\text{-}establish_delay}$).

Table 6.2C.1.2.1-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify_intra_NR}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1-NTN	MAX (200 ms, 5 x T_{SMTC})	K_{multi_SMTC} * MAX (800 ms, 10 x T_{SMTC})
< -8	FR1-NTN	N/A	k * 800 ms Note1, 3
NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when T_{SMTC} > 20 ms and serving cell SSB Ês/Iot < -8 dB.			
NOTE 2: K_{multi_SMTC} is defined in clause 9.2C.5.1.			
NOTE 3: k = 1 if the cells on the target frequency are served by GEO. k = (N+1) if the cells on the target frequency are served by LEO, where N is the number of different satellites associated to the list of configured neighbour cells in ntn-NeighCellConfigList and ntn-NeighCellConfigListExt.			

Table 6.2C.1.2.1-1a: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify_intra_NR}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (200 ms, 5 x T_{SMTC})	K_{multi_SMTC} * MAX (800 ms, 10 x T_{SMTC})
< -8	FR1	N/A	k * MAX(800 ms, 22 x T_{search}) Note2
NOTE 1: K_{multi_SMTC} is defined in clause 9.2C.5.1.			
NOTE 2: k = 1 if the cells on the target frequency are served by GEO. k = (N+1) if the cells on the target frequency are served by LEO, where N is the number of different satellites associated to the list of configured neighbour cells in ntn-NeighCellConfigList and ntn-NeighCellConfigListExt.			

Table 6.2C.1.2.1-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify_inter_NR,\ i}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8 and SMTC is configured	FR1-NTN	MAX (200 ms, 6 x $T_{SMTC,\ i}$)	K_satellite * MAX (800 ms, 13 x $T_{SMTC,\ i}$)
< -8 or SMTC is not configured	FR1-NTN	N/A	k * 800 ms Note1, 3
NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when $T_{SMTC,i}$ > 20 ms and serving cell SSB Ês/Iot < -8 dB.			
NOTE 2: K_satellite is defined in clause 9.3C.4.			
NOTE 3: k = 1 if the cells on the target frequency are served by GEO. k = (N+1) if the cells on the target frequency are served by LEO, where N is the number of different satellites associated to the list of configured neighbour cells in ntn-NeighCellConfigList and ntn-NeighCellConfigListExt.			

Table 6.2C.1.2.1-2a: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell

Serving cell SSB Ês/Iot (dB) and SMTC configuration	FR of target NR cell	$T_{identify_inter_NR,\ i}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8 and SMTC is configured	FR1	MAX (200 ms, 6 x $T_{SMTC,\ i}$)	K_satellite * MAX (800 ms, 13 x $T_{SMTC,\ i}$)
< -8 or SMTC is not configured	FR1	N/A	k * MAX(800 ms, 22 x $T_{search,i}$) Note2
NOTE 1: K_satellite is defined in clause 9.3C.4.			

NOTE 2: k = 1 if the cells on the target frequency are served by GEO. k = (N+1) if the cells on the target frequency are served by LEO, where N is the number of different satellites associated to the list of configured neighbour cells in ntn-NeighCellConfigList and ntn-NeighCellConfigListExt.

6.2C.1.2.2 UE Re-establishment delay requirement for VSAT

The requirements in this clause are applicable to both intra-frequency and inter-frequency RRC Re-establishment.

The requirements in this clause are not applicable for VSAT indicating 'mechanical' via *ntn-VSAT-AntennaType-r18*, if the RRC Re-establishment is initiated due to failure in handover to a different satellite than the satellite which serves the source serving cell.

The requirements in clause 6.2C.1.2.1 shall apply, provided that the serving cell and the target cell are served by the same satellite, and UE is not configured to measure a different satellite for RRC Re-establishment.

6.2C.2 Random access for satellite access

6.2C.2.1 Introduction

This clause contains requirements on the UE regarding random access procedure. The random access procedure is initiated to establish uplink time synchronization for a UE which either has not acquired or has lost its uplink synchronization, or to convey UE's request Other SI, or for beam failure recovery. The random access is specified in clause 8 of TS 38.213 [3] and the control of the RACH transmission is specified in clause 5.1 of TS 38.321 [7]. Two types of procedure are defined for the random access, the 4-step RA type, and the 2-step RA type [7]. The decision on which type of procedure to adopt is as described in clause 5.1.1 of TS 38.321 [7]. The requirements for the 4-step RA type procedure are described in clause 6.2C.2.2, whereas the requirements for the 2-step RA type procedure are described in the clause 6.2C.2.3 of this specification.

6.2C.2.2 Requirements for 4-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as specified in table 6.3.4.2-1 of TS 38.101-1 [18] for FR1-NTN. The relative power applied to additional preambles shall have an accuracy as specified in table 6.3.4.3-1 of TS 38.101-1 [18] for FR1-NTN.

The UE shall indicate a random access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4 in TS 38.321 [7].

The requirements in this clause apply for UE in SA operation mode.

6.2C.2.2.1 Contention based random access

6.2C.2.2.1.1 Correct behaviour when transmitting Random Access Preamble

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SSB is configured, as specified in clause 5.1.2 in TS 38.321 [7].

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

6.2C.2.2.1.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2C.2.2.1.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 in TS 38.321 [7].

6.2C.2.2.1.4 Correct behaviour when receiving an UL grant for msg3 retransmission

The UE shall re-transmit the msg3 upon the reception of UL grant for msg3 retransmission.

6.2C.2.2.1.5 SA: Correct behaviour when receiving a message over Temporary C-RNTI

The UE shall send ACK if the Contention Resolution is successful.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

6.2C.2.2.1.6 Correct behaviour when Contention Resolution Timer expires

The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

6.2C.2.2.2 Non-Contention based random access

6.2C.2.2.2.1 Correct behaviour when transmitting Random Access Preamble

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs is configured, with the UE selected CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs, UE shall have the capability to select the Random Access Preamble corresponding to the selected CSI-RS, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the random access procedure is initialized for beam failure recovery and if the contention-free Random Access Resources and the contention-free PRACH occasions for beam failure recovery request associated with any of the SSBs and/or CSI-RSs is configured, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs or the selected CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, or from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst

the selected SSB associated PRACH occasions or the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

6.2C.2.2.2.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s), if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble, unless the random access procedure is initialized for Other SI request from UE.

The UE may stop monitoring for Random Access Response(s) and shall monitor the Other SI transmission if the Random Access Response only contains a Random Access Preamble identifier which is corresponding to the transmitted Random Access Preamble and the random access procedure is initialized for SI request from UE, as specified in clause 5.1.4 in TS 38.321 [7].

The UE may stop monitoring for Random Access Response(s), if the contention-free Random Access Preamble for beam failure recovery request was transmitted and if the PDCCH addressed to UE's C-RNTI is received, as specified in clause 5.1.4 in TS 38.321 [7].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2C.2.2.2.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated PRACH transmission power, if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon* or if no PDCCH addressed to UE's C-RNTI is received within the RA Response window configured in *BeamFailureRecoveryConfig*, as defined in clause 5.1.4 in TS 38.321 [7].

6.2C.2.3 Requirements for 2-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate MsgA PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and the MsgA PUSCH power formula of clause 7.1.1 of TS 38.213 [3] and apply this power level at the first MsgA or additional MsgA repetitions. The absolute power applied to the first preamble shall have an accuracy as specified in table 6.3.4.2-1 of TS 38.101-1 [18] for frequency range 1. The relative power applied to additional preambles shall have an accuracy as specified in table 6.3.4.3-1 of TS 38.101-1 [18] for frequency range 1.

The UE shall switch to 4-step RA type procedure if the MsgA transmission counter has exceeded *msgA-TransMax*, if configured, as specified in clause 5.1.4a of TS 38.321 [7]. The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell as specified in clause 5.1.4a in TS 38.321 [7].

The requirements in this clause apply for UE in SA operation mode .

6.2C.2.3.1 Contention based random access

6.2C.2.3.1.1 Correct behaviour when transmitting MsgA

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, the UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SS blocks is configured, as specified in clause 5.1.2a in TS 38.321 [7].

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, UE shall have the capability to transmit MsgA PRACH on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured.

The PRACH preamble and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE shall be able to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH occasion,, and preamble index as defined in clause 8.1A in TS 38.213 [3].

6.2C.2.3.1.2 Correct behaviour when receiving MsgB

The UE shall stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

The UE shall send ACK if Success RAR is received in MsgB and the Contention Resolution is successful, as defined in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH and monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

6.2C.2.3.1.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

6.2C.2.3.2 Non-Contention based random access

6.2C.2.3.2.1 Correct behaviour when transmitting MsgA

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE shall be able to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH occasion,, and preamble index as defined in clause 8.1A in TS 38.213 [3].

6.2C.2.3.2.2 Correct behaviour when receiving MsgB

The UE may stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated MsgA PRACH and MsgA

PUSCH transmission power if all received MsgBs contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2C.2.3.2.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit MsgA with the calculated MsgA PRACH and MsgA PUSCH transmission power, if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA* and the Random Access Response Reception has not been considered as successful as defined in clause 5.1.4a in TS 38.321 [7].

6.2C.3 SA: RRC Connection Release with Redirection for Satellite Access

6.2C.3.1 Introduction

This clause contains requirements on the UE regarding RRC connection release with redirection procedure. RRC connection release with redirection is initiated by the *RRCRelease* message with redirection to NR from NR specified in TS 38.331 [2]. The RRC connection release with redirection procedure is specified in clause 5.3.8 of TS 38.331 [2].

6.2C.3.2 Requirements

6.2C.3.2.1 RRC connection release with redirection to NR

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell within $T_{connection_release_redirect_NR}$.

The time delay ($T_{connection_release_redirect_NR}$) is the time between the end of the last slot containing the RRC command, "*RRCRelease*" (TS 38.331 [2]) on the NR PDSCH and the time the UE starts to send random access to the target NR cell. The time delay ($T_{connection_release_redirect_NR}$) shall be less than:

$$T_{connection_release_redirect_NR} = T_{RRC_procedure_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH}$$

The target NR cell shall be considered detectable when for each relevant SSB, the following side conditions are met:

- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.20 for a corresponding NR Band are fulfilled.

- $T_{RRC_procedure_delay}$: It is the RRC procedure delay for processing the received message "*RRCRelease*" as defined in clause 6.2.2 of TS 38.331 [2].

- $T_{identify\text{-}NR}$: It is the time to identify the target NR cell and depends on the FR of the target NR cell. It is defined in table 6.2C.3.2.1-1. Note that $T_{identify\text{-}NR} = T_{PSS/SSS\text{-}sync} + T_{meas}$, in which $T_{PSS/SSS\text{-}sync}$ is the cell search time and T_{meas} is the measurement time due to cell selection criteria evaluation.

- $T_{SI\text{-}NR}$: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released. $T_{RACH:}$ It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. T_{RACH} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

- T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise T_{rs} is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection if UE doesn't support *twoSMTC-Periodicities-r19* or UE support *twoSMTC-Periodicities-r19* but only a single SMTC periodicity is configured, or T_{rs} is the SMTC configured in the *measObjectNR* corresponding to the physical cell ID of the cell being identified if UE support *twoSMTC-Periodicities-r19* and more than one SMTC periodicity are configured. If the UE is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this clause is applied with T_{rs} = 20 ms if the SSB transmission periodicity is not larger than 20 ms; otherwise,

- there is no requirement if the SSB transmission periodicity is larger than 20 ms.

The requirements in this clause apply provided that the ephemeris information provided by the serving cell for the target cell is valid during time delay ($T_{connection_release_redirect_NR}$).

Table 6.2C.3.2.1-1: Time to identify target NR cell for RRC connection release with redirection to NR

FR of target NR cell	$T_{identify-NR}$
FR1-NTN	K_satellite * MAX (680 ms, 11 x T_{rs})
NOTE 1: If the UE has been provided with higher layer signalling of *smtc2* specified in TS 38.331 [2] prior to the redirection command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.	
NOTE 2: K_satellite is defined in clause 9.3C.4.	

6.2D RRC Connection Mobility Control for ATG

6.2D.1 SA: RRC Re-establishment

6.2D.1.1 Introduction

This clause contains requirements on the UE regarding RRC connection re-establishment procedure. RRC connection re-establishment is initiated when a UE in RRC_CONNECTED state on the carrier loses RRC connection due to any of failure cases, including radio link failure, handover failure, and RRC connection reconfiguration failure. The RRC connection re-establishment procedure is specified in clause 5.3.7 of TS 38.331 [2].

The requirements in this clause are applicable for RRC connection re-establishment to NR cell.

6.2D.1.2 Requirements

In RRC_CONNECTED state the UE shall be capable of sending *RRCReestablishmentRequest* message within $T_{re-establish_delay}$ seconds from the moment it detects a loss in RRC connection. The total RRC connection delay ($T_{re-establish_delay}$) shall be less than:

$$T_{re-establish_delay} = T_{UE_re-establish_delay} + T_{UL_grant}$$

T_{UL_grant}: It is the time required to acquire and process uplink grant from the target PCell. The uplink grant is required to transmit *RRCReestablishmentRequest* message.

The UE re-establishment delay ($T_{UE_re-establish_delay}$) is specified in clause 6.2D.1.2.1.

6.2D.1.2.1 UE Re-establishment delay requirement

The UE re-establishment delay ($T_{UE_re-establish_delay}$) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell. The UE re-establishment delay ($T_{UE_re-establish_delay}$) requirement shall be less than:

$$T_{UE_re-establish_delay} = 50\ ms + T_{identify_intra_NR} + \sum_{i=1}^{N_{freq}-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

The intra-frequency target NR cell shall be considered detectable if each relevant SSB can satisfy that:

- SS-RSRP related side conditions given in clause 10.1.2 is fulfilled for a corresponding NR Band for FR1, and
- the conditions of SSB_RP and SSB $\hat{E}s/Iot$ according to Annex B.2.X1 for a corresponding NR Band are fulfilled.

The inter-frequency target NR cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.4 are fulfilled for a corresponding NR Band for FR1, and
- the conditions of SSB_RP and SSB $\hat{E}s/Iot$ according to Annex B.2.X2 for a corresponding NR Band are fulfilled.

$T_{identify_intra_NR}$: It is the time to identify the target intra-frequency NR cell and it depends on whether the target NR cell is known cell or unknown cell. If the UE is not configured with intra-frequency NR carrier for RRC re-establishment then $T_{identify_intra_NR}$=0; otherwise $T_{identify_intra_NR}$ shall not exceed the values defined in table 6.2D.1.2.1-1.

$T_{identify_inter_NR,i}$: It is the time to identify the target inter-frequency NR cell on inter-frequency carrier *i* configured for RRC re-establishment and it depends on whether the target NR cell is known cell or unknown cell. $T_{identify_inter_NR,i}$ shall not exceed the values defined in table 6.2D.1.2.1-2.

T_{SMTC}: It is the periodicity of the SMTC occasion configured for the intra-frequency carrier. If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2*, T_{smtc} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

$T_{SMTC,i}$: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*. If it is not configured, the UE may assume that the target SSB periodicity is no larger than 20 ms.

T_{SI-NR}: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for the target NR cell.

$T_{PRACH:}$ It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. T_{PRACH} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

N_{freq}: It is the total number of NR frequencies to be monitored for RRC re-establishment; N_{freq} = 1 if the target intra-frequency NR cell is known, else N_{freq} = 2 and $T_{identify_intra_NR}$ = 0 if the target inter-frequency NR cell is known.

There is no requirement if the target cell does not contain the UE context.

In the requirement defined in the below tables, the target FR1 cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown.

Table 6.2D.1.2.1-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell

SSB Ês/Iot (dB)	cell	Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (200 ms, 5 x T_{SMTC})	MAX (800 ms, 10 x $N1^{Note2}$ x T_{SMTC})
< -8	FR1	N/A	800^{Note1}
NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when T_{SMTC} > 20 ms and serving cell SSB Ês/Iot < -8 dB. NOTE 2: For ATG UEs capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.			

Table 6.2D.1.2.1-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify_inter_NR,\ i}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (200 ms, 6 x $T_{SMTC,\ i}$)	MAX (800 ms, 13 x $N1^{Note2}$ x $T_{SMTC,\ i}$)
< -8	FR1	N/A	800^{Note1}
NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when $T_{SMTC,i}$ > 20 ms and serving cell SSB Ês/Iot < -8 dB. NOTE 2: For ATG UEs capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.			

6.2D.2 Random access

6.2D.2.1 Introduction

This clause contains requirements on the UE regarding random access procedure. The random access procedure is initiated to establish uplink time synchronization for a UE which either has not acquired or has lost its uplink

synchronization, or to convey UE's request Other SI, or for beam failure recovery. The random access is specified in clause 8 of TS 38.213 [3] and the control of the RACH transmission is specified in clause 5.1 of TS 38.321 [7]. Two types of procedure are defined for the random access, the 4-step RA type, and the 2-step RA type [7]. The decision on which type of procedure to adopt is as described in clause 5.1.1 of TS 38.321 [7]. The requirements for the 4-step RA type procedure are described in clause 6.2D.2.2, whereas the requirements for the 2-step RA type procedure are described in the clause 6.2D.2.3 of this specification.

6.2D.2.2 Requirements for 4-step RA type

The requirements in clause 6.2.2.2 and sub-clauses under 6.2.2.2 shall apply only for FR1 UE in NR SA operation mode.

6.2D.2.3 Requirements for 2-step RA type

The requirements in clause 6.2.2.3 and sub-clauses under 6.2.2.3 shall apply only for FR1 UE in NR SA operation mode.

6.2D.3 SA: RRC Connection Release with Redirection

6.2D.3.1 Introduction

This clause contains requirements on the UE regarding RRC connection release with redirection procedure. RRC connection release with redirection is initiated by the *RRCRelease* message with redirection to NR from NR specified in TS 38.331 [2]. The RRC connection release with redirection procedure is specified in clause 5.3.8 of TS 38.331 [2].

6.2D.3.2 Requirements

6.2D.3.2.1 RRC connection release with redirection to NR

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell within $T_{connection_release_redirect_NR}$.

The time delay ($T_{connection_release_redirect_NR}$) is the time between the end of the last slot containing the RRC command, "*RRCRelease*" (TS 38.331 [2]) on the NR PDSCH and the time the UE starts to send random access to the target NR cell. The time delay ($T_{connection_release_redirect_NR}$) shall be less than:

$$T_{connection_release_redirect_NR} = T_{RRC_procedure_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH}$$

The target NR cell shall be considered detectable when for each relevant SSB, the following side conditions are met:

- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.5 for a corresponding NR Band are fulfilled.

$T_{RRC_procedure_delay}$: It is the RRC procedure delay for processing the received message "*RRCRelease*" as defined in clause 6.2.2 of TS 38.331 [2].

$T_{identify\text{-}NR}$: It is the time to identify the target NR cell and depends on the FR of the target NR cell. It is defined in table 6.2D.3.2.1-1. Note that $T_{identify\text{-}NR} = T_{PSS/SSS\text{-}sync} + T_{meas}$, in which $T_{PSS/SSS\text{-}sync}$ is the cell search time and T_{meas} is the measurement time due to cell selection criteria evaluation. $T_{SI\text{-}NR}$: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released.

T_{RACH}: It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. T_{RACH} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise T_{rs} is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the *measObjectNR*s with the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, T_{rs} is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided with SMTC

configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this clause is applied with T_{rs} = 20 ms if the SSB transmission periodicity is not larger than 20 ms; otherwise,

- there is no requirement if the SSB transmission periodicity is larger than 20 ms.

Table 6.2D.3.2.1-1: Time to identify target NR cell for RRC connection release with redirection to NR

FR of target NR cell	$T_{identify-NR}$
FR1	MAX (680 ms, 11 x $N1^{Note2}$ x T_{rs})
NOTE 1: If the UE has been provided with higher layer signalling of *smtc2* specified in TS 38.331 [2] prior to the redirection command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.	
NOTE 2: For ATG UEs capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	

6.2E RRC Connection Mobility Control for RedCap UE with Satellite Access

6.2E.1 SA: RRC Re-establishment for RedCap UE with Satellite Access

6.2E.1.1 Introduction

This clause contains requirements on the RedCap UE regarding RRC connection re-establishment procedure. RRC connection re-establishment is initiated when a UE in RRC_CONNECTED state on the carrier loses RRC connection due to any of failure cases, including radio link failure, handover failure, and RRC connection reconfiguration failure. The RRC connection re-establishment procedure is specified in clause 5.3.7 of TS 38.331 [2].

A neighbour cell for RRC re-establishment procedures for a RedCap UE is defined as an intra-frequency cell if the centre frequency and subcarrier spacing (SCS) of the reference SSB of the serving cell is same as the centre frequency and SCS of the reference SSB of the neighbour cell; else it is considered as inter-frequency cell, where:

- The reference SSB of the target cell is the CD-SSB of the target cell.

- The reference SSB of the serving cell is the CD-SSB of the serving cell.

The requirements in this clause are applicable for RRC connection re-establishment to NR cell, which is served by satellite access node (SAN).

6.2E.1.2 Requirements

The requirements in clause 6.2C.1.2 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements defined in clause 6.2C.1.2 shall apply except that:

- $T_{identify_intra_NR}$ as specified in table 6.2E.1.2-1.

- $T_{identify_inter_NR,\ i}$ as specified in table 6.2E.1.2-2.

Table 6.2E.1.2-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell for 1Rx RedCap UE

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify_intra_NR}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (200 ms, 6 x T_{SMTC})	MAX (800 ms, 11 x T_{SMTC})
< -8	FR1	N/A	800^{Note1}
NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when T_{SMTC} > 20 ms and serving cell SSB Ês/Iot < -8 dB.			

Table 6.2E.1.2-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell for 1Rx RedCap UE

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify_inter_NR, i}$ [ms]	
		Known NR cell	Unknown NR cell
≥ -8	FR1	MAX (200 ms, 7 x $T_{SMTC, i}$)	MAX (800 ms, 14 x $T_{SMTC, i}$)
< -8	FR1	N/A	800[Note1]
NOTE 1: The UE is not required to successfully identify a cell on any NR frequency layer when $T_{SMTC,i}$ > 20 ms and serving cell SSB Ês/Iot < -8 dB.			

6.2E.2 Random access for RedCap UE with satellite access

6.2E.2.1 Introduction

This clause contains requirements on the RedCap UE regarding random access procedure. The random access procedure is initiated to establish uplink time synchronization for a UE which either has not acquired or has lost its uplink synchronization, or to convey UE's request Other SI, or for beam failure recovery. The random access is specified in clause 8 of TS 38.213 [3] and the control of the RACH transmission is specified in clause 5.1 of TS 38.321 [7]. Two types of procedure are defined for the random access, the 4-step RA type, and the 2-step RA type [7]. The decision on which type of procedure to adopt is as described in clause 5.1.1 of TS 38.321 [7].

The 1 Rx RedCap UE for performing the random access procedure applies:

- *rsrp-ThresholdSSB* as the signaled value of *rsrp-ThresholdSSB* [2] + 1 dB.
- *msgA-RSRP-ThresholdSSB* as the signaled value of *msgA-RSRP-ThresholdSSB* [2] + 1 dB.
- *msgA-RSRP-Threshold* as the signaled value of *msgA-RSRP-Threshold* [2] + 1 dB.
- *rsrp-ThresholdMsg3* as the signaled value of *rsrp-ThresholdMsg3* [2] - 1 dB.

6.2E.2.2 Requirements

The requirements for the 4-step RA type procedure described in clause 6.2C.2.2 and the requirements for the 2-step RA type procedure described in the clause 6.2C.2.3 are applicable for TDD and FDD RedCap UEs. The 4-step and 2-step RA requirements for contention based random access defined in clause 6.2C.2.2 and 6.2C.2.3 respectively apply to HD-FDD UE with the following conditions:

- The RedCap UE operating in HD-FDD mode is not expected to perform PRACH transmission on a PRACH resource of a cell if UE has not received at least one SSB associated with that PRACH resource during the last Tp period in the cell, where Tp=160 ms.
- The RedCap UE operating in HD-FDD mode shall meet the PRACH requirements when performing PRACH transmission on a PRACH resource of a cell provided that the UE has received at least one SSB associated with that PRACH resource during the last Tp period before the PRACH transmission, where Tp=160 ms.

6.2E.3 SA: RRC Connection Release with Redirection for RedCap UE with Satellite Access

6.2E.3.1 Introduction

This clause contains requirements on the RedCap UE regarding RRC connection release with redirection procedure. RRC connection release with redirection is initiated by the *RRCRelease* message with redirection to NR from NR specified in TS 38.331 [2]. The RRC connection release with redirection procedure is specified in clause 5.3.8 of TS 38.331 [2].

6.2E.3.2 Requirements

6.2E.3.2.1 RRC connection release with redirection to NR

The requirements in clause 6.2C.3.2.1 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements defined in clause 6.2C.3.2.1 shall apply except that:

- $T_{identify-NR}$ as specified in table 6.2E.3.2.1-1.

Table 6.2E.3.2.1-1: Time to identify target NR cell for RRC connection release with redirection to NR for 1Rx RedCap UE

FR of target NR cell	$T_{identify-NR}$
FR1	MAX (680 ms, 12 x T_{rs})
NOTE: If the UE has been provided with higher layer signalling of *smtc2* specified in TS 38.331 [2] prior to the redirection command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.	

The HD-FDD UE shall meet the RRC connection release with redirection requirements provided that SSB is available at the UE once every SMTC period during T_{search}.

6.3 L1/L2-Triggered Mobility

6.3.1 LTM PCell Cell Switch

6.3.1.1 Introduction

The purpose of LTM cell switch is to switch the PCell or PSCell to a target cell indicated in LTM cell switch command. The requirements in this section are applicable to LTM PCell switch.

The requirements in this clause are applicable to SA and NR-DC, and to both intra-frequency and inter-frequency LTM cell switch.

The requirements for inter-frequency cell switch in this clause are only applicable, when

- network has configured UE to perform SSB based L3 measurement with beam measurement reporting or L1 measurement for the target cell before the cell switch command, or
- the SFN of the serving cell from which cell switch command is received and the SFN of the target cell are the same.

The requirements in this clause are applicable to SA for the following scenarios:

PCell switch to a neighbouring LTM candidate cell

- FR1 cell to FR1 cell
- FR1 cell to FR2 cell
- FR2 cell to FR2 cell
- FR2 cell to FR1 cell

PCell switch to an LTM candidate cell that is a serving SCell in MCG

- FR1 cell to FR1 cell
- FR2 cell to FR2 cell

The requirements in this clause are applicable to NR-DC for the following scenarios:

PCell switch to a neighbouring LTM candidate cell

- FR1 cell to FR1 cell

PCell switch to an LTM candidate cell that is a serving SCell in MCG

- FR1 cell to FR1 cell

The requirements in this section apply when

- the target cell is known, and
  - the target joint UL/DL TCI state or separate UL and DL TCI states in the MAC-CE LTM cell switch command are known, or
  - the target cell is an FR1 cell, and the UE has reported L3-RSRP measurement result with SSB index associated to the target TCI state within 5 seconds before receiving the LTM cell switch command, and SNR of the SSB associated to the target TCI state ≥ -3dB, or
  - the target cell is an FR1 cell, and the UE is configured with event-triggered L1 measurement reporting and report on leave, and the UE has sent an event-triggered L1 measurement report with RS associated to the target TCI state and has not sent report on leave for the same RS before receiving the cell switch command.
- PL-RS is QCLed with RS of the TCI state indicated by LTM cell switch command, and
  - For CFRA cell switch, RS of the TCI state indicated by LTM cell switch command is QCLed with the SSB indicated for CFRA.

The target cell in the LTM cell switch command is known if the following conditions are met:

- During the last 5 seconds before the reception of the cell switch command:
  - The UE has sent a valid L1 or L3 measurement report for the target cell, and
  - One of the SSBs measured from the NR target cell configured for measurement remains detectable according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell,
- One of the SSBs measured from the NR target cell configured for measurement remains detectable according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell,

Otherwise, the cell is unknown.

The target joint DL/UL TCI state or separate DL and UL TCI states in the LTM cell switch command are known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target DL/UL TCI state to the completion of LTM cell switch, where the RS resource for L1-RSRP measurement is the RS in target DL/UL TCI state or QCLed to the target DL/UL TCI state
  - LTM cell switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
  - The UE has sent at least 1 L1-RSRP report for the target DL/UL TCI state before the LTM cell switch command
  - The target DL/UL TCI state remains detectable during the LTM cell switching period
  - The SSB associated with the target DL/UL TCI state remain detectable during the cell switching period
    - SNR of the TCI state ≥ -3dB

Otherwise, the target joint DL/UL TCI state or separate DL and UL TCI state is unknown.

6.3.1.2 LTM Cell Switch delay

LTM cell switch delay D_{LTM} is the delay from the end of the last TTI containing the MAC-CE command for cell switch until the time the UE transmits the first UL message on the target cell.

LTM cell switch delay is defined as:

$$D_{LTM} = T_{cmd} + T_{LTM\text{-}interrupt}$$

Where:

T_{cmd} equals to T_{HARQ} + 3ms, where T_{HARQ} is the timing between cell switch command and acknowledgement as specified in TS 38.213 [3].

$T_{LTM\text{-}interrupt}$ is as stated in clause 6.3.1.3.

6.3.1.3 Interruption time

The interruption time $T_{LTM\text{-}interrupt}$ is the time from the end of T_{cmd} stated in clause 6.3.1.2 until the time the UE transmits the first UL message on the target cell.

$$T_{LTM\text{-}interrupt} = T_{LTM\text{-}RRC\text{-}processing} + T_{LTM\text{-}processing} + T_{first\text{-}RS} + T_{RS\text{-}proc} + T_{LTM\text{-}IU} \text{ ms},$$

Where:

$T_{LTM\text{-}RRC\text{-}processing}$ is the time for ASN.1 decoding and validity/compliance check for the RRC configuration of the LTM target cell indicated in the LTM cell switch command.

$T_{LTM\text{-}RRC\text{-}processing}$ = 0, if the UE supports *ltm-FastProcessingConfig-r18* capability, and:

- The number of LTM candidate cell configurations does not exceed *maxNumberConfigs-r18* and the number of the configured serving cells and the cells in the LTM configuration does not exceed *maxNumberStoredConfigCells-r18*, or
- The following conditions are fulfilled for the target cell:
  - UE has received LTM candidate cell TCI state activation command for the target cell at least T_{HARQ} + 13 ms before the LTM cell switch command, and/or
  - UE has received PDCCH order for early RACH for the target cell at least $N_{T,2}$+10 ms before the LTM cell switch command, where $N_{T,2}$ is defined in section 8.1 of TS 38.213 [3], and
  - The total number of LTM candidate cells for which TCI state(s) were activated or PDCCH order was received before the cell switch command does not exceed *maxNumberConfigs-r18*, and the total number of serving cells and the cells in the LTM configuration for which TCI state(s) were activated and/or PDCCH order was received before the cell switch does not exceed *maxNumberStoredConfigCells-r18.*

Otherwise $T_{LTM\text{-}RRC\text{-}processing}$ = 10 ms.

$T_{LTM\text{-}processing}$ is the time for UE processing, consisting of applying the target cell parameters and L1/L2 change.

If the UE supports *ltm-FastUE-Processing-r18* capability, the value of $T_{LTM\text{-}processing}$ equals to

- *fr1-r18* for FR1 to FR1 LTM cell switch.
- *fr2-r18 for* FR2 to FR2 LTM cell switch.
- *fr1-AndFR2-r18* for FR1 to FR2 and FR2 to FR1 LTM cell switch.

Otherwise, the value of $T_{LTM\text{-}processing}$ equals to

- 20 ms for FR1 to FR1 and FR2 to FR2 LTM cell switch.
- 40 ms for FR1 to FR2 and FR2 to FR1 LTM cell switch.

$T_{first-RS}$ is the time for fine time tracking and acquiring full timing information of the target cell.

$T_{RS-proc}$ is the time for SSB processing.

$T_{first-RS}$ = 0 and $T_{RS-proc}$= 0 under the following conditions:

- The target TCI state indicated in the LTM cell switch command is in the serving cell active TCI state list, or
- The UE is configured with LTM L1 intra- and/or inter-frequency measurements for the target cell, and
  - The target TCI state in the cell switch command is in the LTM candidate cell active TCI state list, and
    - the time between receiving the LTM candidate cell TCI state activation MAC-CE and the cell switch command is at least TCI state activation delay stated in section 8.25.3 and
    - the time between receiving the LTM candidate cell TCI state activation MAC-CE and the cell switch command is not more than TCI state activation delay stated in section 8.25.3 + 160 ms, or
    - the measurement period of the SSB associated to target TCI state is not larger than 160 ms after the LTM candidate cell TCI state activation MAC-CE is received, or
- The target cell is an FR1 cell, and the UE is not configured with LTM L1 intra- and/or inter-frequency measurements for the target cell, and
  - The target TCI state in the cell switch command is in the LTM candidate cell active TCI state list, and
    - the time between receiving the LTM candidate cell TCI state activation MAC-CE and the cell switch command is at least TCI state activation delay stated in section 8. 25.3, and not more than
      - TCI state activation delay stated in section 8. 25.3 + 480 ms for an intra-frequency target cell, or

        NOTE: longer L3 measurement delay may be expected for 480 ms after TCI state activation delay stated in section 8.25.3.
      - TCI state activation delay stated in section 8. 25.3 + 160 ms for an inter-frequency target cell, or
    - The time between the latest PDCCH ordered RACH preamble transmission on the target cell and the cell switch command is not more than 160 ms.

Otherwise,

$T_{first-RS}$ is the time to the first SSB transmission on the target cell after T_{cmd} + $T_{LTM-RRC-processing}$ + $T_{LTM-processing}$.

$T_{RS-proc}$ = 2 ms.

T_{LTM-IU} is the interruption uncertainty during LTM cell switch.

For RACH-based LTM cell switch, T_{LTM-IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{LTM-IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

For RACH-less LTM cell switch, $T_{LTM-IU_}$is the uncertainty on transmitting the first uplink transmission on the target cell.

6.3.2 Conditional L1/L2-Triggered Mobility

6.3.2.1 Introduction

The purpose of CLTM cell switch is to switch PCell to a target cell based on configured CLTM execution condition.

The requirements in this clause are applicable to both intra-frequency and inter-frequency CLTM cell switch and subsequent CLTM cell switch.

The requirements in this clause are applicable only to SA, including the following scenarios:

PCell switch to a neighbouring CLTM candidate cell

- FR1 cell to FR1 cell
- FR1 cell to FR2 cell
- FR2 cell to FR2 cell
- FR2 cell to FR1 cell

PCell switch to a CLTM candidate cell that is a serving SCell in MCG

- FR1 cell to FR1 cell
- FR2 cell to FR2 cell

6.3.2.2 CLTM Cell Switch delay

Procedure delays for all procedures that can command a CLTM are specified in TS 38.331 [2].

When the UE receives CLTM candidate cell configuration implying CLTM, the UE shall start to transmit the new uplink transmission to the target cell fulfilling the configured CLTM condition within D_{CLTM} seconds from the end of the last TTI containing the CLTM candidate cell configuration.

$$D_{CLTM} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{CLTM\text{-}RRC\text{-}processing} + T_{CLTM\text{-}interrupt}$$

Where:

- T_{RRC} is the RRC procedure delay defined in clause 12 in TS 38.331 [2].
- T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a CLTM configuration until a condition exists at the measurement reference point which will trigger the CLTM cell switch.
- $T_{measure}$ is the time for the UE to measure and realize the condition for CLTM cell switch is fulfilled. $T_{measure}$ equals to the measurement time stated in clause 6.3.2.2.1.
- $T_{CLTM\text{-}RRC\text{-}processing}$ is the time for ASN.1 decoding and validity/compliance check for the RRC configuration of the CLTM target cell stated in clause 6.3.2.2.2.
- $T_{CLTM\text{-}interrupt}$ is the interruption time stated in clause 6.3.2.2.3.

6.3.2.2.1 Measurement time

The measurement delay is defined from the end of T_{Event_DU} until UE starts conditional cell switch execution to a target cell.

In FR2, when the number of neighbor cells to be measured on intra-frequency and inter-frequency without gap is more than 1 and TCI state(s) of at least one of these neighbor cells is in the active TCI state list, the requirements apply only to the cell(s) that have TCI state(s) in the active TCI state list.

1> If SSB based L1-RSRP measurement is used in the event, $T_{measure}$ shall be no larger than the maximum of L1-RSRP measurement periods of the serving cell and target cell.

2> serving cell measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ is defined in clause 9.5.4.1 assuming $T_{Report} = 0$, and

2> if the target cell is an intra-frequency cell:

3> target cell measurement period is $T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra} + T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ as defined in clause 9.2.5.1 and clause 9.14.5.1 assuming $T_{Report} = 0$, if *deriveSSB-IndexFromCell* is enabled or UE has reported SSB index in L3 measurement report of the same cell, or

3> target cell measurement period is $T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra} + T_{L1\text{-}RSRP_Measurement_Period_SSB_intra} + T_{SSB_time_index_intra}$ as defined in clause 9.2.5.1 and clause 9.14.5.1 assuming $T_{Report} = 0$, otherwise.

2> if the target cell is an inter-frequency cell:

3> target cell measurement period is T_{PSS/SSS_sync_inter} + $T_{SSB_measurement_period_inter}$ + $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter}$ as defined in clause 9.3.4 and clause 9.15.5 or 9.15.6 assuming T_{Report} = 0, if *deriveSSB-IndexFromCellInter-r17* is enabled or UE has reported SSB index in L3 measurement report of the same cell, or

3> target cell measurement period is T_{PSS/SSS_sync_inter} + $T_{SSB_measurement_period_inter}$ + $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter}$ + $T_{SSB_time_index_inter}$ as defined clause 9.3.4 and in clause 9.15.5 or 9.15.6 assuming T_{Report} = 0, otherwise.

1> If SSB-based L3-RSRP measurement is used in the event and target cell is in FR1, $T_{measure}$ in CHO stated in clause 6.1.4.2.2 is applicable.

1> If CSI-RS-based L1-RSRP measurement is used in the event, $T_{measure}$ shall be no larger than the maximum of CSI-RS-based L1-RSRP measurement periods of the serving cell and the target cell.

2> serving cell measurement period $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ is defined in clause 9.5.4.2 assuming T_{Report} = 0, and

2> target cell measurement period is $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_intra}$ defined in clause 9.14a.5 assuming T_{Report} = 0

6.3.2.2.2 CLTM RRC processing time

$T_{CLTM\text{-}RRC\text{-}processing}$ is the time for ASN.1 decoding and validity/compliance check for the RRC configuration of the CLTM target cell.

1> if the UE supports *ltm-FastProcessingConfig-r18* capability, and

2> if the number of LTM and CLTM candidate cell configurations does not exceed *maxNumberConfigs-r18*, and

2> if the number of the configured serving cells and the cells in the LTM and CLTM configuration does not exceed *maxNumberStoredConfigCells-r18*

3> $T_{CLTM\text{-}RRC\text{-}processing}$ = 0

2> else

3> if UE has received CLTM candidate cell TCI state activation command for the target cell at least T_{HARQ} + 13 ms before UE starts cell switch execution to the target cell, and/or

3> if UE has received PDCCH order for early RACH for the target cell at least $N_{T,2}$+10 ms before UE starts cell switch execution to the target cell, where $N_{T,2}$ is defined in section 8.1 of TS 38.213 [3], and

3> if the total number of LTM and CLTM candidate cells for which TCI state(s) were activated or PDCCH order was received before UE starts cell switch execution to target cell does not exceed maxNumberConfigs-r18, and

3> if the total number of serving cells and the cells in the LTM and CLTM configuration for which TCI state(s) were activated and/or PDCCH order was received before UE starts cell switch execution to the target cell does not exceed *maxNumberStoredConfigCells-r18*

4> $T_{CLTM\text{-}RRC\text{-}processing}$ = 0

1> else

2> $T_{CLTM\text{-}RRC\text{-}processing}$ = 10 ms

6.3.2.2.3 Interruption time

The interruption time $T_{CLTM\text{-}interrupt}$ is between the time the UE starts to execute cell switch towards the target cell until the time the UE starts to transmit the new uplink transmission to the target cell, excluding $T_{CLTM\text{-}RRC\text{-}processing}$.

$$T_{CLTM\text{-}interrupt} = T_{LTM\text{-}processing} + T_{first\text{-}RS} + T_{RS\text{-}proc} + T_{CLTM\text{-}IU} \text{ ms},$$

Where:

- $T_{LTM-processing}$ is the time for UE processing, consisting of applying the target cell parameters and L1/L2 change, stated in clause 6.3.1.3.

- $T_{first-RS}$ is the time for fine time tracking and acquiring full timing information of the target cell.

- $T_{RS-proc}$ is the time for SSB processing.

  1> if the target TCI state is in the serving cell active TCI state list or is associated to a TCI state in the serving cell active TCI state list

    2> $T_{first-RS}$ = 0 and $T_{RS-proc}$= 0

  1> else if the UE is configured with LTM L1 intra- and/or inter-frequency measurements for the target cell, and

    2> if the target TCI state is in the CLTM candidate cell active TCI state list or is associated to a TCI state in the CLTM candidate cell active TCI state list, and

      3> if the time between receiving the CLTM candidate cell TCI state activation MAC-CE and UE starting to execute cell switch towards the target cell is at least TCI state activation delay stated in section 8.25.3, and

      3> if the time between receiving the CLTM candidate cell TCI state activation MAC-CE and UE starting to execute cell switch towards the target cell is not more than TCI state activation delay stated in section 8.25.3 + 160 ms, or

      3> if the measurement period of the SSB associated to target TCI state is not larger than 160 ms after the CLTM candidate cell TCI state activation MAC-CE is received

        4> $T_{first-RS}$ = 0 and $T_{RS-proc}$= 0

  1> else if the target cell is an FR1 cell, and the UE is not configured with CLTM L1 intra- and/or inter-frequency measurements for the target cell, and

    2> if the target TCI state is in the CLTM candidate cell active TCI state list or is associated to a TCI state in the CLTM candidate cell active TCI state list, and

      3> if the time between receiving the CLTM candidate cell TCI state activation MAC-CE and UE starting to execute cell switch towards the target cell is at least TCI state activation delay stated in section 8.25.3, and

      3> if not more than TCI state activation delay stated in section 8. 25.3 + 480 ms for an intra-frequency target cell, or

        NOTE: longer L3 measurement delay may be expected for 480 ms after TCI state activation delay stated in section 8.25.3.

      3> if not more than TCI state activation delay stated in section 8. 25.3 + 160 ms for an inter-frequency target cell

        4> $T_{first-RS}$ = 0 and $T_{RS-proc}$= 0

    2> else if the time between the latest PDCCH ordered RACH preamble transmission on the target cell and starting to execute cell switch towards the target cell is not more than 160 ms

      3> $T_{first-RS}$ = 0 and $T_{RS-proc}$= 0

  1> else

    2> $T_{first-RS}$ is the time to the first SSB transmission on the target cell after $T_{RRC} + T_{Event_DU} + T_{measure} + T_{CLTM-RRC-processing} + T_{LTM-processing}$.

    2> $T_{RS-proc}$ = 2 ms.

- $T_{CLTM-IU}$ is the interruption uncertainty during CLTM cell switch.

  - For RACH-based CLTM cell switch, $T_{CLTM-IU}$ is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. $T_{CLTM-IU}$ can be up to the summation of SSB to PRACH occasion

association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

- For RACH-less CLTM cell switch, $T_{CLTM-IU}$ is the uncertainty on transmitting the new uplink transmission on the target cell.

6.3.2.3 Subsequent CLTM Cell Switch delay

When the UE sends a *RRCReconfigurationComplete* message indicating completion of the previous CLTM cell switch, the UE shall start to transmit the new uplink transmission to the target cell fulfilling the configured CLTM condition within $D_{Subsequent-CLTM}$ seconds from the end of the last TTI containing the *RRCReconfigurationComplete* message.

$$D_{Subsequent-CLTM} = T_{Event_DU} + T_{measure} + T_{CLTM-RRC-processing} + T_{CLTM-interrupt}$$

Where:

- $T_{measure}$, $T_{CLTM-RRC-processing}$ and $T_{CLTM-interrupt}$ are defined in clause 6.3.2.2.
- T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully sends a *RRCReconfigurationComplete* message indicating completion of the previous CLTM cell switch until a condition exists at the measurement reference point which will trigger the subsequent CLTM cell switch.

7 Timing

7.1 UE transmit timing

7.1.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in RRC_CONNECTED state or when transmitting PUSCH on CG resources for SDT in RRC_INACTIVE. The uplink frame transmission takes place $(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}}) \times T_c$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. For serving cell(s) in pTAG, UE shall use the SpCell as the reference cell for deriving the UE transmit timing for cells in the pTAG. For serving cell(s) in sTAG, UE shall use any of the activated SCells as the reference cell for deriving the UE transmit timing for the cells in the sTAG. For UL-WUS transmission for OD-SIB1, UE shall use the target NES cell as the reference cell for deriving the UE transmit timing. UE initial transmit timing accuracy and gradual timing adjustment requirements are defined in the following requirements.

In the requirements of clause 7.1.2, the term reference cell on a carrier frequency subject to CCA is not available at the UE refers to when at least one SSB is configured by gNB, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available during at least one discovery burst transmission window, at the UE due to DL CCA failures at gNB during the last 1280 ms; otherwise the reference cell on the carrier frequency subject to CCA is considered as available at the UE.

For UE supporting *rach-EarlyTA-Measurement-r18* for LTM, and if the candidate cell is a neighbour cell or a secondary serving cell without uplink carrier,

- UE shall have capability to follow the frame timing of the reference cell. The PRACH transmission for early TA acquisition takes place $(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}}) \times T_c$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. UE shall use this candidate cell as the reference cell for deriving transmit timing. UE initial transmit timing accuracy is defined in the following requirements.

For multi-DCI based multi-TRP operation with two TAs and for asymmetric DL sTRP/UL mTRP deployment with two TAs, for each TAG, the uplink transmission timing takes place $(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}}) \times T_c$ before the reception of the downlink reference point.

For multi-DCI based multi-TRP operation with two TAs, the reference point for PUCCH/PUSCH/SRS, is the first detected path (in time) of one of the corresponding downlink reference signal(s) of the reference cell associated with one of the *DLorJointTCIState* TS 38.331 [2] having the same TAG as the uplink signal.

For asymmetric DL sTRP/UL mTRP deployment with two TAs, for the scenario that UE is configured with PL offset in joint/UL TCI state(s) and UE does not expect to receive SSB from UL TRP(s), the reference point for PRACH/PUCCH/PUSCH/SRS is the first detected path in time of one of the corresponding downlink reference signal(s) of the reference cell associated with one of the DL or Joint TCI state, and is the same for both TAGs.

For asymmetric DL sTRP/UL mTRP deployment with two TAs, for the scenario that UE is not configured with PL offset in joint/UL TCI state(s) and UE may expect to receive SSB from UL TRP(s), for the case UE is configured with *SSB-MTC-additionalPCI*, the reference point for PUCCH/PUSCH/SRS, is the first detected path (in time) of one of the corresponding downlink reference signal(s) of the reference cell associated with one of the *DLorJointTCIState* or -UL TCI states TS 38.331 [2] having the same TAG as the uplink signal.

For multi-DCI based multi-TRP operation with two TAs if the UE is not provided *SSB-MTC-AdditionalPCI*, the reference point for PRACH transmission triggered by PDCCH order, is the first detected path (in time) of one of the downlink reference signal(s) in the DL or joint TCI state of the reference cell associated with the same coresetPoolIndex as PDCCH carrying PDCCH order if PRACH association indicator is 0, and that of the other coresetPoolIndex if PRACH association indicator is 1.

For multi-DCI based multi-TRP operation with two TAs if the UE is provided *SSB-MTC-AdditionalPCI*, the reference point for PRACH transmission triggered by PDCCH order,

- if “PRACH association indicator” is 0, the reference timing is the first detected path (in time) of one of the corresponding downlink reference signal(s) of DL TCI state(s) of the reference cell associated with the first TAG.
- if “PRACH association indicator” is 1, the reference timing is the first detected path (in time) of one of the corresponding downlink reference signal(s) of DL TCI state(s) of the reference cell associated with the second TAG.

For asymmetric DL sTRP/UL mTRP deployment with two TAs, for the scenario that UE is not configured with PL offset in joint/UL TCI state(s) and UE may expect to receive SSB from UL TRP(s), for the case UE is configured with *SSB-MTC-additionalPCI*, the reference point for PRACH transmission triggered by PDCCH order,

- if “PRACH association indicator” in DCI format 1_0 is 0, the reference timing is the first detected path (in time) of one of the corresponding downlink reference signal(s) of DL TCI state(s) of the reference cell associated with the first TAG.
- if “PRACH association indicator” in DCI format 1_0 is 1, the reference timing is the first detected path (in time) of one of the corresponding downlink reference signal(s) of DL or UL TCI state(s) of the reference cell associated with the second TAG.

Where N_{TA} and $N_{TA\,offset}$ are commanded by the network independently for each TAG TS 38.331 [2]. $N_{TA\,offset}$ for first TAG and second TAG are as defined in n-TimingAdvanceOffset and n-TimingAdvanceOffset2 respectively, if configured, otherwise it is $N_{TA\,offset}$ defined in table 7.1.2-2.

In the requirements of clause 7.1.2, the SSB applies for both CD-SSB and NCD-SSB if the UE supports *ncd-SSB-BWP-Wor-r18*.

7.1.2 Requirements

The UE initial transmission timing error shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is specified in table 7.1.2-1. This requirement applies:

- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS, or it is the PRACH transmission, or it is the msgA transmission, or it is the first transmission sent on the PSCell for activating the deactivated SCG without RACH, or it is the UL-WUS transmission for OD-SIB1.
- when it is the transmission for PUSCH on CG resources for SDT in RRC_INACTIVE.
- when it is the first transmission on target cell after UE receives LTM cell switch command.
- when it is the first transmission among SCell(s) in an sTAG after a dormant BWP switching delay as defined in 8.6.2 or 8.6.2A, if the dormant BWP switch includes BWP switch of an SCell configured with UL in the sTAG.

When the UL SCS is 120 kHz or smaller, the UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms. When the UL SCS is 480 kHz the UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available in the last 80 ms. When the UL SCS is 960 kHz the UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available in the last 40 ms.

The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus $(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}}) \times T_c$. The downlink timing is defined as the time when the first path (in time) of the corresponding downlink frame used by the UE to determine downlink timing is received from the reference cell at the UE antenna. N_{TA} for PRACH and UL-WUS for OD-SIB1 is defined as 0.

$(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}}) \times T_c$ (in T_c units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in clause 7.3 was applied. N_{TA} for other channels is not changed until next timing advance is received. The value of $N_{\mathrm{TA\,offset}}$ depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). $N_{\mathrm{TA\,offset}}$ is defined in table 7.1.2-2.

For multi-DCI based multi-TRP operation with two TAs and for asymmetric DL sTRP/UL mTRP deployment with two TAs for first transmission in a DRX cycle for PUCCH, PUSCH, SRS and PRACH transmission triggered by PDCCH order, UE initial transmission timing error requirements specified in this clause is applicable for each TAG and shall be met for each TAG separately. The reference point for each TAG for the PUCCH/PUSCH/SRS and PRACH transmission triggered by PDCCH order is defined in clause 7.1.1.

Table 7.1.2-1: T_e Timing Error Limit

Frequency Range	SCS of SSB signals (kHz)	SCS of uplink signals (kHz)	T_e
1	15	15	12*64*T_c
		30	10*64*T_c
		60	10*64*T_c
	30	15	8*64*T_c
		30	8*64*T_c
		60	7*64*T_c
2-1	120	60	3.5*64*T_c
		120	3.5*64*T_c
	240	60	3*64*T_c
		120	3*64*T_c
2-2	120	120	3.5*64*T_c
		480	1.58*64*T_c
	480	120	2.86*64*T_c
		480	1.35*64*T_c
		960	0.90*64*T_c
	960	120	2.80*64*T_c
		480	1.13*64*T_c
		960	0.86*64*T_c
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6]			

Table 7.1.2-2: The Value of $N_{\mathrm{TA\,offset}}$

Frequency range and band of cell used for uplink transmission	$N_{\mathrm{TA\,offset}}$ (Unit: T_c)
FR1 FDD or TDD band with neither E-UTRA–NR nor NB-IoT–NR coexistence case	25600 (Note 1)
FR1 FDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case	0 (Note 1)
FR1 TDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case	39936 (Note 1)
FR2	13792

Note 1:	The UE identifies $N_{\text{TA offset}}$ based on the information *n-TimingAdvanceOffset* as specified in TS 38.331 [2]. For UL-WUS transmission for OD-SIB1, UE identifies $N_{\text{TA offset}}$ based on the information *n-TimingAdvanceOffset* from UL-WUS configuration as specified in TS 38.331 [2]. If UE is not provided with the information *n-TimingAdvanceOffset*, the default value of $N_{\text{TA offset}}$ is set as 25600 for FR1 band. In case of multiple UL carriers in the same TAG, UE expects that the same value of *n-TimingAdvanceOffset* is provided for all the UL carriers according to clause 4.2 in TS 38.213 [3] and the value 39936 of $N_{\text{TA offset}}$ can also be provided for an FDD serving cell.
Note 2:	Void

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH and SRS transmission, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell except when the timing advance in clause 7.3 is applied.

Table 7.1.2-3: void

If the UE uses a reference cell on a carrier frequency subject to CCA for deriving the UE transmit timing, then the UE shall meet all the transmit timing requirements defined in clause 7.1.2 provided that the reference cell is available at the UE. If the reference cell is not available at the UE on a carrier frequency subject to CCA, then the UE is allowed to transmit in the uplink provided that the UE meets all the transmit timing requirements defined in clause 7.1.2; otherwise the UE shall not transmit any uplink signal.

If a reference cell on a carrier frequency belonging to the pTAG, which is subject to CCA, is not available at the UE then the UE is allowed to use any of available activated SCell(s) at the UE in pTAG as a new reference cell. If the SCell used as reference cell is deactivated, or becomes not available, the UE is allowed to use another active serving cell in pTAG as new reference cell.

If a reference cell on a carrier frequency belonging to the sTAG, which is subject to CCA is not available at the UE then the UE is allowed to use any of available activated SCell(s) at the UE in sTAG as a new reference cell.

7.1.2.1 Gradual timing adjustment

Requirements in this section shall apply regardless of whether the reference cell is on a carrier frequency subject to CCA or not.

When the transmission timing error between the UE and the reference timing exceeds $\pm T_e$ then the UE shall adjust the timing such that timing error is to within $\pm T_e$. The reference timing shall be $(N_{\text{TA}} + N_{\text{TA offset}}) \times T_c$ before the downlink timing of the reference cell. All adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change in one adjustment shall be T_q.

2) The minimum aggregate adjustment rate shall be T_p per second.

3) The maximum aggregate adjustment rate shall be T_q per 200 ms for SCS of UL signals smaller or equal to 120 kHz and 100 ms for SCS of uplink signals larger or equal to 480 kHz.

   where the maximum autonomous time adjustment step T_q and the aggregate adjustment rate T_p are specified in table 7.1.2.1-1.

For multi-DCI based multi-TRP operation with two TAs and asymmetric DL sTRP/UL mTRP deployment with two TAs, gradual timing adjustment specified in this clause applies for each TAG and shall be met for each TAG. The reference point for each TAG for the PUCCH/PUSCH/SRS and PRACH transmission triggered by PDCCH order is defined in clause 7.1.1.

Table 7.1.2.1-1: T_q Maximum Autonomous Time Adjustment Step and T_p Minimum Aggregate Adjustment rate

Frequency Range	SCS of uplink signals (kHz)	T_q	T_p
1	15	$5.5*64*T_c$	$5.5*64*T_c$
	30	$5.5*64*T_c$	$5.5*64*T_c$
	60	$5.5*64*T_c$	$5.5*64*T_c$
2-1	60	$K*64*T_c$	$2.5*64*T_c$

	120	K*64*T_c	2.5*64*T_c
2-2	120	2.5*64*T_c	2.5*64*T_c
	480	0.8*64*T_c	0.8*64*T_c
	960	0.8*64*T_c	0.8*64*T_c
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6] NOTE 2: When *highSpeedMeasFlagFR2-r17* is configured for UE supporting power class 6, K = 4.5; otherwise, K = 2.5.			

7.1.2.2 Void

Table 7.1.2.2-1: Void

7.1.2.3 One shot large UL timing adjustment for FR2 Power Class 6 UE

When *highSpeedMeasFlagFR2-r17* is configured and *highSpeedLargeOneStepUL-TimingFR2-r17* is enabled for UE supporting FR2 power class 6 and *ue-OneShotUL-TimingAdj-r17* capability, the following requirements apply to the UE:

If the UE also indicates to support *tci-StateSwitchInd-r18* and *cross-RRH TCI state indicator for UE-specific PDCCH MAC-CE* as specified in Clause 6.1.3.77 of TS 38.321 [7] is indicated as '1' for the TCI state switch

- the UE transmit timing immediately after TCI state switch shall be $T_{new} - (N_{TA} + N_{TA\,offset}) + 2\times(T_{old} - T_{new})$ and clause 7.1.2.1 requirements do not apply.
  - The UE UL transmission timing error after the TCI state switching procedure shall be less than or equal to $\pm T_e$ as specified in clause 7.1.2 if the new target TCI state is within active TCI state list, otherwise ±7*64*T_c, and the reference point is $T_{new} - (N_{TA} + N_{TA\,offset}) + 2\times(T_{old} - T_{new})$.

If the UE also indicates to support *tci-StateSwitchInd-r18* and *cross-RRH TCI state indicator for UE-specific PDCCH MAC-CE* as specified in Clause 6.1.3.77 of TS 38.321 [7] is indicated as '0' for the TCI state switch

- the requirement in clause 7.1.2.1 apply to the first UL transmission after a TCI state switch.

If the UE does not indicate to support *tci-StateSwitchInd-r18* or *cross-RRH TCI state indicator for UE-specific PDCCH MAC-CE* as specified in Clause 6.1.3.77 of TS 38.321 [7] is not indicated for the TCI state switch

- If the absolute value $|T_{old} - T_{new}| \leq CP/4$, the requirements in clause 7.1.2.1 apply to the first UL transmission after a TCI state switch.
- Otherwise, the UE transmit timing immediately after TCI state switch shall be $T_{new} - (N_{TA} + N_{TA\,offset}) + 2\times(T_{old} - T_{new})$ and clause 7.1.2.1 requirements do not apply.
  - The UE UL transmission timing error after the TCI state switching procedure shall be less than or equal to $\pm T_e$ as specified in clause 7.1.2 if the new target TCI state is within active TCI state list, otherwise ±7*64*T_c, and the reference point is $T_{new} - (N_{TA} + N_{TA\,offset}) + 2\times(T_{old} - T_{new})$.

Above,

- T_{new} (in T_c units) is the DL timing defined as the time when UE receives downlink frame with new target TCI state.
- T_{old} (in T_c units) is the DL timing defined as the time when UE receives downlink frame with old source TCI state.

7.1.2.4 UE transmit timing for positioning measurements

If cell reselection occurs in RRC_INACTIVE within *srs-PosRRC-InactiveValidityArea area*, the UE shall have capability to follow the frame timing change of the reference cell when transmitting SRS for positioning. The uplink frame transmission takes place $(N_{TA} + N_{TA\,offset}) \times T_c$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. The UE shall use the current camping cell as reference cell for deriving the UE transmit timing.

When *autonomousTA-AdjustmentEnabled-r18* is configured, the following requirements apply to the UE supporting *posUE-TA-AutoAdjustment-r18* upon cell reselection to a new camping cell within the SRS validity area (*srs-PosRRC-InactiveValidityArea*):

If the absolute value of the DL timing difference between the new camping cell and the previous camping cell immediately after cell reselection is ≥ CP/4, UE shall autonomously adjust the TA as

$$TA_{adjusted} = TA_{old} + 2 * (T_{new} - T_{old})$$

where $TA_{adjusted}$ and TA_{old} are the TA after adjustment in the new camping cell and TA applied in previous camping cell, respectively, T_{new} is the DL timing of the new camping cell immediatedly after cell reselection and T_{old} is the DL timing of the previous camping cell immediately before cell reselection.

- The UE UL transmission timing error after autonomous TA adjustment shall be less than or equal to $\pm T_e$ in clause 7.1.2.
- If the TA value would be negative after applying the autonomous TA adjustment, the TA is set to zero. i.e. the TA applied in the new camping cell shall be set to $\max(TA_{adjusted}, 0)$.

If the DL timing difference is < CP/4, UE follows the DL timing of the new camping cell by performing gradual timing adjustment as defined in clause 7.1.2.1.

7.1A UE transmit timing for RedCap

7.1A.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in RRC_CONNECTED state or when transmitting PUSCH on CG resources for SDT in RRC_INACTIVE. The uplink frame transmission takes place $(N_{\text{TA}} + N_{\text{TA offset}}) \times T_c$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. UE initial transmit timing accuracy and gradual timing adjustment requirements are defined in the following requirements.

7.1A.2 Requirements

The UE initial transmission timing error shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is specified in table 7.1A.2-1. This requirement applies:

- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS, or it is the PRACH transmission, or it is the msgA transmission.
- when it is the transmission for PUSCH on CG resources for SDT in RRC_INACTIVE.

The UE shall meet the Te requirement for an initial transmission provided that at least one SSB (CD-SSB or NCD-SSB) is available at the UE for acquiring the frame timing of the reference cell during the last 160 ms on the condition that:

- the SSB is within the UE's active BWP, or
- the SSB is not within the UE's active BWP, and the measurement gap is configured.

The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus $(N_{\text{TA}} + N_{\text{TA offset}}) \times T_c$. The downlink timing is defined as the time when the first path (in time) of the corresponding downlink frame used by the UE to determine downlink timing is received from the reference cell at UE antenna. N_{TA} for PRACH is defined as 0.

$(N_{\text{TA}} + N_{\text{TA offset}}) \times T_c$ (in T_c units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in clause 7.3A was applied. N_{TA} for other channels is not changed until next timing advance is received. The value of $N_{\text{TA offset}}$ depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). $N_{\text{TA offset}}$ is defined in table 7.1A.2-2.

Table 7.1A.2-1: T_e Timing Error Limit

Frequency Range	SCS of SSB signals (kHz)	SCS of uplink signals (kHz)	T_e

1	15	15	12*64*T_c
		30	10*64*T_c
		60	10*64*T_c
	30	15	8*64*T_c
		30	8*64*T_c
		60	7*64*T_c
2	120	60	3.5*64*T_c
		120	3.5*64*T_c
	240	60	3*64*T_c
		120	3*64*T_c
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6]			

Table 7.1A.2-2: The Value of $N_{\text{TA offset}}$ $N_{\text{TA offset}}$

Frequency range and band of cell used for uplink transmission	$N_{\text{TA offset}}$ (Unit: T_C)
FR1 FDD or TDD band with neither E-UTRA–NR nor NB-IoT–NR coexistence case	25600 (Note 1)
FR1 FDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case	0 (Note 1)
FR1 TDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case	39936 (Note 1)
FR2	13792
Note 1: The UE identifies $N_{\text{TA offset}}$ based on the information n-TimingAdvanceOffset as specified in TS 38.331 [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of $N_{\text{TA offset}}$ is set as 25600 for FR1 band. Note 2: Void	

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH and SRS transmission, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell except when the timing advance in clause 7.3A is applied.

7.1A.2.1 Gradual timing adjustment

When the transmission timing error between the UE and the reference timing exceeds $\pm T_e$ then the UE is required to adjust its timing to within $\pm T_e$. The reference timing shall be $(N_{\text{TA}} + N_{\text{TA offset}}) \times T_c$ before the downlink timing of the reference cell. All adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change in one adjustment shall be T_q.

2) The minimum aggregate adjustment rate shall be T_p per second.

3) The maximum aggregate adjustment rate shall be T_q per 200 ms.

where the maximum autonomous time adjustment step T_q and the aggregate adjustment rate T_p are specified in table 7.1A.2.1-1.

Table 7.1A.2.1-1: T_q Maximum Autonomous Time Adjustment Step and T_p Minimum Aggregate Adjustment rate

Frequency Range	SCS of uplink signals (kHz)	T_q	T_p
1	15	5.5*64*T_c	5.5*64*T_c
	30	5.5*64*T_c	5.5*64*T_c
	60	5.5*64*T_c	5.5*64*T_c
2	60	2.5*64*T_c	2.5*64*T_c
	120	2.5*64*T_c	2.5*64*T_c
NOTE: T_c is the basic timing unit defined in TS 38.211 [6]			

7.1A.2.2 UE transmit timing for positioning measurements

The requirements defined in clasue 7.1.2.4 shall apply for this clause.

7.1C UE transmit timing for Satellite Access

7.1C.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in RRC_CONNECTED state. The uplink frame transmission takes place $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}} + N_{\mathrm{TA,adj}}^{\mathrm{common}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}}$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. UE initial transmit timing accuracy and gradual timing adjustment requirements are defined in the following requirements.

7.1C.2 Requirements

The UE initial transmission timing error shall be less than or equal to $\pm T_{e_NTN}$ where the timing error limit value T_{e_NTN}:

- is specified in table 7.1C.2-1 for FR1-NTN.
- is specified in table 7.1C.2-2 and table 7.1C.2-3 for VSAT UE in FR2-NTN.

This requirement applies:

- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS, or it is the PRACH transmission, or it is the msgA transmission.

The UE shall meet the T_{e_NTN} requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\text{-}offset}} + N_{\mathrm{TA,adj}}^{\mathrm{common}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}}$.

The downlink timing is defined as the time when the first path (in time) of the corresponding downlink frame used by the UE to determine downlink timing is received from the reference cell at the UE antenna.

N_{TA} for PRACH is defined as 0. $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}} + N_{\mathrm{TA,adj}}^{\mathrm{common}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}}$ (in T_{c} units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in clause 7.3C was applied. or after the last update in $N_{\mathrm{TA,adj}}^{\mathrm{common}}$ or $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$.

The value of $N_{\mathrm{TA\,offset}}$ depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). $N_{\mathrm{TA\,offset}}$is defined in table 7.1.2-2 for FR1-NTN.

$N_{\mathrm{TA\,offset}}$ is defined in table 7.1C.2-4 for VSAT UE in FR2-NTN.

$N_{\mathrm{TA,adj}}^{\mathrm{common}}$ and $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$ are defined in TS 38.211 [6].

Table 7.1C.2-1: T_{e_NTN} Timing Error Limit

Frequency Range	SCS of SSB signals (kHz)	SCS of uplink signals (kHz)	T_{e_NTN}
FR1-NTN	15	15	29*64*T_c
		30	24*64*T_c
		60	N/A
	30	15	24*64*T_c
		30	22*64*T_c
		60	N/A
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6]			

Table 7.1C.2-2: T_{e_NTN} Timing Error Limit for fixed VSAT served by GSO and NGSO

Frequency Range	SCS of SSB signals (kHz)	SCS of uplink signals (kHz)	T_{e_NTN}
FR2-NTN	120	60	13*64*T_c
		120	7.5*64*T_c
	240	60	13*64*T_c
		120	7.5*64*T_c
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6]			

Table 7.1C.2-3: T_{e_NTN} Timing Error Limit for mobile VSAT served by GSO and NGSO

Frequency Range	SCS of SSB signals (kHz)	SCS of uplink signals (kHz)	T_{e_NTN}
FR2-NTN	120	60	13*64*T_c
		120	7.5*64*T_c
	240	60	13*64*T_c
		120	7.5*64*T_c

NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6]
NOTE 2: T_{e_NTN} for 120 kHz UL SCS applies under all the following conditions:
- LOS channel between UE and each GNSS satellite
- The GNSS signal power level greater than or equal to the applicable value specified in Table 6.2-1 of TS 38.171
- The GNSS satellite allocation is no less than the applicable value speicifed in Table 6.2-2 of TS 38.171
- The velocity change within one second does not result in the position difference with respect to the projected position, based on the position and velocity obtained one second before, exceeding 10 meters.

NOTE 3: The requirement with 120 kHz SCS for mobile VSAT served by NGSO applies only to UEs that indicate '*mobile'* via UE capability *ntn-VSAT-AntennaType-r19*. The requirement applies when the interval between adjacent epoch times does not exceed 5.12 sec.

Fixed VSAT and mobile VSAT are defined in TS 38.101-5 [43].

Table 7.1C.2-4: The Value of $N_{\text{TA offset}}$ for VSAT in FR2-NTN

Frequency range and band of cell used for uplink transmission	$N_{\text{TA offset}}$(Unit: T_C)
FR2-NTN	0
Note 1: The UE identifies $N_{\text{TA offset}}$ based on the information n-TimingAdvanceOffset as specified in TS 38.331 [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of $N_{\text{TA offset}}$ is set as 0 for FR2-NTN band.	

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH including PUSCH transmissions in Time Domain Window when *pusch-DMRS-Bundling* is enabled, and SRS transmission, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell, the updating of $N_{\text{TA,adj}}^{\text{common}}$ and the updating of $N_{\text{TA,adj}}^{\text{UE}}$, except when the timing advance in clause 7.3C is applied.

7.1C.2.1 Gradual timing adjustment

When the transmission timing error between the UE and the reference timing exceeds $\pm T_{e_NTN}$ then the UE shall adjust the timing such that timing error is to within $\pm T_{e_NTN}$. The reference timing shall be $\left(N_{\text{TA}} + N_{\text{TA offset}} + N_{\text{TA,adj}}^{\text{common}} + N_{\text{TA,adj}}^{\text{UE}}\right) \times T_c$ before the downlink timing of the reference cell. All adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change, apart from a change of $N_{\text{TA,adj}}^{\text{UE}}$ due to satellite position update and $N_{\text{TA,adj}}^{\text{common}}$ between the previous transmission and the current transmission, in one adjustment shall be T_{q_NTN}.

2) The minimum aggregate adjustment rate, apart from a change of $N_{\text{TA,adj}}^{\text{UE}}$ due to satellite position update and $N_{\text{TA,adj}}^{\text{common}}$ during the last one second, shall be T_{p_NTN} per second.

3a) For a FR1-NTN UE or a FR2-NTN fixed UE, the maximum aggregate adjustment rate, apart from a change of $N_{\text{TA,adj}}^{\text{UE}}$ due to satelliteposition update and $N_{\text{TA,adj}}^{\text{common}}$ during the last 200 ms, shall be T_{q_NTN} per 200 ms.

3b) For a FR2-NTN mobile UE , the maximum aggregate adjustment rate, apart from a change of $N_{\text{TA,adj}}^{\text{UE}}$ due to satellite position update and $N_{\text{TA,adj}}^{\text{common}}$ during the last 200 ms, shall be 3 * T_{q_NTN} per 200 ms.

Where, the maximum autonomous time adjustment step T_{q_NTN} and the aggregate adjustment rate T_{p_NTN} are specified in table 7.1C.2.1-1.

Table 7.1C.2.1-1: T_{q_NTN} Maximum Autonomous Time Adjustment Step and T_{p_NTN} Minimum Aggregate Adjustment rate

Frequency Range	SCS of uplink signals (kHz)	T_{q_NTN}	T_{p_NTN}
FR1-NTN	15	5.5*64*T_c	5.5*64*T_c
	30	5.5*64*T_c	5.5*64*T_c
	60	N/A	N/A
FR2-NTN	60	2.5*64*T_c	2.5*64*T_c
	120	2.5*64*T_c	2.5*64*T_c
NOTE: T_c is the basic timing unit defined in TS 38.211 [6]			

7.1D UE transmit timing for ATG

7.1D.1 Introduction

The ATG UE shall have capability to follow the frame timing change of the reference cell in RRC_CONNECTED state. The uplink frame transmission takes place $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}}$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. ATG UE initial transmit timing accuracy and gradual timing adjustment requirements are defined in the following paragraphs.

7.1D.2 Requirements

The ATG UE initial transmission timing error shall be less than or equal to $\pm T_{e_ATG}$ where the timing error limit value T_{e_ATG} is specified in table 7.1D.2-1. This requirement applies:

- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS, or it is the PRACH transmission, or it is the msgA transmission.

The ATG UE shall meet the T_{e_ATG} requirement for an initial transmission provided that at least one SSB is available at the ATG UE during the last 160 ms. The reference point for the ATG UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}}$.

The downlink timing is defined as the time when the first path (in time) of the corresponding downlink frame used by the ATG UE to determine downlink timing is received from the reference cell at the ATG UE antenna.

N_{TA} for PRACH is defined as 0. $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}}$ (in T_{c} units) for other channels is the difference between ATG UE transmission timing and the downlink timing immediately after when the last timing advance in clause 7.3D was applied, or after the last update in $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$.

The value of $N_{\mathrm{TA\,offset}}$ depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). $N_{\mathrm{TA\,offset}}$ is defined in table 7.1.2-2.

$N_{\mathrm{TA,adj}}^{\mathrm{UE}}$ is defined in TS 38.211 [6].

Table 7.1D.2-1: T_{e_ATG} Timing Error Limit

Frequency Range	SCS of SSB signals (kHz)	SCS of uplink signals (kHz)	T_{e_ATG}
1	15	15	20*64*Tc
		30	18*64*Tc
		60	N/A
	30	15	16*64*Tc
		30	16*64*Tc
		60	N/A
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6]			

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH and SRS transmission, the ATG UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell, the updating of $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$, except when the timing advance in clause 7.3D is applied.

7.1D.2.1 Gradual timing adjustment

When the transmission timing error between the ATG UE and the reference timing exceeds $\pm T_{e_ATG}$ then the ATG UE is required to adjust its timing to within $\pm T_{e_ATG}$. The reference timing shall be $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}}$ before the downlink timing of the reference cell. All adjustments made to the ATG UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change, apart from a change of $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$ due to ATG UE position update, in one adjustment shall be T_{q_ATG}.

2) The minimum aggregate adjustment rate, apart from a change of $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$ due to ATG UE position update, shall be T_{p_ATG} per second.

3) The maximum aggregate adjustment rate, apart from a change of $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$ due to ATG UE position update, shall be T_{q_ATG} per 200 ms.

Where, the maximum autonomous time adjustment step T_{q_ATG} and the aggregate adjustment rate T_{p_ATG} are specified in table 7.1D.2.1-1.

Table 7.1D.2.1-1: T_{q_ATG} Maximum Autonomous Time Adjustment Step and T_{p_ATG} Minimum Aggregate Adjustment rate

Frequency Range	SCS of uplink signals (kHz)	T_{q_ATG}	T_{p_ATG}
1	15	$9.5*64*T_c$	$9.5*64*T_c$
	30	$9.5*64*T_c$	$9.5*64*T_c$
	60	N/A	N/A
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6]			

7.1E UE transmit timing for RedCap with Satellite Access

7.1E.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in RRC_CONNECTED state. The uplink frame transmission takes place $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\,offset}} + N_{\mathrm{TA,adj}}^{\mathrm{common}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}}$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. UE initial transmit timing accuracy and gradual timing adjustment requirements are defined in the following requirements.

7.1E.2 Requirements

The requirements in clause 7.1C.2 for FR1-NTN shall apply:

- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS, or it is the PRACH transmission, or it is the msgA transmission.
- when it is the transmission for PUSCH on CG resources for SDT in RRC_INACTIVE.

7.1E.2.1 Gradual timing adjustment

The requirements in clause 7.1C.2.1 for FR1-NTN shall apply.

7.2 UE timer accuracy

7.2.1 Introduction

UE timers are used in different protocol entities to control the UE behaviour.

7.2.2 Requirements

For UE timers specified in TS 38.331 [2], the UE shall comply with the timer accuracies according to table 7.2.2-1.

The requirements are only related to the actual timing measurements internally in the UE. They do not include the following:

- Inaccuracy in the start and stop conditions of a timer (e.g. UE reaction time to detect that start and stop conditions of a timer is fulfilled), or
- Inaccuracies due to restrictions in observability of start and stop conditions of a UE timer (e.g. slot alignment when UE sends messages at timer expiry).

Table 7.2.2-1

Timer value [s]	Accuracy
timer value < 4	± 0.1 s
timer value ≥ 4	± 2.5 %

7.2A UE timer accuracy for RedCap

7.2A.1 Introduction

UE timers are used in different protocol entities to control the UE behaviour.

7.2A.2 Requirements

For UE timers specified in TS 38.331 [2], the UE shall comply with the timer accuracies according to table 7.2A.2-1.

The requirements are only related to the actual timing measurements internally in the UE. They do not include the following:

- Inaccuracy in the start and stop conditions of a timer (e.g. UE reaction time to detect that start and stop conditions of a timer is fulfilled), or
- Inaccuracies due to restrictions in observability of start and stop conditions of a UE timer (e.g. slot alignment when UE sends messages at timer expiry).

Table 7.2A.2-1

Timer value [s]	Accuracy
timer value < 4	± 0.1 s
timer value ≥ 4	± 2.5 %

7.2C UE timer accuracy for satellite access

7.2C.1 Introduction

UE timers are used in different protocol entities to control the UE behaviour.

7.2C.2 Requirements

The requirements in this clause are applicable for both UE served by SAN in FR1-NTN and VSAT UE served by SAN in FR2-NTN.

For UE timers specified in TS 38.331 [2], the UE shall comply with the timer accuracies according to table 7.2C.2-1.

The requirements are only related to the actual timing measurements internally in the UE. They do not include the following:

- Inaccuracy in the start and stop conditions of a timer (e.g. UE reaction time to detect that start and stop conditions of a timer is fulfilled), or
- Inaccuracies due to restrictions in observability of start and stop conditions of a UE timer (e.g. slot alignment when UE sends messages at timer expiry).

Table 7.2C.2-1

Timer value [s]	Accuracy
timer value < 4	± 0.1 s
timer value ≥ 4	± 2.5 %

7.2D UE timer accuracy for ATG

7.2D.1 Introduction

ATG UE timers are used in different protocol entities to control the ATG UE behaviour.

7.2D.2 Requirements

For ATG UE timers specified in TS 38.331 [2], the ATG UE shall comply with the timer accuracies according to table 7.2D.2-1.

The requirements are only related to the actual timing measurements internally in the ATG UE. They do not include the following:

- Inaccuracy in the start and stop conditions of a timer (e.g. ATG UE reaction time to detect that start and stop conditions of a timer is fulfilled), or
- Inaccuracies due to restrictions in observability of start and stop conditions of a ATG UE timer (e.g. slot alignment when ATG UE sends messages at timer expiry).

Table 7.2D.2-1

Timer value [s]	Accuracy
timer value < 4	± 0.1 s
timer value ≥ 4	± 2.5 %

7.2E UE timer accuracy for RedCap with Satellite Access

7.2E.1 Introduction

UE timers are used in different protocol entities to control the UE behaviour.

7.2E.2 Requirements

The requirements in clause 7.2C.2 for FR1-NTN shall apply.

7.3 Timing advance

7.3.1 Introduction

The timing advance is initiated from gNB to UE in EN-DC, NR-DC, NE-DC and NR SA operation modes, with MAC message that implies the adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

7.3.2 Requirements

7.3.2.1 Timing Advance adjustment delay

UE shall adjust the timing of its uplink transmission timing at time slot *n+ k+1* for a timing advance command received in time slot *n*, and the value of *k* is defined in clause 4.2 in TS 38.213 [3]. The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

7.3.2.2 Timing Advance adjustment accuracy

The UE shall adjust the timing of its transmissions with a relative accuracy better than or equal to the UE Timing Advance adjustment accuracy requirement in table 7.3.2.2-1, to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS 38.213 [3].

Table 7.3.2.2-1: UE Timing Advance adjustment accuracy

UL Sub Carrier Spacing(kHz)	15	30	60	120	480	960
UE Timing Advance adjustment accuracy	±256 T_c	±256 T_c	±128 T_c	±32 T_c	±10 T_c	±6 T_c

7.3A Timing Advance for RedCap

7.3A.1 Introduction

The timing advance is initiated from gNB to UE configured with only PCell, with MAC message that implies the adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

7.3A.2 Requirements

7.3A.2.1 Timing Advance adjustment delay

UE shall adjust the timing of its uplink transmission at time slot *n+ k+1* for a timing advance command received in time slot *n*, and the value of *k* is defined in clause 4.2 in TS 38.213 [3]. The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

7.3A.2.2 Timing Advance adjustment accuracy

The UE shall adjust the timing of its transmissions with a relative accuracy better than or equal to the UE Timing Advance adjustment accuracy requirement in table 7.3A.2.2-1, to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS 38.213 [3].

Table 7.3A.2.2-1: UE Timing Advance adjustment accuracy

UL Sub Carrier Spacing(kHz)	15	30	60	120
UE Timing Advance adjustment accuracy	±256 T_c	±256 T_c	±128 T_c	±32 T_c

7.3C Timing advance for satellite access

7.3C.1 Introduction

The timing advance is initiated by UE configured with only PCell served by SAN, upon initiating a validity timer for $N_{\mathrm{TA,adj}}^{\mathrm{common}}$ and $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$. The timing advance can be adjusted with MAC message that implies the adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

7.3C.2 Requirements

7.3C.2.1 Timing Advance adjustment delay

UE shall adjust the timing of its uplink transmission timing from the beginning of uplink time slot $n+ k+1+2^{\mu} \cdot K_{\mathrm{offset}}$ for a timing advance command received in time slot n, and the value of k, μ and K_{offset} are defined in clause 4.2 in TS 38.213 [3]. The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

7.3C.2.2 Timing Advance adjustment accuracy

The UE shall adjust the timing of its transmissions, apart from a change of $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$ and $N_{\mathrm{TA,adj}}^{\mathrm{common}}$ between the preceding uplink transmission and the current transmission, with a relative accuracy better than or equal to the UE Timing Advance adjustment accuracy requirement in table 7.3C.2.2-1, for FR1-NTN and in table 7.3C.2.2-2 for VAST UE in FR2-NTN to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS 38.213 [3].

Table 7.3C.2.2-1: UE Timing Advance adjustment accuracy

UL Sub Carrier Spacing(kHz)	15	30	60
UE Timing Advance adjustment accuracy	±256 T_c	±256 T_c	N/A

Table 7.3C.2.2-2: UE Timing Advance adjustment accuracy for VSAT UE in FR2-NTN

UL Sub Carrier Spacing(kHz)	60	120
UE Timing Advance adjustment accuracy	±128 T_c	±32 T_c
NOTE 1: VSAT UE are defined in TS 38.101-5 [43]		

7.3D Timing advance for ATG

7.3D.1 Introduction

The timing advance is initiated by ATG UE configured with only PCell. The timing advance can be adjusted with MAC message that implies the adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

7.3D.2 Requirements

7.3D.2.1 Timing Advance adjustment delay

ATG UE shall adjust the timing of its uplink transmission timing from the beginning of uplink at time slot $n+ k+1+2^{\mu} \cdot K_{\mathrm{offset}}$ for a timing advance command received in time slot n, and the value of k, μ and K_{offset} are defined in clause 4.2 in TS 38.213 [3]. The same requirement applies also when the ATG UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

7.3D.2.2 Timing Advance adjustment accuracy

The ATG UE shall adjust the timing of its transmissions, apart from a change of $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$ between the preceding uplink transmission and the current transmission, with a relative accuracy better than or equal to the ATG UE Timing Advance adjustment accuracy requirement in table 7.3D.2.2-1, to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS 38.213 [3].

Table 7.3D.2.2-1: ATG UE Timing Advance adjustment accuracy

UL Sub Carrier Spacing(kHz)	15	30	60
ATG UE Timing Advance adjustment accuracy	±256 T_c	±256 T_c	N/A

7.3E Timing advance for RedCap with Satellite Access

7.3E.1 Introduction

The timing advance is initiated by UE configured with only PCell served by SAN, upon initiating a validity timer for $N_{\mathrm{TA,adj}}^{\mathrm{common}}$ and $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$. The timing advance can be adjusted with MAC message that implies the adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

7.3E.2 Requirements

7.3E.2.1 Timing Advance adjustment delay

The requirements in clause 7.3C.2.1 for FR1-NTN shall apply.

7.3E.2.2 Timing Advance adjustment accuracy

The requirements in clause 7.2C.2.2 for FR1-NTN shall apply.

7.4 Cell phase synchronization accuracy

7.4.1 Definition

Cell phase synchronization accuracy for TDD is defined as the maximum absolute deviation in frame start timing between any pair of cells on the same frequency that have overlapping coverage areas.

7.4.2 Minimum requirements

The cell phase synchronization accuracy measured at BS antenna connectors or radiated interface boundaries shall be better than 3 μs.

7.5 Maximum Transmission Timing Difference

7.5.1 Introduction

A UE shall be capable of handling a relative transmission timing difference between subframe timing boundary of E-UTRA PCell and the closest slot timing boundary of PSCell to be aggregated for EN-DC operation.

A UE shall be capable of handling a relative transmission timing difference among the closest slot timing boundaries of different carriers in FR1 and/or FR2-1 to be aggregated in NR carrier aggregation.

A UE shall be capable of handling a relative transmission timing difference among the closest subframe timing boundaries of different carriers to be aggregated in FR1 and FR2-2 NR inter-band carrier aggregation.

A UE shall be capable of handling a relative transmission timing difference between slot timing boundary of PCell and subframe timing boundary of E-UTRA PSCell to be aggregated for NE-DC operation.

A UE shall be capable of handling a relative transmission timing difference between slot timing boundaries of PCell in FR1 or FR2-1 and the closest slot timing boundary of PSCell in FR1 or FR2-1 to be aggregated in NR-DC operation.

A UE shall be capable of handling a relative transmission timing difference between subframe timing boundaries of PCell in FR1 and the closest subframe timing boundary of PSCell in FR2-2 to be aggregated in NR-DC operation.

A UE supporting *multiDCI-IntraCellMultiTRP-TwoTA-r18 or multiDCI-InterCellMultiTRP-TwoTA-r18* shall be capable of handling a relative transmission timing difference between the closest slot timing boundaries of signals on the same CC transmitted to two TRPs.

7.5.2 Minimum requirements for inter-band EN-DC

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in table 7.5.2-1.

Table 7.5.2-1 Maximum uplink transmission timing difference requirement for asynchronous EN-DC

Sub-carrier spacing in E-UTRA PCell (kHz)	UL Sub-carrier spacing for data in PSCell (kHz)	Maximum uplink transmission timing difference (μs)
15	15	500
15	30	250
15	60	125
15	120[Note1]	62.5
NOTE 1: For E-UTRA FDD-NR FDD intra-band EN-DC, for which the requirement is defined in clause 7.5.3 and this Table 7.5.2-1 is also applicable, the scenario with 120 kHz PSCell does not exist.		

Table 7.5.2-2 Void

7.5.2.1 Minimum requirements for inter-band synchronous EN-DC

The requirements in this clause apply as a reference for inter-band synchronous EN-DC.

The UE shall be capable of handling a maximum uplink transmission timing difference (MTTD) between E-UTRA PCell and PSCell for inter-band synchronous EN-DC as shown in table 7.5.2.1-1 1. The requirements for synchronous EN-DC are applicable for E-UTRA TDD-NR TDD, E-UTRA FDD-NR FDD, E-UTRA TDD-NR FDD and E-UTRA FDD-NR TDD inter-band EN-DC.

For E-UTRA TDD-NR TDD inter-band EN-DC with overlapping or partially overlapping DL bands, only synchronized operation is assumed. The UE shall be capable of handling a maximum uplink transmission timing difference (MTTD) between E-UTRA PCell and PSCell as shown in table 7.5.2.1-1 provided that UE not supporting *requirementTypeIndication-r18* indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* or UE supporting *requirementTypeIndication-r18* is capable of *interBandMRDC-WithOverlapDL-Bands-r16* and not provided with *nonCollocatedTypeMRDC-r18*, and in table 7.5.3-1 provided that UE does not indicate it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* or *interBandMRDC-WithOverlapDL-Bands-r19* or UE supporting *requirementTypeIndication-r18* is capable of *interBandMRDC-WithOverlapDL-Bands-r16* and provided with *nonCollocatedTypeMRDC-r18*.

For E-UTRA FDD-NR FDD inter-band EN-DC with overlapping DL bands, only synchronized operation is assumed if UE does not indicate that it is capable of asynchronous FDD-FDD EN-DC operation. The UE shall be capable of handling a maximum uplink transmission timing difference (MTTD) between E-UTRA PCell and PSCell as shown in table 7.5.2.1-1 provided that UE not supporting *requirementTypeIndication-r18* indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* or UE supporting *requirementTypeIndication-r18* is capable of *interBandMRDC-WithOverlapDL-Bands-r16* and not provided with *nonCollocatedTypeMRDC-r18*, and in table 7.5.3-1 provided that UE does not indicate it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* or *interBandMRDC-WithOverlapDL-Bands-r19* or UE supporting *requirementTypeIndication-r18* is capable of *interBandMRDC-WithOverlapDL-Bands-r16* and provided with *nonCollocatedTypeMRDC-r18*.For E-UTRA TDD-NR TDD inter-band EN-DC with overlapping or partially overlapping DL bands, or E-UTRA FDD-NR FDD inter-band EN-DC with overlapping DL bands, if UE indicates it is capable of *interBandMRDC-WithOverlapDL-Bands-r19*,

1> when UE is configured with *maxMIMO-Layers* with value equal to 4,

2> if *nonCollocatedTypeMRDC-v1900* is present with *"type 4"*,

3> the UE shall be capable of handling a maximum uplink transmission timing difference (MTTD) between E-UTRA PCell and PSCell as shown in table 7.5.2.1-1.

2> otherwise, if *nonCollocatedTypeMRDC-v1900* is present with *"type 1"* or absent,

3> the UE shall be capable of handling a maximum uplink transmission timing difference (MTTD) between E-UTRA PCell and PSCell as shown in table 7.5.3-1.

1> when UE is configured with *maxMIMO-Layers* with value equal to 2,

2> if *nonCollocatedTypeMRDC-r18* is not provided,

3> the UE shall be capable of handling a maximum uplink transmission timing difference (MTTD) between E-UTRA PCell and PSCell as shown in table 7.5.2.1-1.

2> otherwise

3> the UE shall be capable of handling a maximum uplink transmission timing difference (MTTD) between E-UTRA PCell and PSCell as shown in table 7.5.3-1.

Table 7.5.2.1-1 Maximum uplink transmission timing difference requirement for inter-band synchronous EN-DC

Sub-carrier spacing in E-UTRA PCell (kHz)	UL Sub-carrier spacing for data in PSCell (kHz)	Maximum uplink transmission timing difference (μs)
15	15	35.21
15	30	35.21
15	60	35.21
15	120	35.21

7.5.3 Minimum requirements for intra-band EN-DC

For intra-band EN-DC, only co-located deployment is applied.

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in table 7.5.2-1 for E-UTRA FDD-NR FDD intra-band EN-DC provided the UE indicates that it is capable of asynchronous EN-DC operation [2].

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in table 7.5.3-1 for E-UTRA TDD-NR TDD and E-UTRA FDD-NR FDD intra-band EN-DC provided the UE does not indicate that it is capable of asynchronous FDD-FDD EN-DC operation [16].

Table 7.5.3-1: Maximum uplink transmission timing difference requirement for intra-band synchronous EN-DC

Sub-carrier spacing in E-UTRA PCell (kHz)	UL Sub-carrier spacing for data in PSCell (kHz)	Maximum uplink transmission timing difference (μs)
15	15	5.21 Note1,Note 2
15	30	5.21 Note 2
15	60	5.21 Note 2
NOTE 1: This is not applicable for a UE which indicates the capability of only supporting single UL timing (*ul-TimingAlignmentEUTRA-NR* is signalled). Single UL timing for E-UTRA and NR cell is assumed for this UE.		
NOTE 2: If the transmission timing difference exceeds the cyclic prefix length of the UL Sub-carrier spacing for data in PSCell, NR UE Tx EVM degradation is expected for the symbol that is overlapping the LTE subframe boundary		
NOTE 3: The requirement in this table is also applicable for intra-band synchronous NE-DC.		

7.5.4 Minimum requirements for NR Carrier Aggregation

The UE shall be capable of handling at least a relative transmission timing difference between slot timing of all pairs of TAGs in FR1 and/or FR2-1 as shown in table 7.5.4-1, provided that the UE is:

- configured with the pTAG and the sTAG for inter-band NR carrier aggregation in SA or NR-DC mode, or
- configured with more than one sTAG for inter-band NR carrier aggregation in EN-DC or NE-DC mode.

The UE shall be capable of handling at least a relative transmission timing difference between subframe timing of all pairs of TAGs between FR1 and FR2-2 as shown in table 7.5.4-1, provided that the UE is:

- configured with the pTAG and the sTAG for inter-band NR carrier aggregation in SA or NR-DC mode.

For FR1 intra-band non-contiguous NR carrier aggregation, the UE shall be capable of handling at least a relative transmission timing difference as shown in table 7.5.4-1, between slot timing of all FR1 pairs of TAGs provided that UE indicates that it is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided.

For FR1 intra-band non-contiguous NR carrier aggregation and UE supporting *intraBandNR-CA-non-collocated-r19,*

1> when UE is configured with *maxMIMO-Layers* with value equal to 4,

2> if nonCollocatedTypeNR-CA-v1900 is present with “type 4”,

3> the UE shall be capable of handling at least a relative transmission timing difference between slot timing of all FR1 pairs of TAGs as shown in table 7.5.4-1.

1> when UE is configured with *maxMIMO-Layers* with value equal to 2,

2> if *nonCollocatedTypeNR-CA-r18* is not provided,

3> the UE shall be capable of handling at least a relative transmission timing difference between slot timing of all FR1 pairs of TAGs as shown in table 7.5.4-1.

Table 7.5.4-1: Maximum uplink transmission timing difference requirement for inter-band NR carrier aggregation

Frequency Range of the pair of TAGs	Maximum uplink transmission timing difference (μs)
FR1	34.6
FR2-1	8.5 Note1
Between FR1 and FR2-1	26.1
Between FR1 and FR2-2	26.1
NOTE1: This requirement applies to the UE capable of independent beam management for FR2-1 inter-band CA.	

7.5.5 Minimum requirements for inter-band NE-DC

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and E-UTRA PSCell as shown in table 7.5.5-1 for inter-band asynchronous NE-DC.

Table 7.5.5-1: Maximum uplink transmission timing difference requirement for inter-band asynchronous NE-DC

Sub-carrier spacing in PCell (kHz)	UL Sub-carrier spacing for data in E-UTRA PSCell (kHz)	Maximum uplink transmission timing difference (μs)
15	15	500
30	15	250
60	15	125
120	15	62.5
NOTE 1: Void		

Table 7.5.5-2 Void

7.5.5.1 Minimum requirements for inter-band synchronous NE-DC

The requirements in this clause apply as a reference for inter-band synchronous NE-DC.

The UE shall be capable of handling a maximum uplink transmission timing difference (MTTD) between PCell and E-UTRA PSCell for inter-band synchronous NE-DC as shown in table 7.5.5.1-1. The requirements for synchronous NE-DC are applicable for NR TDD- E-UTRA TDD, NR FDD- E-UTRA FDD, NR TDD- E-UTRA FDD and NR FDD- E-UTRA TDD inter-band NE-DC.

For NR FDD-E-UTRA FDD inter-band NE-DC with overlapping DL bands, only synchronized operation is assumed if UE does not indicate that it is capable of asynchronous FDD-FDD NE-DC operation. The UE shall be capable of handling a maximum uplink transmission timing difference (MTTD) between NR PCell and PSCell as shown in table 7.5.5.1-1 if UE indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16*, and the same requirement as in table 7.5.3-1 apply provided that UE does not indicate it is capable of *interBandMRDC-WithOverlapDL-Bands-r16*.

Table 7.5.5.1-1: Maximum uplink transmission timing difference requirement for inter-band synchronous NE-DC

Sub-carrier spacing in PCell (kHz)	UL Sub-carrier spacing for data in E-UTRA PSCell (kHz)	Maximum uplink transmission timing difference (μs)
15	15	35.21
30	15	35.21
60	15	35.21
120	15	35.21

7.5.6 Minimum requirements for inter-band NR-DC

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and PSCell as shown in table 7.5.6-1 provided that the UE indicates that it is capable of synchronous NR-DC only [14].

Table 7.5.6-1: Maximum uplink transmission timing difference requirement for inter-band synchronous NR-DC

Frequency Range		Maximum uplink transmission timing difference (μs)
Cell in MCG	Cell in SCG	
FR1	FR1	34.6
FR2-1	FR2-1	8.5
FR1	FR2-1	34.1
FR1	FR2-2	34.1

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and PSCell as shown in table 7.5.6-2 provided that the UE indicates that it is capable of asynchronous NR-DC [14].

Table 7.5.6-2 Maximum uplink transmission timing difference requirement for inter-band asynchronous NR-DC

Max {Sub-carrier spacing in PCell (kHz), Sub-carrier spacing in PSCell (kHz)}	Maximum uplink transmission timing difference (μs)
15	500
30	250
60	125
120	62.5
480	15.625
960	7.8125

7.5.7 Minimum requirements for multi-TRP

A UE supporting *multiDCI-IntraCellMultiTRP-TwoTA-r18* or *multiDCI-InterCellMultiTRP-TwoTA-r18* shall be capable of handling at least a relative transmission timing difference between slot timing of a pair of TAGs configured on the same carrier as shown in tables 7.5.7-1, if the UE does not indicate support of *rxTimingDiff-r18*.

A UE supporting *multiDCI-IntraCellMultiTRP-TwoTA-r18* or *multiDCI-InterCellMultiTRP-TwoTA-r18* shall be capable of handling at least a relative transmission timing difference between slot timing of the pair of TAGs configured on the same carrier as shown in table 7.5.7-2, provided that the UE indicates that it is capable of *rxTimingDiff-r18*.

A UE supporting *twoTA-InterCellBM-r19* or *twoTA-IntraCellBM-r19* shall be capable of handling at least a relative transmission timing difference between slot timing of a pair of TAGs configured on the same carrier with single DCI as shown in Table 7.5.7-1, if the UE is configured with PL_offset or if the UE does not indicate support of *rxTimingDiff-r18*, and in Table 7.5.7-2, if the UE indicates that it is capable of *rxTimingDiff-r18* and PL_offset is not configured.

Table 7.5.7-1: Maximum uplink transmission timing difference requirement for multi-TRP for UE not supporting *rxTimingDiff-r18*

Frequency Range of the pair of TAGs	Maximum uplink transmission timing difference (μs)
FR1	CP length[note 1]+1.6us
FR2-1	CP length[note 1]+0.5us
NOTE 1: CP length of the maximum SCS on the carrier. NOTE 2: This requirement applies to the UE capable of [STxMP].	

Table 7.5.7-2: Maximum uplink transmission timing difference requirement for multi-TRP for UE supporting *rxTimingDiff-r18*

Frequency Range of the pair of TAGs	Maximum uplink transmission timing difference (μs)
FR1	34.6
FR2-1	8.5

7.6 Maximum Receive Timing Difference

7.6.1 Introduction

A UE shall be capable of handling a relative receive timing difference between subframe timing boundary of an E-UTRA cell belonging to the MCG and the closest slot timing boundary of a cell belonging to SCG to be aggregated for EN-DC operation.

A UE shall be capable of handling a relative receive timing difference between subframe timing boundary of an E-UTRA cell belonging to the SCG to be aggregated for NE-DC operation and the closest slot timing boundary of a cell belonging to MCG.

A UE shall be capable of handling a relative receive timing difference between slot timing boundary of a cell belonging to MCG in FR1 or FR2-1 and the closest slot timing boundary of a cell belonging to the SCG FR1 or FR2-1 to be aggregated for NR-DC operation.

A UE shall be capable of handling a relative receive timing difference between subframe timing boundary of a cell belonging to MCG in FR1 and the closest subframe timing boundary of a cell belonging to the SCG in FR2-2 to be aggregated for NR-DC operation.

A UE shall be capable of handling a relative receive timing difference among the closest slot timing boundaries of different carriers in FR1 and/or FR2-1 to be aggregated in NR carrier aggregation.

A UE shall be capable of handling a relative receive timing difference among the closest subframe timing boundaries of different carriers to be aggregated in FR1 and FR2-2 NR inter-band carrier aggregation.

An FR2-1 PC6 UE supporting *simultaneousReceptionTwoQCL-r18* shall be capable of handling a relative receive timing difference between the subframe boundaries of signals on the same CC received using two different Rx chains simultaneously in HST FR2 bidirectional deployment.

A UE supporting *multiDCI-IntraCellMultiTRP-TwoTA-r18 or multiDCI-InterCellMultiTRP-TwoTA-r18* shall be capable of handling a relative receive timing difference between the slot boundaries of signals on the same CC received from two TRPs.

A UE supporting *schedulingMeasurementRelaxation-r18 or fastBeamSweepingMultiRx-r18* shall be capable of handling a relative receive timing difference among the subframe timing boundary of different TCI states indicated for simultaneous reception on a single carrier.

The requirements defined in clause 7.6 are also applicable when UE is configured to receive multiple PDSCH transmission occasions from one or more QCL sources on any one of the aggregated NR carriers.

The requirements defined in clause 7.6 are also applicable for the UE capable of 2 TA enhancement with single DCI, provided the UE is configured with 2 TAs and not configured with PL offset in joint/UL TCI state(s). In this scenario, when UE is configured with *SSB-MTC-additionalPCI*, the UE may expect to receive SSB from UL TRP(s).

7.6.2 Minimum requirements for inter-band EN-DC

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to SCG at the UE receiver as shown in table 7.6.2-1.

Table 7.6.2-1: Maximum receive timing difference requirement for asynchronous EN-DC

Sub-carrier spacing of E-UTRA cell in MCG (kHz)	DL Sub-carrier spacing of cell in SCG (kHz) (Note 1)	Maximum receive timing difference (μs)
15	15	500
15	30	250
15	60	125
15	120[Note2]	62.5
NOTE 1: DL Sub-carrier spacing is min{SCS_{SS}, SCS_{DATA}}. NOTE 2: For E-UTRA FDD-NR FDD intra-band EN-DC, for which the requirement is defined in clause 7.6.3 and this table 7.6.2-1 is also applicable, the scenario with 120 kHz does not exit.		

Table 7.6.2-2 Void

Table 7.6.2-3 Void

7.6.2.1 Minimum requirements for inter-band synchronous EN-DC

The requirements in this clause apply as a reference for inter-band synchronous EN-DC.

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from an E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to SCG at the UE receiver for inter-band synchronous EN-DC as shown in table 7.6.2.1-1. The requirements for synchronous EN-DC are applicable for E-UTRA TDD-NR TDD, E-UTRA FDD-NR FDD, E-UTRA TDD-NR FDD and E-UTRA FDD-NR TDD inter-band EN-DC.

For E-UTRA TDD-NR TDD inter-band EN-DC with overlapping or partially overlapping DL bands, only synchronized operation is assumed. The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in table 7.6.2.1-1 provided that UE not supporting *requirementTypeIndication-r18* indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* or UE supporting *requirementTypeIndication-r18* is capable of *interBandMRDC-WithOverlapDL-Bands-r16* and not provided with *nonCollocatedTypeMRDC-r18*, and in table 7.6.3-1 provided that UE is not capable of *interBandMRDC-WithOverlapDL-Bands-r16 or interBandMRDC-WithOverlapDL-Bands-r19* or UE supporting *requirementTypeIndication-r18* is capable of *interBandMRDC-WithOverlapDL-Bands-r16* and provided with *nonCollocatedTypeMRDC-r18*.

For E-UTRA FDD-NR FDD inter-band EN-DC with overlapping DL bands, only synchronized operation is assumed if UE does not indicate that it is capable of asynchronous FDD-FDD EN-DC operation. The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in table 7.6.2.1-1 provided that UE not supporting *requirementTypeIndication-r18* indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* or UE supporting *requirementTypeIndication-r18* is capable of *interBandMRDC-WithOverlapDL-Bands-r16* and not provided with *nonCollocatedTypeMRDC-r18*, and in table 7.6.3-1 provided that UE is not capable of *interBandMRDC-WithOverlapDL-Bands-r16 or interBandMRDC-WithOverlapDL-Bands-r19* or UE supporting *requirementTypeIndication-r18* is capable of *interBandMRDC-WithOverlapDL-Bands-r16* and provided with *nonCollocatedTypeMRDC-r18*.

For E-UTRA TDD-NR TDD inter-band EN-DC with overlapping or partially overlapping DL bands, or E-UTRA FDD-NR FDD inter-band EN-DC with overlapping DL bands, if UE indicates it is capable of *interBandMRDC-WithOverlapDL-Bands-r19*,

1> when UE is configured with *maxMIMO-Layers* with value equal to 4,

2> if nonCollocatedTypeMRDC-v1900 is present with “type 4”,

3> the UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in table 7.6.2.1-1.

2> otherwise, if *nonCollocatedTypeMRDC-v1900* is present with *“type 1”* or absent,

3> the UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in table 7.6.3-1.

1> when UE is configured with *maxMIMO-Layers* with value equal to 2,

2> if *nonCollocatedTypeMRDC-r18* is not provided,

3> the UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in table 7.6.2.1-1.

2> otherwise

3> the UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in table 7.6.3-1.

Table 7.6.2.1-1: Maximum receive timing difference requirement for inter-band synchronous EN-DC

Sub-carrier spacing of E-UTRA cell in MCG (kHz)	DL Sub-carrier spacing of cell in SCG (kHz) (Note1)	Maximum receive timing difference (μs)
15	15	33
15	30	
15	60	
15	120	
NOTE 1: DL Sub-carrier spacing is min{SCS_{SS}, SCS_{DATA}}.		

7.6.3 Minimum requirements for intra-band EN-DC

For intra-band EN-DC, only co-located deployment is applied.

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG as shown in table 7.6.2-1 for E-UTRA FDD-NR FDD intra-band EN-DC provided the UE indicates that it is capable of asynchronous EN-DC operation [2].

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG as shown in table

7.6.3-1 for E-UTRA FDD-NR FDD and E-UTRA TDD-NR TDD intra-band EN-DC provided the UE does not indicate that it is capable of asynchronous FDD-FDD EN-DC operation [16].

Table 7.6.3-1 Maximum receive timing difference requirement for intra-band synchronous EN-DC

Sub-carrier spacing of E-UTRA cell in MCG (kHz)	DL Sub-carrier spacing of cell in SCG (kHz) Note1	Maximum receive timing difference (μs)
15	15	3
15	30	3
15	60	3
NOTE 1: DL Sub-carrier spacing is min{SCS_{SS}, SCS_{DATA}}. NOTE 2: The requirement in this table is also applicable for intra-band synchronous NE-DC.		

Table 7.6.3-2: Void

7.6.4 Minimum requirements for NR Carrier Aggregation

For intra-band contiguous CA, only co-located deployment is applied. For intra-band non-contiguous NR carrier aggregation, the UE not capable of *intraBandNR-CA-non-collocated-r18* shall be capable of handling at least a relative receive timing difference between slot timing of different carriers to be aggregated at the UE receiver as shown in table 7.6.4-1 below.

For FR1 intra-band non-contiguous NR carrier aggregation, the UE shall be capable of handling at least a relative receive timing difference as shown in table 7.6.4-2, between slot timing of different FR1 carriers to be aggregated at the UE receiver provided that UE indicates that it is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided. Otherwise, the UE shall be capable of handling at least a relative receive timing difference between slot timing of different carriers to be aggregated at the UE receiver as shown in table 7.6.4-1 below if UE indicates that it is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is provided.

For FR1 intra-band non-contiguous NR carrier aggregation and UE supporting *intraBandNR-CA-non-collocated-r19,*

1> when UE is configured with *maxMIMO-Layers* with value equal to 4,

2> if nonCollocatedTypeNR-CA-v1900 is present with “type 4”,

3> the UE shall be capable of handling at least a relative receive timing difference between slot timing of different FR1 carriers to be aggregated at the UE receiver as shown in table 7.6.4-2.

2> otherwise, if nonCollocatedTypeNR-CA-v1900 is present with “type 1” or absent,

3> the UE shall be capable of handling at least a relative receive timing difference between slot timing of different carriers to be aggregated at the UE receiver as shown in table 7.6.4-1.

1> when UE is configured with *maxMIMO-Layers* with value equal to 2,

2> if *nonCollocatedTypeNR-CA-r18* is not provided,

3> the UE shall be capable of handling at least a relative receive timing difference between slot timing of different FR1 carriers to be aggregated at the UE receiver as shown in table 7.6.4-2.

2> otherwise,

3> the UE shall be capable of handling at least a relative receive timing difference between slot timing of different carriers to be aggregated at the UE receiver as shown in table 7.6.4-1.

Table 7.6.4-1: Maximum receive timing difference requirement for intra-band non-contiguous NR carrier aggregation

Frequency Range	Maximum receive timing difference (μs)
FR1	3[1]
FR2-1	0.26

NOTE 1: In the case of different SCS on different CCs, if the receive time difference exceeds the cyclic prefix length of that SCS, demodulation performance degradation is expected for the first symbol of the slot.

For inter-band NR carrier aggregation,

- the UE shall be capable of handling at least a relative receive timing difference between slot timing of all pairs of carriers in FR1 and FR2-1 to be aggregated at the UE receiver as shown in table 7.6.4-2 below.
- the UE shall be capable of handling at least a relative receive timing difference between subframe timing of all pairs of carriers in FR1 and FR2-2 to be aggregated at the UE receiver as shown in table 7.6.4-2 below.

Table 7.6.4-2: Maximum receive timing difference requirement for inter-band NR carrier aggregation

Frequency Range of the pair of carriers	Maximum receive timing difference (μs)
FR1	33
FR2-1	8 note1
Between FR1 and FR2-1	25
Between FR1 and FR2-2	25
NOTE1: This requirement applies to the UE capable of independent beam management for FR2-1 inter-band CA.	

7.6.5 Minimum requirements for inter-band NE-DC

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and subframe timing of signal from an E-UTRA cell belonging to the SCG at the UE receiver for asynchronous NE-DC as shown in table 7.6.5-1.

Table 7.6.5-1: Maximum receive timing difference requirement for asynchronous NE-DC

Sub-carrier spacing of cell in MCG (kHz)	DL Sub-carrier spacing of EUTRA cell in SCG (kHz) (Note 1)	Maximum receive timing difference (μs)
15	15	500
30	15	250
60	15	125
120	15	62.5
NOTE 1: DL Sub-carrier spacing is min{SCS_{SS}, SCS_{DATA}}. NOTE 2: Void		

Table 7.6.5-2: Void

7.6.5.1 Minimum requirements for inter-band synchronous NE-DC

The requirements in this clause apply as a reference for inter-band synchronous NE-DC.

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and subframe timing of signal from a E-UTRA cell belonging to the SCG at the UE receiver for inter-band synchronous NE-DC as shown in table 7.6.5.1-1. The requirements for synchronous NE-DC are applicable for NR TDD- E-UTRA TDD, NR FDD- E-UTRA FDD, NR TDD- E-UTRA FDD and NR FDD- E-UTRA TDD inter-band NE-DC.

For NR FDD-E-UTRA FDD inter-band NE-DC with overlapping DL bands, only synchronized operation is assumed if UE does not indicate that it is capable of asynchronous FDD-FDD NE-DC operation. The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in table 7.6.2.1-1 provided that UE indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16*, and the same requirement as in table 7.6.3-1 apply provided that UE does not indicate it is capable of *interBandMRDC-WithOverlapDL-Bands-r16*.

Table 7.6.5.1-1: Maximum receive timing difference requirement for inter-band synchronous NE-DC

Sub-carrier spacing of cell in MCG (kHz)	DL Sub-carrier spacing of EUTRA cell in SCG (kHz) (Note1)	Maximum receive timing difference (μs)
15	15	33
30	15	
60	15	
120	15	

7.6.6 Minimum requirements for inter-band NR-DC

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG in FR1 or FR2-1 and slot timing of signal from a cell belonging to the SCG in FR1 or FR2-1 at the UE receiver as shown in table 7.6.6-1 provided that the UE indicates that it is capable of synchronous NR-DC only [16].

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a cell belonging to the MCG in FR1 and subframe timing of signal from a cell belonging to the SCG in FR2-2 at the UE receiver as shown in table 7.6.6-1 provided that the UE indicates that it is capable of synchronous NR-DC only [16].

Table 7.6.6-1: Maximum receive timing difference requirement for inter-band synchronous NR-DC

Frequency Range		Maximum receive timing difference (μs)
Cell in MCG	Cell in SCG	
FR1	FR1	33
FR2-1	FR2-1	8
FR1	FR2-1	33
FR1	FR2-2	33

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG in FR1 or FR2-1 and slot timing of signal from a cell belonging to the SCG in FR1 or FR2-1 at the UE receiver as shown in table 7.6.6-2 provided that the UE indicates that it is capable of asynchronous NR-DC [16].

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a cell belonging to the MCG in FR1 and subframe timing of signal from a cell belonging to the SCG in FR2-2 at the UE receiver as shown in table 7.6.6-2 provided that the UE indicates that it is capable of asynchronous NR-DC [16].

Table 7.6.6-2 Maximum receive timing difference requirement for inter-band asynchronous NR-DC

Max {Sub-carrier spacing in PCell (kHz), Sub-carrier spacing in PSCell (kHz)}	Maximum receive timing difference (μs)
15	500
30	250
60	125
120	62.5
480	15.625
960	7.8125

7.6.7 Minimum requirements for PC6 UE in FR2

In HST FR2 scenario, when *highSpeedMeasFlagFR2-r17* is configured and *highSpeedDeploymentTypeFR2-r17* is configured as bidirectional for a PC6 UE supporting *simultaneousReceptionTwoQCL-r18*, the UE shall be capable of handling a maximum receive timing difference specified as in the below table 7.6.7-1. The specified timing difference

is between the subframe boundaries of the signals on the same CC which UE receives using two different Rx chains simultaneously.

Table 7.6.7-1: Maximum receive timing difference requirement for PC6 UE supporting *simultaneousReceptionTwoQCL-r18*

Frequency Range	Subcarrier spacing (kHz)	Maximum receive timing difference (μs)
FR2-1	120	8

7.6.8 Minimum requirements for Multi-TRPs

A UE supporting *multiDCI-IntraCellMultiTRP-TwoTA-r18* or *multiDCI-InterCellMultiTRP-TwoTA-r18* shall be capable of handling at least a relative receive timing difference between slot timing of different TRPs on the same carrier at the UE receiver as shown in table 7.6.8-1 below, if the UE does not indicate support of *rxTimingDiff-r18*.

A UE supporting *multiDCI-IntraCellMultiTRP-TwoTA-r18* or *multiDCI-InterCellMultiTRP-TwoTA-r18* shall be capable of handling at least a relative receive timing difference between slot timing of different TRPs on the same carrier at the UE receiver as shown in table 7.6.8-2 below, provided that the UE indicates that it is capable of *rxTimingDiff-r18*.

A UE supporting 2 TA enhancement with single DCI provided no PL_offset is configured shall be capable of handling at least a relative receive timing difference between slot timing of different TRPs on the same carrier at the UE receiver as shown in table 7.6.8-1 below, if the UE does not indicate support of *rxTimingDiff-r18*, and in Table 7.6.8-2, if the UE indicates that it is capable of *rxTimingDiff-r18*.

Table 7.6.8-1: Maximum receive timing difference requirement for multi-TRPs with two TAs for UE not capable of *rxTimingDiff-r18*

Frequency Range	Maximum receive timing difference
FR1	CP length[note 1]
FR2-1	CP length[note 1]
NOTE 1: CP length of the maximum SCS on the carrier.	

Table 7.6.8-2: Maximum receive timing difference requirement for multi-TRPs with two TAs for UE capable of *rxTimingDiff-r18*

Frequency Range of the pair of carriers	Maximum receive timing difference (μs)
FR1	33
FR2-1	8

A UE supporting *schedulingMeasurementRelaxation-r18 or fastBeamSweepingMultiRx-r18* shall be capable of handling at least a relative receive timing difference between slot timing of different TCI states on the same carrier at the UE receiver as shown in table 7.6.8-3.

Table 7.6.8-3: Maximum receive timing difference requirement for UE supporting multi-RX

Frequency Range	Maximum receive timing difference
FR2-1	CP length

7.6D Maximum Receive Timing Difference for ATG UE

7.6D.1 Introduction

An ATG UE shall be capable of handling a relative receive timing difference between the closest slot timing boundaries of different carriers in FR1 to be aggregated in NR carrier aggregation.

7.6D.2 Minimum requirements for NR Carrier Aggregation

The ATG UE shall be capable of handling at least a relative receive timing difference between slot timing of all pairs of carriers in FR1 to be aggregated at the ATG UE receiver as shown in table 7.6D.2-1 below.

Table 7.6D.2-1: Maximum receive timing difference requirement for ATG UE in inter-band NR carrier aggregation

Frequency Range of the pair of carriers	Maximum receive timing difference (μs)
FR1	33

7.7 *deriveSSB-IndexFromCell* tolerance

7.7.1 Minimum requirements

When *deriveSSB-IndexFromCell* is enabled, the UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the same frequency carrier is within a tolerance not worse than

- min (2 SSB symbols, 1 PDSCH symbol) for sub-carrier spacings of SSB and PDSCH up to 240 kHz,
- min (3 SSB symbols, N_{PDSCH} PDSCH symbols) for sub-carrier spacing of 480 kHz and 960 kHz of either SSB or PDSCH where N_{PDSCH} is defined in table 7.7.1-1

and the SFNs of all cells on the same frequency carrier are the same.

Table 7.7.1-1 N_{PDSCH} when deriveSSB-IndexFromCell is enabled

SSB SCS (kHz)	PDSCH SCS (kHz)	N_{PDSCH}
120	480	3
120	960	6
480	120	1
480	480	3
480	960	6
960	120	1
960	480	2
960	960	3

When *deriveSSB-IndexFromCell* is not enabled, the UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the same frequency carrier is within a tolerance not worse than 6 SSB symbols for sub-carrier spacing of 960 kHz and the SFNs of all cells on the same frequency carrier are the same.

7.7A deriveSSB-IndexFromCell tolerance for RedCap

7.7A.1 Minimum requirements

When *deriveSSB-IndexFromCell* is enabled, the RedCap UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the same frequency carrier is within a tolerance not worse than min(2 SSB symbols, 1 PDSCH symbol) and the SFNs of all cells on the same frequency carrier are the same.

7.7D DeriveSSB-IndexFromCell tolerance for ATG

7.7D.1 Minimum requirements

When *deriveSSB-IndexFromCell* is enabled, the ATG UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the same frequency carrier is within a tolerance not worse than min(2 SSB symbols, 1 PDSCH symbol) and the SFNs of all cells on the same frequency carrier are the same.

UE does not expect the *deriveSSB-IndexFromCell* to be set as true when frame boundary across detectable cells on the same frequency carrier is larger than the minimum tolerance requirement.

7.8 Void

7.9 *deriveSSB-IndexFromCellInter-r17* tolerance

7.9.1 Minimum requirements

When *deriveSSB-IndexFromCellInter-r17* is enabled, the UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the target carrier and reference cell is within a tolerance not worse than min(2 SSB symbols of target carrier, 1 PDSCH symbol of the reference cell) and the SFNs of all cells on the target carrier and reference cell are the same. The reference cell is the serving cell which is used for SSB indexes derivation as indicated via *deriveSSB-IndexFromCellInter-r17*.

7.9D *DeriveSSB-IndexFromCellInter-r17* tolerance for ATG

7.9D.1 Minimum requirements

When *deriveSSB-IndexFromCellInter-r17* is enabled, the ATG UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the target carrier and reference cell is within a tolerance not worse than min (2 SSB symbols of target carrier, 1 PDSCH symbol of the reference cell) and the SFNs of all cells on the target carrier and reference cell are the same. The reference cell is the serving cell which is used for SSB indexes derivation as indicated via *deriveSSB-IndexFromCellInter-r17*.

UE does not expect the *deriveSSB-IndexFromCellInter-r17* to be set as true when frame boundary across detectable cells on the target carrier and reference cell is larger than the minimum tolerance requirement.

8 Signalling characteristics

8.1 Radio Link Monitoring

8.1.1 Introduction

The requirements in clause 8.1 apply for radio link monitoring on:

- PCell in SA NR, NR-DC and NE-DC operation mode,
- PCell operating with less than 5 MHz BW in SA NR (single carrier) operation mode,
- PSCell in NR-DC and EN-DC operation mode,
- Deactivated PSCell in NR-DC and EN-DC operation mode, when configured.

The UE shall monitor the downlink radio link quality based on the reference signal configured as RLM-RS resource(s) in order to detect the downlink radio link quality of the PCell, PSCell and deactivated PSCell if configured with *bfd-and-RLM* with value *true* as specified in TS 38.331 [2]. The configured RLM-RS resources can be all SSBs, or all CSI-RSs, or a mix of SSBs and CSI-RSs. The configured RLM-RSs can be from the same or different TRPs. UE is not required to perform RLM outside the active DL BWP unless the UE supports *bwpOperationMeasWithoutInterrupt-r18*, provided that the SSB is within the configured UE-specific CBW. For UE supporting *ncd-SSB-BWP-Wor-r18*, the SSB and SMTC in this clause applies for both CD-SSB and NCD-SSB if it is not additional specified. If SSB in the active DL BWP of serving cell *i* is NCD-SSB, for serving cell *i* the requirements in clause 8.1 apply provided that serving cell *i* is PCell or activated PSCell.

On each RLM-RS resource, the UE shall estimate the downlink radio link quality and compare it to the thresholds Q_{out} and Q_{in} for the purpose of monitoring downlink radio link quality of the cell.

When a CORESET that the UE uses for monitoring PDCCH includes two TCI states and the UE is provided *sfnSchemePdcch* set to 'sfnSchemeA' or 'sfnSchemeB', the UE shall estimate a single downlink radio link quality to derive single SNR and compare it to the single thresholds Q_{out} and Q_{in} for the purpose of monitoring downlink radio link quality of the cell(s). How to compute the single SNR based on two active TCI states is up to UE implementation.

The threshold Q_{out} is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to the out-of-sync block error rate ($BLER_{out}$) as defined in table 8.1.1-1. For SSB based radio link monitoring, Q_{out_SSB} is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1.2.1-1. For CSI-RS based radio link monitoring, $Q_{out_CSI\text{-}RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1.3.1-1.

The threshold Q_{in} is defined as the level at which the downlink radio link quality can be received with significantly higher reliability than at Q_{out} and shall correspond to the in-sync block error rate ($BLER_{in}$) as defined in table 8.1.1-1. For SSB based radio link monitoring, Q_{in_SSB} is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1.2.1-2. For CSI-RS based radio link monitoring, $Q_{in_CSI\text{-}RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1.3.1-2.

The out-of-sync block error rate ($BLER_{out}$) and in-sync block error rate ($BLER_{in}$) are determined from the network configuration via parameter *rlmInSyncOutOfSyncThreshold* signalled by higher layers. When UE is not configured with *rlmInSyncOutOfSyncThreshold* from the network, UE determines out-of-sync and in-sync block error rates from Configuration #0 in table 8.1.1-1 by default. All requirements in clause 8.1 are applicable for BLER Configuration #0 in table 8.1.1-1.

Table 8.1.1-1: Out-of-sync and in-sync block error rates

Configuration	$BLER_{out}$	$BLER_{in}$
0	10 %	2 %

UE shall be able to monitor up to N_{RLM} RLM-RS resources of the same or different types in each corresponding carrier frequency range, depending on a maximum number L_{max} of SSBs per half frame according to TS 38.213 [3], where N_{RLM} is specified in table 8.1.1-2 according TS 38.213 [3], and meet the requirements as specified in clause 8.1. UE is not required to meet the requirements in clause 8.1 if RLM-RS is not configured and no TCI state for PDCCH is activated.

Table 8.1.1-2: Maximum number of RLM-RS resources N_{RLM}

Carrier frequency range of PCell/PSCell	L_{max}	Maximum number of RLM-RS resources, N_{RLM}
FR1, ≤ 3 GHz[Note]	4	2
FR1, > 3 GHz[Note]	8	4
FR2	64	8
NOTE: For unpaired spectrum operation with Case C - 30 kHz SCS, 3 GHz is replaced by 1.88 GHz, as specified in clause 4.1 in TS 38.213 [3].		

8.1.1.1 Introduction of Requirement on Radio Link Monitoring for UE Configured with Relaxed Measurement Criteria

For the UE supports *rlm-Relaxation-r17*and configured with explicit signalling *goodServingCellEvaluationRLM*, which is always configured to the UE when the network enables RLM relaxation for the UE as specified in TS 38.331 [2], the relaxed requirements defined in clause 8.1.2.4 for SSB based radio link monitoring and the relaxed requirements defined in clause 8.1.3.4 for CSI-RS based radio link monitoring are allowed to apply to the relaxed RLM measurements on SpCell after fulfilling the following conditions:

- for the serving cells in intra-band carrier aggregation configured with SSB-based or CSI-RS based RLM on SpCell together with CSI-RS based BFD on SCell, when
  - the good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the serving cell based on the measurements that are configured for SSB-based or CSI-RS based RLM on SpCell together with CSI-RS based BFD on SCell in the intra-band carrier aggregation if the *lowMobilityEvaluationConnected* is not configured, or
  - the UE is also configured with *lowMobilityEvaluationConnected* and both low mobility criterion defined in clause 5.7.13.1 of TS 38.331 [2] is fulfilled for a period of $T_{SearchDeltaP-Connected}$ and good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the serving cell based on the measurements that are configured for SSB-based or CSI-RS based RLM on SpCell together with CSI-RS based BFD on SCell in the intra-band carrier aggregation.
- for other serving cells, when
  - the good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the SpCell if the *lowMobilityEvaluationConnected* is not configured, or
  - the UE is also configured with *lowMobilityEvaluationConnected* and both low mobility criterion defined in clause 5.7.13.1 of TS 38.331 [2] is fulfilled for a period of $T_{SearchDeltaP-Connected}$ and good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the SpCell.

Otherwise, UE shall apply the requirements defined in clause 8.1.2.2 for SSB based radio link monitoring and the requirements defined in clause 8.1.3.2 for CSI-RS based radio link monitoring. Note that when multiple resources are configured on a serving cell for RLM or BFD evaluation, the good serving cell quality critierion is considered as fulfilled for the serving cell when any resource configured for the cell fulfills the good serving defined in clause 5.7.13.2 of TS 38.331 [2].

The UE is no longer allowed to relax RLM measurements and apply the relaxed radio link monitoring provided that at least one of the following conditions is met:

- The UE sends out-of sync indications to the higher layers,
- The timer T310 is running.
- No DRX is configured or configured DRX cycle is longer than 80 ms

NOTE: Applicability of DRX configuration follows TS 38.331 [2] clause 5.7.13.0.

8.1.2 Requirements for SSB based radio link monitoring

8.1.2.1 Introduction

The requirements in this clause apply for each SSB based RLM-RS resource configured for PCell, PSCell or deactivated PSCell, provided that the SSB configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1.2.2 unless the UE supports *bwpOperationMeasWithoutInterrupt-r18*, provided that the SSB is within the configured UE-specific CBW.

Table 8.1.2.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	4 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	4 dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1.2.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	4
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1.2.1-3: PDCCH transmission parameters for out-of-sync evaluation for a UE operating on a cell with less than 5 MHz BW

Attribute	**Value for BLER Configuration #0**		
Channel BW	**3 MHz**		**5 MHz**
[DL Transmission BW]	**12 PRBs**	**15 PRBs**	**20 PRBs**
DCI format	1-0		
Number of control OFDM symbols	2	3	3
Aggregation level (CCE)	4	8	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	4 dB		
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	4 dB		
Bandwidth (PRBs)	12	15	20
Sub-carrier spacing (kHz)	SCS of the active DL BWP		
DMRS precoder granularity	REG bundle size		
REG bundle size	6		
CP length	Normal		

Mapping from REG to CCE	Distributed	Non-Distributed[Note 1]	Distributed
NOTE 1: For 15 PRB Transmission BW, distributed mapping may lead to unexpected out-of-sync indication.			

Table 8.1.2.1-4: PDCCH transmission parameters for in-sync evaluation for a UE operating on a cell with less than 5 MHz BW

Attribute	Value for BLER Configuration #0		
Channel BW	**3 MHz**		**5 MHz**
[DL Transmission BW]	**12 PRBs**	**15 PRBs**	**20 PRBs**
DCI format	1-0		
Number of control OFDM symbols	2	3	3
Aggregation level (CCE)	2	4	4
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB		
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB		
Bandwidth (PRBs)	12	15	20
Sub-carrier spacing (kHz)	SCS of the active DL BWP		
DMRS precoder granularity	REG bundle size		
REG bundle size	6		
CP length	Normal		
Mapping from REG to CCE	Distributed	Non-Distributed	Distributed

8.1.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_out_SSB}$ period becomes worse than the threshold Q_{out_SSB} within $T_{Evaluate_out_SSB}$ evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_in_SSB}$ period becomes better than the threshold Q_{in_SSB} within $T_{Evaluate_in_SSB}$ evaluation period.

$T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ are defined in table 8.1.2.2-1 for FR1.

$T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ are defined in table 8.1.2.2-2 for FR2 with scaling factor N, where

- N=2, 4, or 6 for FR2-1 for UE supporting *fastBeamSweepingMultiRx-r18* according to the conditions in clause 3.6.19, and
- N=8 for other cases in FR2-1, and
- N=12 for FR2-2.

for FR2 power classes other than power class 6 or for FR2 power class 6 when *highSpeedMeasFlagFR2-r17* is not configured.

$T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ are defined in table 8.1.2.2-3 for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*.

$T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ are defined in table 8.1.2.2-4 for FR1 (deactivated PSCell).

$T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ are defined in table 8.1.2.2-5 for FR2 (deactivated PSCell) with scaling factor N=8 for FR2-1 and N=12 for FR2-2.

For a UE supporting LowBandCA-via-Switching-r19, or for a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent measurement gap(s) with NCSG(s) are configured, or a UE supporting *concurrentMeasGap-r17* or *musim-GapPreference-r17* or both *concurrentMeasGap-r17* and *musim-GapPreference-r17*, and when concurrent measurement gaps or periodic MUSIM gaps or both concurrent GAPs and periodic MUSIM gaps are configured,

- an RLM-RS resource occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clauses 9.1.8 and 9.1.10,

P value for an RLM-RS resource to be measured is defined as

- N_{total} / $N_{outside_MG}$ in FR1
- $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
- N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0

- For a window W of duration max($T_{L1,}$ xRP_max, switching pattern periodicity), where xRP_max is the maximum xRP across all configured per-UE measurement gaps or periodic MUSIM gap(s) or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any RLM-RS resource occasion:
  - N_{total} is the total number of RLM-RS resource occasions within the window W, including those overlapped with GAP occasions, MUSIM gap occasions or SMTC occasions within the window W. For UEs supporting LowBandCA-via-Switching-r19, N_{total} also includes RLM-RS occasions that overlap with the SDL ON duration within the window, as defined by the configured switching pattern, and
  - $N_{outside_MG}$ is the number of RLM-RS resource occasions that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion, or number of RLM-RS resource occasions that are overlapped with PCell ON duration corresponding to the LB CA switching pattern within the window W, and
  - $N_{available}$ is the number of RLM-RS resource occasions that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion nor any SMTC occasion within the window W, and
  - an RLM-RS resource occasion is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion, and
  - T_{L1} is periodicity of the target RLM-RS.
  - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.
  - for UEs that support LB CA via switching, switching pattern periodicity is the periodicity of the RRC configured semi-static switching pattern; otherwise, it is not applicable.
  - RLM requirement in this clause is not applied when $N_{outside_MG}$ = 0.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* nor supporting *musim-GapPreference-r17* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s), concurrent measurement gap(s) with NCSG(s), and periodic MUSIM gaps,

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, and these GAPs are overlapping with some but not all occasions of the SSB; and
- P = 1 when in the monitored cell there are no GAPs overlapping with any occasion of the SSB.

For FR2

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when RLM-RS resource is not overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when the RLM-RS resource is not overlapped with GAP and RLM-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{SSB}}{xRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and

- $T_{SMTCperiod} \neq$ xRP or
- $T_{SMTCperiod}$ = xRP and $T_{SSB} < 0.5*T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{xRP}}$, when the RLM-RS is partially overlapped with GAP and the RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod}$ = xRP and $T_{SSB} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{SSB}}{Min(xRP,T_{SMTCperiod})}}$, when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{xRP}}$, when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod} <$ xRP)

where,

- $P_{sharing\ factor}$ = 1, if the RLM-RS resource outside GAP is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
  - not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.
- $P_{sharing\ factor}$ = 3, otherwise.
- If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.
- When a GAP is configured only and the GAP is not NCSG,
  - an RLM-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a GAP occasion, and
  - xRP = MGRP
- Otherwise, when NCSG is configured,
  - an RLM-RS resource or an SMTC occasion is considered to be overlapped with the GAP if
    - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,
  - and
    - xRP = VIRP
- If the UE is configured with Pre-MG only, an RLM-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.
- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG(s) are configured, an RLM-RS resource or an SMTC occasion is not considered as overlapped by a

GAP occasion if the GAP occasion is dropped according to clause 9.1.8, clause 9.1.12, clause 9.1.13, respectively.

If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

For UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, the UE is not required to perform SSB measurements during the cancelled gap occasions, and no restrictions on the scheduling availability apply during the cancelled gap occasions.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and GAP configurations does not meet previous conditions.

When the configured aperiodic MUSIM gap is overlapping with RLM-RS resource occasion, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and if RLM-RS resource occasions are fully overlapped with MUSIM gap(s) or the union of MUSIM gap(s) and GAPs, no requirement applies for SSB based RLM.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 8.1.2.2-1: Evaluation period $T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ for FR1

Configuration	$T_{Evaluate_out_SSB}$ (ms)	$T_{Evaluate_in_SSB}$ (ms)
no DRX	$Max(200, Ceil(10 \times P) \times T_{SSB})$	$Max(100, Ceil(5 \times P) \times T_{SSB})$
DRX cycle≤320 ms	$Max(200, Ceil(15 \times P) \times Max(T_{DRX},T_{SSB}))$	$Max(100, Ceil(7.5 \times P) \times Max(T_{DRX},T_{SSB}))$
DRX cycle>320 ms	$Ceil(10 \times P) \times T_{DRX}$	$Ceil(5 \times P) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.		

Table 8.1.2.2-2: Evaluation period $T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ for FR2

Configuration	$T_{Evaluate_out_SSB}$ (ms)	$T_{Evaluate_in_SSB}$ (ms)
no DRX	$Max(200, Ceil(10 \times P \times N) \times T_{SSB})$	$Max(100, Ceil(5 \times P \times N) \times T_{SSB})$
DRX cycle≤320 ms	$Max(200, Ceil(15 \times P \times N) \times Max(T_{DRX},T_{SSB}))$	$Max(100, Ceil(7.5 \times P \times N) \times Max(T_{DRX},T_{SSB}))$
DRX cycle>320 ms	$Ceil(10 \times P \times N) \times T_{DRX}$	$Ceil(5 \times P \times N) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.		

Table 8.1.2.2-3: Evaluation period $T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*

Configuration	$T_{Evaluate_out_SSB}$ (ms)	$T_{Evaluate_in_SSB}$ (ms)
no DRX	$Max(200, Ceil(10 \times P \times N^{Note2}) \times T_{SSB})$	$Max(100, Ceil(5 \times P \times N^{Note2}) \times T_{SSB})$
DRX cycle≤80 ms	$Max(200, Ceil(15 \times P \times N^{Note2}) \times Max(T_{DRX},T_{SSB}))$	$Max(100, Ceil(7.5 \times P \times N^{Note2}) \times Max(T_{DRX},T_{SSB}))$
NOTE 1: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length. NOTE 2: For a UE not supporting *simultaneousReceptionTwoQCL-r18* or when *highSpeedDeploymentTypeFR2-r17* is not configured as *bi-directional*, scaling factor N=2 when *highSpeedMeasFlagFR2-r17* is configured to set1 and scaling factor N=6 when *highSpeedMeasFlagFR2-r17* is configured to set2. For a UE supporting *simultaneousReceptionTwoQCL-r18* and when *highSpeedDeploymentTypeFR2-r17* is configured as *bidirectional*, scaling factor N=1.5 when *highSpeedMeasFlagFR2-r17* is configured to set1 and scaling factor N=4 when *highSpeedMeasFlagFR2-r17* is configured to set2		

Table 8.1.2.2-4: Evaluation period $T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ for FR1(deactivated PSCell)

Configuration	$T_{Evaluate_out_SSB}$ (ms)	$T_{Evaluate_in_SSB}$ (ms)

no DRX	Ceil(10 × P) × measCyclePSCell	Ceil(5 × P) × measCyclePSCell
DRX cycle≤ 320 ms	Ceil(15 × P) × Max(T_{DRX}, measCyclePSCell)	Ceil(7.5 × P) × Max(T_{DRX}, measCyclePSCell)
DRX cycle> 320 ms	Ceil(10 × P) × Max(T_{DRX}, measCyclePSCell)	Ceil(5 × P) × Max(T_{DRX}, measCyclePSCell)
NOTE: T_{DRX} is the DRX cycle length of SCG. measCyclePSCell is the measurement cycle length of the deactivated PSCell.		

Table 8.1.2.2-5: Evaluation period $T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ for FR2(deactivated PSCell)

Configuration	$T_{Evaluate_out_SSB}$ (ms)	$T_{Evaluate_in_SSB}$ (ms)
no DRX	Ceil(10 × P× N) × measCyclePSCell	Ceil(5 × P× N) × measCyclePSCell
DRX cycle≤ 320 ms	Ceil(15 × P× N) × Max(T_{DRX}, measCyclePSCell)	Ceil(7.5 × P× N) × Max(T_{DRX}, measCyclePSCell)
DRX cycle> 320 ms	Ceil(10 × P× N) × Max(T_{DRX}, measCyclePSCell)	Ceil(5 × P× N) × Max(T_{DRX}, measCyclePSCell)
NOTE: T_{DRX} is the DRX cycle length of SCG. measCyclePSCell is the measurement cycle length of the deactivated PSCell.		

8.1.2.3 Measurement restrictions for SSB based RLM

The UE is required to be capable of measuring SSB for RLM without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following scenarios.

For FR1, when the SSB OFDM symbols used for RLM fully or partially overlap with CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for RLM without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for RLM without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for RLM and CSI-RS. Longer measurement period for SSB based RLM is expected, and no requirements are defined

For FR2, when the SSB for RLM measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for RLM and CSI-RS. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

For FR2, when the SSB for RLM measurement on one CC is in the same or adjacent OFDM symbol as SSB from cell with additional PCI for BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSBs. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

For FR2, when the SSB for RLM measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both SSBs. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

For FR2, when the SSB for RLM measurement on one CC fully or partially overlaps with the OFDM symbol as CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement, UE is required to measure either SSB or CSI-RS but not both. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

For FR2, there is no measurement restriction allowed when the network configures mixed numerology between SSB for RLM measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, provided that UE is capable of independent beam management on this FR2 band pair.

8.1.2.4 Minimum requirement of SSB based radio link monitoring for UE fulfilling relaxed measurement criteria

This clause contains minimum requirements for relaxed radio link monitoring based on SSB.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_out_SSB_Relax}$ period becomes worse than the threshold Q_{out_SSB} within $T_{Evaluate_out_SSB_Relax}$ evaluation period.

$T_{Evaluate_out_SSB_Relax}$ is defined in table 8.1.2.4-1 for FR1.

$T_{Evaluate_out_SSB_Relax}$ is defined in table 8.1.2.4-2 for FR2 with scaling factor N=8.

The value of P is defined in clause 8.1.2.2.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 8.1.2.4-1: Evaluation period $T_{Evaluate_out_SSB_Relax}$ for FR1

Configuration	$T_{Evaluate_out_SSB_Relax}$ (ms)
$Max(T_{DRX},T_{SSB}) \leq 80$ ms	$Max(200 \times K3^{NOTE3}, Ceil(15 \times K1^{NOTE2} \times P) \times Max(T_{DRX},T_{SSB}))$
80 ms < $Max(T_{DRX},T_{SSB}) \leq 160$ ms	$Ceil(15 \times P) \times Max(T_{DRX},T_{SSB})$
NOTE 1: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length and no longer than 80 ms. NOTE 2: K1 = 4 for $Max(T_{DRX},T_{SSB}) \leq 40$ ms and K1 = 2 for 40 ms<$Max(T_{DRX},T_{SSB}) \leq 80$ ms. NOTE 3: K3 = K1, if K1 ≤ 2; otherwise K3 = 1.	

Table 8.1.2.4-2: Evaluation period $T_{Evaluate_out_SSB_Relax}$ for FR2

Configuration	$T_{Evaluate_out_SSB_Relax}$ (ms)
$Max(T_{DRX},T_{SSB}) \leq 80$ ms	$Max(200 \times K4^{NOTE3}, Ceil(15 \times K2^{NOTE2} \times P \times N) \times Max(T_{DRX},T_{SSB}))$
80 ms < $Max(T_{DRX},T_{SSB}) \leq 160$ ms	$Ceil(15 \times P \times N) \times Max(T_{DRX},T_{SSB})$
NOTE 1: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length and no longer than 80 ms. NOTE 2: K2 = 2. NOTE 3: K4 = K2, if K2 ≤ 2; otherwise K4 = 1.	

8.1.3 Requirements for CSI-RS based radio link monitoring

8.1.3.1 Introduction

The requirements in this clause apply for each CSI-RS based RLM-RS resource configured for PCell, PSCell or deactivated PSCell, provided that the CSI-RS configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1.3.2. UE is not expected to perform radio link monitoring measurements on the CSI-RS configured as RLM-RS if the CSI-RS is not in the active TCI state of any CORESET configured in the UE active BWP.

Table 8.1.3.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0

DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	4 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	4 dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1.3.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	4
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0 dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.1.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_out_CSI\text{-}RS}$ period becomes worse than the threshold $Q_{out_CSI\text{-}RS}$ within $T_{Evaluate_out_CSI\text{-}RS}$ evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_in_CSI\text{-}RS}$ ms period becomes better than the threshold $Q_{in_CSI\text{-}RS}$ within $T_{Evaluate_in_CSI\text{-}RS}$ ms evaluation period.

- $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ are defined in table 8.1.3.2-1 for FR1.
- $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ are defined in table 8.1.3.2-2 for FR2 with scaling factor N=1.
- $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ are defined in table 8.1.3.2-3 for FR1 (deactivated PSCell).
- $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ are defined in table 8.1.3.2-4 for FR2 (deactivated PSCell) with scaling factor N=1.

The requirements of $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ apply provided that the CSI-RS for RLM is not in a resource set configured with repetition ON. The requirements do not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for RLM and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For the value of $L1_{Out}$ and $L1_{In}$,

1> If the UE does not support *supportSBFD* or SBFD is not configured by the network,

2> $L1_{Out}$ is not applicable;

2> $L1_{In}$ is not applicable;

1> Else if the UE supports *supportSBFD* and SBFD is configured by the network,

2> If DRX is not configured,

3> $L1_{Out}$ is the number of occasions of the CSI-RS resource for RLM that are overlapping with dynamic UL transmission on SBFD symbols during $T_{Evaluate_Out_CSI-RS}$;

3> $L1_{In}$ is the number of occasions of the CSI-RS resource for RLM that are overlapping with dynamic UL transmission on SBFD symbols during $T_{Evaluate_In_CSI-RS}$, when DRX is not configured

2> If DRX is configured,

3> $L1_{Out}$ is the number of DRX cycles in which at least one occasion of the CSI-RS resource for RLM is overlapping with dynamic UL transmission on SBFD symbols during $T_{Evaluate_Out_CSI-RS}$;

3> $L1_{In}$ is the number of DRX cycles in which at least one occasion of the CSI-RS resource for RLM is overlapping with dynamic UL transmission on SBFD symbols during $T_{Evaluate_In_CSI-RS}$;

If the UE supports *supportSBFD* and SBFD is configured by the network, the requirements in this clause apply provided that all the occasions of the CSI-RS resource are in the same type (i.e., SBFD or non-SBFD) of symbols.

For a UE supporting LowBandCA-via-Switching-r19, or for a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent measurement gap(s) with NCSG(s) are configured, or a UE supporting *concurrentMeasGap-r17* or *musim-GapPreference-r17* or both *concurrentMeasGap-r17* and *musim-GapPreference-r17*, and when concurrent measurement gaps or periodic MUSIM gaps or both concurrent GAPs and periodic MUSIM gaps are are configured,

- an RLM-RS resource occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clauses 9.1.8 and 9.1.10,
- P value for an RLM-RS resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with Navailable > 0
- For a window W of duration max($T_{L1,}$ xRP_max, switching pattern periodicity), where xRP_max is the maximum xRP across all configured per-UE measurement gaps or periodic MUSIM gap(s) or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any RLM-RS resource occasion:
  - N_{total} is the total number of RLM-RS resource occasions within the window W, including those overlapped with GAP occasions, MUSIM gap occasions or SMTC occasions within the window W. For UEs supporting LowBandCA-via-Switching-r19, N_{total} also includes RLM-RS occasions that overlap with the SDL ON duration within the window, as defined by the configured switching pattern, and
  - $N_{outside_MG}$ is the number of RLM-RS resource occasions that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion, or number of RLM-RS resource occasions that are overlapped with PCell ON duration corresponding to the LB CA switching pattern within the window W, and
  - $N_{available}$ is the number of RLM-RS resource occasions that are not overlapped with any non-dropped GAP occasion, nor non-dropped MUSIM gap occasion, nor any SMTC occasion within the window W, and
  - an RLM-RS resource occasion is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion, and
  - T_{L1} is periodicity of the target RLM-RS.
  - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.
  - for UEs that support LB CA via switching, switching pattern periodicity is the periodicity of the RRC configured semi-static switching pattern; otherwise, it is not applicable.
  - RLM requirement in this clause is not applied when $N_{outside_MG}$ = 0.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* nor supporting *musim-GapPreference-r17* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s), concurrent measurement gap(s) with NCSG(s), and periodic MUSIM gaps,

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, and these GAPs] are overlapping with some but not all occasions of the CSI-RS; and
- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when the RLM-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$, when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is not overlapped with SMTC occasion ($T_{CSI-RS} < xRP$)
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the RLM-RS resource is not overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).
- $P = P_{sharing\ factor}$, when the RLM-RS resource is not overlapped with GAP and RLM-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{xRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and
  - $T_{SMTCperiod} \neq xRP$ or
  - $T_{SMTCperiod} = xRP$ and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$
- $P = \frac{P_{\text{sharing factor}}}{1-\frac{T_{CSI-RS}}{xRP}}$, when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod} = xRP$ and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{Min(xRP,T_{SMTCperiod})}}$, when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP
- $P = \frac{P_{\text{sharing factor}}}{1-\frac{T_{CSI-RS}}{xRP}}$, when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod} < xRP$)

where,

- $P_{sharing\ factor} = 1$, if the RLM-RS resource outside GAP is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

  - not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{sharing\ factor}$ = 3, otherwise.

- If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

- When a GAP is configured only and the GAP is not NCSG,

  - an RLM-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a GAP occasion, and

  - xRP = MGRP

- Otherwise, when NCSG is configured,

  - an RLM-RS resource or an SMTC occasion is considered to be overlapped with the GAP if

    - it overlaps the VIL1 or VIL2 of NCSG, or

    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

  - and

    - xRP = VIRP

If the UE is configured with Pre-MG only, an RLM-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG(s) are configured , an RLM-RS resource or an SMTC occasion is not considered to be overlapped by a GAP occasion if the GAP occasion is dropped according to clause 9.1.8, clause 9.1.12, clause 9.1.13, respectively.

If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

NOTE: The overlap between CSI-RS for RLM and SMTC means that CSI-RS based RLM is within the SMTC window duration.

For UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, the UE is not required to perform CSI-RS measurements during the cancelled gap occasions, and no restrictions on the scheduling availability apply during the cancelled gap occasions.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and GAP configurations does not meet previous conditions.

When the configured aperiodic MUSIM gap is overlapping with RLM-RS resource occasion, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and if RLM-RS resource occasions are fully overlapped with MUSIM gap(s) or the union of MUSIM gap(s) and GAPs, no requirement applies for CSI-RS based RLM.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of M_{out} and M_{in} used in table 8.1.3.2-1, table 8.1.3.2-2, table 8.1.3.2-3 and table 8.1.3.2-4 are defined as:

- M_{out} = 20 and M_{in} = 10, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth $\geqslant$ 24 PRBs.

If the UE supports *supportSBFD* and SBFD is configured by the network, the requirements in this clause apply provided that the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth $\geqslant$ 24 PRBs in at least one DL subband.

Table 8.1.3.2-1: Evaluation period $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ for FR1

Configuration	$T_{Evaluate_out_CSI\text{-}RS}$ (ms)	$T_{Evaluate_in_CSI\text{-}RS}$ (ms)
no DRX	Max(200, Ceil((M_{out}+ $L1_{Out}$)×P)×max($T_{CSI\text{-}RS}$, T_{proc}))	Max(100, Ceil((M_{in}+ $L1_{In}$)×P) × max($T_{CSI\text{-}RS}$, T_{proc}))
DRX $\leqslant$ 320 ms	Max(200, Ceil(1.5×(M_{out}+ $L1_{Out}$)×P)× Max(T_{DRX}, $T_{CSI\text{-}RS}$, T_{proc}))	Max(100, Ceil(1.5×(M_{in}+ $L1_{In}$)×P)× Max(T_{DRX}, $T_{CSI\text{-}RS}$, T_{proc}))
DRX > 320 ms	Ceil((M_{out}+ $L1_{Out}$)×P) × T_{DRX}	Ceil((M_{in}+ $L1_{In}$)×P) × T_{DRX}
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for $T_{CSI\text{-}RS}$ equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length. NOTE 2: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for RLM is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.		

Table 8.1.3.2-2: Evaluation period $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ for FR2

Configuration	$T_{Evaluate_out_CSI\text{-}RS}$ (ms)	$T_{Evaluate_in_CSI\text{-}RS}$ (ms)
no DRX	Max(200, Ceil((M_{out}+ $L1_{Out}$)×P×N)× max($T_{CSI\text{-}RS}$, T_{proc}))	Max(100, Ceil((M_{in}+ $L1_{In}$)×P×N) × max($T_{CSI\text{-}RS}$, T_{proc}))
DRX $\leqslant$ 320 ms	Max(200, Ceil(1.5×(M_{out}+ $L1_{Out}$)×P×N)× Max(T_{DRX}, $T_{CSI\text{-}RS}$, T_{proc}))	Max(100, Ceil(1.5×(M_{in}+ $L1_{In}$)×P×N)× Max(T_{DRX}, $T_{CSI\text{-}RS}$, T_{proc}))
DRX > 320 ms	Ceil((M_{out}+ $L1_{Out}$)×P×N) × T_{DRX}	Ceil((M_{in}+ $L1_{In}$)×P×N) × T_{DRX}
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for $T_{CSI\text{-}RS}$ equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length. NOTE 2: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for RLM is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.		

Table 8.1.3.2-3: Evaluation period $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ for FR1 (deactivated PSCell)

Configuration	$T_{Evaluate_out_CSI\text{-}RS}$ (ms)	$T_{Evaluate_in_CSI\text{-}RS}$ (ms)
no DRX	Ceil(M_{out}×P) × measCyclePSCell	Ceil(M_{in}×P) × measCyclePSCell
DRX ≤ 320 ms	Ceil(1.5 ×M_{out}×P) × Max(T_{DRX}, measCyclePSCell)	Ceil(1.5 ×M_{in}×P) × Max(T_{DRX}, measCyclePSCell)
DRX > 320 ms	Ceil(M_{out}×P) × Max(T_{DRX}, measCyclePSCell)	Ceil(M_{in}×P) × Max(T_{DRX}, measCyclePSCell)
NOTE: T_{DRX} is the DRX cycle length of SCG. measCyclePSCell is the measurement cycle length of the deactivated PSCell.		

Table 8.1.3.2-4: Evaluation period $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ for FR2 (deactivated PSCell)

Configuration	$T_{Evaluate_out_CSI\text{-}RS}$ (ms)	$T_{Evaluate_in_CSI\text{-}RS}$ (ms)
no DRX	Ceil(M_{out}×P×N) × measCyclePSCell	Ceil(M_{in}×P×N) × measCyclePSCell
DRX ≤ 320 ms	Ceil(1.5 × M_{out}×P×N) × Max(T_{DRX}, measCyclePSCell)	Ceil(1.5 × M_{in}×P×N) × Max(T_{DRX}, measCyclePSCell)
DRX > 320 ms	Ceil(M_{out}×P×N) × Max(T_{DRX}, measCyclePSCell)	Ceil(M_{in}×P×N) × Max(T_{DRX}, measCyclePSCell)
NOTE: T_{DRX} is the DRX cycle length of SCG. measCyclePSCell is the measurement cycle length of the deactivated PSCell.		

8.1.3.3 Measurement restrictions for CSI-RS based RLM

The SSB mentioned in this clause can be associated with either the serving cell PCI or a PCI different from serving cell PCI or intra-frequency neighbor cell(s) configured with L1-RSRP measurement or inter-frequency neighbor cell(s) configured with L1-RSRP measurement without gap.

The UE is required to be capable of measuring CSI-RS for RLM without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following clauses.

For both FR1 and FR2, when the CSI-RS for RLM is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for RLM in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD, or L1-RSRP measurement has same SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement has different SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS for RLM measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for RLM and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR1, when the CSI-RS for RLM is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for RLM without any restriction.

For FR2, when the CSI-RS for RLM measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, or L1-RSRP measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for RLM and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For both FR1 and FR2, when the CSI-RS for RLM measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, UE is not required to receive CSI-RS for RLM measurement in the PRBs that overlap with an SSB.

For both FR1 and FR2, when the CSI-RS for RLM measurement fully or partially overlaps with the OFDM symbol as CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement, UE is not required to receive CSI-RS for RLM measurement in the PRBs that overlap with the CSI-RS from candidate LTM neighbour cell.

For FR1, when the CSI-RS for RLM measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, if CSI-RS and SSB have different SCS and UE does not support simultaneousRxDataSSB-DiffNumerology, UE is required to measure one of but not both CSI-RS for RLM measurement and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR2, when the CSI-RS for RLM measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both CSI-RS for RLM measurement and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR2, when the CSI-RS for RLM measurement on one CC fully or partially overlaps with the OFDM symbol as CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement, UE is required to measure one of but not both CSI-RS for RLM measurement and CSI-RS for candidate LTM neighbour L1-RSRP measurement. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR2, when the CSI-RS for RLM measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for RLM and the other CSI-RS. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

  - The CSI-RS for RLM or the other CSI-RS in a resource set configured with repetition ON, or

  - The other CSI-RS is configured in q1 and beam failure is detected, or

  - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-RS for RLM without any restriction.

For FR2-1, there is no measurement restriction allowed for UE supporting *schedulingMeasurementRelaxation-r18*, according to the conditions described in clause 3.6.19, and the UE is required to measure both the CSI-RS for RLM and the other CSI-RS for RLM, BFD or L1-RSRP measurement, while meeting requirements in clause 8.1.3.2, provided the following conditions are met:

- Both CSI-RSs are not in any CSI-RS resource set with repetition ON, and
- One CSI-RS has same QCL source as either
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to TS 38.214 [26] clause 5.1.5, and
- the other CSI-RS has same QCL source as either
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to TS 38.214 [26] clause 5.1.5, and
- Resources of the active TCI states of the two PDSCHs, or QCL sources of the default QCL assumption, or the active TCI state of PDSCH and QCL source of the default QCL assumption have been reported as a resource group in Rel-17 group-based RSRP report.

8.1.3.4 Minimum requirement of CSI-RS based radio link monitoring for UE fulfilling relaxed measurement criteria

This clause contains minimum requirements for relaxed radio link monitoring based on CSI-RS.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_out_CSI-RS_Relax}$ period becomes worse than the threshold Q_{out_CSI-RS} within $T_{Evaluate_out_CSI-RS_Relax}$ evaluation period.

$T_{Evaluate_out_CSI-RS_Relax}$ is defined in table 8.1.3.4-1 for FR1.

$T_{Evaluate_out_CSI-RS_Relax}$ is defined in table 8.1.3.4-2 for FR2 with scaling factor N=1.

The value of P is defined in clause 8.1.3.2.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of M_{out} used in table 8.1.3.4-1 and table 8.1.3.4-2 are defined as:

- M_{out} = 20, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth $\geq$ 24 PRBs.

Table 8.1.3.4-1: Evaluation period $T_{Evaluate_out_CSI-RS_Relax}$ for FR1

Configuration	$T_{Evaluate_out_CSI-RS_Relax}$ (ms)
$Max(T_{DRX}, T_{CSI-RS}) \leq 80$ ms	$Max(200 \times K3^{NOTE3}, Ceil(1.5 \times M_{out} \times P \times K1^{NOTE2}) \times Max(T_{DRX}, T_{CSI-RS})^{NOTE1})$
NOTE1: T_{CSI-RS} is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for T_{CSI-RS} equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length and no longer than 80 ms.	

NOTE2: K1 = 2 for 40 ms < MAX(T_{DRX}, T_{CSI-RS}) ≤ 80 ms, K1 = 4 for MAX(T_{DRX}, T_{CSI-RS}) ≤ 40 ms
NOTE3: K3 = K1, if K1 ≤ 2; K3 = 1 otherwise.

Table 8.1.3.4-2: Evaluation period $T_{Evaluate_out_CSI-RS_Relax}$ for FR2

Configuration	$T_{Evaluate_out_CSI-RS_Relax}$ (ms)
Max(T_{DRX}, T_{CSI-RS}) ≤ 80 ms	Max(200 × K4 [NOTE3], Ceil(1.5 × M_{out} × P × N × K2 [NOTE2]) × Max(T_{DRX}, T_{CSI-RS}) [NOTE1])
NOTE1: T_{CSI-RS} is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for T_{CSI-RS} equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length and no longer than 80 ms. NOTE2: K2 = 2. NOTE3: K4 = K2, if K2 ≤ 2; K4 = 1 otherwise.	

8.1.4 Minimum requirement at transitions

When the UE transitions between DRX and no DRX or when DRX cycle periodicity changes, for each RLM-RS resource, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation period corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode for each RLM-RS resource. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of RLM resources to a second configuration of RLM resources that is different from the first configuration, for each RLM resource present in the second configuration, for a duration of time equal to the evaluation period corresponding to the second configuration after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first configuration and the second configuration. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second configuration for each RLM resource present in the second configuration. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of active TCI state of the CORESET to a second configuration of active TCI state of the CORESET, for each CSI-RS for RLM present in the second configuration, the UE shall use an evaluation period corresponding to the second configuration from the time of transition. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

For UE supporting *ncd-SSB-BWP-Wor-r18*, when the UE transitions between RLM CD-SSB resource and RLM NCD-SSB resource due to BWP switching or due to SCG activation or deactivation during one evaluation period, the UE shall use an evaluation period that is the maximum of the evaluation periods corresponding to the first SSB type and the second SSB type after the BWP switching or the SCG activation or deactivation. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second SSB type for each RLM-RS resource.

8.1.5 Minimum requirement for UE turning off the transmitter

The transmitter power of the UE in the monitored cell shall be turned off within 40 ms after expiry of T310 timer as specified in TS 38.331 [2].

8.1.6 Minimum requirement for L1 indication

When the downlink radio link quality on all the configured RLM-RS resources is worse than Q_{out}, layer 1 of the UE shall send an out-of-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the out-of-sync indications as specified in TS 38.331 [2].

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than Q_{in}, layer 1 of the UE shall send an in-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the in-sync indications as specified in TS 38.331 [2].

The out-of-sync and in-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication_interval}$.

When DRX is not used $T_{Indication_interval}$ is max(10 ms, $T_{RLM\text{-}RS,M}$), where $T_{RLM\text{-}RS,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to T_{SSB} specified in clause 8.1.2 if the RLM-RS resource is SSB, or $T_{CSI\text{-}RS}$ specified in clause 8.1.3 if the RLM-RS resource is CSI-RS.

In case DRX is used, $T_{Indication_interval}$ is Max(10ms, 1.5 × DRX_cycle_length, 1.5 × $T_{RLM\text{-}RS,M}$)) if DRX_cycle_length is less than or equal to 320ms, and $T_{Indication_interval}$ is DRX_cycle_length if DRX_cycle_length is greater than 320ms. Upon start of T310 timer as specified in TS 38.331 [2], the UE shall monitor the configured RLM-RS resources for recovery using the evaluation period and layer 1 indication interval corresponding to the no DRX mode until the expiry or stop of T310 timer.

For deactivated PSCell, when DRX is not used $T_{Indication_interval}$ is Max (10ms, *measCyclePSCell*). In case DRX is used, $T_{Indication_interval}$ is Max(10ms, 1.5 × DRX_cycle_length, 1.5 × *measCyclePSCell*)) if DRX_cycle_length is less than or equal to 320ms, and $T_{Indication_interval}$ is Max (DRX_cycle_length, *measCyclePSCell*) if DRX_cycle_length is greater than 320ms.

8.1.7 Scheduling availability of UE during radio link monitoring

When the reference signal to be measured for RLM has different subcarrier spacing than PDSCH/PDCCH or is in FR2, there are restrictions on the scheduling availability as described in the following clauses.

8.1.7.1 Scheduling availability of UE performing radio link monitoring with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH on FR1.

8.1.7.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for radio link monitoring.

When intra-band carrier aggregation in FR1 is performed, the scheduling restrictions on FR1 serving PCell or PSCell applies to all serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18*, there are no scheduling restrictions on FR1 serving cell(s) configured on the non-contiguous CC(s) in the same band if *nonCollocatedTypeNR-CA-r18* is not provided. Otherwise, the scheduling restrictions on FR1 serving PCell or PSCell applies to all serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

When intra-band non-contiguous carrier aggregation is configured for a UE supporting *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v1900* is “type 4”

3> there are no scheduling restrictions on FR1 serving cell(s) configured on the non-contiguous CC(s) in the same band

2> if *nonCollocatedTypeNR-CA-v1900* is “type 1”

3> the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there are no scheduling restrictions on FR1 serving cell(s) configured on the non-contiguous CC(s) in the same band

2>else

3> the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band FR1-FR1 NR-DC is configured, there are no scheduling restrictions on FR1 serving cell(s) in the bands due to radio link monitoring performed on FR1 serving PCell or PSCell in different bands.

8.1.7.3 Scheduling availability of UE performing radio link monitoring on FR2

The following scheduling restriction applies due to radio link monitoring on an FR2 serving PCell and/or PSCell.

- If the RLM-RS is CSI-RS which is type-D QCLed with active TCI state for PDCCH or PDSCH, and the CSI-RS is not in a CSI-RS resource set with repetition ON,
  - There are no scheduling restrictions due to radio link monitoring based on the CSI-RS.
- For FR2-1, for UE supporting *schedulingMeasurementRelaxation-r18*,, according to the conditions described in clause 3.6.19, and is configured to receive two PDSCH transmission occasions from two different QCL sources on PCell, there are no scheduling restrictions for the PDSCHs due to radio link monitoring based on the CSI-RS, when following conditions are met:
  - The CSI-RS is not in a CSI-RS resource set with repetition ON,
  - The CSI-RS has same QCL source as the active TCI state of one of the PDSCHs and has different QCL-TypeD from the other PDSCH,
  - The CSI-RS and both of the PDSCHs are on the same OFDM symbol(s),
  - The CSI-RS and both of the PDSCHs are on the same OFDM symbol(s), or the CSI-RS and one of the PDSCHs with different QCL typeD are on the same OFDM symbol(s) when partially overlapping PDSCHs are scheduled,
  - Resources of the active TCI states for the two PDSCHs have been reported as a resource group in Rel-17 group-based RSRP report.
- Otherwise
  - For FR2-1 or the RLM-RS is not using 480 kHz SCS or 960 kHz SCS on FR2-2, the UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on RLM-RS symbols to be measured for radio link monitoring.
  - For FR2-2 and the RLM-RS is using 480 kHz SCS or 960 kHz SCS, the UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on RLM-RS symbols to be measured for radio link monitoring, and on one data symbol before each RLM-RS symbol to be measured and one data symbol after each RLM-RS symbol to be measured.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions on FR2 serving PCell or PSCell applies to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cell(s) in the bands for the following cases, provided that UE is capable of independent beam management on this FR2 band pair:

- when performing radio link monitoring performed on FR2 serving PCell or PSCell in different bands,

- the UE is configured with same or different numerology between SSB on one FR2 band and data on the other FR2 band.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB for RLM and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for RLM; and

For the SSB for RLM and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for RLM.

8.1.7.4 Scheduling availability of UE performing radio link monitoring on FR1 or FR2 in case of FR1-FR2 inter-band CA and NR-DC

There are no scheduling restrictions on FR1 serving cell(s) due to radio link monitoring performed on FR2 serving PCell and/or PSCell.

There are no scheduling restrictions on FR2 serving cell(s) due to radio link monitoring performed on FR1 serving PCell and/or PSCell.

8.1.8 Minimum requirement under IDC Interference

When the UE is provided with IDC solution, the UE shall also perform radio link monitoring and meet the corresponding requirements in clause 8.1.

8.1A Radio Link Monitoring with CCA on Target Frequency

8.1A.1 Introduction

The requirements in clause 8.1A apply for radio link monitoring on a carrier frequency with CCA for cells:

- PCell in SA NR operation mode,
- PSCell in EN-DC operation mode.
- PSCell in NR-DC operation mode.

The UE shall monitor the downlink radio link quality based on the reference signal configured as RLM-RS resource(s) in order to detect the downlink radio link quality of the PCell and PSCell as specified in TS 38.213 [3]. The configured RLM-RS resources can be all SSBs, or all CSI-RSs, or a mix of SSBs and CSI-RSs. UE is not required to perform RLM outside the active DL BWP.

On each RLM-RS resource, the UE shall estimate the downlink radio link quality and compare it to the thresholds $Q_{out,CCA}$ and $Q_{in,CCA}$ for the purpose of monitoring downlink radio link quality of the cell.

The threshold $Q_{out,CCA}$ is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to the out-of-sync block error rate ($BLER_{out,CCA}$) as defined in table 8.1A.1-1. For SSB based radio link monitoring, $Q_{out_SSB,CCA}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1A.2.1-1.

The threshold $Q_{in,CCA}$ is defined as the level at which the downlink radio link quality can be received with significantly higher reliability than at $Q_{out,CCA}$ and shall correspond to the in-sync block error rate ($BLER_{in}$) as defined in table 8.1A.1-1. For SSB based radio link monitoring, $Q_{in_SSB,CCA}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1A.2.1-2.

The out-of-sync block error rate ($BLER_{out,CCA}$) and in-sync block error rate ($BLER_{in,CCA}$) are determined from the network configuration via parameter *rlmInSyncOutOfSyncThreshold* signalled by higher layers. When UE is not configured with *rlmInSyncOutOfSyncThreshold* from the network, UE determines out-of-sync and in-sync block error rates from Configuration #0 in table 8.1A.1-1 as default. All requirements in clause 8.1A are applicable for BLER Configuration #0 in table 8.1A.1-1.

Table 8.1A.1-1: Out-of-sync and in-sync block error rates

Configuration	$BLER_{out,CCA}$	$BLER_{in,CCA}$
0	10 %	2 %

UE shall be able to monitor up to N_{RLM} RLM-RS resources of the same or different types in each corresponding carrier frequency range, depending on a maximum number L_{max} of SSBs per half frame according to TS 38.213 [3], where N_{RLM} is specified in table 8.1A.1-2, and meet the requirements as specified in clause 8.1A. UE is not required to meet the requirements in clause 8.1A if RLM-RS is not configured and no TCI state for PDCCH is activated.

Table 8.1A.1-2: Maximum number of RLM-RS resources N_{RLM}

Carrier frequency range of PCell/PSCell	L_{max}	Maximum number of RLM-RS resources, N_{RLM}
FR1	8	4
FR2-2	64	8

In the requirements of clause 8.1A, the term RLM-RS SSB occasion not available at the UE refers to when the RLM-RS SSB is configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the set of configured RLM-RS resources are not available at the UE due to DL CCA failures at gNB during the corresponding evaluation period; otherwise the RLM-RS SSB is considered as available at the UE.

The requirements in clause 8.1A apply for any *channelAccessMode* configuration [2].

8.1A.2 Requirements for SSB Based Radio Link Monitoring

8.1A.2.1 Introduction

The requirements in this clause apply for each SSB based RLM-RS resource configured for PCell or PSCell, provided that the SSB configured for RLM are actually configured to be transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1A.2.2 but occasionally may not be transmitted due to CCA operation.

Table 8.1A.2.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	4 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	4 dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1A.2.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	4

Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.1A.2.2 Minimum Requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_out_SSB,CCA}$ period becomes worse than the threshold $Q_{out_SSB,CCA}$ within $T_{Evaluate_out_SSB,CCA}$ evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_in_SSB,CCA}$ period becomes better than the threshold $Q_{in_SSB,CCA}$ within $T_{Evaluate_in_SSB,CCA}$ evaluation period. During the in-sync evaluation procedure, layer 1 of the UE shall not send any in-sync indication for the cell to the higher layers when L_{in} exceeds $L_{in,max}$, where L_{in} and $L_{in,max}$ are defined in table 8.1A.2.2-1.

$T_{Evaluate_out_SSB,CCA}$ and $T_{Evaluate_in_SSB,CCA}$ are defined in table 8.1A.2.2-1 for FR1.

$T_{Evaluate_out_SSB,CCA}$ and $T_{Evaluate_in_SSB,CCA}$ are defined in table 8.1A.2.2-2 for FR2-2 with scaling factor N = 12.

For a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent measurement gap(s) with NCSG(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for an RLM-RS resource to be measured is defined as N_{total} / $N_{outside_MG}$
- For a window W of duration max(T_{L1}, xRP_max), where xRP_max is the maximum xRP across all configured per-UE measurement gap or NCSGs and per-FR measurement gap or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any RLM-RS resource occasion:
  - N_{total} is the total number of RLM-RS resource occasions within the window W, including those overlapped with GAP occasions within the window W, and
  - $N_{outside_MG}$ is the number of RLM-RS resource occasions that are not overlapped with any GAP occasion within the window W
  - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG(s),

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, and these GAPs are overlapping with some but not all occasions of the SSB RLM-RS resources; and
- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the SSB RLM-RS resources.

When a GAP is configured only and the GAP is not NCSG,

- an RLM-RS resource is considered to be overlapped with the GAP f it overlaps a GAP occasion, and
- xRP = MGRP

Otherwise, when NCSG only is configured,

- an RLM-RS resource is considered to be overlapped with the GAP if it overlaps the VIL1 or VIL2 of NCSG, and
- xRP = VIRP

If the UE is configured with Pre-MG only, an RLM-RS resource is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG(s) are configured, an RLM-RS resource is not considered to be overlapped by a GAP occasion if the GAP occasion is dropped according to clause 9.1.8, clause 9.1.12, clause 9.1.13, respectively.

For FR2-2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when RLM-RS resource is not overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when the RLM-RS resource is not overlapped with GAP and RLM-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the RLM-RS is partially overlapped with GAP and the RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5 \times T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MRGP}}$, when the RLM-RS resource is partially overlapped with GAP and the RLM-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod} <$ MGRP)
- $P_{sharing\ factor} = 1$, if the RLM-RS resource outside GAP is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and K data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and K data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and K is defined in clause 9.2.5.3.3, and,
  - not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and K data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and K data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured, and K is defined in clause 9.2.5.3.3.
- $P_{sharing\ factor} = 3$, otherwise.

where,

If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2-2 band, provided the SMTC offset of all CCs in FR2-2 have the same offset.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and GAP configurations does not meet previous conditions.

Table 8.1A.2.2-1: Evaluation period $T_{Evaluate_out_SSB,CCA}$ and $T_{Evaluate_in_SSB,CCA}$ for FR1

Configuration	$T_{Evaluate_out_SSB,CCA}$ (ms)		$T_{Evaluate_in_SSB,CCA}$ (ms)
	RLM-RS SSB Es/Iot[Note4] ≥-7 dB	RLM-RS SSB Es/Iot [Note4] <-7 dB	
no DRX	Max(200, Ceil(17*P)*T_{SSB})	Max(200, Ceil(24*P)*T_{SSB})	Max(100, Ceil((5+L_{in})*P)*T_{SSB})
DRX cycle≤320	Max(200, Ceil(1.5*15*P)*Max(T_{DRX},T_{SSB}))	Max(200, Ceil(1.5*20*P)*Max(T_{DRX},T_{SSB}))	Max(100, Ceil(1.5*(5+L_{in})*P)*Max(T_{DRX},T_{SSB}))
DRX cycle>320	Ceil(13*P)*T_{DRX}	Ceil(16*P)*T_{DRX}	Ceil((5+L_{in})*P)*T_{DRX}

NOTE 1: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.
NOTE 2: When DRX is not configured, L_{in} is the number of RLM-RS SSB occasions which are not available at the UE during $T_{Evaluate_in_SSB,CCA}$, where $L_{in} \le L_{in,max}$. When DRX is configured, L_{in} is the number of DRX cycles in which at least one RLM-RS SSB occasion is not available at the UE during $T_{Evaluate_in_SSB,CCA}$, where $L_{in} \le L_{in,max}$. The UE is not required to determine the availability of SSB occasions more frequent than
Once per Max(10 ms, P * T_{SSB}) if no DRX is used,
Once per Max(10 ms, Ceil(1.5 * P) * Max(T_{DRX}, T_{SSB})) if DRX cycle ≤ 320 ms,
Once per P * T_{DRX} if DRX cycle > 320 ms.
NOTE 3: $L_{in,max}$=7 for Max(T_{DRX},T_{SSB}) ≤ 40 assuming T_{DRX}=0 for non-DRX case,
$L_{in,max}$=5 for 40<Max(T_{DRX},T_{SSB})≤320,
$L_{in,max}$=3 for T_{DRX}>320.
NOTE 4: RLM-RS SSB Es/Iot is the averaged Es/Iot over the most recent previous out-of-sync evaluation period.

Table 8.1A.2.2-2: Evaluation period $T_{Evaluate_out_SSB,CCA}$ and $T_{Evaluate_in_SSB,CCA}$ for FR2-2

Configuration	$T_{Evaluate_out_SSB,CCA}$ (ms)	$T_{Evaluate_in_SSB,CCA}$ (ms)
no DRX	Max(200, Ceil(12*P* N)*T_{SSB})	Max(100, Ceil((5 +L_{in})*P* N)*T_{SSB})
DRX cycle≤320	Max(200, Ceil(1.5*10*P* N)*Max(T_{DRX},T_{SSB}))	Max(100, Ceil(1.5*(5 +L_{in})*P* N)*Max(T_{DRX},T_{SSB}))
DRX cycle>320	Ceil(10*P* N)*T_{DRX}	Ceil((5+L_{in})*P* N)*T_{DRX}

NOTE 1: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.
NOTE 2: When DRX is not configured, L_{in} is the number of RLM-RS SSB occasions groups which are not available at the UE during $T_{Evaluate_in_SSB,CCA}$, where $L_{in} \le L_{in,max}$. An RLM-RS SSB occasions group consists of N consecutive RLM-RS SSB occasions, and the RLM-RS SSB occasions group is not available at the UE when at least one RLM-SSB occasion in the group is not transmitted by the gNB. When DRX is configured, L_{in} is the number of DRX cycles groups which are not available at the UE during $T_{Evaluate_in_SSB,CCA}$, where Lin ≤ $L_{in,max}$. A DRX group consists of N DRX cycles, and the DRX group is not available when there is at least one DRX in which at least one RLM-RS SSB occasion is not available. The UE is not required to determine the availability of SSB occasions more frequent than once per DRX cycle length, when configured with DRX.
NOTE 3: $L_{in,max}$=7 for Max(T_{DRX},T_{SSB}) ≤ 40 assuming T_{DRX}=0 for non-DRX case,
$L_{in,max}$=5 for 40<Max(T_{DRX},T_{SSB})≤320,
$L_{in,max}$=3 for T_{DRX}>320.

8.1A.2.3 Measurement Restrictions for SSB based RLM

The UE is required to be capable of measuring SSB for RLM without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following clauses.

For FR1, when the SSB for RLM is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for RLM without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for RLM without any restriction;

- If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure SSB for RLM.

For FR2-2, when the SSB for RLM measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for RLM and CSI-RS. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

8.1A.3 Minimum requirement at transitions

When the UE transitions between DRX and no DRX or when DRX cycle periodicity changes, for each RLM-RS resource, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation period corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode for each RLM-RS resource. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of RLM resources to a second configuration of RLM resources that is different from the first configuration, for each RLM resource present in the second configuration, for a duration of time equal to the evaluation period corresponding to the second configuration after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first configuration and the second configuration. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second configuration for each RLM resource present in the second configuration. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

8.1A.4 Minimum requirement for UE turning off the transmitter

The transmitter power of the UE in the monitored cell shall be turned off within 40 ms after expiry of T310 timer as specified in TS 38.331 [2]. The UE shall not perform CCA procedure on any of the serving carrier frequencies with CCA after the expiry of T310.

8.1A.5 Minimum requirement for L1 indication

When the downlink radio link quality on all the configured RLM-RS resources is worse than $Q_{out,CCA}$, layer 1 of the UE shall send an out-of-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the out-of-sync indications as specified in TS 38.331 [2].

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than $Q_{in,CCA}$, layer 1 of the UE shall send an in-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the in-sync indications as specified in TS 38.331 [2].

The out-of-sync and in-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication_interval,CCA}$.

When DRX is not used $T_{Indication_interval,CCA}$ is max(10 ms, $T_{RLM\text{-}RS,M}$), where $T_{RLM,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to T_{SSB} specified in clause 8.1A.2 if the RLM-RS resource is SSB.

In case DRX is used, $T_{Indication_interval,CCA}$ is Max(10ms, 1.5 × DRX_cycle_length, 1.5 × $T_{RLM\text{-}RS,M}$)) if DRX_cycle_length is less than or equal to 320ms, and $T_{Indication_interval,CCA}$ is DRX_cycle_length if DRX_cycle_length is greater than 320ms. Upon start of T310 timer as specified in TS 38.331 [2], the UE shall monitor the configured RLM-RS resources for recovery using the evaluation period and layer 1 indication interval corresponding to the no DRX mode until the expiry or stop of T310 timer.

8.1A.6 Scheduling availability of UE during radio link monitoring

When the reference signal to be measured for RLM on a carrier frequency with CCA has different subcarrier spacing than PDSCH/PDCCH, there are restrictions on the scheduling availability as described in the following clauses.

8.1A.6.1 Scheduling availability of UE performing radio link monitoring with the same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH on FR1.

8.1A.6.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for radio link monitoring.

When intra-band carrier aggregation is performed, the scheduling restrictions on PCell or PSCell applies to all serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols.

8.1A.6.3 Scheduling availability of UE performing radio link monitoring on FR2-2

The following scheduling restriction applies due to radio link monitoring on an FR2-2 serving PCell and/or PSCell.

- If the RLM-RS is CSI-RS which is type-D QCLed with active TCI state for PDCCH or PDSCH, and the CSI-RS is not in a CSI-RS resource set with repetition ON,
  - There are no scheduling restrictions due to radio link monitoring based on the CSI-RS.
- Otherwise
  - When the RLM-RS is using 120 kHz SCS, the UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on RLM-RS symbols to be measured for radio link monitoring.
  - When the RLM-RS is using 480 kHz SCS or 960 kHz SCS, the UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on RLM-RS resource symbols to be measured for radio link monitoring, and on one data symbol before each RLM-RS symbol to be measured and one data symbol after each RLM-RS symbol to be measured.

When intra-band carrier aggregation in FR2-2 is performed, the scheduling restrictions on FR2-2 serving PCell or PSCell applies to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

For FR2-2, if following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE’s reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB for RLM and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for RLM; and

For the SSB for RLM and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for RLM.

8.1A.6.4 Scheduling availability of UE performing radio link monitoring on FR1 or FR2-2 in case of FR1-FR2-2 inter-band CA and NR-DC

There are no scheduling restrictions on FR1 serving cell(s) due to radio link monitoring performed on FR2-2 serving PCell and/or PSCell.

There are no scheduling restrictions on FR2-2 serving cell(s) due to radio link monitoring performed on FR1 serving PCell and/or PSCell.

8.1B Radio Link Monitoring for RedCap

8.1B.1 Introduction

The requirements in clause 8.1B apply for radio link monitoring on UE with reduced capabilities:

- PCell in SA NR operation mode,

The UE shall monitor the downlink radio link quality based on the reference signal configured as RLM-RS resource(s) in order to detect the downlink radio link quality of the PCell as specified in TS 38.213 [3]. The configured RLM-RS resources can be all SSBs, or all CSI-RSs, or a mix of SSBs and CSI-RSs. UE is not required to perform RLM outside the active DL BWP. The SSB and SMTC in this clause applies for both CD-SSB and NCD-SSB if it is not additional specified.

On each RLM-RS resource, the UE shall estimate the downlink radio link quality and compare it to the thresholds $Q_{out,RedCap}$ and $Q_{in,RedCap}$ for the purpose of monitoring downlink radio link quality of the cell.

The threshold $Q_{out,RedCap}$ is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to the out-of-sync block error rate ($BLER_{out}$) as defined in table 8.1B.1-1. For SSB based radio link monitoring, $Q_{out_SSB,RedCap}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1B.2.1-1. For CSI-RS based radio link monitoring, $Q_{out_CSI\text{-}RS,RedCap}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1B.3.1-1.

The threshold $Q_{in,RedCap}$ is defined as the level at which the downlink radio link quality can be received with significantly higher reliability than at $Q_{out,RedCap}$ and shall correspond to the in-sync block error rate ($BLER_{in,RedCap}$) as defined in table 8.1B.1-1. For SSB based radio link monitoring, $Q_{in_SSB,RedCap}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1B.2.1-2. For CSI-RS based radio link monitoring, $Q_{in_CSI\text{-}RS,RedCap}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1B.3.1-2.

The out-of-sync block error rate ($BLER_{out,RedCap}$) and in-sync block error rate ($BLER_{in,RedCap}$) are determined from the network configuration via parameter *rlmInSyncOutOfSyncThreshold* signalled by higher layers. When UE is not configured with *rlmInSyncOutOfSyncThreshold* from the network, UE determines out-of-sync and in-sync block error rates from Configuration #0 in table 8.1B.1-1 by default. All requirements in clause 8.1B are applicable for BLER Configuration #0 in table 8.1B.1-1.

Table 8.1B.1-1: Out-of-sync and in-sync block error rates for RedCap UE

Configuration	$BLER_{out,RedCap}$	$BLER_{in,RedCap}$
0	10 %	2 %

UE shall be able to monitor up to N_{RLM} RLM-RS resources of the same or different types in each corresponding carrier frequency range, depending on a maximum number L_{max} of SSBs per half frame according to TS 38.213 [3], where N_{RLM} is specified in table 8.1B.1-2 according TS 38.213 [3], and meet the requirements as specified in clause 8.1B. UE is not required to meet the requirements in clause 8.1B if RLM-RS is not configured and no TCI state for PDCCH is activated.

Table 8.1B.1-2: Maximum number of RLM-RS resources N_{RLM} for RedCap UE

Carrier frequency range of PCell	L_{max}	Maximum number of RLM-RS resources, N_{RLM}
FR1, ≤ 3 GHz[Note]	4	2
FR1, > 3 GHz[Note]	8	4

FR2	64	8
NOTE: For unpaired spectrum operation with Case C - 30 kHz SCS, 3 GHz is replaced by 1.88 GHz, as specified in clause 4.1 in TS 38.213 [3].		

8.1B.2 Requirements for SSB based radio link monitoring

8.1B.2.1 Introduction

The requirements in this clause apply for each SSB based RLM-RS resource configured for PCell, provided that the SSB configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1B.2.2.

Table 8.1B.2.1-1: PDCCH transmission parameters for out-of-sync evaluation for RedCap UE

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	16; for RedCap UE with 1Rx branch. 8; for RedCap UE with 2Rx branches.
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	4 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	4 dB
Bandwidth (PRBs)	48; for RedCap UE with 1Rx branch. 24; for RedCap UE with 2Rx branches.
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed
NOTE: SCS = 60kHz is not applicable for FR1.	

Table 8.1B.2.1-2: PDCCH transmission parameters for in-sync evaluation for RedCap UE

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8; for RedCap UE with 1Rx branch. 4; for RedCap UE with 2Rx branches.
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	48; for RedCap UE with 1Rx branch. 24; for RedCap UE with 2Rx branches.
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed
NOTE: SCS = 60kHz is not applicable for FR1.	

8.1B.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_out_SSB,RedCap}$ period becomes worse than the threshold $Q_{out_SSB,RedCap}$ within $T_{Evaluate_out_SSB,RedCap}$ evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_in_SSB,RedCap}$ period becomes better than the threshold $Q_{in_SSB,RedCap}$ within $T_{Evaluate_in_SSB,RedCap}$ evaluation period.

$T_{Evaluate_out_SSB,RedCap}$ and $T_{Evaluate_in_SSB,RedCap}$ are defined in table 8.1B.2.2-1 and table 8.1B.2.2-3 for FR1 for UE with 2Rx RedCap and 1Rx RedCap, respectively.

$T_{Evaluate_out_SSB,RedCap}$ and $T_{Evaluate_in_SSB,RedCap}$ are defined in table 8.1B.2.2-2 and for FR2 with scaling factor N=8 for 2Rx RedCap.

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, and these measurement gaps are overlapping with some but not all occasions of the SSB; and
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when RLM-RS resource is not overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when the RLM-RS resource is not overlapped with measurement gap and RLM-RS resource is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5 \times T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MRGP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} <$ MGRP)
- $P_{sharing\ factor}$ = 1, if the RLM-RS resource outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
  - not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.
- $P_{sharing\ factor}$ = 3, otherwise.

where,

If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 8.1B.2.2-1: Evaluation period $T_{Evaluate_out_SSB,RedCap}$ and $T_{Evaluate_in_SSB,RedCap}$ for FR1 for 2Rx RedCap UE

Configuration	$T_{Evaluate_out_SSB,RedCap}$ (ms)	$T_{Evaluate_in_SSB,RedCap}$ (ms)
no DRX	Max(200, Ceil(10 × P) × T_{SSB})	Max(100, Ceil(5 × P) × T_{SSB})
DRX cycle≤320 ms	Max(200, Ceil(15 × P) × Max(T_{DRX},T_{SSB}))	Max(100, Ceil(7.5 × P) × Max(T_{DRX},T_{SSB}))
DRX cycle>320 ms	Ceil(10 × P) × T_{DRX}	Ceil(5 × P) × T_{DRX}
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.		

Table 8.1B.2.2-2: Evaluation period $T_{Evaluate_out_SSB,RedCap}$ and $T_{Evaluate_in_SSB,RedCap}$ for FR2 for 2Rx RedCap UE

Configuration	$T_{Evaluate_out_SSB,RedCap}$ (ms)	$T_{Evaluate_in_SSB,RedCap}$ (ms)
no DRX	Max(200, Ceil(10 × P × N) × T_{SSB})	Max(100, Ceil(5 × P × N) × T_{SSB})
DRX cycle≤320 ms	Max(200, Ceil(15 × P × N) × Max(T_{DRX},T_{SSB}))	Max(100, Ceil(7.5 × P × N) × Max(T_{DRX},T_{SSB}))
DRX cycle>320 ms	Ceil(10 × P × N) × T_{DRX}	Ceil(5 × P × N) × T_{DRX}
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.		

Table 8.1B.2.2-3: Evaluation period $T_{Evaluate_out_SSB,RedCap}$ and $T_{Evaluate_in_SSB,RedCap}$ for FR1 for 1Rx RedCap UE

Configuration	$T_{Evaluate_out_SSB,RedCap}$ (ms)	$T_{Evaluate_in_SSB,RedCap}$ (ms)
no DRX	Max(400, Ceil(20 × P) × T_{SSB})	Max(100, Ceil(5 × P) × T_{SSB})
DRX cycle≤320 ms	Max(400, Ceil(30 × P) × Max(T_{DRX},T_{SSB}))	Max(100, Ceil(7.5 × P) × Max(T_{DRX},T_{SSB}))
DRX cycle>320 ms	Ceil(20 × P) × T_{DRX}	Ceil(5 × P) × T_{DRX}
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.		

8.1B.2.3 Measurement restrictions for SSB based RLM

The UE is required to be capable of measuring SSB for RLM without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following scenarios.

For FR1, when the SSB for RLM is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for RLM without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for RLM without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for RLM and CSI-RS. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

For FR2, when the SSB for RLM measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE is required to measure one of but not both SSB for RLM and CSI-RS. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

8.1B.3 Requirements for CSI-RS based radio link monitoring

8.1B.3.1 Introduction

The requirements in this clause apply for each CSI-RS based RLM-RS resource configured for PCell, provided that the CSI-RS configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1B.3.2. UE is not expected to perform radio link monitoring measurements on the CSI-RS configured as RLM-RS if the CSI-RS is not in the active TCI state of any CORESET configured in the UE active BWP.

Table 8.1B.3.1-1: PDCCH transmission parameters for out-of-sync evaluation for RedCap UE

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	16; for RedCap UE with 1Rx branch. 8; for RedCap UE with 2Rx branches.
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	4 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	4 dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed
NOTE: SCS = 60kHz is not applicable for FR1.	

Table 8.1B.3.1-2: PDCCH transmission parameters for in-sync evaluation for RedCap UE

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8; for RedCap UE with 1Rx branch. 4; for RedCap UE with 2Rx branches.
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0 dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed
NOTE: SCS = 60kHz is not applicable for FR1.	

8.1B.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_out_CSI\text{-}RS,RedCap}$ period becomes worse than the threshold $Q_{out_CSI\text{-}RS,RedCap}$ within $T_{Evaluate_out_CSI\text{-}RS,RedCap}$ evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_in_CSI\text{-}RS,RedCap}$ period becomes better than the threshold $Q_{in_CSI\text{-}RS,RedCap}$ within $T_{Evaluate_in_CSI\text{-}RS,RedCap}$ evaluation period.

- $T_{Evaluate_out_CSI\text{-}RS,RedCap}$ and $T_{Evaluate_in_CSI\text{-}RS,RedCap}$ are defined in table 8.1B.3.2-1 and table 8.1B.3.2-3 for FR1 for RedCap 2Rx RedCap and 1Rx RedCap, respectively.

- $T_{Evaluate_out_CSI\text{-}RS,RedCap}$ and $T_{Evaluate_in_CSI\text{-}RS,RedCap}$ are defined in table 8.1B.3.2-2 for FR2 with scaling factor N=1 for 2 Rx RedCap.

The requirements of $T_{Evaluate_out_CSI-RS,RedCap}$ and $T_{Evaluate_in_CSI-RS,RedCap}$ apply provided that the CSI-RS for RLM is not in a resource set configured with repetition ON. The requirements do not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for RLM and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, and these measurement gaps are overlapping with some but not all occasions of the CSI-RS; and
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when the RLM-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is not overlapped with SMTC occasion ($T_{CSI-RS} < MGRP$)
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the RLM-RS resource is not overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).
- $P = P_{sharing\ factor}$, when the RLM-RS resource is not overlapped with measurement gap and RLM-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq MGRP$ or
  - $T_{SMTCperiod} = MGRP$ and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$
- $P = \frac{P_{\text{sharing factor}}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod} = MGRP$ and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap
- $P = \frac{P_{\text{sharing factor}}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} < MGRP$)
- $P_{sharing\ factor} = 1$, if the RLM-RS resource outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
  - not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{sharing\ factor}$ = 3, otherwise.

where,

If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

NOTE: The overlap between CSI-RS for RLM and SMTC means that CSI-RS based RLM is within the SMTC window duration.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of $M_{out,RedCap}$ and $M_{in,RedCap}$ used in table 8.1B.3.2-1 and table 8.1B.3.2-2 for UE with 2Rx are defined as:

- $M_{out,RedCap}$ = 20 and $M_{in,RedCap}$ = 10, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth $\geqslant$ 24 PRBs.

The values of $M_{out,RedCap}$ and $M_{in,RedCap}$ used in table 8.1B.3.2-3 for RedCap UE with 1Rx are defined as:

- $M_{out,RedCap}$ = 40 and $M_{in,RedCap}$ = 10, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth $\geqslant$ 24 PRBs.

Table 8.1B.3.2-1: Evaluation period $T_{Evaluate_out_CSI\text{-}RS,RedCap}$ and $T_{Evaluate_in_CSI\text{-}RS,RedCap}$ for FR1 for 2Rx RedCap UE

Configuration	$T_{Evaluate_out_CSI\text{-}RS,RedCap}$ (ms)	$T_{Evaluate_in_CSI\text{-}RS,RedCap}$ (ms)
no DRX	Max(200, Ceil($M_{out,RedCap}$×P)×$T_{CSI\text{-}RS}$)	Max(100, Ceil($M_{in,RedCap}$×P) × $T_{CSI\text{-}RS}$)
DRX ≤ 320 ms	Max(200, Ceil(1.5×$M_{out,RedCap}$ ×P)× Max(T_{DRX}, $T_{CSI\text{-}RS}$))	Max(100, Ceil(1.5×$M_{in,RedCap}$×P)× Max(T_{DRX}, $T_{CSI\text{-}RS}$))
DRX > 320 ms	Ceil($M_{out,RedCap}$ ×P) × T_{DRX}	Ceil($M_{in,RedCap}$ ×P) × T_{DRX}
NOTE: $T_{CSI\text{-}RS}$ is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for $T_{CSI\text{-}RS}$ equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length.		

Table 8.1B.3.2-2: Evaluation period $T_{Evaluate_out_CSI\text{-}RS,RedCap}$ and $T_{Evaluate_in_CSI\text{-}RS,RedCap}$ for FR2 for 2Rx RedCap UE

Configuration	$T_{Evaluate_out_CSI\text{-}RS,RedCap}$ (ms)	$T_{Evaluate_in_CSI\text{-}RS,RedCap}$ (ms)
no DRX	Max(200, Ceil($M_{out,RedCap}$×P×N)×$T_{CSI\text{-}RS}$)	Max(100, Ceil($M_{in,RedCap}$×P×N) × $T_{CSI\text{-}RS}$)
DRX ≤ 320 ms	Max(200, Ceil(1.5×$M_{out,RedCap}$×P×N)× Max(T_{DRX}, $T_{CSI\text{-}RS}$))	Max(100, Ceil(1.5×$M_{in,RedCap}$×P×N)× Max(T_{DRX}, $T_{CSI\text{-}RS}$))
DRX > 320 ms	Ceil($M_{out,RedCap}$×P×N) × T_{DRX}	Ceil($M_{in,RedCap}$×P×N) × T_{DRX}
NOTE: $T_{CSI\text{-}RS}$ is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for $T_{CSI\text{-}RS}$ equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length.		

Table 8.1B.3.2-3: Evaluation period $T_{Evaluate_out_CSI\text{-}RS,RedCap}$ and $T_{Evaluate_in_CSI\text{-}RS,RedCap}$ for FR1 for 1Rx RedCap UE

Configuration	$T_{Evaluate_out_CSI\text{-}RS,RedCap}$ (ms)	$T_{Evaluate_in_CSI\text{-}RS,RedCap}$ (ms)
no DRX	Max(400, Ceil($M_{out,RedCap}$×P)×$T_{CSI\text{-}RS}$)	Max(100, Ceil($M_{in,RedCap}$×P) × $T_{CSI\text{-}RS}$)
DRX ≤ 320 ms	Max(400, Ceil(1.5×$M_{out,RedCap}$ ×P)× Max(T_{DRX}, $T_{CSI\text{-}RS}$))	Max(100, Ceil(1.5×$M_{in,RedCap}$×P)× Max(T_{DRX}, $T_{CSI\text{-}RS}$))
DRX > 320 ms	Ceil($M_{out,RedCap}$ ×P) × T_{DRX}	Ceil($M_{in,RedCap}$ ×P) × T_{DRX}
NOTE: $T_{CSI\text{-}RS}$ is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for $T_{CSI\text{-}RS}$ equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length.		

8.1B.3.3 Measurement restrictions for CSI-RS based RLM

The UE is required to be capable of measuring CSI-RS for RLM without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following clauses.

For both FR1 and FR2, when the CSI-RS for RLM is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for RLM in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD, or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS for RLM measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for RLM and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR1, when the CSI-RS for RLM is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for RLM without any restriction.

For FR2, when the CSI-RS for RLM is in the same OFDM symbol as SSB for RLM, BFD, or L1-RSRP measurement, or in the same symbol as SSB for CBD when beam failure is detected, UE is required to measure one of but not both CSI-RS for RLM and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR2, when the CSI-RS for RLM measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- In the following cases, UE is required to measure one of but not both CSI-RS for RLM and the other CSI-RS. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.
  - The CSI-RS for RLM or the other CSI-RS in a resource set configured with repetition ON, or
  - The other CSI-RS is configured in q1 and beam failure is detected, or
  - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS for RLM without any restriction.

8.1B.4 Minimum requirement at transitions

When the UE transitions between RLM CD-SSB resource and RLM NCD-SSB resource due to BWP switching during one evaluation period, the UE shall use an evaluation period that is the maximum of the evaluation periods corresponding to the first SSB type and the second SSB type after the BWP switching. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second SSB type for each RLM-RS resource.

The requirements in clause 8.1.4 shall also apply except the scenarios described above.

8.1B.5 Minimum requirement for UE turning off the transmitter

The requirements in clause 8.1.5 shall apply.

8.1B.6 Minimum requirement for L1 indication

When the downlink radio link quality on all the configured RLM-RS resources is worse than $Q_{out,RedCap}$, layer 1 of the UE shall send an out-of-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the out-of-sync indications as specified in TS 38.331 [2].

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than $Q_{in,RedCap}$, layer 1 of the UE shall send an in-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the in-sync indications as specified in TS 38.331 [2].

The out-of-sync and in-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication_interval,RedCap}$.

When DRX is not used for RedCap UEs, $T_{Indication_interval,RedCap}$ is max(10 ms, $T_{RLM\text{-}RS,M}$), where $T_{RLM,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to T_{SSB} specified in clause 8.1B.2 if the RLM-RS resource is SSB, or $T_{CSI\text{-}RS}$ specified in clause 8.1B.3 if the RLM-RS resource is CSI-RS.

In case DRX is used for RedCap UEs, $T_{Indication_interval,RedCap}$ is Max(10ms, 1.5 × DRX_cycle_length, 1.5 × $T_{RLM\text{-}RS,M}$)) if DRX_cycle_length is less than or equal to 320ms, and $T_{Indication_interval}$ is DRX_cycle_length if DRX_cycle_length is greater than 320ms. Upon start of T310 timer as specified in TS 38.331 [2], the UE shall monitor the configured RLM-RS resources for recovery using the evaluation period and layer 1 indication interval corresponding to the no DRX mode until the expiry or stop of T310 timer.

When DRX is not used for HD-FDD RedCap UEs, $T_{Indication_interval,RedCap}$ is max(10 ms, $T_{RLM\text{-}RS,M}$), where $T_{RLM,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to T_{SSB} specified in clause 8.1B.2 if the RLM-RS resource is SSB, or $T_{CSI\text{-}RS}$ specified in clause 8.1B.3 if the RLM-RS resource is CSI-RS, under the following condition

- For each RLM-RS configuration, at least one RLM-RS sample must fall with DL occasion within an indication period.

In case DRX is used for HD-FDD RedCap UEs, $T_{Indication_interval,RedCap}$ is Max(10ms, 1.5 × DRX_cycle_length, 1.5 × $T_{RLM\text{-}RS,M}$)) if DRX_cycle_length is less than or equal to 320ms, and $T_{Indication_interval}$ is DRX_cycle_length if DRX_cycle_length is greater than 320ms, under the following condition

- For each RLM-RS configuration, at least one RLM-RS sample must fall with DL occasion within an indication period.

8.1B.7 Scheduling availability of UE during radio link monitoring

The requirements in clause 8.1.7 shall apply.

8.1B.7.1 Scheduling availability of UE performing radio link monitoring with a same subcarrier spacing as PDSCH/PDCCH on FR1

The requirements in clause 8.1.7.1 shall apply.

8.1B.7.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for radio link monitoring.

8.1B.7.3 Scheduling availability of UE performing radio link monitoring on FR2

The following scheduling restriction applies due to radio link monitoring on an FR2 serving PCell.

- If the RLM-RS is CSI-RS which is type-D QCLed with active TCI state for PDCCH or PDSCH, and the CSI-RS is not in a CSI-RS resource set with repetition ON,
  - There are no scheduling restrictions due to radio link monitoring based on the CSI-RS.
- Otherwise

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on RLM-RS symbols to be measured for radio link monitoring.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB for RLM and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for RLM; and

For the SSB for RLM and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for RLM.

8.1C Radio Link Monitoring for Satellite Access

8.1C.1 Introduction

The requirements in clause 8.1C apply for radio link monitoring on PCell and the UE is configured with only PCell, which is served by satellite access node (SAN). The UE shall monitor the downlink radio link quality based on the reference signal configured as RLM-RS resource(s) in order to detect the downlink radio link quality of the PCell as specified in TS 38.213 [3]. The configured RLM-RS resources can be all SSBs, or all CSI-RSs, or a mix of SSBs and CSI-RSs. UE is not required to perform RLM outside the active DL BWP.

On each RLM-RS resource, the UE shall estimate the downlink radio link quality and compare it to the thresholds Q_{out} and Q_{in} for the purpose of monitoring downlink radio link quality of the cell.

The threshold Q_{out} is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to the out-of-sync block error rate ($BLER_{out}$) as defined in table 8.1C.1-1. For SSB based radio link monitoring, Q_{out_SSB} is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1C.2.1-1, and table 8.1C.2.1-3 for a UE operating on a cell with less than 5 MHz BW. For CSI-RS based radio link monitoring, $Q_{out_CSI\text{-}RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1C.3.1-1.

The threshold Q_{in} is defined as the level at which the downlink radio link quality can be received with significantly higher reliability than at Q_{out} and shall correspond to the in-sync block error rate ($BLER_{in}$) as defined in table 8.1C.1-1. For SSB based radio link monitoring, Q_{in_SSB} is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1C.2.1-2. For CSI-RS based radio link monitoring, $Q_{in_CSI\text{-}RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1C.3.1-2.

The out-of-sync block error rate ($BLER_{out}$) and in-sync block error rate ($BLER_{in}$) are determined from the network configuration via parameter *rlmInSyncOutOfSyncThreshold* signalled by higher layers. When UE is not configured with *rlmInSyncOutOfSyncThreshold* from the network, UE determines out-of-sync and in-sync block error rates from Configuration #0 in table 8.1C.1-1 by default. All requirements in clause 8.1C are applicable for BLER Configuration #0 in table 8.1C.1-1.

Table 8.1C.1-1: Out-of-sync and in-sync block error rates

Configuration	$BLER_{out}$	$BLER_{in}$
0	10 %	2 %

UE shall be able to monitor up to N_{RLM} RLM-RS resources of the same or different types in each corresponding carrier frequency range, depending on a maximum number L_{max} of SSBs per half frame according to TS 38.213 [3], where N_{RLM} is specified in table 8.1C.1-2 according TS 38.213 [3], and meet the requirements as specified in clause 8.1C. UE is not required to meet the requirements in clause 8.1C if RLM-RS is not configured and no TCI state for PDCCH is activated.

Table 8.1C.1-2: Maximum number of RLM-RS resources N_{RLM}

Carrier frequency range of PCell	L_{max}	Maximum number of RLM-RS resources, N_{RLM}
FR1-NTN, ≤ 3 GHz[Note]	4	2
FR1-NTN, > 3 GHz[Note]	8	4
FR2-NTN[Note 2]	64	8
NOTE: For unpaired spectrum operation with Case C - 30 kHz SCS, 3 GHz is replaced by 1.88 GHz, as specified in clause 4.1 in TS 38.213 [3].		
NOTE 2: NTN bands within this frequency range are regarded as a FR2-1 band when references from other specifications unless otherwise stated.		

8.1C.2 Requirements for SSB based radio link monitoring

8.1C.2.1 Introduction

The requirements in this clause apply for each SSB based RLM-RS resource configured for PCell, provided that the SSB configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1C.2.2.

Table 8.1C.2.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8 for FR1-NTN 16 for FR2-NTN
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	4 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	4 dB
Bandwidth (PRBs)	24 for FR1-NTN 48 for FR2-NTN
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1C.2.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	4 for FR1-NTN 8 for FR2-NTN
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	24 for FR1-NTN 48 for FR2-NTN
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1C.2.1-3: PDCCH transmission parameters for out-of-sync evaluation for a UE operating on a cell with less than 5MHz BW

Attribute	Value for BLER Configuration #0
Channel BW	**3MHz**
DL Transmission BW	**15 PRBs**

DCI format	1-0
Number of control OFDM symbols	3
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	4dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	4dB
Bandwidth (PRBs)	15
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Non-Distributed[Note 1]
NOTE 1: For 15 PRB Transmission BW, distributed mapping may lead to unexpected out-of-sync indication.	

Table 8.1C.2.1-4: PDCCH transmission parameters for in-sync evaluation for a UE operating on a cell with less than 5MHz BW

Attribute	Value for BLER Configuration #0
Channel BW	**3MHz**
DL Transmission BW	**15 PRBs**
DCI format	1-0
Number of control OFDM symbols	3
Aggregation level (CCE)	4
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0dB
Bandwidth (PRBs)	15
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Non-Distributed

8.1C.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_out_SSB}$ period becomes worse than the threshold Q_{out_SSB} within $T_{Evaluate_out_SSB}$ evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_in_SSB}$ period becomes better than the threshold Q_{in_SSB} within $T_{Evaluate_in_SSB}$ evaluation period.

$T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ are defined in table 8.1C.2.2-1 and table 8.1C.2.2-2 for FR1-NTN and FR2-NTN, respectively.

P value for an RLM-RS resource to be measured is defined as

- $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
- $N_{total} / N_{available}$ with $N_{available} > 0$

For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:

- N_{total} is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
- $N_{outside_MG}$ is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
- $N_{available}$ is
  - the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W, if UE does not support *parallelMeasurementWithoutRestriction* and LEO satellites are measured for intra-frequency measurement, and
  - same as $N_{outside_MG}$, otherwise
- T_{L1} is periodicity of the target RLM-RS
- $P_{sharing\ factor} = 3$.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For an FR1-NTN and FR2-NTN serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

Table 8.1C.2.2-1: Evaluation period $T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ for FR1-NTN

Configuration	$T_{Evaluate_out_SSB}$ (ms)	$T_{Evaluate_in_SSB}$ (ms)
no DRX	Max(200, Ceil(10 × P) × T_{SSB})	Max(100, Ceil(5 × P) × T_{SSB})
DRX cycle≤320 ms	Max(200, Ceil(15 × P) × Max(T_{DRX},T_{SSB}))	Max(100, Ceil(7.5 × P) × Max(T_{DRX},T_{SSB}))
DRX cycle>320 ms	Ceil(10 × P) × T_{DRX}	Ceil(5 × P) × T_{DRX}
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.		

Table 8.1C.2.2-2: Evaluation period $T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ for FR2-NTN

Configuration	$T_{Evaluate_out_SSB}$ (ms)	$T_{Evaluate_in_SSB}$ (ms)
no DRX	Max(200, Ceil(20 × P) × T_{SSB})	Max(100, Ceil(5 × P) × T_{SSB})
DRX cycle≤320 ms	Max(200, Ceil(30 × P) × Max(T_{DRX},T_{SSB}))	Max(100, Ceil(7.5 × P) × Max(T_{DRX},T_{SSB}))
DRX cycle>320 ms	Ceil(20 × P) × T_{DRX}	Ceil(5 × P) × T_{DRX}
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.		

8.1C.2.3 Measurement restrictions for SSB based RLM

The UE is required to be capable of measuring SSB for RLM without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following scenarios.

For FR1-NTN and FR2-NTN, when the SSB for RLM is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for RLM without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for RLM without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for RLM and CSI-RS. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

8.1C.3 Requirements for CSI-RS based radio link monitoring

8.1C.3.1 Introduction

The requirements in this clause apply for each CSI-RS based RLM-RS resource configured for PCell, provided that the CSI-RS configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1C.3.2. UE is not expected to perform radio link monitoring measurements on the CSI-RS configured as RLM-RS if the CSI-RS is not in the active TCI state of any CORESET configured in the UE active BWP.

Table 8.1C.3.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8 for FR1-NTN 16 for FR2-NTN
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	4 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	4 dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1C.3.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	4 for FR1-NTN 8 for FR2-NTN
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0 dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.1C.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_out_CSI\text{-}RS}$ period becomes worse than the threshold $Q_{out_CSI\text{-}RS}$ within $T_{Evaluate_out_CSI\text{-}RS}$ evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_in_CSI\text{-}RS}$ period becomes better than the threshold $Q_{in_CSI\text{-}RS}$ within $T_{Evaluate_in_CSI\text{-}RS}$ evaluation period.

- $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ are defined in table 8.1C.3.2-1 for FR1-NTN.
- $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ are defined in table 8.1C.3.2-2 for FR2-NTN.

The requirements of $T_{Evaluate_out_CSI\text{-}RS}$ and $T_{Evaluate_in_CSI\text{-}RS}$ apply provided that the CSI-RS for RLM is not in a resource set configured with repetition ON. The requirements do not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for RLM and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

P value for an RLM-RS resource to be measured is defined as

- $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
- $N_{total} / N_{available}$ with $N_{available} > 0$

For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:

- N_{total} is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
- $N_{outside_MG}$ is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
- $N_{available}$ is
  - the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W, if UE does not support *parallelMeasurementWithoutRestriction* and LEO satellites are measured for intra-frequency measurement, and
  - same as $N_{outside_MG}$, otherwise
- T_{L1} is periodicity of the target RLM-RS
- $P_{sharing\ factor} = 3$.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For an FR1-NTN and FR2-NTN serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

The values of M_{out} and M_{in} used in table 8.1C.3.2-1 are defined as:

- $M_{out} = 20$ and $M_{in} = 10$, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth $\geqslant$ 24 PRBs.

The values of M_{out} and M_{in} used in table 8.1C.3.2-2 are defined as:

- $M_{out} = 40$ and $M_{in} = 10$, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* TS 38.211 [6], clause 7.4.1, set to 3 and over the bandwidth $\geqslant$ 24 PRBs.

Table 8.1C.3.2-1: Evaluation period $T_{Evaluate_out_CSI-RS}$ and $T_{Evaluate_in_CSI-RS}$ for FR1-NTN

Configuration	$T_{Evaluate_out_CSI-RS}$ (ms)	$T_{Evaluate_in_CSI-RS}$ (ms)
no DRX	$Max(200, Ceil(M_{out}×P)×T_{CSI-RS})$	$Max(100, Ceil(M_{in}×P) × T_{CSI-RS})$
DRX ≤ 320 ms	$Max(200, Ceil(1.5×M_{out}×P)× Max(T_{DRX}, T_{CSI-RS}))$	$Max(100, Ceil(1.5×M_{in}×P)× Max(T_{DRX}, T_{CSI-RS}))$
DRX > 320 ms	$Ceil(M_{out}×P) × T_{DRX}$	$Ceil(M_{in}×P) × T_{DRX}$
NOTE: T_{CSI-RS} is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for T_{CSI-RS} equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length.		

Table 8.1C.3.2-2: Evaluation period $T_{Evaluate_out_CSI-RS}$ and $T_{Evaluate_in_CSI-RS}$ for FR2-NTN

Configuration	$T_{Evaluate_out_CSI-RS}$ (ms)	$T_{Evaluate_in_CSI-RS}$ (ms)
no DRX	$Max(200, Ceil(M_{out}×P)×T_{CSI-RS})$	$Max(100, Ceil(M_{in}×P) × T_{CSI-RS})$
DRX ≤ 320 ms	$Max(200, Ceil(1.5×M_{out}×P)× Max(T_{DRX}, T_{CSI-RS}))$	$Max(100, Ceil(1.5×M_{in}×P)× Max(T_{DRX}, T_{CSI-RS}))$
DRX > 320 ms	$Ceil(M_{out}×P) × T_{DRX}$	$Ceil(M_{in}×P) × T_{DRX}$
NOTE: T_{CSI-RS} is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for T_{CSI-RS} equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length.		

8.1C.3.3 Measurement restrictions for CSI-RS based RLM

The UE is required to be capable of measuring CSI-RS for RLM without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following clauses.

For FR1-NTN and FR2-NTN, when the CSI-RS for RLM is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for RLM in the PRBs that overlap with an SSB.

For FR1-NTN and FR2-NTN, when the SSB for RLM, BFD, CBD, or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1-NTN and FR2-NTN, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS for RLM measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for RLM and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR1-NTN and FR2-NTN, when the CSI-RS for RLM is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for RLM without any restriction.

8.1C.4 Minimum requirement at transitions

When the UE transitions between DRX and no DRX or when DRX cycle periodicity changes, for each RLM-RS resource, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation period corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode for each RLM-RS resource. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of RLM resources to a second configuration of RLM resources that is different from the first configuration, for each RLM resource present in the second configuration, for a duration of time equal to the evaluation period corresponding to the second configuration after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first configuration and the second configuration. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second configuration for each RLM resource present in the second configuration. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of active TCI state of the CORESET to a second configuration of active TCI state of the CORESET, for each CSI-RS for RLM present in the second configuration, the UE shall use an evaluation period corresponding to the second configuration from the time of transition. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

8.1C.5 Minimum requirement for UE turning off the transmitter

The transmitter power of the UE in the monitored cell shall be turned off within 40 ms after expiry of T310 timer as specified in TS 38.331 [2].

8.1C.6 Minimum requirement for L1 indication

When the downlink radio link quality on all the configured RLM-RS resources is worse than Q_{out}, layer 1 of the UE shall send an out-of-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the out-of-sync indications as specified in TS 38.331 [2].

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than Q_{in}, layer 1 of the UE shall send an in-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the in-sync indications as specified in TS 38.331 [2].

The out-of-sync and in-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication_interval}$.

When DRX is not used $T_{Indication_interval}$ is max(10 ms, $T_{RLM\text{-}RS,M}$), where $T_{RLM\text{-}RS,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to T_{SSB} specified in clause 8.1C.2 if the RLM-RS resource is SSB, or $T_{CSI\text{-}RS}$ specified in clause 8.1C.3 if the RLM-RS resource is CSI-RS.

In case DRX is used, $T_{Indication_interval}$ is Max(10ms, 1.5 × DRX_cycle_length, 1.5 × $T_{RLM\text{-}RS,M}$)) if DRX_cycle_length is less than or equal to 320ms, and $T_{Indication_interval}$ is DRX_cycle_length if DRX_cycle_length is greater than 320ms. Upon start of T310 timer as specified in TS 38.331 [2], the UE shall monitor the configured RLM-RS resources for recovery using the evaluation period and layer 1 indication interval corresponding to the no DRX mode until the expiry or stop of T310 timer.

8.1C.7 Scheduling availability of UE during radio link monitoring

When the reference signal to be measured for RLM has different subcarrier spacing than PDSCH/PDCCH , there are restrictions on the scheduling availability as described in the following clauses.

8.1C.7.1 Scheduling availability of UE performing radio link monitoring with a same subcarrier spacing as PDSCH/PDCCH on FR1-NTN and FR2-NTN

There are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH on FR1-NTN and FR2-NTN.

8.1C.7.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH on FR1-NTN and FR2-NTN

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for radio link monitoring.

8.1D Radio Link Monitoring for ATG

8.1D.1 Introduction

The requirements in clause 8.1D apply for radio link monitoring on ATG UE.

The UE shall monitor the downlink radio link quality based on the reference signal configured as RLM-RS resource(s) in order to detect the downlink radio link quality of the PCell as specified in TS 38.213 [3]. The configured RLM-RS resources can be all SSBs, or all CSI-RSs, or a mix of SSBs and CSI-RSs. UE is not required to perform RLM outside the active DL BWP.

On each RLM-RS resource, the UE shall estimate the downlink radio link quality and compare it to the thresholds Q_{out} and Q_{in} for the purpose of monitoring downlink radio link quality of the cell.

The threshold Q_{out} is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to the out-of-sync block error rate ($BLER_{out}$) as defined in table 8.1.1-1. For SSB based radio link monitoring, Q_{out_SSB} is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1.2.1-1. For CSI-RS based radio link monitoring, $Q_{out_CSI\text{-}RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1.3.1-1.

The threshold Q_{in} is defined as the level at which the downlink radio link quality can be received with significantly higher reliability than at Q_{out} and shall correspond to the in-sync block error rate ($BLER_{in}$) as defined in table 8.1.1-1. For SSB based radio link monitoring, Q_{in_SSB} is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1.2.1-2. For CSI-RS based radio link monitoring, $Q_{in_CSI\text{-}RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.1.3.1-2.

The out-of-sync block error rate ($BLER_{out}$) and in-sync block error rate ($BLER_{in}$) are determined from the network configuration via parameter *rlmInSyncOutOfSyncThreshold* signalled by higher layers. When UE is not configured with *rlmInSyncOutOfSyncThreshold* from the network, UE determines out-of-sync and in-sync block error rates from Configuration #0 in table 8.1.1-1 by default. All requirements in clause 8.1D are applicable for BLER Configuration #0 in table 8.1.1-1.

Table 8.1D.1-1: Void

UE shall be able to monitor up to N_{RLM} RLM-RS resources of the same or different types in each corresponding carrier frequency range, depending on a maximum number L_{max} of SSBs per half frame according to TS 38.213 [3], where N_{RLM} is specified in table 8.1D.1-2 according TS 38.213 [3], and meet the requirements as specified in clause 8.1D. UE is not required to meet the requirements in clause 8.1D if RLM-RS is not configured and no TCI state for PDCCH is activated.

Table 8.1D.1-2: Maximum number of RLM-RS resources N_{RLM}

Carrier frequency range of PCell	L_{max}	Maximum number of RLM-RS resources, N_{RLM}
FR1, ≤ 3 GHz[Note]	4	2
FR1, > 3 GHz[Note]	8	4
NOTE: For unpaired spectrum operation with Case C - 30 kHz SCS, 3 GHz is replaced by 1.88 GHz, as specified in clause 4.1 in TS 38.213 [3].		

8.1D.2 Requirements for SSB based radio link monitoring

8.1D.2.1 Introduction

The requirements in this clause apply for each SSB based RLM-RS resource configured for PCell, provided that the SSB configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1D.2.2.

Table 8.1D.2.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	4 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	4 dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1D.2.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	4
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.1D.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_out_SSB}$ period becomes worse than the threshold Q_{out_SSB} within $T_{Evaluate_out_SSB}$ evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_in_SSB}$ period becomes better than the threshold Q_{in_SSB} within $T_{Evaluate_in_SSB}$ evaluation period.

$T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ are defined in table 8.1D.2.2-1 for FR1.

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency or inter-frequency measurements, and these measurement gaps are overlapping with some but not all occasions of the SSB; and
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR1 ATG UE with the antenna array on the measured carrier,

- P value for an RLM-RS resource to be measured is defined as
  - $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
  - $N_{total} / N_{available}$ with $N_{available} > 0$
    - For a window W of duration max(T_{L1}, $MGRP_{max}$), where $MGRP_{max}$ is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:
    - N_{total} is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
    - $N_{outside_MG}$ is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
    - -- $N_{available}$ is
      - If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams
        - the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RSs resource occasions for L3 measurements of the same serving cell within the window W,
      - otherwise,
    - the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
    - T_{L1} is periodicity of the target RLM-RS
    - $P_{sharing\ factor} = 3$.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

Table 8.1D.2.2-1: Evaluation period $T_{Evaluate_out_SSB}$ and $T_{Evaluate_in_SSB}$ for FR1

Configuration	$T_{Evaluate_out_SSB}$ (ms)	$T_{Evaluate_in_SSB}$ (ms)
no DRX	Max(200, Ceil(10 × P) × T_{SSB})	Max(100, Ceil(5 × P) × T_{SSB})
DRX cycle≤320 ms	Max(200, Ceil(15 × P) × Max(T_{DRX},T_{SSB}))	Max(100, Ceil(7.5 × P) × Max(T_{DRX},T_{SSB}))
DRX cycle>320 ms	Ceil(10 × P) × T_{DRX}	Ceil(5 × P) × T_{DRX}

NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.

8.1D.2.3 Measurement restrictions for SSB based RLM

The UE is required to be capable of measuring SSB for RLM without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following clauses.

For FR1, when the SSB for RLM is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for RLM without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for RLM without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for RLM and CSI-RS. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

8.1D.3 Requirements for CSI-RS based radio link monitoring

8.1D.3.1 Introduction

The requirements in this clause apply for each CSI-RS based RLM-RS resource configured for PCell, provided that the CSI-RS configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1D.3.2. UE is not expected to perform radio link monitoring measurements on the CSI-RS configured as RLM-RS if the CSI-RS is not in the active TCI state of any CORESET configured in the UE active BWP.

Table 8.1D.3.1-1: Void

Table 8.1D.3.1-2: Void

8.1D.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_out_CSI-RS}$ period becomes worse than the threshold Q_{out_CSI-RS} within $T_{Evaluate_out_CSI-RS}$ evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate_in_CSI-RS}$ period becomes better than the threshold Q_{in_CSI-RS} within $T_{Evaluate_in_CSI-RS}$ evaluation period.

- $T_{Evaluate_out_CSI-RS}$ and $T_{Evaluate_in_CSI-RS}$ are defined in table 8.1D.3.2-1 for FR1.

The requirements of $T_{Evaluate_out_CSI-RS}$ and $T_{Evaluate_in_CSI-RS}$ apply provided that the CSI-RS for RLM is not in a resource set configured with repetition ON. The requirements do not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for RLM and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency or inter-frequency measurements, and these measurement gaps are overlapping with some but not all occasions of the CSI-RS; and
- P = 1, when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR1 ATG UE with the antenna array on the measured carrier,

- P value for an RLM-RS resource to be measured is defined as

$P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$

$N_{total} / N_{available}$ with $N_{available} > 0$

- For a window W of duration max(T_{L1}, $MGRP_{max}$), where $MGRP_{max}$ is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:
- N_{total} is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
- $N_{outside_MG}$ is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
- $N_{available}$ is
  - If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams
    - the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RSs resource occasions for L3 measurements of the same serving cell within the window W,
  - otherwise,
    - the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
- T_{L1} is periodicity of the target RLM-RS
- $P_{sharing\ factor} = 3$.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

The values of M_{out} and M_{in} used in table 8.1D.3.2-1 are defined as:

- $M_{out} = 20$ and $M_{in} = 10$, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth $\geqslant$ 24 PRBs.

Table 8.1D.3.2-1: Evaluation period $T_{Evaluate_out_CSI-RS}$ and $T_{Evaluate_in_CSI-RS}$ for FR1

Configuration	$T_{Evaluate_out_CSI-RS}$ (ms)	$T_{Evaluate_in_CSI-RS}$ (ms)
no DRX	Max(200, Ceil(M_{out}×P)×T_{CSI-RS})	Max(100, Ceil(M_{in}×P) × T_{CSI-RS})
DRX ≤ 320 ms	Max(200, Ceil(1.5×M_{out}×P)× Max(T_{DRX}, T_{CSI-RS}))	Max(100, Ceil(1.5×M_{in}×P)× Max(T_{DRX}, T_{CSI-RS}))
DRX > 320 ms	Ceil(M_{out}×P) × T_{DRX}	Ceil(M_{in}×P) × T_{DRX}
NOTE: T_{CSI-RS} is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for T_{CSI-RS} equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length.		

8.1D.3.3 Measurement restrictions for CSI-RS based RLM

The UE is required to be capable of measuring CSI-RS for RLM without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following clauses.

For FR1, when the CSI-RS for RLM is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for RLM in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD, or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS for RLM measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for RLM and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR1, when the CSI-RS for RLM is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for RLM without any restriction.

8.1D.4 Minimum requirement at transitions

The requirement in clause 8.1.4 shall apply.

8.1D.5 Minimum requirement for UE turning off the transmitter

The requirement in clause 8.1.5 shall apply.

8.1D.6 Minimum requirement for L1 indication

The requirements in clause 8.1.6 shall apply only for UE in NR SA operation mode.

8.1D.7 Scheduling availability of UE during radio link monitoring

When the reference signal to be measured for RLM has different subcarrier spacing than PDSCH/PDCCH, there are restrictions on the scheduling availability as described in the following clauses.

8.1D.7.1 Scheduling availability of UE performing radio link monitoring with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH on FR1.

8.1D.7.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for radio link monitoring.

When intra-band carrier aggregation in FR1 is performed, the scheduling restrictions on FR1 serving PCell applies to all serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols.

When inter-band carrier aggregation within FR1 is performed, there are no scheduling restrictions on FR1 serving cell(s) in the bands due to radio link monitoring performed on FR1 serving PCell in different bands.

8.1E Radio Link Monitoring for RedCap UE with Satellite Access

8.1E.1 Introduction

The requirements in clause 8.1C.1 shall apply for RedCap UE except that:

- clause 8.1C is replaced with 8.1E, and

- table 8.1C.1-2 is replaced with 8.1E.1-2, and

- table 8.1C.2.1-1 is replaced with 8.1E.2.1-1, and
- table 8.1C.2.1-2 is replaced with 8.1E.2.1-2, and
- table 8.1C.3.1-1 is replaced with 8.1E.3.1-1, and
- table 8.1C.3.1-2 is replaced with 8.1E.3.1-2, and
- Maximum number of RLM-RS resources N_{RLM} as specified in Table 8.1E.1-2.

Table 8.1E.1-2: Maximum number of RLM-RS resources N_{RLM}

Carrier frequency range of PCell	L_{max}	Maximum number of RLM-RS resources, N_{RLM}
FR1, ≤ 3 GHz[Note]	4	2
FR1, > 3 GHz[Note]	8	4
NOTE: For unpaired spectrum operation with Case C - 30 kHz SCS, 3 GHz is replaced by 1.88 GHz, as specified in clause 4.1 in TS 38.213 [3].		

8.1E.2 Requirements for SSB based radio link monitoring

8.1E.2.1 Introduction

The requirements in this clause apply for each SSB based RLM-RS resource configured for PCell, provided that the SSB configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1E.2.2.

Table 8.1E.2.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	16; for RedCap UE with 1Rx branch. 8; for RedCap UE with 2Rx branches.
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	4 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	4 dB
Bandwidth (PRBs)	48; for RedCap UE with 1Rx branch. 24; for RedCap UE with 2Rx branches.
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1E.2.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8; for RedCap UE with 1Rx branch. 4; for RedCap UE with 2Rx branches.
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	48; for RedCap UE with 1Rx branch. 24; for RedCap UE with 2Rx branches.
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.1E.2.2 Minimum requirement

The requirements in clause 8.1C.2.2 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements defined in clause 8.1C.2.2 for FR1 shall apply except that:

- $T_{Evaluate_BFD_SSB_RedCap}$ as defined in table 8.1E.2.2-1 for FR1.

Table 8.1E.2.2-1: Evaluation period $T_{Evaluate_out_SSB,RedCap}$ and $T_{Evaluate_in_SSB,RedCap}$ 1Rx RedCap UE

Configuration	$T_{Evaluate_out_SSB,RedCap}$ (ms)	$T_{Evaluate_in_SSB,RedCap}$ (ms)
no DRX	$\text{Max}(400, \text{Ceil}(20 \times P) \times T_{SSB})$	$\text{Max}(100, \text{Ceil}(5 \times P) \times T_{SSB})$
DRX cycle≤320 ms	$\text{Max}(400, \text{Ceil}(30 \times P) \times \text{Max}(T_{DRX}, T_{SSB}))$	$\text{Max}(100, \text{Ceil}(7.5 \times P) \times \text{Max}(T_{DRX}, T_{SSB}))$
DRX cycle>320 ms	$\text{Ceil}(20 \times P) \times T_{DRX}$	$\text{Ceil}(5 \times P) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.		

8.1E.2.3 Measurement restrictions for SSB based RLM

The requirements for FR1 in clause 8.1C.2.3 shall apply.

8.1E.3 Requirements for CSI-RS based radio link monitoring

8.1E.3.1 Introduction

The requirements in this clause apply for each CSI-RS based RLM-RS resource configured for PCell, provided that the CSI-RS configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1E.3.2.

Table 8.1E.3.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	16; for RedCap UE with 1Rx branch. 8; for RedCap UE with 2Rx branches.
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	4 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	4 dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1E.3.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8; for RedCap UE with 1Rx branch. 4; for RedCap UE with 2Rx branches.
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0 dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.1E.3.2 Minimum requirement

The requirements in clause 8.1C.3.2 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements defined in clause 8.1C.3.2 for FR1 shall apply except that:

- $T_{Evaluate_BFD_SSB_RedCap}$ as defined in table 8.1E.3.2-1 for FR1.

Table 8.1E.3.2-1: Evaluation period $T_{Evaluate_out_CSI-RS,RedCap}$ and $T_{Evaluate_in_CSI-RS,RedCap}$ 1Rx RedCap UE

Configuration	$T_{Evaluate_out_CSI-RS,RedCap}$ (ms)	$T_{Evaluate_in_CSI-RS,RedCap}$ (ms)
no DRX	$Max(400, Ceil(M_{out,RedCap} \times P) \times T_{CSI-RS})$	$Max(100, Ceil(M_{in,RedCap} \times P) \times T_{CSI-RS})$
DRX ≤ 320 ms	$Max(400, Ceil(1.5 \times M_{out,RedCap} \times P) \times Max(T_{DRX}, T_{CSI-RS}))$	$Max(100, Ceil(1.5 \times M_{in,RedCap} \times P) \times Max(T_{DRX}, T_{CSI-RS}))$
DRX > 320 ms	$Ceil(M_{out,RedCap} \times P) \times T_{DRX}$	$Ceil(M_{in,RedCap} \times P) \times T_{DRX}$
NOTE: T_{CSI-RS} is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for T_{CSI-RS} equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length.		

For HD-FDD UE indicating *CollisionHandlingOfHDFDDOperation*, the requirements in clause 8.1E.3.2 shall apply, provided that the following conditions are met:

there is no collision between the CSI-RS resources for RLM measurements and UL transmission when network indicates *ntn-PrioritizeUl-semiStatichalfDuplexRedCapcollision*, or

in case of collision between the CSI-RS resources for RLM measurements and UL transmission except PRACH, and *ntn-PrioritizeUl-semiStatichalfDuplexRedCapcollision* is not indicated by network.

there is no collision between the CSI-RS resources for RLM measurements and PRACH.

8.1E.3.3 Measurement restrictions for CSI-RS based RLM

The requirements for FR1 in clause 8.1C.3.3 shall apply.

8.1E.4 Minimum requirement at transitions

The requirements in clause 8.1C.4 shall apply.

8.1E.5 Minimum requirement for UE turning off the transmitter

The requirements in clause 8.1C.5 shall apply.

8.1E.6 Minimum requirement for L1 indication

The requirements in clause 8.1C.6 shall apply.

In addition, for HD-FDD UE, the conditions and requirements for $T_{Indication_interval_BFD_Redcap}$ apply given that for each BFD-RS configuration, at least one BFD-RS sample must fall with DL occasion within an indication period.

8.1E.7 Scheduling availability of UE during radio link monitoring

When the reference signal to be measured for RLM has different subcarrier spacing than PDSCH/PDCCH , there are restrictions on the scheduling availability as described in the following clauses.

8.1E.7.1 Scheduling availability of UE performing radio link monitoring with a same subcarrier spacing as PDSCH/PDCCH

For FD-FDD and TDD RedCap UEs, there are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH.

For HD-FDD UE, scheduling restrictions apply for transmission on PUCCH/PUSCH/SRS during radio link monitoring,

except when UE indicates *CollisionHandlingOfHDFDDOperation* and is indicated that UL transmission is prioritized over RLM measurements via *ntn-PrioritizeUl-semiStatichalfDuplexRedCapcollision* in case of collision between CSI-RS resources to be measured and UL transmission.

8.1E.7.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for radio link monitoring.

8.2 Interruption

8.2.1 EN-DC Interruption

8.2.1.1 Introduction

This clause contains the requirements related to the interruptions on PSCell, and SCell, when

- E-UTRA PCell transitions between active and non-active during DRX, or
- E-UTRA PCell transitions from non-DRX to DRX, or
- E-UTRA SCell in MCG or SCell in SCG is added or released, or
- E-UTRA SCell in MCG or SCell(s) in SCG is activated or deactivated, or
- measurements on SCC with deactivated SCell in either E-UTRA MCG or NR SCG, or
- a supplementary UL carrier or an UL carrier is configured or de-configured, or
- UL/DL active BWP is switched on PSCell or SCell in SCG, or
- E-UTRA SCell in MCG or SCell(s) in SCG is directly activated and hibernated, or
- E-UTRA SCell in MCG is hibernated, or
- Multiple SCells in SCG are activated or deactivated, or
- SCell dormancy switches, or
- CQI/RRM measurement happens during SCell dormancy, or
- UE-specific CBW is changed on PSCell or SCell in SCG, or
- CGI reading of an NR neighbour cell with autonomous gaps, or
- CGI reading of an E-UTRA neighbour cell with autonomous gaps, or
- NR SRS carrier based switching, or
- E-UTRA SRS carrier based switching, or
- NR SRS antenna port switching, or
- UE dynamic Tx switches between two uplink carriers, or
- SCell in SCG is activated based on aperiodic CSI-RS.

The requirements shall apply for E-UTRA-NR-DC with an E-UTRA PCell.

This clause contains interruptions where victim cell is PSCell or SCell belonging to SCG. Requirements for interruptions requirements when the victim cell is E-UTRA PCell or E-UTRA SCell belonging to MCG are specified in TS 36.133 [15].

For a UE which does not support per-FR measurement gaps, interruptions to the PSCell or activated SCG SCells may be caused by EUTRA PCell, EUTRA SCells or SCells on any frequency range. For UE which support per-FR gaps, interruptions to the PSCell or activated SCG SCells may be caused by EUTRA PCell, EUTRA SCells or SCells on the same frequency range as the victim cell.

8.2.1.2 Requirements

8.2.1.2.1 Interruptions at transitions between active and non-active during DRX

Interruption on PSCell and the activated SCell if configured due to E-UTRA PCell transitions between active and non-active during DRX when PSCell or SCell is in non-DRX are allowed with up to 1% probability of missed ACK/NACK when the configured E-UTRA PCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured E-UTRA PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slots as defined in table 8.2.1.2.1-1.

Table 8.2.1.2.1-1: Interruption length X at transition between active and non-active during DRX

μ	NR Slot length (ms)	Interruption length X (slots)	
		Sync	Async
0	1	1	2
1	0.5	1	2
2	0.25	3	
3	0.125	5	

When both E-UTRA PCell and PSCell are in DRX, no interruption is allowed.

8.2.1.2.2 Interruptions at transitions from non-DRX to DRX

Interruption on PSCell and the activated SCell if configured due to E-UTRA PCell transitions from non-DRX to DRX when PSCell or SCell is in non-DRX shall not exceed X slots as defined in table 8.2.1.2.1-1.

When PSCell and the activated SCell are in DRX, no interruption due to E-UTRA PCell transitions from non-DRX to DRX is allowed.

8.2.1.2.3 Interruptions at SCell addition/release

The requirements in this clause shall apply for the UE configured with PSCell.

When one E-UTRA SCell in MCG is added or released, the UE is allowed an interruption on any active serving cell in SCG:

- of up to X1 slots, if the active serving cell is not in the same band as any of the E-UTRA SCells being added or released, or
- of up to X1 slots, if the active serving cell is in the band overlapping or partially overlapping with the E-UTRA SCell being added or released and UE not supporting *requirementTypeIndication-r18* indicates it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is not provided with *nonCollocatedTypeMRDC-r18*, or
- of up to max{Y1 slots + $T_{SMTC_duration}$, 5ms}, if the active serving cells are in the same band or in the band overlapping or partially overlapping with the E-UTRA SCells being added or released, and UE does not indicates it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE capable of *requirementTypeIndication-r18* indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and provided with *nonCollocatedTypeMRDC-r18*, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being added or released are available in the same slot, where $T_{SMTC_duration}$ is the longest SMTC duration among all above active serving cells in SCG;

- if the active serving cell is in the band overlapping or partially overlapping with the E-UTRA SCell being added or released,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for all corresponding serving cells, in case of TDD-TDD inter-band (NG) EN-DC with overlapping or partially overlapping bands

2> if UE supporting *requirementTypeIndication-r18* is capable of *interBandMRDC-WithOverlapDL-Bands-r19* on this band pair

3> if *nonCollocatedTypeMRDC-v19xy* is presented with "type 4"

4> of up to X1 slots

3>else if *nonCollocatedTypeMRDC-v19xy* is presented with "type 1"

4> of up to max{Y1 slots + $T_{SMTC_duration}$, 5ms}

3>else if *nonCollocatedTypeMRDC-v19xy* is not provided

4> of up to max{Y1 slots + $T_{SMTC_duration}$, 5ms}

2> else if UE not supporting *requirementTypeIndication-r18* indicates it is capable of *interBandMRDC-WithOverlapDL-Bands-r19* on this band pair

3> of up to X1 slots

1> when UE is configured with maxMIMO-Layers with value equal to 2 for all corresponding serving cells, in case of TDD-TDD inter-band (NG) EN-DC with overlapping or partially overlapping bands

2> if *nonCollocatedTypeMRDC-r18* is not provided

3> of up to X1 slots

2> else

3> of up to max{Y1 slots + $T_{SMTC_duration}$, 5ms},

Where X1 and Y1 are specified in table 8.2.1.2.3-1.

When one SCell in SCG is added or released, the UE is allowed an interruption on any active serving cell in SCG:

- of up to X1 slot, if the active serving cell and the SCell being added or released are in a FR1 band pair or in a FR1+FR2 band pair.

- of up to X1 slots, if the active serving cell and the SCell being added or released are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair

- of up to X1 slots, if the active serving cell is non-contiguous to the SCell being added or released in the same FR1 band and UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided.

or

- of up to Y1 slots + $T_{SMTC_duration}$, if the active serving cells are contiguous to any of the SCells being added or released in the same FR1 band, or if the active serving cells are non-contiguous to any of the SCells being added or released in the same FR1 band and UE is not capable of *intraBandNR-CA-non-collocated-r18* or UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is provided, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot,

- if the active serving cell is non-contiguous to the SCell being added or released in the same FR1 band, and UE is capable of *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for all corresponding serving cells, in case of TDD-TDD intra-band NR-CA

2> if *nonCollocatedTypeNR-CA-v19xy* is presented with "type 4"

3> of up to X1 slots

2> else if *nonCollocatedTypeNR-CA-v19xy* is presented with "type 1"

3> of up to Y1 slots + $T_{SMTC_duration}$

2> else if *nonCollocatedTypeNR-CA-v19xy* is not provided

3> of up to Y1 slots + $T_{SMTC_duration}$

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA for all corresponding serving cells, in case of TDD-TDD intra-band NR-CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> of up to X1 slots

2> else

3> of up to Y1 slots + $T_{SMTC_duration}$

where, $T_{SMTC_duration}$ is

- the longest SMTC duration among all above active serving cells in SCG and the SCell being added when one SCell is added. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being added, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC\ duration}$ for the SCell being added is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being added. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being added, $T_{SMTC\ duration}$ for the SCell being added is 0 ms;
- the longest SMTC duration among all above active serving cells in SCG when one SCell is released.

- of up to Y1 slots + $T_{SMTC_duration}$ if the active serving cells are in the same FR2 band as any of the SCells being added or released, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot, where, $T_{SMTC_duration}$ is
  - the longest SMTC duration among all above active serving cells in SCG and the SCell being added when one SCell is added. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being added, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC\ duration}$ for the SCell being added is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being added. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being added, $T_{SMTC\ duration}$ for the SCell being added is 0 ms;
  - the longest SMTC duration among all above active serving cells in SCG when one SCell is released.

Where X1 and Y1 are specified in table 8.2.1.2.3-2.

For UE supporting On-demand SSB operation, when one OD-SSB SCell in SCG is added or released, no interruption is allowed on any active serving cell in SCG before OD-SSB is activated on the SCell wherein there is only OD-SSB transmission without the first SSB transmission.

Table 8.2.1.2.3-1: Interruption length X1 and Y1 at E-UTRA SCell addition/Release

μ	NR Slot length (ms)	Interruption length X1 (slots)		Interruption length Y1 (slots)	
		Sync	Async	Sync	Async
0	1	1	2	1	2
1	0.5	2	3	2	3
2	0.25	5		4	5
3	0.125	9		N/A	- N/A

Table 8.2.1.2.3-2: Interruption length X1 and Y1 at SCell addition/Release

μ	NR Slot length	Interruption length X1 (slots)	Interruption length Y1 (slots)

	(ms) of victim cell			
0	1	1		1
1	0.5	2		2
2	0.25	Both aggressor cell and victim cell are on FR2	4	4
		Either aggressor cell or victim cell is on FR1	5	
3	0.125	Aggressor cell is on FR2	8	8
		Aggressor cell is on FR1	9	

8.2.1.2.4 Interruptions at SCell activation/deactivation

The requirements in this clause shall apply for the UE configured with PSCell and one SCell.

When one E-UTRA SCell in MCG is activated from deactivated or dormant state, or deactivated from activated or dormant state, the UE is allowed an interruption on any active serving cell in SCG:

- of up to X2 slots, if the active serving cell is not in the same band as any of the E-UTRA SCells being activated or deactivated, or

- of up to X2 slots, if the active serving cell is in the band overlapping or partially overlapping with the E-UTRA SCell being activated or deactivated and UE not supporting *requirementTypeIndication-r18* indicates it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and not provided with *nonCollocatedTypeMRDC-r18*, or

- of up to max{Y2 slots + $T_{SMTC_duration}$, 5ms}, if the active serving cells are in the same band or in the band overlapping or partially overlapping with the E-UTRA SCells being activated or deactivated, and UE does not indicate it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is provided with *nonCollocatedTypeMRDC-r18*, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being activated or deactivated are available in the same slot, where $T_{SMTC_duration}$ is the longest SMTC duration among all above active serving cells in SCG.

- if the active serving cell is in the band overlapping or partially overlapping with the E-UTRA SCell being added or released,

  1> when UE is configured with maxMIMO-Layers with value equal to 4 for all corresponding serving cells, in case of TDD-TDD inter-band (NG) EN-DC with overlapping or partially overlapping bands

    2> if UE supporting *requirementTypeIndication-r18* is capable of *interBandMRDC-WithOverlapDL-Bands-r19*on this band pair

      3> if *nonCollocatedTypeMRDC-v19xy* is presented with “type 4”

        4> of up to X2 slots

      3> else if *nonCollocatedTypeMRDC-v19xy* is presented with “type 1”

        4> of up to max{Y2 slots + $T_{SMTC_duration}$, 5ms}

      3> else if *nonCollocatedTypeMRDC-v19xy* is not provided

        4> of up to max{Y2 slots + $T_{SMTC_duration}$, 5ms}

    2> else if UE not supporting *requirementTypeIndication-r18* indicates it is capable of *interBandMRDC-WithOverlapDL-Bands-r19* on this band pair

      3> of up to X2 slots

  1> when UE is configured with maxMIMO-Layers with value equal to 2 for all corresponding serving cells, in case of TDD-TDD inter-band (NG) EN-DC with overlapping or partially overlapping bands

2> if *nonCollocatedTypeMRDC-r18* is not provided

3> of up to X2 slots

2> else

3> of up to max{Y2 slots + $T_{SMTC_duration}$, 5ms}Where X2 and Y2 are specified in table 8.2.1.2.4-1.

When one SCell in SCG is activated or deactivated, the UE is allowed an interruption on any active serving cell in SCG:

- of up to X2 slots, if the active serving cell and the SCell being activated or deactivated are in a FR1 band pair or in a FR1+FR2 band pair.
- of up to X2 slots, if the active serving cells and the SCells being activated or deactivated are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.
- of up to X2 slots, if the active serving cell is non-contiguous to the SCell being activated or deactivated in the same FR1 band and UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided.

or

- of up to Y2 slots + $T_{SMTC_duration}$, if the active serving cells are contiguous to any of the SCells being activated or deactivated in the same FR1 band, or if the active serving cells are non-contiguous to any of the SCells being activated or deactivated in the same FR1 band and UE is not capable of *intraBandNR-CA-non-collocated-r18* or UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is provided, provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot,
- if the active serving cell is non-contiguous to the SCell being activated or deactivated in the same FR1 band, and UE is capable of *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for all corresponding serving cells, in case of TDD-TDD intra-band NR-CA

2> if *nonCollocatedTypeMRDC-v19xy* is presented with “type 4”

3> of up to X1 slots

2> else if *nonCollocatedTypeMRDC-v19xy* is presented with “type 1”

3> of up to Y1 slots + $T_{SMTC_duration}$

2> else if *nonCollocatedTypeMRDC-v19xy* is not provided

3> of up to Y1 slots + $T_{SMTC_duration}$

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA for all corresponding serving cells, in case of TDD-TDD intra-band NR-CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> of up to X1 slots

2> else

3> of up to Y1 slots + $T_{SMTC_duration}$

,where, $T_{SMTC_duration}$ is

- the longest SMTC duration among all above active serving cells in SCG and the SCell being activated when one SCell is activated. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being activated, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC\ duration}$ for the SCell being activated is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being activated. If neither SSB configuration (*absoluteFrequencySSB*) nor

SMTC configuration is provided for the SCell being activated, $T_{SMTC\ duration}$ for the SCell being activated is 0ms;

- the longest SMTC duration among all above active serving cells in SCG when one SCell is deactivated.

- of up to Y2 slots + $T_{SMTC_duration}$ if the active serving cells are in the same FR2 band as any of the SCells being activated or deactivated, provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot, where, $T_{SMTC_duration}$ is

- the longest SMTC duration among all above active serving cells in SCG and the SCell being activated when one SCell is activated. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being activated, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC\ duration}$ for the SCell being activated is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being activated. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being activated, $T_{SMTC\ duration}$ for the SCell being activated is 0ms;

  - the longest SMTC duration among all above active serving cells in SCG when one SCell is deactivated.

Where X2 and Y2 are specified in table 8.2.1.2.4-2.

For UE supporting *On-demand SSB operation*, when one OD-SSB SCell in SCG is activated or deactivated, the requirements in this clause shall apply provided OD-SSB is activated on the SCell or OD-SSB activation/deactivation command and SCell activation/deactivation command are received in the same MAC command.

Table 8.2.1.2.4-1: Interruption length X2 and Y2 at E-UTRA SCell activation/deactivation

μ	NR Slot length (ms)	nterruption length X2 (slots)		Interruption length Y2 (slots)	
		Sync	Async	Sync	Async
0	1	1	2	1	2
1	0.5	1	2	1	2
2	0.25	3		2	3
3	0.125	5		N/A	N/A

Table 8.2.1.2.4-2: Interruption length X2 and Y2 at SCell activation/deactivation

μ	NR Slot length (ms) of victim cell	Interruption length X2 (slots)		Interruption length Y2 (slots)
0	1	1		1
1	0.5	1		1
2	0.25	Both aggressor cell and victim cell are on FR2	2	2
		Either aggressor cell or victim cell is on FR1	3	
3	0.125	Aggressor cell is on FR2	4	4
		Aggressor cell is on FR1	5	

8.2.1.2.5 Interruptions during measurements on SCC

8.2.1.2.5.1 Interruptions during measurements on deactivated NR SCC

Interruption on PSCell and other activated NR SCell(s) during measurement on the deactivated NR SCC shall meet requirements in clause 8.2.2.2.3, where the term PCell in clause 8.2.2.2.3 shall be deemed to be replaced with PSCell.

8.2.1.2.5.2 Interruptions during measurements on deactivated E-UTRAN SCC

When one E-UTRA SCell in MCG is deactivated, the UE is allowed due to measurements on the E-UTRA SCC with the deactivated E-UTRA SCell:

- an interruption on PSCell or any activated SCell with up to 0.5 % probability of missed ACK/NACK when any of the configured *measCycleSCell* [15] for the deactivated E-UTRA SCells is 640 ms or longer.

- an interruption on PSCell or any activated SCell with up to 0.5 % probability of missed ACK/NACK regardless of the configured *measCycleSCell* [15] for the deactivated E-UTRA SCells if indicated by the network using IE *allowInterruptions* [15].

Each interruption shall not exceed

- X3 slots, if the PSCell or activated SCell is not in the same band as the E-UTRA deactivated SCC being measured, or

- X3 slots, if the PSCell or activated SCell is in the band overlapping or partially overlapping with the E-UTRA deactivated SCC being measured, and UE not supporting *requirementTypeIndication-r18* indicates it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is not provided with *nonCollocatedTypeMRDC-r18*, or

- Y3 slots + SMTC duration, if the PSCell or activated SCell is in the same band or in the band overlapping or partially overlapping with the E-UTRA deactivated SCC being measured, and UE does not indicate it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is provided with *nonCollocatedTypeMRDC-r18*, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA deactivated SCC being measured are available in the same slot.

Table 8.2.1.2.5.2-1: Interruption length X3 and Y3 at measurements on deactivated E-UTRA SCC

μ	NR Slot length (ms)	Interruption length X3 (slots)		Interruption length Y3 (slots)	
		Sync	Async	Sync	Async
0	1	1	2	1	2
1	0.5	1	2	1	2
2	0.25	3		2	3
3	0.125	5		N/A	N/A

8.2.1.2.5.3 Interruptions during CQI measurements on dormant E-UTRAN SCell

When one E-UTRA SCell in MCG is dormant, the UE is allowed due to CQI measurements on the dormant E-UTRA SCell:

- an interruption on PSCell or any activated SCell with up to 0.5 % probability of missed ACK/NACK.

Each interruption shall not exceed

- X3 slots, if the PSCell or activated SCell is not in the same band as the E-UTRA dormant SCell being measured, or

- X3 slots, if the PSCell or activated SCell is in the band overlapping or partially overlapping with the E-UTRA dormant SCC being measured, and UE not supporting *requirementTypeIndication-r18* indicates it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is not provided with *nonCollocatedTypeMRDC-r18*, or

- Y3 slots + SMTC duration, if the PSCell or activated SCell is in the same band or in the band overlapping or partially overlapping with the E-UTRA dormant SCell being measured, and UE does not report *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* indicates that it is capable of *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is provided with *nonCollocatedTypeMRDC-r18*, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA dormant SCell being measured are available in the same slot.

Where X3 and Y3 are defined in table 8.2.1.2.5.2-1.

8.2.1.2.5.4 Interruptions during RRM measurements on dormant E-UTRAN SCC

When one E-UTRA SCell in MCG is dormant, the UE is allowed due to RRM measurements on the E-UTRA SCC with the dormant E-UTRA SCell:

- an interruption on PSCell or any activated SCell with up to 0.5 % probability of missed ACK/NACK.

Each interruption shall not exceed

- X3 slots, if the PSCell or activated SCell is not in the same band as the E-UTRA dormant SCC being measured, or
- X3 slots, if the PSCell or activated SCell is in the band overlapping or partially overlapping with the E-UTRA dormant SCC being measured, and UE not supporting *requirementTypeIndication-r18* reports *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* reports *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is not provided with *nonCollocatedTypeMRDC-r18*, or
- Y3 slots + SMTC duration, if the PSCell or activated SCell is in the same band or in the band overlapping or partially overlapping with the E-UTRA dormant SCC being measured, and UE does not report *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* reports *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is provided with *nonCollocatedTypeMRDC-r18*, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA dormant SCC being measured are available in the same slot.

Where X3 and Y3 are defined in table 8.2.1.2.5.2-1.

8.2.1.2.6 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NR non-standalone operation as defined in TS 38.331 [2].

When an UL carrier or supplementary UL carrier is configured or de-configured, an interruption of up to X4 slots, is allowed during the RRC reconfiguration procedure [2] on E-UTRA PCell, all activated E-UTRA SCells, PSCell and all activated SCells within the same FR as the reconfigured uplink carrier. The interruption is for both uplink and downlink of E-UTRA PCell, all activated E-UTRA SCells, PSCell and all activated SCells within the same FR as the configured or de-configured UL.

Table 8.2.1.2.6-1: Interruption length X4 at UL carrier RRC reconfiguration

μ	NR Slot length (ms)	Interruption length X4 (slots)	
		Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	
3	0.125	9	

8.2.1.2.7 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch, timer-based BWP switch or UL BWP switch triggered by consistent uplink CCA failures in this clause apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this clause apply for each BWP switch.

When UE receives a DCI indicating UE to switch its active BWP involving changes in any of the parameters listed in table 8.2.1.2.7-2, the UE is allowed to cause interruption of up to X slots to other active serving cells if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in table 8.2.1.2.7-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption

of up to X slots to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in table 8.2.1.2.7-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay $T_{MultipleBWPswitchDelay}$ +Y as defined in clause 8.6.2A.1 when BWP switch occurs on multiple CCs. Interruptions are not allowed during BWP switch involving any other parameter change.

When a BWP timer *bwp-InactivityTimer* defined in TS 38.331 [2] expires, UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in table 8.2.1.2.7-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in table 8.2.1.2.7-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slots to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in table 8.2.1.2.7-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay $T_{MultipleBWPswitchDelay}$ as defined in clause 8.6.2B.1 when BWP switch occurs on multiple CCs simultaneously or $T_{MultipleBWPswitchDelayTotal}$ as defined in clause 8.6.2B.2 when BWP switch occurs on multiple CCs over partially overlapping time period. Interruptions are not allowed during BWP switch involving any other parameter change.

When UE receives an RRC reconfiguration that only requests UE to switch its active BWP on one single CC, the UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in table 8.2.1.2.7-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in table 8.2.1.2.7-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slots to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in table 8.2.1.2.7-1. The interruption is only allowed within the delay $T_{RRCprocessingDelay}$ + $T_{BWPswitchDelayRRC}$ defined in clause 8.6.3 when BWP switch occurs on a single CC. The interruption is only allowed within the delay $T_{RRCprocessingDelay}$ + $T_{BWPswitchDelayRRC}$ + D_{RRC}*(N-1) as defined in clause 8.6.3A when BWP switch occurs on multiple CCs.

When UL BWP switch is triggered by consistent uplink CCA failures [7], the UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its active UL BWP involving changes in any of the parameters listed in table 8.2.1.2.7-2 if the UE is not capable of per-FR gap, or if the UL BWP switching involves SCS changing. When the UL BWP switch imposes changes in any of the parameters listed in table 8.2.1.2.7-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slots to other active serving cells in the same frequency range wherein the UE is performing UL BWP switching. X is defined in table 8.2.1.2.7-1. The starting time of interruption is only allowed within the UL BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2. Interruptions are not allowed during UL BWP switch involving other parameter change.

Table 8.2.1.2.7-1: interruption length X

μ	NR Slot length (ms)	Interruption length X (slots)
0	1	1
1	0.5	1
2	0.25	3
3	0.125	5
NOTE 1: void.		

Table 8.2.1.2.7-2: Parameters which cause interruption other than SCS

Parameters	Comment
locationAndBandwidth	From TS 38.331 [2]
nrofSRS-Ports	
maxMIMO-Layers-r16	

8.2.1.2.8 Interruptions at direct SCell activation and hibernation

8.2.1.2.8.1 Interruptions during direct SCell activation and hibernation of E-UTRA SCell

When one E-UTRA SCell in MCG is directly activated and hibernated, the UE is allowed an interruption on any active serving cell in SCG:

- of up to X1 slots, if the active serving cell is not in the same band as any of the E-UTRA SCells being directly activated or hibernated, or

- of up to X1 slots, if the active serving cell is in the band overlapping or partially overlapping with any of the E-UTRA SCells being directly activated or hibernated, and UE not supporting *requirementTypeIndication-r18* reports *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE capable of *requirementTypeIndication-r18* reports *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is not provided with *nonCollocatedTypeMRDC-r18*, or

  - of up to max{Y1 slots + $T_{SMTC_duration}$, 5ms} if the active serving cells are in the same band or in the band overlapping or partially overlapping with any of the E-UTRA SCells being directly activated or hibernated, and UE does not report *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* reports *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is provided with *nonCollocatedTypeMRDC-r18*, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being directly activated or hibernated are available in the same slot, where $T_{SMTC_duration}$ is the longest SMTC duration among all above active serving cells in MCG Where X1 and Y1 are specified in table 8.2.1.2.3-1.

8.2.1.2.8.2 Interruptions during direct SCell activation

When one or multiple SCell(s) in SCG are directly activated at SCell addition, the UE is allowed an interruption on any active serving cell in SCG:

- of up to X1 slots, if the active serving cell is not in the same band as the SCell being directly activated, or

- of up to max{Y1 slots + $T_{SMTC_duration}$, 5ms} if the active serving cells are in the same band as the SCell being directly activated, provided the cell specific reference signals from the active serving cells and the SCell being directly activated are available in the same slot, where $T_{SMTC_duration}$ is the longest SMTC duration among all above active serving cells in SCG.

  Where X1 and Y1 are specified in table 8.2.1.2.3-2.

8.2.1.2.9 Interruptions at SCell hibernation

When one E-UTRA SCell in MCG is hibernated, the UE is allowed an interruption on any active serving cell in SCG:

- of up to X2 slots, if the active serving cell is not in the same band as any of the E-UTRA SCells being hibernated, or

- of up to X2 slots, if the active serving cell is in the band overlapping or partially overlapping with any of the E-UTRA SCells being hibernated, and UE not supporting *requirementTypeIndication-r18* reports *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* reports *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is not provided with *nonCollocatedTypeMRDC-r18*, or

  - of up to max{Y2 slots + $T_{SMTC_duration}$, 5ms}, if the active serving cells are in the same band or in the band overlapping or partially overlapping with any of the E-UTRA SCells being hibernated, and UE does not report *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair or UE supporting *requirementTypeIndication-r18* reports *interBandMRDC-WithOverlapDL-Bands-r16* on this band pair and is provided with *nonCollocatedTypeMRDC-r18*, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being hibernated are available in the same slot.Where X2 and Y2 are specified in table 8.2.1.2.4-1.

8.2.1.2.10 Interruptions at SCell activation/deactivation with multiple downlink SCells

The requirements in this clause shall apply for the UE configured with PSCell and up to 6 downlink SCell(s).

When multiple SCells in SCG are activated or deactivated by one single MAC CE command, the UE is allowed an interruption on any serving cell in SCG as specified in clause 8.2.1.2.4.

8.2.1.2.11 Interruptions due to UE-specific CBW change

When UE receives an RRC reconfiguration that changes *offsetToCarrier* or *carrierBandwidth*, the UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its CBW. X is defined in table 8.2.1.2.11-1. The interruption is only allowed within the delay $T_{RRCprocessingDelay} + T_{CBWchangeDelayRRC}$ defined in clause 8.7.

Table 8.2.1.2.11-1: interruption length X

μ	NR Slot length (ms)	Interruption length X (slots)
0	1	1
1	0.5	1
2	0.25	3
3	0.125	5

8.2.1.2.12 Interruptions at NR SRS carrier based switching

SRS transmission can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic SRS on a carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting SRS, provided that:

- switching is from a configured carrier to an active UL BWP of another activated carrier;
- the carrier of SCells not configured for PUCCH/PUSCH transmission to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission, or indicated by MAC-CE for semi-persistent SRS transmission, or configured via RRC for periodic SRS transmission;
- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex and srs-SwitchFromCarrier in TS 38.331 [2];
- the SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [26];
- the SRS switching is not colliding with any SSB/CSI-RS based L3 measurements and the measurements for RLM/BFD in SCG;
- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [2], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101-3 [20], the SRS transmission are not simultaneously scheduled with DL SSB/CSI-RS for L3 or L1 measurements transmission on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of per-FR gap, during the switching to the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slots as specified in table 8.2.1.2.12-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of per-FR gap, or on active serving cell(s) in SCG in FR2 if UE is capable of per-FR gap, during the switching to the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slots as specified in table 8.2.1.2.12-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of per-FR gap, during the switching from the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slots as specified in table 8.2.1.2.12-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of per-FR gap, or on active serving cell(s) in SCG in FR2 if UE is capable of per-FR gap, during the switching from the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slots as specified in table 8.2.1.2.12-2.

Table 8.2.1.2.12-1: Interruption length X1 (slots)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us)[Note 1]	Interruption length X1 (slots)	
			Sub carrier spacing for aggressor cell (kHz)	
			15	30
0	1	≤ 200	2	2
		300, 500	2	2
		900	3	3
1	0.5	≤ 200	3	2
		300, 500	3	3
		900	4	4
2	0.25	≤ 200	4	3
		300, 500	5	4
		900	7	6
3	0.125	≤ 200	7	5
		300, 500	9	7
		900	12	10
NOTE 1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.				

Table 8.2.1.2.12-2: Interruption length X2 (slots)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us) [Note]	Interruption length X2 (slots)	
			Sub carrier spacing for aggressor cell (kHz)	
			60	120
0	1	≤ 200	2	2
1	0.5	≤ 200	2	2
2	0.25	≤ 200	3	3
3	0.125	≤ 200	4	4
NOTE 1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.				

For intra-band SRS carrier switching in FR1 or FR2, interruptions in table 8.2.1.2.12-1 and in table 8.2.1.2.12-2 based on SRS carrier switching time $\leq 200\mu s$ shall apply. For inter-band SRS carrier switching in FR1, interruptions in table 8.2.1.2.12-1 and in table 8.2.1.2.12-2 shall apply.

8.2.1.2.13 Interruptions at E-UTRA SRS carrier based switching

A PUSCH-less carrier of E-UTRA SCell is a TDD carrier without PUCCH/PUSCH configured. When a UE needs to transmit periodic or aperiodic SRS [23] and/or non-contention based PRACH on a PUSCH-less carrier of E-UTRA SCell, the UE can perform carrier based switching to one or more PUSCH-less carrier of E-UTRA SCells from a E-UTRA carrier with PUSCH or from another PUSCH-less E-UTRA carrier of SCell prior to transmitting SRS and/or PRACH, provided that:

- switching is from a configured E-UTRA carrier to another activated TDD E-UTRA carrier;
- the PUSCH-less carrier of E-UTRA SCells to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission or configured via RRC [15] for periodic SRS transmission;
- the E-UTRA serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex [15];

the SRS switching is not colliding with any other transmission with higher priority defined in TS 36.213 [39];

- the SRS switching is not colliding with PDCCH in subframe 0 and 5 as specified in TS 36.213 [39];
- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [16], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [25], the SRS or RACH transmission are not simultaneously scheduled with DL subframe #0 or DL subframe #5 on other E-UTRA carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between E-UTRA carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of per-FR gap, during the switching to the PUSCH-less carrier of a serving cell,

- with up to X3 slots as specified in table 8.2.1.2.13-1.

When SRS carrier based switching is performed between E-UTRA carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of per-FR gap, during the switching from the PUSCH-less carrier of a serving cell,

- with up to X3 slots as specified in table 8.2.1.2.13-1

Table 8.2.1.2.13-1: Interruption length X3 (slots)

μ	NR Slot length (ms)	Interruption length X3 (slots)
0	1	2
1	0.5	3
2	0.25	5
3	0.125	9

8.2.1.2.14 DL Interruptions at switching between two uplink carriers

The DL interruption requirements at dynamic switching between two uplink carriers specified in this clause are applicable for an uplink band pair of an inter-band EN-DC configuration when the capability *uplinkTxSwitchingPeriod* is present, and is only applicable for uplink switching mechanism specified in clause 6.1.6 of TS 38.214 [26], where E-UTRA UL carrier is capable of one transmit antenna connector and NR UL carrier is capable of two transmit antenna connectors, and the two uplink carriers are in different bands with different carrier frequencies.

When dynamic switching between two uplink carriers is conducted, UE is allowed to cause DL interruption of X OFDM symbols in NR downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption* [2]. The DL interruption starts from the first OFDM symbol which fully or partially overlaps with the UL switching period located in NR carrier. The DL interruption lengths of X for NR carrier(s) are defined in table 8.2.1.2.14-1.

No DL interruption is allowed in the NR downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption*. No DL interruption is allowed for some inter-band EN-DC configurations as specified in clause 5.5B.4 of TS 38.101-3 [20].

Table 8.2.1.2.14-1: DL interruption length on NR carrier(s) in the unit of OFDM symbols (X) for switching between two uplink carriers

μ	NR Slot length (ms)	Uplink Tx switching period Note1	
		35μs	140μs
0	1	2	3
1	0.5	3	6
2	0.25	4	10
NOTE 1: Uplink Tx switching period depends on UE capability *uplinkTxSwitchingPeriod.*			

8.2.1.2.15 Interruptions due to SCell dormancy

8.2.1.2.15.1 Interruptions due to SCell dormancy switch

When one SCell in SCG is switched from dormancy to non-dormancy or from non-dormancy to dormancy [7] when UE is in DRX active time,

- the UE is allowed an interruption on active serving cell in SCG as defined in clause 8.2.1.2.7, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP
- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6.2.

When multiple SCells in SCG are switched from dormancy to non-dormancy or vice versa when the UE is in DRX active time, the interruption requirement described above applies for each BWP switch.

8.2.1.2.15.2 Interruptions due to CQI measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5 %.

8.2.1.2.15.3 Interruptions due to RRM measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed 1.0 %.

8.2.1.2.16 Interruptions when identifying CGI of an NR cell with autonomous gaps

When a UE is identifying CGI of an NR cell with autonomous gaps, the UE is allowed interruptions on PSCell or any activated SCell:

- with up to K1 interruptions with interrupted slots up to interruption length X1 specified in table 8.2.1.2.16-1 for each interruption during MIB decoding time period T_{MIB} (ms) specified in clause 9.11.
- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in table 8.2.1.2.16-1 for each interruption during SIB1 decoding time period T_{SIB1} (ms) specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 1.
- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in table 8.2.1.2.16-1 for each interruption during SIB1 decoding time period T_{SIB1} (ms) specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

- K1 = 6 for the target cell carrier frequency on FR1 and K1 = 25 for the target cell carrier frequency on FR2, and
- L1 = $T_{SIB1}/20$, and
- L2 = T_{SIB1}/T_{SMTC}, where T_{SMTC} is the periodicity of the SMTC occasion configured for the target cell carrier.

Table 8.2.1.2.16-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	Interruption length Y1 (slots)	Interruption length Y2 (slots)
0	1	6	7	6
1	0.5	12	13	10
2	0.25	24	25	19

3	0.125	48	49	37

8.2.1.2.17 Interruptions when identifying CGI of an E-UTRA cell with autonomous gaps

When a UE is identifying CGI of an E-UTRA FDD cell or E-UTRA TDD cell with autonomous gaps, within time period

- $T_{identify_CGI,\ intra}$ specified in clause 8.1.2.2.3, or clause 8.1.2.2.4 in TS 36.133 [15], or
- $T_{identify_CGI,\ inter}$ specified in clause 8.1.2.3.5, or clause 8.1.2.3.6, or clause 8.1.2.3.7, or clause 8.1.2.3.6 in TS 36.133 [15], or
- $T_{identify_CGI,\ E\text{-}UTRA}$ specified in clause 9.4.7.1

the UE shall be able to transmit at least the number of ACK/NACKs specified in table 8.2.1.2.17-1 on PSCell or any activated SCell in the frequency range where autonomous gaps are used, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- 2 slot ACK/NACK feedback is configured,
- 20 ms SMTC period is configured.

Table 8.2.1.2.17-1: Minimum number of ACK/NACKs transmitted by the UE

Minimum number of transmitted ACK/NACKs	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

8.2.1.2.18 Interruptions at NR SRS antenna port switching

The requirements in this clause are applicable to SRS antenna port switching on FR1 and SRS resource(s) is only configured within the last 6 symbols of a slot. For interruption caused by SRS antenna port switching, the victim cell is based on the entry number of the band indicated by *txSwitchImpactToRx* and/or *txSwitchWithAnotherBand* regardless of per-FR MG capability. An UL interruption is allowed on any of the serving cells as indicated in *txSwitchWithAnotherBand*, and a DL interruption is allowed on any of the serving cells as indicated in *txSwitchImpactToRx*.

The UE shall perform SRS antenna port switching only if the below conditions are met.

- the SRS switching is not colliding with any other UL transmission with higher priority defined in TS 38.214 [26] if the serving cell on which the higher priority transmission is performed is a victim cell based on *txSwitchWithAnotherBand* or is the same carrier on which SRS is transmitted.
- the SRS switching is not colliding with any NR measurements (i.e. SSB/CSI-RS based L1/L3 measurements) and the measurements for RLM/BFD/CBD if the serving cell on which the NR measurements and the

measurements for RLM/BFD/CBD is performed is a victim cell based on *txSwitchImpactToRx* or is the same carrier on which SRS is transmitted.

No requirements are defined for SRS antenna port switching if aperiodic SRS switching is colliding with aperiodic L1-RSRP/L1-SINR measurements and the serving cell on which the aperiodic L1-RSRP/L1-SINR measurement is configured is indicated in *txSwitchImpactToRx* or is the same carrier on which aperiodic SRS is scheduled/configured.

No requirements apply when SRS antenna port switching is colliding with E-UTRA measurement if the carrier on which the E-UTRA measurement is performed is indicated in *txSwitchImpactToRx* or is the same carrier on which SRS is scheduled/configured.When 1 SRS symbol is configured in a slot for SRS antenna switching and the aggressor and victim cells are synchronized, the interruption requirement in table 8.2.1.2.18-1 applies.

When 1 SRS symbol is configured in a slot for SRS antenna switching and the aggressor and victim cells are asynchronized, the interruption requirement in table 8.2.1.2.18-2 applies. For the rest of SRS configurations, the interruption requirement in table 8.2.1.2.18-3 applies.

Table 8.2.1.2.18-1: Interruption length in symbols of victim CC when 1 SRS symbol is configured, and aggressor and victim cells are synchronized

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)		
	15	30	60
15	3	2	2
30	4	3	3
60	8	6	5
120	14	10	8

Table 8.2.1.2.18-2: Interruption length in slots of victim CC when 1 SRS symbol is configured, and aggressor and victim cells are asynchronized

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)		
	15	30	60
15	2	2	2
30	2	2	2
60	2	2	2
120	2	2	2

Table 8.2.1.2.18-3: Interruption length in slots of victim CC for rest of the SRS configurations for synchronized and asynchronized scenarios

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)		
	15	30	60
15	2	2	2
30	2	2	2
60	3	2	2
120	5	3	3

8.2.1.2.19 Interruptions at fast SCell activation

The requirements in this clause shall apply for the UE configured with PSCell and one SCell when aperiodic CSI-RS resources is configured for fast SCell activation.

When one SCell in SCG configured with aperiodic CSI-RS resources is configured for fast SCell activation is activated from deactivated, the UE is allowed an interruption on any serving cell in SCG:

- of up to X2 slots, if the active serving cell and the SCell being activated are in a FR1 band pair or in a FR1+FR2 band pair.
- of up to X2 slots, if the active serving cells and the SCells being activated are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.

or

- of up to Y2 slots +$T_{ATRS_duration}$ if the active serving cells are in the same band as any of the SCells being activated, when

  - SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is larger than 2400ms, or

  - SCell is unknown and belongs to FR1, and SCell is contiguous to an active serving cell in the same band.

or

- of up to Y2 slots if the active serving cells are in the same band as any of the SCells being activated, when

  - SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is equal to or smaller than 2400ms, or

  - SCell to be activated belongs to FR2.

Where:

- $T_{ATRS_duration}$ is CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots on the being activated SCell.

- X2 and Y2 are specified in table 8.2.1.2.4-2.

8.2.1.2.20 Interruptions due to PUCCH SCell activation/deactivation

When one SCell in SCG configured with PUCCH is activated or deactivated,

- The UE is allowed an interruption on active serving cell in SCG as defined in clause 8.2.1.2.4.

- The starting time of interruption shall be within the delay as defined in clause 8.3.12.

- For inter-band CA, if the UE is not capable of *parallelTxPRACH-SRS-PUCCH-PUSCH*, additional interruption is allowed on SRS/PUCCH/PUSCH of active serving cells when colliding with RACH transmission on PUCCH SCell. Interruption occurs on the symbols containing SRS/PUCCH/PUSCH, which overlap with the duration of the PRACH preamble [3] transmitted on the PUCCH SCell.

8.2.1.2.21 Interruptions at OD-SSB activation/deactivation

The requirements in this clause shall apply for the UE configured with PSCell and at least one deactivated OD-SSB SCell. If more than one deactivated SCells are configured with OD-SSB transmission, the requirements in this clause shall apply provided that OD-SSB is activated or deactivated on only one of the deactivated OD-SSB SCells.

When OD-SSB is activated or deactivated on one deactivated SCell in SCG by a MAC CE, the UE is allowed an interruption on any active serving cell in SCG, provided that the OD-SSB activation/deactivation command and SCell activation/deactivation command are not received at the same time:

- of up to X2 slots, if the active serving cell and the SCell on which the OD-SSB is being activated or deactivated are in a FR1 band pair or in a FR1+FR2 band pair.

- of up to X2 slots, if the active serving cells and the SCells on which the OD-SSB is being activated or deactivated are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.

- of up to X2 slots, if the active serving cell is non-contiguous to the SCell on which the OD-SSB is being activated or deactivated in the same FR1 band and UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided.

or

- of up to Y2 slots, if the active serving cells are contiguous to the SCell on which the OD-SSB is being activated or deactivated in the same FR1 band, or if the active serving cells are non-contiguous to the SCell on which the OD-SSB is being activated or deactivated in the same FR1 band and UE is not capable of *intraBandNR-CA-non-collocated-r18* or UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is provided, provided the cell specific reference signals from the active serving cells and the SCells on which the OD-SSB is being activated or deactivated are available in the same slot.

- of up to Y2 slots if the active serving cells are in the same FR2 band as the SCell on which the OD-SSB is being activated or deactivated, provided the cell specific reference signals from the active serving cells and the SCells on which the OD-SSB is being activated or deactivated are available in the same slot.

Where X2 and Y2 are specified in table 8.2.1.2.21-1.

Table 8.2.1.2.21-1: Interruption length X2 and Y2 at OD-SSB activation/deactivation

μ	NR Slot length (ms) of victim cell	Interruption length X2 (slots)		Interruption length Y2 (slots)
0	1	1		1
1	0.5	1		1
2	0.25	Both aggressor cell and victim cell are on FR2	2	2
		Either aggressor cell or victim cell is on FR1	3	
3	0.125	Aggressor cell is on FR2	4	4
		Aggressor cell is on FR1	5	

8.2.2 SA: Interruptions with Standalone NR Carrier Aggregation

8.2.2.1 Introduction

This clause contains the requirements related to the interruptions on PCell and activated SCell if configured, when

- up to 7 SCells are configured, de-configured, activated or deactivated, or
- a supplementary UL carrier or an UL carrier is configured or de-configured, or
- measurements on SCC with deactivated SCell in NR SCG, or
- UL/DL BWP is switched on PCell or SCell, or
- CGI reading of an NR neighbour cell with autonomous gaps, or
- CGI reading of an E-UTRA neighbour cell with autonomous gaps, or
- UE-specific CBW is changed on PCell or SCell, or
- NR SRS carrier based switching, or
- NR SRS antenna port switching, or
- UE dynamic Tx switches between two uplink carriers, or
- SCell is activated based on aperiodic CSI-RS, or
- PDCCH ordered RACH on target cell in LTM.

NOTE: interruptions at SCell addition/release, activation/deactivation and during measurements on SCC may not be required by all UEs.

The interruptions shall not interrupt RRC signalling or ACK/NACKs related to RRC reconfiguration procedure according to TS 38.331 [2] for SCell addition/release or MAC control signalling according to TS 37.340 [17] for SCell activation/deactivation command.

This clause additionally contains requirements related to interruptions at inter-frequency SFTD between PCell in FR1 and neighbour cell in FR2.

For a UE which does not support per-FR measurement gap, interruptions to the PCell and activated SCell may be caused by SCells on any frequency range. For a UE which supports per-FR gaps, interruptions to PCell and activated SCell may be caused by SCells on the same frequency range as the victim cell.

In addition to standalone NR carrier aggregation when no CCA is configured, the requirements in clause 8.2.2. and all subclauses of 8.2.2 apply when the UE is configured with

- A PCell not using CCA in downlink and one or more SCells using CCA in downlink, or
- A PCell and one or more SCells using CCA in downlink.

8.2.2.2 Requirements

8.2.2.2.1 Interruptions at SCell addition/release

When any number of SCells between one and 7 is added or released using the same *RRCConnectionReconfiguration* message as defined in TS 38.331 [2], the UE is allowed an interruption on any active serving cell during the RRC reconfiguration procedure as follows:

- of up to X1 slots, if the active serving cell and the SCell being added or released are in a FR1 band pair or in a FR1+FR2 band pair.
- of up to X1 slots, if the active serving cell and the SCell being added or released are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.
- of up to X1 slots, if the active serving cell is non-contiguous to the SCell being added or released in the same FR1 band and UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided.

Where X1 is specified in table 8.2.2.2.1-1.

or

- of up to the duration shown in table 8.2.2.2.1-2, if the active serving cells are contiguous to any of the SCells being added or released in the same FR1 band, or if the active serving cells are non-contiguous to any of the SCells being added or released in the same FR1 band and UE is not capable of *intraBandNR-CA-non-collocated-r18* or UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is provided, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot.
- of up to the duration shown in table 8.2.2.2.1-2, if the active serving cells are in the same FR2 band as any of the SCells being added or released, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot.
- if the active serving cell is non-contiguous to the SCell being added or released in the same FR1 band, and UE is capable of *intraBandNR-CA-non-collocated-r19*,

  1> when UE is configured with maxMIMO-Layers with value equal to 4 for all corresponding serving cells, in case of TDD-TDD intra-band NR-CA

    2> if *nonCollocatedTypeMRDC-v19xy* is presented with “type 4”

      3> of up to X1 slots

    2>else if *nonCollocatedTypeMRDC-v19xy* is presented with “type 1”

      3> of up to the duration shown in table 8.2.2.2.1-2

    2>else if *nonCollocatedTypeMRDC-v19xy* is not provided

      3> of up to the duration shown in table 8.2.2.2.1-2

  1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA for all corresponding serving cells, in case of TDD-TDD intra-band NR-CA

    2> if *nonCollocatedTypeNR-CA-r18* is not provided

      3> of up to X1 slots

2> else

3> of up to the duration shown in table 8.2.2.2.1-2

For UE supporting On-demand SSB operation, when one OD-SSB SCell in SCG is added or released, no interruption is allowed on any active serving cell during the RRC reconfiguration procedure before OD-SSB is activated on the SCell wherein there is only OD-SSB transmission without the first SSB transmission.

Table 8.2.2.2.1-1: Interruption length X1 for SCell addition/release for inter-band CA

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	
0	1	1	
1	0.5	2	
2	0.25	Both aggressor cell and victim cell are on FR2	4
		Either aggressor cell or victim cell is on FR1	5
3	0.125	Aggressor cell is on FR2	8
		Aggressor cell is on FR1	9
5	0.03125	Aggressor cell is on FR1	33
6	0.015625	Aggressor cell is on FR1	65

Table 8.2.2.2.1-2: Interruption duration for SCell addition/release for intra-band CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
1	0.5	2 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
2	0.25	4 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
3	0.125	8 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
5	0.03125	32+ $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
6	0.015625	64+ $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$

NOTE 1: When UE is not supporting *On-demand SSB operation* or OD-SSB transmission is not indicated, $T_{SMTC_duration}$ measured in subframes is
- the longest SMTC duration among all above active serving cells and the SCell being added when one SCell is added. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being added, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC\ duration}$ for the SCell being added is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being added. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being added, $T_{SMTC\ duration}$ for the SCell being added is 0ms;
- the longest SMTC duration among all active serving cells in the same band when one SCell is released.

Otherwise, $T_{SMTC\ duration}$ for the SCell being activated with OD-SSB is the periodicity of OD-SSB

NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].

8.2.2.2.2 Interruptions at SCell activation/deactivation

When an SCell is activated or deactivated as defined in TS 37.340 [17], the UE is allowed an interruption on any active serving cell:

- of up to X2 slots, if the active serving cell and the SCell being activated or deactivated are in a FR1 band pair or in a FR1+FR2 band pair.
- of up to X2 slots, if the active serving cell and the SCell being activated or deactivated are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.
- of up to X2 slots, if the active serving cell is non-contiguous to the SCell being activated or deactivated in the same FR1 band and UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided.

Where X2 is specified in table 8.2.2.2.2-1.

or

- of up to the duration shown in table 8.2.2.2.2-2, if the active serving cells are contiguous to any of the SCells being activated or deactivated in the same FR1 band, or if the active serving cells are non-contiguous to any of the SCells being activated or deactivated in the same FR1 band and UE is not capable of *intraBandNR-CA-non-collocated-r18* or UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is provided, provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot.

- of up to the duration shown in table 8.2.2.2.2-2, if the active serving cells are in the same FR2 band as any of the SCells being activated or deactivated provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot.

- if the active serving cell is non-contiguous to the SCell being activated or deactivated in the same FR1 band, and UE is capable of *intraBandNR-CA-non-collocated-r19*,

  1> when UE is configured with maxMIMO-Layers with value equal to 4 for all corresponding serving cells, in case of TDD-TDD intra-band NR-CA

    2> if *nonCollocatedTypeMRDC-v19xy* is presented with “type 4”

      3> of up to X2 slots

    2>else if *nonCollocatedTypeMRDC-v19xy* is presented with “type 1”

      3> of up to the duration shown in table 8.2.2.2.2-2

    2>else if *nonCollocatedTypeMRDC-v19xy* is not provided

      3> of up to the duration shown in table 8.2.2.2.2-2

  1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA for all corresponding serving cells, in case of TDD-TDD intra-band NR-CA

    2> if *nonCollocatedTypeNR-CA-r18* is not provided

      3> of up to X2 slots

    2> else

      3> of up to the duration shown in table 8.2.2.2.2-2

For UE supporting *On-demand SSB operation*, when one OD-SSB SCell is activated or deactivated, the requirements in this clause shall apply provided OD-SSB is activated on the SCell or OD-SSB activation/deactivation command and SCell activation/deactivation command are received in the same MAC command.

Table 8.2.2.2.2-1: Interruption length X2 for SCell activation/deactivation for inter-band CA

μ	NR Slot length (ms) of victim cell	Interruption length X2 (slots)	
0	1		1
1	0.5		1
2	0.25	Both aggressor cell and victim cell are on FR2	2
		Either aggressor cell or victim cell is on FR1	3
3	0.125	Aggressor cell is on FR2	4
		Aggressor cell is on FR1	5
5	0.03125	Aggressor cell is on FR1	17
6	0.015625	Aggressor cell is on FR1	33

Table 8.2.2.2.2-2: Interruption duration for SCell activation/deactivation for intra-band CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	$1 + T_{SMTC_duration} * N_{slot}^{subframe,\mu}$
1	0.5	$1 + T_{SMTC_duration} * N_{slot}^{subframe,\mu}$

2	0.25	2 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
3	0.125	4 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
5	0.03125	16+ $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
6	0.015625	32+ $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
NOTE 1: When UE is not supporting *On-demand SSB operation* or OD-SSB transmission is not indicated, $T_{SMTC_duration}$ measured in subframes is - the longest SMTC duration among all above active serving cells and the SCell being activated when one SCell is activated. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being activated, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC\ duration}$ for the SCell being activated is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being activated. If no SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being activated, $T_{SMTC\ duration}$ for the SCell being activated is 0ms; - the longest SMTC duration among all active serving cells in the same band when one SCell is deactivated. Otherwise, $T_{SMTC\ duration}$ for the SCell being activated is 0ms.		
NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].		

8.2.2.2.3 Interruptions during measurements on deactivated SCC

Interruptions on PCell or activated SCell(s) due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK

when the configured *measCycleSCell* [2] is 640 ms or longer.

- If the PCell or activated SCell(s) is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on PCell or activated SCell(s) immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in table 8.2.2.2.2-1.

- If the PCell or activated SCell(s) is non-contiguous to the deactivated SCell in the same FR1 band and UE is capable of *intraBandNR-CA-non-collocated-r18* on this FR1 band and *nonCollocatedTypeNR-CA-r18* is not provided, the UE is only allowed to cause interruptions on PCell or activated SCell(s) immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in table 8.2.2.2.2-1.

- If the PCell or activated SCell(s) is contiguous to the deactivated SCell in the same FR1 band, or if the PCell or activated SCell(s) is non-contiguous to the deactivated SCell in the same FR1 band and UE is not capable of *intraBandNR-CA-non-collocated-r18* or UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is provided, the UE is only allowed to cause an interruption on PCell or activated SCell(s) no earlier than X slots before $T_{SMTC_duration}$ and no later than X slots after $T_{SMTC_duration}$, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and $T_{SMTC_duration}$ are given by table 8.2.2.2.3-1. The interruption shall not exceed requirements in table 8.2.2.2.3-1.

- If the PCell or activated SCell(s) is contiguous to the deactivated SCell in the same FR1 band, or if the PCell or activated SCell(s) is non-contiguous to the deactivated SCell in the same FR1 band and UE is not capable of *intraBandNR-CA-non-collocated-r18* or UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is provided, the UE is only allowed to cause an interruption on PCell or activated SCell(s) no earlier than X slots before $T_{SMTC_duration}$ and no later than X slots after $T_{SMTC_duration}$, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and $T_{SMTC_duration}$ are given by table 8.2.2.2.3-1. The interruption shall not exceed requirements in table 8.2.2.2.3-1.

- If the PCell or activated SCell(s) is non-contiguous to the deactivated SCell in the same FR1 band, and UE is capable of *intraBandNR-CA-non-collocated-r19*,

  1> when UE is configured with maxMIMO-Layers with value equal to 4 for all corresponding serving cells, in case of TDD-TDD intra-band NR-CA

    2> if *nonCollocatedTypeNR-CA-v1900* is presented with “type 4”

      3> the UE is only allowed to cause interruptions on PCell or activated SCell(s) immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in table 8.2.2.2.2-1.

2> if *nonCollocatedTypeNR-CA-v1900* is presented with "type 1"

3> the UE is only allowed to cause an interruption on PCell or activated SCell(s) no earlier than X slots before $T_{SMTC_duration}$ and no later than X slots after $T_{SMTC_duration}$, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and $T_{SMTC_duration}$ are given by table 8.2.2.2.3-1. The interruption shall not exceed requirements in table 8.2.2.2.3-1.

2>else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the UE is only allowed to cause an interruption on PCell or activated SCell(s) no earlier than X slots before $T_{SMTC_duration}$ and no later than X slots after $T_{SMTC_duration}$, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and $T_{SMTC_duration}$ are given by table 8.2.2.2.3-1. The interruption shall not exceed requirements in table 8.2.2.2.3-1.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA for all corresponding serving cells, in case of TDD-TDD intra-band NR-CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> the UE is only allowed to cause interruptions on PCell or activated SCell(s) immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in table 8.2.2.2.2-1.

2> else

3> the UE is only allowed to cause an interruption on PCell or activated SCell(s) no earlier than X slots before $T_{SMTC_duration}$ and no later than X slots after $T_{SMTC_duration}$, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and $T_{SMTC_duration}$ are given by table 8.2.2.2.3-1. The interruption shall not exceed requirements in table 8.2.2.2.3-1.

The interruption requirements in table 8.2.2.2.3-1 are not applicable when a UE is configured with NCSG in the same frequency range as the deactivated SCell unless the SMTC on the deactivated SCC is fully non-overlapped with NCSG.

For UE supporting *On-demand SSB operation,*

- No interruption is allowed on activated SCell(s) due to measurements on deactivated SCC before OD-SSB is activated on the deactivated OD-SSB SCell wherein there is only OD-SSB but not the first SSB transmission.

- If UE does not receive SCell activation command before the end of FMW, the interruption requirement in Table 8.2.2.2.3-1 shall apply, provided that the measCycleSCell equal or longer than 640ms when

Table 8.2.2.2.3-1: Interruption duration for measurement on deactivated SCC for intra-band CA

μ	NR Slot length (ms)	X (slots)	Interruption length (slots)
0	1	1	2 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
1	0.5	1	2 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
2	0.25	2	4 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
3	0.125	4	8 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
5	0.03125	16	32 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
6	0.015625	32	64 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
NOTE 1: $T_{SMTC_duration}$ measured in subframes is the longest SMTC duration among all above active serving cells and the deactivated SCell to be measured i;			
NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].			

For a UE supporting *LB-CA via switching* and configured with switch pattern, interruptions on PCell due to the measurement on deactivated SDL SCell are allowed with up to Y % probability of missed ACK/NACK. The value of Y is defined as $\frac{2*Length_int}{measCycleSCell}$; where, Length_int is equal to (Tuning time from PCell to SCell + $T_{SMTC_duation}$ + Retuning time from SCell to PCell),

Tuning time from PCell to SCell is equal to the RRC configured switching gap from PCell to SCell, i.e., LBCA-SwitchingGap-Duration-PCelltoSCell-r19 in slots

Returning time from SCell to PCell is equal to the RRC configured switching gap from SCell to PCell, i.e., LBCA-SwitchingGap-SCelltoPCell-r19 in slots

8.2.2.2.4 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NR standalone carrier aggregation as defined in TS 38.331 [2]. Further, the requirements in this clause are applicable to UE capable of independent beam management in FR2 inter-band CA and UE capable of FR2 intra-band CA and FR1.

When an UL carrier or supplementary UL carrier is configured or de-configured, an interruption of up to the duration shown in table 8.2.2.2.4-1, is allowed during the RRC reconfiguration procedure [2] on PCell and all activated SCells within the same FR as the reconfigured uplink carrier. The interruption is for both uplink and downlink of PCell and all the activated SCells within the same FR as the configured or de-configured UL.

Table 8.2.2.2.4-1: Interruption duration for UL carrier RRC reconfiguration

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1
1	0.5	2
2	0.25	4
3	0.125	8
5	0.03125	32
6	0.015625	64

8.2.2.2.5 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch, timer-based BWP switch or UL BWP switch triggered by consistent uplink CCA failures in this clause apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this clause apply for each BWP switch. Further, the requirements in this clause are applicable to UE capable of independent beam management in FR2 inter-band CA and UE capable of FR2 intra-band CA and FR1.

When UE receives a DCI indicating UE to switch its active BWP involving changes in any of the parameters listed in table 8.2.2.2.5-2, the UE is allowed to cause interruption of up to X slots to other active serving cells if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in table 8.2.2.2.5-2 and the UE is capable of per-FR gap the UE is allowed to cause interruption of up to X slots to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in table 8.2.2.2.5-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay $T_{MultipleBWPswitchDelay}$ +Y as defined in clause 8.6.2A.1 when BWP switch occurs on multiple CCs. Interruptions are not allowed during BWP switch involving any other parameter change.

When a BWP timer *bwp-InactivityTimer* defined in TS 38.331 [2] expires, UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in table 8.2.2.2.5-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in table 8.2.2.2.5-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slots to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in table 8.2.2.2.5-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay $T_{MultipleBWPswitchDelay}$ as defined in clause 8.6.2B.1 when BWP switch occurs on multiple CCs simultaneously or $T_{MultipleBWPswitchDelayTotal}$ as defined in clause 8.6.2B.2 when BWP switch occurs on multiple CCs over partially overlapping time period. Interruptions are not allowed during BWP switch involving any other parameter change.

When UE receives an RRC reconfiguration that only requests UE to switch its active BWP on one single CC, the UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in table 8.2.2.2.5-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in table 8.2.2.2.5-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slots to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in table 8.2.2.2.5-1. The interruption is only allowed within the delay $T_{RRCprocessingDelay}$ + $T_{BWPswitchDelayRRC}$ defined in clause 8.6.3 when BWP switch occurs on a single CC. The interruption is only allowed within the delay $T_{RRCprocessingDelay}$ + $T_{BWPswitchDelayRRC}$ + D_{RRC}*(N-1) as defined in clause 8.6.3A when BWP switch occurs on multiple CCs.

When UL BWP switch is triggered by consistent uplink CCA failures [7], UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its active UL BWP involving changes in any of the parameters listed in table 8.2.2.2.5-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the UL BWP switch imposes changes in any of the parameters listed in table 8.2.2.2.5-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slots to other active serving cells in the same frequency range wherein the UE is performing UL BWP switching. X is defined in table 8.2.2.2.5-1. The starting time of interruption is only allowed within the UL BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2. Interruptions are not allowed during BWP switch involving other parameter change.

Table 8.2.2.2.5-1: Interruption length X

μ	NR Slot length (ms)	Interruption length X (slots)
0	1	1
1	0.5	1
2	0.25	3
3	0.125	5
5	0.03125	17
6	0.015625	33
Note1: void		

Table 8.2.2.2.5-2: Parameters which cause interruption other than SCS

Parameters	Comment
locationAndBandwidth	From TS 38.331 [2]
nrofSRS-Ports	
maxMIMO-Layers-r16	

8.2.2.2.6 Interruptions at inter-frequency SFTD measurement

The requirements in this clause concern interruptions on PCell, as well as on activated SCells in MCG, when the UE is performing SFTD measurements on inter-frequency neighbour cell(s). The following requirements apply when no PSCell is configured.

For a UE supporting per-FR gap capability:

- for neighbour cell in FR1:
  - the percentage of interrupted slots on uplink and downlink on FR1 serving cells during the SFTD measurement period $T_{measure_SFTD1}$ specified in clause 9.3.8 shall not exceed the percentages specified in table 8.2.2.2.6-1. No interruption is allowed on FR2 serving cells.
  - the length of each interruption on FR1 serving cells shall not exceed the number of slots specified in table 8.2.2.2.6-2.
- for neighbour cell in FR2:
  - the percentage of interrupted slots on uplink and downlink on FR2 serving cells during the SFTD measurement period $T_{measure_SFTD1}$ specified in clause 9.3.8 shall not exceed the percentages specified in table 8.2.2.2.6-1. No interruption is allowed on FR1 serving cells.

- the length of each interruption on FR2 serving cells shall not exceed the number of slots specified in table 8.2.2.2.6-2.

For a UE not supporting per-FR gap capability:

- for neighbour cell in FR1 or FR2:
  - the percentage of interrupted slots on uplink and downlink on FR1 and FR2 serving cells during the SFTD measurement period $T_{measure_SFTD1}$ specified in clause 9.3.8 shall not exceed the percentages specified in table 8.2.2.2.6-1.
  - the length of each interruption on FR1 and FR2 serving cells shall not exceed the number of slots specified in table 8.2.2.2.6-2.

Table 8.2.2.2.6-1: Requirements on maximum percentage of interrupted slots in serving cell in inter-frequency SFTD

SFTD configuration	Serving cell μ	Neighbour cell SMTC periodicity					
		5 ms	10 ms	20 ms	40 ms	80 ms	160 ms
With RSRP report	0	8.4 %	6.3 %	8.4 %	6.3 %	5.3 %	4.7 %
	1						
	2						
	3						
Without RSRP report	0	11.4 %	8.6 %	7.9 %	6.8 %	6.3 %	6.0 %
	1						
	2						
	3						

Table 8.2.2.2.6-2: Interruption duration for FR1 serving cell in inter-frequency SFTD with neighbour cell in FR1

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1
1	0.5	2
2	0.25	4
3	0.125	8

Table 8.2.2.2.6-3: Void

Table 8.2.2.2.6-4: Void

8.2.2.2.7 Interruptions at SCell activation/deactivation with multiple downlink SCells

The requirements in this clause shall apply for the UE configured with PCell and up to 7 downlink SCell(s).

When multiple SCell is activated or deactivated by one single MAC CE command, the UE is allowed an interruption on any active serving cell as specified in clause 8.2.2.2.2:

8.2.2.2.8 Interruptions due to UE-specific CBW change

When UE receives an RRC reconfiguration that changes *offsetToCarrier* or *carrierBandwidth*, the UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its CBW. X is defined in table 8.2.2.2.8-1. The interruption is only allowed within the delay $T_{RRCprocessingDelay} + T_{CBWchangeDelayRRC}$ defined in clause 8.13.

Table 8.2.2.2.8-1: interruption length X

μ	NR Slot length (ms)	Interruption length X (slots)
0	1	1
1	0.5	1
2	0.25	3

3	0.125	5
5	0.03125	17
6	0.015625	33

8.2.2.2.9 Interruptions at NR SRS carrier based switching

SRS transmission can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic SRS on a carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting SRS, provided that:

- switching is from a configured carrier to another activated carrier;
- the carrier of SCells not configured for PUCCH/PUSCH transmission to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission, or indicated by MAC-CE for semi-persistent SRS transmission, or configured via RRC for periodic SRS transmission;
- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex and srs-SwitchFromCarrier in TS 38.331 [2];
- the SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [26];
- the SRS switching is not colliding with any SSB/CSI-RS based L3 measurements and the measurements for RLM/BFD;
- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [2], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101-1 [18] for FR1 and TS 38.101-2 [19] for FR2, the SRS transmission are not simultaneously scheduled with DL SSB/CSI-RS for L3 or L1 measurements transmission on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of per-FR gap, or on active serving cell(s) in FR1 if UE is capable of per-FR gap, during the switching to the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in table 8.2.2.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of per-FR gap, or on active serving cell(s) in FR2 if UE is capable of per-FR gap, during the switching to the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slots as specified in table 8.2.2.2.9-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of per-FR gap, or on active serving cell(s) in FR1 if UE is capable of per-FR gap, during the switching from the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slots as specified in table 8.2.2.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of per-FR gap, or on active serving cell(s) in FR2 if UE is capable of per-FR gap, during the switching from the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slots as specified in table 8.2.2.2.9-2.

Table 8.2.2.2.9-1: Interruption length X1 (slots)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us)[Note 1]	Interruption length X1 (slots)	
			Sub carrier spacing for aggressor cell (kHz)	
			15	30
0	1	≤ 200	2	2
		300, 500	2	2
		900	2	2
1	0.5	≤ 200	3	2
		300, 500	3	3
		900	4	4
2	0.25	≤ 200	4	3
		300, 500	5	4
		900	7	6
3	0.125	≤ 200	7	5
		300, 500	9	7
		900	12	10
5	0.03125	≤ 200	22	15
		300, 500	31	24
		900	44	37
6	0.015625	≤ 200	42	28
		300, 500	61	47
		900	87	73
NOTE 1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.				

Table 8.2.2.2.9-2: Interruption length X2 (slot)

μ	length (ms) of victim cell	switching time (us) [Note 1]	Sub carrier spacing for aggressor cell (kHz)			
			60	120	480	960
0	1	≤ 200	2	2	2	2
1	0.5	≤ 200	2	2	2	2
2	0.25	≤ 200	3	3	2	2
3	0.125	≤ 200	4	4	3	3
5	0.03125	≤ 200	11	10	8	8
6	0.015625	≤ 200	21	18	15	15
NOTE 1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.						

For intra-band SRS carrier switching in FR1 or FR2, interruptions in table 8.2.2.2.9-1 and in table 8.2.2.2.9-2 based on SRS carrier switching time ≤ 200μs shall apply. For inter-band SRS carrier switching in FR1, interruptions in table 8.2.2.2.9-1 and in table 8.2.2.2.9-2 shall apply.

8.2.2.2.10 DL Interruptions at UE switching between two uplink carriers

The DL interruption requirements at dynamic switching between two uplink carreirs specified in this clause are applicable for an uplink band pair of an inter-band UL CA configuration in FR1 when the capability *uplinkTxSwitchingPeriod* is present, and is only applicable for uplink switching mechanism specified in clause 6.1.6 of TS 38.214 [26], where NR uplink carrier 1 is capable of one transmit antenna connector and NR uplink carrier 2 is capable of two transmit antenna connectors, and the two uplink carriers are in different bands with different carrier frequencies.

When dynamic switching between two uplink carriers is conducted, UE is allowed to cause DL interruption of X OFDM symbols in NR downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption* [2]. The DL interruption starts from the first OFDM symbol which fully or partially overlaps with the UL switching period located in either NR carrier 1 or carrier 2 as indicated in RRC signalling [2]. The DL interruption lengths of X are defined in table 8.2.2.2.10-1.

No DL interruption is allowed in the NR downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption*. No DL interruption is allowed for some inter-band UL CA configurations as specified in clause 5.2A.2 of TS 38.101-1 [18].

Table 8.2.2.2.10-1: DL interruption length on NR carrier(s) in the unit of OFDM symbols (X) for switching between two uplink carriers

μ	NR Slot length (ms)	Uplink Tx switching period Note1		
		35μs	140μs	210μs
0	1	2	3	4
1	0.5	3	6	7
2	0.25	4	10	14
NOTE 1: Uplink Tx switching period depends on UE capability *uplinkTxSwitchingPeriod*				

8.2.2.2.10A DL Interruptions at UE switching between two uplink carriers with two transmit antenna connectors

The DL interruption requirements at dynamic switching between two uplink carriers specified in this clause are applicable for an uplink band pair of an inter-band UL CA configuration when the capability *[uplinkTxSwitchingPeriod2T2T]* is present, and is only applicable for uplink switching mechanism specified in clause 6.1.6 of TS 38.214 [26], where NR UL carrier 1 is capable of two transmit antenna connectors and NR UL carrier 2 is capable of two transmit antenna connectors, and the two uplink carriers are in different bands with different carrier frequencies.

When dynamic switching between two uplink carriers is conducted, UE is allowed to cause DL interruption of X OFDM symbols in NR downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption* [2]. The DL interruption starts from the first OFDM symbol which fully or partially overlaps with the UL switching period located in either NR carrier 1 or carrier 2 as indicated in RRC signalling [2]. The DL interruption lengths of X are defined in table 8.2.2.2.10A-1.

No DL interruption is allowed in the NR downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption*. No DL interruption is allowed for some inter-band UL CA configurations as specified in clause 5.2A.2 of TS 38.101-1 [18].

Table 8.2.2.2.10A -1: DL interruption length on NR carrier(s) in the unit of OFDM symbols (X) for switching between two uplink carriers

μ	NR Slot length (ms)	Uplink Tx switching period Note1		
		35μs	140μs	210μs
0	1	2	3	4
1	0.5	3	6	7
2	0.25	4	10	14
NOTE 1: Uplink Tx switching period depends on UE capability [*uplinkTxSwitchingPeriod2T2T*].				

8.2.2.2.10B DL Interruptions at UE switching between one uplink band with one transmit antenna connector and one uplink band with two transmit antenna connectors

The DL interruption requirements at dynamic switching between two uplink bands specified in this clause are applicable for an uplink band pair of an inter-band UL CA configuration when the capability *[uplinkTxSwitchingPeriod]* is present, and is only applicable for uplink switching mechanism specified in clause 6.1.6 of TS 38.214 [26], where NR UL carrier 1 in band A is capable of one transmit antenna connector, NR UL carrier 2 and carrier 3 in band B are capable of two transmit antenna connectors. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers, and band A and band B are different bands with different carrier frequencies.

When dynamic switching between two uplink bands is conducted, UE is allowed to cause DL interruption of X OFDM symbols in NR downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption* [2]. The DL interruption starts

from the first OFDM symbol which fully or partially overlaps with the UL switching period located in either NR band A or band B as indicated in RRC signalling [2]. The DL interruption lengths of X are defined in table 8.2.2.2.10-1.

No DL interruption is allowed in the NR downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption*. No DL interruption is allowed for some inter-band UL CA configurations as specified in clause 5.2A.2 of TS 38.101-1 [18].

8.2.2.2.10C DL Interruptions at UE switching between two uplink bands with two transmit antenna connectors

The DL interruption requirements at dynamic switching between two uplink bands specified in this clause are applicable for an uplink band pair of an inter-band UL CA configuration when the capability *[uplinkTxSwitchingPeriod2T2T]* is present, and is only applicable for uplink switching mechanism specified in clause 6.1.6 of TS 38.214 [26], where NR UL carrier 1 in band A is capable of two transmit antenna connectors, NR UL carrier 2 and carrier 3 in band B are capable of two transmit antenna connectors. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers, and band A and band B are different bands with different carrier frequencies.

When dynamic switching between two uplink bands is conducted, UE is allowed to cause DL interruption of X OFDM symbols in NR downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption* [2]. The DL interruption starts from the first OFDM symbol which fully or partially overlaps with the UL switching period located in either NR band A or band B as indicated in RRC signalling [2]. The DL interruption lengths of X are defined in table 8.2.2.2.10A -1.

No DL interruption is allowed in the NR downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption*. No DL interruption is allowed for some inter-band UL CA configurations as specified in clause 5.2A.2 of TS 38.101-1 [18].

8.2.2.2.10D DL Interruptions at UE switching across three or four uplink bands

The DL interruption requirements at dynamic switching across three or four uplink bands specified in this clause are applicable for an NR inter-band CA configuration and SUL band configuration with inter-band CA when the capability [*BandCombination-UplinkTxSwitch-v1800*] is present, and are only applicable for uplink switching mechanisms specified in clause [6.1.6] of TS 38.214 [26]. In the NR inter-band CA configuration and SUL band configuration with inter-band CA, the number of NR uplink bands with different carrier frequencies is three or four. NR UL carrier(s) in each of the three or four uplink bands are capable of one or two transmit antenna connector(s), according to the UE capability.

When dynamic switching across three or four uplink bands is conducted, UE is allowed to cause DL interruption of X OFDM symbols in NR downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption* [2]. The DL interruption starts from the first OFDM symbol which fully or partially overlaps with the UL Tx switching period located in uplink NR band(s) as indicated in RRC signalling [2]. The DL interruption lengths of X for single TAG and for 2-TAG are defined in table 8.2.2.2.10D-1 and table 8.2.2.2.10D-2.

NOTE: If one downlink carrier is indicated to be interrupted by two band pairs for dynamic switching simultaneously, the DL interruption length on the victim carrier is determined by the maximum of uplink switching periods of the two band pairs. If [*UplinkTxSwitchingAdditionalPeriodDualUL-r18*] is reported, DL interruption length is determined by the uplink Tx switching period, which is indicated by [*UplinkTxSwitchingAdditionalPeriodDualUL-r18*]. If [*periodOnULBands-r18*] is reported, DL interruption length is determined by the uplink Tx switching period, which is indicated by [*periodOnULBands-r18*].

No DL interruption is allowed in the NR downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption*. No DL interruption is allowed for some inter-band UL CA configurations and SUL band configurations with inter-band CA as specified in TS 38.101-1 [18].

Table 8.2.2.2.10D -1: DL interruption length on NR carrier(s) in the unit of OFDM symbols (X) for switching across three or four uplink bands for single TAG

μ	NR Slot length (ms)	Uplink Tx switching period Note1		
		35μs	140μs	210μs
0	1	2	3	4
1	0.5	3	6	7
2	0.25	4	10	14

Note 1: Uplink Tx switching period depends on UE capability. Note 2: RTD=3 μs is assumed to derive the DL interruption length.

Table 8.2.2.2.10D -2: DL interruption length on NR carrier(s) in the unit of OFDM symbols (X) for switching across three or four uplink bands for two TAGs

μ	NR Slot length (ms)	Uplink Tx switching period Note1		
		35μs	140μs	210μs
0	1	2	3	4
1	0.5	3	6	8
2	0.25	4	10	14
Note 1: Uplink Tx switching period depends on UE capability. Note 2: RTD=9 μs is assumed to derive the DL interruption length.				

8.2.2.2.10E DL Interruptions at UE switching between two uplink bands with three transmit antenna connectors and maximum two transmit antenna connectors for each band

The DL interruption requirements at dynamic switching between two uplink bands specified in this clause are applicable for an uplink band pair of an inter-band UL CA configuration when the capability *Uplink3TxSwitchingPeriodUpTo2TPerBandDualUL* is present, and is only applicable for uplink switching mechanism specified in clause 6.1.6 of TS 38.214 [26], where NR UL carriers in band A and B are capable of a maximum of two transmit antenna connectors, but simultaneously only a maximum of three transmit antenna connector are supported across both bands. Band A and band B are different bands with different carrier frequencies. The UE shall support the switch between the following two transmit configurations 1 and 2:

- *Configuration 1*: Two antenna ports on band A and one antenna port on band B
- *Configuration 2*: One antenna port on band A and two antenna ports on band B

When dynamic switching between configurations 1 and 2 is conducted, UE is allowed to cause DL interruption of X OFDM symbols in NR downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption-DualUL* [2]. The DL interruption starts from the first OFDM symbol which fully or partially overlaps with the UL switching period located in either NR band A or band B as indicated in RRC signalling [2]. The DL interruption lengths of X for single TAG and for 2-TAG are defined in table 8.2.2.2.10D-1 and table 8.2.2.2.10D-2.

No DL interruption is allowed in the NR downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption-DualUL*. No DL interruption is allowed for some inter-band UL CA configurations as specified in clause 5.2A.2 of TS 38.101-1 [18].

8.2.2.2.11 Interruptions at direct SCell activation

When one or multiple SCell(s) are directly activated at SCell addition, the UE is allowed an interruption on any active serving cell:

- of up to the duration shown in table 8.2.2.2.1-1, if the active serving cell is not in the same band as the SCell being directly activated, or

- of up to the duration shown in table 8.2.2.2.1-2, if the active serving cells are in the same band as the SCell being activated provided the cell specific reference signals from the active serving cells and the SCell being activated are available in the same slot.

8.2.2.2.12 Interruptions due to SCell dormancy

8.2.2.2.12.1 Interruptions due to SCell dormancy switch

When one SCell in MCG is switched from dormancy to non-dormancy or from non-dormancy to dormancy [7] when UE is in DRX active time,

- the UE is allowed an interruption on active serving cell in MCG as defined in clause 8.2.2.2.5, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP

- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6.2.

When multiple SCells in MCG are switched from dormancy to non-dormancy or vice versa when the UE is in DRX active time, the interruption requirement described above applies for each BWP switch.

8.2.2.2.12.2 Interruptions due to CQI measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5 %.

8.2.2.2.12.3 Interruptions due to RRM measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed 1.0 %.

8.2.2.2.13 Interruptions at transitions between active and non-active during DRX

For the UEs that are capable of *secondaryDRX-Group*[14] in FR1+FR2 CA, when two DRX groups are configured each group of serving cells, no interruption is allowed for UEs supporting either per UE or per FR gaps.

8.2.2.2.14 Interruptions when identifying CGI of an NR cell with autonomous gaps

When a UE is identifying CGI of an NR cell with autonomous gaps, the UE is allowed interruptions on PCell or any activated SCell:

- with up to K1 interruptions with interrupted slots up to interruption length X1 specified in table 8.2.2.2.14-1 for each interruption during MIB decoding time period T_{MIB} (ms) specified in clause 9.11.

- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in table 8.2.2.2.14-1 for each interruption during SIB1 decoding time period T_{SIB1} (ms) specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 1.

- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in table 8.2.2.2.14-1 for each interruption during SIB1 decoding time period T_{SIB1} (ms) specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

- K1 = 6 for the target cell carrier frequency on FR1 and K1 = 25 for the target cell carrier frequency on FR2, and

- L1 = T_{SIB1}/20and

- L2 = T_{SIB1}/T_{SMTC}, where T_{SMTC} is the periodicity of the SMTC occasion configured for the target cell carrier.

Table 8.2.2.2.14-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	Interruption length Y1 (slots)	Interruption length Y2 (slots)
0	1	6	7	6
1	0.5	12	13	10
2	0.25	24	25	19
3	0.125	48	49	37

8.2.2.2.15 Interruptions when identifying CGI of an E-UTRA cell with autonomous gaps

When a UE is identifying CGI of an E-UTRA FDD cell or E-UTRA TDD cell with autonomous gaps, within time period $T_{identify_CGI,\ E\text{-}UTRA}$ specified in clause 9.4.7.1, the UE shall be able to transmit at least the number of ACK/NACKs specified in table 8.2.2.2.15-1 on PCell or any activated SCell in the frequency range where autonomous gaps are used, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- 2 slot ACK/NACK feedback is configured,
- 20 ms SMTC period is configured.

Table 8.2.2.2.15-1: Minimum number of ACK/NACKs transmitted by the UE during $T_{identify_CGI,\ E\text{-}UTRA}$

Minimum number of transmitted ACK/NACKs	SCS	
	Duplex mode configuration	SCS
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

8.2.2.2.16 Interruptions at NR SRS antenna port switching

The requirements in this clause are applicable to SRS antenna port switching on FR1 and SRS resource(s) is only configured within the last 6 symbols of a slot. For interruption caused by SRS antenna port switching, the victim cell is based on the entry number of the band indicated by *txSwitchImpactToRx* and/or *txSwitchWithAnotherBand* regardless of per-FR MG capability. An UL interruption is allowed on any of the serving cells as indicated in *txSwitchWithAnotherBand*, and a DL interruption is allowed on any of the serving cells as indicated in *txSwitchImpactToRx*.

The UE shall perform SRS antenna port switching only if the below conditions are met.

- the SRS switching is not colliding with any other UL transmission with higher priority defined in TS 38.214 [26] if the serving cell on which the higher priority transmission is performed is a victim cell based on *txSwitchWithAnotherBand* or is the same carrier on which SRS is transmitted.
- the SRS switching is not colliding with any NR measurements (i.e. SSB/CSI-RS based L1/L3 measurements) and the measurements for RLM/BFD/CBD if the serving cell on which the NR measurements and the measurements for RLM/BFD/CBD is performed is a victim cell based on *txSwitchImpactToRx* or is the same carrier on which SRS is transmitted.

No requirements are defined for SRS antenna port switching if aperiodic SRS switching is colliding with aperiodic L1-RSRP/L1-SINR measurements and the serving cell on which the aperiodic L1-RSRP/L1-SINR measurement is configured is indicated in *txSwitchImpactToRx* or is the same carrier on which aperiodic SRS is scheduled/configured.

When 1 SRS symbol is configured in a slot for SRS antenna switching, the interruption requirement in table 8.2.2.2.16-1 applies. For the rest of SRS configurations, the interruption requirement in table 8.2.2.2.16-3 applies.

Table 8.2.2.2.16-1: Interruption length in symbols of victim CC when 1 SRS symbol is configured

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)		
	15	30	60
15	3	2	2
30	4	3	3
60	8	6	5
120	14	10	8

Table 8.2.2.2.16.2: Void

Table 8.2.2.2.16-3: Interruption length in slots of victim CC for rest of the SRS configurations

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)		
	15	30	60
15	2	2	2
30	2	2	2
60	3	2	2
120	5	3	3

8.2.2.2.17 Interruptions at fast SCell activation

The requirements in this clause shall apply for the UE configured with PCell and one SCell when aperiodic CSI-RS resources is configured for fast SCell activation.

When one SCell in MCG configured with aperiodic CSI-RS resources is configured for fast SCell activation is activated from deactivated, the UE is allowed an interruption on any active serving cell:

- of up to X2 slots, if the active serving cell and the SCell being activated are in a FR1 band pair or in a FR1+FR2 band pair.
- of up to X2 slots, if the active serving cell and the SCell being activated are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.

Where X2 is specified in table 8.2.2.2.2-1.

or

- of up to Y2 slots +$T_{ATRS_duration}$, if the active serving cells are in the same band as any of the SCells being activated, when
  - SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is larger than 2400ms, or
  - SCell is unknown and belongs to FR1, and SCell is contiguous to an active serving cell in the same band.

or

  - of up to Y2 slots if the active serving cells are in the same band as any of the SCells being activated, when
    - SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms, or
- SCell to be activated belongs to FR2

Where:

  - $T_{ATRS_duration}$ is CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots on the being activated SCell.
  - Y2 are specified in table 8.2.1.2.4-2.

8.2.2.2.18 Interruptions due to PUCCH SCell activation/deactivation

When one SCell configured with PUCCH is activated or deactivated,

- The UE is allowed an interruption on active serving cell as defined in clause 8.2.2.2.2.
- The starting time of interruption shall be within the delay as defined in clause 8.3.12.
- For inter-band CA, if the UE is not capable of *parallelTxPRACH-SRS-PUCCH-PUSCH*, additional interruption is allowed on SRS/PUCCH/PUSCH of active serving cells when colliding with RACH transmission on PUCCH SCell. Interruption occurs on the symbols containing SRS/PUCCH/PUSCH, which overlap with the duration of the PRACH preamble [3] transmitted on the PUCCH SCell.

8.2.2.2.19 Interruptions due to measurements without gap carried out by UE supporting *NeedForInterruptionInfoNR*

When a UE supports *NeedForInterruptionInfoNR-r18* and indicates *no-gap-with-interruption* on intra-frequency SSB-based or inter-frequency SSB-based measurements, the UE is allowed to cause interruptions while performing measurements on the frequency layers of the bands for which *no-gap-with-interruption* is indicated.

The UE is allowed to cause interruption on each of the active serving cells due to UE measurements without gap on a certain frequency layer *i* which equals to $\frac{2L}{T_{cycle,i}}$, where

- $T_{cycle,i}$ is the interruption cycle on a certain frequency layer i, specified in table 8.2.2.2.19-1, and
- $CSSF_{outside_gap,i}$ is defined in clause 9.1.5.1 for measurement conducted outside measurement gaps.

Table 8.2.2.2.19-1: $T_{cycle,i}$ length for inter/intra-frequency measurement on frequency layer *i*

DRX cycle	$T_{Cycle,i}$
No DRX	max (80 ms, SMTC period) x $CSSF_{outside_gap,i}$
DRX cycle ≤ 320 ms	1.5*max(80 ms, SMTC period, DRX cycle) x $CSSF_{outside_gap,i}$
DRX cycle>320 ms	DRX cycle x $CSSF_{outside_gap,i}$

The total allowed maximum interruption ratio (D) on any active serving cell if UE does not support per-FR measurement gaps or in the same FR if UE supports per-FR measurement gaps is specified as

$$D = \sum_{i=1}^{N} \frac{2L}{T_{cycle,i}}$$

Where,

- N is the total number of configured SSB based frequency layers to be measured outside gap including intra-frequency and inter-frequency target carriers in the bands where UE indicates that interruption is needed through *no-gap-with-interruption*, and
- L is the maximum interruption length for each interruption occasion specified in table 8.2.2.2.19-2 and 8.2.2.2.19-3.

When no SMTC occasion of the NR measurement objects occurs within the time period which starts from 2 ms before the starting point of the DRX ON duration to 2 ms after the ending point of the DRX ON duration, UE is not allowed to cause interruption during DRX ON duration except the time duration extended due to *drx-inactivityTimer*.

Table 8.2.2.2.19-2: Interruption length L in FR1

μ	SCS (kHz) of victim cell	NR Slot length (ms) of victim cell	Number of interrupted slots in the victim cell (slots)	Interruption length L (ms)
0	15	1	1	1
1	30	0.5	2	1
2	60	0.25	4	1

Table 8.2.2.2.19-3: Interruption length L in FR2

μ	SCS (kHz) of victim cell	NR Slot length (ms) of victim cell	Number of interrupted slots in the victim cell (slots)	Interruption length L (ms)
2	60	0.25	3	0.75
3	120	0.125	6	0.75

8.2.2.2.20 Interruptions due to PDCCH ordered RACH on target LTM cell

When PRACH transmission is triggered by PDCCH order on target LTM cell,

- During RACH transmission, the UE is allowed an interruption on activated serving cell's DL slot(s) overlapped with RACH occasion depending on UE capability *pdcch-RACH-AffectedBandsList-r18*.
  - If UE indicates NoInterruption for an activated serving band in the pdcch-RACH-AffectedBandsList-r18, the UE shall not cause interruption on DL slot(s) overlapped with RACH occasion for the serving band indicated in the band pair.
  - If UE indicates Interruption for an activated serving band in the pdcch-RACH-AffectedBandsList-r18, the UE may cause interruption on DL slot(s) overlapped with RACH occasion for the serving band indicated in the band pair.
- Before and after PRACH transmission, UE is allowed an interruption on any activated serving cell as follows:
  - of up to the duration shown in table 8.2.2.2.20-1, if PRACH bandwidth is outside active UL BWP but within one of configured UL BWPs of any active serving cell, or
  - of up to ceil(Y/NR Slot length)+1 slots, where Yms as reported in *pdcch-RACH-SwitchingTimeList-r18*, if PRACH bandwidth is outside any of the configured UL BWPs of any active serving cell
  - of up to ceil((Y+1)/NR Slot length)+1 slots, where Yms as reported in *pdcch-RACH-SwitchingTimeList-r18*, if PRACH bandwidth is outside any of the configured UL BWPs of any active serving cell, and if the number of RRC-configured LTM cells whose PRACH resources are not fully contained in any of UE's configured UL BWP(s) of serving cell(s) is more than 2, and if UE is configured with SRS carrier switching.

Table 8.2.2.2.20-1: Interruption duration due to PDCCH ordered RACH on target LTM cell when PRACH bandwidth is outside active UL BWP but within one of configured UL BWPs of any active serving cell

μ	NR Slot length (ms) of victim cell	Interruption length X (slots)
0	1	2
1	0.5	2
2	0.25	4
3	0.125	6

8.2.2.2.21 Interruptions at NR SRS bandwidth aggregation for positioning

The requirements in this clause are applicable to SRS transmission for positioning with bandwidth aggregation, when SRS resource configured in a CC without PUSCH/PUCCH is linked for aggregation with an SRS resource configured in an UL active BWP of a CC with PUSCH/PUCCH.

SRS resource sets across two or three CCs are aggregated for positioning when UE is configured with linkage information *SRS-PosResourceSetLinkedForAggBW* specified in TS 38.331 [2], provided that:

- the aggregated SRS transmission satisfy all the conditions defined in clause 6.2.1.4.2 in TS 38.214 [26];

- the aggregated SRS transmission and the guard period before and after the SRS transmission are not colliding with any other UL transmission or/and DL reception with higher priority in victim cells defined in TS 38.214 [26];

- the aggregated SRS transmission and the guard period before and after does not collide with any NR L3 or L1 measurements on victim cells.

For interruption caused by SRS transmission for positioning with bandwidth aggregation, the victim cell is identified based on the entry number of the band indicated by UE in *posSRS-BWA-AffectedBandList-r18* regardless of per-FR MG capability.

NOTE 1: UE may indicate no other bands in the band combination are affected by the SRS carrier switching, in which case, only the band with the aggregated SRS transmissions is affected.

NOTE 2: If the capability is not indicated, interruption is allowed on all serving cells.

For each SRS transmission, interruption with up to X OFDM symbols is allowed on any active serving cell on the band as indicated in *posSRS-BWA-AffectedBandList-r18*, during the guard periods before and after aggregated SRS transmission and the aggregated SRS transmission duration, where X equals to (Y+Z+1). Interruption length of one extra OFDM symbol is added to cover the impact of receive timing difference between aggressor and victim cells.

The supported guard period is reported by UE in *guardPeriod* in *PosSRS-BWA-IndependentCA-RRC-Connected-r18* [2] and the total duration Y of guard periods before and after aggregated SRS transmission is converted into number of OFDM symbols in table 8.2.2.2.21-1.

Table 8.2.2.2.21-1: Total duration Y of guard periods before and after aggregated SRS transmission (OFDM symbols)

	Guard period (μs)				
SCS of victim cell (kHz)	**0**	**30**	**100**	**140**	**200**
15	0	1	3	4	6
30		2	6	8	12
60		4	12	16	23
120		7	23	32	45
480		27	87	122	174
960		53	174	244	348

The duration of aggregated SRS transmission is given by *nrofSymbols* in corresponding SRS-Resource configurations [2]. This duration in number of *nrofSymbols* OFDM symbols is converted to Z OFDM symbols in victim cells according to the SCS configurations among the aggressor cell and victim cell(s). Z is specified in table 8.2.2.2.21-2, table 8.2.2.2.21-3, table 8.2.2.2.21-4, table 8.2.2.2.21-5 and table 8.2.2.2.21-6 for *nrofSymbols* equal to {1, 2, 4, 8, 12} respectively with different SCS configurations.

Table 8.2.2.2.21-2: Duration Z of aggregated SRS transmission with *nrofSymbols* = 1 (OFDM symbols)

	SCS of aggressor cell (kHz)			
SCS of victim cell (kHz)	**15**	**30**	**60**	**120**
15	1	1	1	1
30	2	1	1	1
60	4	2	1	1
120	8	4	2	1
480	32	16	8	4
960	64	32	16	8

Table 8.2.2.2.21-3: Duration Z of aggregated SRS transmission with *nrofSymbols* = 2 (OFDM symbols)

	SCS of aggressor cell (kHz)			
SCS of victim cell (kHz)	**15**	**30**	**60**	**120**
15	2	1	1	1
30	4	2	1	1
60	8	4	2	1
120	16	8	4	2
480	64	32	16	8
960	128	64	32	16

Table 8.2.2.2.21-4: Duration Z of aggregated SRS transmission with *nrofSymbols* = 4 (OFDM symbols)

	SCS of aggressor cell (kHz)			
SCS of victim cell (kHz)	**15**	**30**	**60**	**120**
15	4	2	1	1
30	8	4	2	1
60	16	8	4	2
120	32	16	8	4
480	128	64	32	16
960	256	128	64	32

Table 8.2.2.2.21-5: Duration Z of aggregated SRS transmission with *nrofSymbols* = 8 (OFDM symbols)

	SCS of aggressor cell (kHz)			
SCS of victim cell (kHz)	**15**	**30**	**60**	**120**
15	8	4	2	1
30	16	8	4	2
60	32	16	8	4
120	64	32	16	8
480	256	128	64	32
960	512	256	128	64

Table 8.2.2.2.21-6: Duration Z of aggregated SRS transmission with *nrofSymbols* = 12 (OFDM symbols)

	SCS of aggressor cell (kHz)			
SCS of victim cell (kHz)	**15**	**30**	**60**	**120**
15	12	6	3	2
30	24	12	6	3
60	48	24	12	6
120	96	48	24	12
480	384	192	96	48
960	768	384	192	96

8.2.2.2.22 Interruptions at OD-SSB activation/deactivation

The requirements in this clause shall apply for the UE configured with at least one deactivated OD-SSB SCell. If more than one deactivated SCells are configured with OD-SSB transmission, the requirements in this clause shall apply provided OD-SSB is activated or deactivated on only one of the deactivated OD-SSB SCells.

When OD-SSB is activated or deactivated on a deactivated SCell, the UE is allowed an interruption on any active serving cell, provided that the OD-SSB activation/deactivation command and SCell activation/deactivation command are not received at the same time:

- of up to X2 slots, if the active serving cell and the SCell on which the OD-SSB is being activated or deactivated are in a FR1 band pair or in a FR1+FR2 band pair.
- of up to X2 slots, if the active serving cell and the SCell on which the OD-SSB is being activated or deactivated are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.
- of up to X2 slots, if the active serving cell is non-contiguous to the SCell on which the OD-SSB is being activated or deactivated in the same FR1 band and UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided.

Where X2 is specified in table 8.2.2.2.22-1.

or

- of up to the duration shown in table 8.2.2.2.22-2, if the active serving cells are contiguous to the SCell on which the OD-SSB is being activated or deactivated in the same FR1 band, or if the active serving cells are non-contiguous to the SCell on which the OD-SSB is being activated or deactivated in the same FR1 band and UE is not capable of *intraBandNR-CA-non-collocated-r18* or UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is provided, provided the cell specific reference signals from the active serving cells and the SCells on which the OD-SSB is being activated or deactivated are available in the same slot.
- of up to the duration shown in table 8.2.2.2.22-2, if the active serving cells are in the same FR2 band as the SCell on which the OD-SSB is being activated or deactivated provided the cell specific reference signals from the active serving cells and the SCells on which the OD-SSB is being activated or deactivated are available in the same slot.

Table 8.2.2.2.22-1: Interruption length X2 for OD-SSB activation/deactivation for inter-band CA

μ	NR Slot length (ms) of victim cell	Interruption length X2 (slots)	
0	1		1
1	0.5		1
2	0.25	Both aggressor cell and victim cell are on FR2	2
		Either aggressor cell or victim cell is on FR1	3
3	0.125	Aggressor cell is on FR2	4
		Aggressor cell is on FR1	5
5	0.03125	Aggressor cell is on FR1	17
6	0.015625	Aggressor cell is on FR1	33

Table 8.2.2.2.22-2: Interruption duration for OD-SSB activation/deactivation for intra-band CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1
1	0.5	1
2	0.25	2
3	0.125	4
5	0.03125	16
6	0.015625	32

8.2.3 NE-DC Interruptions

8.2.3.1 Introduction

This clause contains the requirements related to the interruptions on PCell and SCell, when

- E-UTRA PSCell transitions between active and non-active during DRX, or
- E-UTRA PSCell transitions from non-DRX to DRX, or
- E-UTRA PSCell/SCell in SCG or SCell in MCG is added or released, or
- E-UTRA PSCell/SCell in SCG or SCell(s) in MCG is activated or deactivated, or
- measurements on SCC with deactivated SCell in either E-UTRA SCG or NR MCG or
- PUSCH/PUCCH carrier configuration and deconfiguration in NR MCG, or
- UL/DL BWP is switched on PCell or SCell in MCG, or
- UE-specific CBW is changed on PCell or SCell in MCG, or
- CGI reading of an NR neighbour cell with autonomous gaps, or
- CGI reading of an E-UTRA neighbour cell with autonomous gaps, or
- NR SRS carrier based switching, or
- E-UTRA SRS carrier based switching, or
- NR SRS antenna port switching, or
- SCell in NR MCG is activated based on aperiodic CSI-RS.

The requirements shall apply for NE-DC with an NR PCell.

This clause contains interruptions where victim cell is PCell or SCell belonging to MCG. Requirements for interruptions requirements when the victim cell is E-UTRA PSCell or E-UTRA SCell belonging to SCG are specified in TS 36.133 [15].

For a UE which does not support per-FR measurement gap, interruptions to the PCell, E-UTRA PSCell or activated MCG SCells may be caused by EUTRA PSCell, EUTRA SCells or SCells on any frequency range. For UE which support per-FR gap, interruptions to the PCell, E-UTRA PSCell or activated MCG SCells may be caused by EUTRA PSCell, EUTRA SCells or SCells on the same frequency range as the victim cell.

8.2.3.2 Requirements

8.2.3.2.1 Interruptions at transitions between active and non-active during DRX

Interruption on PCell and the activated SCell if configured due to E-UTRA PSCell transitions between active and non-active during DRX when PCell or SCell is in non-DRX are allowed with up to 1% probability of missed ACK/NACK when the configured E-UTRA PSCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured E-UTRA PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slots as defined in table 8.2.3.2.1-1.

Table 8.2.3.2.1-1: Interruption length X at transition between active and non-active during DRX

μ	NR slot length (ms)	Interruption length X (slots)	
		Sync	Async
0	1	1	2
1	0.5	1	2
2	0.25	3	
3	0.125	5	

When both PCell and E-UTRA PSCell are in DRX, no interruption is allowed.

8.2.3.2.2 Interruptions at transitions from non-DRX to DRX

Interruption on PCell and the activated SCell if configured due to E-UTRA PSCell transitions from non-DRX to DRX when PCell or SCell is in non-DRX shall not exceed X slots as defined in table 8.2.3.2.1-1.

8.2.3.2.3 Interruptions at PSCell/SCell addition/release

The requirements in this clause shall apply for the UE configured with E-UTRA PSCell.

When one E-UTRA PSCell/SCell in SCG is added or released, the UE is allowed an interruption on any active serving cell in MCG:

- of up to X1 slots, if the active serving cell is not in the same band as any of the E-UTRA PSCell/SCells being added or released, or
- of up to max{Y1 slots + $T_{SMTC_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA PSCell/SCells being added or released, provided the cell specific reference signals from the active serving cells and the E-UTRA PSCell/SCells being added or released are available in the same slot, where $T_{SMTC_duration}$ is the longest SMTC duration among all above activated serving cells in MCG;

Where X1 and Y1 are specified in table 8.2.3.2.3-1.

When one SCell in MCG is added or released, the UE is allowed an interruption on any activated serving cell in MCG:

- of up to X1 slots, if the active serving cell and the SCell being added or released are in a FR1 band pair or in a FR1+FR2 band pair.
- of up to X1 slots, if the active serving cell and the SCell being added or released are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.

or

- of up to Y1 slots + $T_{SMTC_duration}$ if the active serving cells are in the same band as any of the SCells being added or released, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot, where, $T_{SMTC_duration}$ is
  - the longest SMTC duration among all above active serving cells in MCG and the SCell being added when one SCell is added. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being added, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC\ duration}$ for the SCell being added is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being added. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being added, $T_{SMTC\ duration}$ for the SCell being added is 0ms;
  - the longest SMTC duration among all above active serving cells in MCG when one SCell is released.

Where X1 and Y1 are specified in table 8.2.3.2.3-2.

Table 8.2.3.2.3-1: Interruption length X1 and Y1 at E-UTRA PSCell/SCell addition/release

μ	NR Slot length (ms)	Interruption length X1 (slots)		Interruption length Y1 (slots)	
		Sync	Async	Sync	Async
0	1	1	2	1	2
1	0.5	2	3	2	3
2	0.25	5		4	5
3	0.125	9		N/A	N/A

Table 8.2.3.2.3-2: Interruption length X1 and Y1 at SCell addition/Release

μ	NR Slot length (ms) of	Interruption length X1 (slots)	Interruption length Y1 (slots)

	victim cell			
0	1	1		1
1	0.5	2		2
2	0.25	Both aggressor cell and victim cell are on FR2	4	4
		Either aggressor cell or victim cell is on FR1	5	
3	0.125	Aggressor cell is on FR2	8	8
		Aggressor cell is on FR1	9	

8.2.3.2.4 Interruptions at SCell activation/deactivation

The requirements in this clause shall apply for the UE configured with E-UTRA PSCell and one SCell.

When one E-UTRA SCell in SCG is activated from deactivated or dormant state, or deactivated from activated or dormant state the UE is allowed an interruption on any active serving cell in MCG:

- of up to X2 slots, if the active serving cell is not in the same band as any of the SCells being activated or deactivated, or

- of up to max{Y2 slots + $T_{SMTC_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being activated or deactivated, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being activated or deactivated are available in the same slot, where $T_{SMTC_duration}$ is the longest SMTC duration among all above active serving cells in MCG.

Where X2 and Y2 are specified in table 8.2.3.2.4-1.

When one SCell in MCG is activated or deactivated the UE is allowed an interruption on any serving cell in MCG:

- of up to X2 slots, if the active serving cell is not in the same band as any of the SCells being activated or deactivated, or

- of up to Y2 slots + $T_{SMTC_duration}$ if the active serving cells are in the same band as any of the SCells being activated or deactivated, provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot, where, $T_{SMTC_duration}$ is

  - the longest SMTC duration among all above active serving cells in MCG and the SCell being activated when one SCell is activated, If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being activated, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC\ duration}$ for the SCell being activated is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being activated. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being activated, $T_{SMTC\ duration}$ for the SCell being activated is 0ms;

  - the longest SMTC duration among all above active serving cells in MCG when one SCell is deactivated.

Where X2 and Y2 are specified in table 8.2.3.2.4-2.

Table 8.2.3.2.4-1: Interruption length X2 and Y2 at E-UTRA SCell activation/deactivation

μ	NR Slot length (ms)	Interruption length X2 (slots)		Interruption length Y2 (slots)	
		Sync	Async	Sync	Async
0	1	1	2	1	2
1	0.5	1	2	1	2
2	0.25	3		2	3
3	0.125	5		N/A	N/A

Table 8.2.3.2.4-2: Interruption length X2 and Y2 at SCell activation/deactivation

μ	NR Slot length (ms) of victim cell	Interruption length X2 (slots)		Interruption length Y2 (slots)
0	1	1		1
1	0.5	1		1
2	0.25	Both aggressor cell and victim cell are on FR2	2	2
		Either aggressor cell or victim cell is on FR1	3	
3	0.125	Aggressor cell is on FR2	4	4
		Aggressor cell is on FR1	5	

8.2.3.2.5 Interruptions during measurements on SCC

8.2.3.2.5.1 Interruptions during measurements on deactivated NR SCC

Interruption on PCell and other activated SCell(s) during measurement on the deactivated NR SCC shall meet requirements in clause 8.2.2.2.3.

8.2.3.2.5.2 Interruptions during measurements on deactivated E-UTRAN SCC

When one E-UTRA SCell in SCG is deactivated, the UE is allowed due to measurements on the E-UTRA SCC with the deactivated E-UTRA SCell:

- an interruption on PCell or any activated SCell with up to 0.5 % probability of missed ACK/NACK when any of the configured *measCycleSCell* [15] for the deactivated E-UTRA SCells is 640 ms or longer.
- an interruption on PCell or any activated SCell with up to 0.5 % probability of missed ACK/NACK regardless of the configured *measCycleSCell* [15] for the deactivated E-UTRA SCells if indicated by the network using IE *allowInterruptions* [15].

Each interruption shall not exceed

- X3 slots, if the PCell or activated SCell is not in the same band as the E-UTRA deactivated SCC being measured, or
- Y3 slots + SMTC duration, if the PCell or activated SCell is in the same band as the E-UTRA deactivated SCC being measured, provided the cell specific reference signals from the PCell or activated SCell and the E-UTRA deactivated SCC being measured are available in the same slot.

  Where X3 and Y3 are specified in table 8.2.3.2.5-1

Table 8.2.3.2.5-1: Interruption length X3 and Y3 at measurements on deactivated E-UTRA SCC

μ	NR Slot length (ms)	Interruption length X3 (slots)		Interruption length Y3 (slot)	
		Sync	Async	Sync	Async
0	1	1	2	1	2
1	0.5	1	2	1	2
2	0.25	3		2	3
3	0.125	5		N/A	N/A

8.2.3.2.5.3 Interruptions during CQI measurements on dormant E-UTRAN SCC

When one E-UTRA SCell in SCG is dormant, the UE is allowed due to CQI measurements on the dormant E-UTRA SCell:

- an interruption on PCell or any activated SCell with up to 0.5 % probability of missed ACK/NACK.

Each interruption shall not exceed

- X3 slots, if the PCell or activated SCell is not in the same band as the E-UTRA dormant SCell being measured, or
- Y3 slots + SMTC duration, if the PCell or activated SCell is in the same band as the E-UTRA dormant SCell being measured, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA dormant SCell being measured are available in the same slot.

Where X3 and Y3 are defined in table 8.2.3.2.5.2-1.

8.2.3.2.5.4 Interruptions during RRM measurements on dormant E-UTRAN SCC

When one E-UTRA SCell in SCG is dormant, the UE is allowed due to RRM measurements on the E-UTRA SCC with the dormant E-UTRA SCell:

- an interruption on PCell or any activated SCell with up to 0.5 % probability of missed ACK/NACK.

Each interruption shall not exceed

- X3 slots, if the PCell or activated SCell is not in the same band as the E-UTRA dormant SCC being measured, or
- Y3 slots + SMTC duration, if the PCell or activated SCell is in the same band as the E-UTRA dormant SCC being measured, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA dormant SCC being measured are available in the same slot.

Where X3 and Y3 are defined in table 8.2.3.2.5.2-1.

8.2.3.2.6 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NE-DC.

When an UL carrier or supplementary UL carrier is configured or deconfigured, an interruption of up to X4 slots as specified in table 8.2.3.2.6-1, is allowed during the RRC reconfiguration procedure in TS 38.331 [2] on PCell, all activated SCells within the same FR as the reconfigured uplink carrier. The interruption is for both uplink and downlink of PCell, all activated E-UTRA SCells, E-UTRA PSCell and all activated SCells within the same FR as the configured or de-configured UL.

Table 8.2.3.2.6-1: Interruption length X4 at UL carrier RRC reconfiguration

μ	NR Slot length (ms)	Interruption length X4 (slots)	
		Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	
3	0.125	9	

8.2.3.2.7 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch , timer-based BWP switch or UL BWP switch triggered by consistent uplink CCA failures in this clause apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this clause apply for each BWP switch.

When UE receives a DCI indicating the UE to switch its active BWP, or when a BWP timer *bwp-InactivityTimer* defined in TS 38.331 [2] expires, or when the UE receives an RRC command indicating the UE to switch its active BWP or when UL BWP switch is triggered by consistent uplink CCA failures, the UE is allowed an interruption on PCell and any activated SCells as defined in clause 8.2.2.2.5.

8.2.3.2.8 Interruptions at direct SCell activation and hibernation

8.2.3.2.8.1 Interruptions during direct SCell activation and hibernation of E-UTRA SCell

When one E-UTRA SCell in SCG is directly activated and hibernated, the UE is allowed an interruption on any active serving cell in MCG:

- of up to X1 slots, if the active serving cell is not in the same band as any of the E-UTRA SCells being directly activated or hibernated, or
- of up to max{Y1 slots + $T_{SMTC_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being directly activated or hibernated, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being directly activated or hibernated are available in the same slot, where $T_{SMTC_duration}$ is the longest SMTC duration among all above active serving cells in MCG.

Where X1 and Y1 are specified in table 8.2.3.2.3-1.

8.2.3.2.8.2 Interruptions during direct SCell activation

When one or multiple SCell(s) in MCG are directly activated at SCell addition, the UE is allowed an interruption on any active serving cell in MCG:

- of up to X1 slots, if the active serving cell is not in the same band as the SCell being directly activated, or
- of up to max{Y1 slots + $T_{SMTC_duration}$, 5ms} if the active serving cells are in the same band as the SCell being directly activated, provided the cell specific reference signals from the active serving cells and the SCell being directly activated are available in the same slot, where $T_{SMTC_duration}$ is the longest SMTC duration among all above active serving cells in MCG.

  Where X1 and Y1 are specified in table 8.2.3.2.3-2.

8.2.3.2.9 Interruptions at SCell hibernation

When one E-UTRA SCell in SCG is hibernated, the UE is allowed an interruption on any active serving cell in MCG:

- of up to X2 slots, if the active serving cell is not in the same band as any of the E-UTRA SCells being hibernated, or
- of up to max{Y2 slots + $T_{SMTC_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being hibernated, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being hibernated are available in the same slot, where $T_{SMTC_duration}$ is the longest SMTC duration among all above active serving cells in MCG.

  Where X2 and Y2 are specified in table 8.2.3.2.4-1.

8.2.3.2.10 Interruptions at SCell activation/deactivation with multiple downlink SCells

The requirements in this clause shall apply for the UE configured with E-UTRA PSCell and up to 6 downlink SCell(s).

When multiple SCells in MCG are activated or deactivated by one single MAC CE command, the UE is allowed an interruption on any serving cell in MCG as specified in clause 8.2.3.2.4.

8.2.3.2.11 Interruptions at NR SRS carrier based switching

SRS transmission can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic SRS on a carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting SRS, provided that:

- switching is from a configured carrier to another activated carrier;

- the carrier of SCells not configured for PUCCH/PUSCH transmission to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission, or indicated by MAC-CE for semi-persistent SRS transmission, or configured via RRC for periodic SRS transmission;

- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex and srs-SwitchFromCarrier in TS 38.331 [2];

- the SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [26];

- the SRS switching is not colliding with any SSB/CSI-RS based L3 measurements and the measurements for RLM/BFD in MCG.- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [2], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101-3 [20], the SRS transmission are not simultaneously scheduled with DL SSB/CSI-RS for L3 or L1 measurements transmission on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of per-FR gap, or on active serving cell(s) in MCG in FR1 if UE is capable of per-FR gap, during the switching to the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slots as specified in table 8.2.3.2.11-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of per-FR gap, or on active serving cell(s) in MCG in FR2 if UE is capable of per-FR gap, during the switching to the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slots as specified in table 8.2.3.2.11-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of per-FR gap, or on active serving cell(s) in MCG in FR1 if UE is capable of per-FR gap, during the switching from the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slots as specified in table 8.2.3.2.11-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of per-FR gap, or on active serving cell(s) in MCG in FR2 if UE is capable of per-FR gap, during the switching from the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slots as specified in table 8.2.3.2.11-2.

Table 8.2.3.2.11-1: Interruption length X1 (slots)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us)[Note 1]	Interruption length X1 (slots)	
			Sub carrier spacing for aggressor cell (kHz)	
			15	30
0	1	≤ 200	2	2
		300, 500	2	2
		900	3	3
1	0.5	≤ 200	3	2
		300, 500	3	3
		900	4	4
2	0.25	≤ 200	4	3
		300, 500	5	4
		900	7	6
3	0.125	≤ 200	7	5
		300, 500	9	7
		900	12	10
NOTE 1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.				

Table 8.2.3.2.11-2: Interruption length X2 (slots)

	NR Slot	SRS carrier	Interruption length X2 (slots)

μ	length (ms) of victim cell	switching time (us) Note 1	Sub carrier spacing for aggressor cell (kHz)	
			60	120
0	1	$\leq$ 200	2	2
1	0.5	$\leq$ 200	2	2
2	0.25	$\leq$ 200	3	3
3	0.125	≤ 200	4	4
NOTE 1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.				

For intra-band SRS carrier switching in FR1 or FR2, interruptions in table 8.2.3.2.11-1 and in table 8.2.3.2.11-2 based on SRS carrier switching time $\leq$ 200μs shall apply. For inter-band SRS carrier switching in FR1, interruptions in table 8.2.3.2.11-1 and in table 8.2.3.2.11-2 shall apply.

8.2.3.2.12 Interruptions at E-UTRA SRS carrier based switching

A PUSCH-less carrier of E-UTRA SCell is a TDD carrier without PUCCH/PUSCH configured. When a UE needs to transmit periodic or aperiodic SRS [23] and/or non-contention based PRACH on a PUSCH-less E-UTRA carrier of SCell, the UE can perform carrier based switching to one or more PUSCH-less carrier of E-UTRA SCells from a E-UTRA carrier with PUSCH or from another PUSCH-less E-UTRA carrier of SCell prior to transmitting SRS and/or PRACH, provided that:

- switching is from a configured E-UTRA carrier to another activated TDD carrier;
- the PUSCH-less carrier of E-UTRA SCells to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission or configured via RRC [15] for periodic SRS transmission;
- the E-UTRA serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex [15];
- the SRS switching is not colliding with any other transmission with higher priority defined in [39];
- the SRS switching is not colliding with PDCCH in subframe 0 and 5 as specified in [39];
- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [16], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [25], the SRS or RACH transmission are not simultaneously scheduled with DL subframe #0 or DL subframe #5 on other E-UTRA carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between E-UTRA carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of per-FR gap, or on active serving cell(s) in MCG in FR1 if UE is capable of per-FR gap, during the switching to the PUSCH-less carrier of a serving cell,

- with up to X2 slot as specified in table 8.2.3.2.12-1.

When SRS carrier based switching is performed between E-UTRA carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of per-FR gap, or on active serving cell(s) in MCG in FR1 if UE is capable of per-FR gap, during the switching from the PUSCH-less carrier of a serving cell,

- with up to X2 slots as specified in table 8.2.3.2.12-1

Table 8.2.3.2.12-1: Interruption length X2 (slots)

μ	NR Slot length (ms)	Interruption length X2 (slots)
0	1	2
1	0.5	3
2	0.25	5
3	0.125	9

8.2.3.2.13 Interruptions due to SCell dormancy

8.2.3.2.13.1 Interruptions due to SCell dormancy switch

When one SCell in MCG is switched from dormancy to non-dormancy or from non-dormancy to dormancy [7] when UE is in DRX active time,

- the UE is allowed an interruption on active serving cell in MCG as defined in clause 8.2.3.2.7, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP
- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6.2.

When multiple SCells in MCG are switched from dormancy to non-dormancy or vice versa when the UE is in DRX active time, the interruption requirement described above applies for each BWP switch.

8.2.3.2.13.2 Interruptions due to CQI measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5 %.

8.2.3.2.13.3 Interruptions due to RRM measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed 1.0 %.

8.2.3.2.14 Interruptions when identifying CGI of an NR cell with autonomous gaps

When a UE is identifying CGI of an NR cell with autonomous gaps, the UE is allowed interruptions on PCell or any activated SCell:

- with up to K1 interruptions with interrupted slots up to interruption length X1 specified in table 8.2.3.2.14-1 for each interruption during MIB decoding time period T_{MIB} (ms) specified in clause 9.11.
- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in table 8.2.3.2.14-1 for each interruption during SIB1 decoding time period T_{SIB1} (ms) specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 1.
- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in table 8.2.3.2.14-1 for each interruption during SIB1 decoding time period T_{SIB} Where:
- K1 = 6 for the target cell carrier frequency on FR1 and K1 = 25 for the target cell carrier frequency on FR2, and
- L1 = $T_{SIB1}/20$, and
- L2 = T_{SIB1}/T_{SMTC}, where T_{SMTC} is the periodicity of the SMTC occasion configured for the target cell carrier.

Table 8.2.3.2.14-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	Interruption length Y1 (slots)	Interruption length Y2 (slots)
0	1	6	7	6
1	0.5	12	13	10
2	0.25	24	25	19
3	0.125	48	49	37

8.2.3.2.15 Interruptions when identifying CGI of an E-UTRA cell with autonomous gaps

When a UE is identifying CGI of an E-UTRA FDD cell or E-UTRA TDD cell with autonomous gaps, within time period

- $T_{identify_CGI,\ intra}$ specified in clause 8.1.2.2.3, or clause 8.1.2.2.4 in TS 36.133 [15], or
- $T_{identify_CGI,\ inter}$ specified in clause 8.1.2.3.5, or clause 8.1.2.3.6, or clause 8.1.2.3.7, or clause 8.1.2.3.6 in TS 36.133 [15], or
- $T_{identify_CGI,\ E\text{-}UTRA}$ specified in clause 9.4.7.1

the UE shall be able to transmit at least the number of ACK/NACKs specified in table 8.2.3.2.15-1 on PCell or any activated SCell in the frequency range where autonomous gaps are used, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- 2 slot ACK/NACK feedback is configured,
- 20 ms SMTC period is configured.

Table 8.2.3.2.15-1: Minimum number of ACK/NACKs transmitted by the UE

Minimum number of transmitted ACK/NACKs	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

8.2.3.2.16 Interruptions at NR SRS antenna port switching

The requirements in this clause are applicable to SRS antenna port switching on FR1 and SRS resource(s) is only configured within the last 6 symbols of a slot. For interruption caused by SRS antenna port switching, the victim cell is based on the entry number of the band indicated by *txSwitchImpactToRx* and/or *txSwitchWithAnotherBand* regardless of per-FR MG capability. An UL interruption is allowed on any of the serving cells as indicated in *txSwitchWithAnotherBand*, and a DL interruption is allowed on any of the serving cells as indicated in *txSwitchImpactToRx*.

The UE shall perform SRS antenna port switching only if the below conditions are met.

- the SRS switching is not colliding with any other UL transmission with higher priority defined in TS 38.214 [26] if the serving cell on which the higher priority transmission is performed is a victim cell based on *txSwitchWithAnotherBand* or is the same carrier on which SRS is transmitted.
- the SRS switching is not colliding with any NR measurements (i.e. SSB/CSI-RS based L1/L3 measurements) and the measurements for RLM/BFD/CBD if the serving cell on which the NR measurements and the measurements for RLM/BFD/CBD is performed is a victim cell based on *txSwitchImpactToRx* or is the same carrier on which SRS is transmitted.

No requirements are defined for SRS antenna port switching if aperiodic SRS switching is colliding with aperiodic L1-RSRP/L1-SINR measurements and the serving cell on which the aperiodic L1-RSRP/L1-SINR measurement is configured is indicated in *txSwitchImpactToRx* or is the same carrier on which aperiodic SRS is scheduled/configured.

No requirements apply when SRS antenna port switching is colliding with E-UTRA measurement if the carrier on which the E-UTRA measurement is performed is indicated in *txSwitchImpactToRx* or is the same carrier on which SRS is scheduled/configured.

When 1 SRS symbol is configured in a slot for SRS antenna switching and the aggressor and victim cells are synchronized, the interruption requirement in table 8.2.3.2.16-1 applies. When 1 SRS symbol is configured in a slot for SRS antenna switching and the aggressor and victim cells are asynchronized, the interruption requirement in table 8.2.3.2.16-2 applies. For the rest of SRS configurations, the interruption requirement in table 8.2.3.2.16-3 applies.

Table 8.2.3.2.16-1: Interruption length in symbols of victim CC when 1 SRS symbol is configured, and aggressor and victim cells are synchronized

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)		
	15	30	60
15	3	2	2
30	4	3	3
60	8	6	5
120	14	10	8

Table 8.2.3.2.16-2: Interruption length in slots of victim CC when 1 SRS symbol is configured, and aggressor and victim cells are asynchronized

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)		
	15	30	60
15	2	2	2
30	2	2	2
60	2	2	2
120	2	2	2

Table 8.2.3.2.16-3: Interruption length in slots of victim CC for rest of the SRS configurations for synchronised and asynchronized scenarios

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)		
	15	30	60
15	2	2	2
30	2	2	2
60	3	2	2
120	5	3	3

8.2.3.2.17 Interruptions at fast SCell activation

The requirements in this clause shall apply for the UE configured with E-UTRA PSCell and one SCell in MCG when aperiodic CSI-RS resources is configured for fast SCell activation.

When one SCell in MCG configured with aperiodic CSI-RS resources is configured for fast SCell activation is activated from deactivated, the UE is allowed an interruption on any serving cell in MCG:

- of up to X2 slots, if the active serving cell is not in the same band as any of the SCells being activated, or
- of up to Y2 slots + $T_{ATRS_duration}$ if the active serving cells are in the same band as any of the SCells being activated, when
  - SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is larger than 2400ms, or
  - SCell is unknown and belongs to FR1, and SCell is contiguous to an active serving cell in the same band.
- of up to Y2 slots if the active serving cells are in the same band as any of the SCells being activated, when

- SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is equal to or smaller than 2400ms, or

- SCell to be activated belongs to FR2.

Where

- $T_{ATRS_duration}$ is CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots on the being activated SCell.

- X2 and Y2 are specified in table 8.2.3.2.4-2.

8.2.3.2.18 Interruptions due to UE-specific CBW change

The requirements in clause 8.2.1.2.11 apply for this clause.

8.2.3.2.19 Interruptions due to PUCCH SCell activation/deactivation

When one SCell in MCG configured with PUCCH is activated or deactivated,

The UE is allowed an interruption on active serving cell in MCG as defined in clause 8.2.3.2.4.

- The starting time of interruption shall be within the delay as defined in clause 8.3.12.

- For inter-band CA, if the UE is not capable of *parallelTxPRACH-SRS-PUCCH-PUSCH*, additional interruption is allowed on SRS/PUCCH/PUSCH of active serving cells when colliding with RACH transmission on PUCCH SCell. Interruption occurs on the symbols containing SRS/PUCCH/PUSCH, which overlap with the duration of the PRACH preamble [3] transmitted on the PUCCH SCell.

8.2.3.2.20 Interruptions at OD-SSB activation/deactivation

The requirements in this clause shall apply for the UE configured with E-UTRA PSCell and one SCell.

When OD-SSB on one deactivated SCell in MCG is activated or deactivated the UE is allowed an interruption on any serving cell in MCG, provided that the OD-SSB activation/deactivation command and SCell activation/deactivation command are not received at the same time:

- of up to X2 slots, if the active serving cell is not in the same band as any of the SCells on which OD-SSB is being activated or deactivated, or

- of up to Y2 slots if the active serving cells are in the same band as any of the SCells on which OD-SSB is being activated or deactivated, provided the cell specific reference signals from the active serving cells and the SCells on which OD-SSB is being activated or deactivated are available in the same slot.

Where X2 and Y2 are specified in table 8.2.3.2.20-1.

Table 8.2.3.2.20-1: Interruption length X2 and Y2 at OD-SSB activation/deactivation

μ	NR Slot length (ms) of victim cell	Interruption length X2 (slots)		Interruption length Y2 (slots)
0	1	1		1
1	0.5	1		1
2	0.25	Both aggressor cell and victim cell are on FR2	2	2
		Either aggressor cell or victim cell is on FR1	3	
3	0.125	Aggressor cell is on FR2	4	4
		Aggressor cell is on FR1	5	

8.2.4 NR-DC: Interruptions

8.2.4.1 Introduction

This clause contains the requirements related to the interruptions on PCell, PSCell and activated SCell if configured, when

- up to 1 SCell in FR1 and up to 7 SCell(s) in FR2 are configured, deconfigured, activated or deactivated when UE is operating in NR-DC (FR1+FR2), or
- up to [4] SCell(s) in FR1 are configured, deconfigured, activated or deactivated when UE is operating in NR-DC (FR1+FR1), or
- a supplementary UL carrier or an UL carrier is configured or de-configured, or
- measurements on SCC with deactivated SCell in NR SCG, or
- measurements on the deactivated PSCell in NR SCG, or
- UL/DL BWP is switched on PCell, PSCell or SCell, or
- UE-specific CBW is changed on PCell, PSCell or SCell, or
- transitions between active and non-active during DRX, or
- transitions from non-DRX to DRX, or
- CGI reading of an NR neighbour cell with autonomous gaps, or
- CGI reading of an E-UTRA neighbour cell with autonomous gaps, or
- NR SRS carrier based switching, or
- NR SRS antenna port switching, or
- RLM/BFD Measurement on deactivatd NR PSCell, or
- NR SCell is activated based on aperiodic CSI-RS, or
- PDCCH ordered RACH on target cell in LTM, or
- PSCell cell switch.

NOTE: interruptions at SCell addition/release, activation/deactivation and during measurements on SCC may not be required by all UEs.

The interruptions shall not interrupt RRC signalling or ACK/NACKs related to RRC reconfiguration procedure [2] for SCell addition/release or MAC control signalling [17] for SCell activation/deactivation command.

The requirements shall apply for NR-DC with an NR PCell, PSCell or SCell.

For a UE which does not support per-FR measurement gap, interruptions to the PCell and activated SCell may be caused by SCells on any frequency range. For a UE which supports per-FR gaps, interruptions to PCell, PSCell and activated SCell may be caused by SCells on the same frequency range as the victim cell.

8.2.4.2 Requirements

8.2.4.2.1 Interruptions at PSCell/SCell addition/release

When PSCell or one or more SCells is added or released using the same *RRCConnectionReconfiguration* message as defined in TS 38.331 [2], the UE is allowed an interruption on any activated serving cell during the RRC reconfiguration procedure as follows:

- of up to the duration shown in table 8.2.4.2.1-1, if the active serving cell is not in the same band as the PSCell or SCell being added or released, where the requirements for Sync apply for synchronous NR-DC, and for

asynchronous NR-DC if the active serving cell is in the same CG as the PSCell or SCell being added or released, and the requirements for Async apply for asynchronous NR-DC if the active serving cell is not in the same CG as the PSCell or SCell being added or released, or

- of up to the duration shown in table 8.2.4.2.1-2, if the active serving cells are in the same band as the SCell being added or released, provided the cell specific reference signals from the active serving cells and the SCell being added or released are available in the same slot.

Table 8.2.4.2.1-1: Interruption duration for PSCell/SCell addition/release for inter-band DC/CA

μ	NR Slot length (ms) of victim cell	Interruption length (slots)		
		Sync		Async
0	1	1		2
1	0.5	2		3
2	0.25	Both aggressor cell and victim cell are on FR2	4	5
		Either aggressor cell or victim cell is on FR1	5	
3	0.125	Aggressor cell is on FR2	8	9
		Aggressor cell is on FR1	9	
5	0.03125	Aggressor cell is on FR1	33	33
6	0.015625	Aggressor cell is on FR1	65	65

Table 8.2.4.2.1-2: Interruption duration for SCell addition/release for intra-band DC/CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
1	0.5	2 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
2	0.25	4 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
3	0.125	8 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
5	0.03125	32+ $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
6	0.015625	64+ $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$

NOTE 1: $T_{SMTC_duration}$ measured in subframes is
- the longest SMTC duration among all above active serving cells and the SCell being added when one SCell is added. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being added, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC\ duration}$ for the SCell being added is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being added. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being added, $T_{SMTC\ duration}$ for the SCell being added is 0ms;
- the longest SMTC duration among all active serving cells in the same band when one SCell is released.

NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].

8.2.4.2.2 Interruptions at SCell activation/deactivation

When a SCell is activated or deactivated as defined in TS 37.340 [17], the UE is allowed an interruption on any active serving cell:

- of up to the duration shown in table 8.2.4.2.2-1, if the active serving cell is not in the same band as any of the SCells being activated or deactivated, where the requirements for Sync apply for synchronous NR-DC, and for asynchronous NR-DC if the active serving cell is in the same CG as all the SCells being activated, and the requirements for Async apply for asynchronous NR-DC if the active serving cell is not in the same CG as any of the SCells being activated, or

- of up to the duration shown in table 8.2.4.2.2-2, if the active serving cells are in the same band as any of the SCells being activated or deactivated provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot.

Table 8.2.4.2.2-1: Interruption duration for SCell activation/deactivation for inter-band DC/CA

μ	NR Slot length (ms) of victim cell	Interruption length (slots)		
		Sync		Async
0	1	1		2
1	0.5	1		2
2	0.25	Both aggressor cell and victim cell are on FR2	2	3
		Either aggressor cell or victim cell is on FR1	3	
3	0.125	Aggressor cell is on FR2	4	5
		Aggressor cell is on FR1	5	
5	0.03125	Aggressor cell is on FR1	17	17
6	0.015625	Aggressor cell is on FR1	33	33

Table 8.2.4.2.2-2: Interruption duration for SCell activation/deactivation for intra-band DC/CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
1	0.5	1 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
2	0.25	2 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
3	0.125	4 + $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
5	0.03125	16+ $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$
6	0.015625	32+ $T_{SMTC_duration}$ * $N_{slot}^{subframe,\mu}$

NOTE 1: $T_{SMTC_duration}$ measured in subframes is
- the longest SMTC duration among all above active serving cells and the SCell being activated when one SCell is activated. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being activated, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC\ duration}$ for the SCell being activated is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being activated. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being activated, $T_{SMTC\ duration}$ for the SCell being activated is 0ms;
- the longest SMTC duration among all active serving cells in the same band when one SCell is deactivated.

NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].

8.2.4.2.3 Interruptions during measurements on SCC

Interruption on PCell, PSCell and other activated SCell(s) during measurement on the deactivated NR SCC shall meet requirements in clause 8.2.2.2.3, where the term PCell in clause 8.2.2.2.3 shall be deemed to be replaced with SpCell.

8.2.4.2.4 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NR-DC as defined in TS 38.331 [2].

When an UL carrier or supplementary UL carrier is configured or de-configured, an interruption of up to the duration shown in table 8.2.4.2.4-1, is allowed during the RRC reconfiguration procedure in TS 38.331 [2] on all the other activated serving cells within the same FR as the reconfigured uplink carrier. The interruption is for both uplink and downlink of all the other serving cells within the same FR as the configured or de-configured UL.

Table 8.2.4.2.4-1: Interruption duration for UL carrier RRC reconfiguration

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1

1	0.5	2
2	0.25	4
3	0.125	8
5	0.03125	32
6	0.015625	64

8.2.4.2.5 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch, timer-based BWP switch or UL BWP switch triggered by consistent uplink CCA failures in this clause apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this clause apply for each BWP switch.

When UE receives a DCI indicating the UE to switch its active BWP, or when a BWP timer bwp-InactivityTimer defined in TS 38.331 [2] expires, or when the UE receives an RRC command indicating the UE to switch its active BWP or when UL BWP switch is triggered by consistent uplink CCA failures,, the UE is allowed to cause an interruption on any other serving cells as defined in clause 8.2.2.2.5. In addition to what is defined in clause 8.2.2.5, when RRC-based BWP switch occurs on multiple CCs over partially overlapping period, the interruption is only allowed within the delay $T_{RRCprocessingDelay} + T_{Waiting} + T_{BWPswitchDelayRRC} + D_{RRC}*(M-1)$ as defined in clause 8.6.3A.3. Besides, in asynchronous scenario the UE is allowed an additional interrupt of 1 slot length.

8.2.4.2.6 Interruptions at transitions between active and non-active during DRX

When PCell is in non-DRX and PSCell is in DRX, interruptions on PCell and the activated SCell in MCG if configured due to transitions from active to non-active and from non-active to active during PSCell DRX are allowed with up to 1 % probability of missed ACK/NACK when the configured PSCell DRX cycle is less than 640 ms, and 0.625 % probability of missed ACK/NACK is allowed when the configured PSCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slots as defined in table 8.2.4.2.6-1.

When PSCell is in non-DRX and PCell is in DRX, interruptions on PSCell on the activated SCell in SCG if configured due to transitions from active to non-active and from non-active to active during PCell DRX are allowed with up to 1 % probability of missed ACK/NACK when the configured PCell DRX cycle is less than 640 ms, and 0.625 % probability of missed ACK/NACK is allowed when the configured PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slots as defined in table 8.2.4.2.6-1.

Table 8.2.4.2.6-1: Interruption length X at transition between active and non-active during DRX

μ	NR Slot length (ms)	Interruption length X (slots)	
		Sync	Async
0	1	1	2
1	0.5	1	2
2	0.25	3	
3	0.125	5	
5	0.03125	17	
6	0.015625	33	

When both PCell and PSCell are in DRX, no interruption is allowed.

8.2.4.2.7 Interruptions at transitions from non-DRX to DRX

Interruption on PCell and the activated SCell in MCG if configured due to PSCell transitions from non-DRX to DRX when PCell is in non-DRX shall not exceed X slots as defined in table 8.2.4.2.6-1.

Interruption on PSCell and the activated SCell in SCG if configured due to PCell transitions from non-DRX to DRX when PSCell is in non-DRX shall not exceed X slots as defined in table 8.2.4.2.6-1.

8.2.4.2.8 Interruptions at SCell activation/deactivation with multiple downlink SCells

The requirements in this clause shall apply for the UE configured with NR-DC and up to 1 downlink SCell in FR1 and up to 7 downlink SCell(s) in FR2.

When multiple SCell are activated or deactivated by one single MAC CE command in MCG or SCG, the UE is allowed an interruption on any serving cell in MCG or SCG as specified in clause 8.2.4.2.2.

When multiple SCell are activated or deactivated in both MCG and SCG by two MAC CE commands respectively, the UE is allowed an interruption:

- on any serving cell in MCG as specified in clause 8.2.4.2.2, and
- on any serving cell in SCG as specified in clause 8.2.4.2.2.

8.2.4.2.9 Interruptions at NR SRS carrier based switching

SRS transmission can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic SRS on a carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting SRS, provided that:

- switching is from a configured carrier to another activated carrier;
- the carrier of SCells not configured for PUCCH/PUSCH transmission to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission, or indicated by MAC-CE for semi-persistent SRS transmission, or configured via RRC for periodic SRS transmission;
- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex and srs-SwitchFromCarrier in TS 38.331 [2];
- the SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [26];
- the SRS switching is not colliding with any SSB/CSI-RS based L3 measurements and the measurements for RLM/BFD in the same CG.- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [2], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101-3 [20], the SRS transmission are not simultaneously scheduled with DL SSB/CSI-RS for L3 or L1 measurements transmission on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of per-FR gap, or on active serving cell(s) in FR1 if UE is capable of per-FR gap, during the switching to the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slots as specified in table 8.2.4.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of per-FR gap, or on active serving cell(s) in FR2 if UE is capable of per-FR gap, during the switching to the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slots as specified in table 8.2.4.2.9-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of per-FR gap, or on active serving cell(s) in FR1 if UE is capable of per-FR gap, during the switching from the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slots as specified in table 8.2.4.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of per-FR gap, or on active serving cell(s) in FR2 if UE is capable of per-FR gap, during the switching from the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slots as specified in table 8.2.4.2.9-2.

Table 8.2.4.2.9-1: Interruption length X1 (slots)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us)[Note 1]	Interruption length X1 (slots)	
			Sub carrier spacing for aggressor cell (kHz)	
			15	30
0	1	$\leq$ 200	2	2
		300, 500	2	2
		900	3	3
1	0.5	$\leq$ 200	3	2
		300, 500	3	3
		900	4	4
2	0.25	≤ 200	4	3
		300, 500	5	4
		900	7	6
3	0.125	≤ 200	7	5
		300, 500	9	7
		900	12	10
5	0.03125	≤ 200	22	15
		300, 500	31	24
		900	44	37
6	0.015625	≤ 200	42	28
		300, 500	61	47
		900	87	73
NOTE 1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.				

Table 8.2.4.2.9-2: Interruption length X2 (slots)

μ	NR Slot length (ms) of victim cell	SRS carrie switching time (us) [Note 1]	Interruption length X2 (slots)			
			Sub carrier spacing for aggressor cell (kHz)			
			60	120	480	960
0	1	≤ 200	2	2	2	2
1	0.5	≤ 200	2	2	2	2
2	0.25	≤ 200	3	3	2	2
3	0.125	≤ 200	4	4	3	3
5	0.03125	≤ 200	11	10	8	8
6	0.015625	≤ 200	21	18	15	15
NOTE 1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.						

For intra-band SRS carrier switching in FR1or FR2, interruptions in table 8.2.2.2.9-1 and in table 8.2.2.2.9-2 based on SRS carrier switching time ≤ 200μs shall apply. For inter-band SRS carrier switching in FR1, interruptions in table 8.2.2.2.9-1 and in table 8.2.2.2.9-2 shall apply.

8.2.4.2.10 Interruptions at direct SCell activation

When one or multiple SCell(s) are directly activated at SCell addition, the UE is allowed an interruption on any active serving cell:

- of up to the duration shown in table 8.2.4.2.1-1, if the active serving cell is not in the same band as the SCell being directly activated, where the requirements for Sync apply for synchronous NR-DC, and for asynchronous NR-DC if the active serving cell is in the same CG as the SCell being directly activated, and the requirements for Async apply for asynchronous NR-DC if the active serving cell is not in the same CG as the SCell being directly activated, or

- of up to the duration shown in table 8.2.4.2.1-2, if the active serving cells are in the same band as the SCell being directly activated provided the cell specific reference signals from the active serving cells and the SCell being directly activated are available in the same slot.

8.2.4.2.11 Interruptions when identifying CGI of an NR cell with autonomous gaps

When a UE is identifying CGI of an NR cell with autonomous gaps, the UE is allowed interruptions on PCell, PSCell or any activated SCell:

- with up to K1 interruptions with interrupted slots up to interruption length X1 specified in table 8.2.4.2.11-1 for each interruption during MIB decoding time period T_{MIB} (ms) specified in clause 9.11.
- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in table 8.2.4.2.11-1 for each interruption during SIB1 decoding time period T_{SIB1} (ms) specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 1.
- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in table 8.2.4.2.11-1 for each interruption during SIB1 decoding time period T_{SIB1} (ms) specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

- K1 = 6 for the target cell carrier frequency on FR1 and K1 = 25 for the target cell carrier frequency on FR2, and
- L1 = $T_{SIB1}/20$, and
- L2 = T_{SIB1}/T_{SMTC}, where T_{SMTC} is the periodicity of the SMTC occasion configured for the target cell carrier.

Table 8.2.4.2.11-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	Interruption length Y1 (slots)	Interruption length Y2 (slots)
0	1	6	7	6
1	0.5	12	13	10
2	0.25	24	25	19
3	0.125	48	49	37
5	0.03125	192	193	145
6	0.015625	384	385	289

8.2.4.2.12 Interruptions when identifying CGI of an E-UTRA cell with autonomous gaps

When a UE is identifying CGI of an E-UTRA FDD cell or E-UTRA TDD cell with autonomous gaps, within time period $T_{identify_CGI,\ E\text{-}UTRA}$ specified in clause 9.4.7.1, the UE shall be able to transmit at least the number of ACK/NACKs specified in table 8.2.4.2.12-1 on PCell, PSCell or any activated SCell in the frequency range where autonomous gaps are used, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- 2 slot ACK/NACK feedback is configured,
- 20 ms SMTC period is configured.

Table 8.2.4.2.12-1: Minimum number of ACK/NACKs transmitted by the UE during $T_{identify_CGI,\ E\text{-}UTRA}$

Minimum number of transmitted ACK/NACKs	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz

233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

8.2.4.2.13 Interruptions due to SCell dormancy

8.2.4.2.13.1 Interruptions due to SCell dormancy switch

When one SCell in MCG or SCG is switched from dormancy to non-dormancy or from non-dormancy to dormancy [7] when UE is in DRX active time,

- the UE is allowed an interruption on active serving cell in MCG and SCG as defined in clause 8.2.4.2.5, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP

- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6.2.

When multiple SCells in MCG or SCG are switched from dormancy to non-dormancy or vice versa when the UE is in DRX active time, the interruption requirement described above applies for each BWP switch.

8.2.4.2.13.2 Interruptions due to CQI measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5 %.

8.2.4.2.13.3 Interruptions due to RRM measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed 1.0 %.

8.2.4.2.14 Interruptions at NR SRS antenna port switching

The requirements in this clause are applicable to SRS antenna port switching on FR1 and SRS resource(s) is only configured within the last 6 symbols of a slot. For interruption caused by SRS antenna port switching, the victim cell is based on the entry number of the band indicated by *txSwitchImpactToRx* and/or *txSwitchWithAnotherBand* regardless of per-FR MG capability. An UL interruption is allowed on any of the serving cells as indicated in *txSwitchWithAnotherBand*, and a DL interruption is allowed on any of the serving cells as indicated in *txSwitchImpactToRx*..

The UE shall perform SRS antenna port switching only if the below conditions are met.

- the SRS switching is not colliding with any other UL transmission with higher priority defined in TS 38.214 [26] if the serving cell on which the higher priority transmission is performed is a victim cell based on *txSwitchWithAnotherBand* or is the same carrier on which SRS is transmitted.

- the SRS switching is not colliding with any NR measurements (i.e. SSB/CSI-RS based L1/L3 measurements) and the measurements for RLM/BFD/CBD if the serving cell on which the NR measurements and the measurements for RLM/BFD/CBD is performed is a victim cell based on *txSwitchImpactToRx* or is the same carrier on which SRS is transmitted.

No requirements are defined for SRS antenna port switching if aperiodic SRS switching is colliding with aperiodic L1-RSRP/L1-SINR measurements and the serving cell on which the aperiodic L1-RSRP/L1-SINR measurement is configured is indicated in *txSwitchImpactToRx* or is the same carrier on which aperiodic SRS is scheduled/configured.

When 1 SRS symbol is configured in a slot for SRS antenna switching and the aggressor and victim cells are synchronized, the interruption requirement in table 8.2.4.2.14-1 applies. When 1 SRS symbol is configured in a slot for SRS antenna switching and the aggressor and victim cells are asynchronized, the interruption requirement in table 8.2.4.2.14-2 applies. For the rest of SRS configurations, the interruption requirement in table 8.2.4.2.14-3 applies.

Table 8.2.4.2.14-1: Interruption length in symbols of victim CC when 1 SRS symbol is configured, and aggressor and victim cells are synchronized

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)		
	15	30	60
15	3	2	2
30	4	3	3
60	8	6	5
120	14	10	8

Table 8.2.4.2.14-2: Interruption length in slots of victim CC when 1 SRS symbol is configured, and aggressor and victim cells are asynchronized

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)		
	15	30	60
15	2	2	2
30	2	2	2
60	2	2	2
120	2	2	2

Table 8.2.4.2.14-3: Interruption length in slots of victim CC for rest of the SRS configurations for synchronised and asynchronized scenarios

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)		
	15	30	60
15	2	2	2
30	2	2	2
60	3	2	2
120	5	3	3

8.2.4.2.15 Interruptions at fast SCell activation

The requirements in this clause shall apply for the UE configured with one SCell when aperiodic CSI-RS resources is configured for fast SCell activation.

When one SCell in MCG or SCG is activated from deactivated, and aperiodic CSI-RS resources is configured for fast SCell activation, the UE is allowed an interruption on any active serving cell:

- of up to the duration shown in table 8.2.4.2.2-1, if the active serving cell is not in the same band as the SCell being activated, where the requirements for Sync apply for synchronous NR-DC, and for asynchronous NR-DC if the active serving cell is in the same CG as the SCell being activated, and the requirements for Async apply for asynchronous NR-DC if the active serving cell is not in the same CG as the SCell being activated, or
- of up to Y2 slots + $T_{ATRS_duration}$ if the active serving cells are in the same band as the SCell being activated, when
  - SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is larger than 2400ms, or
  - SCell is unknown and belongs to FR1, and SCell is contiguous to an active serving cell in the same band.
- of up to Y2 slots if the active serving cells are in the same band as any of the SCells being activated, when
  - SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is equal to or smaller than 2400ms, or
  - SCell to be activated belongs to FR2.

Where

- $T_{ATRS_duration}$ is CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots on the being activated SCell.
- Y2 are specified in table 8.2.3.2.4-2.

8.2.4.2.16 Interruptions at SCG activation/deactivation

When SCG is activated or deactivated using an *RRCConnectionReconfiguration* message as defined in TS 38.331 [2], the UE is allowed an interruption on any activated serving cell in MCG during the RRC reconfiguration procedure as follows:

- of up to the duration shown in table 8.2.4.2.16-1, if the active serving cell is not in the same band as the PSCell being activated or deactivated, where the requirements for Sync apply for synchronous NR-DC. The requirements for Async apply for asynchronous NR-DC.

Table 8.2.4.2.16-1: Interruption duration for SCG activation/deactivation for inter-band DC/CA

μ	NR Slot length (ms) of victim cell	Interruption length (slots)		
		Sync		Async
0	1	1		2
1	0.5	2		3
2	0.25	Both aggressor cell and victim cell are on FR2	4	5
		Either aggressor cell or victim cell is on FR1	5	
3	0.125	Aggressor cell is on FR2	8	9
		Aggressor cell is on FR1	9	

8.2.4.2.17 Interruptions due to RRM measurements on deactivated SCG

If the UE is not configured with RLM or BFD on the deactivated PSCell, interruptions on PCell or activated SCell(s) due to measurements on the deactivated PSCell are allowed with up to 0.5 % probability of missed ACK/NACK feedback when the configured *measCyclePSCell* is 640 ms or longer. The UE is only allowed to cause interruptions on PCell or activated SCell(s) immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in table 8.2.2.2.2-1.

If the UE is configured with RLM or BFD on the deactivated PSCell, the rate of ACK/NACK feedback loss on any active serving cell resulting from RRM measurements on the deactivated PSCell shall not exceed 1.0 %.

8.2.4.2.18 Interruptions during RLM/BFD measurements on deactivated PSCell

When PSCell is configured with *bfd-and-RLM* with value *true*, if NR PSCell is deactivated, the UE is for the purpose of RLM/BFD measurements on the deactivated PSCell allowed to cause interruptions to activated serving cell(s) which can either be PCell or SCell in MCG.

The rate of ACK/NACK feedback loss on any activated serving cell resulting from RLM/BFD measurements on deactivated PSCell shall not exceed 0.5 %.

8.2.4.2.19 Interruptions due to UE-specific CBW change

The requirements in clause 8.2.2.2.8 apply for this clause.

8.2.4.2.20 Interruptions due to PDCCH ordered RACH on target LTM cell

When PRACH transmission is triggered by PDCCH order on target LTM cell,

- During RACH transmission, the UE is allowed an interruption on activated serving cell's DL slot(s) overlapped with RACH occasion depending on UE capability *pdcch-RACH-AffectedBandsList-r18*.
- Before and after PRACH transmission, UE is allowed an interruption on any activated serving cell as follows:

- of up to the duration shown in table 8.2.4.2.20-1, if PRACH bandwidth is outside active UL BWP but within one of configured UL BWPs of any active serving cell, or

- of up to ceil(Y/NR Slot length)+1 slots, where Yms as reported in *pdcch-RACH-SwitchingTimeList-r18*, if PRACH bandwidth is outside any of the configured UL BWPs.

- of up to ceil((Y+1)/NR Slot length)+1 slots, where Yms as reported in *pdcch-RACH-SwitchingTimeList-r18*, if PRACH bandwidth is outside any of the configured UL BWPs of any active serving cell, and if the number of RRC-configured LTM cells whose PRACH resources are not fully contained in any of UE's configured UL BWP(s) of serving cell(s) is more than 2, and if UE is configured with SRS carrier switching.

Table 8.2.4.2.20-1: Interruption duration due to PDCCH ordered RACH on target LTM cell when PRACH bandwidth is outside active UL BWP but within one of configured UL BWPs of any active serving cell

μ	NR Slot length (ms) of victim cell	Interruption length X (slots)
0	1	2
1	0.5	2
2	0.25	4
3	0.125	6

8.2.4.2.21 Interruptions at PSCell Cell switch

When PSCell cell switch is triggered using the LTM Cell Switch Command as defined in TS 38.321 [7], the UE is allowed an interruption of up to the duration shown in table 8.2.4.2.21-1 on any activated serving cell in MCG during the cell switch delay.

Table 8.2.4.2.21-1: Interruption duration for PSCell cell switch for inter-band DC

μ	NR Slot length (ms) of victim cell	Interruption length (slots)		
		Sync		Async
0	1	1		2
1	0.5	2		3
2	0.25	Both aggressor cell and victim cell are on FR2-1	4	5
		Either aggressor cell or victim cell is on FR1	5	
3	0.125	Aggressor cell is on FR2-1	8	9
		Aggressor cell is on FR1	9	

8.2.4.2.22 Interruptions at OD-SSB activation/deactivation

When OD-SSB is activated or deactivated on a deactivated SCell, the UE is allowed an interruption on any active serving cell, provided that the OD-SSB activation/deactivation command and SCell activation/deactivation command are not received at the same time:

- of up to the duration shown in table 8.2.4.2.22-1, if the active serving cell is not in the same band as any of the SCells on which OD-SSB is being activated or deactivated, where the requirements for Sync apply for synchronous NR-DC, and for asynchronous NR-DC if the active serving cell is in the same CG as all the SCells on which OD-SSB is being activated, and the requirements for Async apply for asynchronous NR-DC if the active serving cell is not in the same CG as any of the SCells on which OD-SSB is being activated, or

- of up to the duration shown in table 8.2.4.2.22-2, if the active serving cells are in the same band as any of the SCells on which OD-SSB is being activated or deactivated provided the cell specific reference signals from the active serving cells and the SCells on which OD-SSB is being activated or deactivated are available in the same slot.

Table 8.2.4.2.22-1: Interruption duration for OD-SSB activation/deactivation for inter-band DC/CA

μ	NR Slot length (ms) of victim cell	Interruption length (slots)	
		Sync	Async

0	1	1		2
1	0.5	1		2
2	0.25	Both aggressor cell and victim cell are on FR2	2	3
		Either aggressor cell or victim cell is on FR1	3	
3	0.125	Aggressor cell is on FR2	4	5
		Aggressor cell is on FR1	5	
5	0.03125	Aggressor cell is on FR1	17	17
6	0.015625	Aggressor cell is on FR1	33	33

Table 8.2.4.2.22-2: Interruption duration for OD-SSB activation/deactivation for intra-band DC/CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1
1	0.5	1
2	0.25	2
3	0.125	4
5	0.03125	16
6	0.015625	32

8.2.4.2A Void

8.2.4.2A.1 Void

8.2.4.2A.2 Void

8.2.4.2A.3 Void

8.2D Interruption for ATG UE

8.2D.1 Interruptions with Standalone NR Carrier Aggregation

8.2D.1.1 Introduction

This clause contains the requirements related to the interruptions on PCell and activated SCell if configured to an ATG UE, when

- Single DL SCell is configured, de-configured, activated or deactivated, or
- UL/DL BWP is switched on PCell or DL BWP is switched on SCell, or
- CGI reading of an NR neighbour cell with autonomous gaps, or
- UE-specific CBW is changed on PCell or SCell, or
- NR SRS antenna port switching on PCell, or
- SCell is activated based on aperiodic CSI-RS.

NOTE: interruptions at SCell addition/release, activation/deactivation and during measurements on SCC may not be required by all UEs.

The interruptions shall not interrupt RRC signalling or ACK/NACKs related to RRC reconfiguration procedure according to TS 38.331 [2] for SCell addition/release or MAC control signalling according to TS 37.340 [17] for SCell activation/deactivation command.

8.2D.1.2 Requirements

8.2D.1.2.1 Interruptions at SCell addition/release

When one DL SCell is added or released using the same *RRCConnectionReconfiguration* message as defined in TS 38.331 [2], the ATG UE is allowed an interruption on any active serving cell during the RRC reconfiguration based SCell addition/release procedures as follows:

- of up to the interruption length specified in table 8.2D.1.2.1-1, if the active serving cells are contiguous to the SCell being added or released in the same FR1 band, provided the cell specific reference signals from the active serving cells and the SCell being added or released are available in the same slot or,

- of up to the interruption length sepcified in table 8.2D.1.2.1-2, if the active serving cell and the SCell being added or released are in a FR1 band pair.

Table 8.2D.1.2.1-1: Interruption length for SCell addition/release for ATG intra-band contiguous CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1 + $T_{SMTC_duration_ATG}$ * $N_{slot}^{subframe,\mu}$
1	0.5	2 + $T_{SMTC_duration_ATG}$ * $N_{slot}^{subframe,\mu}$
NOTE 1: $T_{SMTC_duration_ATG}$ measured in subframes is - the longest SMTC duration among all above active serving cells and the SCell being added when one SCell is added. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being added, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC_duration_ATG}$ for the SCell being added is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being added. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being added, $T_{SMTC_duration_ATG}$ for the SCell being added is 0ms; - the longest SMTC duration among all active serving cells in the same band when one SCell is released. NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].		

Table 8.2D.1.2.1-2: Interruption length for SCell addition/release for ATG inter-band CA

μ	NR Slot length (ms) of victim cell	Interruption length (slots)
0	1	1
1	0.5	2

8.2D.1.2.2 Interruptions at SCell activation/deactivation

When an SCell is activated or deactivated as defined in TS 37.340 [17], the ATG UE is allowed an interruption on any active serving cell:

- of up to the interruption length specified in table 8.2D.18.2D.1.2.2-2, if the active serving cell and the SCell being activated or deactivated are in a FR1 band pair.

Table 8.2D.1.2.2-1: Interruption length for SCell activation/deactivation for ATG intra-band contiguous CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1 + $T_{SMTC_duration_ATG}$ * $N_{slot}^{subframe,\mu}$
1	0.5	1 + $T_{SMTC_duration_ATG}$ * $N_{slot}^{subframe,\mu}$
NOTE 1: $T_{SMTC_duration_ATG}$ measured in subframes is - the longest SMTC duration among all above active serving cells and the SCell being activated when one SCell is activated. If SSB configuration (*absoluteFrequencySSB*) but no SMTC configuration is provided for the SCell being activated, the SSB transmission periodicity is assumed to be 5ms and $T_{SMTC_duration_ATG}$ for the SCell being activated is x ms, where x = the number of consecutive subframes containing all SSBs in one SSB burst transmitted by the SCell being activated. If neither SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration is provided for the SCell being activated, $T_{SMTC_duration_ATG}$ for the SCell being activated is 0ms; - the longest SMTC duration among all active serving cells in the same band when one SCell is deactivated.		

NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].

Table 8.2D.1.2.2-2: Interruption length for SCell activation/deactivation for ATG inter-band CA

μ	NR Slot length (ms) of victim cell	Interruption length (slots)
0	1	1
1	0.5	1

8.2D.1.2.3 Interruptions during measurements on deactivated SCC

Interruptions on PCell due to measurements when an SCell is deactivated are allowed for an ATG UE with up to 0.5 % probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer.

- If the PCell is not in the same band as the deactivated SCell, the ATG UE is only allowed to cause interruptions on PCell immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in table 8.2D.1.2.2-1 or,

- If the PCell is contiguous to the deactivated SCell in the same FR1 band, the ATG UE is allowed to cause an interruption on PCell no earlier than X slots before $T_{SMTC_duration_ATG}$ and no later than X slots after $T_{SMTC_duration_ATG}$, provided the cell specific reference signals from the active serving cells and the deactivated SCell are available in the same slot, where X and $T_{SMTC_duration_ATG}$ are given by table 8.2D.1.2.3-1. The interruption shall not exceed requirements in table 8.2D.1.2.3-1.

Table 8.2D.1.2.3-1: Interruption duration for measurement on deactivated SCell for intra-band CA

μ	NR Slot length (ms)	X (slots)	Interruption length (slots)
0	1	1	2 + $T_{SMTC_duration_ATG}$ * $N_{slot}^{subframe,\mu}$
1	0.5	1	2 + $T_{SMTC_duration_ATG}$ * $N_{slot}^{subframe,\mu}$
NOTE 1: $T_{SMTC_duration_ATG}$ measured in subframes is the longest SMTC duration among all above active serving cells and the deactivated SCell to be measured;			
NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].			

8.2D.1.2.4 Interruptions at direct SCell activation

When one SCell is directly activated at SCell addition, the ATG UE is allowed an interruption on any active serving cell:

- of up to the interruption length specified in table 8.2D.1.2.1-1, if the active serving cells are in the same band as the SCell being activated provided the cell specific reference signals from the active serving cells and the SCell being activated are available in the same slot or,

- of up to the interruption length specified in table 8.2D.1.2.1-2, if the active serving cell is not in the same band as the SCell being directly activated.

8.2D.1.2.5 Interruptions due to SCell dormancy

8.2D.1.2.5.1 Interruptions due to SCell dormancy switch

When one SCell is switched from dormancy to non-dormancy or from non-dormancy to dormancy [7] when ATG UE is in DRX active time,

- the ATG UE is allowed an interruption on PCell as defined in clause 8.2D.1.2.7, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP and,

- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6D.2.

8.2D.1.2.5.2 Interruptions due to CQI measurements during SCell dormancy

The requirements specified in clause 8.2.2.2.12.2 apply to ATG UE.

8.2D.1.2.5.3 Interruptions due to RRM measurements during SCell dormancy

The requirements specified in clause 8.2.2.2.12.3 apply to ATG UE.

8.2D.1.2.6 Interruptions at fast SCell activation

The requirements in this clause shall apply for the ATG UE configured with PCell and one SCell when aperiodic CSI-RS resources is configured for fast SCell activation.

When one SCell in MCG configured with aperiodic CSI-RS resources is configured for fast SCell activation is activated from deactivated, the ATG UE is allowed an interruption on any active serving cell:

- of up to the interruption length specified in table 8.2D.1.2.2-2, if the active serving cell and the SCell being activated are in a FR1 band pair.

or

- of up to A slots +$T_{ATRS_duration_ATG}$, if the active serving cells are in the same band as any of the SCells being activated, when
  - SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is larger than 2400ms, or
  - SCell is unknown and belongs to FR1, and SCell is contiguous to an active serving cell in the same band.

or

- of up to A slots if the active serving cells are in the same band as any of the SCells being activated, when SCell to be activated is known and belongs to FR1, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.

Where:

- $T_{ATRS_duration_ATG}$ is CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots on the being activated SCell.
- A is specified in table 8.2D.1.2.6-1.

Table 8.2D.1.2.6-1: Interruption length A at SCell activation/deactivation for ATG UE

μ	NR Slot length (ms) of victim cell	Interruption length A (slots)
0	1	1
1	0.5	1

8.2D.1.2.7 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch, timer-based BWP switch in this clause apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When the DCI-based, timer-based or RRC-based downlink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this clause apply for each BWP switch.

When ATG UE receives a DCI indicating UE to switch its active BWP involving changes in any of the parameters listed in table 8.2D.1.2.7-2, the ATG UE is allowed to cause interruption of up to X slots to other active serving cells. X is defined in table 8.2D.1.2.7-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6D.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay $T_{MultipleBWPswitchDelay}$ +Y as defined in clause

8.6D.2A.1 when BWP switch occurs on multiple CCs. Interruptions are not allowed during BWP switch involving any other parameter change.

When a BWP timer *bwp-InactivityTimer* defined in TS 38.331 [2] expires, the ATG UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in table 8.2D.1.2.7-2. X is defined in table 8.2D.1.2.7-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6D.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay $T_{MultipleBWPswitchDelay}$ as defined in clause 8.6D.2B.1 when BWP switch occurs on multiple CCs simultaneously or $T_{MultipleBWPswitchDelayTotal}$ as defined in clause 8.6D.2B.2 when BWP switch occurs on multiple CCs over partially overlapping time period. Interruptions are not allowed during BWP switch involving any other parameter change.

When ATG UE receives an RRC reconfiguration that only requests UE to switch its active BWP on one single CC, the ATG UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in table 8.2D.1.2.7-2. X is defined in table 8.2D.1.2.7-1. The interruption is only allowed within the delay $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC}$ defined in clause 8.6D.3 when BWP switch occurs on a single CC. The interruption is only allowed within the delay $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC} + D_{RRC}*(N-1)$ as defined in clause 8.6D.3A when BWP switch occurs on multiple CCs.

Table 8.2D.1.2.7-1: Interruption length X

μ	NR Slot length (ms)	Interruption length X (slots)
0	1	1
1	0.5	1

Table 8.2D.1.2.7-2: Parameters which cause interruption other than SCS

Parameters	Comment
locationAndBandwidth	From TS 38.331 [2]
nrofSRS-Ports	
maxMIMO-Layers-r16	

8.2D.1.2.8 Interruptions due to UE-specific CBW change

When an ATG UE receives an RRC reconfiguration that changes *offsetToCarrier* or *carrierBandwidth*, the ATG UE is allowed to cause interruption of up to X slots to other active serving cells due to switching its CBW. X is defined in table 8.2D.1.2.8-1. The interruption is only allowed within the delay $T_{RRCprocessingDelay} + T_{CBWchangeDelayRRC}$ defined in clause 8.13D.

Table 8.2D.1.2.8-1: interruption length X

μ	NR Slot length (ms)	Interruption length X (slots)
0	1	1
1	0.5	1

8.2D.1.2.9 Interruptions when identifying CGI of an NR cell with autonomous gaps

When an ATG UE is identifying CGI of an NR cell with autonomous gaps, the ATG UE is allowed interruptions on PCell or any activated SCell:

- with up to K1 interruptions with interrupted slots up to interruption length X1 specified in table 8.2D.1.2.9-1 for each interruption during MIB decoding time period T_{MIB} (ms) specified in clause 9.11D.

- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in table 8.2D.1.2.9-1 for each interruption during SIB1 decoding time period T_{SIB1} (ms) specified in clause 9.11D for SSB and CORESET for RMSI scheduling multiplexing patterns 1.

- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in table 8.2D.1.2.9-1 for each interruption during SIB1 decoding time period T_{SIB1} (ms) specified in clause 9.11D for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

- K1 = 6 for the target cell carrier frequency on FR1, and

- L1 = T_{SIB1}/20and

- L2 = T_{SIB1}/T_{SMTC}, where T_{SMTC} is the periodicity of the SMTC occasion configured for the target cell carrier.

Table 8.2D.1.2.9-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	Interruption length Y1 (slots)	Interruption length Y2 (slots)
0	1	6	7	6
1	0.5	12	13	10

8.2D.1.2.10 Interruptions at NR SRS antenna port switching

The requirements in this clause are applicable to ATG UE SRS antenna port switching on FR1 and SRS resource(s) is only configured within the last 6 symbols of a slot. For interruption caused by SRS antenna port switching, the victim cell is based on the entry number of the band indicated by *txSwitchImpactToRx*. DL interruption is allowed on any of the serving cells as indicated in *txSwitchImpactToRx*.

The ATG UE shall perform SRS antenna port switching only if the below conditions are met.

- the SRS switching is not colliding with any NR measurements (i.e. SSB/CSI-RS based L1/L3 measurements) and the measurements for RLM/BFD/CBD if the serving cell on which the NR measurements and the measurements for RLM/BFD/CBD is performed is a victim cell based on *txSwitchImpactToRx* or is the same carrier on which SRS is transmitted.

No requirements are defined for SRS antenna port switching if aperiodic SRS switching is colliding with aperiodic L1-RSRP/L1-SINR measurements and the serving cell on which the aperiodic L1-RSRP/L1-SINR measurement is configured is indicated in *txSwitchImpactToRx* or is the same carrier on which aperiodic SRS is scheduled/configured.

When 1 SRS symbol is configured in a slot for SRS antenna switching, the interruption requirement in table 8.2D.1.2.10-1 applies. For the rest of SRS configurations, the interruption requirement in table 8.2D.1.2.10-2 applies.

Table 8.2D.1.2.10-1: Interruption length in symbols of victim CC when 1 SRS symbol is configured

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)	
	15	30
15	3	2
30	4	3

Table 8.2D.1.2.10-2: Interruption length in slots of victim CC for rest of the SRS configurations

Victim cell SCS(kHz)	Aggressor cell SCS (kHz)	
	15	30
15	2	2
30	2	2

8.3 SCell Activation and Deactivation Delay

8.3.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to activate at least one deactivated SCell and deactivate at least one activated SCell in EN-DC, or in standalone NR carrier aggregation, or in NE-DC, or in NR-DC.

The requirements shall apply for EN-DC, standalone NR carrier aggregation, NE-DC, and NR-DC.

8.3.2 SCell Activation Delay Requirement for Deactivated SCell

The requirements in this clause shall apply for the UE configured with at least one downlink SCell in EN-DC, or in standalone NR carrier aggregation or in NE-DC or in NR-DC and when one SCell is being activated.

When the UE is configured with *LowBandCA-Switching-r19* in FR1, the following requirements apply for activation of SDL SCell, when the SDL SCell reference signals to be measured for SCell activation are fully or partially overlapped with the SDL SCell active periods based on the *switchingPattern-r19*. The requirements do not apply if none of the SDL SCell reference signals to be measured for SDL SCell activation are overlapping with SCell active periods of the *switchingPattern-r19*.

When the UE is configured with *LowBandCA-Switching-r19*and the SCell to be activated is an SDL SCell, upon receiving SCell activation command in slot *n*, the UE shall activate the configured *switchingPattern-r19* at slot $n + \frac{T_{HARQ}+3ms+T_{LBCA}}{NR\ slot\ length}$, where T_{LBCA} = 1 ms is the UE processing delay for activating the *switchingPattern-r19*.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot $n + \frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation_time}$ is the SCell activation delay in milliseconds.

If the SCell is known and belongs to FR1, $T_{activation_time}$ is:

- $T_{FirstSSB}$+ T_{Δ} + 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.
- $T_{FirstSSB_MAX}$ + T_{rs}+ T_{Δ} + 5 ms, if the measurement period of the SCell being activated is larger than 2400 ms.

If the SCell is unknown and belongs to FR1, and if one of the following conditions is met

- ‘ssb-PositionInBurst’ indicates only one SSB is being actually transmitted, or
- ‘ssb-PositionInBurst’ indicates multiple SSBs and TCI indication is provided in same MAC PDU with SCell activation,

provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled, $T_{activation_time}$ is:

- If UE supports *shortMeasInterval-r18*, then
  - $T_{FirstSSB_MAX,\ enhanced}$ + $T_{SMTC_MAX,\ enhanced}$ + $T_{rs,\ enhanced}$ + 5 ms, if the following conditions are met,
    - the SCell is contiguous to an active serving cell in the same band, and
    - its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and
    - its SMTC offset is same as the one of contiguous FR1 active serving cell, and

- its RTD with contiguous FR1 active serving cell is smaller than or equal to 260 ns with respect to the to-be-activated SCell's SSB numerology, and its reception power difference with contiguous FR1 active serving cell is smaller than or equal to 6 dB;

- $T_{FirstSSB_MAX,\ enhanced} + T_{SMTC_MAX,\ enhanced} + 2*T_{rs,\ enhanced} + 5$ ms, otherwise.

- Otherwise

  - $T_{FirstSSB_MAX} + T_{SMTC_MAX} + T_{rs} + 5$ ms, if the following conditions are met,

    - the SCell is contiguous to an active serving cell in the same band, and

    - its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and

    - its SMTC offset is same as the one of contiguous FR1 active serving cell, and

    - its RTD with contiguous FR1 active serving cell is smaller than or equal to 260 ns, and its reception power difference with contiguous FR1 active serving cell is smaller than or equal to 6 dB;

  - $T_{FirstSSB_MAX} + T_{SMTC_MAX} + 2*T_{rs} + T_{\Delta} + 5$ ms, otherwise.

Otherwise, provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled, $T_{activation_time}$ is:

- If UE supports *shortMeasInterval-r18*, then

  - $6\text{ ms} + T_{FirstSSB_MAX,\ enhanced} + T_{SMTC_MAX,\ enhanced} + T_{rs,\ enhanced} + T_{L1\text{-}RSRP,\ enhanced_measure} + T_{L1\text{-}RSRP,\ report} + T_{HARQ} + \max(T_{uncertainty_MAC} + T_{FineTiming} + 2\text{ ms}, T_{uncertainty_SP})$, if semi-persistent CSI-RS is used for CSI reporting,

  - $3\text{ ms} + T_{FirstSSB_MAX,\ enhanced} + T_{SMTC_MAX,\ enhanced} + T_{rs,\ enhanced} + T_{L1\text{-}RSRP,\ enhanced_measure} + T_{L1\text{-}RSRP\ ,report} + \max(T_{HARQ} + T_{uncertainty_MAC} + 5\text{ ms} + T_{FineTiming}, T_{uncertainty_RRC} + T_{RRC_delay})$, if periodic CSI-RS is used for CSI reporting.

- Otherwise

  - $6\text{ ms} + T_{FirstSSB_MAX} + T_{SMTC_MAX} + T_{rs} + T_{\Delta} + T_{L1\text{-}RSRP,\ measure} + T_{L1\text{-}RSRP,report} + T_{HARQ} + \max(T_{uncertainty_MAC} + T_{FineTiming} + 2\text{ ms}, T_{uncertainty_SP})$, if semi-persistent CSI-RS is used for CSI reporting,

  - $3\text{ ms} + T_{FirstSSB_MAX} + T_{SMTC_MAX} + T_{rs} + T_{\Delta} + T_{L1\text{-}RSRP,\ measure} + T_{L1\text{-}RSRP,report} + \max(T_{HARQ} + T_{uncertainty_MAC} + 5\text{ ms} + T_{FineTiming}, T_{uncertainty_RRC} + T_{RRC_delay})$, if periodic CSI-RS is used for CSI reporting.

- However, when the following conditions are fulfilled, no activation requirement will be applied for this unknown SCell:

  - the SCell is contiguous to an active serving cell in the same band, and

  - A single SSB is used in the unknown SCell; or multiple SSBs are used in the SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and

  - its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and

  - its SMTC offset is same as the one of contiguous FR1 active serving cell

  - its RTD with contiguous FR1 active serving cell is larger than 260 ns, or its reception power difference with contiguous FR1 active serving cell is larger than 6 dB;

If the SCell being activated belongs to FR1 and if there is at least one active serving cell contiguous to the SCell on that FR1 band, if the UE is not provided with SSB configuration (*absoluteFrequencySSB*) or SMTC configuration for the target SCell, $T_{activation_time}$ is 3 ms for UE supporting *scellWithoutSSB*, provided

- The RTD between the target SCell and the contiguous active serving cell is within ±260ns, and

- The difference of the reception power with the contiguous active serving cell is <= 6 dB, and

- The RS(s) of SCell being activated is (are) QCL-TypeA with TRS(s) of the SCell being activated, and the TRS(s) of the SCell being activated is (are) further QCL-TypeC with SSB(s) of any active serving cell that is contiguous to the SCell being activated on that FR1 band.

For a UE supporting *scellWithoutSSB-InterBandCA-r18* if the SCell being activated belongs to FR1 and if the UE is not provided with SSB configuration (*absoluteFrequencySSB*) in the target SCell (FrequencyInfoDL) nor SMTC configuration for the target SCell, and if there is one collocated active reference serving cell on different FR1 band, when the following conditions are fulfilled,

- The RTD between the target SCell and the collocated reference serving cell is within CP where CP is corresponding to the SCS of SSB-less SCell, and

- The EPRE difference at the UE is smaller than or equal to 30 dB, where EPRE difference is the power difference between TRS/A-TRS symbol on the SSB-less SCell and SSB symbol on the reference serving cell normalized by SCSs of SSB of reference cell and A-TRS/P-TRS of SSB-less SCell, and

- The RS(s) of the SSB-less SCell being activated is (are) QCL-TypeA with TRS(s) of the SSB-less SCell being activated, and the TRS(s) of the SSB-less SCell being activated is (are) further QCL-TypeC with SSB(s) of an inter-band active serving cell, and the inter-band active serving cell shall be same as the reference serving cell.

where the reference serving cell can be indicated by higherlayer parameter *referenceCell-r18*. If UE is not indicated with *referenceCell-r18*, the reference serving cell is assumed to be the QCL-typeC source cell if there is only one active QCL-typeC source cell configured.

$T_{activation_time}$ is

- $T_{first_TRS} + T_{TRS}$ +5 ms, if aperiodic CSI-RS resources are not configured for SCell activation or UE do not support *aperiodicCSI-RS-FastScellActivation-r17,* when the EPRE difference at UE is smaller than or equal to 12 dB, or

- $T_{first_ATRS} + T_{gap} + T_{ATRS}$ + 5 ms if aperiodic CSI-RS resources are configured for SCell activation for UE supporting *aperiodicCSI-RS-FastScellActivation-r17*, when the EPRE difference at UE is smaller than or equal to 12 dB, or

- $T_{first_TRS} + 2*T_{TRS}$ +5 ms, when the EPRE difference at UE is larger than 12 dB but smaller than or equal to 30 dB.

For a UE supporting *scellWithoutSSB-InterBandCA-r18*, when UE receive SCell activation command for more than one SSB-less SCell, the SCell activation delay for each of the to-be-activated SSB-less SCell in FR1 is the same as the single SSB-less SCell activation delay, when

- SSB-less SCells being activated are on different bands, or

- all SCells being activated are SSB-less SCells, the SCells are contiguous on the same band, and all to-be-activated SCells have the same QCL-typeC QCL source cell.

If the SCell being activated belongs to FR2 and if there is at least one active serving cell on that FR2 band, then $T_{activation_time}$ is $T_{FirstSSB}$+ 5ms provided:

- the UE is provided with SMTC for the target SCell, and

- the SSBs in the serving cell(s) and the SSBs in the SCell fulfil the condition defined in clause 3.6.3, and

- the parameter ssb-PositionsInBurst is same for the serving cell(s) and the SCell, and

- SSB is in the same half-frame on the SCell and the contiguous FR2 active serving cell.

If the SCell being activated belongs to FR2 and if there is at least one active serving cell on that FR2 band, if the UE supporting *scellWithoutSSB* is not provided with any SMTC for the target SCell, $T_{activation_time}$ is 3 ms, provided

- the RS (s) of SCell being activated is (are) QCL-TypeD with RS (s) of one active serving cell on that FR2 band.

If the SCell being activated belongs to FR2 and if there is at least one active serving cell on that FR2 band, if *highSpeedMeasFlagFR2-r17* is configured for the FR2 power class 6 UE supporting *scellWithoutSSB* and *measEnhCAInterFreqFR2-r18*, $T_{activation_time}$ is 3 ms , provided

- the RS (s) of SCell being activated is (are) QCL-TypeD with RS (s) of one active serving cell on that FR2 band.

If the SCell being activated belongs to FR2 and if there is no active serving cell on that FR2 band provided that PCell or PSCell is in FR1 or in FR2:

If the target SCell is known to UE and semi-persistent CSI-RS is used for CSI reporting, then $T_{activation_time}$ is:

- 3 ms + max($T_{uncertainty_MAC}$ + $T_{FineTiming}$ + 2 ms, $T_{uncertainty_SP}$), where $T_{uncertainty_MAC}$=0 and $T_{uncertainty_SP}$=0 if UE receives the SCell activation command, semi-persistent CSI-RS activation command and TCI state activation command at the same time.

If the target SCell is known to UE and periodic CSI-RS is used for CSI reporting, then $T_{activation_time}$ is:

- max($T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}-T_{HARQ}), where $T_{uncertainty_MAC}$=0 if UE receives the SCell activation command and TCI state activation commands at the same time.

If the PCell/PSCell and the target SCell are configured as FR1-FR2-1 CA or if the PCell/PSCell and the target SCell are in a FR2-1 band pair with independent beam management, and the target SCell is unknown to UE and semi-persistent CSI-RS is used for CSI reporting, provided that the side condition $\hat{E}s/Iot \geq$ -2 dB is fulfilled, then $T_{activation_time}$ is:

- 6 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + T_{HARQ} + max($T_{uncertainty_MAC}$ + $T_{FineTiming}$ + 2 ms, $T_{uncertainty_SP}$), or

- 6 ms + $T_{FirstSSB_MAX,enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ + T_{HARQ} + max($T_{uncertainty_MAC}$ + $T_{FineTiming}$ + 2 ms, $T_{uncertainty_SP}$) if UE supports *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* and/or *shortMeasInterval-r18* capabilities, and when SCell activation triggered L3 report is not configured or SCell activation triggered L3 report is configured but not reported.

If the PCell/PSCell and the target SCell are configured as FR1-FR2-2 CA or if the PCell/PSCell and the target SCell are in a FR2-2 band pair with independent beam management, and the target SCell is unknown to UE and semi-persistent CSI-RS is used for CSI reporting, provided that the side condition $\hat{E}s/Iot \geq$ -2 dB is fulfilled, then $T_{activation_time}$ is:

- 6 ms + $T_{FirstSSB_MAX}$ + 23*T_{SMTC_MAX} + 12*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + T_{HARQ} + max($T_{uncertainty_MAC}$ + $T_{FineTiming}$ + 2 ms, $T_{uncertainty_SP}$).

If the PCell/PSCell and the target SCell are configured as FR1-FR2-1 CA or if the PCell/PSCell and the target SCell are in a FR2-1 band pair with independent beam management, and the target SCell is unknown to UE and periodic CSI-RS is used for CSI reporting, provided that the side condition $\hat{E}s/Iot \geq$ -2 dB is fulfilled, then $T_{activation_time}$ is:

- 3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, or

- 3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})} if UE supports *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* and/or *shortMeasInterval-r18* capabilities, and when SCell activation triggered L3 report is not configured or SCell activation triggered L3 report is configured but not reported.

If the PCell/PSCell and the target SCell are configured as FR1-FR2-2 CA or if the PCell/PSCell and the target SCell are in a FR2-2 band pair with independent beam management, and the target SCell is unknown to UE and periodic CSI-RS is used for CSI reporting, provided that the side condition $\hat{E}s/Iot \geq$ -2 dB is fulfilled, then $T_{activation_time}$ is:

- 3 ms + $T_{FirstSSB_MAX}$ + 23*T_{SMTC_MAX} + 12*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}.

where,

T_{SMTC_MAX}:

- In FR1, in case of intra-band contiguous SCell activation or in case of intra-band non-contiguous SCell activation for UE not capable of *intraBandNR-CA-non-collocated-r18* or UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is provided, T_{SMTC_MAX} is the longer SMTC periodicity between active serving cells and SCell being activated provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in the same slot; in case of intra-band non-contiguous SCell activation for UE capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided or in case of inter-band SCell activation, T_{SMTC_MAX} is the SMTC periodicity of SCell being activated.

- In FR1, in case of intra-band non-contiguous SCell activation for UE capable of *intraBandNR-CA-non-collocated-r19*,

  1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

    2> if *nonCollocatedTypeNR-CA-v1900* is *"type 4"*

      3> T_{SMTC_MAX} is the SMTC periodicity of SCell being activated

    2> if *nonCollocatedTypeNR-CA-v1900* is *"type 1"*

      3> T_{SMTC_MAX} is the longer SMTC periodicity between active serving cells and SCell being activated provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in the same slot

    2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

      3> T_{SMTC_MAX} is the longer SMTC periodicity between active serving cells and SCell being activated provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in the same slot

  1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

    2> if *nonCollocatedTypeNR-CA-r18* is not provided

      3> T_{SMTC_MAX} is the SMTC periodicity of SCell being activated

    2>else

      3> T_{SMTC_MAX} is the longer SMTC periodicity between active serving cells and SCell being activated provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in the same slot

- In FR2, in case of intra-band SCell activation, T_{SMTC_MAX} is the longer SMTC periodicity between active serving cells and SCell being activated provided that in Rel-15 only support FR2 intra-band CA; in case of FR2 inter-band SCell activation, T_{SMTC_MAX} is the SMTC periodicity of SCell being activated.

- T_{SMTC_MAX} is bounded to a minimum value of 10 ms.

$T_{SMTC_MAX,\ enhanced}$:

- In FR1 or FR2-1, a UE supporting *shortMeasInterval-r18* if the SMTC for SCell being activated is only configured in measObjectNR, $T_{SMTC_MAX,\ enhanced}$ is the SSB periodicity of SCell being activated. Otherwise, $T_{SMTC_MAX,\ enhanced} = T_{SMTC_MAX}$.

T_{rs} is the SMTC periodicity of the SCell being activated if the UE has been provided with an SMTC configuration for the SCell in SCell addition message, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, Trs is the periodicity of one of the SMTC which is up to UE implementation. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement which involves T_{rs} is applied with T_{rs}

= 5 ms assuming the SSB transmission periodicity is 5 ms. There are no requirements if the SSB transmission periodicity is not 5 ms.

$T_{rs,\ enhanced}$ is the SSB periodicity of the SCell being activated for a UE supporting *shortMeasInterval-r18* in FR1 or FR2-1, if the SMTC for SCell being activated is only configured in the *measObjectNR*. Otherwise, $T_{rs,\ enhanced} = T_{rs}$

T_{Δ} is the additional time for fine time tracking and acquiring full timing information of the SCell. $T_{\Delta} = 2*T_{rs}$ ms for SCell operating with 12 PRB SSB BW. Otherwise, $T_{\Delta} = 0$ ms.

$T_{FirstSSB}$: is the time to the end of the first complete SSB burst indicated by the SMTC, or within 5 ms if SMTC is not configured, after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$.

$T_{FirstSSB_MAX}$: Is the time to the end of the first complete SSB burst indicated by the SMTC, or within 5 ms if SMTC is not configured, after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, further fulfilling:

- In FR1, in case of intra-band contiguous SCell activation or in case of intra-band non-contiguous SCell activation for UE not capable of *intraBandNR-CA-non-collocated-r18* or UE is capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is provided, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of intra-band non-contiguous SCell activation for UE capable of *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided or in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.

- In FR1, in case of intra-band non-contiguous SCell activation for UE capable of *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 4"*

3>the first occasion when the SCell being activated is transmitting SSB burst

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 1"*

3> the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot

2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> the first occasion when the SCell being activated is transmitting SSB burst

2>else

3> the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot

- In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

$T_{FirstSSB_MAX,\ enhanced}$: For a UE supporting *shortMeasInterval-r18* in FR1 or FR2-1, if the SMTC for SCell being activated is only configured in the measObjectNR, $T_{FirstSSB_MAX,\ enhanced}$ is the time to the end of the first complete SSB burst indicated by the SSB periodicity of the SCell being activated, after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$. Otherwise, $T_{FirstSSB_MAX,\ enhanced} = T_{FirstSSB_MAX}$

When the UE is configured with *LowBandCA-Switching-r19* in FR1, when the SCell to be activated is an SDL SCell:

- for each applicable SCell activation delay requirement, the definition of $T_{FirstSSB}$, $T_{FirstSSB_MAX}$, T_{SMTC_MAX}, and T_{rs} in this section apply with the difference that only the SSBs and SMTCs that overlap with the SCell active periods according to the *switchingPattern* after slot n +$\frac{T_{HARQ}+3\text{ ms}+T_{LBCA}}{NR\ slot\ length}$ are taken into account.

  $T_{FineTiming}$ is the time period between UE finish processing the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and the timing of first complete available SSB corresponding to the TCI state.

  X1 is equal to the reported value in *reduceForCellDetection* in FR2-1. Otherwise, if *reduceForCellDetection* is absent, X1 is 8.

  $T_{L1\text{-}RSRP,\ measure}$ is L1-RSRP measurement delay $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ or $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ based on applicability as defined in clause 9.5 assuming M=1 and T_{Report}=0.

  $T_{L1\text{-}RSRP,\ enhanced_measure}$ is

  - SSB based L1-RSRP measurement delay $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ based on applicability as defined in clause 9.5 assuming M=1 and T_{Report}=0; N is equal to the value reported by the UE in *reduceForSSB-L1-RSRP-Meas*. Otherwise, if *reduceForSSB-L1-RSRP-Meas* is absent, N= 8. Or,

  - CSI-RS based L1-RSRP measurement delay $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ based on applicability as defined in clause 9.5 assuming M=1 and T_{Report}=0.

  - If UE supports *shortMeasInterval-r18* capability, L1-RSRP measurement for $T_{L1\text{-}RSRP,\ enhanced_measure}$ can be performed based on non-DRX mode even if DRX is configured.

  $T_{L1\text{-}RSRP,\ report}$ is delay of acquiring CSI reporting resources.

  $T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable) relative to

  - SCell activation command for known case;

  - First valid L1-RSRP reporting for unknown case.

  $T_{uncertainty_RRC}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to

  - SCell activation command for known case;

  - First valid L1-RSRP reporting for unknown case.

  $T_{uncertainty_SP}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to

  - SCell activation command for known case;

  - First valid L1-RSRP reporting for unknown case.

  T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

  Longer delays for RRM measurement requirements, and in case of FR2 also SSB based RLM/BFD/CBD/L1-RSRP measurement requirements, can be expected during the cell detection time for unknown SCell activation.

  When *absoluteFrequencySSB* is not configured in *DownlinkConfigCommon* for target SCell but SMTC for target SCell is configured, no requirement would be applied.

$T_{CSI_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

$T_{firstTRS}$: is the time to the end of the first complete periodic CSI-RS burst for SCell activation after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$. If multiple TRSs of the SSB-less SCell being activated are QCL-TypeC with SSBs of the reference serving cell, the TRS used for activation is the one QCL-typeC with the SSB associated with the active TCI for PDCCH/PDSCH DMRS in the reference serving cell.

T_{TRS} is the periodicity of periodic CSI-RS burst used for SCell activation.

$T_{firstATRS}$: is the time to the end of the first complete aperiodic CSI-RS burst for SCell activation after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots.

T_{ATRS} is the aperiodic CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots.

T_{gap} is a gap length between two aperiodic CSI-RS bursts,

- at least 2 slots for 15 kHz and 30 kHz
- at least 3 slots for 60 kHz

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5*measCycleSCell, 5*DRX cycles) for FR1 before the reception of the SCell activation command:
  - the UE has sent a valid measurement report for the SCell being activated and
  - the SSB measured remains detectable according to the cell identification conditions specified in clause 9.2 and 9.3.
- the SSB measured during the period equal to max(5*measCycleSCell, 5*DRX cycles) also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2 and 9.3.

Otherwise SCell in FR1 is unknown.

For the first SCell activation in FR2 bands, the SCell is known if it has been meeting the following conditions:

- During the period equal to 4 s for UE supporting power class 1/5 and 3 s for UE supporting power class 2/3/4 before UE receives the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and semi-persistent CSI-RS for CQI reporting (when applicable):
  - the UE has sent a valid L3-RSRP measurement report with SSB index, and
  - SCell activation command is received after L3-RSRP reporting and no later than the time when UE receives MAC-CE command for TCI activation
- During the period from L3-RSRP reporting to the valid CQI reporting, the reported SSBs with indexes remain detectable according to the cell identification conditions specified in clauses 9.2 and 9.3, and the TCI state is selected based on one of the latest reported SSB indexes.

Otherwise, the first SCell in FR2 band is unknown. The requirement for unknown SCell applies provided that the activation commands for PDCCH TCI, PDSCH TCI (when applicable), semi-persistent CSI-RS for CQI reporting (when applicable), and configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) are based on the latest valid L1-RSRP reporting.

If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the activation command, T_{SMTC_Scell} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. T_{SMTC_MAX} follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot slot n+1+$\frac{T_{HARQ}+3ms+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being activated, and T_X is:

- 0, if $T_{activation_time}$ is 3 ms;
- $T_{FirstSSB}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB_MAX}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB_MAX}$;
- $T_{uncertainty_MAC} + T_{FineTiming}$, for any scenario where $T_{activation_time}$ includes only $T_{FineTiming}$ and no $T_{FirstSSB_MAX}$;
- T_{first_TRS}, for FR1 inter-band SSB-less SCell activation scenario where $T_{activation_time}$ includes T_{first_TRS};
- T_{first_ATRS}, for FR1 inter-band SSB-less SCell activation scenario where $T_{activation_time}$ includes T_{first_ATRS}.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

The requirements in this clause and requirements on interruption due to SCell activation in clause 8.2 apply provided that the SSB of the to-be-activated SCell is within the first active DL BWP of the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

8.3.2A SCell Activation Delay Requirement for Deactivated SCell based on measurement in IDLE/INACTIVE mode

The requirements in this clause shall apply for the UE configured with at least one downlink SCell in EN-DC, or in standalone NR carrier aggregation or in NE-DC or in NR-DC and when one SCell is being activated.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot n + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{CSI_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

$T_{activation_time}$ is the SCell activation delay in millisecond, which is defined as:

Requirements in this clause apply if the SCell is unknown, provided:

- UE supports *measValidationReportEMR* and *measIdleValidityDuration-r18* is configured or,
- UE supports *measValidationReportReselectionMeasurements* and *measReselectionValidityDuration-r18* is configured or,
- UE supports *idleInactiveNR-MeasReport-r16*, and neither *measIdleValidityDuration-r18* nor *measReselectionValidityDuration-r18* is configured and *measIdleDuration-r16* has not expired at the moment of initiation of RRC state transition to CONNECTED mode,

The SCell is unknown if the corresponding known conditions specified in clause 8.3.2 are not met.

If the SCell belongs to FR1, $T_{activation_time}$ is $T_{FirstSSB_MAX} + T_{rs}$ + 5ms provided that the side condition $\hat{E}s/Iot \geq$ -2dB is fulfilled, if the following conditions are met:

- During the period equal to 5s for FR1 before the reception of the SCell activation command:

- the UE has sent a measurement report with SSB index according to the reporting requirements in 4.7.3 or 5.8.3.

- the SSB measured is detectable from the earliest measurement to the end of the defined SCell activation latency (i.e., a valid CQI reporting)

  - If *measIdleValidityDuration-r18* or *measReselectionValidityDuration-r18* is configured, the earliest measurement refers to the time instance *measIdleValidityDuration-r18* or *measReselectionValidityDuration-r18* before Msg1 transmission.

  - If only *measIdleDuration-r16* is configured, the earliest measurement refers to the time instance when the UE obtained the configuration parameter.

  - the SSB measured remains detectable according to the IDLE/INACTIVE mode measurement conditions specified in 4.2 or the CA/DC measurement conditions specified in 4.4 when UE is in IDLE/INACTIVE state and

  - the SSB measured remains detectable according to the cell identification conditions specified in clause 9.2 and 9.3 when UE is in CONNECTED mode.

If the SCell belongs to FR2, provided that the side condition $\hat{E}s/Iot \geq -2dB$ is fulfilled, and if the following conditions are met:

- During the period equal to 4s for UE supporting power class 1/5 and 3s for UE supporting power class 2/3/4 before UE receives the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and semi-persistent CSI-RS for CQI reporting (when applicable):

  - the UE has sent a measurement report with SSB index according to the reporting requirements in 4.7.3 or 5.8.3.

- the SSB measured is detectable from the earliest measurement to the end of the defined SCell activation latency (i.e. a valid CQI reporting)

  - If *measIdleValidityDuration-r18* or *measReselectionValidityDuration-r18* is configured, the earliest measurement refers to the time instance *measIdleValidityDuration-r18* or *measReselectionValidityDuration-r18* before Msg1 transmission.

  - If only *measIdleDuration-r16* is configured, the earliest measurement refers to the time instance when the UE obtained the configuration parameter.

  - the SSB measured remains detectable according to the IDLE/ INACTIVE mode measurement conditions specified in 4.2 or the CA/DC measurement conditions specified in 4.4 when UE is in IDLE/INACTIVE state and

  - the SSB measured remains detectable according to the cell identification conditions specified in clause 9.2 and 9.3 when UE is in CONNECTED mode.

Then $T_{activation_time}$ is:

If the PCell/PSCell and the target SCell are configured as FR1-FR2-1 CA or if the PCell/PSCell and the target SCell are in a FR2-1 band pair with independent beam management, and the target SCell is unknown to UE and semi-persistent CSI-RS is used for CSI reporting, provided that the side condition $\hat{E}s/Iot \geq -2dB$ is fulfilled, then $T_{activation_time}$ is:

- $3ms + T_{FirstSSB_MAX} + 15*T_{SMTC_MAX} + \max(T_{uncertainty_MAC} + T_{FineTiming} + 2ms, T_{uncertainty_SP})$ where $T_{uncertainty_MAC}=0$ and $T_{uncertainty_SP}=0$ if UE receives the SCell activation command, semi-persistent CSI-RS activation command and TCI state activation command at the same time.

If the PCell/PSCell and the target SCell are configured as FR1-FR2-1 CA or if the PCell/PSCell and the target SCell are in a FR2-1 band pair with independent beam management, and the target SCell is unknown to UE and periodic CSI-RS is used for CSI reporting, provided that the side condition $\hat{E}s/Iot \geq -2dB$ is fulfilled, then $T_{activation_time}$ is:

- $T_{FirstSSB_MAX} + 15*T_{SMTC_MAX} + \max(T_{uncertainty_MAC} + 5ms + T_{FineTiming}, T_{uncertainty_RRC} + T_{RRC_delay} - T_{HARQ})$ where $T_{uncertainty_MAC}=0$ if UE receives the SCell activation command and TCI state activation commands at the same time.

Where:

$T_{FirstSSB_MAX}$, T_{rs}, T_{SMTC_MAX}, $T_{FineTiming}$ and T_{RRC_delay} are same as that defined in clause 8.3.2.

$T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable) relative to SCell activation command, and the TCI state is selected based on one of the latest reported SSB indexes

$T_{uncertainty_RRC}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to SCell activation command, and the TCI state is selected based on one of the latest reported SSB indexes;

$T_{uncertainty_SP}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to SCell activation command, the TCI state for semi-persistent CSI-RS is selected based on one of the latest reported SSB indexes.

8.3.3 SCell Deactivation Delay Requirement for Activated SCell

The requirements in this clause shall apply for the UE configured with at least one downlink SCell in EN-DC, or in standalone NR carrier aggregation or in NE-DC or in NR-DC and when one SCell is being deactivated.

Upon receiving SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot $n + \frac{T_{HARQ}+3ms}{NR\ slot\ length}$.

When a UE is configured with *LowBandCA-Switching-r19*, upon receiving SCell deactivation command in slot *n*, when the SCell to be deactivated is an SDL SCell, the UE shall deactivate the configured *switchingPattern-r19* at slot $n + \frac{T_{HARQ}+3\text{ms}+T_{LBCA}}{NR\ slot\ length}$, where T_{LBCA} = 1 ms is the UE processing delay for deactivating the *switchingPattern-r19*.

The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot n+1+$\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being deactivated.

Upon expiry of the *sCellDeactivationTimer* in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot $n + \frac{3ms}{NR\ slot\ length}$. The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1 and not occur after slot n+1+ $\frac{3ms}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being deactivated.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

8.3.4 Direct SCell Activation at SCell addition

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], with one SCell for which the parameter *sCellState* is set to *activated*. If the RRC reconfiguration message for direct SCell activation also configures PSCell addition or PSCell change, the direct SCell activation delay may be longer than the requirements defined in this clause.

When the UE is configured with *LowBandCA-Switching-r19*in FR1, the following requirements apply for activation of SDL SCell, when the SDL SCell reference signals to be measured for SCell activation are fully or partially overlapped with the SDL SCell active periods based on the *switchingPattern-r19*. The requirements do not apply if none of the SDL SCell reference signals to be measured for SDL SCell activation are overlapping with SCell active periods of the *switchingPattern-r19*.

When the UE is configured with *switchingPattern-r19* and the SCell to be activated is an SDL SCell, the UE shall activate the configured *switchingPattern-r19* at slot $n + \frac{T_{RRC_Process}}{NR\ slot\ length}$.

If the RRC reconfiguration message for direct SCell activation also configures TCI state information, the requirements in clause 8.3.2 based on that TCI state activation command is received at the same time as SCell activation command shall apply.

The UE shall configure the SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. The UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot n + $\frac{N_{direct}}{NR\ slot\ length}$,

where:

- Slot n is the last slot overlapping with the PDSCH containing the RRC reconfiguration message,
- $N_{direct} = T_{RRC_Process} + T_1 + T_{activation_time} + T_{CSI_Reporting}$ - 3 ms for the cases specified in clause 8.3.2 that TCI state is not indicated within $T_{activation_time}$; otherwise, $N_{direct} = T_{RRC_Process} + T_1 + T_{HARQ} + T_{activation_time} + T_{CSI_Reporting}$
  - $T_{RRC_Process}$: RRC procedure delay as specified in clause 11.2 of TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC procedure delay defined in clause 12 of TS 38.331 [2],
  - T_1: Delay from slot $n + \frac{T_{RRC_Process}}{NR\ slot\ length}$ until the transmission of *RRCReconfigurationComplete* message,

NOTE: T_1 is UE implementation dependent.

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3],

If target SCell is unknown, $T_{activation_time}$ is specified in 8.3.2A provided the following conditions are met:

- UE supports *measValidationReportEMR* and *measIdleValidityDuration-r18* is configured or,
- UE supports *measValidationReportReselectionMeasurements* and *measReselectionValidityDuration-r18* is configured or,
- UE supports idleInactiveNR-*MeasReport-r16*, and neither *measIdleValidityDuration-r18* nor *measReselectionValidityDuration*-r18 is configured and *measIdleDuration*-r16 has not expired at the moment of initiation of RRC state transition to CONNECTED mode,

Otherwise:

- Otherwise, $T_{activation_time}$ and $T_{CSI_Reporting}$ are specified in clause 8.3.2, where the following definitions of $T_{FirstSSB}$ and $T_{FirstSSB_MAX}$ shall override the existing ones:
  - $T_{FirstSSB}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC_Process}+T_1}{NR\ slot\ length}$
  - $T_{FirstSSB_MAX}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC_{Process}}+T_1}{NR\ slot\ length}$
    - In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.
    - In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

When the UE is configured with *LowBandCA-Switching-r19* in FR1, when the SCell to be activated is an SDL SCell:

- for each applicable SCell activation delay requirement, the definition of $T_{FirstSSB}$, $T_{FirstSSB_MAX}$ in this section and the definition of T_{SMTC_MAX}, and T_{rs} in section 8.3.2 apply with the difference that only the SSBs and SMTCs that overlap with the SCell active periods according to the *switchingPattern* after slot n + $\frac{T_{RRC_Process}}{NR\ slot\ length}$ are taken into account.
- If a UE supports, *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* and/or *shortMeasInterval-r18* capabilities, the reduced $T_{activation_time}$ specified in clause 8.3.2 when UE supports these capabilities is applicable for Direct SCell activation at SCell addition also.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The SCell in FR1 is known provided the following conditions are met for the SCell:

- During the last 5 seconds before the reception of the direct SCell configuration command:
  - the UE has sent a valid measurement report for the SCell being directly activated, and
  - the SSB measured remains detectable according to the cell identification conditions specified in clauses 9.2 and 9.3,
- the SSB measured during the period equal to [5] seconds also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2 and 9.3.

Otherwise, the SCell is unknown.

The SCell in FR2 is known provided it meets the corresponding conditions as defined in clause 8.3.2. Otherwise, the SCell is unknown.

The UE may be allowed to cause interruptions to serving cells on other component carriers during an interruption window, as specified in clause 8.2. The starting point of an interruption window on SpCell or any activated SCell shall not occur before slot n+1, and shall not occur after slot $n+1+\frac{T_{RRC_Process}+T_1+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology of the SCell being activated, and T_X is:

- $T_{FirstSSB}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB_MAX}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB_MAX}$;
- $T_{uncertainty_MAC} + T_{FineTiming}$, for any scenario where $T_{activation_time}$ includes $T_{FineTiming}$.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

Starting from the slot $n + \frac{T_{RRC_Process} + T_1}{NR\ slot\ length}$ until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

8.3.5 Direct SCell Activation at Handover

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], for handover with one SCell for which the parameter *sCellState* is set to *activated*.

The UE shall configure the SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. The UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot n + $\frac{N_{direct}}{NR\ slot\ length}$,

Where:

- Slot n is the last slot overlapping with the PDSCH containing RRC reconfiguration message.
- $N_{direct} = T_{RRC_process} + T_{interrupt} + T_2 + T_3 + T_{activation_time} + T_{CSI_Reporting}$ - 3 ms for the cases specified in clause 8.3.2 that TCI state is not indicated within $T_{activation_time}$; otherwise, $N_{direct} = T_{RRC_process} + T_{interrupt} + T_2 + T_3 + T_{HARQ} + T_{activation_time} + T_{CSI_Reporting}$
- $T_{RRC_Process}$: RRC procedure delay as specified in clause 11.2 of TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC procedure delay defined in clause 12 of TS 38.331 [2],
- $T_{interrupt}$: Interruption time during handover as specified in clause 6.1.1,
- T_2: Delay from slot $n + \frac{T_{RRC_Process}+T_{interrupt}}{NR\ slot\ length}$ until UE has obtained a valid TA command for the target PCell,

- T_3: Delay for applying the received TA for uplink transmission in the target PCell, and greater than or equal to k+1 slot, where k is defined in clause 4.2 in TS 38.213 [3],

- T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3],

- If the SCell is known and belongs to FR1, $T_{CSI_Reporting}$ is specified in clause 8.3.2 and $T_{activation_time}$ is defined as:

  - $T_{FirstSSB}$+ 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.

  - $T_{FirstSSB_MAX}$ + T_{rs} + 5 ms, if measurement period of the SCell being activated is larger than 2400 ms.

    where,

    the measurement period in table 9.2.5.2-1 applies if the target SCell was in an intra-frequency layer corresponding to an activated SCell;

    the measurement period in table 9.2.5.2-3 applies if the target SCell was in an intra-frequency layer corresponding to a deactivated SCell;

    the measurement period in table 9.3.5-1 applies if the target SCell was in an inter-frequency layer.

- Otherwise, $T_{activation_time}$ and $T_{CSI_Reporting}$ are specified in clause 8.3.2, where the following definitions of $T_{FirstSSB}$ and $T_{FirstSSB_MAX}$ shall override the existing ones:

  - $T_{FirstSSB}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC_Process}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$

  - $T_{FirstSSB_MAX}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC_{Process}}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$

    - In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.

    - In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

- If a UE supports, *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* and/or *shortMeasInterval-r18* capabilities, the reduced $T_{activation_time}$ specified in clause 8.3.2 when UE supports these capabilities is applicable for Direct SCell activation at handover also.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The SCell in FR1 is known provided the following conditions are met for the SCell:

- During the last 5 seconds before the reception of the direct SCell configuration command:

  - the UE has sent a valid measurement report for the SCell being directly activated, and

  - the SSB measured remains detectable according to the cell identification conditions specified in clauses 9.2 and 9.3,

  - the SSB measured during the period equal to [5] seconds also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2 and 9.3.

Otherwise, the SCell is unknown.

The SCell in FR2 is known provided it meets the corresponding conditions as defined in clause 8.3.2. Otherwise, the SCell is unknown.

The UE may be allowed to cause interruptions to PCell during an interruption window, as specified in clause 8.2. The starting point of an interruption window on PCell shall not occur before slot n+1+ $\frac{T_{RRC\ Processing}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$, and

not occur after slot n+1+$\frac{T_{RRC\ Processing}+T_{interrupt}+T_2+T_3+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology of the SCell being activated, and T_X is:

- $T_{FirstSSB}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB_MAX}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB_MAX}$;
- $T_{uncertainty_MAC}$ +$T_{FineTiming}$, for any scenario where $T_{activation_time}$ includes $T_{FineTiming}$.

The length of the interruption window depends on the frequency band relation between the aggressor SCell and the victim PCell.

Starting from the slot $n + \frac{T_{RRC_Process} + T_{interrupt}+T_2+ T_3}{NR\ slot\ length}$ and until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

8.3.6 Direct SCell Activation at RRCResume

The requirements in this clause apply for UE being configured in the RRC reconfiguration message in TS 38.331 [2] for RRC Resume with one SCell for which the parameter *sCellState* is set to *activated*.

The requirements in clause 8.3.4 shall apply, except that the definition of T_1 shall be deemed to be replaced with

T_1: Delay from slot $n + \frac{T_{RRC_Process}}{NR\ slot\ length}$ until the transmission of RRCResumeComplete message,

8.3.7 SCell Activation Delay Requirement for Deactivated SCell with Multiple Downlink SCells

The requirements in this clause shall apply for the UE configured with more than one downlink SCells.

In EN-DC, NE-DC, standalone NR carrier aggregation, or in one CG of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE only receives one single MAC command for multiple SCell activation within the activation period defined in this clause
- in each single CG, there are no other SCell activation, deactivation, addition or release before activation is completed for all the SCells activated by the single MAC CE in this clause, and
- in EN-DC and NE-DC, there are no E-UTRAN SCell activation, deactivation, addition or release before multiple SCell activation is completed in this clause, and
- any to-be-activated unknown SCell has active serving cell(s) or known to-be-activated SCell(s) on the same band

In two CGs of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE receives one MAC command per CG for multiple SCell activation within the activation period defined in this clause, and
- UE supports per-FR measurement gap capability, and
- any to-be-activated unknown SCell has active serving cell(s) or known to-be-activated SCell(s) on the same band

The delay within which the UE shall be able to activate the deactivated SCell with other downlink to-be-activated SCell(s) depends upon the specified conditions.

Upon receiving SCell activation command in slot *n* for more than one SCell, for each of the to-be-activated SCell, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot $n + \frac{T_{HARQ}+T_{activation_time_multiple_scells}+T_{CSI_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation_time_multiple_scells}$ is the target SCell activation delay in milliseconds in multiple SCell activation scenario.

If the SCell is known and belongs to FR1 and the measurement period of the SCell being activated is equal to or smaller than 2400ms, $T_{activation_time_multiple_scells}$ is:

- $T_{FirstSSB_MAX_multiple_scells} + T_{rs}$ + 5ms, if on the same band UE also has at least one parallel to-be-activated SCell which is FR1 known SCell with the measurement period larger than 2400ms but does not have any parallel to-be-activated SCell which is FR1 unknown SCell.

- $T_{FirstSSB_MAX_multiple_scells} + T_{SMTC_MAX_multiple_scells} + T_{rs}$ + 5ms, if on the same band UE also has at least one parallel to-be-activated SCell which is FR1 unknown SCell

- otherwise, $T_{FirstSSB_MAX_multiple_scells}$ + 5ms.

If the SCell is known and belongs to FR1 and the measurement period of the SCell being activated is larger than 2400 ms, $T_{activation_time_multiple_scells}$ is:

- $T_{FirstSSB_MAX_multiple_scells} + T_{SMTC_MAX_multiple_scells} + T_{rs}$ + 5ms, if on the same band UE also has at least one parallel to-be-activated SCell which is FR1 unknown SCell

- otherwise, $T_{FirstSSB_MAX_multiple_scells} + T_{rs}$ + 5 ms

If the SCell is unknown and belongs to FR1, provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled, $T_{activation_time_multiple_scells}$ is:

- $T_{FirstSSB_MAX_multiple_scells} + T_{SMTC_MAX_multiple_scells} + T_{rs}$ +5 ms, if the SCell is not counted in N_1

  - The activation delay may be longer if SSB is not in the same half-frame on the SCell and the contiguous FR1 known cell or contiguous FR1 active serving cell

otherwise

- if the following conditions are met

  - 'ssb-PositionInBurst' indicates only one SSB is being actually transmitted, or

  - 'ssb-PositionInBurst' indicates multiple SSBs and TCI indication is provided in same MAC PDU with SCell activation,

- $T_{activation_time_multiple_scells}$ is:

  - $T_{FirstSSB_MAX_multiple_scells} + T_{SMTC_MAX_multiple_scells} + T_{rs} * N_1 + T_{rs}$ +5 ms,

- Otherwise:

  $T_{activation_time_multiple_scells}$ is:

  - 6 ms + $T_{FirstSSB_MAX_multiple_scells} + T_{SMTC_MAX_multiple_scells} + T_{rs} * N_1 + T_{L1\text{-}RSRP,measure} + T_{L1\text{-}RSRP,report} + T_{HARQ} + \max(T_{uncertainty_MAC_multiple_scells} + T_{FineTiming} + 2$ ms, $T_{uncertainty_SP_multiple_scells})$, if semi-persistent CSI-RS is used for CSI reporting,

  - 3 ms + $T_{FirstSSB_MAX_multiple_scells} + T_{SMTC_MAX_multiple_scells} + T_{rs} * N_1 + T_{L1\text{-}RSRP,measure} + T_{L1\text{-}RSRP,report} + \max(T_{HARQ} + T_{uncertainty_MAC_multiple_scells} + 5$ ms + $T_{FineTiming}, T_{uncertainty_RRC_multiple_scells} + T_{RRC_delay})$, if periodic CSI-RS is used for CSI reporting.

If the SCell being activated belongs to FR1 and if there is at least one active serving cell contiguous to the SCell on that FR1 band, if the UE is not provided with SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration for the target SCell, $T_{activation_time_multiple_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.2.

If the SCell being activated belongs to FR2 and if there is at least one active serving cell on that FR2 band, then $T_{activation_time_multiple_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.2.

If the SCell being activated belongs to FR2 and if there is no active serving cell on that FR2 band provided that PCell or PSCell is FR1:

If the target SCell is known to UE and semi-persistent CSI-RS is used for CSI reporting, then $T_{activation_time_multiple_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.2.

If the target SCell is known to UE and periodic CSI-RS is used for CSI reporting, then $T_{activation_time_multiple_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.2.

If the target SCell is unknown to UE and semi-persistent CSI-RS is used for CSI reporting, provided that the side condition $\hat{E}s/Iot \geq -2dB$ is fulfilled, then $T_{activation_time_multiple_scells}$ is:

- 3 ms + max($T_{uncertainty_MAC_multiple_scells}$ +$T_{FineTiming}$ + 2ms, $T_{uncertainty_SP_multiple_scells}$), if on the same band UE also has at least one parallel to-be-activated SCell which is FR2 known SCell. $T_{uncertainty_MAC_multiple_scells}$ =0 and $T_{uncertainty_SP_multiple_scells}$ =0 if UE receives the SCell activation command, semi-persistent CSI-RS activation command and TCI state activation commands at the same time.

If the target SCell is unknown to UE and periodic CSI-RS is used for CSI reporting, provided that the side condition $\hat{E}s/Iot \geq -2dB$ is fulfilled, then $T_{activation_time_multiple_scells}$ is:

- max($T_{uncertainty_MAC_multiple_scells}$ + 5ms + $T_{FineTiming}$, $T_{uncertainty_RRC_multiple_scells}$ + T_{RRC_delay}-T_{HARQ}), if on the same band UE also has at least one parallel to-be-activated SCell which is FR2 known SCell . $T_{uncertainty_MAC_multiple_scells}$ =0 if UE receives the SCell activation command and TCI state activation commands at the same time.

The requirements for FR2 unknown SCells apply provided that the parameter *ssb-PositionsInBurst* is same for the SCell and the known serving cell on the same FR2 band. The activation delay FR2 unknown SCell may be longer if SSB is not in the same half-frame on the SCell and the FR2 known cell on the same band.

Where,

N_1 is the number counting for parallel FR1 unknown to-be-activated SCell(s) only except the ones which fulfilled the following conditions:

- contiguous to an active serving cell in the same band, or to a known SCell in the same band being activated by the same MAC PDU, and
- A single SSB is used in the unknown SCell; or multiple SSBs are used in the unknown SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and
- its *ssb-PositionInBurst* is same as the one of contiguous FR1 known cell or contiguous FR1 active serving cell, and
- its RTD with contiguous FR1 known cell or contiguous FR1 active serving cell is smaller than or equal to 260 ns and its reception power difference with contiguous FR1 known cell or contiguous FR1 active serving cell is smaller than or equal to 6 dB, and
- its SMTC offset is same as the one of contiguous FR1 known cell or contiguous FR1 active serving cell

However, when the following conditions are fulfilled, no activation requirement will be applied for this unknown SCell and other SCells being activated and counted in N_1:

- contiguous to an active serving cell in the same band, or to a known SCell in the same band being activated by the same MAC PDU, and
- A single SSB is used in the unknown SCell; or multiple SSBs are used in the unknown SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and
- its *ssb-PositionInBurst* is same as the one of FR1 known cell or FR1 active serving cell, and
- its RTD with contiguous FR1 known cell or contiguous FR1 active serving cell is larger than 260 ns or its reception power difference with contiguous FR1 known cell or contiguous FR1 active serving cell is larger than 6 dB, and
- its SMTC offset is same as the one of FR1 known cell or FR1 active serving cell

$T_{SMTC_MAX_multiple_scells}$:

- In FR1, in case of intra-band SCell activation, $T_{SMTC_MAX_multiple_scells}$ is the longest SMTC periodicity between active serving cells and SCells being activated on the same band provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in

the same slot; in case of inter-band SCell activation, $T_{SMTC_MAX_multiple_scells}$ is the longest SMTC periodicity of SCells being activated on the same band.

- In FR2, $T_{SMTC_MAX_multiple_scells}$ is the longest SMTC periodicity between active serving cells and SCell(s) being activated in FR2 intra-band CA.

- $T_{SMTC_MAX_multiple_scells}$ is bounded to a minimum value of 10 ms.

$T_{FirstSSB_MAX_multiple_scells}$: is the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, further fulfilling:

- In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCells being activated are transmitting SSB burst.

- In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

$T_{uncertainty_MAC_multiple_scells}$ is the time period between reception of the activation command for PDCCH TCI, PDSCH TCI (when applicable) and SCell activation command of this unknown SCell.

$T_{uncertainty_SP_multiple_scells}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting and SCell activation command of this unknown SCell.

$T_{uncertainty_RRC_multiple_scells}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) and SCell activation command of this unknown SCell.

T_{rs}, $T_{FineTiming}$, and T_{RRC_delay} is defined in clause 8.3.2.

Longer delays for RRM measurement requirements, and in case of FR2 also SSB based RLM/BFD/CBD/L1-RSRP measurement requirements, can be expected during the cell detection time for unknown SCell activation.

The condition of known SCell in FR1 or FR2 is defined in clause 8.3.2.

If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the activation command, T_{SMTC_Scell} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. $T_{SMTC_MAX_multiple_scell}$ follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

The starting point and the end-point of an interruption window on PCell or any activated SCell in MCG for NR standalone mode, or on PSCell or any activated SCell in SCG for EN-DC mode is same as single SCell activation requirement in clause 8.3.2.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Upon receiving SCell activation command in slot *n*, if the start of the first complete SSB used in the T_X in the different bands which have SCells being activated after $n+\frac{T_{HARQ}+3ms}{NR\ slot\ length}$ are not aligned on time domain among

- SCells in different bands being activated by the same MAC CE if UE does not support per FR gap, or

- SCells in different FR1 bands being activated by the same MAC CE if UE supports per FR gap,

additional interruptions may be expected for the activated serving cells, where

- The number of additional interruptions is no more than the number of FR1 bands which have both SCell being activated for which the activation requirements involve $T_{FirstSSB_MAX\ multiple_scells}$ with T_{rs} and the active serving cell, and

- In each interruption occasion, the interruption length is defined in clause 8.2.2.2.2, and

- Longer activation delay may be expected for multiple SCell activation under one MAC CE with multiple interruptions, and

- T_X is:
  - $T_{FirstSSB}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{FirstSSB}$;
  - $T_{FirstSSB_MAX\ multiple_scells}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{FirstSSB_MAX\ multiple_scells}$;
  - $T_{uncertainty_MAC}+T_{FineTiming}$ or $T_{uncertainty_MAC\ multiple_scells}+T_{FineTiming}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{FineTiming}$.

Otherwise, no additional interruption is expected due to activation of multiple SCells.

Starting from slot $n + T_{HARQ} + 3$ ms where slot n is the slot where SCell activation command is received (as specified in clause 4.3 of TS 38.213 [3]) and until the SCell activation completion at UE, after at least one CSI-RS transmission occasion for the channel measurement and reporting (specified in clause 5.2.2.5 of TS 38.214 [26]), the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

8.3.8 SCell Deactivation Delay Requirement for Activated SCell with Multiple Downlink SCells

The requirements in this clause shall apply for the UE configured with multiple downlink SCells in EN-DC, or in standalone NR carrier aggregation, or in NE-DC, or in NR-DC, provided that,

- in each single CG, there are no other SCell activation, deactivation, addition or release before deactivation is completed for all the SCells deactivated by the single MAC CE in this clause, and
- in EN-DC and NE-DC, there are no E-UTRAN SCell activation, deactivation, addition or release before multiple SCell deactivation is completed in this clause, and
- in EN-DC, NE-DC, NR-DC and standalone NR, UE only receives one single MAC command for multiple SCell deactivation within the deactivation period defined in this clause, or, in NR-DC, per-FR measurement gap capable UE receives one MAC command per CG for multiple SCell deactivation within the deactivation period defined in this clause

Upon receiving SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated within the same delay as specified in clause 8.3.3.

The starting point and the end-point of an interruption window on PCell or any activated SCell in MCG for NR standalone mode, or on PSCell or any activated SCell in SCG for EN-DC mode is same as single SCell activation requirement in clause 8.3.3.

8.3.9 Direct SCell Activation of Multiple Downlink SCells at SCell addition

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], with 2 SCells for which the parameter *sCellState* is set to *activated*.

In EN-DC, NE-DC, stand-alone NR, or in one CG of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE only receives one RRC reconfiguration message for direct activation of SCells within the activation period defined in this clause,
- in each single CG, there are no other SCell activation, deactivation, addition or release before direct activation is completed for all the SCells activated by the single RRC reconfiguration message in this clause, and
- in EN-DC and NE-DC, there are no E-UTRAN SCell activation, deactivation, addition or release before the direct SCell activation of multiple SCells in this clause is completed.

In two CGs of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE receives one RRC message per CG for direct activation of SCells within the activation period defined in this clause,
- UE supports per-FR measurement gap capability, and
- any to-be-activated unknown SCell has active serving cell(s) or known to-be-activated SCell(s) on the same band.

The UE shall configure the SCells in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. The UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot n + $\frac{N_{direct_multiple_scells}}{NR\ slot\ length}$,

where:

- Slot n is the last slot overlapping with the PDSCH containing the RRC reconfiguration message.
- $N_{direct_multiple_scells} = T_{RRC_Process} + T_1 + T_{activation_time_multiple_scells} + T_{CSI_Reporting}$ - 3 ms for the cases specified in clause 8.3.7 that TCI state is not indicated within $T_{activation_time}$; otherwise, $N_{direct_multiple_scells} = T_{RRC_Process} + T_1 + T_{HARQ} + T_{activation_time_multiple_scells} + T_{CSI_Reporting}$
  - T_1 and $T_{RRC_Process}$ are specified in clause 8.3.4,
  - T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3],
  - $T_{activation_time_multiple_scells}$ and $T_{CSI_Reporting}$ are specified in clause 8.3.7, where the following definition of $T_{FirstSSB}$, $T_{FirstSSB_MAX}$, and $T_{FirstSSB_MAX_multiple_scells}$ shall override the existing ones:
    - $T_{FirstSSB}$ and $T_{FirstSSB_MAX}$: as specified in clause 8.3.4,
    - $T_{FirstSSB_MAX_multiple_scells}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot $n + \frac{T_{RRC_{Process}} + T_1}{NR\ slot\ length}$, further fulfilling:
      - In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCells being activated are transmitting SSB burst.
      - In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.
  - If a UE supports, *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* and/or *shortMeasInterval-r18* capabilities, the reduced $T_{activation_time}$ specified in clause 8.3.2 when UE supports these capabilities is applicable for Direct SCell activation at SCell addition also.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The UE may be allowed to cause interruptions to serving cells on other component carriers during an interruption window, as specified in clause 8.2. The starting point of an interruption window on SpCell or any activated SCell shall not occur before slot $n+1+\frac{T_{HARQ}}{NR\ slot\ length}$, and shall not occur after slot $n+1+\frac{T_{RRC_Process}+T_1+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology of the SCell being activated, and T_X is:

- $T_{FirstSSB}$, for any scenario where $T_{activation_time_multiple_scells}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB_MAX}$, for any scenario where $T_{activation_time_multiple_scells}$ includes $T_{FirstSSB_MAX}$;
- $T_{FirstSSB_MAX_multiple_scell}$, for any scenario where $T_{activation_time_multiple_scells}$ includes $T_{FirstSSB_MAX_multiple_scells}$;
- $T_{uncertainty_MAC} + T_{FineTiming}$, for any scenario where $T_{activation_time_multiple_scells}$ includes $T_{FineTiming}$.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

Starting from the slot $n + \frac{T_{RRC_Process} + T_1}{NR\ slot\ length}$ until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCells.

8.3.10 Direct SCell Activation of Multiple Downlink SCells at Handover

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], for handover with 2 SCells for which the parameter *sCellState* is set to *activated*.

In MCG of NE-DC, MCG of NR-DC, or in stand-alone NR, the requirements in this clause shall apply when the following conditions are met:

- UE does not receive any RRC reconfiguration message for direct activation of SCells within the activation period defined in this clause,
- there is no other SCell activation, deactivation, addition or release before direct activation is completed for all the SCells activated by the single RRC reconfiguration message in this clause, and
- in NE-DC, there is no E-UTRAN SCell activation, deactivation, addition or release before the direct activation of SCells in this clause is completed.

The UE shall configure the SCells in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. The UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCells no later than in slot n + $\frac{N_{direct_multiple_scells}}{NR\ slot\ length}$ where:

- Slot n is the last slot overlapping with the PDSCH containing the RRC reconfiguration message,
- $N_{direct_multiple_scells} = T_{RRC_process} + T_{interrupt} + T_2 + T_3 + T_{activation_time_multiple_scells} + T_{CSI_Reporting}$ - 3 ms for the cases specified in clause 8.3.7 that TCI state is not indicated within $T_{activation_time}$; otherwise, $N_{direct_multiple_scells} = T_{RRC_process} + T_{interrupt} + T_2 + T_3 + T_{HARQ} + T_{activation_time_multiple_scells} + T_{CSI_Reporting}$
  - $T_{RRC_Process}$, $T_{interrupt}$,T_2, and T_3 are specified in clause 8.3.5,
  - T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3],
  - $T_{activation_time_multiple_scells}$ and $T_{CSI_Reporting}$ are specified in clause 8.3.7, where the following definitions of $T_{FirstSSB}$, $T_{FirstSSB_MAX}$, and $T_{FirstSSB_MAX_multiple_scells}$ shall override the existing ones:
    - $T_{FirstSSB}$, $T_{FirstSSB_MAX}$: as specified in clause 8.3.5,
    - $T_{FirstSSB_MAX_multiple_scell}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC_Process}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$, further fulfilling:
      - In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCells being activated are transmitting SSB burst.
      - In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.
  - If a UE supports, *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* and/or *shortMeasInterval-r18* capabilities, the reduced $T_{activation_time}$ specified in clause 8.3.2 when UE supports these capabilities is applicable for Direct SCell activation at handover also.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The UE may be allowed to cause interruptions to PCell during an interruption window, as specified in clause 8.2. The starting point of an interruption window on PCell shall not occur before slot n+1+ $\frac{T_{RRC\ Processing}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$, and not occur after slot n+1+$\frac{T_{RRC\ Processing}+T_{interrupt}+T_2+T_3+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology of the SCell being activated, and T_X is:

- $T_{FirstSSB}$, for any scenario where $T_{activation_time_multiple_scells}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB_MAX}$, for any scenario where $T_{activation_time_multiple_scells}$ includes $T_{FirstSSB_MAX}$;
- $T_{FirstSSB_MAX_multiple_scell}$, for any scenario where $T_{activation_time_multiple_scells}$ includes $T_{FirstSSB_MAX_multiple_scells}$;
- $T_{uncertainty_MAC} + T_{FineTiming}$, for any scenario where $T_{activation_time_multiple_scells}$ includes $T_{FineTiming}$.

The length of the interruption window depends on the frequency band relation between the aggressor SCell and the victim PCell.

Starting from the slot $n + \frac{T_{RRC_Process} + T_{interrupt} + T_2 + T_3}{NR\,slot\,length}$ and until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCells.

8.3.11 Direct SCell Activation of Multiple Downlink SCells at RRC Resume

The requirements in this clause apply for UE being configured in the RRC reconfiguration message in TS 38.331 [2] for RRC Resume with 2 SCells for which the parameter *sCellState* is set to *activated*.

The requirements in clause 8.3.9 shall apply, except that the definition of T_1 shall be replaced by the corresponding definition in clause 8.3.6.

8.3.12 SCell Activation Delay Requirement for Deactivated PUCCH SCell

The requirements in this clause shall apply for the UE configured with one downlink SCell and when PUCCH is configured for the SCell being activated.

If the UE has a valid TA for transmitting on an SCell then the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated on the PUCCH SCell no later than in slot $n+\frac{T_{HARQ}+T_{activation_time}+\max\left((T_{First_available_CSI}+T_{CSI_processing}),\ 3*T_{target_PL-RS}\right)+T_{CSI_Reporting_after}}{NR\,slot\,length}$,

Where:

- A TA is considered to be valid provided that the *TimeAlignmentTimer* [2] associated with the TAG containing the PUCCH SCell is running.
- T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].
- $T_{activation_time}$ is the SCell activation delay in milliseconds.

  If target SCell is unknown, $T_{activation_time}$ is specified in 8.3.2A provided the following conditions are met:

  - UE supports *measValidationReportEMR* and *measIdleValidityDuration-r18* is configured or,
  - UE supports *measValidationReportReselectionMeasurements* and *measReselectionValidityDuration-r18* is configured or,
  - UE supports idleInactiveNR-*MeasReport-r16*, and neither *measIdleValidityDuration-r18* nor *measReselectionValidityDuration*-r18 is configured and *measIdleDuration*-r16 has not expired at the moment of initiation of RRC state transition to CONNECTED mode,

  For the UE capable of *l3-MeasUnknownSCellActivation-r18*, if the UE is provided with *ReportOnScellActivation* and it reports valid L3 measurement results after receiving the SCell activation command for unknown SCell, the $T_{activation_time}$ is the SCell activation delay with L3 reporting in milliseconds as specified in clause 8.3.17 except the definition of $T_{uncertainty_MAC}$ is replaced with:

  - $T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable), UL spatial relation (for FR2) relative to
    - SCell activation command for known case;
    - First valid L3 report for unknown case, if UE reports valid L3-RSRP before receiving TCI activation command;

- First valid L1-RSRP reporting for unknown case, if UE reports valid L3-RSRP after receiving TCI activation command.

Otherwise, $T_{activation_time}$ is the SCell activation delay in milliseconds as specified in clause 8.3.2 except the definition of $T_{uncertainty_MAC}$ is replaced with:

- $T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable), UL spatial relation (for FR2) relative to
  - SCell activation command for known case;
  - First valid L1-RSRP reporting for unknown case.

- $T_{target_PL\text{-}RS}$ is the periodicity of the target pathloss reference signal determined during PUCCH SCell activation.
- $T_{First_available_CSI}$ is the delay uncertainty (in ms) in acquiring the first available downlink CSI reference resource.
- $T_{CSI_processing}$ is the UE processing time for CSI reporting.
- $T_{CSI_reporting_after}$ is the delay uncertainty (in ms) in acquiring the first available CSI reporting resources after end of max (($T_{First_available_CSI}$ + $T_{CSI_processing}$), 3*$T_{target_PL\text{-}RS}$)

If the UE does not have a valid TA for transmitting on an SCell then the UE shall be capable to perform downlink actions related to the SCell activation command as specified in [7] for the SCell being activated on the PUCCH SCell no later than in slot n+$\frac{T_{HARQ}+T_{activation_time}}{NR\,slot\,length}$, and shall be capable to perform uplink actions related to the SCell activation command as specified in [7] for the SCell being activated on the PUCCH SCell no later than in slot n + $\frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\,slot\,length}$ and shall transmit valid CSI report for the SCell being activated on the PUCCH SCell no later than in slot n + $\frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\,slot\,length}$, where:

$T_{delay_PUCCH_SCell}$ = $T_{activation_time}$ + max (($T_{First_available_CSI}$ + $T_{CSI_processing}$), (T1+T2+T3), 3*$T_{target_PL\text{-}RS}$) + $T_{CSI_reporting_after}$

Where:

- $T_{activation_time}$ is the SCell activation delay in milliseconds.

  If target SCell is unknown, $T_{activation_time}$ is specified in 8.3.2A provided the following conditions are met:

  - UE supports *measValidationReportEMR* and *measIdleValidityDuration-r18* is configured or,
  - UE supports *measValidationReportReselectionMeasurements* and *measReselectionValidityDuration-r18* is configured or,
  - UE supports idleInactiveNR-*MeasReport-r16*, and neither *measIdleValidityDuration-r18* nor *measReselectionValidityDuration*-r18 is configured and *measIdleDuration*-r16 has not expired at the moment of initiation of RRC state transition to CONNECTED mode,

  For the UE capable of *l3-MeasUnknownSCellActivation-r18*, if the UE is provided with *ReportOnScellActivation* and it reports valid L3 measurement results after receiving the SCell activation command for unknown SCell, the $T_{activation_time}$ is the SCell activation delay with L3 reporting in milliseconds as specified in clause 8.3.17 except the definition of $T_{uncertainty_MAC}$ is replaced with:

  - $T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable), UL spatial relation (for FR2) relative to
    - SCell activation command for known case;
    - First valid L3 report for unknown case, if UE reports valid L3-RSRP before receiving TCI activation command;
    - First valid L1-RSRP reporting for unknown case, if UE reports valid L3-RSRP after receiving TCI activation command;

  Otherwise, $T_{activation_time}$ is the SCell activation delay in milliseconds as specified in clause 8.3.2 except the definition of $T_{uncertainty_MAC}$ is replaced with:

- $T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable), UL spatial relation (when applicable in FR2) relative to
  - SCell activation command for known case;
  - First valid L1-RSRP reporting for unknown case.

- $T_{target_PL\text{-}RS}$ is the periodicity of the target pathloss reference signal determined during PUCCH SCell activation.
- $T_{First_available_CSI}$ is the delay uncertainty (in ms) in acquiring the first available downlink CSI reference resource.
- $T_{CSI_processing}$ is the UE processing time for CSI reporting.
- $T_{CSI_reporting_after}$ is the delay uncertainty (in ms) in acquiring the first available CSI reporting resources after end of max (($T_{First_available_CSI}$ + $T_{CSI_processing}$), (T1+T2+T3), 3*$T_{target_PL\text{-}RS}$)
- T1 is the delay uncertainty in acquiring the first available PDCCH triggered PRACH occasion in the PUCCH SCell after the slot n+$\frac{T_{HARQ}+T_{activation_time}}{NR\ slot\ length}$.
  - T1 is up to the summation of a delay uncertainty for reception of PDCCH order, SSB to PRACH occasion association period and 10 ms, where SSB to PRACH occasion association period is defined in table 8.1-1 of TS 38.213 [3]
- T2 is the delay from slot n+$\frac{T_{HARQ}+T_{activation_time}+T_1}{NR\ slot\ length}$until UE has obtained a valid TA command for the target PUCCH Scell being activated. Slot n is the slot where the UE receives PUCCH SCell activation command.
- T3 is the delay for applying the received TA for uplink transmission on target PUCCH SCell being activated, as specified in clause 4.2 in TS 38.213 [3].

The pathloss reference signal is known for known PUCCH SCell during activation if the following conditions are met during the period between the last transmission of the RS resource used for L3 measurement reporting and the completion of PUCCH SCell activation, where the RS resource is the target pathloss reference signal or QCLed (with Type D) to the target pathloss reference signal:

- The PUCCH SCell activation command is received within 1280 ms upon the last transmission of the RS resource used for L3 measurement reporting
- The target pathloss reference signal determination is based on the latest L3 measurement reporting
- The target pathloss reference signal remains detectable during the PUCCH SCell activation period
  - SNR of the target pathloss reference signal≥-3 dB
- The associated SSBs with the target pathloss reference signal remain detectable during the PUCCH SCell activation period
  - SNR of the associated SSB ≥-3 dB

If the target SCell is unknown and following conditions are met:

- UE supports *measValidationReportEMR* and *measIdleValidityDuration-r18* is configured or,
- UE supports *measValidationReportReselectionMeasurements* and *measReselectionValidityDuration-r18* is configured or,
- UE supports idleInactiveNR-*MeasReport-r16*, and neither *measIdleValidityDuration-r18* nor *measReselectionValidityDuration*-r18 is configured and *measIdleDuration*-r16 has not expired at the moment of initiation of RRC state transition to CONNECTED mode,

the pathloss reference signal is known for unknown PUCCH SCell during activation if the following conditions are met during the period between the last transmission of the RS resource used for EMR reporting and the completion of PUCCH SCell activation, where the RS resource is the target pathloss reference signal or QCLed (with Type D) to the target pathloss reference signal.

- The target pathloss reference signal determination is based on the EMR reporting in 4.7.3 and 5.8.3.

- The target pathloss reference signal remains detectable during the PUCCH SCell activation period
  - SNR of the target pathloss reference signal≥-3dB
- The associated SSBs reported in EMR report with the target pathloss reference signal remain detectable during the PUCCH SCell activation period
  - SNR of the associated SSB reported in EMR report≥-3dB

For the UE capable of *l3-MeasUnknownSCellActivation-r18*, if the UE is provided with *ReportOnScellActivation* and it reports valid L3 measurement results after receiving the SCell activation command for unknown SCell, the pathloss reference signal is known for unknown PUCCH SCell during activation if the following conditions are met during the period between the last transmission of the RS resource used for L3 reporting after SCell activation command and the completion of PUCCH SCell activation, where the RS resource is the target pathloss reference signal or QCLed (with Type D) to the target pathloss reference signal.

- The PUCCH SCell activation command is received within 1280 ms upon the last transmission of the RS resource used for the L3 reporting after SCell activation command
- -- The target pathloss reference signal determination is based on either the latest L1-RSRP measurement reporting or the L3 reporting after SCell activation command, if UE reports both before receiving TCI activation command
- The target pathloss reference signal remains detectable during the PUCCH SCell activation period
  - SNR of the target pathloss reference signal≥-3 dB
- The associated SSBs with the target pathloss reference signal remain detectable during the PUCCH SCell activation period
  - SNR of the associated SSB ≥-3 dB

Otherwise, the pathloss reference signal is known for unknown PUCCH SCell during activation if the following conditions are met during the period between the last transmission of the RS resource used for L1-RSRP measurement reporting and the completion of PUCCH SCell activation, where the RS resource is the target pathloss reference signal or QCLed (with Type D) to the target pathloss reference signal.

- The PUCCH SCell activation command is received within 1280 ms upon the last transmission of the RS resource used for L1-RSRP measurement reporting
- The target pathloss reference signal determination is based on the latest L1-RSRP measurement reporting
- The target pathloss reference signal remains detectable during the PUCCH SCell activation period
  - SNR of the target pathloss reference signal≥-3 dB
- The associated SSBs with the target pathloss reference signal remain detectable during the PUCCH SCell activation period
  - SNR of the associated SSB ≥-3 dB

Otherwise, the pathloss reference signal is unknown.

The above delay requirement shall apply provided that:

- The target pathloss reference signal determined during PUCCH SCell activation is known otherwise longer activation time is expected if the pathloss reference signal is unknown; and
- The RA on PUCCH SCell is not interrupted by the RA on PCell otherwise additional delay to activate the SCell is expected; and
- No SRS carrier based switching or SRS antenna port switching occurs during the SCell activation procedure otherwise the PUCCH SCell activation delay can be extended.

The starting point and the end-point of an interruption window on PCell or any activated SCell in MCG for NR standalone mode, or on PSCell or any activated SCell in SCG for EN-DC mode is the same as the interruption in single SCell activation requirement in clause 8.3.2.

In addition to the interruption due to RF retuning during PUCCH SCell activation, if the UE is not capable of *parallelTxPRACH-SRS-PUCCH-PUSCH*, and PRACH on PUCCH SCell and PUCCH/PUSCH/SRS on other active serving cell are fully or partially overlapping in time, the UE shall transmit PRACH on PUCCH SCell and is allowed to drop or cause interruption to SRS or PUCCH or PUSCH transmission on the SpCell or on any activated SCell. Otherwise, UE is not allowed to drop or cause any interruption to SRS or PUCCH or PUSCH transmission on SpCell or on any activated SCell.

For unknown PUCCH SCell activation in FR2, the requirement only applies when UE supports *ReportingCrossPUCCH-Grp-r16*, and UE is configured with CSI reporting via SpCell. For unknown PUCCH SCell activation in FR1, the requirement only applies when UE supports *ReportingCrossPUCCH-Grp-r16*, and UE is configured with CSI reporting via SpCell, if 'ssb-PositionInBurst' indicates multiple SSBs but TCI state indication is not provided in same MAC PDU with SCell activation.

The requirement for unknown PUCCH SCell applies provided that the PDCCH order (when applicable) and the activation commands for TCI, UL spatial relation and PL-RS (when applicable) are based on the latest valid L1-RSRP reporting or the L3 reporting after SCell activation command via Primary PUCCH group or EMR reporting as defined in 8.3.2A, 4.7.3 and 5.8.3.

8.3.13 SCell activation delay Requirement for Deactivated PUCCH SCell with Multiple SCells

The requirements in this clause shall apply for the UE configured with multiple deactivated downlink SCells and PUCCH is configured for a SCell, and when PUCCH SCell with downlink SCell(s) are activated by one MAC command.

For EN-DC, NE-DC, and standalone NR, the requirements in this clause shall apply when the following conditions are met:

- UE only receives a single MAC command for multiple SCell activation within the activation period defined in this clause
- in each single CG, there are no other SCell activation, deactivation, addition or release before activation is completed for all the SCells activated by the single MAC CE in this clause, and
- in EN-DC and NE-DC, there are no E-UTRAN SCell activation, deactivation, addition or release before multiple SCell activation is completed in this clause, and
- any to-be-activated unknown non-PUCCH SCell in a different band from to-be-activated PUCCH SCell has active serving cell(s) or known to-be-activated non-PUCCH SCell(s) on the same band.
- All DL SCells being activated in the secondary PUCCH group are unknown if PUCCH SCell being activated is unknown.
- If the to-be-activated FR2 PUCCH SCell is unknown, and there is no to-be-activated FR1 SCell which is counted in N1 as defined in clause 8.3.7.

Upon receiving SCell activation command in slot *n* for more than one SCell and one among the multiple SCells is PUCCH SCell, the UE shall be able to transmit valid CSI report on PUCCH SCell and apply actions related to the SCell activation command as specified in [7] for the PUCCH SCell being activated no later than in slot *n*+ $T_{activate_total_PUCCH_SCell}$. The UE shall be capable to transmit valid CSI report of other SCell no later than in slot n+ $T_{activate_total_other_SCell.}$

Where:

- $T_{activate_total_PUCCH_SCell}$ is $\frac{T_{HARQ}+T_{delay_multiple_SCells_PUCCH_SCell}}{NR\ slot\ length}$,
- $T_{activate_total_other_SCell}$ is $\frac{T_{HARQ}+T_{delay_multiple_SCells_other_SCell}}{NR\ slot\ length}$

Where:

- $T_{delay_multiple_SCells_other_SCell}$ is the SCell activation delay for other SCell when PUCCH SCell is activated with multiple SCells and is given by $T_{activation_time_multiple_scells}$ +$T_{CSI_Reporting}$.

- $T_{delay_multiple_SCells_PUCCH_SCell}$ is the SCell activation delay for PUCCH SCell when it is activated with multiple SCells and is given as below.

If UE has a Valid TA for transmitting on PUCCH SCell,

- A TA is considered to be valid provided that the *TimeAlignmentTimer* [2] associated with the TAG containing the PUCCH SCell is running.

$T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + \max((T_{First_available_CSI} + T_{CSI_processing}), 3*T_{target_PL\text{-}RS}) + T_{CSI_reporting_after}$

If UE does not have valid TA for PUCCH SCell,

$T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + \max((T_{First_available_CSI} + T_{CSI_processing}), (T1+T2+T3), 3*T_{target_PL\text{-}RS}) + T_{CSI_reporting_after}$

Where:

- For UE which is capable of *l3-MeasUnknownSCellActivation-r18*, $T_{activation_time_multiple_scells}$ is equal to $T_{activation_time}$ which is the SCell activation delay in milliseconds as specified in clause 8.3.18 except the definition of $T_{uncertainty_MAC}$ and $T_{uncertainty_RRC}$ are replaced with:
  - $T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable), UL spatial relation (for FR2) relative to
  - First valid L3 report of a to-be-activated SCell within the same band for unknown case, if UE reports valid L3 report and L3 report is earlier than TCI command.
  - $T_{uncertainty_RRC}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to
  - First valid L3 reporting of a to-be-activated SCell within the same band for unknown case, if UE reports valid L3 and L3 report is earlier than TCI command.

  Otherwise, when the to-be-activated PUCCH SCell is FR2 unknown SCell, $T_{activation_time_multiple_scells}$ is equal to $T_{activation_time}$ as defined in clause 8.3.12; otherwise, $T_{activation_time_multiple_scells}$ is the target SCell activation delay in milliseconds in multiple SCell activation scenario as specified in clause 8.3.7.
- $T_{target_PL\text{-}RS}$ is the periodicity of PL-RS resource when PL-RS of target PUCCH SCell is known
- $T_{first_available_CSI}$: the delay uncertainty in acquiring the first available downlink CSI reference resources for secondary PUCCH group.
- $T_{CSI_processing}$: the UE processing time for CSI reporting of secondary group PUCCH SCells.
- $T_{CSI_reporting_after}$ the delay uncertainty in acquiring the first available CSI reporting resource after end of max $((T_{First_available_CSI} + T_{CSI_processing}), 3*T_{target_PL\text{-}RS})$ if UE has a valid TA for PUCCH SCell or after end of max $((T_{First_available_CSI} + T_{CSI_processing}), (T1+T2+T3), 3*T_{target_PL\text{-}RS})$ if UE does not have a valid TA for PUCCH SCell.
- T1 is the delay uncertainty in acquiring the first available PDCCH triggered PRACH occasion in the PUCCH SCell after $T_{activation_time_multiple_scells}$.
- T1 is up to the summation of a delay uncertainty for reception of PDCCH order, SSB to PRACH occasion association period and 10 ms, where SSB to PRACH occasion association period is defined in the table 8.1-1 of TS 38.213 [3]
- T2 is the delay from slot n + $(T_{HARQ} + T_{activation_time_multiple_scells}$ + T1)/NR slot length until UE has obtained a valid TA command for the target PUCCH SCell being activated. Slot n is the slot where the UE receives PUCCH SCell activation command.
- T3 is the delay for applying the received TA for uplink transmission on target PUCCH SCell being activated, and greater than or equal to k+1 slot, where k is defined in clause 4.2 in TS 38.213 [3].

Starting from slot n + T_{HARQ} + 3 ms where n is the slot where SCell activation command is received (as specified in clause 4.3 of TS 38.213 [3]) and until the SCell activation completion at UE, after at least one CSI-RS transmission

occasion for the channel measurement and reporting (specified in clause 5.2.2.5 of TS 38.214 [26]), the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

The starting point and the endpoint of an interruption window on PCell or any activated SCell in MCG for NR standalone mode, or on PSCell or any activated SCell in SCG for EN-DC mode is same as single SCell activation requirement in clause 8.3.2.

In addition to the interruption due to RF retuning during multiple SCell activation, if the UE is not capable of *parallelTxPRACH-SRS-PUCCH-PUSCH* for inter-band CA, and PRACH on PUCCH SCell and PUCCH/PUSCH/SRS on other active serving cell are fully or partially overlapping in time, the UE shall transmit PRACH on PUCCH SCell and is allowed to drop or cause interruption to SRS or PUCCH or PUSCH transmission on the SpCell or on any activated SCell. Otherwise, UE is not allowed to drop or cause any interruption of SRS or PUCCH or PUSCH transmission on SpCell or on any activated SCell.

Upon receiving SCell activation command in slot *n*, if the start of the first complete SSB used in the T_X in the different bands which have SCells being activated after $n+\frac{T_{HARQ}+3ms}{NR\ slot\ length}$ are not aligned on time domain among

- SCells in different bands being activated by the same MAC CE if UE does not support per FR gap, or
- SCells in different FR1 bands being activated by the same MAC CE if UE supports per FR gap,

additional interruptions may be expected for the activated serving cells, where

- The number of additional interruptions is no more than the number of FR1 bands which have both SCell being activated for which the activation requirements involve $T_{FirstSSB_MAX\ multiple_scells}$ with T_{rs} and the active serving cell, and
- In each interruption occasion, the interruption length is defined in clause 8.2.2.2.2, and
- Longer activation delay may be expected for multiple SCell activation under one MAC CE with multiple interruptions, and
- T_X is:
  - $T_{FirstSSB}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{FirstSSB}$;
  - $T_{FirstSSB_MAX\ multiple_scells}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{FirstSSB_MAX\ multiple_scells}$;
  - $T_{uncertainty_MAC}+T_{FineTiming}$ or $T_{uncertainty_MAC\ multiple_scells}+T_{FineTiming}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{FineTiming}$.

Otherwise, no additional interruption is expected due to activation of multiple SCells.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

8.3.14 SCell Deactivation Delay Requirement for Activated PUCCH SCell

The requirements in this clause shall apply for the UE configured with one SCell configured with PUCCH in EN-DC, or in standalone NR carrier aggregation, or in NE-DC.

Upon receiving PUCCH SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the PUCCH SCell being deactivated no later than in slot $n + \frac{T_{HARQ}+3ms}{NR\ slot\ length}$. The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot $n+1+\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot $n+1+\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the PUCCH SCell being deactivated.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

8.3.15 SCell Deactivation Delay Requirement for Activated PUCCH SCell with Multiple Downlink SCells

The requirements in this clause shall apply for the UE configured with multiple downlink SCells and one SCell configured with PUCCH in EN-DC, or in standalone NR carrier aggregation, or in NE-DC, provided that,

- in each single CG, there are no other SCell activation, deactivation, addition or release before deactivation is completed for all the SCells deactivated by the single MAC CE in this clause, and
- in EN-DC and NE-DC, there are no E-UTRAN SCell activation, deactivation, addition or release before multiple SCell deactivation is completed in this clause, and
- in EN-DC, NE-DC and standalone NR, UE only receives one single MAC command for multiple SCell deactivation within the deactivation period defined in this clause

Upon receiving SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the SCells (including one SCell configured with PUCCH) being deactivated within the same delay as specified in clause 8.3.14.

The starting point and the end-point of an interruption window on PCell or any activated SCell in MCG for NR standalone mode, or on PSCell or any activated SCell in SCG for EN-DC mode is same as single SCell activation requirement in clause 8.3.14.

8.3.16 Fast SCell Activation Delay Requirement for Deactivated SCell

Aperiodic CSI-RS resources can be configured for fast SCell activation. The requirements in this clause shall apply for the UE configured with one downlink SCell in EN-DC, or in standalone NR carrier aggregation or in NE-DC or in NR-DC and when one SCell is being activated. The requirements in this clause shall apply for the UE provided with aperiodic CSI-RS resources for SCell activation for the target SCell.

NOTE: If UE is allocated A-TRS for fast Scell activation, the UE is not required to use the SSB of the target Scell.

The transmitted SSB defined in clause 8.3.x1 is also applied in this clause if UE supports *On-demand SSB operation* and OD-SSB transmission is indicated.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot n + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation_time}$ is the SCell activation delay in milliseconds.

If the SCell is known and belongs to FR1, $T_{activation_time}$ is:

- $T_{FirstATRS}$+ 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.
- $T_{FirstATRS}$ + T_{gap} + T_{ATRS} + 5 ms, if the measurement period of the SCell being activated is larger than 2400 ms.

NOTE: The RSs on the activated serving cell in the same band are not required to be transmitted in the same slot as the temporary RS.

NOTE: UE may report inaccurate non-zero CQI for any activated Cell and being activated SCell during the fast SCell activation procedure only if the RSs on the activated serving cell in the same band are not transmitted in the same slot as the aperiodic CSI-RS for fast SCell activation.

If the SCell is unknown and belongs to FR1, and SCell is contiguous to an active serving cell in the same band, provided that the side condition $\hat{E}s/Iot \geq$ -2 dB is fulfilled, $T_{activation_time}$ is:

- $T_{FirstATRS}$ + T_{gap} + T_{ATRS} + 5 ms, if the following conditions are met,

- the SCell is contiguous to an active serving cell in the same band, and
- its *ssb-PositionInBurst* or *od-ssb-PositionsInBurst* if provided for the Scell is same as *ssb-PositionsInBurst* of contiguous FR1 active serving cell, and
- its SMTC offset is same as the one of contiguous FR1 active serving cell, and
- its RTD with contiguous FR1 active serving cell is smaller than or equal to 260 ns with respect to the to-be-activated SCell's SSB numerology, and its reception power difference with contiguous FR1 active serving cell is smaller than or equal to 6 dB;

NOTE: The RSs on the activated serving cell in the same band are not required to be transmitted in the same slot as the temporary RS.

NOTE: UE may report inaccurate non-zero CQI for any activated SCell and being activated SCell during the fast SCell activation procedure only if the RSs on the activated serving cell in the same band are not transmitted in the same slot as the aperiodic CSI-RS for fast SCell activation.

If the SCell being activated belongs to FR2 and if there is at least one active serving cell on that FR2 band, then $T_{activation_time}$ is $T_{FirstATRS}$+ 5 ms provided:

- The UE is provided with aperiodic CSI-RS resources for SCell activation for the target SCell, and
- The SSBs in the serving cell(s) and the SSBs or OD-SSBs in the SCell being activated fulfil the condition defined in clause 3.6.3, and
- The parameter *ssb-PositionsInBurst* for the serving cell(s) is same as the *ssb-PositionsInBurst* or *od-ssb-PositionsInBurst* if provided for the Scell, and
- SSB or OD-SSB is in the same half-frame on the SCell and the FR2 active serving cell.

If the SCell being activated belongs to FR2 and if there is no active serving cell on that FR2 band provided that PCell or PSCell is in FR1 or in FR2, and assuming PDCCH TCI and PDSCH TCI (when applicable) are associated with the triggered aperiodic CSI-RS resources for fast SCell activation, and when the following conditions are fulfillied:

- One of the candidate TCI states configured in TCI-StatesPDCCH-ToAddList has the same QCL source of the triggered A-TRS,
- The QCL source of CSI-RS for CQI reporting is the same as the triggered A-TRS,
- The TCI state for PDCCH/PDSCH is the same as A-TRS remain unchanged during SCell activation,

- If the target SCell belongs to FR2 is known to UE and semi-persistent CSI-RS is used for CSI reporting, then $T_{activation_time}$ is:
  - 3 ms + max($T_{FirstATRS}$ + 2 ms, $T_{uncertainty_SP}$), where $T_{uncertainty_SP}$=0 if UE receives the SCell activation command and semi-persistent CSI-RS activation command at the same time.
- If the target SCell belongs to FR2 is known to UE and periodic CSI-RS is used for CSI reporting, then $T_{activation_time}$ is:
  - max($T_{FirstATRS}$ + 5 ms, $T_{uncertainty_RRC}$ + T_{RRC_delay}-T_{HARQ}).

  where,

  $T_{FirstATRS}$: is the time to the end of the first complete CSI-RS burst for SCell activation after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots.

  T_{ATRS} is the CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots.

  - T_{gap} is a gap length between two aperiodic CSI-RS bursts,
  - at least 2 slots for 15 kHz and 30 kHz

- at least 3 slots for 60 kHz

$T_{uncertainty_RRC}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to SCell activation command.

$T_{uncertainty_SP}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to SCell activation command for known case.

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

$T_{CSI_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5*measCycleSCell, 5*DRX cycles) for FR1 before the reception of the SCell activation command:
  - the UE has sent a valid measurement report for the SCell being activated and
  - the SSB measured remains detectable according to the cell identification conditions specified in clauses 9.2 and 9.3.
- the SSB measured during the period equal to max(5*measCycleSCell, 5*DRX cycles) also remains detectable during the SCell activation delay according to the cell identification conditions specified in clauses 9.2 and 9.3.

Otherwise SCell in FR1 is unknown.

For the first SCell activation in FR2 bands, the SCell is known if it has been meeting the following conditions:

- During the period equal to 4 s for UE supporting power class 1/5 and 3 s for UE supporting power class 2/3/4 before UE receives the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and semi-persistent CSI-RS for CQI reporting (when applicable):
  - the UE has sent a valid L3-RSRP measurement report with SSB index
  - SCell activation command is received after L3-RSRP reporting and no later than the time when UE receives MAC-CE command for TCI activation
- During the period from L3-RSRP reporting to the valid CQI reporting, the reported SSBs with indexes remain detectable according to the cell identification conditions specified in clauses 9.2 and 9.3, and the TCI state is selected based on one of the latest reported SSB indexes.

Otherwise, the first SCell in FR2 band is unknown.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot slot n+1+$\frac{T_{HARQ}+3ms+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being activated, and T_X is:

- $T_{FirstATRS}$, for any scenario where $T_{activation_time}$ includes $T_{FirstATRS}$;

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

The requirements in this clause and requriements on interruption due to SCell activation in clause 8.x apply provided that the SSB and/or the OD-SSB and A-TRS of the to-be-activated SCell is within the first active DL BWP of the Scell.

Starting from slot n + T_{HARQ} + 3 ms where slot n is the slot where SCell activation command is received (as specified in clause 4.3 of TS 38.213 [3]) and until the SCell activation completion at UE, after at least one CSI-RS transmission occasion for the channel measurement and reporting (specified in clause 5.2.2.5 of TS 38.214 [26]), the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

8.3.17 SCell Activation Delay Requirement for Deactivated SCell with the L3 reporting during activation

The requirements in this clause shall apply for UE supporting *l3-MeasUnknownSCellActivation-r18* and is configured with *ReportOnScellActivation* and reporting valid L3 measurement results after receiving the SCell activation command for unknown SCell. The requirements in this clause shall apply for the UE configured with one downlink SCell in EN-DC, or in standalone NR carrier aggregation or in NE-DC or in NR-DC and when one SCell is being activated. Clause 8.3.2 is applied for UE who does not report L3 measurement results after receiving SCell activation command for unknown SCell.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot n + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation_time}$ is the SCell activation delay in milliseconds.

- $T_{activation_time}$ is:
  - 10 ms + $T_{L3,report}$+ T_{HARQ} + max($T_{uncertainty_MAC}$ + $T_{FineTiming}$ + 2 ms, $T_{uncertainty_SP}$), if semi-persistent CSI-RS is used for CSI reporting,
  - 7 ms + $T_{L3,report}$+ max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}), if periodic CSI-RS is used for CSI reporting,

If the following conditions are met:

If the SCell being activated belongs to FR1 and if there is no active serving cell contiguous to the SCell on that FR1 band provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled:

If the target SCell belongs to FR1 and none of the following conditions is met

- 'ssb-PositionInBurst' indicates only one SSB is being actually transmitted, or
- 'ssb-PositionInBurst' indicates multiple SSBs and TCI indication is provided in same MAC PDU with SCell activation;

If the SCell being activated belongs to FR2-1 and if there is no active serving cell on that FR2-1 band provided that PCell or PSCell is in FR1 or in FR2-1:

If the PCell/PSCell and the target SCell are configured as FR1-FR2-1 CA or if the PCell/PSCell and the target SCell are in a FR2-1 band pair with independent beam management, and the target SCell is unknown to UE provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled.

Otherwise, $T_{activation_time}$ in clause 8.3.2 is applied for unknown SCell activation.

However, when the following conditions are fulfilled, no activation requirement will be applied for this unknown SCell:

- the SCell is contiguous to an active serving cell in the same band, and
- a single SSB is used in the unknown SCell; or multiple SSBs are used in the SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and
- its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and
- its SMTC offset is same as the one of contiguous FR1 active serving cell
- its RTD with contiguous FR1 active serving cell is larger than 260 ns with respect to the to-be-activated SCell's SSB numerology, or its reception power difference with contiguous FR1 active serving cell is larger than 6 dB;

where,

$T_{L3, report}$ is delay of acquiring the first available UL resource for L3 reporting from 7 ms +T_{HARQ} after receiving SCell activation command.

- The L3 measurement reporting requirement is defined in clause 9.2.4.4
- UE is ready to report the L3 measurement result no later than 7 ms + T_{HARQ} ms from receiving the SCell activation command.

UE is not required to report the L3 results after 3 ms + T_{HARQ}+ M ms from receiving the SCell activation command where

- For FR1,
  - M= 2*T_{SSB} + $T_{L1\text{-}RSRP,report}$ for UE supporting *shortMeasInterval-r18* capability,
  - Otherwise, M = T_{SMTC} +T_{SSB} + $T_{L1\text{-}RSRP,report}$
- For FR2-1,
  - M= (X1+X2)*T_{SSB} + $T_{L1\text{-}RSRP,report}$ for UE supporting *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* and *shortMeasInterval-r18* capability,
  - M = X1*T_{SMTC} +X2*T_{SSB} + $T_{L1\text{-}RSRP,report}$ for UE supporting *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* without supporting *shortMeasInterval-r18* capability,
  - M = 16*T_{SSB} + $T_{L1\text{-}RSRP,report}$ for UE supporting *shortMeasInterval-r18* without supporting *reduceForCellDetection* and *reduceForSSB-L1-RSRP-Meas* capability,
- Otherwise, M = 8*T_{SMTC} +8*T_{SSB} + $T_{L1\text{-}RSRP,report}$

  Where, X1 and X2 are UE capabilities as reported in *reduceForCellDetection* and *reduceForSSB-L1-RSRP-Meas* respectively. T_{SSB} is the same as $T_{rs, enhanced}$ as specified in clause 8.3.2. T_{SMTC} is the same as T_{SMTC_MAX} as specified in clause 8.3.2.

$T_{FineTiming}$ is the time period between UE finish processing the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and the timing of first complete available SSB corresponding to the TCI state.

$T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable) relative to

- First valid L3-RSRP reporting for unknown case, if UE reports valid L3-RSRP before receiving TCI activation command
- First valid L1-RSRP reporting for unknown case, if UE reports valid L3-RSRP after receiving TCI activation command

$T_{uncertainty_RRC}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to

- First valid L3-RSRP reporting for unknown case, if UE reports valid L3-RSRP before receiving TCI activation command
- First valid L1-RSRP reporting for unknown case, if UE reports valid L3-RSRP after receiving TCI activation command

$T_{uncertainty_SP}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to

- First valid L3-RSRP reporting for unknown case, if UE reports valid L3-RSRP before receiving TCI activation command
- First valid L1-RSRP reporting for unknown case, if UE reports valid L3-RSRP after receiving TCI activation command

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

Longer delays for RRM measurement requirements, and in case of FR2-1 also SSB based RLM/BFD/CBD/L1-RSRP measurement requirements, can be expected during the cell detection time for unknown SCell activation.

When *absoluteFrequencySSB* is not configured in *DownlinkConfigCommon* for target SCell but SMTC for target SCell is configured, no requirement would be applied.

$T_{CSI_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5*measCycleSCell, 5*DRX cycles) for FR1 before the reception of the SCell activation command:
  - the UE has sent a valid measurement report for the SCell being activated and
  - the SSB measured remains detectable according to the cell identification conditions specified in clause 9.2 and 9.3.
- the SSB measured during the period equal to max(5*measCycleSCell, 5*DRX cycles) also remains detectable during the SCell activation delay according to the cell identification conditions specified in clauses 9.2 and 9.3.

Otherwise SCell in FR1 is unknown.

For the first SCell activation in FR2-1 bands, the SCell is known if it has been meeting the following conditions:

- During the period equal to 4 s for UE supporting power class 1/5 and 3 s for UE supporting power class 2/3/4 before UE receives the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and semi-persistent CSI-RS for CQI reporting (when applicable):
  - the UE has sent a valid L3-RSRP measurement report with SSB index, and
  - SCell activation command is received after L3-RSRP reporting and no later than the time when UE receives MAC-CE command for TCI activation
- During the period from L3-RSRP reporting to the valid CQI reporting, the reported SSBs with indexes remain detectable according to the cell identification conditions specified in clauses 9.2 and 9.3, and the TCI state is selected based on one of the latest reported SSB indexes.

Otherwise, the first SCell in FR2-1 band is unknown.

The requirement for unknown SCell applies provided that the activation commands for PDCCH TCI, PDSCH TCI (when applicable), semi-persistent CSI-RS for CQI reporting (when applicable), and configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) are based on either L1-RSRP or L3-RSRP if any one of them is reported before receiving TCI activation command.

If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the activation command, T_{SMTC_Scell} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. T_{SMTC_MAX} follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot slot n+1+$\frac{T_{HARQ}+3ms+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being activated, and T_X is:

- $T_{uncertainty_MAC}$ +$T_{FineTiming}$, for any scenario where $T_{activation_time}$ includes only $T_{FineTiming}$ and no $T_{FirstSSB_MAX}$.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

The requirements in this clause and requriements on interruption due to SCell activation in clause 8.2 apply provided that the SSB of the to-be-activated SCell is within the first active DL BWP of the Scell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

8.3.18 SCell Activation Delay Requirement for Deactivated SCell with Multiple Downlink SCells with L3 reporting

The requirements in this clause shall apply for the UE configured with more than one SCells and supporting *l3-MeasUnknownSCellActivation-r18* and the UE is configured with *ReportOnScellActivation*.

In EN-DC, NE-DC, standalone NR, or in one CG of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE only receives one single MAC command for multiple SCell activation within the activation period defined in this clause, and
- in each single CG, there are no other SCell activation, deactivation, addition or release before activation is completed for all the SCells activated by the single MAC CE in this clause, and
- in EN-DC and NE-DC, there are no E-UTRAN SCell activation, deactivation, addition or release before multiple SCell activation is completed in this clause, and
- all to-be-activated SCells are unknown on the same FR2 band, and there is neither active serving cell(s) nor known SCell(s) on the same band, or,
- all to-be-activated SCells are unknown on the same FR1 band, and there is neither active serving cell contiguous to the SCell nor known SCell(s) contiguous to the to-be-activated SCell on the same band, and
- the UE reports valid L3 measurement results after receiving the SCell activation command for all the to-be-activated unknown SCells in FR1, or at least one unknown SCell in the same FR2 band

In two CGs of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE receives one MAC command per CG for multiple SCell activation within the activation period defined in this clause, and
- UE supports per-FR measurement gap capability, and
- all to-be-activated SCells are unknown on the same FR2 band, and there is neither active serving cell(s) nor known SCell(s) on the same band, or,
- all to-be-activated SCells are unknown on the same FR1 band, and there is neither active serving cell contiguous to the SCell nor known SCell(s) contiguous to the to-be-activated SCell on the same band, and
- the UE reports valid L3 measurement results after receiving the SCell activation command for all the to-be-activated unknown SCells in FR1, or at least one unknown SCell in the same FR2 band

Otherwise, clause 8.3.7 is applied.

Upon receiving SCell activation command in slot *n* for more than one SCell, for each of the to-be-activated SCell, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot n + $\frac{T_{HARQ}+T_{activation_time_multiple_scells}+T_{CSI_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation_time_multiple_scells}$ is the target SCell activation delay in milliseconds in multiple SCell activation scenario.

$T_{activation_time_multiple_scells}$ is:

- 10ms + T_{HARQ} + $T_{L3,report}$ + max($T_{uncertainty_MAC}$ + $T_{FineTiming}$ + 2ms, $T_{uncertainty_SP}$), if the semi-persistent CSI-RS is used for CSI reporting
- 7ms + $T_{L3,report}$ + max (T_{HARQ} + $T_{uncertainty_MAC}$ + 5ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}), if the periodic CSI-RS is used for CSI reporting

When the following conditions are met:

If the SCell being activated belongs to FR1 provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled:

If the target SCell belongs to FR1 and none of the following conditions is met

- 'ssb-PositionInBurst' indicates only one SSB is being actually transmitted, or
- 'ssb-PositionInBurst' indicates multiple SSBs and TCI indication is provided in same MAC PDU with SCell activation;

If the SCell being activated belongs to FR2 and the PCell or PSCell is in FR1 provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled.

Otherwise, $T_{activation_time_multiple_scells}$ in clause 8.3.7 is applied.

where,

$T_{L3\ report}$ is the delay to acquire the first available UL resource for L3 reporting from 7 ms +T_{HARQ} after receiving the SCell activation command.

- The L3 reporting requirement is defined at clause 9.2.4.4
- UE is ready to report the L3 measurement result no later than 7 ms + T_{HARQ} ms from receiving the SCell activation command,
- UE is not required to report the L3 measurement results after 3 ms + T_{HARQ}+ M ms from receiving the SCell activation command where

  For FR1,

  - M= 2*T_{SSB} + $T_{L1\text{-}RSRP,report}$ for UE supporting *shortMeasInterval-r18* capability,
  - Otherwise, M = T_{SMTC}+T_{SSB} + $T_{L1\text{-}RSRP,report}$,

  For FR2-1,

  - M = (X1+X2)*T_{SSB} + $T_{L1\text{-}RSRP,report}$ for UE supporting *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* and *shortMeasInterval-r18* capability,
  - M = X1*T_{SMTC} +X2*T_{SSB} + $T_{L1\text{-}RSRP,report}$ for UE supporting *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* without supporting *shortMeasInterval-r18* capability,
  - M = 16*T_{SSB} + $T_{L1\text{-}RSRP,report}$ for UE supporting *shortMeasInterval-r18* without supporting *reduceForCellDetection* and *reduceForSSB-L1-RSRP-Meas* capability,
- Otherwise, M = 8*T_{SMTC} +8*T_{SSB} + $T_{L1\text{-}RSRP,report}$

Where, X1 and X2 are the values indicated by *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* in UE capability. T_{SSB} is the same as $T_{rs,\ enhanced}$ as specified in clause 8.3.2. T_{SMTC} is the same as $T_{SMTC_MAX_multiple_scells}$ as specified in clause 8.3.7.

$T_{FineTiming}$ is the time period between UE finish processing the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and the timing of first complete available SSB corresponding to the TCI state.

$T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable) relative to

- First valid L3 report for unknown case, if UE reports valid L3 report and L3 report is earlier than TCI command

- First valid L1-RSRP reporting for unknown case, if UE reports valid L3 report after TCI command

$T_{uncertainty_RRC}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to

- First valid L3 report for unknown case, if UE reports valid L3 report and L3 report is earlier than TCI command

- First valid L1-RSRP reporting for unknown case, if UE reports valid L3 report after TCI command

$T_{uncertainty_SP}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to

- First valid L3 reporting for unknown case, if UE reports valid L3 report and L3 report is earlier than TCI command

- First valid L1-RSRP reporting for unknown case, if UE reports valid L3 report after TCI command

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

When *absoluteFrequencySSB* is not configured in *DownlinkConfigCommon* for target SCell but SMTC for target SCell is configured, no requirement would be applied.

$T_{CSI_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

The condition of known SCell in FR1 or FR2 is defined in clause 8.3.2.

If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the activation command, T_{SMTC} follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

The starting point and the end-point of an interruption window on PCell or any activated SCell in MCG for NR standalone mode, or on PSCell or any activated SCell in SCG for EN-DC mode is same as single SCell activation requirement in clause 8.3.2.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Upon receiving SCell activation command in slot *n*, if the start of the first complete SSB used in the T_X in the different bands which have SCells being activated after $n+\frac{T_{HARQ}+3ms}{NR\ slot\ length}$ are not aligned on time domain among

- SCells in different bands being activated by the same MAC CE if UE does not support per FR gap, or

- SCells in different FR1 bands being activated by the same MAC CE if UE supports per FR gap,

additional interruptions may be expected for the activated serving cells, where

- The number of additional interruptions is no more than the number of FR1 bands which have both SCell being activated for which the activation requirements involve $T_{FirstSSB_MAX\ multiple_scells}$ with T_{rs} and the active serving cell, and

- In each interruption occasion, the interruption length is defined in clause 8.2.2.2.2, and

- Longer activation delay may be expected for multiple SCell activation under one MAC CE with multiple interruptions, and

- T_X is:

  - $T_{FirstSSB}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{FirstSSB}$;

- $T_{FirstSSB_MAX\ multiple_scells}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{FirstSSB_MAX\ multiple_scells}$;

- $T_{uncertainty_MAC}+T_{FineTiming}$ or $T_{uncertainty_MAC\ multiple_scells}+T_{FineTiming}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{FineTiming}$.

Otherwise, no additional interruption is expected due to activation of multiple SCells.

Starting from slot $n + T_{HARQ} + 3$ ms where slot n is the slot where SCell activation command is received (as specified in clause 4.3 of TS 38.213 [3]) and until the SCell activation completion at UE, after at least one CSI-RS transmission occasion for the channel measurement and reporting (specified in clause 5.2.2.5 of TS 38.214 [26]), the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

8.3.19 OD-SSB based SCell Activation Delay Requirement for Deactivated SCell

The requirements in this clause shall apply for the UE supporting On-demand SSB operation and configured with at least one downlink OD-SSB SCell in EN-DC, or in standalone NR carrier aggregation or in NE-DC or in NR-DC and when one OD-SSB SCell is being activated.

The requirements in the clause 8.3.x1 apply, provided the following conditions are met:

- an OD-SSB transmission is activated in a configured DL BWP where a first SSB transmission is not configured, or

- an OD-SSB transmission is activated in a configured DL BWP where a first SSB transmission is configured and the OD-SSB cannot be used to obtain SIB1.

Where the first SSB transmission is specified as in TS 38.213 and have the following relations with the OD-SSB transmission:

- are with the same physical cell identity, and

- are in the same frequency location, and

- are with same sub-carrier spacing, and

- are with the same downlink transmit power, and

- are quasi co-located with respect to Doppler shift, Doppler spread, average gain, average delay, delay spread and, when applicable, spatial RX parameters, when they have a same SSB index.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot n, the UE shall perform SCell activation procedure based on the transmitted SSBs, where the transmitted SSBs are

- OD-SSBs being transmitted in the configured DL BWP if no first SSB transmission is configured, or

- the union of OD-SSBs and first SSBs if first SSBs are transmitted and the time instance when receiving OD-SSB activation indication is no later than the time instance when receiving the SCell activation command, or

- first SSBs only if first SSBs are transmitted but no OD-SSB transmission during the SCell activation.

Upon receiving SCell activation command in slot n, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot $n + \frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation_time}$ is the SCell activation delay in milliseconds.

If the SCell is known and belongs to FR1, $T_{activation_time}$ is:

- $T_{First, OD-SSB} + T_{\Delta} + 5$ ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.

- $T_{First, OD-SSB} + T_{rs, OD-SSB} + T_{\Delta} + 5$ ms, if the measurement period of the SCell being activated is larger than 2400 ms.

If the SCell is unknown and belongs to FR1, and if one of the following conditions is met

- only one SSB is indicated in '*od-ssb-PositionInBurst*' if provided; otherwise, in *ssb-PositionsInBurst*, or

- multiple SSBs are indicated in '*od-ssb-PositionInBurst*' if provided; otherwise, in *ssb-PositionsInBurst* and TCI indication of SSBs is provided in same MAC PDU with SCell activation,

provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled, $T_{activation_time}$ is:

- $T_{First, OD-SSB} + 2* T_{rs,OD-SSB} + 5$ ms, if the following conditions are met,
  - the SCell is contiguous to an active serving cell in the same band, and
  - its *od-ssb-PositionInBurst* if provided; otherwise, *ssb-PositionsInBurst* provided is the same as the one of contiguous FR1 active serving cell, and
  - OD-SSB is in the same half-frame on the SCell and the SSB of the contiguous FR1 active serving cell, and
  - its RTD with contiguous FR1 active serving cell is smaller than or equal to 260 ns with respect to the to-be-activated SCell's SSB numerology, and its reception power difference with contiguous FR1 active serving cell is smaller than or equal to 6 dB;
- $T_{First, OD-SSB} + 3*T_{rs, OD-SSB} + 5$ ms, otherwise.

Otherwise, provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled, $T_{activation_time}$ is:

- 6 ms + $T_{First, OD-SSB} + 2*T_{rs, OD-SSB} + T_{L1-RSRP, measure, OD-SSB} + T_{L1-RSRP, report} + T_{HARQ} + \max(T_{uncertainty_MAC} + T_{FineTiming, OD-SSB} + 2$ ms, $T_{uncertainty_SP})$, if semi-persistent CSI-RS is used for CSI reporting,

- 3 ms + $T_{First, OD-SSB} + 2*T_{rs, OD-SSB} + T_{L1-RSRP, measure, OD-SSB} + T_{L1-RSRP ,report} + \max(T_{HARQ} + T_{uncertainty_MAC} + 5$ ms + $T_{FineTiming, OD-SSB}$, $T_{uncertainty_RRC} + T_{RRC_delay})$, if periodic CSI-RS is used for CSI reporting.

- However, when the following conditions are fulfilled, no activation requirement will be applied for this unknown SCell:
  - the SCell is contiguous to an active serving cell in the same band, and
  - A single SSB is used in the unknown SCell; or multiple SSBs are used in the SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and
  - its *od-ssb-PositionInBurst* if provided; otherwise, *ssb-PositionsInBurst* provided is same as the one of contiguous FR1 active serving cell, and
  - OD-SSB is in the same half-frame on the SCell and the SSB of the contiguous FR1 active serving cell, and
  - its RTD with contiguous FR1 active serving cell is larger than 260 ns, or its reception power difference with contiguous FR1 active serving cell is larger than 6 dB;

If the SCell being activated belongs to FR2 and if there is at least one active serving cell on that FR2 band, then $T_{activation_time}$ is $T_{First\ OD_SSB}$ + 5ms provided:

- the SSBs in the serving cell(s) and the SSBs in the SCell fulfil the condition defined in clause 3.6.3, and

- the parameter *od-ssb-PositionsInBurst* if provided; otherwise, *ssb-PositionsInBurst* provided if the SCell being activated is same for the serving cell(s), and

- the SSB is in the same half-frame on the SCell and the contiguous FR2 active serving cell.

If the SCell being activated belongs to FR2 and if there is no active serving cell on that FR2 band provided that PCell or PSCell is in FR1 or in FR2:

If the target SCell is known to UE and semi-persistent CSI-RS is used for CSI reporting, then $T_{activation_time}$ is:

- 3 ms + max($T_{uncertainty_MAC}$ + $T_{FineTiming, OD-SSB}$ + 2 ms, $T_{uncertainty_SP}$), where $T_{uncertainty_MAC}$=0 and $T_{uncertainty_SP}$=0, if
  - UE receives the SCell activation command, semi-persistent CSI-RS activation command and TCI state activation command at the same time, or
  - Provided this is the initial activation after SCell addition, and
    - TCI-ActivatedConfig is configured for the SCell, and UE receives the SCell activation command and semi-persistent CSI-RS activation command at the same time.

If the target SCell is known to UE and periodic CSI-RS is used for CSI reporting, then $T_{activation_time}$ is:

- max($T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming, OD-SSB}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}-T_{HARQ}), where $T_{uncertainty_MAC}$=0, if
  - UE receives the SCell activation command and TCI state activation commands at the same time, or
  - Provided this is the initial activation after SCell addition, and
    - UE receives the SCell activation command and TCI-ActivatedConfig is configured for the SCell.

If the PCell/PSCell and the target SCell are configured as FR1-FR2-1 CA or if the PCell/PSCell and the target SCell are in a FR2-1 band pair with independent beam management, and the target SCell is unknown to UE and semi-persistent CSI-RS is used for CSI reporting, provided that the side condition Ês/Iot ≥ -2 dB is fulfilled, then $T_{activation_time}$ is:

- 6 ms + $T_{First, OD-SSB}$ + 23*$T_{rs, OD-SSB}$ + $T_{L1-RSRP, measure, OD-SSB}$ + $T_{L1-RSRP, report}$ + T_{HARQ} + max($T_{uncertainty_MAC}$ + $T_{FineTiming, OD-SSB}$ + 2 ms, $T_{uncertainty_SP}$), or

If the PCell/PSCell and the target SCell are configured as FR1-FR2-1 CA or if the PCell/PSCell and the target SCell are in a FR2-1 band pair with independent beam management, and the target SCell is unknown to UE and periodic CSI-RS is used for CSI reporting, provided that the side condition Ês/Iot ≥ -2 dB is fulfilled, then $T_{activation_time}$ is:

- 3 ms + $T_{First\ OD-SSB}$ + 23*$T_{rs, OD-SSB}$ + $T_{L1-RSRP, measure, OD-SSB}$ + $T_{L1-RSRP, report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming, OD-SSB}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}.

where,

$T_{rs, OD-SSB}$ is the periodicity of the transmitted SSB.

T_{Δ} is the additional time for fine timing tracking and acquiring full timing information of the SCell. T_{Δ} = 2*$T_{rs, OD-SSB}$ ms for SCell operating with 12 PRB SSB BW. Otherwise, T_{Δ} = 0 ms.

$T_{First, OD-SSB}$ is the time to the end of the first complete transmitted SSB burst after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, where the transmitted SSB is

- OD-SSB in the configured DL BWP if no first SSB transmission is configured, or
- the union of OD-SSB and first SSB if first SSB is transmitted and the time instance when receiving OD-SSB activation indication is no later than the time instance when receiving the SCell activation command, or
- first SSB only if first SSB is transmitted but no OD-SSB transmission during the SCell activation.

$T_{FineTiming, OD-SSB}$ is the time period between UE finish processing the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and the timing of first complete transmited SSB burst corresponding to the TCI state.

$T_{L1-RSRP, measure, OD-SSB}$ is the transmited SSB based L1-RSRP measurement delay $T_{L1-RSRP_Measurement_Period_SSB}$ based on applicability as defined in clause 9.5.4 assuming M=1 and T_{Report}=0

$T_{L1\text{-}RSRP,\ report}$ is delay of acquiring CSI reporting resources.

$T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable) relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

$T_{uncertainty_RRC}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

$T_{uncertainty_SP}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

$T_{CSI_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

Longer delays for RRM measurement requirements, and in case of FR2 also SSB based RLM/BFD/CBD/L1-RSRP measurement requirements, can be expected during the cell detection time for unknown SCell activation.

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5*measCycleSCell, 5*DRX cycles) for FR1 before the reception of the SCell activation command:
  - the UE has sent a valid measurement report for the SCell being activated and
  - the SSB measured remains detectable according to the cell identification conditions specified in clause 9.2 and 9.3.
- the SSB measured during the period equal to max(5*measCycleSCell, 5*DRX cycles) or the SSB used for SCell activation which has the same SSB index of the SSB measured also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2 and 9.3.

Otherwise SCell in FR1 is unknown.

For the first SCell activation in FR2 bands, the SCell is known if it has been meeting the following conditions:

- During the period equal to 4 s for UE supporting power class 1/5 and 3 s for UE supporting power class 2/3/4 before UE receives the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and semi-persistent CSI-RS for CQI reporting (when applicable):
  - the UE has sent a valid L3-RSRP measurement report with SSB index, and
  - SCell activation command is received after L3-RSRP reporting and no later than the time when UE receives MAC-CE command for TCI activation
- During the period from L3-RSRP reporting to the valid CQI reporting, the reported SSBs with the indexes or the SSBs used for SCell activation with the same indexes remain detectable according to the cell identification conditions specified in clauses 9.2 and 9.3, and the TCI state is selected based on one of the latest reported SSB indexes.

Otherwise, the first SCell in FR2 band is unknown.

The requirement for unknown SCell applies provided that the activation commands for PDCCH TCI, PDSCH TCI (when applicable), semi-persistent CSI-RS for CQI reporting (when applicable), and configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) are based on the latest valid L1-RSRP reporting.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot slot n+1+$\frac{T_{HARQ}+3ms+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being activated, and T_X is:

- 0, if $T_{activation_time}$ is 3 ms;
- $T_{First,\ OD\text{-}SSB}$, for any scenario where $T_{activation_time}$ includes $T_{First,\ OD\text{-}SSB}$;
- $T_{uncertainty_MAC}$ + $T_{FineTiming,\ OD\text{-}SSB}$, for any scenario where $T_{activation_time}$ includes only $T_{FineTiming,\ OD\text{-}SSB}$ and no $T_{First,\ OD\text{-}SSB}$.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

The requirements in this clause and requirements on interruption due to SCell activation in clause 8.2 apply provided that the first SSB and the OD-SSB of the to-be-activated SCell is within the first active DL BWP of the SCell.

No OD-SSB based SCell activation requirement applies if OD-SSB is transmitting upon UE receiving the SCell activation command but NW deactivates the OD-SSB earlier than the slot n + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

8.3.20 OD-SSB based SCell Deactivation Delay Requirement for Activated SCell

The requirements in this clause shall apply for the UE supporting *On-demand SSB operation* configured with at least one downlink SCell, where OD-SSB transmission is activated, in EN-DC, or in standalone NR carrier aggregation or in NE-DC or in NR-DC and when one SCell is being deactivated.

Upon receiving SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot *n* + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$. The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot n+1+$\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being deactivated.

Upon expiry of the *sCellDeactivationTimer* in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot *n* + $\frac{3ms}{NR\ slot\ length}$. The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1 and not occur after slot n+1+ $\frac{3ms}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being deactivated.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

8.3.21 OD-SSB based Direct SCell Activation at SCell addition

The requirements in this clause apply for UE supporting On-demand SSB operation being configured in the RRC reconfiguration message, TS 38.331 [2], with one SCell for which the parameter *sCellState* is set to *activated* and OD-SSB configuration is provided. If the RRC reconfiguration message for OD-SSB based direct SCell activation also configures PSCell addition or PSCell change, the direct SCell activation delay may be longer than the requirements defined in this clause.

The applicability of OD-SSB based SCell activation defined in clause 8.3.x1 is also applied in this clause.

If the RRC reconfiguration message for direct SCell activation also configures TCI state information, the requirements in clause 8.3.x1 based on that TCI state activation command is received at the same time as SCell activation command shall apply.

The UE shall configure the SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. The UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot n + $\frac{N_{direct}}{NR\ slot\ length}$,

where:

- Slot n is the last slot overlapping with the PDSCH containing the RRC reconfiguration message,
- N_{direct} = $T_{RRC_Process}$ + T_1 + $T_{activation_time}$ + $T_{CSI_Reporting}$ - 3 ms for the cases specified in clause 8.3.2 that TCI state is not indicated within $T_{activation_time}$; otherwise, N_{direct} = $T_{RRC_Process}$ + T_1 + T_{HARQ} + $T_{activation_time}$ + $T_{CSI_Reporting}$
  - $T_{RRC_Process}$: RRC procedure delay defined in clause 12 of TS 38.331 [2],
  - T_1: Delay from slot $n + \frac{T_{RRC_Process}}{NR\ slot\ length}$ until the transmission of *RRCReconfigurationComplete* message,

NOTE: T_1 is UE implementation dependent.

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3],

If the SCell is known and belongs to FR1, $T_{CSI_Reporting}$ is specified in clause 8.3.x1 and $T_{activation_time}$ is defined as:

- $T_{First,\ OD\text{-}SSB}$+ 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.
- $T_{First,\ OD\text{-}SSB}$ + $T_{rs,\ OD\text{-}SSB}$ + 5 ms, if measurement period of the SCell being activated is larger than 2400 ms.

  where,

  the measurement period in table 9.2.5.2-1 applies if the target SCell was in an intra-frequency layer corresponding to an activated SCell;

  the measurement period in table 9.2.5.2-3 applies if the target SCell was in an intra-frequency layer corresponding to a deactivated SCell;

  the measurement period in table 9.3.5-1 applies if the target SCell was in an inter-frequency layer.

- Otherwise, $T_{activation_time}$ and $T_{CSI_Reporting}$ are specified in clause 8.3.x1, where the following definition of $T_{FirstSSB}$ shall override the existing one:
  - $T_{First,\ OD\text{-}SSB}$ is the time to the end of the first complete transmitted SSB burst after slot n + $\frac{T_{RRC_Process}+T_1}{NR\ slot\ length}$.
- If a UE supports, *reduceForCellDetection* and/or *reduceForSSB-L1-RSRP-Meas* capabilities, the reduced $T_{activation_time}$ specified in clause 8.3.x1 when UE supports these capabilities is applicable for Direct SCell activation at SCell addition also.

The transmitted SSB defined in clause 8.3.x1 is also applied in this clause for OD-SSB based direct SCell activation at SCell addition.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The SCell in FR1 is known provided the following conditions are met for the SCell:

- During the last 5 seconds before the reception of the direct SCell configuration command:
  - the UE has sent a valid measurement report for the SCell being directly activated, and
  - the SSB measured remains detectable according to the cell identification conditions specified in clauses 9.2 and 9.3,
- the SSB measured or the SSB used for SCell activation which has the same SSB index of the SSB measured during the period equal to 5 seconds also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2 and 9.3.

Otherwise, the SCell is unknown.

The SCell in FR2 is known provided it meets the corresponding conditions as defined in clause 8.3.x1. Otherwise, the SCell is unknown.

The UE may be allowed to cause interruptions to serving cells on other component carriers during an interruption window, as specified in clause 8.2. The starting point of an interruption window on SpCell or any activated SCell shall not occur before slot n+1, and shall not occur after slot $n+1+\frac{T_{RRC_Process}+T_1+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology of the SCell being activated, and T_X is:

- $T_{First,\ OD\text{-}SSB}$, for any scenario where $T_{activation_time}$ includes $T_{First,\ OD\text{-}SSB}$;
- $T_{uncertainty_MAC}$ +$T_{FineTiming,\ OD\text{-}SSB}$, for any scenario where $T_{activation_time}$ includes $T_{FineTiming,\ OD\text{-}SSB}$ and no $T_{First,\ OD\text{-}SSB}$.

The length of the interruption window may be different for different victim cells and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

Starting from the slot $n + \frac{T_{RRC_Process} + T_1}{NR\ slot\ length}$ until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

8.3.22 OD-SSB based SCell Activation Delay Requirement for Deactivated SCell with Multiple Downlink SCells

The requirements in this clause shall apply for the UE configured with more than one downlink OD-SSB based SCells.

In EN-DC, NE-DC, standalone NR carrier aggregation, or in one CG of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE only receives one single MAC command for multiple SCell activation within the activation period defined in this clause
- in each single CG, there are no other SCell activation, deactivation, addition or release before activation is completed for all the SCells activated by the single MAC CE in this clause, and
- in EN-DC and NE-DC, there are no E-UTRAN SCell activation, deactivation, addition or release before multiple SCell activation is completed in this clause, and
- any to-be-activated unknown SCell has active serving cell(s) or known to-be-activated SCell(s) on the same band

In two CGs of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE receives one MAC command per CG for multiple SCell activation within the activation period defined in this clause, and
- UE supports per-FR measurement gap capability, and
- any to-be-activated unknown SCell has active serving cell(s) or known to-be-activated SCell(s) on the same band

The applicability of OD-SSB based SCell activation defined in clause 8.3.x1 is also applied in this clause.

The transmited SSB defined in clause 8.3.x1 is also applied in this clause for OD-SSB based multiple downlink SCells activation.

The delay within which the UE shall be able to activate the deactivated SCell with other downlink to-be-activated SCell(s) depends upon the specified conditions. The deactivated SCell and other downlink to-be-activated SCell(s) are OD-SSB based SCells.

Upon receiving SCell activation command in slot *n* for more than one SCell, for each of the to-be-activated SCell, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot $n + \frac{T_{HARQ}+T_{activation_time_multiple_scells}+T_{CSI_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation_time_multiple_scells}$ is the target SCell activation delay in milliseconds in multiple SCell activation scenario.

If the SCell is known and belongs to FR1 and the measurement period of the SCell being activated is equal to or smaller than 2400ms, $T_{activation_time_multiple_scells}$ is:

- $T_{First,\ OD\text{-}SSB_multiple_scells} + T_{rs,\ OD\text{-}SSB}$ + 5ms, if on the same band UE also has at least one parallel to-be-activated SCell which is FR1 known SCell with the measurement period larger than 2400ms but does not have any parallel to-be-activated SCell which is FR1 unknown SCell.

- $T_{First,\ OD\text{-}SSB_multiple_scells} + 2*T_{rs,\ OD\text{-}SSB}$ + 5ms, if on the same band UE also has at least one parallel to-be-activated SCell which is FR1 unknown SCell

- otherwise, $T_{First,\ OD\text{-}SSB_multiple_scells}$ + 5ms.

If the SCell is known and belongs to FR1 and the measurement period of the SCell being activated is larger than 2400 ms, $T_{activation_time_multiple_scells}$ is:

- $T_{First,\ OD\text{-}SSB_multiple_scells} + 2*T_{rs,\ OD\text{-}SSB}$ + 5ms, if on the same band UE also has at least one parallel to-be-activated SCell which is FR1 unknown SCell

- otherwise, $T_{First,\ OD\text{-}SSB_multiple_scells} + T_{rs,\ OD\text{-}SSB}$ + 5 ms

If the SCell is unknown and belongs to FR1, provided that the side condition $\hat{E}s/Iot \geq$ -2 dB is fulfilled, $T_{activation_time_multiple_scells}$ is:

- $T_{First,\ OD\text{-}SSB_multiple_scells} + 2*T_{rs,\ OD\text{-}SSB}$ +5 ms, if the SCell is not counted in N_1

  - The activation delay may be longer if SSB is not in the same half-frame on the SCell and the contiguous FR1 known cell or contiguous FR1 active serving cell

otherwise

- if the following conditions are met

  - its *od-ssb-PositionInBurst* if provided; otherwise, by *ssb-PositionsInBurst* indicates only one SSB is being actually transmitted, or

  - its *od-ssb-PositionInBurst* if provided; otherwise, by *ssb-PositionsInBurst* indicates multiple SSBs and TCI indication is provided in same MAC PDU with SCell activation,

- $T_{activation_time_multiple_scells}$ is:

  - $T_{First,\ OD\text{-}SSB_multiple_scells} + T_{rs,\ OD\text{-}SSB} + T_{rs,\ OD\text{-}SSB}*N_1 + T_{rs,\ OD\text{-}SSB}$ +5 ms,

- Otherwise:

  $T_{activation_time_multiple_scells}$ is:

  - 6 ms + $T_{First,\ OD\text{-}SSB_multiple_scells} + T_{rs,\ OD\text{-}SSB} + T_{rs,\ OD\text{-}SSB}*N_1 + T_{L1\text{-}RSRP,\ measure,\ OD\text{-}SSB} + T_{L1\text{-}RSRP,report} + T_{HARQ} + \max(T_{uncertainty_MAC_multiple_scells} + T_{FineTiming,\ OD\text{-}SSB} + 2\ ms, T_{uncertainty_SP_multiple_scells})$, if semi-persistent CSI-RS is used for CSI reporting,

- 3 ms + $T_{First, OD-SSB_multiple_scells}$ + $T_{rs, OD-SSB}$ + $T_{rs, OD-SSB}$*N_1 + $T_{L1-RSRP, measure, OD-SSB}$ + $T_{L1-RSRP,report}$ + max(T_{HARQ} + $T_{uncertainty_MAC_multiple_scells}$ + 5 ms + $T_{FineTiming, OD-SSB}$, $T_{uncertainty_RRC_multiple_scells}$ + T_{RRC_delay}), if periodic CSI-RS is used for CSI reporting.

If the SCell being activated belongs to FR1 and if there is at least one active serving cell contiguous to the SCell on that FR1 band, if the UE is not provided with SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration for the target SCell, $T_{activation_time_multiple_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.x1.

If the SCell being activated belongs to FR2 and if there is at least one active serving cell on that FR2 band, then $T_{activation_time_multiple_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.x1.

If the SCell being activated belongs to FR2 and if there is no active serving cell on that FR2 band provided that PCell or PSCell is FR1:

If the target SCell is known to UE and semi-persistent CSI-RS is used for CSI reporting, then $T_{activation_time_multiple_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.x1.

If the target SCell is known to UE and periodic CSI-RS is used for CSI reporting, then $T_{activation_time_multiple_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.x1.

If the target SCell is unknown to UE and semi-persistent CSI-RS is used for CSI reporting, provided that the side condition $\hat{E}s/Iot \geq -2dB$ is fulfilled, then $T_{activation_time_multiple_scells}$ is:

- 3 ms + max($T_{uncertainty_MAC_multiple_scells}$ +$T_{FineTiming, OD-SSB}$ + 2ms, $T_{uncertainty_SP_multiple_scells}$), if on the same band UE also has at least one parallel to-be-activated SCell which is FR2 known SCell. $T_{uncertainty_MAC_multiple_scells}$ =0 and $T_{uncertainty_SP_multiple_scells}$ =0 if

- UE receives the SCell activation command, semi-persistent CSI-RS activation command and TCI state activation commands at the same time, or

- Provided this is the initial activation after SCell addition, and

  - TCI-ActivatedConfig is configured for the SCell, and UE receives the SCell activation command and semi-persistent CSI-RS activation command at the same time.

If the target SCell is unknown to UE and periodic CSI-RS is used for CSI reporting, provided that the side condition $\hat{E}s/Iot \geq -2dB$ is fulfilled, then $T_{activation_time_multiple_scells}$ is:

- max($T_{uncertainty_MAC_multiple_scells}$ + 5ms + $T_{FineTiming, OD-SSB}$, $T_{uncertainty_RRC_multiple_scells}$ + T_{RRC_delay}-T_{HARQ}), if on the same band UE also has at least one parallel to-be-activated SCell which is FR2 known SCell. $T_{uncertainty_MAC_multiple_scells}$ =0 if:

- UE receives the SCell activation command and TCI state activation commands at the same time, or

- Provided this is the initial activation after SCell addition, and

  - UE receives the SCell activation command and TCI-ActivatedConfig is configured for the SCell.

The requirements for FR2 unknown SCells apply provided that the parameter *od-ssb-PositionsInBurst* if provided; otherwise, by *ssb-PositionsInBurst* is same for the SCell and the known serving cell on the same FR2 band. The activation delay FR2 unknown SCell may be longer if SSB is not in the same half-frame on the SCell and the FR2 known cell on the same band.

Where,

N_1 is the number counting for parallel FR1 unknown to-be-activated SCell(s) only except the ones which fulfilled the following conditions:

- contiguous to an active serving cell in the same band, or to a known SCell in the same band being activated by the same MAC PDU, and

- A single SSB is used in the unknown SCell; or multiple SSBs are used in the unknown SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and

- its *od-ssb-PositionsInBurst* if provided; otherwise, by *ssb-PositionInBurst* is same as the one of contiguous FR1 known cell or contiguous FR1 active serving cell, and

- its RTD with contiguous FR1 known cell or contiguous FR1 active serving cell is smaller than or equal to 260 ns and its reception power difference with contiguous FR1 known cell or contiguous FR1 active serving cell is smaller than or equal to 6 dB, and

- its transmitted SSB offset is same as the one of contiguous FR1 known cell or contiguous FR1 active serving cell

However, when the following conditions are fulfilled, no activation requirement will be applied for this unknown SCell and other SCells being activated and counted in N_1:

- contiguous to an active serving cell in the same band, or to a known SCell in the same band being activated by the same MAC PDU, and

- A single SSB is used in the unknown SCell; or multiple SSBs are used in the unknown SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and

- its *od-ssb-PositionsInBurst* if provided; otherwise, by *ssb-PositionInBurst* is same as the one of FR1 known cell or FR1 active serving cell, and

- its RTD with contiguous FR1 known cell or contiguous FR1 active serving cell is larger than 260 ns or its reception power difference with contiguous FR1 known cell or contiguous FR1 active serving cell is larger than 6 dB, and

- its transmitted SSB offset is same as the one of FR1 known cell or FR1 active serving cell

$T_{First,\ OD\text{-}SSB_multiple_scells}$ is the time to the end of the first complete transmitted SSB burst after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, further fulfilling:

- In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCells being activated are transmitting SSB burst.

- In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

$T_{uncertainty_MAC_multiple_scells}$ is the time period between reception of the activation command for PDCCH TCI, PDSCH TCI (when applicable) and SCell activation command of this unknown SCell.

$T_{uncertainty_SP_multiple_scells}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting and SCell activation command of this unknown SCell.

$T_{uncertainty_RRC_multiple_scells}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) and SCell activation command of this unknown SCell.

$T_{rs,\ OD\text{-}SSB}$, $T_{FineTiming,\ OD\text{-}SSB}$, and T_{RRC_delay} is defined in clause 8.3.x1.

Longer delays for RRM measurement requirements, and in case of FR2 also SSB based RLM/BFD/CBD/L1-RSRP measurement requirements, can be expected during the cell detection time for unknown SCell activation.

The condition of known SCell in FR1 or FR2 is defined in clause 8.3.x1.

The starting point and the end-point of an interruption window on PCell or any activated SCell in MCG for NR standalone mode, or on PSCell or any activated SCell in SCG for EN-DC mode is same as single SCell activation requirement in clause 8.3.2.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Upon receiving SCell activation command in slot *n*, if the start of the first complete transmitted SSB used in the T_X in the different bands which have SCells being activated after $n+\frac{T_{HARQ}+3ms}{NR\ slot\ length}$ are not aligned on time domain among

- SCells in different bands being activated by the same MAC CE if UE does not support per FR gap, or
- SCells in different FR1 bands being activated by the same MAC CE if UE supports per FR gap,

additional interruptions may be expected for the activated serving cells, where

- The number of additional interruptions is no more than the number of FR1 bands which have both SCell being activated for which the activation requirements involve $T_{First, OD-SSB_multiple_scells}$ with $T_{rs, OD-SSB}$ and the active serving cell, and
- In each interruption occasion, the interruption length is defined in clause 8.2.2.2.2, and
- Longer activation delay may be expected for multiple SCell activation under one MAC CE with multiple interruptions, and
- T_X is:
  - $T_{First, OD-SSB}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{First, OD-SSB}$;
  - $T_{First, OD-SSB_multiple_scells}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{First, OD-SSB_multiple_scells}$;
  - $T_{uncertainty_MAC} + T_{FineTiming, OD-SSB}$ or $T_{uncertainty_MAC\ multiple_scells} + T_{FineTiming, OD-SSB}$, for any scenario where $T_{activation_time\ multiple_scells}$ includes $T_{FineTiming}$.

Otherwise, no additional interruption is expected due to activation of multiple SCells.

Starting from slot $n + T_{HARQ} + 3$ ms where slot n is the slot where SCell activation command is received (as specified in clause 4.3 of TS 38.213 [3]) and until the SCell activation completion at UE, after at least one CSI-RS transmission occasion for the channel measurement and reporting (specified in clause 5.2.2.5 of TS 38.214 [26]), the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

8.3.23 OD-SSB based SCell Deactivation Delay Requirement for Activated SCell with Multiple Downlink SCells

The requirements in this clause shall apply for the UE supporting *On-demand SSB operation* configured with multiple downlink SCells, where OD-SSB transmission is activated, in EN-DC, or in standalone NR carrier aggregation, or in NE-DC, or in NR-DC, provided that,

- in each single CG, there are no other SCell activation, deactivation, addition or release before deactivation is completed for all the SCells deactivated by the single MAC CE in this clause, and
- in EN-DC and NE-DC, there are no E-UTRAN SCell activation, deactivation, addition or release before multiple SCell deactivation is completed in this clause, and
- in EN-DC, NE-DC, NR-DC and standalone NR, UE only receives one single MAC command for multiple SCell deactivation within the deactivation period defined in this clause, or, in NR-DC, per-FR measurement gap capable UE receives one MAC command per CG for multiple SCell deactivation within the deactivation period defined in this clause

Upon receiving SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated within the same delay as specified in clause 8.3.20.

The starting point and the end-point of an interruption window on PCell or any activated SCell in MCG for NR standalone mode, or on PSCell or any activated SCell in SCG for EN-DC mode is same as single SCell activation requirement in clause 8.3.20.

8.3.24 SCell Activation Delay Requirement for Deactivated PUCCH SCell based on OD-SSB

The requirements in this clause shall apply for the UE configured with one downlink SCell and when PUCCH is configured for the SCell being activated.

For a UE supporting OD-SSB operation, if UE receives SSB activation command together with on-demand SSB activation command, UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated on the PUCCH SCell as required by clause 8.3.12, expect $T_{activation_time}$. $T_{activation_time}$ is defined in clause 8.3.19.

8.3.25 OD-SSB based SCell Deactivation Delay Requirement for Activated PUCCH SCell

The requirements in this clause shall apply for the UE supporting *On-demand SSB operation* configured with one SCell configured with PUCCH, where OD-SSB transmission is activated, in EN-DC, or in standalone NR carrier aggregation, or in NE-DC.

Upon receiving PUCCH SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the PUCCH SCell being deactivated no later than in slot $n + \frac{T_{HARQ}+3ms}{NR\,slot\,length}$. The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot $n+1+\frac{T_{HARQ}}{NR\,slot\,length}$ and not occur after slot $n+1+\frac{T_{HARQ}+3ms}{NR\,slot\,length}$, where NR slot length is with respect to the numerology used in the PUCCH SCell being deactivated.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

8.3.26 OD-SSB based SCell Activation Delay Requirement for Deactivated SCell with the L3 reporting during activation

The requirements in this clause shall apply for UE supporting *l3-MeasUnknownSCellActivation-r18* and *On-demand SSB operation* and reporting valid L3 measurement results after receiving the SCell activation command for unknown SCell configured with OD-SSB operation. The requirements in this clause shall apply for the UE configured with one downlink OD-SSB SCell in EN-DC, or in standalone NR carrier aggregation or in NE-DC or in NR-DC and when one SCell is being activated. Clause 8.3.19 is applied for UE who does not report L3 measurement results after receiving SCell activation command for unknown OD-SSB SCell.

The requirements in clause 8.3.17 shall apply, except that the definitions of following parameters are replaced with:

- $T_{FineTiming}$ is the time period between UE finish processing the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and the timing of first complete available SSB burst corresponding to the TCI state.
- T_{SSB} is the same as $T_{rs,\ OD\text{-}SSB}$ as specified in clause 8.3.19.
- T_{SMTC} is the same as $T_{rs,\ OD\text{-}SSB}$ as specified in clause 8.3.19.
- *ssb-PositionInBurst* is replaced with *od-ssb-PositionsInBurst* if provided.

The OD-SSB SCell in FR1 or FR2 is known if it has been meeting the corresponding known conditions as defined in clause 8.3.x1. Otherwise, the OD-SSB SCell is unknown.

8.3A SCell Activation and Deactivation Delay in Carriers with CCA

8.3A.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to activate a deactivated SCell operating with CCA and deactivate an activated SCell operating with CCA in EN-DC or in standalone NR carrier aggregation.

In the requirements of clause 8.3A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 8.3A, the term CSI-RS occasion not available at the UE due to DL CCA failures referes to when the CSI-RS is configured by gNB for the UE but not available at the UE due to DL CCA failures at gNB during the corresponding period.

The requirements shall apply for EN-DC and standalone NR carrier aggregation.

8.3A.2 SCell Activation Delay Requirement for Deactivated SCell

The requirements in this clause shall apply for the UE configured with at least one downlink SCell operating with CCA in EN-DC or in standalone NR carrier aggregation and when one SCell operating with CCA is being activated but none of the RRC parameters *CO-DurationPerCell-r16*, *SlotFormatIndicator*, and *CSI-RS-ValidationWith-DCI-r16* is configured and all of the CSI reporting resources for being-activated SCell are available.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot n + (T_{HARQ} + $T_{activation_time_withCCA}$ + $T_{CSI_reporting_withCCA}$)/*NR_slot_length*, where:

- T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]. In the event of UE not being able to transmit the acknowledgment due to UL CCA failures: T_{HARQ} is extended to also include the time to all next HARQ feedback transmission and retransmission opportunities, until the time of its successful transmission, as specified in TS 38.213 [3]; no extension of T_{HARQ} due to UL CCA failures is allowed for Type 2C UL channel access procedure as defined in TS 37.213 [33].

  - $T_{activation_time_withCCA}$ is the SCell activation delay in milliseconds.

    - If the SCell is known and belongs to FR1, $T_{activation_time_withCCA}$ is:

      - $T_{FirstSSB} + L_1 * T_{rs}$ + 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.

      - $T_{FirstSSB_MAX} + L_{2,1} * T_{SMTC_MAX} + (1 + L_{2,2}) * T_{rs}$ + 5 ms, if the measurement period of the SCell being activated is larger than 2400 ms.

    - If the SCell is unknown and belongs to FR1, provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled and the SCell can be successfully detected in one attempt, $T_{activation_time_withCCA}$ is:

    - $T_{FirstSSB_MAX} + (1 + L_{3,1}) * T_{SMTC_MAX} + (2 + L_{3,2}) * T_{rs}$ + 5 ms.

    - If the SCell being activated belongs to FR2-2 and if there is at least one active serving cell on that FR2-2 band, if the UE supporting *scellWithoutSSB* is not provided with any SMTC for the target SCell, $T_{activation_time_withCCA}$ is 3 ms, provided

      - the RS (s) of SCell being activated is (are) QCL-TypeD with RS (s) of one active serving cell on that FR2-2 band.

- If the SCell being activated belongs to FR2-2 and if there is no active serving cell on that FR2-2 band provided that PCell or PSCell is in FR1 or in FR2-2:

  - If the target SCell is known to UE and semi-persistent CSI-RS is used for CSI reporting, then $T_{activation_time_withCCA}$ is:

    - 3 ms + max($T_{uncertainty_MAC}$ + $T_{FineTiming}$ + 2 ms, $T_{uncertainty_SP}$), where $T_{uncertainty_MAC}$=0 and $T_{uncertainty_SP}$=0 if UE receives the SCell activation command, semi-persistent CSI-RS activation command and TCI state activation command at the same time.

  - If the target SCell is known to UE and periodic CSI-RS is used for CSI reporting, then $T_{activation_time}$ is:

    - max($T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}-T_{HARQ}), where $T_{uncertainty_MAC}$=0 if UE receives the SCell activation command and TCI state activation commands at the same time.

  - If the PCell/PSCell and the target SCell are configured as FR1-FR2-2 CA or if the PCell/PSCell and the target SCell are in a FR2-2 band pair with independent beam management, and the target SCell is unknown to UE and semi-persistent CSI-RS is used for CSI reporting, provided that the side condition Ês/Iot ≥ -2 dB is fulfilled, then $T_{activation_time_withCCA}$ is:

    - 6 ms + $T_{FirstSSB_MAX}$ + (23+N*$L_{4,1}$)*T_{SMTC_MAX} + (12+N *$L_{4,2}$)*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + T_{HARQ} + max($T_{uncertainty_MAC}$ + $T_{FineTiming}$ + 2 ms, $T_{uncertainty_SP}$).

  - If the PCell/PSCell and the target SCell are configured as FR1-FR2-2 CA or if the PCell/PSCell and the target SCell are in a FR2-2 band pair with independent beam management, and the target SCell is unknown to UE and periodic CSI-RS is used for CSI reporting, provided that the side condition Ês/Iot ≥ -2 dB is fulfilled, then $T_{activation_time_withCCA}$ is:

    - 3 ms + $T_{FirstSSB_MAX}$ + (23+N*$L_{5,1}$)*T_{SMTC_MAX} + (12+N *$L_{5,2}$)*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}.

  Where,

  T_{SMTC_MAX}:

  - In case of intra-band SCell activation, T_{SMTC_MAX} is the longest SMTC periodicity between active serving cells and SCell being activated provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in the same slot;

  - In case of inter-band SCell activation, T_{SMTC_MAX} is the SMTC periodicity of SCell being activated;

  - T_{SMTC_MAX} is bounded to a minimum value of 10 ms.

  T_{rs} is the SMTC periodicity of the SCell being activated if the UE has been provided with an SMTC configuration for the SCell in SCell addition message, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement which involves T_{rs} is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There are no requirements if the SSB transmission periodicity is not 5 ms

  $T_{FirstSSB}$: is the time to the end of the first complete configured SSB burst indicated by the SMTC after slot n + (T_{HARQ}+3 ms)/*NR_slot_length*

  $T_{FirstSSB_MAX}$: is the time to the end of first complete configured SSB burst indicated by the SMTC after slot n + (T_{HARQ}+3 ms)/*NR_slot_length* when all active serving cells and SCells being activated or released have configured SSB bursts in the same slot for intra-band scenario. In case of inter-band SCell activation, $T_{FirstSSB_MAX}$ is the time to the end of the first complete configured SSB burst of the SCell being activated. In FR2-2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

  L_1 ($L_1 \leq L_{1,max}$) is the number of configured SMTC occasions not available at the UE. $L_{1,max}$ = 2 if $T_{rs} \leq$ 40 ms; otherwise $L_{1,max}$ = 1.

  $L_{2,1}$ ($L_{2,1} \leq L_{2,1,max}$) and $L_{3,1}$ ($L_{3,1} \leq L_{3,1,max}$) are the numbers of configured SMTC occasions not available at the UE, for a known and unknown SCell activation respectively,

in the SCell being activated, for inter-band scenario, or

in any of the SCells already activated or being activated provided their cell specific reference signals are configured in the same slot, for intra-band scenario

and $L_{2,1,max} = 2$ if $T_{SMTC_MAX} \leq 40$ ms; otherwise $L_{2,1,max} = 1$. $L_{3,1,max} = 2$ if $T_{SMTC_MAX} \leq 40$ ms; otherwise $L_{3,1,max} = 1$.

$L_{2,2}$ ($L_{2,2} \leq L_{2,2,max}$) and $L_{3,2}$ ($L_{3,2} \leq L_{3,2,max}$) are the number of configured SMTC occasions not available at the UE in the SCell being activated. $L_{2,2,max} = 2$ if $T_{rs} \leq 40$ ms; otherwise $L_{2,2,max} = 1$. $L_{3,2,max} = 2$ if $T_{rs} \leq 40$ ms; otherwise $L_{3,2,max} = 1$.

N = 12 for an FR2-2 unknown SCell activation.

$L_{4,1}$ ($L_{4,1} \leq L_{4,1,max}$) and $L_{5,1}$ ($L_{5,1} \leq L_{5,1,max}$) are the numbers of SMTC occasions groups not available at the UE, for an FR2-2 unknown SCell activation,

in the SCell being activated, for inter-band scenario, or

in any of the SCells already activated or being activated provided their cell specific reference signals are configured in the same slot, for intra-band scenario

and $L_{4,1,max} = 2$ if $T_{SMTC_MAX} \leq 40$ ms; otherwise $L_{4,1,max} = 1$. $L_{5,1,max} = 2$ if $T_{SMTC_MAX} \leq 40$ ms; otherwise $L_{5,1,max} = 1$.

$L_{4,2}$ ($L_{4,2} \leq L_{4,2,max}$) and $L_{5,2}$ ($L_{5,2} \leq L_{5,2,max}$) are the number of SMTC occasions groups not available at the UE in the FR2-2 unknown SCell being activated. $L_{4,2,max} = 2$ if $T_{rs} \leq 40$ ms; otherwise $L_{4,2,max} = 1$. $L_{5,2,max} = 2$ if $T_{rs} \leq 40$ ms; otherwise $L_{5,2,max} = 1$.

$T_{FineTiming}$ is the time period between UE finish processing the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and the timing of first complete available SSB corresponding to the TCI state.

$T_{L1\text{-}RSRP,\ measure}$ is L1-RSRP measurement delay $T_{L1\text{-}RSRP_Measurement_Period_SSB_CCA}$ ms as defined in clause 9.5A.4.1 with the assumption of M=1.

$T_{L1\text{-}RSRP,\ report}$ is delay of acquiring CSI reporting resources.

$T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable) relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

$T_{uncertainty_RRC}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

$T_{uncertainty_SP}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

Longer delays for RRM measurement requirements, and in case of FR2-2 also SSB based RLM/BFD/CBD/L1-RSRP measurement requirements, can be expected during the cell detection time for unknown SCell activation.

When *absoluteFrequencySSB* is not configured in *DownlinkConfigCommon* for target SCell but SMTC for target SCell is configured, no requirements apply.

$T_{CSI_reporting_withCCA} = T_{CSI_reporting} + T_{CSI_ReportingDelay}$, where

$T_{CSI_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

$T_{CSI_ReportingDelay}$ is the additional delay in transmission of CSI reporting due to UL CCA failures at the UE. If there are no uplink resources for reporting the valid CSI, then the UE shall use the next available opportunities for reporting the corresponding valid CSI as specified in TS 38.213 [3].

Upon exceeding any of the maximum numbers $L_{1,max}$, $L_{2,1,max}$, $L_{2,2,max}$, $L_{3,1,max}$, and $L_{3,2,max}$ of SMTC occasions or CSI-RS occasions, respectively, not available at the UE, the UE shall abandon the SCell activation procedure.

SCell operating with CCA in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5 measCycleSCell, 5 DRX cycles) before the reception of the SCell activation command:
  - the UE has sent a valid measurement report for the SCell being activated and
  - the SSB measured remains detectable in the SMTC occasions available at the UE, according to the cell identification conditions specified in clause 9.2A and 9.3A.
- the SSB measured during the period equal to max(5 measCycleSCell, 5 DRX cycles) also remains detectable - the SSB measured during the period equal to max(5 measCycleSCell, 5 DRX cycles) also remains detectable in the SMTC occasions available at the UE during the SCell activation delay according to the cell identification conditions specified in clause 9.2A and 9.3A.

Otherwise SCell operating with CCA in FR1 is unknown.

For the first SCell activation with CCA in FR2-2 bands, the SCell is known if it has been meeting the following conditions:

- During the period equal to 4 s for UE supporting power class 1/5 and 3 s for UE supporting power class 2/3/4 before UE receives the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and semi-persistent CSI-RS for CQI reporting (when applicable):
  - the UE has sent a valid L3-RSRP measurement report with SSB index
  - SCell activation command is received after L3-RSRP reporting and no later than the time when UE receives MAC-CE command for TCI activation
- During the period from L3-RSRP reporting to the valid CQI reporting, the reported SSBs with indexes remain detectable according to the cell identification conditions specified in clauses 9.2 and 9.3, and the TCI state is selected based on one of the latest reported SSB indexes.

Otherwise, the first SCell with CCA in FR2-2 band is unknown. The requirement for unknown SCell applies provided that the activation commands for PDCCH TCI, PDSCH TCI (when applicable), semi-persistent CSI-RS for CQI reporting (when applicable), and configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) are based on the latest valid L1-RSRP reporting.

If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the activation command, T_{SMTC_Scell} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. T_{SMTC_MAX} follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

For intra-band CA, the starting point of an interruption window on SpCell or any activated SCell as specified in clause 8.2, shall not occur before slot $n+1+\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot $n+1+\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$, where T_X is:

- $T_{FirstSSB}$, for known SCell activation when SCell measurement cycle is equal to or smaller than 160 ms;
- $T_{FirstSSB_MAX} + L_{2,1} * T_{SMTC_MAX}$ for known SCell activation when SCell measurement cycle is greater than 160 ms;

- $T_{FirstSSB_MAX} + L_{3,1} * T_{SMTC_MAX}$ for unknown SCell activation

For inter-band CA, the starting point of an interruption window on SpCell or any activated SCell as specified in clause 8.2, shall not occur before slot n+1+ $\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot n+1+$\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$, where T_X is:

- $T_{FirstSSB}$, for known SCell activation when SCell measurement cycle is equal to, or smaller than, 160 ms.

For intra-band CA,

- While the SCell being activated is known with measurement cycle equal to or smaller than 160 ms, no more than one interruption is allowed during SCell activation.
- While the SCell being activated is known with measurement cycle greater than 160 ms, up to $1+L_{2,1}$ interruptions are allowed during SCell activation,
- While the SCell being activated is unknown, up to $1+L_{3,1}$ interruptions are allowed during SCell activation. When $L_{3,1}>0$, performance degradation may be expected on any activated intra-band victim cells during the SCell activation
- For a single interruption (L=0), interruption window length at SCell activation does not depend on DL CCA failures.

For inter-band CA,

- For any active cell in the same band with the SCell being activated, the interruption requirements (i.e. number of interruptions and starting point of an interruption) for intra-band CA apply.
- For any active cell outside the band with the SCell being activated, a single interruption applies

The number of interruptions and length of each interruption window may be different for different victim cells and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell. For a single interruption (L=0), the interruption window length at SCell activation does not depend on DL CCA failures.

Starting from slot *n* + T_{HARQ} + 3 ms where slot *n* is the slot where SCell activation command is received (as specified in clause 4.3 of TS 38.213 [3]) and until the SCell activation completion at UE, after at least one CSI-RS transmission occasion for the channel measurement and reporting (specified in clause 5.2.2.5 of TS 38.214 [26]), the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

The requirements in this clause do not apply when *sCellDeactivationTimer* [2] is not configured and when $T_{activation_time_withCCA}$ exceeds 1280 ms.

8.3A.3 SCell Deactivation Delay Requirement for Activated SCell

The requirements in this clause shall apply for the UE configured with at least one downlink SCell operating with CCA in EN-DC or in standalone NR carrier aggregation and one SCell is deactivated.

Upon receiving SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot *n*+(T_{HARQ} +3 ms)/*NR_slot_length*. The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot n+1+$\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being deactivated.

Upon expiry of the *sCellDeactivationTimer* in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot *n* + $\frac{3ms}{NR\ slot\ length}$. The starting point of an interruption window on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1 and not occur after slot n+1+ $\frac{3ms}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being deactivated. The length of the

interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

The requirements in this clause do not apply when *sCellDeactivationTimer* [2] is not configured and when SCell deactivation delay exceeds 1280 ms.

8.3D SCell Activation and Deactivation Delay for ATG

8.3D.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to activate at least one deactivated SCell and deactivate at least one activated SCell in standalone NR carrier aggregation.

8.3D.2 SCell Activation Delay Requirement for Deactivated SCell

The requirements in this clause shall apply for the UE configured with at least one downlink SCell in standalone NR carrier aggregation and when one SCell is being activated.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot n + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation_time}$ is the SCell activation delay in milliseconds.

If the SCell is known and belongs to FR1, $T_{activation_time}$ is:

- $T_{FirstSSB}$+ 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.
- $T_{FirstSSB_MAX}$ + T_{rs} + 5 ms, if the measurement period of the SCell being activated is larger than 2400 ms.

If the SCell is unknown and belongs to FR1, and if one of the following conditions is met

- ‘ssb-PositionInBurst’ indicates only one SSB is being actually transmitted, or
- ‘ssb-PositionInBurst’ indicates multiple SSBs and TCI indication is provided in same MAC PDU with SCell activation,

provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled, $T_{activation_time}$ is:

- If UE supports *shortMeasInterval-r18*, then
  - $T_{FirstSSB_MAX,\ enhanced}$ + $T_{SMTC_MAX,\ enhanced}$ + $T_{rs,\ enhanced}$ + 5 ms, if the following conditions are met,
    - the SCell is contiguous to an active serving cell in the same band, and
    - its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and
    - its SMTC offset is same as the one of contiguous FR1 active serving cell, and
    - its RTD with contiguous FR1 active serving cell is smaller than or equal to 260 ns with respect to the to-be-activated SCell’s SSB numerology, and its reception power difference with contiguous FR1 active serving cell is smaller than or equal to 6 dB;
  - $T_{FirstSSB_MAX,\ enhanced}$ + $T_{SMTC_MAX,\ enhanced}$ + 2*$T_{rs,\ enhanced}$ + 5 ms, otherwise.
- Otherwise
  - $T_{FirstSSB_MAX}$ + T_{SMTC_MAX} + T_{rs} + 5 ms, if the following conditions are met,

- the SCell is contiguous to an active serving cell in the same band, and
- its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and
- its SMTC offset is same as the one of contiguous FR1 active serving cell, and
- its RTD with contiguous FR1 active serving cell is smaller than or equal to 260 ns, and its reception power difference with contiguous FR1 active serving cell is smaller than or equal to 6 dB;

- $T_{FirstSSB_MAX} + T_{SMTC_MAX} + 2*T_{rs}$ + 5 ms, otherwise.

Otherwise, provided that the side condition $\hat{E}s/Iot \geq$ -2 dB is fulfilled, $T_{activation_time}$ is:

- If UE supports *shortMeasInterval-r18*, then
  - 6 ms + $T_{FirstSSB_MAX, enhanced} + T_{SMTC_MAX, enhanced} + T_{rs, enhanced} + T_{L1\text{-}RSRP, enhanced_measure} + T_{L1\text{-}RSRP, report} + T_{HARQ} + \max(T_{uncertainty_MAC} + T_{FineTiming} + 2 \text{ ms}, T_{uncertainty_SP})$, if semi-persistent CSI-RS is used for CSI reporting,
  - 3 ms + $T_{FirstSSB_MAX, enhanced} + T_{SMTC_MAX, enhanced} + T_{rs, enhanced} + T_{L1\text{-}RSRP, enhanced_measure} + T_{L1\text{-}RSRP ,report} + \max(T_{HARQ} + T_{uncertainty_MAC} + 5 \text{ ms} + T_{FineTiming}, T_{uncertainty_RRC} + T_{RRC_delay})$, if periodic CSI-RS is used for CSI reporting.
- Otherwise
  - 6 ms + $T_{FirstSSB_MAX} + T_{SMTC_MAX} + T_{rs} + T_{L1\text{-}RSRP, measure} + T_{L1\text{-}RSRP,report} + T_{HARQ} + \max(T_{uncertainty_MAC} + T_{FineTiming} + 2 \text{ ms}, T_{uncertainty_SP})$, if semi-persistent CSI-RS is used for CSI reporting,
  - 3 ms + $T_{FirstSSB_MAX} + T_{SMTC_MAX} + T_{rs} + T_{L1\text{-}RSRP, measure} + T_{L1\text{-}RSRP,report} + \max(T_{HARQ} + T_{uncertainty_MAC} + 5 \text{ ms} + T_{FineTiming}, T_{uncertainty_RRC} + T_{RRC_delay})$, if periodic CSI-RS is used for CSI reporting.
- However, when the following conditions are fulfilled, no activation requirement will be applied for this unknown SCell:
  - the SCell is contiguous to an active serving cell in the same band, and
  - A single SSB is used in the unknown SCell; or multiple SSBs are used in the SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and
  - its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and
  - its SMTC offset is same as the one of contiguous FR1 active serving cell
  - its RTD with contiguous FR1 active serving cell is larger than 260 ns, or its reception power difference with contiguous FR1 active serving cell is larger than 6 dB;

If the SCell being activated belongs to FR1 and if there is at least one active serving cell contiguous to the SCell on that FR1 band, if the UE is not provided with SSB configuration (*absoluteFrequencySSB*) or SMTC configuration for the target SCell, $T_{activation_time}$ is 3 ms for UE supporting *scellWithoutSSB*, provided

- The RTD between the target SCell and the contiguous active serving cell is within ±260ns, and
- The difference of the reception power with the contiguous active serving cell is <= 6 dB, and
- The RS(s) of SCell being activated is (are) QCL-TypeA with TRS(s) of the SCell being activated, and the TRS(s) of the SCell being activated is (are) further QCL-TypeC with SSB(s) of any active serving cell that is contiguous to the SCell being activated on that FR1 band.

For a UE supporting *scellWithoutSSB-InterBandCA-r18* if the SCell being activated belongs to FR1 and if the UE is not provided with SSB configuration (*absoluteFrequencySSB*) in the target SCell (FrequencyInfoDL) nor SMTC configuration for the target SCell, and if there is one collocated active reference serving cell on different FR1 band, when the following conditions are fulfilled,

- The RTD between the target SCell and the collocated reference serving cell is within CP where CP is corresponding to the SCS of SSB-less SCell, and

- The EPRE difference at the UE is smaller than or equal to 30 dB, where EPRE difference is the power difference between TRS/A-TRS symbol on the SSB-less SCell and SSB symbol on the reference serving cell normalized by SCSs of SSB of reference cell and A-TRS/P-TRS of SSB-less SCell, and

- The RS(s) of the SSB-less SCell being activated is (are) QCL-TypeA with TRS(s) of the SSB-less SCell being activated, and the TRS(s) of the SSB-less SCell being activated is (are) further QCL-TypeC with SSB(s) of an inter-band active serving cell, and the inter-band active serving cell shall be same as the reference serving cell.

where the reference serving cell can be indicated by higher layer parameter *referenceCell-r18*. If UE is not indicated with *referenceCell-r18*, the reference serving cell is assumed to be the QCL-typeC source cell if there is only one active QCL-typeC source cell configured.

$T_{activation_time}$ is

- $T_{first_TRS} + T_{TRS}$ +5 ms, if aperiodic CSI-RS resources are not configured for SCell activation or UE do not support *aperiodicCSI-RS-FastScellActivation-r17*, when the the EPRE difference is smaller than or equal to 12 dB

- $T_{first_ATRS} + T_{gap} + T_{ATRS}$ + 5 ms if aperiodic CSI-RS resources are configured for SCell activation for UE supporting *aperiodicCSI-RS-FastScellActivation-r17*, when the the EPRE difference is smaller than or equal to 12 dB

- $T_{first_TRS} + 2*T_{TRS}$ +5 ms, when the EPRE difference is larger than 12 dB but smaller than or equal to 30 dB

where,

T_{SMTC_MAX}:

- In FR1, in case of intra-band contiguous SCell activation, T_{SMTC_MAX} is the longer SMTC periodicity between active serving cells and SCell being activated provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in the same slot; in case of inter-band SCell activation, T_{SMTC_MAX} is the SMTC periodicity of SCell being activated.

- T_{SMTC_MAX} is bounded to a minimum value of 10 ms.

$T_{SMTC_MAX,\ enhanced}$:

- In FR1, a UE supporting *shortMeasInterval-r18* if the SMTC for SCell being activated is only configured in measObjectNR, $T_{SMTC_MAX,\ enhanced}$ is the SSB periodicity of SCell being activated. Otherwise, $T_{SMTC_MAX,\ enhanced} = T_{SMTC_MAX}$.

T_{rs} is the SMTC periodicity of the SCell being activated if the UE has been provided with an SMTC configuration for the SCell in SCell addition message, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement which involves T_{rs} is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There are no requirements if the SSB transmission periodicity is not 5 ms.

$T_{rs,\ enhanced}$ is the SSB periodicity of the SCell being activated for a UE supporting *shortMeasInterval-r18* in FR1, if the SMTC for SCell being activated is only configured in the *measObjectNR*. Otherwise, $T_{rs,\ enhanced} = T_{rs}$

$T_{FirstSSB}$: is the time to the end of the first complete SSB burst indicated by the SMTC, or within 5 ms if SMTC is not configured, after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$.

$T_{FirstSSB_MAX}$: Is the time to the end of the first complete SSB burst indicated by the SMTC, or within 5 ms if SMTC is not configured, after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, further fulfilling:

- In FR1, in case of intra-band contiguous SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.

$T_{FirstSSB_MAX,\ enhanced}$: For a UE supporting *shortMeasInterval-r18* in FR1, if the SMTC for SCell being activated is only configured in the measObjectNR, $T_{FirstSSB_MAX,\ enhanced}$ is the time to the end of the first complete SSB burst indicated by the SSB periodicity of the SCell being activated, after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$. Otherwise, $T_{FirstSSB_MAX,\ enhanced} = T_{FirstSSB_MAX}$

$T_{FineTiming}$ is the time period between UE finish processing the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and the timing of first complete available SSB corresponding to the TCI state.

$T_{L1\text{-}RSRP,\ measure}$ is L1-RSRP measurement delay $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ or $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ based on applicability as defined in clause 9.5D assuming M=1 and T_{Report}=0.

$T_{L1\text{-}RSRP,\ enhanced_measure}$ is

- SSB based L1-RSRP measurement delay $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ based on applicability as defined in clause 9.5D assuming M=1 and T_{Report}=0; Or,
- CSI-RS based L1-RSRP measurement delay $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ based on applicability as defined in clause 9.5D assuming M=1 and T_{Report}=0.
- If UE supports *shortMeasInterval-r18* capability, L1-RSRP measurement for $T_{L1\text{-}RSRP,\ enhanced_measure}$ can be performed based on non-DRX mode even if DRX is configured.

$T_{L1\text{-}RSRP,\ report}$ is delay of acquiring CSI reporting resources.

$T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable) relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

$T_{uncertainty_RRC}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

$T_{uncertainty_SP}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

Longer delays for RRM measurement requirements can be expected during the cell detection time for unknown SCell activation.

When *absoluteFrequencySSB* is not configured in *DownlinkConfigCommon* for target SCell but SMTC for target SCell is configured, no requirement would be applied.

$T_{CSI_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

$T_{FirstTRS}$: is the time to the end of the first complete periodic CSI-RS burst for SCell activation after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$.

T_{TRS} is the periodicity of periodic CSI-RS burst for SCell activation.

$T_{FirstATRS}$: is the time to the end of the first complete CSI-RS burst for SCell activation after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots.

T_{ATRS} is the CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots.

T_{gap} is a gap length between two aperiodic CSI-RS bursts,

- at least 2 slots for 15 kHz and 30 kHz
- at least 3 slots for 60 kHz

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5*measCycleSCell, 5*DRX cycles) for FR1 before the reception of the SCell activation command:
  - the UE has sent a valid measurement report for the SCell being activated and
  - the SSB measured remains detectable according to the cell identification conditions specified in clause 9.2D and 9.3D.
- the SSB measured during the period equal to max(5*measCycleSCell, 5*DRX cycles) also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2D and 9.3D.

Otherwise SCell in FR1 is unknown.

If the UE has been provided with higher layer in TS 38.331 [2] signalling of *smtc2* prior to the activation command, T_{SMTC_Scell} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. T_{SMTC_MAX} follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

The starting point of an interruption window on Pcell or any activated SCell, as specified in clause 8.2D, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot slot n+1+$\frac{T_{HARQ}+3ms+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being activated, and T_X is:

- 0, if $T_{activation_time}$ is 3 ms;
- $T_{FirstSSB}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB_MAX}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB_MAX}$;
- $T_{uncertainty_MAC}$ +$T_{FineTiming}$, for any scenario where $T_{activation_time}$ includes only $T_{FineTiming}$ and no $T_{FirstSSB_MAX}$;
- T_{first_TRS}, for FR1 inter-band SSB-less SCell activation scenario where $T_{activation_time}$ includes T_{first_TRS};
- T_{first_ATRS}, for FR1 inter-band SSB-less SCell activation scenario where $T_{activation_time}$ includes T_{first_ATRS}.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

The requirements in this clause and requirements on interruption due to SCell activation in clause 8.2D apply provided that the SSB of the to-be-activated SCell is within the first active DL BWP of the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

8.3D.3 SCell Deactivation Delay Requirement for Activated SCell

The requirements in this clause shall apply for the UE configured with at least one downlink SCell in standalone NR carrier aggregation and when one SCell is being deactivated.

Upon receiving SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot $n + \frac{T_{HARQ}+3ms}{NR\ slot\ length}$. The starting point of an interruption window on PCell or any activated SCell, as specified in clause 8.2D, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot n+1+$\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being deactivated.

Upon expiry of the *sCellDeactivationTimer* in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot $n + \frac{3ms}{NR\ slot\ length}$. The starting point of an interruption window on Pcell or any activated SCell, as specified in clause 8.2D, shall not occur before slot n+1 and not occur after slot n+1+ $\frac{3ms}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being deactivated.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

8.3D.4 Direct SCell Activation at SCell addition

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], with one SCell for which the parameter *sCellState* is set to *activated*.

If the RRC reconfiguration message for direct SCell activation also configures TCI state information, the requirements in clause 8.3D.2 based on that TCI state activation command is received at the same time as SCell activation command shall apply.

The UE shall configure the SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. The UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot n + $\frac{N_{direct}}{NR\ slot\ length}$,

where:

- Slot n is the last slot overlapping with the PDSCH containing the RRC reconfiguration message,
- $N_{direct} = T_{RRC_Process} + T_1 + T_{activation_time} + T_{CSI_Reporting}$ - 3 ms for the cases specified in clause 8.3D.2 that TCI state is not indicated within $T_{activation_time}$; otherwise, $N_{direct} = T_{RRC_Process} + T_1 + T_{HARQ} + T_{activation_time} + T_{CSI_Reporting}$
  - $T_{RRC_Process}$: RRC procedure delay as specified in clause 12 of TS 38.331 [2],
  - T_1: Delay from slot $n + \frac{T_{RRC_Process}}{NR\ slot\ length}$ until the transmission of *RRCReconfigurationComplete* message,

NOTE: T_1 is UE implementation dependent.

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3],

If the SCell is known and belongs to FR1, $T_{CSI_Reporting}$ is specified in clause 8.3D.2 and $T_{activation_time}$ is defined as:

- $T_{FirstSSB}$+ 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.
- $T_{FirstSSB_MAX} + T_{rs}$ + 5 ms, if measurement period of the SCell being activated is larger than 2400 ms.

  where,

  the measurement period in table 9.2D.5.2-1 applies if the target SCell was in an intra-frequency layer corresponding to an activated SCell;

  the measurement period in table 9.2D.5.2-2 applies if the target SCell was in an intra-frequency layer corresponding to a deactivated SCell;

the measurement period in table 9.3D.5-1 applies if the target SCell was in an inter-frequency layer.

- Otherwise, $T_{activation_time}$ and $T_{CSI_Reporting}$ are specified in clause 8.3D.2, where the following definitions of $T_{FirstSSB}$ and $T_{FirstSSB_MAX}$ shall override the existing ones:
  - $T_{FirstSSB}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC_Process}+T_1}{NR\ slot\ length}$
  - $T_{FirstSSB_MAX}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC_{Process}}+T_1}{NR\ slot\ length}$
    - In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.
- If a UE supports *shortMeasInterval-r18* capability, the reduced $T_{activation_time}$ specified in clause 8.3D.2 when UE supports the capability is applicable for Direct SCell activation at SCell addition also.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The SCell in FR1 is known provided the following conditions are met for the SCell:

- During the last 5 seconds before the reception of the direct SCell configuration command:
  - the UE has sent a valid measurement report for the SCell being directly activated, and
  - the SSB measured remains detectable according to the cell identification conditions specified in clauses 9.2D and 9.3D,
- the SSB measured during the period equal to [5] seconds also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2D and 9.3D.

Otherwise, the SCell is unknown.

The UE may be allowed to cause interruptions to serving cells on other component carriers during an interruption window, as specified in clause 8.2D. The starting point of an interruption window on Pcell or any activated SCell shall not occur before slot n+1, and shall not occur after slot n+1+$\frac{T_{RRC_Process}+T_1+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology of the SCell being activated, and T_X is:

- $T_{FirstSSB}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB_MAX}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB_MAX}$;
- $T_{uncertainty_MAC}$ +$T_{FineTiming}$, for any scenario where $T_{activation_time}$ includes $T_{FineTiming}$.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

Starting from the slot $n + \frac{T_{RRC_Process} + T_1}{NR\ slot\ length}$ until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

8.3D.5 Direct SCell Activation at Handover

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], for handover with one SCell for which the parameter *sCellState* is set to *activated*.

The UE shall configure the SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. The UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot n + $\frac{N_{direct}}{NR\ slot\ length}$,

Where:

- Slot n is the last slot overlapping with the PDSCH containing RRC reconfiguration message.
- $N_{direct} = T_{RRC_process} + T_{interrupt} + T_2 + T_3 + T_{activation_time} + T_{CSI_Reporting}$ - 3 ms for the cases specified in clause 8.3D.2 that TCI state is not indicated within $T_{activation_time}$; otherwise, $N_{direct} = T_{RRC_process} + T_{interrupt} + T_2 + T_3 + T_{HARQ} + T_{activation_time} + T_{CSI_Reporting}$
- $T_{RRC_Process}$: RRC procedure delay as specified in clause 12 of TS 38.331 [2],
- $T_{interrupt}$: Interruption time during handover as specified in clause 6.1E.1,
- T_2: Delay from slot $n + \frac{T_{RRC_Process}+T_{interrupt}}{NR\ slot\ length}$ until UE has obtained a valid TA command for the target PCell,
- T_3: Delay for applying the received TA for uplink transmission in the target PCell, and greater than or equal to k+1 slot, where k is defined in clause 4.2 in TS 38.213 [3],
- T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3],
- If the SCell is known and belongs to FR1, $T_{CSI_Reporting}$ is specified in clause 8.3D.2 and $T_{activation_time}$ is defined as:
  - $T_{FirstSSB}$+ 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.
  - $T_{FirstSSB_MAX} + T_{rs}$ + 5 ms, if measurement period of the SCell being activated is larger than 2400 ms.

    where,

    the measurement period in table 9.2D.5.2-1 applies if the target SCell was in an intra-frequency layer corresponding to an activated SCell;

    the measurement period in table 9.2D.5.2-2 applies if the target SCell was in an intra-frequency layer corresponding to a deactivated SCell;

    the measurement period in table 9.3D.5-1 applies if the target SCell was in an inter-frequency layer.
- Otherwise, $T_{activation_time}$ and $T_{CSI_Reporting}$ are specified in clause 8.3D.2, where the following definitions of $T_{FirstSSB}$ and $T_{FirstSSB_MAX}$ shall override the existing ones:
  - $T_{FirstSSB}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC_Process}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$
  - $T_{FirstSSB_MAX}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC_{Process}}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$
    - In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.
- If a UE supports *shortMeasInterval-r18* capability, the reduced $T_{activation_time}$ specified in clause 8.3D.2 when UE supports the capability is applicable for Direct SCell activation at handover also.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The SCell in FR1 is known provided the following conditions are met for the SCell:

- During the last 5 seconds before the reception of the direct SCell configuration command:
  - the UE has sent a valid measurement report for the SCell being directly activated, and
  - the SSB measured remains detectable according to the cell identification conditions specified in clauses 9.2D and 9.3D,

- the SSB measured during the period equal to [5] seconds also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2D and 9.3D.

Otherwise, the SCell is unknown.

The UE may be allowed to cause interruptions to PCell during an interruption window, as specified in clause 8.2D. The starting point of an interruption window on PCell shall not occur before slot n+1+ $\frac{T_{RRC\ Processing}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$, and not occur after slot n+1+$\frac{T_{RRC\ Processing}+T_{interrupt}+T_2+T_3+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology of the SCell being activated, and T_X is:

- $T_{FirstSSB}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB_MAX}$, for any scenario where $T_{activation_time}$ includes $T_{FirstSSB_MAX}$;
- $T_{uncertainty_MAC}$ +$T_{FineTiming}$, for any scenario where $T_{activation_time}$ includes $T_{FineTiming}$.

The length of the interruption window depends on the frequency band relation between the aggressor SCell and the victim PCell.

Starting from the slot $n + \frac{T_{RRC_Process} + T_{interrupt}+T_2+ T_3}{NR\ slot\ length}$ and until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

8.3D.6 Direct SCell Activation at RRC Resume

The requirements in this clause apply for UE being configured in the RRC reconfiguration message in TS 38.331 [2] for RRC Resume with one SCell for which the parameter *sCellState* is set to *activated*.

The requirements in clause 8.3D.4 shall apply, except that the definition of T_1 shall be deemed to be replaced with

T_1: Delay from slot $n + \frac{T_{RRC_Process}}{NR\ slot\ length}$ until the transmission of RRCResumeComplete message,

8.3D.7 Fast SCell Activation Delay Requirement for Deactivated SCell

Aperiodic CSI-RS resources can be configured for fast SCell activation. The requirements in this clause shall apply for the UE configured with one downlink SCell in standalone NR carrier aggregation and when one SCell is being activated. The requirements in this clause shall apply for the UE provided with aperiodic CSI-RS resources for SCell activation for the target SCell.

NOTE: If UE is allocated A-TRS for fast SCell activation, the UE is not required to use the SSB of the target SCell.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot n + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation_time}$ is the SCell activation delay in milliseconds.

If the SCell is known and belongs to FR1, $T_{activation_time}$ is:

- $T_{FirstATRS}$+ 5 ms, if the measurement period of the SCell being activated is equal to or smaller than 2400 ms.
- $T_{FirstATRS}$ + T_{gap} + T_{ATRS} + 5 ms, if the measurement period of the SCell being activated is larger than 2400 ms.

NOTE: The RSs on the activated serving cell in the same band are not required to be transmitted in the same slot as the temporary RS.

NOTE: UE may report inaccurate non-zero CQI for any activated Cell and being activated SCell during the fast SCell activation procedure only if the RSs on the activated serving cell in the same band are not transmitted in the same slot as the aperiodic CSI-RS for fast SCell activation.

If the SCell is unknown and belongs to FR1, and SCell is contiguous to an active serving cell in the same band, provided that the side condition $\hat{E}s/Iot \geq -2$ dB is fulfilled, $T_{activation_time}$ is:

- $T_{FirstATRS} + T_{gap} + T_{ATRS} + 5$ ms, if the following conditions are met,
  - the SCell is contiguous to an active serving cell in the same band, and
  - its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and
  - its SMTC offset is same as the one of contiguous FR1 active serving cell, and
  - its RTD with contiguous FR1 active serving cell is smaller than or equal to 260 ns with respect to the to-be-activated SCell's SSB numerology, and its reception power difference with contiguous FR1 active serving cell is smaller than or equal to 6 dB;

NOTE: The RSs on the activated serving cell in the same band are not required to be transmitted in the same slot as the temporary RS.

NOTE: UE may report inaccurate non-zero CQI for any activated SCell and being activated SCell during the fast SCell activation procedure only if the RSs on the activated serving cell in the same band are not transmitted in the same slot as the aperiodic CSI-RS for fast SCell activation.

where,

$T_{FirstATRS}$: is the time to the end of the first complete CSI-RS burst for SCell activation after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots.

T_{ATRS} is the CSI-RS burst for SCell activation where the CSI-RS burst is defined as four CSI-RS resources in two consecutive slots.

- T_{gap} is a gap length between two aperiodic CSI-RS bursts,
  - at least 2 slots for 15 kHz and 30 kHz
  - at least 3 slots for 60 kHz

$T_{CSI_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5*measCycleSCell, 5*DRX cycles) for FR1 before the reception of the SCell activation command:
  - the UE has sent a valid measurement report for the SCell being activated and
  - the SSB measured remains detectable according to the cell identification conditions specified in clauses 9.2D and 9.3D.
- the SSB measured during the period equal to max(5*measCycleSCell, 5*DRX cycles) also remains detectable during the SCell activation delay according to the cell identification conditions specified in clauses 9.2D and 9.3D.

Otherwise SCell in FR1 is unknown.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

The starting point of an interruption window on PCell or any activated SCell, as specified in clause 8.2D, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot slot n+1+$\frac{T_{HARQ}+3ms+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being activated, and T_X is:

- $T_{FirstATRS}$, for any scenario where $T_{activation_time}$ includes $T_{FirstATRS}$;

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

The requirements in this clause and requriements on interruption due to SCell activation in clause 8.2D apply provided that the SSB and A-TRS of the to-be-activated SCell is within the first active DL BWP of the Scell.

Starting from slot *n* + T_{HARQ} + 3 ms where slot *n* is the slot where SCell activation command is received (as specified in clause 4.3 of TS 38.213 [3]) and until the SCell activation completion at UE, after at least one CSI-RS transmission occasion for the channel measurement and reporting (specified in clause 5.2.2.5 of TS 38.214 [26]) , the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

8.3D.8 SCell Activation Delay Requirement for Deactivated SCell with the L3 reporting during activation

The requirements in this clause shall apply for UE supporting *l3-MeasUnknownSCellActivation-r18* and is configured with *ReportOnScellActivation* and reporting valid L3 measurement results after receiving the SCell activation command for unknown SCell. The requirements in this clause shall apply for the UE configured with one downlink SCell in NR carrier aggregation and when one SCell is being activated. clause 8.3D.2 is applied for UE who does not report L3 measurement results after receiving SCell activation command for unknown SCell.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot n + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation_time}$ is the SCell activation delay in milliseconds.

- $T_{activation_time}$ is:
  - 10 ms + $T_{L3,report}$+ T_{HARQ} + max($T_{uncertainty_MAC}$ + $T_{FineTiming}$ + 2 ms, $T_{uncertainty_SP}$), if semi-persistent CSI-RS is used for CSI reporting,
  - 7 ms + $T_{L3,report}$+ max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}), if periodic CSI-RS is used for CSI reporting,

If the following conditions are met:

If the SCell being activated belongs to FR1 and if there is no active serving cell contiguous to the SCell on that FR1 band provided that the side condition Ês/Iot ≥ -2 dB is fulfilled:

If the target SCell belongs to FR1 and none of the following conditions is met

- 'ssb-PositionInBurst' indicates only one SSB is being actually transmitted, or
- 'ssb-PositionInBurst' indicates multiple SSBs and TCI indication is provided in same MAC PDU with SCell activation;

Otherwise, $T_{activation_time}$ in clause 8.3D.2 is applied for unknown SCell activation.

However, when the following conditions are fulfilled, no activation requirement will be applied for this unknown SCell:

- the SCell is contiguous to an active serving cell in the same band, and

- a single SSB is used in the unknown SCell; or multiple SSBs are used in the SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and
- its *ssb-PositionInBurst* is same as the one of contiguous FR1 active serving cell, and
- its SMTC offset is same as the one of contiguous FR1 active serving cell
- its RTD with contiguous FR1 active serving cell is larger than 260 ns with respect to the to-be-activated SCell's SSB numerology, or its reception power difference with contiguous FR1 active serving cell is larger than 6 dB;

where,

$T_{L3,\ report}$ is delay of acquiring the first available UL resource for L3 reporting from 7 ms +T_{HARQ} after receiving SCell activation command.

- The L3 measurement reporting requirement is defined in clause 9.2D.4.4
- UE is ready to report the L3 measurement result no later than 7 ms + T_{HARQ} ms from receiving the SCell activation command.

UE is not required to report the L3 results after 3 ms + T_{HARQ}+ M ms from receiving the SCell activation command where

- For FR1,
  - M= 2*T_{SSB} + $T_{L1\text{-}RSRP,report}$ for UE supporting *shortMeasInterval-r18* capability,
  - Otherwise, M = T_{SMTC} +T_{SSB} + $T_{L1\text{-}RSRP,report}$

$T_{FineTiming}$ is the time period between UE finish processing the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and the timing of first complete available SSB corresponding to the TCI state.

$T_{uncertainty_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable) relative to

- First valid L3-RSRP reporting for unknown case, if UE reports valid L3-RSRP before receiving TCI activation command
- First valid L1-RSRP reporting for unknown case, if UE reports valid L3-RSRP after receiving TCI activation command

$T_{uncertainty_RRC}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to

- First valid L3-RSRP reporting for unknown case, if UE reports valid L3-RSRP before receiving TCI activation command
- First valid L1-RSRP reporting for unknown case, if UE reports valid L3-RSRP after receiving TCI activation command

$T_{uncertainty_SP}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to

- First valid L3-RSRP reporting for unknown case, if UE reports valid L3-RSRP before receiving TCI activation command
- First valid L1-RSRP reporting for unknown case, if UE reports valid L3-RSRP after receiving TCI activation command

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

Longer delays for RRM measurement requirements, can be expected during the cell detection time for unknown SCell activation.

When *absoluteFrequencySSB* is not configured in *DownlinkConfigCommon* for target SCell but SMTC for target SCell is configured, no requirement would be applied.

$T_{CSI_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5*measCycleSCell, 5*DRX cycles) for FR1 before the reception of the SCell activation command:
  - the UE has sent a valid measurement report for the SCell being activated and
  - the SSB measured remains detectable according to the cell identification conditions specified in clause 9.2D and 9.3D.
- the SSB measured during the period equal to max(5*measCycleSCell, 5*DRX cycles) also remains detectable during the SCell activation delay according to the cell identification conditions specified in clauses 9.2D and 9.3D.

Otherwise SCell in FR1 is unknown.

The requirement for unknown SCell applies provided that the activation commands for PDCCH TCI, PDSCH TCI (when applicable), semi-persistent CSI-RS for CQI reporting (when applicable), and configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) are based on either L1-RSRP or L3-RSRP if any one of them is reported before receiving TCI activation command.

If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the activation command, T_{SMTC_Scell} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. T_{SMTC_MAX} follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

The starting point of an interruption window on PCell or any activated SCell, as specified in clause 8.2D, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot slot n+1+$\frac{T_{HARQ}+3ms+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being activated, and T_X is:

- $T_{uncertainty_MAC}$ +$T_{FineTiming}$, for any scenario where $T_{activation_time}$ includes only $T_{FineTiming}$ and no $T_{FirstSSB_MAX}$.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

The requirements in this clause and requirements on interruption due to SCell activation in clause 8.2D apply provided that the SSB of the to-be-activated SCell is within the first active DL BWP of the Scell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

8.4 UE UL carrier RRC reconfiguration delay

8.4.1 Introduction

The requirements in this clause apply for a UE being configured or deconfigured with a supplementary UL carrier or NR UL carrier.

8.4.2 UE UL carrier configuration delay requirement

When the UE receives a RRC message implying NR UL or supplementary UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within $T_{UL_carrier_config}$ from the end of slot n.

Where

- Slot n is the last slot overlapping with the PDSCH containing the RRC command.
- $T_{UL_carrier_config}$ equals the maximum RRC procedure delay defined in clause 11.2 in TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it equals the maximum RRC procedure delay defined in clause 12 in TS 38.331 [2].

8.4.3 UE UL carrier deconfiguration delay requirement

When the UE receives a RRC message implying NR UL or supplementary UL carrier deconfiguration RRC signalling, the UE shall stop UL signalling on the deconfigured UL carrier within $T_{UL_carrier_deconfig}$ from the end of slot n.

Where

- Slot n is the last slot overlapping with the PDSCH containing the RRC command.
- $T_{UL_carrier_deconfig}$ equals the maximum RRC procedure delay defined in clause 11.2 in TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it equals the maximum RRC procedure delay defined in clause 12 in TS 38.331 [2].

8.5 Link Recovery Procedures

8.5.1 Introduction

The UE shall assess the downlink radio link quality of a serving cell based on the reference signal in the set $\bar{q}_0$ as specified in TS 38.213 [3] in order to detect beam failure on:

- PCell in SA, NR-DC, or NE-DC operation mode,
- PSCell in NR-DC and EN-DC operation mode,
- SCell in SA, NR-DC, NE-DC or EN-DC operation mode,
- Deactivated PSCell in NR-DC and EN-DC operation mode

The RS resource configurations in the set $\bar{q}_0$ on PCell, PSCell or deactivated PSCell (if configured with *bfd-and-RLM* with value *true*) can be periodic CSI-RS resources and/or SSBs. RS resource configuration in the set $\bar{q}_0$ on SCell shall be periodic CSI-RS. A UE supporting *bwpOperationMeasWithoutInterrupt-r18* is required to perform beam failure detection outside the active DL BWP, provided the SSB is within the configured UE-specific CBW, in addition to performing beam failure detection within the active DL BWP. Otherwise, the UE is not required to perform beam failure detection outside the active DL BWP. UE is not required to meet the requirements in clause 8.5.2 and 8.5.3 if UE does not have set $\bar{q}_0$. UE is not required to perform beam failure detection on a deactivated SCell, and also not required to perform beam failure detection on resources which is implicitly configured for a deactivated SCell. When more than 2 periodic CSI-RS resources on a CC are configured in the set $\bar{q}_0$ for current SCell or implicitly configured in the set $\bar{q}_0$ for other SCell, it is up to UE implementation to select two of CSI-RS resources in active BWP in current CC to perform beam failure detection. UE is not required to perform beam failure detection on a SCell on which $\bar{q}_1$ is not configured.

On each RS resource configuration in the set $\bar{q}_0$, the UE shall estimate the radio link quality and compare it to the threshold Q_{out_LR} for the purpose of accessing downlink radio link quality of the serving cell beams.

When a CORESET that the UE uses for monitoring PDCCH includes two TCI states and the UE is provided *sfnSchemePdcch* set to 'sfnSchemeA' or 'sfnSchemeB', the UE shall estimate a single downlink radio link quality to derive a single SNR and compare it to the single thresholds Q_{out_LR} for the purpose of accessing downlink radio link quality of the serving cell beams. How to compute the single SNR based on two active TCI states is up to UE implementation.

The threshold Q_{out_LR} is defined as the level at which the downlink radio level link of a given resource configuration on set $\bar{q}_0$ cannot be reliably received and shall correspond to the $BLER_{out}$ = 10% block error rate of a hypothetical PDCCH transmission. For SSB based beam failure detection, $Q_{out_LR_SSB}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5.2.1-1. For CSI-RS based beam failure detection, $Q_{out_LR_CSI\text{-}RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5.3.1-1.

Upon request the UE shall deliver configuration indexes from the set $\bar{q}_1$as specified in TS 38.213 [3] , to higher layers, and the corresponding L1-RSRP measurement provided that the measured L1-RSRP is equal to or better than the threshold Q_{in_LR}, which is indicated by higher layer parameter *rsrp-ThresholdSSB*. The UE applies the Q_{in_LR} threshold to the L1-RSRP measurement obtained from an SSB. The UE applies the Q_{in_LR} threshold to the L1-RSRP measurement obtained for a CSI-RS resource after scaling a respective CSI-RS reception power with a value provided by higher layer parameter *powerControlOffsetSS*. The RS resource configurations in the set $\bar{q}_1$ can be periodic CSI-RS resources or SSBs or both SSB and CSI-RS resources. A UE supporting *bwpOperationMeasWithoutInterrupt-r18* is required to perform beam failure detection outside the active DL BWP, provided the SSB is within the configured UE-specific CBW, in addition to performing beam failure detection within the active DL BWP. Otherwise, the UE is not required to perform candidate beam detection outside the active DL BWP. UE is not required to perform candidate beam detection on a SCell on which $\bar{q}_1$ is not configured.

For a deactivated SCG, the UE may be provided via an RRC reconfiguration message with *tci-info* for PDCCH/PDSCH reception at the transition from deactivated SCG to activated SCG while the SCG is deactivated. After the reception of the RRC reconfiguration message the UE shall perform the BFD on the PSCellof the deactivated SCG using the TCI states according to *tci-info* specified in clause 6.3.2 in TS 38.331 [2].

For UE supporting *ncd-SSB-BWP-Wor-r18*, the SSB and SMTC in this clause applies for both CD-SSB and NCD-SSB if it is not explicitly specified otherwise. If SSB in the active DL BWP of serving cell *i* is NCD-SSB, for serving cell *i* the requirements in clause 8.5 apply provided that serving cell *i* is PCell or activated PSCell.

8.5.1.1 Introduction of Requirement on Link Recovery Procedures for UE configured with relaxed measurement criteria

For the UE supports *bfd-Relaxation-r17* and configured with dedicated signalling *goodServingCellEvaluationBFD*, which is always configured to the UE when the network enables BFD relaxation for the UE as specified in TS 38.331[2], the relaxed requirements defined in clause 8.5.2.4 for SSB based beam failure detection and the relaxed requirements defined in clause 8.5.3.4 for CSI-RS based beam failure detection are allowed to apply to the relaxed BFD measurements on the serving cell after fulfilling the following conditions:

- for the serving cells in intra-band carrier aggregation configured with SSB-based or CSI-RS based RLM on SpCell together with CSI-RS based BFD on SCell, when
  - the good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the serving cell based on the measurements that are configured for SSB-based or CSI-RS based RLM on SpCell together with CSI-RS based BFD on SCell in the intra-band carrier aggregation if the *lowMobilityEvaluationConnected* is not configured, or
  - the UE is also configured with *lowMobilityEvaluationConnected* and both low mobility criterion defined in clause 5.7.13.1 of TS 38.331 [2] is fulfilled for a period of $T_{SearchDeltaP\text{-}Connected}$ and good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the serving cell based on the measurements that are configured for SSB-based or CSI-RS based RLM on SpCell together with CSI-RS based BFD on SCell in the intra-band carrier aggregation.
- for other serving cells, when
  - the good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the serving cell configured with BFD-RS if the *lowMobilityEvaluationConnected* is not configured, or
  - the UE is also configured with *lowMobilityEvaluationConnected*, and both low mobility criterion defined in clause 5.7.13.1 of TS 38.331 [2] is fulfilled for a period of $T_{SearchDeltaP\text{-}Connected}$ and good serving cell quality criterion defined in clause 5.7.13.2 of TS 38.331 [2] is fulfilled for the serving cell configured with BFD-RS.

Otherwise, UE shall apply the requirements defined in clause 8.5.2.2 for SSB based beam failure detection and the requirements defined in clause 8.5.3.2 for CSI-RS based beam failure detection. Note that when multiple resources are configured on a serving cell for RLM or BFD evaluation, the good serving cell quality critierion is considered as

fulfilled for the serving cell when any resource configured for the cell fulfills the good serving defined in clause 5.7.13.2 of TS 38.331 [2].

The scenario and RS resource configurations in the set $\bar{q}_0$ defined in clause 8.5.1 apply for this clause.

The UE is no longer allowed to relax BFD measurements and apply the relaxed link recovery procedures provided that at least one of the following conditions is met:

- The timer *beamFailureDetectionTimer* is running.
- No DRX is configured or configured DRX cycle is longer than 80 ms

NOTE: Applicability of DRX configuration follows TS 38.331 [2] clause 5.7.13.0.

8.5.2 Requirements for SSB based beam failure detection

8.5.2.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\bar{q}_0$ configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5.2.2 unless the UE supports *bwpOperationMeasWithoutInterrupt-r18*, provided that the SSB is within the configured UE-specific CBW. The requirements in this clause could not be applicable if UE is required to perform beam failure detection on more than 1 serving cell per band unless otherwise specified. For UE supporting *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided for the configured FR1 intra-band non-contiguous CA, the requirements in this clause apply when UE is required to perform beam failure detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers, and no more than 1 serving cell per band otherwise.

For UE supporting *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v19xy* is *"type 4"*

3> the requirements in this clause apply when UE is required to perform beam failure detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers

2> if *nonCollocatedTypeNR-CA-v19xy* is *"type 1"*

3> the requirements in this clause apply when UE is required to perform beam failure detection on no more than 1 serving cell per band

2> else if *nonCollocatedTypeNR-CA-v19xy* is not provided

3> the requirements in this clause apply when UE is required to perform beam failure detection on no more than 1 serving cell per band

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> the requirements in this clause apply when UE is required to perform beam failure detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers

2>else

3> the requirements in this clause apply when UE is required to perform beam failure detection on no more than 1 serving cell per band

Table 8.5.2.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0

Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	Same as the SCS of RMSI CORESET
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.5.2.1-2: PDCCH transmission parameters for beam failure instance for a UE operating on a cell with less than 5 MHz BW

Attribute	**Value for BLER**		
Channel BW	**3 MHz**		**5 MHz**
[DL Transmission BW]	**12 PRBs**	**15 PRBs**	**20 PRBs**
DCI format	1-0		
Number of control OFDM symbols	2	3	3
Aggregation level (CCE)	4	8 Note 1	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB		
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB		
Bandwidth (PRBs)	12	15	20
Sub-carrier spacing (kHz)	Same as the SCS of RMSI CORESET		
DMRS precoder granularity	REG bundle size		
REG bundle size	6		
CP length	Normal		
Mapping from REG to CCE	Distributed	Non-Distributed Note2	[Distributed]
NOTE 1: PDCCH puncturing as defined in TS 38.214 [26] applies. NOTE 2: For 15PRB Transmission BW, distributed mapping may lead to unexpected beam failure detection.			

8.5.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set $\tilde{q}_0$ estimated over the last $T_{Evaluate_BFD_SSB}$ period becomes worse than the threshold $Q_{out_LR_SSB}$ within $T_{Evaluate_BFD_SSB}$ period.

The value of $T_{Evaluate_BFD_SSB}$ is defined in table 8.5.2.2-1 or table 8.5.2.2-4 (deactivated PSCell) for FR1.

The value of $T_{Evaluate_BFD_SSB}$ is defined in table 8.5.2.2-2 or table 8.5.2.2-5 (deactivated PSCell) for FR2 with scaling factor N, where

- N = 2, 4 or 6 for serving cell in FR2-1 for UE supporting *fastBeamSweepingMultiRx-r18* according to the conditions in clause 3.6.19,
- N=8 for other cases in FR2-1, and
- N=12 for FR2-2,

for FR2 power classes other than power class 6 or for FR2 power class 6 when *highSpeedMeasFlagFR2-r17* is not configured.

The value of $T_{Evaluate_BFD_SSB}$ is defined in table 8.5.2.2-5 (deactivated PSCell) for FR2 with scaling factor N=8 for FR2-1 and N=12 for FR2-2, for FR2 power classes other than power class 6 or for FR2 class 6 when *highSpeedMeasFlagFR2-r17* is not configured.

The value of $T_{Evaluate_BFD_SSB}$ is defined in table 8.5.2.2-3 for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*.

For a UE supporting LowBandCA-via-Switching-r19, or for a UE supporting [*support for Case 1 requirements*] and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting [*support for Case 2 requirements*] and when concurrent measurement gap(s) with NCSG(s) are configured, or a UE supporting

concurrentMeasGap-r17 or *[musim-GapPreference-r17]* or both *concurrentMeasGap-r17* and *[musim-GapPreference-r17]*, and when concurrent gaps or periodic MUSIM gaps or both concurrent GAPs and periodic MUSIM gaps are configured,

- an SSB resource occasion for beam failure detection is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clauses 9.1.8 and 9.1.10,
- P value for a BFD-RS resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with $N_{available}$> 0
- For a window W of duration max(T_{L1}, xRP_max, switching pattern periodicity), where xRP_max is the maximum xRP across all configured per-UE measurement gaps or periodic MUSIM gap(s) or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any BFD-RS resource occasion:
  - N_{total} is the total number of BFD-RS resource occasions within the window W, including those overlapped with GAP occasions, MUSIM gap occasions or SMTC occasions within the window W,

    For UEs supporting LB CA via switching and configured with low band CA via switching:
    - for the BFD monitoring on PCell, N_{total} also includes SSB resource occasions that overlap with the SDL ON duration within the window,
    - for the BFD monitoring on SCell, N_{total} also includes SSB resource occasions that overlap with the PCell ON duration within the window, as defined by the configured switching pattern, and
  - $N_{outside_MG}$ is the number of BFD-RS resource occasions within the window W,
    - that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion, and
    - that are overlapped with PCell ON duration corresponding to the LB CA switching pattern, for the BFD on PCell for a UE supporting *LowBandSwitching-r19* and configured with low band CA via switching,
    - that are overlapped with SCell ON duration corresponding to the LB CA switching pattern, for the BFD on SCell for a UE supporting *LowBandSwitching-r19* and configured with low band CA via switching, and
  - $N_{available}$ is the number of BFD-RS resource occasions that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion nor any SMTC occasion within the window W, and
  - an SSB resource occasion for beam failure detection is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion, and- T_{L1} is periodicity of the target BFD-RS.
  - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.
  - for UE not supporting LB CA via switching, switching pattern periodicity is not applicable.
  - BFD requirement in this clause is not applied when $N_{outside_MG}$ = 0.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* nor supporting *musim-GapPreference-r17* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG(s), and periodic MUSIM gaps,

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB.

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the SSB.

For FR2

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when BFD-RS resource is not overlapped with GAPs and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).

- $P = P_{sharing\ factor}$, when the BFD-RS resource is not overlapped with GAP and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{SSB}}{xRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and

  - $T_{SMTCperiod} \neq$ xRP or

  - $T_{SMTCperiod}$ = xRP and $T_{SSB} < 0.5*T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{xRP}}$, when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod}$ = xRP and $T_{SSB} = 0.5*T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{SSB}}{Min(xRP, T_{SMTCperiod})}}$, when the BFD-RS resource is partially overlapped with GAP (T_{SSB} <xRP) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP.

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{xRP}}$, when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod}$ < xRP)

where,

- $P_{sharing\ factor}$ = 1, if the BFD-RS resource outside GAP is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

  - not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{sharing\ factor}$ = 3, otherwise.

- If the higher layer in TS 38.331 [2] signalling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, given the SMTC offset of all CCs in FR2 provided the same offset.

- When a GAP is configured only and the GAP is not NCSG,

  - a BFD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a GAP occasion, and

  - xRP = MGRP

- Otherwise, when NCSG only is configured,

- a BFD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if
  - it overlaps the VIL1 or VIL2 of NCSG, or

    it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,
- and
  - xRP = VIRP
- If the UE is configured with Pre-MG only, a BFD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.
- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG(s) are configured, a BFD-RS resource or an SMTC occasion is not considered to be overlapped by a GAP occasion if the GAP occasion is dropped according to clause 9.1.8, clause 9.1.12, clause 9.1.13, respectively.

For UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, the UE is not required to perform SSB measurements during the cancelled gap occasions, and no restrictions on the scheduling availability apply during the cancelled gap occasions.

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and GAP configurations does not meet previous conditionsFor either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

When the configured aperiodic MUSIM gap is overlapping with SSB resource occasion for beam failure detection, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and if SSB resource occasions for beam failure detection are fully overlapped with MUSIM gap(s), or the union of MUSIM gap(s) and GAPs, no requirement applies for SSB based beam failure detection.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 8.5.2.2-1: Evaluation period $T_{Evaluate_BFD_SSB}$ for FR1

Configuration	$T_{Evaluate_BFD_SSB}$ (ms)
no DRX	$Max(50, Ceil(5 \times P) \times T_{SSB})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(7.5 \times P) \times Max(T_{DRX}, T_{SSB}))$
DRX cycle > 320 ms	$Ceil(5 \times P) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.	

Table 8.5.2.2-2: Evaluation period $T_{Evaluate_BFD_SSB}$ for FR2

Configuration	$T_{Evaluate_BFD_SSB}$ (ms)
no DRX	$Max(50, Ceil(5 \times P \times N) \times T_{SSB})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(7.5 \times P \times N) \times Max(T_{DRX}, T_{SSB}))$
DRX cycle > 320 ms	$Ceil(5 \times P \times N) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.	

Table 8.5.2.2-3: Evaluation period $T_{Evaluate_BFD_SSB}$ for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*

Configuration	$T_{Evaluate_BFD_SSB}$ (ms)
no DRX	$Max(50, Ceil(5 \times P \times N^{Note2}) \times T_{SSB})$
DRX cycle ≤ 80 ms	$Max(50, Ceil(7.5 \times P \times N^{Note2}) \times Max(T_{DRX}, T_{SSB}))$

Note 1:	T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.
Note 2:	scaling factor N=2 when *highSpeedMeasFlagFR2-r17* is configured to set1 or scaling factor N=6 when *highSpeedMeasFlagFR2-r17* is configured to set2, if UE is not supporting *simultaneousReceptionTwoQCL-r18* or when *highSpeedDeploymentTypeFR2-r17* is not configured as bidirectional; Scaling factor N=1.5 when *highSpeedMeasFlagFR2-r17* is configured to set1 or scaling factor N=4 when *highSpeedMeasFlagFR2-r17* is configured to set2, if UE is supporting *simultaneousReceptionTwoQCL-r18* and when *highSpeedDeploymentTypeFR2-r17* is configured as bidirectional.

Table 8.5.2.2-4: Evaluation period $T_{Evaluate_BFD_SSB}$ for deactivated PSCell in FR1

Configuration	$T_{Evaluate_BFD_SSB}$ (ms)
no DRX	Ceil(5 × P) × measCyclePscell
DRX cycle ≤ 320 ms	Ceil(7.5 × P) × Max(measCyclePscell, T_{DRX})
DRX cycle > 320 ms	Ceil(5 × P) × Max(measCyclePscell, T_{DRX})
NOTE: DRX cycle is the configured DRX cycle of the PSCell. measCyclePSCell is the measurement cycle length of the deactivated PSCell.	

Table 8.5.2.2-5: Evaluation period $T_{Evaluate_BFD_SSB}$ for deactivated PSCell in FR2

Configuration	$T_{Evaluate_BFD_SSB}$ (ms)
no DRX	Ceil(5 × P × N) × measCyclePscell
DRX cycle ≤ 320 ms	Ceil(7.5 × P × N) × Max(measCyclePscell, T_{DRX})
DRX cycle > 320 ms	Ceil(5 × P × N) × Max(measCyclePscell, T_{DRX})
NOTE: DRX cycle is the configured DRX cycle of the PSCell. measCyclePSCell is the measurement cycle length of the deactivated PSCell.	

8.5.2.3 Measurement restriction for SSB based beam failure detection

The UE is required to be capable of measuring SSB for BFD without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following scenarios.

For FR1, when the SSB OFDM symbols used for BFD measurement fully or partially overlap with CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for BFD measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for BFD measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

For FR2, when the SSB for BFD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

For FR2, when the SSB for BFD measurement on one CC is in the same or adjacent OFDM symbol as SSB from cell with additional PCI for L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSBs. Longer measurement period for SSB based BFD is expected, and no requirements are defined.

For FR2, when the SSB for BFD measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both SSBs. Longer measurement period for SSB based BFD is expected, and no requirements are defined.

For FR2, when the SSB for BFD measurement on one CC fully or partially overlaps with the OFDM symbol as CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement, UE is required to measure one of but not both SSB and CSI-RS. Longer measurement period for SSB based BFD is expected, and no requirements are defined.

For FR2, if the network configures same or mixed numerology between SSB for BFD measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, UE shall be able to perform the related SSB based measurements in one band without any measurement restrictions on the other band, provided that UE is capable of independent beam management on this FR2 band pair.

8.5.2.4 Minimum requirement of SSB based beam failure detection for UE fulfilling relaxed measurement criteria

This clause contains minimum requirements for SSB based relaxed beam failure detection.

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set $\bar{q}_0$ estimated over the last $T_{Evaluate_BFD_SSB_Relax}$ period becomes worse than the threshold $Q_{out_LR_SSB}$ within $T_{Evaluate_BFD_SSB_Relax}$ period.

The value of $T_{Evaluate_BFD_SSB_Relax}$ is defined in table 8.5.2.4-1 for FR1.

The value of $T_{Evaluate_BFD_SSB_Relax}$ is defined in table 8.5.2.4-2 for FR2 with scaling factor N=8.

The value of P is defined in clause 8.5.2.2.

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{identify_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 8.5.2.4-1: Evaluation period $T_{Evaluate_BFD_SSB_Relax}$ for FR1

Configuration	$T_{Evaluate_BFD_SSB_Relax}$ (ms)
$Max(T_{DRX}, T_{SSB}) \le 80$ ms	$Max(50 \times K3, Ceil(7.5 \times K1 \times P) \times Max(T_{DRX},T_{SSB}))$
80 ms $< Max(T_{DRX}, T_{SSB}) \le 160$ ms	$Max(50, Ceil(7.5 \times P) \times Max(T_{DRX},T_{SSB}))$
Note 1: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length and no longer than 80ms. Note 2: K1 is the relaxation factor. K1 = 2 for 40ms $< Max(T_{DRX}, T_{SSB}) \le 80$ ms, K1 = 4 for $Max(T_{DRX}, T_{SSB}) \le 40$ ms Note 3: K3 is the relaxation factor for the lower bound. K3 = K1, if 1 < K1 ≤ 2; K3 = 1 otherwise.	

Table 8.5.2.4-2: Evaluation period $T_{Evaluate_BFD_SSB_Relax}$ for FR2

Configuration	$T_{Evaluate_BFD_SSB_Relax}$ (ms)
$Mas(T_{DRX}, T_{SSB}) \le 80$ ms	$Max(50 \times K4, Ceil(7.5 \times K2 \times P \times N) \times Max(T_{DRX},T_{SSB}))$
80 ms $< Max(T_{DRX}, T_{SSB}) \le 160$ ms	$Max(50, Ceil(7.5 \times P \times N) \times Max(T_{DRX},T_{SSB}))$
Note 1: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length and no longer than 80ms. Note 2: K2 is the relaxation factor. K2 = 2. Note 3: K4 is the relaxation factor for the lower bound. K4 = K2, if 1 < K2 ≤ 2; K4 = 1 otherwise.	

8.5.3 Requirements for CSI-RS based beam failure detection

8.5.3.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\bar{q}_0$ of resource configurations for a serving cell, provided that the CSI-RS resource(s) in set $\bar{q}_0$ for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5.3.2. UE is not expected to perform beam failure detection measurements on the CSI-RS configured for BFD if the CSI-RS is not QCL-ed, with QCL-TypeD when applicable, with the RS in the active TCI state of any CORESET configured in the UE active BWP. The requirements in this clause apply when UE is required to perform beam failure detection on no more than 1 serving cell per band unless otherwise specified. For UE supporting *intraBandNR-CA-non-collocated-r18* and *nonCollocatedTypeNR-CA-r18* is not provided for the configured FR1 intra-band non-contiguous CA, the requirements in this clause apply when UE is required to perform beam failure detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers, and no more than 1 serving cell per band otherwise.

For UE supporting *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v19xy* is *"type 4"*

3> the requirements in this clause apply when UE is required to perform beam failure detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers

2> if *nonCollocatedTypeNR-CA-v19xy* is *"type 1"*

3> the requirements in this clause apply when UE is required to perform beam failure detection on no more than 1 serving cell per band

2> else if *nonCollocatedTypeNR-CA-v19xy* is not provided

3> the requirements in this clause apply when UE is required to perform beam failure detection on no more than 1 serving cell per band

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> the requirements in this clause apply when UE is required to perform beam failure detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers

2>else

3> the requirements in this clause apply when UE is required to perform beam failure detection on no more than 1 serving cell per band

Table 8.5.3.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0 dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.5.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set $\tilde{q}_0$ estimated over the last $T_{Evaluate_BFD_CSI\text{-}RS}$ period becomes worse than the threshold $Q_{out_LR_CSI\text{-}RS}$ within $T_{Evaluate_BFD_CSI\text{-}RS}$ period.

The value of $T_{Evaluate_BFD_CSI\text{-}RS}$ is defined in table 8.5.3.2-1 or table 8.5.3.2-3 (deactivated PSCell) for FR1.

The value of $T_{Evaluate_BFD_CSI\text{-}RS}$ is defined in table 8.5.3.2-2 or table 8.5.3.2-4 (deactivated PSCell) for FR2 with N=1. The requirements of $T_{Evaluate_BFD_CSI\text{-}RS}$ apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

- For a UE supporting LowBandCA-via-Switching-r19, or for a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent measurement gap(s) with NCSG(s) are configured, or a UE supporting *concurrentMeasGap-r17* or *[musim-GapPreference-r17]* or both *concurrentMeasGap-r17* and *musim-GapPreference-r17,* and when concurrent gaps or periodic MUSIM gaps or both concurrent GAPs and periodic MUSIM gaps are configured,

- an CSI-RS resource occasion for beam failure detection is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8 and 9.1.10,

- P value for a BFD-RS resource to be measured is defined as

  - N_{total} / $N_{outside_MG}$ in FR1

  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0

  - N_{total} / $N_{available}$ in FR2 with $N_{available}$> 0

- For a window W of duration max($T_{L1,}$ xRP_max, switching pattern periodicity), where xRP_max is the maximum xRP across all configured per-UE measurement gaps or MUSIM gap(s) or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any BFD-RS resource occasion:

  - N_{total} is the total number of BFD-RS resource occasions within the window W, including those overlapped with GAP occasions, MUSIM gap occasions or SMTC occasions within the window W,

    For UEs supporting LB CA via switching and configured with low band CA via switching:

    - for the BFD monitoring on PCell, N_{total} also includes SSB resource occasions that overlap with the SDL ON duration within the window,

    - for the BFD monitoring on SCell, N_{total} also includes SSB resource occasions that overlap with the PCell ON duration within the window, as defined by the configured switching pattern, and

  - $N_{outside_MG}$ is the number of BFD-RS resource occasions within the window W, that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion, and

    - that are overlapped with PCell ON duration corresponding to the LB CA switching pattern, for the BFD on PCell for a UE supporting *LowBandSwitching-r19* and configured with low band CA via switching,

    - that are overlapped with SCell ON duration corresponding to the LB CA switching pattern, for the BFD on SCell for a UE supporting *LowBandSwitching-r19* and configured with low band CA via switching, and

  - $N_{available}$ is the number of BFD-RS resource occasions that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion nor any SMTC occasion within the window W, and

  - an CSI-RS resource occasion for beam failure detection is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion, and

    T_{L1} is periodicity of the target BFD-RS.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.
- for UE not supporting LB CA via switching, switching pattern periodicity is not applicable.
- BFD requirement in this clause is not applied when $N_{outside_MG} = 0$.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* nor supporting *musim-GapPreference-r17* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG(s), and periodic MUSIM gaps,For FR1,

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS.
- P = 1 when in the monitored cell there are no GAPs overlapping with any occasion of the CSI-RS.

For FR2,

- P = 1, when the BFD-RS resource is not overlapped with GAP and also not overlapped with SMTC occasion.
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$, when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is not overlapped with SMTC occasion ($T_{CSI-RS} < xRP$)
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is not overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).
- $P = P_{sharing\ factor}$, when the BFD-RS resource is not overlapped with GAP and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{xRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and
  - $T_{SMTCperiod} \neq xRP$ or
  - $T_{SMTCperiod} = xRP$ and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{xRP}}$, when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod} = xRP$ and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{Min(xRP,T_{SMTCperiod})}}$, when the BFD-RS resource is partially overlapped with GAP ($T_{CSI-RS} < xRP$) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP.
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{xRP}}$, when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod} < xRP$)

where,

- $P_{sharing\ factor} = 1$, if the BFD-RS resource outside gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure*

is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{sharing\ factor}$ = 3, otherwise.

- If the higher layer in TS 38.331 [2] signalling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

- When a GAP is configured only and the GAP is not NCSG,

  - a BFD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a GAP occasion, and

  - xRP = MGRP

- Otherwise, when NCSG GAP only is configured,

  - a BFD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if

    - it overlaps the VIL1 or VIL2 of NCSG, or

    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

  - and

    - xRP = VIRP

    - If the UE is configured with Pre-MG only, a BFD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG(s) are configured, a BFD-RS resource or an SMTC occasion is not considered to be overlapped by a GAP occasion if the GAP occasion is dropped according to clause 9.1.8, clause 9.1.12, clause 9.1.13, respectively.

NOTE: The overlap between CSI-RS for BFD and SMTC means that CSI-RS for BFD is within the SMTC window duration.

For the value of L1,

1> If the UE does not support *supportSBFD* or SBFD is not configured by the network

2> L1 is not applicable;

1> Else if the UE supports *supportSBFD* and SBFD is configured by the network

2> If DRX is not configured,

3> L1 is the number of occasions of the configured BFD-RS resource that are overlapping with the dynamic UL transmission on SBFD symbols during $T_{Evaluate_BFD_CSI-RS}$;

2> Else if DRX is configured,

3> L1 is the number of DRX cycles in which at least one occasion of the BFD-RS resource is overlapping with the dynamic UL transmission on SBFD symbols during $T_{Evaluate_BFD_CSI-RS}$.

If the UE supports *supportSBFD* and SBFD is configured by the network, the requirements in this clause apply provided that all occasions of the BFD-RS resource are in the same type (i.e., SBFD or non-SBFD) of symbols.

For UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, the UE is not required to perform CSI-RS measurements during the cancelled gap occasions, and no restrictions on the scheduling availability apply during the cancelled gap occasions.

Longer evaluation period would be expected if the combination of the BFD-RS resource, SMTC occasion and GAP configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

When the configured aperiodic MUSIM gap is overlapping with CSI-RS resource occasion for beam failure detection, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and if CSI-RS resource occasions for beam failure detection are fully overlapped with MUSIM gap(s), or the union of MUSIM gap(s) and GAPs, no requirement applies for CSI-RS based beam failure detection.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{identify_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of M_{BFD} used in table 8.5.3.2-1 and table 8.5.3.2-2 are defined as

- M_{BFD} = 10, if the CSI-RS resource(s) in set $\bar{q}_0$ used for BFD is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs.

Note: If UE supports *supportSBFD* and SBFD is configured by the network, the requirements in this clause apply provided that CSI-RS resource(s) in set $\bar{q}_0$ used for BFD is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs in at least one DL subband.

The values of P_{BFD} used in table 8.5.3.2-1 and table 8.5.3.2-2 are defined as

For each CSI-RS resource in the set $\bar{q}_0$ configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- P_{BFD} = 1.

For each CSI-RS resource in the set $\bar{q}_0$ configured for PSCell in NR-DC

- P_{BFD} = 2 if UE is configured for beam failure detection on SCell, 1 otherwise.

For each CSI-RS resource in the set $\bar{q}_0$ configured for a SCell

- P_{BFD} = Z in EN-DC or NE-DC or SA.
- P_{BFD} = 2* Z in NR-DC.
  - Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell.

Table 8.5.3.2-1: Evaluation period $T_{Evaluate_BFD_CSI-RS}$ for FR1

Configuration	$T_{Evaluate_BFD_CSI-RS}$ (ms)
no DRX	$Max(50, Ceil((M_{BFD}+L1) \times P \times P_{BFD}) \times Max(T_{CSI-RS}, T_{proc}))$
DRX cycle $\leqslant$ 320 ms	$Max(50, Ceil(1.5 \times (M_{BFD}+L1) \times P \times P_{BFD}) \times Max(T_{DRX}, T_{CSI-RS}, T_{proc}))$
DRX cycle > 320 ms	$Ceil((M_{BFD}+L1) \times P \times P_{BFD}) \times T_{DRX}$
NOTE 1: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length. NOTE 2: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for BFD is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

Table 8.5.3.2-2: Evaluation period $T_{Evaluate_BFD_CSI-RS}$ for FR2

Configuration	$T_{Evaluate_BFD_CSI-RS}$ (ms)
no DRX	$Max(50, Ceil((M_{BFD}+L1) \times P \times N \times P_{BFD}) \times Max(T_{CSI-RS}, T_{proc}))$

DRX cycle $\leqslant$ 320 ms	Max(50, Ceil(1.5 × (M_{BFD}+L1) × P × N × P_{BFD}) × Max(T_{DRX}, T_{CSI-RS}, T_{proc}))
DRX cycle > 320 ms	Ceil((M_{BFD}+L1) × P × N × P_{BFD}) × T_{DRX}
NOTE 1: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\overline{q}_0$. T_{DRX} is the DRX cycle length.	
NOTE 2: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for BFD is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

Table 8.5.3.2-3: Evaluation period $T_{Evaluate_BFD_CSI-RS}$ for deactivated PSCell in FR1

Configuration	$T_{Evaluate_BFD_CSI-RS}$ (ms)
no DRX	Ceil(M_{BFD} × P × P_{BFD}) × measCyclePscell
DRX cycle ≤ 320 ms	Ceil(1.5 × M_{BFD} × P × P_{BFD}) × Max(T_{DRX}, measCyclePscell)
DRX cycle > 320 ms	Ceil(M_{BFD} × P × P_{BFD}) × Max(T_{DRX}, measCyclePscell)
NOTE: DRX cycle is the configured DRX cycle of the PSCell. measCyclePSCell is the measurement cycle length of the deactivated PSCell.	

Table 8.5.3.2-4: Evaluation period $T_{Evaluate_BFD_CSI-RS}$ for deactivated PSCell in FR2

Configuration	$T_{Evaluate_BFD_CSI-RS}$ (ms)
no DRX	Ceil(M_{BFD} × P × N × P_{BFD}) × measCyclePscell
DRX cycle ≤ 320 ms	Ceil(1.5 × M_{BFD} × P × N × P_{BFD}) × Max(T_{DRX}, measCyclePscell)
DRX cycle > 320 ms	Ceil(M_{BFD} × P × N × P_{BFD}) × Max(T_{DRX}, measCyclePscell)
NOTE: DRX cycle is the configured DRX cycle of the PSCell. measCyclePSCell is the measurement cycle length of the deactivated PSCell.	

8.5.3.3 Measurement restrictions for CSI-RS beam failure detection

The SSB mentioned in this clause can be associated with either the serving cell PCI or a PCI different from serving cell PCI or intra-frequency neighbor cell(s) configured with L1-RSRP measurement or inter-frequency neighbor cell(s) configured with L1-RSRP measurement without gap.

The UE is required to be capable of measuring CSI-RS for BFD without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following scenarios.

For both FR1 and FR2, when the CSI-RS for BFD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for BFD measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement has same SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement has different SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for BFD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

For FR2, when the CSI-RS for BFD measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD or L1-RSRP measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.For both FR1 and FR2, when the CSI-RS for BFD measurement fully or partially overlaps with the OFDM symbol as SSB or CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, UE is not required

to receive CSI-RS for BFD measurement in the PRBs that overlap with an SSB or CSI-RS from candidate LTM neighbour cell.

For FR1, when the CSI-RS for BFD measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, if CSI-RS and SSB have different SCS and UE does not support simultaneousRxDataSSB-DiffNumerology, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD is expected, and no requirements are defined.

For FR2, when the CSI-RS for BFD measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD is expected, and no requirements are defined.

For FR2, when the CSI-RS for BFD measurement on one CC fully or partially overlaps with the OFDM symbol as CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement, UE is required to measure one of but not both CSI-RS for BFD measurement and CSI-RS for candidate LTM neighbour cell for intra-frequency L1-RSRP measurement. Longer measurement period for CSI-RS based BFD is expected, and no requirements are defined.

For FR2, when the CSI-RS for BFD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for BFD measurement and the other CSI-RS. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.
  - The CSI-RS for BFD measurement or the other CSI-RS in a resource set configured with repetition ON, or
  - The other CSI-RS is configured in set $\tilde{q}_1$ and beam failure is detected, or
  - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

For FR2-1, when the first CSI-RS for BFD measurement is in the same OFDM symbol as the second CSI-RS for RLM, BFD or L1-RSRP measurement on the same serving cell according to the conditions in clause 3.6.19, the UE supporting *schedulingMeasurementRelaxation-r18* is required to measure both the first and the second CSI-RSs without measurement restrictions, provided the following conditions are met:

- Both CSI-RSs are not in any CSI-RS resource set with repetition ON, and
- One CSI-RS has same QCL source as either
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to TS 38.214 [26] clause 5.1.5, and
- the other CSI-RS has same QCL source as either
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to TS 38.214 [26] clause 5.1.5, and
- Resources of the active TCI states of the two PDSCHs, or QCL sources of the default QCL assumption, or the active TCI state of PDSCH and QCL source of the default QCL assumption have been reported as a resource group in Rel-17 group-based RSRP report.

8.5.3.4 Minimum requirement of CSI-RS based beam failure detection for UE fulfilling relaxed measurement criteria

This clause contains the minimum requirements for CSI-RS based relaxed beam failure detection.

UE shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set $\bar{q}_0$ estimated over the last $T_{Evaluate_BFD_CSI-RS_Relax}$ period becomes worse than the threshold $Q_{out_LR_CSI-RS}$ within $T_{Evaluate_BFD_CSI-RS_Relax}$ period.

The value of $T_{Evaluate_BFD_CSI-RS_Relax}$ is defined in table 8.5.3.4-1 for FR1.

The value of $T_{Evaluate_BFD_CSI-RS_Relax}$ is defined in table 8.5.3.4-2 for FR2 with N=1.

The values of P, M_{BFD} and P_{BFD} is defined in clause 8.5.3.2.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 8.5.3.4-1: Evaluation period $T_{Evaluate_BFD_CSI-RS_Relax}$ for FR1

Configuration	$T_{Evaluate_BFD_CSI-RS\ Relax}$ (ms)
$Max(T_{DRX}, T_{CSI-RS}) \le 80$ ms	$Max(50 \times K3, Ceil(K1 \times 1.5 \times M_{BFD} \times P \times P_{BFD}) \times Max(T_{DRX}, T_{CSI-RS}))$
NOTE 1: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length and no longer than 80 ms. NOTE 2: K1 is the relaxation factor. K1 = 2 for 40 ms < $MAX(T_{DRX}, T_{CSI-RS}) \le 80$ ms, K1 = 4 for $MAX(T_{DRX}, T_{CSI-RS}) \le 40$ ms NOTE 3: K3 is the relaxation factor for the lower bound. K3 = K1, if 1 < K1 ≤ 2; K3 = 1 otherwise.	

Table 8.5.3.4-2: Evaluation period $T_{Evaluate_BFD_CSI-RS_Relax}$ for FR2

Configuration	$T_{Evaluate_BFD_CSI-RS\ Relax}$ (ms)
$Max(T_{DRX}, T_{CSI-RS}) \le 80$ ms	$Max(50 \times K4, Ceil(K2 \times 1.5 \times M_{BFD} \times P \times N \times P_{BFD}) \times Max(T_{DRX}, T_{CSI-RS}))$
NOTE 1: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length and no longer than 80 ms. NOTE 2: K2 is the relaxation factor. K2 = 2 NOTE 3: K4 is the relaxation factor for the lower bound. K4 = K2, if 1 < K2 ≤ 2; K4 = 1 otherwise.	

8.5.4 Minimum requirement for L1 indication

When the radio link quality on all the RS resources in set $\bar{q}_0$ is worse than Q_{out_LR}, layer 1 of the UE shall send a beam failure instance indication to the higher layers

The beam failure instance evaluation for the RS resources in set $\bar{q}_0$ shall be performed as specified in clause 6 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication_interval_BFD}$.

When DRX is not used, $T_{Indication_interval_BFD}$ is max(2ms, $T_{SSB-RS,M}$)) or max(2ms, $T_{CSI-RS,M}$), where $T_{SSB-RS,M}$ and $T_{CSI-RS,M}$ is the shortest periodicity of all RS resources in set $\bar{q}_0$ for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set $\bar{q}_0$ or CSI-RS resource in the set $\bar{q}_0$.

When DRX is used, for SSB based link quality measurement,

- $T_{Indication_interval_BFD} = Max(1.5 \times DRX_cycle_length, 1.5 \times T_{SSB-RS,M})$, if DRX_cycle_length ≤ 320 ms,
- $T_{Indication_interval_BFD}$ = DRX_cycle_length, if DRX_cycle_length > 320 ms.

When DRX is used, for CSI-RS based link quality measurement,

- $T_{Indication_interval_BFD} = Max(1.5 \times DRX_cycle_length, 1.5 \times T_{CSI-RS,M})$, if DRX_cycle_length ≤ 320 ms,
- $T_{Indication_interval_BFD}$ = DRX_cycle_length, if DRX_cycle_length > 320 ms.

For deactivated PSCell,

when DRX is not used, $T_{Indication_interval_BFD}$ is Max (2 ms, *measCyclePSCell*).

when DRX is used, for SSB based link quality measurement,

- $T_{Indication_interval_BFD}$ = Max (1.5 × DRX_cycle_length, 1.5 × *measCyclePSCell*), if DRX_cycle_length ≤ 320 ms,
- $T_{Indication_interval_BFD}$ = Max (DRX_cycle_length, *measCyclePSCell*), if DRX_cycle_length > 320 ms.

When DRX is used, for CSI-RS based link quality measurement,

- $T_{Indication_interval_BFD}$ = Max (1.5 × DRX_cycle_length, 1.5 × *measCyclePSCell*), if DRX_cycle_length ≤ 320 ms,
- $T_{Indication_interval_BFD}$ = Max (DRX_cycle_length, *measCyclePSCell*), if DRX_cycle_length > 320 ms.

8.5.5 Requirements for SSB based candidate beam detection

8.5.5.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\bar{q}_1$ configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5.5.2 unless the UE supports *bwpOperationMeasWithoutInterrupt-r18*, provided that the SSB is within the configured UE-specific CBW. The requirements in this clause apply when UE is required to perform candidate beam detection on no more than 1 serving cell per band unless otherwise specified. For UE supporting *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided for the configured FR1 intra-band non-contiguous CA, the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers, and no more than 1 serving cell per band otherwise.

For UE supporting *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v19xy* is *"type 4"*

3> the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers

2> if *nonCollocatedTypeNR-CA-v19xy* is *"type 1"*

3> the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 1 serving cell per band

2> else if *nonCollocatedTypeNR-CA-v19xy* is not provided

3> the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 1 serving cell per band

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers

2>else

3> the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 1 serving cell per band

For UE supporting *On-demand SSB operation* and when OD- SSB transmission is indicated, the UE shall be able to perform candidate beam detection of configured SSBs, provided that the SSB is within the configured DL BWP.

8.5.5.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set $\bar{q}_1$ estimated over the last $T_{Evaluate_CBD_SSB}$ period becomes better than the threshold Q_{in_LR} provided SSB_RP and SSB $\hat{E}s/Iot$ are according to Annex table B.2.4.1 for a corresponding band.The UE shall monitor the configured SSB resources using the evaluation period in table 8.5.5.2-1 and 8.5.5.2-2 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320 ms.

The value of $T_{Evaluate_CBD_SSB}$ is defined in table 8.5.5.2-1 for FR1.

The value of $T_{Evaluate_CBD_SSB}$ is defined in table 8.5.5.2-2 for FR2 with scaling factor N, where

- N = 2, 4 or 6 for serving cell in FR2-1 if the UE supports *fastBeamSweepingMultiRx-r18* according to the conditions in clause 3.6.19,
- N=8 for other cases in FR2-1, and
- N=12 for FR2-2.
- For a UE supporting LowBandCA-via-Switching-r19, or for a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent measurement gap(s) with NCSG(s) are configured, or a UE supporting *concurrentMeasGap-r17* or *musim-GapPreference-r17* or both *concurrentMeasGap-r17* and *musim-GapPreference-r17*, and when concurrent gaps or periodic MUSIM gaps or both concurrent GAPs and periodic MUSIM gaps are configured,
- an SSB resource occasion for candidate beam detection is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clauses 9.1.8 and 9.1.10,
- P value for a CBD-RS resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with $N_{available}$> 0
- For a window W of duration max($T_{L1,}$ xRP_max, switching pattern periodicity), where xRP_max is the maximum xRP across all configured per-UE measurement gaps or periodic MUSIM gap(s) or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any CBD-RS resource occasion:
  - N_{total} is the total number of CBD-RS resource occasions within the window W, including those overlapped with GAP occasions, MUSIM gap occasions or SMTC occasions within the window W,

    For UEs supporting LB CA via switching and configured with low band CA via switching:
    - for the BFD monitoring on PCell, N_{total} also includes SSB resource occasions that overlap with the SDL ON duration within the window,
    - for the BFD monitoring on SCell, N_{total} also includes SSB resource occasions that overlap with the PCell ON duration within the window, as defined by the configured switching pattern, and
  - $N_{outside_MG}$ is the number of CBD-RS resource occasions within the window W,
    - that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion, and
    - that are overlapped with PCell ON duration corresponding to the LB CA switching pattern, for the BFD on PCell for a UE supporting *LowBandSwitching-r19* and configured with low band CA via switching.
    - that are overlapped with SCell ON duration corresponding to the LB CA switching pattern, for the BFD on SCell for a UE supporting *LowBandSwitching-r19* and configured with low band CA via switching, and

- $N_{available}$ is the number of CBD-RS resource occasions that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion nor any SMTC occasion within the window W, and

- an SSB resource occasion for candidate beam detection is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion, and

  - T_{L1} is periodicity of the target CBD-RS.

  - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

  - for UE not supporting LB CA via switching, switching pattern periodicity is not applicable.

  - CBD requirement in this clause is not applied when $N_{outside_MG} = 0$.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* nor supporting *musim-GapPreference-r17* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s), concurrent measurement gap(s) with NCSG(s), and periodic MUSIM gaps,

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB,

- P = 1 when in the monitored cell there are no GAPs overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).

- P is $P_{sharing\ factor}$, when candidate beam detection RS is not overlapped with GAP and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{SSB}}{xRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and

  - $T_{SMTCperiod} \neq$ xRP or

  - $T_{SMTCperiod}$ = xRP and $T_{SSB} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{xRP}}$, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod}$ = xRP and $T_{SSB} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{SSB}}{Min(xRP,T_{SMTCperiod})}}$, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{xRP}}$, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod} <$ xRP)

where,

- $P_{sharing\ factor}$ = 1, if the CBD-RS resource outside gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{\text{sharing factor}} = 3$, otherwise.

- If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{\text{SMTCperiod}}$ follows *smtc2*; Otherwise $T_{\text{SMTCperiod}}$ follows *smtc1*. $T_{\text{SMTCperiod}}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

- When a measurement gap is configured and the measurement gap is not NCSG,

  - a CBD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

  - xRP = MGRP

- Otherwise, when NCSG is measurement gap only is configured,

  - a CBD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if

    - it overlaps the VIL1 or VIL2 of NCSG, or

    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

  - and

    - xRP = VIRP

    - If the UE is configured with Pre-MG only, an CBD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG(s) are configured, a CBD-RS resource or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8, clause 9.1.12, clause 9.1.13, respectively.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and GAP configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{\text{identify_CGI}}$ when the UE is requested to decode an NR CGI.

When the configured aperiodic MUSIM gap is overlapping with SSB resource occasion for candidate beam detection, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and if SSB resource occasions for candidate beam detection are fully overlapped with MUSIM gap(s), or the union of MUSIM gap(s) and GAPs, no requirement applies for SSB based candidate beam detection.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period $T_{\text{identify_CGI,E-UTRAN}}$ when the UE is requested to decode an LTE CGI.

The values of P_{CBD} used in table 8.5.5.2-1 and table 8.5.5.2-2 are defined as

For each SSB resource in the set $\tilde{q}_1$ configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- P_{CBD} = 1.

For each SSB resource in the set $\bar{q}_1$ configured for PSCell in NR-DC

- P_{CBD} = 2 if UE is configured for candidate beam detection on SCell, 1 otherwise.

For each SSB resource in the set $\bar{q}_1$ configured for a SCell

- P_{CBD} = Z in EN-DC or NE-DC or SA.
- P_{CBD} = 2* Z in NR-DC.
  - Where Z is the number of band(s) on which UE is performing candidate beam detection only for SCell
- P_{CBD} is the number of band(s) on which UE is performing candidate beam detection only for SCell.

Table 8.5.5.2-1: Evaluation period $T_{Evaluate_CBD_SSB}$ for FR1

Configuration	$T_{Evaluate_CBD_SSB}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	Max(25, Ceil(3 × P × P_{CBD}) × T_{SSB})
DRX cycle > 320 ms	Ceil(3 × P × P_{CBD}) × T_{DRX}
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_1$ for UE not supporting *On-demand SSB operation* or when OD-SSB transmission is not indicated, otherwise, T_{SSB} = EMP of SSB in the set $\bar{q}_1$. The EMP is the periodicity of OD-SSBs in the configured DL BWP if no first SSB transmission is configured, or if UE supports *timec1nc2* and OD-SSB transmission is indicated with first SSB transmission and the union of the first SSB transmission and OD-SSB transmission has a non-periodic time domain pattern, or the periodicity of the union of OD-SSBs and first SSBs if first SSBs are transmitted and the OD-SSB activation is indicated and the union of OD-SSBs and first SSBs has a periodic time domain pattern. T_{DRX} is the DRX cycle length.	

Table 8.5.5.2-2: Evaluation period $T_{Evaluate_CBD_SSB}$ for FR2

Configuration	$T_{Evaluate_CBD_SSB}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	Max(25, Ceil(3 × P × N × P_{CBD}) × T_{SSB})
DRX cycle > 320 ms	Ceil(3 × P × N × P_{CBD}) × T_{DRX}
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_1$ if UE not supporting *On-demand SSB operation* or when OD-SSB transmission is not indicated, otherwise, T_{SSB} = EMP of SSB in the set $\bar{q}_1$. The EMP is the periodicity of OD-SSBs in the configured DL BWP if no first SSB transmission is configured, or if UE supports *timec1nc2* and OD-SSB transmission is indicated with first SSB transmission and the union of the first SSB transmission and OD-SSB transmission has a non-periodic time domain pattern, or the periodicity of the union of OD-SSBs and first SSBs if first SSBs are transmitted and the OD-SSB activation is indicated and the union of OD-SSBs and first SSBs has a periodic time domain pattern. T_{DRX} is the DRX cycle length.	

8.5.5.3 Measurement restriction for SSB based candidate beam detection

For FR1, when the SSB OFDM symbols used for CBD measurement fully or partially overlap with CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for CBD measurement without any restrictions;
- If SSB and CSI-RS have different SCS
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for CBD measurement without any restriction;

- If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

For FR2, when the SSB for CBD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

For FR2, when the SSB for CBD measurement on one CC is in the same OFDM symbol as SSB from cell with additional PCI for BFD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSBs. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

For FR2, when the SSB for CBD measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both SSBs. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

For FR2, when the SSB for CBD measurement on one CC fully or partially overlaps with the OFDM symbol as CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement, UE is required to measure one of but not both SSB and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

For FR2, if network configures same or mixed numerology between SSB for CBD measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, UE shall be able to perform the related SSB based measurements in one band without any measurement restrictions in the other band, provided that UE is capable of independent beam management on this FR2 band pair.

For UE supporting *On-demand SSB operation*, when OD-SSB transmission is indicated without first SSB transmission, the measurement restriction is expected for OD-SSB occasions only.

For UE supporting *On-demand SSB operation*, when OD-SSB transmission is indicated with first SSB transmission, no measurement restriction is expected for first SSB occasions if UE supports *Time-C1nC2* and the union of the first SSB transmission and OD-SSB transmission has a non-periodic time domain pattern. Otherwise, the measurement restriction is expected for both first SSB and OD-SSB occasions.

8.5.6 Requirements for CSI-RS based candidate beam detection

8.5.6.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\bar{q}_1$ configured for a serving cell, provided that the CSI-RS resources configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5.6.2. The requirements in this clause apply when UE is required to perform candidate beam detection on no more than 1 serving cell per band unless otherwise specified. For UE supporting *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided for the configured FR1 intra-band non-contiguous CA, the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers, and no more than 1 serving cell per band otherwise.

For UE supporting *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v19xy* is *"type 4"*

3> the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers

2> if *nonCollocatedTypeNR-CA-v19xy* is *"type 1"*

3> the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 1 serving cell per band

2> else if *nonCollocatedTypeNR-CA-v19xy* is not provided

3> the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 1 serving cell per band

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 2 serving cells per band if these 2 serving cells are in non-contiguous carriers

2>else

3> the requirements in this clause apply when UE is required to perform candidate beam detection on no more than 1 serving cell per band

8.5.6.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set $\bar{q}_1$ estimated over the last $T_{Evaluate_CBD_CSI\text{-}RS}$ period becomes better than the threshold Q_{in_LR} within $T_{Evaluate_CBD_CSI\text{-}RS}$ period provided CSI-RS $\hat{E}s/Iot$ is according to annex B.2.4.2 for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in table 8.5.6.2-1 and 8.5.6.2-2 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320 ms.

The value of $T_{Evaluate_CBD_CSI\text{-}RS}$ is defined in table 8.5.6.2-1 for FR1.

The value of $T_{Evaluate_CBD_CSI\text{-}RS}$ is defined in table 8.5.6.2-2 for FR2 with scaling factor N, where

- N = 2, 4 or 6 for serving cell in FR2-1 if the UE supports *fastBeamSweepingMultiRx-r18* according to the conditions in clause 3.6.19
- N=8 for other cases in FR2-1, and
- N=12 for FR2-2.

For the value of L1,

1> If the UE does not support *supportSBFD* or SBFD is not configured by the network,

2> L1 is not applicable;

1> Else if the UE supports *supportSBFD* and SBFD is configured by the network,

2> If DRX is not configured,

3> L1 is the number of occasions of the CSI-RS resource for candidate beam detection that are overlapping with dynamic UL transmission on SBFD symbols during $T_{Evaluate_CBD_CSI\text{-}RS}$;

2> If DRX is configured,

3> L1 is the number of DRX cycles in which at least one occasion of the CSI-RS resource for candidate beam detection is overlapping with dynamic UL transmission on SBFD symbols during $T_{Evaluate_CBD_CSI\text{-}RS}$.

If the UE supports *supportSBFD* and SBFD is configured by the network, the requirements in this clause apply provided that all the occasions of the CSI-RS resource are in the same type (i.e., SBFD or non-SBFD) of symbols.

For a UE supporting LowBandCA-via-Switching-r19, or for a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent measurement gap(s) with NCSG(s) are configured, or a UE supporting *concurrentMeasGap-*

r17 or *musim-GapPreference-r17* or both *concurrentMeasGap-r17* and *musim-GapPreference-r17* and when concurrent gaps or periodic MUSIM gaps or both concurrent GAPs and periodic MUSIM gaps are configured,

- an CSI-RS resource occasion for candidate beam detection is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8 and 9.1.10,

- P value for a CBD-RS resource to be measured is defined as

  - N_{total} / $N_{outside_MG}$ in FR1

  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0

  - N_{total} / $N_{available}$ in FR2 with $N_{available}$> 0

- For a window W of duration max($T_{L1,}$ xRP_max, switching pattern periodicity), where xRP_max is the maximum xRP across all configured per-UE measurement gaps or periodic MUSIM gap(s) or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any CBD-RS resource occasion:

  - N_{total} is the total number of CBD-RS resource occasions within the window W, including those overlapped with GAP occasions, MUSIM gap occasions or SMTC occasions within the window W,

    For UEs supporting LB CA via switching and configured with low band CA via switching:

    - for the CBD monitoring on PCell, N_{total} also includes SSB resource occasions that overlap with the SDL ON duration within the window,

    - for the CBD monitoring on SCell, N_{total} also includes SSB resource occasions that overlap with the PCell ON duration within the window, as defined by the configured switching pattern, and

  - $N_{outside_MG}$ is the number of CBD-RS resource occasions within the window W,

    - that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion, and

    - that are overlapped with PCell ON duration corresponding to the LB CA switching pattern, for the CBD on PCell for a UE supporting *LowBandSwitching-r19* and configured with low band CA via switching, or

    - that are overlapped with SCell ON duration corresponding to the LB CA switching pattern, for the CBD on SCell for a UE supporting *LowBandSwitching-r19* and configured with low band CA via switching, and

  - $N_{available}$ is the number of CBD-RS resource occasions that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion nor any SMTC occasion within the window W, and

  - an CSI-RS resource occasion for candidate beam detection is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion, and

  - T_{L1} is periodicity of the target CBD-RS, and

  - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

  - for UE not supporting LB CA via switching, switching pattern periodicity is not applicable.

  - CBD requirement in this clause is not applied when $N_{outside_MG}$ = 0.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* nor supporting *musim-GapPreference-r17* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s), concurrent measurement gap(s) with NCSG(s), and periodic MUSIM gaps,

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P = 1 when in the monitored cell there are no GAPs overlapping with any occasion of the CSI-RS.

For FR2,

- P = 1, when candidate beam detection RS is not overlapped with GAP and also not overlapped with SMTC occasion.

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$ when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is not overlapped with SMTC occasion ($T_{CSI-RS} < xRP$)

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).

- $P = P_{sharing\ factor}$, when candidate beam detection RS is not overlapped with GAP and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{xRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$,, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and

  - $T_{SMTCperiod} \neq xRP$ or

  - $T_{SMTCperiod} = xRP$ and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{xRP}}$, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod} = xRP$ and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{Min(xRP,T_{SMTCperiod})}}$, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP

- $P = \frac{3}{1-\frac{T_{CSI-RS}}{xRP}}$,, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod} < xRP$)

where,

- $P_{sharing\ factor} = 1$, if the CBD-RS resource outside GAP is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

  - not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{sharing\ factor} = 3$, otherwise.

- If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

  - When a GAP is configured only and the GAP is not NCSG,

- a CBD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if it overlaps the GAP occasion, and
- xRP = MGRP

- Otherwise, when NCSG GAP only is configured,
  - a CBD-RS resource or an SMTC occasion is considered to be overlapped with the GAP if
    - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,
  - and
    - xRP = VIRP
- If the UE is configured with Pre-MG only, an CBD-RS resource or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.
- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG(s) are configured, a CBD-RS resource or an SMTC occasion is not considered to be overlapped by a GAP occasion if the GAP occasion is dropped according to clause 9.1.8, clause 9.1.12, clause 9.1.13, respectively.

NOTE: The overlap between CSI-RS for CBD and SMTC means that CSI-RS for CBD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and GAP configurations does not meet previous conditions.

Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM, BFD, BM-RS, or other CBD-RS, according to the measurement restrictions defined in clause 8.5.6.3.

When the configured aperiodic MUSIM gap is overlapping with CSI-RS resource occasion for candidate beam detection, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and if CSI-RS resource occasions for candidate beam detection are fully overlapped with MUSIM gap(s), or the union of MUSIM gap(s) and GAPs, no requirement applies for CSI-RS based candidate beam detection.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of M_{CBD} used in table 8.5.6.2-1 and table 8.5.6.2-2 are defined as

- M_{CBD} = 3, if the CSI-RS resource configured in the set $\bar{q}_1$ is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs.

If the UE supports *supportSBFD* and SBFD is configured by the network, the requirements in this clause apply provided that CSI-RS resource configured in the set $\bar{q}_1$ is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs in at least one DL subband.

The values of P_{CBD} used in table 8.5.6.2-1 and table 8.5.6.2-2 are defined as

- For each CSI-RS resource in the set $\bar{q}_1$ configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC
  - P_{CBD} = 1.

- For each CSI-RS resource in the set $\bar{q}_1$ configured for PSCell in NR-DC
  - P_{CBD} = 2 if UE is configured for candidate beam detection on SCell, 1 otherwise.
- For each CSI-RS resource in the set $\bar{q}_1$ configured for a SCell
  - P_{CBD} = Z in EN-DC or NE-DC or SA.
  - P_{CBD} = 2* Z in NR-DC.
    - Where Z is the number of band(s) on which UE is performing candidate beam detection only for SCell
  - P_{CBD} is the number of band(s) on which UE is performing candidate beam detection only for SCell.

Table 8.5.6.2-1: Evaluation period $T_{Evaluate_CBD_CSI-RS}$ for FR1

Configuration	$T_{EvaluateC_CBD_CSI-RS}$ (ms)
non-DRX, DRX cycle ⩽ 320 ms	Max(25, Ceil((M_{CBD}+L1) × P × P_{CBD}) × max(T_{CSI-RS}, T_{proc}))
DRX cycle > 320 ms	Ceil((M_{CBD}+L1) × P × P_{CBD}) × T_{DRX}
NOTE 1: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length. NOTE 2: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for CBD is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

Table 8.5.6.2-2: Evaluation period $T_{Evaluate_CBD_CSI-RS}$ for FR2

Configuration	$T_{Evaluate_CBD_CSI-RS}$ (ms)
non-DRX, DRX cycle ⩽ 320 ms	Max(25, Ceil((M_{CBD}+L1) × P × N × P_{CBD}) × max(T_{CSI-RS}, T_{proc}))
DRX cycle > 320 ms	Ceil((M_{CBD}+L1) × P × N × P_{CBD}) × T_{DRX}
NOTE 1: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length. NOTE 2: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for CBD is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

8.5.6.3 Measurement restriction for CSI-RS based candidate beam detection

The SSB mentioned in this clause can be associated with either the serving cell PCI or a PCI different from serving cell PCI or intra-frequency neighbor cell(s) configured with L1-RSRP measurement or inter-frequency neighbor cell(s) configured with L1-RSRP measurement without gap.

For both FR1 and FR2, when the CSI-RS for CBD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for CBD measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement has same SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement has different SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS based CBD measurement for without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer measurement period for CSI-RS based CBD measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for CBD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for CBD measurement without any restriction.

For FR2, when the CSI-RS for CBD measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer evaluation period for CSI-RS based CBD measurement is expected, and no requirements are defined.For both FR1 and FR2, when the CSI-RS for CBD measurement fully or partially overlaps with the OFDM symbol as SSB or CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, UE is not required to receive CSI-RS for CBD measurement in the PRBs that overlap with an SSB or CSI-RS from candidate LTM neighbour cell.

For FR1, when the CSI-RS for CBD measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, if CSI-RS and SSB have different SCS and UE does not support simultaneousRxDataSSB-DiffNumerology, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer measurement period for CSI-RS based CBD is expected, and no requirements are defined.

For FR2, when the CSI-RS for CBD measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer measurement period for CSI-RS based CBD is expected, and no requirements are defined.

For FR2, when the CSI-RS for CBD measurement on one CC fully or partially overlaps with the OFDM symbol as CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement, UE is required to measure one of but not both CSI-RS for CBD measurement and CSI-RS for intra-frequency L1-RSRP measurement. Longer measurement period for CSI-RS based CBD is expected, and no requirements are defined.

For FR2, when the CSI-RS for CBD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and the other CSI-RS. Longer evaluation period for CSI-RS based CBD measurement is expected, and no requirements are defined.

8.5.7 Scheduling availability of UE during beam failure detection

Scheduling availability restrictions when the UE is performing beam failure detection are described in the following clauses.

8.5.7.1 Scheduling availability of UE performing beam failure detection with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to beam failure detection performed on SSB and CSI-RS configured for BFD with the same SCS as PDSCH or PDCCH in FR1.

8.5.7.2 Scheduling availability of UE performing beam failure detection with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to beam failure detection when SSB is configured as BFD. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to beam failure detection when SSB is configured as BFD.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for beam failure detection.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

When intra-band non-contiguous carrier aggregation is configured for a UE supporting intraBandNR-CA-non-collocated-r19,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v19xy* is “type 4”

3> there are no scheduling restrictions on FR1 serving cell(s) configured on the non-contiguous CC(s) in the same band

2> if *nonCollocatedTypeNR-CA-v19xy* is “type 1”

3> the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v19xy* is not provided

3> the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there are no scheduling restrictions on FR1 serving cell(s) configured on the non-contiguous CC(s) in the same band

2>else

3> the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which PCell or PSCell is configured.

When inter-band FR1-FR1 NR-DC is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in the bands due to beam failure detection performed on FR1 serving PCell or PSCell in different bands.

8.5.7.3 Scheduling availability of UE performing beam failure detection on FR2

The following scheduling restriction applies due to beam failure detection.

- For the case where no RSs are provided for BFD, or when CSI-RS is configured for BFD is explicitly configured and is type-D QCLed with active TCI state for PDCCH or PDSCH, and the CSI-RS is not in a CSI-RS resource set with repetition ON
  - There are no scheduling restrictions due to beam failure detection performed based on the CSI-RS.
- For the case when UE supporting *schedulingMeasurementRelaxation-r18* in FR2-1 is configured to receive two PDSCH transmission occasions from two different QCL sources on the cell according to the conditions in clause 3.6.19, there are no scheduling restrictions for the PDSCHs due to beam failure detection performed based on the CSI-RS, when following conditions are met:
  - the CSI-RS configured for BFD is not in a CSI-RS resource set with repetition ON, and
  - the CSI-RS configured for BFD has same QCL source as the active TCI state of one of PDSCHs and has different QCL-TypeD from the other PDSCH, and
  - [The two CSI-RS resources and both PDSCHs are overlapped on the same OFDM symbol], and
  - The CSI-RS and both of the PDSCHs are on the same OFDM symbol(s), or the CSI-RS and one of the PDSCHs with different QCL typeD are on the same OFDM symbol(s) when partially overlapping PDSCHs are scheduled, and

- Resources of the active TCI states for the two PDSCHs have been reported as a resource group in Rel-17 group-based RSRP report

- Otherwise

  - For FR2-1 or the BFD-RS is not using 480 kHz SCS or 960 kHz SCS on FR2-2, the UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on BFD-RS resource symbols to be measured for beam failure detection.

  - For FR2-2 and the BFD-RS is using 480 kHz SCS or 960 kHz SCS, the UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on BFD-RS resource symbols to be measured for beam failure detection, and on one data symbol before each BFD-RS symbol to be measured and one data symbol after each BFD-RS symbol to be measured.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions on FR2 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to beam failure detection performed on FR2 serving cell(s) in different band(s), provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,

- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for BFD measurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for BFD measurement.

8.5.7.4 Scheduling availability of UE performing beam failure detection on FR1 or FR2 in case of FR1-FR2 inter-band CA and NR-DC

There are no scheduling restrictions on FR1 serving cell(s) due to beam failure detection performed on FR2 serving PCell and/or PSCell.

There are no scheduling restrictions on FR2 serving cell(s) due to beam failure detection performed on FR1 serving PCell and/or PSCell.

8.5.8 Scheduling availability of UE during candidate beam detection

Scheduling availability restrictions when the UE is performing L1-RSRP measurement for candidate beam detection are described in the following clauses.

8.5.8.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as link recovery detection resource with the same SCS as PDSCH or PDCCH in FR1.

8.5.8.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as link recovery detection resource. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured as link recovery detection resource.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, TRS, CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for L1-RSRP.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on one serving cell apply to all other serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions on one serving cell apply to all other serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

When intra-band non-contiguous carrier aggregation is configured for a UE supporting intraBandNR-CA-non-collocated-r19,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v19xy* is “type 4”

3> there are no scheduling restrictions on FR1 serving cell(s) configured on the non-contiguous CC(s) in the same band

2> if *nonCollocatedTypeNR-CA-v19xy* is “type 1”

3> the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v19xy* is not provided

3> the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there are no scheduling restrictions on FR1 serving cell(s) configured on the non-contiguous CC(s) in the same band

2>else

3> the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands.

When inter-band FR1-FR1 NR-DC is configured, there are no scheduling restrictions on FR1 serving cell(s) in one band due to candidate beam detection performed on FR1 serving cell(s) in other bands.

8.5.8.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to candidate beam detection

- For FR2-1 or the reference symbols to be measured for candidate beam detection is not using 480 kHz SCS or 960 kHz SCS on FR2-2, the UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, CSI-RS for tracking or CSI-RS for CQI on reference symbols to be measured for candidate beam detection.

- For FR2-2 and the reference symbols to be measured for candidate beam detection is using 480 kHz SCS or 960 kHz SCS, the UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, CSI-RS for tracking or CSI-RS for CQI on reference symbols to be measured for candidate beam detection, and on one data symbol before each reference symbol to be measured for candidate beam detection and one data symbol after each reference symbol to be measured for candidate beam detection.

When intra-band carrier aggregation in FR2 is configured, the scheduling restrictions on to one serving cell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to candidate beam detection performed on FR2 serving cell(s) in different band(s), provided that the FR2 serving cell(s) and the FR2 serving cell(s) for candidate beam detection are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,

- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for CBD mesurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for CBD mesurement.

8.5.8.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA and NR-DC

There are no scheduling restrictions on FR1 serving cell(s) due to L1-RSRP measurement performed on FR2 serving cell(s).

There are no scheduling restrictions on FR2 serving cell(s) due to L1-RSRP measurement performed on FR1 serving cell(s).

8.5.9 Requirements for Beam Failure Recovery in SCell

8.5.9.1 Introduction

For the UE provided with a configuration of PUCCH transmission with a link recovery request (LRR) as described in clause 9.2.4 in TS 38.213 [3], if beam recovery procedure is triggered for any of SCells, the UE shall transmit SR for UL resource followed by MAC CE providing one index for at least one corresponding SCell with radio link quality is worse than $Q_{out,LR}$, and the index q_{new} for a periodic CSI-RS configuration or for a SSB provided by higher layer, as described in clause 5.17 of TS 38.321 [7], if any, for a corresponding SCell.

For the UE not provided with a configuration of PUCCH transmission with a link recovery request (LRR) as described in clause 9.2.4 in TS 38.213 [3], if beam recovery procedure is triggered for any of SCells, the UE shall transmit preamble for UL-SCH resource application, followed by MAC CE providing one index for at least one corresponding SCell with radio link quality is worse than $Q_{out,LR}$, and the index q_{new} for a periodic CSI-RS configuration or for a SSB provided by higher layer, as described in clause 5.17 of TS 38.321 [7], if any, for a corresponding SCell.

8.5.9.2 Requirement

Provided that UE is configured by *schedulingRequestIDForBFR* a configuration for LRR in a PUCCH transmission, after BFR is triggered on any of SCells as described in clause 5.17 of TS 38.321 [7], UE shall be capable of transmit PUCCH with an LRR within a period of T, where

- $T = T_1 \times Ceil((T_2+D)/T_1)$ in which T_1, T_2 and D are defined as
  - T_1 is equal to the periodicity of PUCCH configured with *schedulingRequestIDForBFR*.
  - $T_2 = T_{Evaluate_CBD}$ is the evaluation period specified in clause 8.5.5 or 8.5.6 for SSB or CSI-RS based candidate beam detection, that is $T_{Evaluate_CBD_SSB}$ or $T_{Evaluate_CBD_CSI-RS}$, depending on the applicable reference signal configured for candidate beam detection.
  - D = 2 ms is the UE processing time.

8.5.10 Minimum requirement at transitions for beam failure detection

When the UE transitions between DRX and no DRX or when DRX cycle periodicity changes, for each BFD-RS resource, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation period corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode for each BFD-RS resource.

When the UE transitions from a first configuration of BFD resources to a second configuration of BFD resources that is different from the first configuration, for each BFD resource present in the second configuration, for a duration of time equal to the evaluation period corresponding to the second configuration after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first configuration and the second configuration. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second configuration for each BFD resource present in the second configuration.

When the UE transitions from a first configuration of active TCI state of the CORESET to a second configuration of active TCI state of the CORESET, for each CSI-RS for BFD present in the second configuration, the UE shall use an evaluation period corresponding to the second configuration from the time of transition.

For UE supporting *ncd-SSB-BWP-Wor-r18*, when the UE transitions between BFD CD-SSB resource and BFD NCD-SSB resource due to BWP switching or due to SCG activation or deactivation during one evaluation period, the UE shall use an evaluation period that is the maximum of the evaluation period corresponding to the first SSB type and the second SSB type after the BWP switching or the SCG activation or deactivation. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second SSB type for each BFD-RS resource.

For UE supporting *On-demand SSB operation*, when UE is indicated, by on-demand SSB Activation/Deactivation MAC-CE, adaptation of periodicities for the activated transmission of OD-SSBs when the SCell is activated, the evaluation period requirements for candidate beam detection are based on the adapted OD-SSB burst periodicity which applies from the first OD-SSB burst after an additional processing time as 2ms or 5ms depending on *OD-SSB post processing time*.

8.5.11 Minimum requirement under IDC Interference

When the UE is provided with IDC solution, the UE shall also assess the downlink radio link quality and meet the corresponding requirements in clause 8.5.

8.5.12 Minimum requirement at transitions for candidate beam detection

For UE supporting *On-demand SSB operation*, when UE is indicated, by a MAC-CE, adaptation of periodicities for the activated transmission of OD-SSBs when the SCell is activated, the candidate beam detection requirements are based on the EMP of adapted OD-SSB burst periodicity which applies from the first OD-SSB burst after the time point as defined in TS 38.213 for adaptation of the second SS/PBCH blocks transmissionplus additional processing time as 2ms or 5ms depending on *OD-SSB post processing time*.

For UE supporting *ssb-BurstPeriodicityAdaptation-r19*, when UE receives DCI format 2_9 that indicates a change in SSB burst periodicity of the SSB transmission during one evaluation period, the evaluation period requirements for

candidate beam detection based on the indicated SSB burst periodicity applies from the first SSB burst after the time point as defined in TS 38.213 plus 2 ms and 3 ms for FR1 and FR2 respectively.

8.5A Link Recovery Procedures when CCA is used on target frequency

8.5A.1 Introduction

The requirements for link recovery procedure in the clause apply when CCA is used on a serving frequency on the downlink.

The UE shall assess the downlink radio link quality of a serving cell based on the reference signal in the set $\bar{q}_0$ as specified in TS 38.213 [3] in order to detect beam failure on:

- PCell in SA operation mode,
- PSCell in EN-DC operation mode.
- PSCell in NR-DC operation mode.

The RS resource configurations in the set $\bar{q}_0$ can be periodic SSBs. UE is not required to perform beam failure detection outside the active DL BWP. UE is not required to meet the requirements in clause 8.5A.2 and 8.5A.3 if UE does not have set $\bar{q}_0$.

On each RS resource configuration in the set $\bar{q}_0$, the UE shall estimate the radio link quality and compare it to the threshold $Q_{out_LR,CCA}$ for the purpose of accessing downlink radio link quality of the serving cell beams.

The threshold $Q_{out_LR,CCA}$ is defined as the level at which the downlink radio level link of a given resource configuration on set $\bar{q}_0$ cannot be reliably received and shall correspond to the $BLER_{out,CCA}$ = 10 % block error rate of a hypothetical PDCCH transmission. For SSB based beam failure detection, $Q_{out_LR_SSB,CCA}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5A.2.1-1.

Upon request the UE shall deliver configuration indexes from the set $\bar{q}_1$ as specified in TS 38.213 [3] , to higher layers, and the corresponding L1-RSRP measurement provided that the measured L1-RSRP is equal to or better than the threshold $Q_{in_LR,CCA}$, which is indicated by higher layer parameter *rsrp-ThresholdSSB*. The UE applies the $Q_{in_LR,CCA}$ threshold to the L1-RSRP measurement obtained from an SSB. The RS resource configurations in the set $\bar{q}_1$ can be periodic SSBs. UE is not required to perform candidate beam detection outside the active DL BWP.

In the requirements of clause 8.5A, the term CBD-RS SSB occasions not available at the UE refers to when the CBD-RS SSB is configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the set of configured CBD-RS resources are not available at the UE due to DL CCA failures at gNB during the corresponding evaluation period; otherwise the CBD-RS SSB is considered as available at the UE.

The requirements in clause 8.5A apply for any *channelAccessMode* configuration [2].

8.5A.2 Requirements for SSB based beam failure detection

8.5A.2.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\bar{q}_0$ configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5A.2.2, but occasionally may not be transmitted due to CCA operation.

Table 8.5A.2.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB

Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	Same as the SCS of RMSI CORESET
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.5A.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured BFD-RS SSB resource in set $\bar{q}_0$ estimated over the last $T_{Evaluate_BFD_SSB_CCA}$ period becomes worse than the threshold $Q_{out_LR_SSB,CCA}$ within $T_{Evaluate_BFD_SSB_CCA}$ period.

The value of $T_{Evaluate_BFD_SSB_CCA}$ is defined in table 8.5A.2.2-1 for FR1.

The value of $T_{Evaluate_BFD_SSB_CCA}$ is defined in table 8.5A.2.2-2 for FR2-2 with scaling factor N=12.

- For a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent measurement gap(s) with NCSG(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for a BFD-RS resource to be measured is defined as N_{total} / $N_{outside_MG}$

- For a window W of duration max(T_{L1}, xRP_max), where xRP_max is the maximum xRP across all configured per-UE measurement gaps or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any BFD-RS resource occasion:

  - N_{total} is the total number of BFD-RS resource occasions within the window W, including those overlapped with GAP occasions within the window W, and

  - $N_{outside_MG}$ is the number of BFD-RS resource occasions that are not overlapped with any GAP occasion within the window W

  - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

- Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG(s),

- $P = \frac{1}{1-\frac{T_{SSB}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the BFD-RS SSB.

  - P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the BFD-RS SSB.

- When a GAP is configured only and the GAP is not NCSG,

  - a BFD-RS resource is considered to be overlapped with the GAP if it overlaps a GAP occasion, and

  - xRP = MGRP

  - If the UE is configured with Pre-MG, a BFD-RS resource is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG only is configured,

  - a BFD-RS resource is considered to be overlapped with the GAP if it overlaps the VIL1 or VIL2 of NCSG, and

  - xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG(s) are configured, a BFD-RS resource is not considered to be overlapped by a GAP occasion if the GAP occasion is dropped according to clause 9.1.8, clause 9.1.12, clause 9.1.13, respectively.

For FR2-2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when BFD-RS resource is not overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).

- $P = P_{sharing\ factor}$, when the BFD-RS resource is not overlapped with GAP and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5*T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with GAP (T_{SSB} <MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP.

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the BFD-RS resource is partially overlapped with GAP and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod}$ < MGRP)

Where,

- $P_{sharing\ factor}$ = 1, if the BFD-RS resource outside GAP is

  - not overlapped with the SSB symbols indicated by SSB-ToMeasure and K data symbol before each consecutive SSB symbols indicated by SSB-ToMeasure and K data symbol after each consecutive SSB symbols indicated by SSB-ToMeasure, given that SSB-ToMeasure is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and K is defined in clause 9.2.5.3.3, and;

  - not overlapped with the RSSI symbols indicated by ss-RSSI-Measurement and K data symbol before each RSSI symbol indicated by ss-RSSI-Measurement and K data symbol after each RSSI symbol indicated by ss-RSSI-Measurement, given that ss-RSSI-Measurement is configured, and K is defined in clause 9.2.5.3.3.

- $P_{sharing\ factor}$ = 3, otherwise.

If the higher layer in TS 38.331 [2] signalling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2-2 band, given the SMTC offset of all CCs in FR2-2 provided the same offset.

Longer evaluation period would be expected if the combination of BFD-RS SSB resource, SMTC occasion and GAP configurations does not meet previous conditions.

Table 8.5A.2.2-1: Evaluation period $T_{Evaluate_BFD_SSB_CCA}$ for FR1

Configuration	$T_{Evaluate_BFD_SSB_CCA}$ (ms)	
	BFD-RS SSB Es/Iot [Note2] ≥ -7 dB	BFD-RS SSB Es/Iot [Note2] < -7 dB

no DRX	Max(50, Ceil((10 × P) × T_{SSB}))	Max(50, Ceil((12 × P) × T_{SSB}))
DRX cycle ≤ 320 ms	Max(50, Ceil(1.5 × 8 × P) × Max(T_{DRX},T_{SSB}))	Max(50, Ceil(1.5 × 10 × P) × Max(T_{DRX},T_{SSB}))
DRX cycle > 320 ms	Ceil(7 × P) × T_{DRX}	Ceil(8 × P) × T_{DRX}
NOTE 1: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length. NOTE 2: BFD-RS SSB Es/Iot is the averaged BFD-RS SSB Es/Iot over the most recent previous evaluation period.		

Table 8.5A.2.2-2: Evaluation period $T_{Evaluate_BFD_SSB_CCA}$ for FR2-2

Configuration	$T_{Evaluate_BFD_SSB_CCA}$ (ms)
no DRX	Max(200, Ceil(12*P* N)*T_{SSB})
DRX cycle ≤ 320 ms	Max(200, Ceil(1.5*10*P* N)*Max(T_{DRX},T_{SSB}))
DRX cycle > 320 ms	Ceil(10*P* N)*T_{DRX}
NOTE 1: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.	

8.5A.2.3 Measurement restriction for SSB based beam failure detection

The UE is required to be capable of measuring SSB for BFD without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following clauses.

For FR1, when the SSB for BFD measurement is in the same OFDM symbol as CSI-RS for BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for BFD measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for BFD measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure SSB for BFD measurement.

For FR2-2, when the SSB for BFD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

8.5A.3 Void

8.5A.4 Minimum requirement for L1 indication

When the radio link quality on all the RS resources in set $\bar{q}_0$ is worse than $Q_{out_LR,CCA}$, layer 1 of the UE shall send a beam failure instance indication to the higher layers.

The beam failure instance evaluation for the RS resources in set $\bar{q}_0$ shall be performed as specified in clause 6 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication_interval_BFD_CCA}$.

When DRX is not used, $T_{Indication_interval_BFD_CCA}$ is max(2 ms, $T_{SSB\text{-}RS,M}$)), where $T_{SSB\text{-}RS,M}$ is the shortest periodicity of all RS resources in set $\bar{q}_0$ for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set $\bar{q}_0$.

When DRX is used, for SSB based link quality measurement,

- $T_{Indication_interval_BFD_CCA}$ = Max(1.5 × DRX_cycle_length, 1.5 × $T_{SSB\text{-}RS,M}$), if DRX_cycle_length ≤ 320 ms,
- $T_{Indication_interval_BFD_CCA}$ = DRX_cycle_length, if DRX_cycle_length > 320 ms.

8.5A.5 Requirements for SSB based candidate beam detection

8.5A.5.1 Introduction

The requirements in this clause apply for each CBD-RS SSB resource in the set $\bar{q}_1$ configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5A.5.2, but occasionally may not be transmitted due to CCA operation.

8.5A.5.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CBD-RS SSB resource in set $\bar{q}_1$ estimated over the last $T_{Evaluate_CBD_SSB_CCA}$ period becomes better than the threshold $Q_{in_LR,CCA}$ provided SSB_RP and SSB Ês/Iot are according to annex B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 8.5A.5.2-1 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320 ms.

The value of $T_{Evaluate_CBD_SSB_CCA}$ is defined in table 8.5A.5.2-1 for FR1.

The value of $T_{Evaluate_CBD_SSB_CCA}$ is defined in table 8.5A.5.2-2 for FR2-2 with scaling factor N=12.

For FR1,

- For a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent measurement gap(s) with NCSG(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,
  - P value for a CBD-RS resource to be measured is defined as N_{total} / $N_{outside_MG}$
  - For a window W of duration max(T_{L1}, xRP_max), where xRP_max is the maximum xRP across all configured per-UE measurement gaps or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any CBD-RS resource occasion:
    - N_{total} is the total number of CBD-RS resource occasions within the window W, including those overlapped with GAP occasions within the window W, and
    - $N_{outside_MG}$ is the number of CBD-RS resource occasions that are not overlapped with any GAP occasion within the window W
    - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.
- Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG(s),
  - $P = \frac{1}{1-\frac{T_{SSB}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CBD-RS SSB,
  - P = 1 when in the monitored cell there are no GAPs overlapping with any occasion of the CBD-RS SSB.

For FR2-2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when candidate beam detection RS is not overlapped with GAP and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when candidate beam detection RS is partially overlapped with GAP and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod}$ < MGRP)

- $P_{sharing\ factor}$ = 1, if the candidate beam detection RS outside GAP is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and K data symbols before consecutive SSB symbols indicated by *SSB-ToMeasure* and K data symbols after consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and where K is defined in clause 9.2.5.3.3, and;

  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and K data symbols before each RSSI symbol indicated by *ss-RSSI-Measurement* and K data symbols after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured, and where K is defined in clause 9.2.5.3.3.

- $P_{sharing\ factor}$ = 3, otherwise.

where,

- If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2-2 band, provided the SMTC offset of all CCs in FR2-2 have the same offset.

- When a GAP is configured only and the GAP is not NCSG,

  - a CBD-RS resource is considered to be overlapped with the GAP if it overlaps a GAP occasion, and

  - xRP = MGRP

  - If the UE is configured with Pre-MG, a CBD-RS resource is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG only is configured,

  - a CBD-RS resource is considered to be overlapped with the GAP if it overlaps the VIL1 or VIL2 of NCSG, and

  - xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG(s) are configured, a CBD-RS resource is not considered to be overlapped by a GAP occasion if the GAP occasion is dropped according to clause 9.1.8, clause 9.1.12, clause 9.1.13, respectively.

Table 8.5A.5.2-1: Evaluation period $T_{Evaluate_CBD_SSB_CCA}$ for FR1

Configuration	$T_{Evaluate_CBD_SSB_CCA}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	$Max(25, Ceil((3 + L_{CBD}) \times P) \times T_{SSB})$
DRX cycle > 320 ms	$Ceil((3 + L_{CBD}) \times P) \times T_{DRX}$
NOTE 1: T_{SSB} is the periodicity of SSB in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length. NOTE 2: When DRX is not configured, L_{CBD} is the number of CBD-RS SSB occasions not available at the UE during $T_{Evaluate_CBD_SSB_CCA}$ where $L_{CBD} \le L_{CBD,max}$. When DRX is configured, L_{CBD} is the number of DRX cycles in which at least one of the CBD-RS SSB occasions not available at the UE during $T_{Evaluate_CBD_SSB_CCA}$ where $L_{CBD} \le L_{CBD,max}$. The UE, which is configured with DRX, is not required to determine the availability of SSB occasions more frequent than Once per $Max(25\ ms, P * T_{SSB})$ if DRX cycle ≤ 320 ms, Once per $P * T_{DRX}$ if DRX cycle > 320 ms. NOTE 3: $L_{CBD,max}=7$ for $Max(T_{DRX}, T_{SSB}) \le 40$ assuming $T_{DRX}=0$ for non-DRX, $L_{CBD,max}=5$ for $40 < Max(T_{DRX}, T_{SSB}) \le 320$, $L_{CBD,max}=3$ for $T_{DRX} > 320$. NOTE 4 If $L_{CBD}>L_{CBD,max}$, the UE shall assume no new candidate beams are found for this evaluation period.	

Table 8.5A.5.2-2: Evaluation period $T_{Evaluate_CBD_SSB_CCA}$ for FR2-2

Configuration	$T_{Evaluate_CBD_SSB_CCA}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	$Max(25, Ceil((3 + L_{CBD}) \times P \times N) \times T_{SSB})$
DRX cycle > 320 ms	$Ceil((3 + L_{CBD}) \times P \times N) \times T_{DRX}$
NOTE 1: T_{SSB} is the periodicity of SSB in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length. NOTE 2: When DRX is not configured, L_{in} is the number of CBD-RS SSB occasions group which are not available at the UE during $T_{Evaluate_CBD_SSB,CCA}$, where $L_{CBD} \le L_{CBD,max}$. A CBD-RS SSB occasions group consists of N consecutive CBD-RS SSB occasions, and the CBD-RS SSB occasions group is not available at the UE when at least one CBD-SSB occasion in the group is not transmitted by the gNB. When DRX is configured, L_{in} is the number of DRX cycles groups which are not available at the UE during $T_{Evaluate_CBD_SSB,CCA}$, where $L_{in} \le L_{CBD,max}$. A DRX group consists of N DRX cycles, and the DRX group is not available when there is at least one DRX in which at least one CBD-RS SSB occasion is not available. The UE is not required to determine the availability of SSB occasions more frequent than once per DRX cycle length, when configured with DRX. NOTE 3: $L_{CBD,max}=7$ for $Max(T_{DRX}, T_{SSB}) \le 40$ assuming $T_{DRX}=0$ for non-DRX, $L_{CBD,max}=5$ for $40 < Max(T_{DRX}, T_{SSB}) \le 320$, $L_{CBD,max}=3$ for $T_{DRX} > 320$. NOTE 4: If $L_{CBD}>L_{CBD,max}$, the UE shall assume no new candidate beams are found for this evaluation period.	

8.5A.5.3 Measurement restriction for SSB based candidate beam detection

For FR1, when the SSB for CBD measurement is in the same OFDM symbol as CSI-RS for BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for CBD measurement without any restrictions;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for CBD measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure SSB for CBD measurement.

For FR2-2, when the SSB for CBD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

8.5A.6 Void

8.5A.7 Scheduling availability of UE during beam failure detection

Scheduling availability restrictions when the UE is performing beam failure detection are described in the following clauses.

8.5A.7.1 Scheduling availability of UE performing beam failure detection with a same subcarrier spacing as PDSCH/PDCCH

In this clause, the same requirements apply as in clause 8.5.7.1.

8.5A.7.2 Scheduling availability of UE performing beam failure detection with a different subcarrier spacing than PDSCH/PDCCH

In this clause, the same requirements apply as in clause 8.5.7.2.

8.5A.7.3 Scheduling availability of UE performing beam failure detection on FR2-2

In this clause, the same requirements apply as in clause 8.5.7.3.

8.5A.7.4 Scheduling availability of UE performing beam failure detection on FR1 or FR2-2 in case of FR1-FR2-2 inter-band CA and NR-DC

In this clause, the same requirements apply as in clause 8.5.7.4.

8.5A.8 Scheduling availability of UE during candidate beam detection

Scheduling availability restrictions when the UE is performing L1-RSRP measurement for candidate beam detection are described in the following clauses.

8.5A.8.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

In this clause, the same requirements apply as in clause 8.5.8.1.

8.5A.8.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

In this clause, the same requirements apply as in clause 8.5.8.2.

8.5A.8.3 Scheduling availability of UE performing L1-RSRP measurement on FR2-2

In this clause, the same requirements apply as in clause 8.5.8.3.

8.5.8A.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2-2 in case of FR1-FR2-2 inter-band CA and NR-DC

In this clause, the same requirements apply as in clause 8.5.8.4.

8.5B Link Recovery Procedures for Redcap

8.5B.1 Introduction

The Redcap UE shall assess the downlink radio link quality of a serving cell based on the reference signal in the set $\bar{q}_0$ as specified in TS 38.213 [3] in order to detect beam failure on PCell in SA. The SSB and SMTC in this clause applies for both CD-SSB and NCD-SSB if it is not additional specified.

The RS resource configurations in the set $\bar{q}_0$ on PCell can be periodic CSI-RS resources and/or SSBs. UE is not required to perform beam failure detection outside the active DL BWP. UE is not required to meet the requirements in clause 8.5B.2 and 8.5B.3 if UE does not have set $\bar{q}_0$.

On each RS resource configuration in the set $\bar{q}_0$, the UE shall estimate the radio link quality and compare it to the threshold $Q_{out_LR_Redcap}$ for the purpose of accessing downlink radio link quality of the serving cell beams.

The threshold $Q_{out_LR_Redcap}$ is defined as the level at which the downlink radio level link of a given resource configuration on set $\bar{q}_0$ cannot be reliably received and shall correspond to the $BLER_{out}$ = 10% block error rate of a hypothetical PDCCH transmission. For SSB based beam failure detection, $Q_{out_LR_SSB}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5B.2.1-1. For CSI-RS based beam failure detection, $Q_{out_LR_CSI\text{-}RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5B.3.1-1.

Upon request the UE shall deliver configuration indexes from the set $\bar{q}_1$as specified in TS 38.213 [3] , to higher layers, and the corresponding L1-RSRP measurement provided that the measured L1-RSRP is equal to or better than the threshold $Q_{in_LR_RedCap}$, which is indicated by higher layer parameter *rsrp-ThresholdSSB*. The UE applies the $Q_{in_LR_RedCap}$ threshold to the L1-RSRP measurement obtained from an SSB. The UE applies the $Q_{in_LR_RedCap}$ threshold to the L1-RSRP measurement obtained for a CSI-RS resource after scaling a respective CSI-RS reception power with a value provided by higher layer parameter *powerControlOffsetSS*. The RS resource configurations in the set $\bar{q}_1$ can be periodic CSI-RS resources or SSBs or both SSB and CSI-RS resources. UE is not required to perform candidate beam detection outside the active DL BWP.

8.5B.2 Requirements for SSB based beam failure detection for Redcap

8.5B.2.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\bar{q}_0$ configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5B.2.2.

Table 8.5B.2.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	16 for 1 Rx UE; 8 for 2 Rx UE
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	48 for 1 Rx UE; 24 for 2 Rx UE
Sub-carrier spacing (kHz)	Same as the SCS of RMSI CORESET
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed
NOTE 1: SCS=60 kHz is not applicable for FR1	

8.5B.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set $\bar{q}_0$ estimated over the last $T_{Evaluate_BFD_SSB_Redcap}$ period becomes worse than the threshold $Q_{out_LR_SSB}$ within $T_{Evaluate_BFD_SSB_Redcap}$ period.

The value of $T_{Evaluate_BFD_SSB_Redcap}$ is defined in table 8.5B.2.2-1 for FR1.

The value of $T_{Evaluate_BFD_SSB_Redcap}$ is defined in table 8.5B.2.2-2 for FR2 with scaling factor N=8.

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB.
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- $P = P_{sharing\ factor}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5*T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap (T_{SSB} <MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} <$ MGRP)
- $P_{sharing\ factor}$ = 1, if the BFD-RS resource outside measurement gap is
  - not overlapped with the SSB symbols indicated by SSB-ToMeasure and 1 data symbol before each consecutive SSB symbols indicated by SSB-ToMeasure and 1 data symbol after each consecutive SSB symbols indicated by SSB-ToMeasure, given that SSB-ToMeasure is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;
  - not overlapped with the RSSI symbols indicated by ss-RSSI-Measurement and 1 data symbol before each RSSI symbol indicated by ss-RSSI-Measurement and 1 data symbol after each RSSI symbol indicated by ss-RSSI-Measurement, given that ss-RSSI-Measurement is configured.
  - Psharing factor = 3, otherwise.

where,

If the higher layer in TS 38.331 [2] signalling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{identify_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 8.5B.2.2-1: Evaluation period $T_{Evaluate_BFD_SSB_Redcap}$ for FR1

Configuration	$T_{Evaluate_BFD_SSB_Redcap}$ (ms) for Redcap UE with 2 Rx	$T_{Evaluate_BFD_SSB_Redcap}$ (ms) for 1 Rx Redcap
no DRX	Max(50, Ceil(5 × P) × T_{SSB})	[Max(50, Ceil(10 × P) × T_{SSB})]
DRX cycle ≤ 320 ms	Max(50, Ceil(7.5 × P) × Max(T_{DRX},T_{SSB}))	[Max(50, Ceil(15 × P) × Max(T_{DRX},T_{SSB}))]
DRX cycle > 320 ms	Ceil(5 × P) × T_{DRX}	[Ceil(10 × P) × T_{DRX}]
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.		

Table 8.5B.2.2-2: Evaluation period $T_{Evaluate_BFD_SSB_Redcap}$ for FR2

Configuration	$T_{Evaluate_BFD_SSB_Redcap}$ (ms)
no DRX	Max(50, Ceil(5 × P × N) × T_{SSB})
DRX cycle ≤ 320 ms	Max(50, Ceil(7.5 × P × N) × Max(T_{DRX},T_{SSB}))
DRX cycle > 320 ms	Ceil(5 × P × N) × T_{DRX}
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.	

8.5B.2.3 Measurement restriction for SSB based beam failure detection

The UE is required to be capable of measuring SSB for BFD without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following scenarios.

For FR1, when the SSB for BFD measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for BFD measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for BFD measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

For FR2, when the SSB for BFD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

8.5B.3 Requirements for CSI-RS based beam failure detection for Redcap

8.5B.3.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\bar{q}_0$ of resource configurations for a serving cell, provided that the CSI-RS resource(s) in set $\bar{q}_0$ for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5B.3.2. UE is not expected to perform beam failure detection measurements on the CSI-RS configured for BFD if the CSI-RS is not QCL-ed, with QCL-TypeD when applicable, with the RS in the active TCI state of any CORESET configured in the UE active BWP.

Table 8.5B.3.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	16 for 1 Rx UE; 8 for 2 Rx UE
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0 dB
Bandwidth (PRBs)	48 for 1 Rx UE; 24 for 2 Rx UE
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed
NOTE 1: SCS=60 kHz is not applicable for FR1	

8.5B.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set $\tilde{q}_0$ estimated over the last $T_{Evaluate_BFD_CSI\text{-}RS_Redcap}$ period becomes worse than the threshold $Q_{out_LR_CSI\text{-}RS}$ within $T_{Evaluate_BFD_CSI\text{-}RS_Redcap}$ period.

The value of $T_{Evaluate_BFD_CSI\text{-}RS_Redcap}$ is defined in table 8.5B.3.2-1 for FR1.

The value of $T_{Evaluate_BFD_CSI\text{-}RS_Redcap}$ is defined in table 8.5B.3.2-2 for FR2 with N=1. The requirements of $T_{Evaluate_BFD_CSI\text{-}RS_Redcap}$ apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS.
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P = 1, when the BFD-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is not overlapped with SMTC occasion ($T_{CSI\text{-}RS}$ < MGRP)
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI\text{-}RS} < T_{SMTCperiod}$).
- $P = P_{sharing\ factor}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{CSI\text{-}RS} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI\text{-}RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{CSI\text{-}RS} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap (T_{CSI-RS} < MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

- $P_{sharing\ factor}$ = 1, if the BFD-RS resource outside measurement gap is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;

  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

- $P_{sharing\ factor}$ = 3, otherwise.

where,

If the higher layer in TS 38.331 [2] signalling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

NOTE: The overlap between CSI-RS for BFD and SMTC means that CSI-RS for BFD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the BFD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{identify_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of M_{BFD} used in table 8.5B.3.2-1 and table 8.5B.3.2-2 are defined as

- M_{BFD} = 10, if the CSI-RS resource(s) in set $\bar{q}_0$ used for BFD is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs.

The values of P_{BFD} used in table 8.5B.3.2-1 and table 8.5B.3.2-2 are defined as

For each CSI-RS resource in the set $\bar{q}_0$ configured for PCell

- P_{BFD} = 1.

Table 8.5B.3.2-1: Evaluation period $T_{Evaluate_BFD_CSI-RS_Redcap}$ for FR1

Configuration	$T_{Evaluate_BFD_CSI-RS_Redcap}$ (ms) for Redcap UE with 2 Rx	$T_{Evaluate_BFD_CSI-RS_Redcap}$ (ms) for 1 Rx Redcap
no DRX	Max(50, Ceil($M_{BFD} \times P \times P_{BFD}$) × T_{CSI-RS})	Max(50, Ceil(2×$M_{BFD} \times P \times P_{BFD}$) × T_{CSI-RS})
DRX cycle ≤ 320 ms	Max(50, Ceil(1.5 × $M_{BFD} \times P \times P_{BFD}$) × Max($T_{DRX}$, T_{CSI-RS}))	Max(50, Ceil(2×1.5 × $M_{BFD} \times P \times P_{BFD}$) × Max($T_{DRX}$, T_{CSI-RS}))
DRX cycle > 320 ms	Ceil($M_{BFD} \times P \times P_{BFD}$) × T_{DRX}	Ceil(2×$M_{BFD} \times P \times P_{BFD}$) × T_{DRX}

NOTE: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.

Table 8.5B.3.2-2: Evaluation period $T_{Evaluate_BFD_CSI-RS_Redcap}$ for FR2

Configuration	$T_{Evaluate_BFD_CSI-RS_Redcap}$ (ms)
no DRX	$Max(50, Ceil(M_{BFD} \times P \times N \times P_{BFD}) \times T_{CSI-RS})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(1.5 \times M_{BFD} \times P \times N \times P_{BFD}) \times Max(T_{DRX}, T_{CSI-RS}))$
DRX cycle > 320 ms	$Ceil(M_{BFD} \times P \times N \times P_{BFD}) \times T_{DRX}$
NOTE: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length	

8.5B.3.3 Measurement restrictions for CSI-RS beam failure detection

The UE is required to be capable of measuring CSI-RS for BFD without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following scenarios.

For both FR1 and FR2, when the CSI-RS for BFD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for BFD measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for BFD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

For FR2, when the CSI-RS for BFD measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD or L1-RSRP measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for BFD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for BFD measurement and the other CSI-RS. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.
  - The CSI-RS for BFD measurement or the other CSI-RS in a resource set configured with repetition ON, or
  - The other CSI-RS is configured in set $\bar{q}_1$ and beam failure is detected, or
  - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

8.5B.4 Minimum requirement for L1 indication for Redcap

When the radio link quality on all the RS resources in set $\bar{q}_0$ is worse than $Q_{out_LR_Redcap}$, layer 1 of the UE shall send a beam failure instance indication to the higher layers

The beam failure instance evaluation for the RS resources in set $\bar{q}_0$ shall be performed as specified in clause 6 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication_interval_BFD_Redcap}$.

When DRX is not used, $T_{Indication_interval_BFD_Redcap}$ is max(2ms, $T_{SSB-RS,M}$)) or max(2ms, $T_{CSI-RS,M}$), where $T_{SSB-RS,M}$ and $T_{CSI-RS,M}$ is the shortest periodicity of all RS resources in set $\bar{q}_0$ for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set $\bar{q}_0$ or CSI-RS resource in the set $\bar{q}_0$.

When DRX is used, for SSB based link quality measurement,

- $T_{Indication_interval_BFD_Redcap}$ = Max(1.5 × DRX_cycle_length, 1.5 × $T_{SSB-RS,M}$), if DRX_cycle_length ≤ 320 ms,
- $T_{Indication_interval_BFD_Redcap}$ = DRX_cycle_length, if DRX_cycle_length > 320 ms.

When DRX is used, for CSI-RS based link quality measurement,

- $T_{Indication_interval_BFD_Redcap}$ = Max(1.5 × DRX_cycle_length, 1.5 × $T_{CSI-RS,M}$), if DRX_cycle_length ≤ 320 ms,
- $T_{Indication_interval_BFD_Redcap}$ = DRX_cycle_length, if DRX_cycle_length > 320 ms.

For HD-FDD UE, the above conditions and requirements $T_{Indication_interval_BFD_Redcap}$ apply given that for each BFD-RS configuration, at least one BFD-RS sample must fall with DL occasion within an indication perio

8.5B.5 Requirements for SSB based candidate beam detection for Redcap

8.5B.5.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\bar{q}_1$ configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5.5.2.

8.5B.5.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set $\bar{q}_1$ estimated over the last $T_{Evaluate_CBD_SSB}$ period becomes better than the threshold $Q_{in_LR_RedCap}$ provided SSB_RP and SSB Ês/Iot are according to annex B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 8.5B.5.2-1 and 8.5B.5.2-2 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320 ms.

The value of $T_{Evaluate_CBD_SSB_Redcap}$ is defined in table 8.5B.5.2-1 for FR1.

The value of $T_{Evaluate_CBD_SSB_Redcap}$ is defined in table 8.5B.5.2-2 for FR2 with scaling factor N=8.

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB,
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

- $T_{SMTCperiod} \neq$ MGRP or
- $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

- $P_{sharing\ factor}$ = 1, if the candidate beam detection RS outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;
  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured
- $P_{sharing\ factor}$ = 3, otherwise.

where,

If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period $T_{identify_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of P_{CBD} used in table 8.5.5.2-1 and table 8.5.5.2-2 are defined as:

For each SSB resource in the set $\bar{q}_1$ configured for PCell

- P_{CBD} = 1.

Table 8.5B.5.2-1: Evaluation period $T_{Evaluate_CBD_SSB_Redcap}$ for FR1

Configuration	$T_{Evaluate_CBD_SSB_Redcap}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	Max(25, Ceil($3 \times P \times P_{CBD}$) × T_{SSB})
DRX cycle > 320 ms	Ceil($3 \times P \times P_{CBD}$) × T_{DRX}
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length.	

Table 8.5B.5.2-2: Evaluation period $T_{Evaluate_CBD_SSB_Redcap}$ for FR2

Configuration	$T_{Evaluate_CBD_SSB_Redcap}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	Max(25, Ceil($3 \times P \times N \times P_{CBD}$) × T_{SSB})

DRX cycle > 320 ms	Ceil(3 × P × N × P_{CBD}) × T_{DRX}
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length.	

8.5B.5.3 Measurement restriction for SSB based candidate beam detection

For FR1, when the SSB for CBD measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for CBD measurement without any restrictions;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for CBD measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

For FR2, when the SSB for CBD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

8.5B.6 Requirements for CSI-RS based candidate beam detection for Redcap

8.5B.6.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\bar{q}_1$ configured for a serving cell, provided that the CSI-RS resources configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5B.6.2.

8.5B.6.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set $\bar{q}_1$ estimated over the last $T_{Evaluate_CBD_CSI\text{-}RS_Redcap}$ period becomes better than the threshold $Q_{in_LR_RedCap}$ within $T_{Evaluate_CBD_CSI\text{-}RS_Redcap}$ period provided CSI-RS Ês/Iot is according to annex B.2.4.2 for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in table 8.5B.6.2-1 and 8.5B.6.2-2 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320 ms.

The value of $T_{Evaluate_CBD_CSI\text{-}RS_Redcap}$ is defined in table 8.5B.6.2-1 for FR1.

The value of $T_{Evaluate_CBD_CSI\text{-}RS_Redcap}$ is defined in table 8.5B.6.2-2 for FR2 with scaling factor N=8.

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P = 1, when candidate beam detection RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$ when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is not overlapped with SMTC occasion (T_{CSI-RS} < MGRP)

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).

- P =$P_{sharing\ factor}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$,, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap

- $P = \frac{3}{1-\frac{T_{CSI-RS}}{MGRP}}$,, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

- $P_{sharing\ factor}$ = 1, if the candidate beam detection RS outside measurement gap is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;

  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{sharing\ factor}$ = 3, otherwise.

where,

If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

NOTE: The overlap between CSI-RS for CBD and SMTC means that CSI-RS for CBD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM, BFD, BM-RS, or other CBD-RS, according to the measurement restrictions defined in clause 8.5.6.3.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of M_{CBD} used in table 8.5B.6.2-1 and table 8.5B.6.2-2 are defined as

- M_{CBD} = 3, if the CSI-RS resource configured in the set $\bar{q}_1$ is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs.

The values of P_{CBD} used in table 8.5B.6.2-1 and table 8.5B.6.2-2 are defined as

For each CSI-RS resource in the set $\bar{q}_1$ configured for PCell

- P_{CBD} = 1.

Table 8.5B.6.2-1: Evaluation period $T_{Evaluate_CBD_CSI\text{-}RS_Redcap}$ for FR1

Configuration	$T_{EvaluateC_CBD_CSI\text{-}RS_Redcap}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	$Max(25, Ceil(M_{CBD} \times P \times P_{CBD}) \times T_{CSI\text{-}RS})$
DRX cycle > 320 ms	$Ceil(M_{CBD} \times P \times P_{CBD}) \times T_{DRX}$
NOTE: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS resource in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length.	

Table 8.5B.6.2-2: Evaluation period $T_{Evaluate_CBD_CSI\text{-}RS_Redcap}$ for FR2

Configuration	$T_{Evaluate_CBD_CSI\text{-}RS_Redcap}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	$Max(25, Ceil(M_{CBD} \times P \times N \times P_{CBD}) \times T_{CSI\text{-}RS})$
DRX cycle > 320 ms	$Ceil(M_{CBD} \times P \times N \times P_{CBD}) \times T_{DRX}$
NOTE: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS resource in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length.	

8.5B.6.3 Measurement restriction for CSI-RS based candidate beam detection

For both FR1 and FR2, when the CSI-RS for CBD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for CBD measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS based CBD measurement for without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer measurement period for CSI-RS based CBD measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for CBD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for CBD measurement without any restriction.

For FR2, when the CSI-RS for CBD measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer evaluation period for CSI-RS based CBD measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for CBD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to

measure one of but not both CSI-RS for CBD measurement and the other CSI-RS. Longer evaluation period for CSI-RS based CBD measurement is expected, and no requirements are defined.

8.5B.7 Scheduling availability of UE during beam failure detection for Redcap

Scheduling availability restrictions when the UE is performing beam failure detection are described in the following clauses.

8.5B.7.1 Scheduling availability of UE performing beam failure detection with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to beam failure detection performed on SSB and CSI-RS configured for BFD with the same SCS as PDSCH or PDCCH in FR1.

8.5B.7.2 Scheduling availability of UE performing beam failure detection with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to beam failure detection when SSB is configured as BFD. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to beam failure detection when SSB is configured as BFD.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for beam failure detection.

8.5B.7.3 Scheduling availability of UE performing beam failure detection on FR2

The following scheduling restriction applies due to beam failure detection.

- For the case where no RSs are provided for BFD, or when CSI-RS is configured for BFD is explicitly configured and is type-D QCLed with active TCI state for PDCCH or PDSCH, and the CSI-RS is not in a CSI-RS resource set with repetition ON
  - There are no scheduling restrictions due to beam failure detection performed based on the CSI-RS.
- Otherwise
  - The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on BFD-RS resource symbols to be measured for beam failure detection.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE’s reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for BFD mesurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for BFD mesurement.

8.5B.8 Scheduling availability of UE during candidate beam detection for Redcap

Scheduling availability restrictions when the UE is performing L1-RSRP measurement for candidate beam detection are described in the following clauses.

8.5B.8.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as link recovery detection resource with the same SCS as PDSCH or PDCCH in FR1.

8.5B.8.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as link recovery detection resource. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured as link recovery detection resource.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, TRS, CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for L1-RSRP.

8.5B.8.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to candidate beam detection

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, CSI-RS for tracking or CSI-RS for CQI on reference symbols to be measured for candidate beam detection.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for CBD mesurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for CBD mesurement.

8.5B.9 Minimum requirement at transitions for beam failure detection for Redcap

When the UE transitions between BFD CD-SSB resource and BFD NCD-SSB resource due to BWP switching during one evaluation period, the UE shall use an evaluation period that is the maximum of the evaluation period corresponding to the first SSB type and the second SSB type after the BWP switching. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second SSB type for each BFD-RS resource.

The requirements in clause 8.5.10 shall also apply except the scenarios described above.

8.5C Link Recovery Procedures for Satellite Access

8.5C.1 Introduction

The UE shall assess the downlink radio link quality of a serving cell based on the reference signal in the set $\bar{q}_0$ as specified in TS 38.213 [3] in order to detect beam failure on PCell and the UE is configured with only PCell, which is served by satellite access node (SAN).

The RS resource configurations in the set $\bar{q}_0$ on PCell can be periodic CSI-RS resources and/or SSBs.

On each RS resource configuration in the set $\bar{q}_0$, the UE shall estimate the radio link quality and compare it to the threshold Q_{out_LR} for the purpose of accessing downlink radio link quality of the serving cell beams.

The threshold Q_{out_LR} is defined as the level at which the downlink radio level link of a given resource configuration on set $\bar{q}_0$ cannot be reliably received and shall correspond to the $BLER_{out}$ = 10% block error rate of a hypothetical PDCCH transmission. For SSB based beam failure detection, $Q_{out_LR_SSB}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5.2.1C-1, and table 8.5.2.1C-2 for a UE operating on a cell with less than 5 MHz BW. For CSI-RS based beam failure detection, $Q_{out_LR_CSI\text{-}RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5C.3.1-1, and table 8.5.2.1C-2 for a UE operating on a cell with less than 5 MHz BW.

Upon request the UE shall deliver configuration indexes from the set $\bar{q}_1$as specified in TS 38.213 [3] , to higher layers, and the corresponding L1-RSRP measurement provided that the measured L1-RSRP is equal to or better than the threshold Q_{in_LR}, which is indicated by higher layer parameter *rsrp-ThresholdSSB*. The UE applies the Q_{in_LR} threshold to the L1-RSRP measurement obtained from an SSB. The UE applies the Q_{in_LR} threshold to the L1-RSRP measurement obtained for a CSI-RS resource after scaling a respective CSI-RS reception power with a value provided by higher layer parameter *powerControlOffsetSS*. The RS resource configurations in the set $\bar{q}_1$ can be periodic CSI-RS resources or SSBs or both SSB and CSI-RS resources.

8.5C.2 Requirements for SSB based beam failure detection

8.5C.2.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\bar{q}_0$ configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5C.2.2.

Table 8.5.2.1C-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	Same as the SCS of RMSI CORESET
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.5.2.1C-2: PDCCH transmission parameters for beam failure instance for a UE operating on a cell with less than 5 MHz BW

Attribute	Value for BLER
Channel BW	**3 MHz**
[DL Transmission BW]	**15 PRBs**
DCI format	1-0
Number of control OFDM symbols	3
Aggregation level (CCE)	8 Note 1
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	15
Sub-carrier spacing (kHz)	Same as the SCS of RMSI CORESET
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal

Mapping from REG to CCE	Non-Distributed[Note2]
NOTE 1: PDCCH puncturing as defined in TS 38.214 [26] applies. NOTE 2: For 15PRB Transmission BW, distributed mapping may lead to unexpected beam failure detection.	

8.5C.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set $\bar{q}_0$ estimated over the last $T_{Evaluate_BFD_SSB}$ period becomes worse than the threshold $Q_{out_LR_SSB}$ within $T_{Evaluate_BFD_SSB}$ period.

The value of $T_{Evaluate_BFD_SSB}$ is defined in table 8.5C.2.2-1 for FR1-NTN.

P value for an RLM-RS resource to be measured is defined as

- $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
- $N_{total} / N_{available}$ with $N_{available} > 0$

For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:

- N_{total} is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
- $N_{outside_MG}$ is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
- $N_{available}$ is
  - the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W, if UE does not support *parallelMeasurementWithoutRestriction* and LEO satellites are measured for intra-frequency measurement, and
  - same as $N_{outside_MG}$, otherwise
- T_{L1} is periodicity of the target RLM-RS
- $P_{sharing\ factor} = 3$.

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For an FR1-NTN serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

Table 8.5C.2.2-1: Evaluation period $T_{Evaluate_BFD_SSB}$ for FR1-NTN

Configuration	$T_{Evaluate_BFD_SSB}$ (ms)
no DRX	$Max(50, Ceil(5 \times P) \times T_{SSB})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(7.5 \times P) \times Max(T_{DRX}, T_{SSB}))$
DRX cycle > 320 ms	$Ceil(5 \times P) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.	

8.5C.2.3 Measurement restriction for SSB based beam failure detection

The UE is required to be capable of measuring SSB for BFD without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following scenarios.

For FR1-NTN, when the SSB for BFD measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for BFD measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for BFD measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

8.5C.3 Requirements for CSI-RS based beam failure detection

8.5C.3.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\bar{q}_0$ of resource configurations for a serving cell, provided that the CSI-RS resource(s) in set $\bar{q}_0$ for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5C.3.2. UE is not expected to perform beam failure detection measurements on the CSI-RS configured for BFD if the CSI-RS is not QCL-ed, with QCL-TypeD when applicable, with the RS in the active TCI state of any CORESET configured in the UE active BWP.

Table 8.5C.3.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0 dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.5C.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set $\bar{q}_0$ estimated over the last $T_{Evaluate_BFD_CSI\text{-}RS}$ period becomes worse than the threshold $Q_{out_LR_CSI\text{-}RS}$ within $T_{Evaluate_BFD_CSI\text{-}RS}$ period.

The value of $T_{Evaluate_BFD_CSI\text{-}RS}$ is defined in table 8.5C.3.2-1 for FR1-NTN.

The requirements of $T_{Evaluate_BFD_CSI\text{-}RS}$ apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

P value for an RLM-RS resource to be measured is defined as

- $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
- $N_{total} / N_{available}$ with $N_{available} > 0$

For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:

- N_{total} is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- $N_{outside_MG}$ is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- $N_{available}$ is

  - the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W, if UE does not support *parallelMeasurementWithoutRestriction* and LEO satellites are measured for intra-frequency measurement, and

  - same as $N_{outside_MG}$, otherwise

- T_{L1} is periodicity of the target RLM-RS

- $P_{sharing\ factor} = 3$.

NOTE: The overlap between CSI-RS for BFD and SMTC means that CSI-RS for BFD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the BFD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For an FR1-NTN serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

The values of M_{BFD} used in table 8.5C.3.2-1 are defined as

- $M_{BFD} = 10$, if the CSI-RS resource(s) in set $\bar{q}_0$ used for BFD is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs.

The values of P_{BFD} used in table 8.5C.3.2-1 are defined as

For each CSI-RS resource in the set $\bar{q}_0$ configured for PCell SA

- $P_{BFD} = 1$.

Table 8.5C.3.2-1: Evaluation period $T_{Evaluate_BFD_CSI\text{-}RS}$ for FR1-NTN

Configuration	$T_{Evaluate_BFD_CSI\text{-}RS}$ (ms)
no DRX	$Max(50, Ceil(M_{BFD} \times P \times P_{BFD}) \times T_{CSI\text{-}RS})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(1.5 \times M_{BFD} \times P \times P_{BFD}) \times Max(T_{DRX}, T_{CSI\text{-}RS}))$
DRX cycle > 320 ms	$Ceil(M_{BFD} \times P \times P_{BFD}) \times T_{DRX}$
NOTE: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS resource in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.	

8.5C.3.3 Measurement restrictions for CSI-RS beam failure detection

The UE is required to be capable of measuring CSI-RS for BFD without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following scenarios.

For FR1-NTN, when the CSI-RS for BFD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for BFD measurement in the PRBs that overlap with an SSB.

For FR1-NTN, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1-NTN, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.

For FR1-NTN, when the CSI-RS for BFD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

8.5C.4 Minimum requirement for L1 indication

When the radio link quality on all the RS resources in set $\bar{q}_0$ is worse than Q_{out_LR}, layer 1 of the UE shall send a beam failure instance indication to the higher layers

The beam failure instance evaluation for the RS resources in set $\bar{q}_0$ shall be performed as specified in clause 6 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication_interval_BFD}$.

When DRX is not used, $T_{Indication_interval_BFD}$ is max(2ms, $T_{SSB\text{-}RS,M}$)) or max(2ms, $T_{CSI\text{-}RS,M}$), where $T_{SSB\text{-}RS,M}$ and $T_{CSI\text{-}RS,M}$ is the shortest periodicity of all RS resources in set $\bar{q}_0$ for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set $\bar{q}_0$ or CSI-RS resource in the set $\bar{q}_0$.

When DRX is used, for SSB based link quality measurement,

- $T_{Indication_interval_BFD}$ = Max(1.5 × DRX_cycle_length, 1.5 × $T_{SSB\text{-}RS,M}$), if DRX_cycle_length ≤ 320 ms,
- $T_{Indication_interval_BFD}$ = DRX_cycle_length, if DRX_cycle_length > 320 ms.

When DRX is used, for CSI-RS based link quality measurement,

- $T_{Indication_interval_BFD}$ = Max(1.5 × DRX_cycle_length, 1.5 × $T_{CSI\text{-}RS,M}$), if DRX_cycle_length ≤ 320 ms,
- $T_{Indication_interval_BFD}$ = DRX_cycle_length, if DRX_cycle_length > 320 ms.

8.5C.5 Requirements for SSB based candidate beam detection

8.5C.5.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\bar{q}_1$ configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5C.5.2.

8.5C.5.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set $\bar{q}_1$ estimated over the last $T_{Evaluate_CBD_SSB}$ period becomes better than the threshold Q_{in_LR} provided SSB_RP and SSB Ês/Iot are according to annex B.2.19.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 8.5C.5.2-1 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320 ms.

The value of $T_{Evaluate_CBD_SSB}$ is defined in table 8.5C.5.2-1 for FR1-NTN.

where,

P value for an RLM-RS resource to be measured is defined as

- $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ with $N_{available}$ = 0
- N_{total} / $N_{available}$ with $N_{available}$ > 0

For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:

- N_{total} is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
- $N_{outside_MG}$ is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
- $N_{available}$ is
  - the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W, if UE does not support *parallelMeasurementWithoutRestriction* and LEO satellites are measured for intra-frequency measurement, and
  - same as $N_{outside_MG}$, otherwise
- T_{L1} is periodicity of the target RLM-RS
- $P_{sharing\ factor} = 3$.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For an FR1-NTN serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

The values of P_{CBD} used in table 8.5C.5.2-1 are defined as:

For each SSB resource in the set $\bar{q}_1$ configured for PCell.

- $P_{CBD} = 1$.

Table 8.5C.5.2-1: Evaluation period $T_{Evaluate_CBD_SSB}$ for FR1-NTN

Configuration	$T_{Evaluate_CBD_SSB}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	$Max(25, Ceil(3 \times P \times P_{CBD}) \times T_{SSB})$
DRX cycle > 320 ms	$Ceil(3 \times P \times P_{CBD}) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length.	

8.5C.5.3 Measurement restriction for SSB based candidate beam detection

For FR1-NTN, when the SSB for CBD measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for CBD measurement without any restrictions;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for CBD measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

8.5C.6 Requirements for CSI-RS based candidate beam detection

8.5C.6.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\bar{q}_1$ configured for a serving cell, provided that the CSI-RS resources configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5C.6.2.

8.5C.6.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set $\bar{q}_1$ estimated over the last $T_{Evaluate_CBD_CSI\text{-}RS}$ period becomes better than the threshold Q_{in_LR} within $T_{Evaluate_CBD_CSI\text{-}RS}$ period provided CSI-RS Ês/Iot is according to annex B.2.19.2 for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in tables 8.5C.6.2-1 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320ms.

The value of $T_{Evaluate_CBD_CSI\text{-}RS}$ is defined in table 8.5C.6.2-1 for FR1-NTN.

P value for an RLM-RS resource to be measured is defined as:

- $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
- $N_{total} / N_{available}$ with $N_{available} > 0$

For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:

- N_{total} is the total number of RLM-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
- $N_{outside_MG}$ is the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
- $N_{available}$ is
  - the number of RLM-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W, if UE does not support *parallelMeasurementWithoutRestriction* and LEO satellites are measured for intra-frequency measurement, and
  - same as $N_{outside_MG}$, otherwise
- T_{L1} is periodicity of the target RLM-RS
- $P_{sharing\ factor} = 3$.

Note: The overlap between CSI-RS for CBD and SMTC means that CSI-RS for CBD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For an FR1-NTN serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

he values of M_{CBD} used in table 8.5C.6.2-1 are defined as:

- $M_{CBD} = 3$, if the CSI-RS resource configured in the set $\bar{q}_1$ is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs.

The values of P_{CBD} used in table 8.5C.6.2-1 are defined as:

For each CSI-RS resource in the set $\bar{q}_1$ configured for SA

- $P_{CBD} = 1$.

Table 8.5C.6.2-1: Evaluation period $T_{Evaluate_CBD_CSI\text{-}RS}$ for FR1-NTN

Configuration	$T_{EvaluateC_CBD_CSI\text{-}RS}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	$Max(25, Ceil(M_{CBD} \times P \times P_{CBD}) \times T_{CSI\text{-}RS})$
DRX cycle > 320 ms	$Ceil(M_{CBD} \times P \times P_{CBD}) \times T_{DRX}$
NOTE: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS resource in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length.	

8.5C.6.3 Measurement restriction for CSI-RS based candidate beam detection

For FR1-NTN, when the CSI-RS for CBD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for CBD measurement in the PRBs that overlap with an SSB.

For FR1-NTN, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement without restrictions.

For FR1-NTN, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS based CBD measurement for without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer measurement period for CSI-RS based CBD measurement is expected, and no requirements are defined.

For FR1-NTN, when the CSI-RS for CBD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for CBD measurement without any restriction.

8.5C.7 Scheduling availability of UE during beam failure detection

Scheduling availability restrictions when the UE is performing beam failure detection are described in the following clauses.

8.5C.7.1 Scheduling availability of UE performing beam failure detection with a same subcarrier spacing as PDSCH/PDCCH on FR1-NTN

There are no scheduling restrictions due to beam failure detection performed on SSB and CSI-RS configured for BFD with the same SCS as PDSCH or PDCCH in FR1-NTN.

8.5C.7.2 Scheduling availability of UE performing beam failure detection with a different subcarrier spacing than PDSCH/PDCCH on FR1-NTN

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to beam failure detection when SSB is configured as BFD. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to beam failure detection when SSB is configured as BFD.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for beam failure detection.

8.5C.8 Scheduling availability of UE during candidate beam detection

Scheduling availability restrictions when the UE is performing L1-RSRP measurement for candidate beam detection are described in the following clauses.

8.5C.8.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1-NTN

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as link recovery detection resource with the same SCS as PDSCH or PDCCH in FR1-NTN.

8.5C.8.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1-NTN

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as link recovery detection resource. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured as link recovery detection resource.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, TRS, CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for L1-RSRP.

8.5C.9 Minimum requirement at transitions for beam failure detection

When the UE transitions between DRX and no DRX or when DRX cycle periodicity changes, for each BFD-RS resource, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation period corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode for each BFD-RS resource.

When the UE transitions from a first configuration of BFD resources to a second configuration of BFD resources that is different from the first configuration, for each BFD resource present in the second configuration, for a duration of time equal to the evaluation period corresponding to the second configuration after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first configuration and the second configuration. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second configuration for each BFD resource present in the second configuration.

When the UE transitions from a first configuration of active TCI state of the CORESET to a second configuration of active TCI state of the CORESET, for each CSI-RS for BFD present in the second configuration, the UE shall use an evaluation period corresponding to the second configuration from the time of transition.

8.5D Link Recovery Procedures for ATG

8.5D.1 Introduction

The requirements in clause 8.5D apply for link recovery procedure on ATG UE.

The UE shall assess the downlink radio link quality of a serving cell based on the reference signal in the set $\bar{q}_0$ as specified in TS 38.213 [3] in order to detect beam failure on PCell and SCell.

The RS resource configurations in the set $\bar{q}_0$ can be periodic CSI-RS resources and/or SSBs. RS resource configuration in the set $\bar{q}_0$ on SCell shall be periodic CSI-RS. UE is not required to perform beam failure detection outside the active DL BWP. UE is not required to meet the requirements in clause 8.5D.2 and 8.5D.3 if UE does not have set $\bar{q}_0$. UE is not required to perform beam failure detection on a deactivated SCell, and also not required to perform beam failure detection on resources which is implicitly configured for a deactivated SCell. When more than 2 periodic CSI-RS resources on a CC are configured in the set $\bar{q}_0$ for current SCell or implicitly configured in the set $\bar{q}_0$ for other SCell, it is up to UE implementation to select two of CSI-RS resources in active BWP in current CC to perform beam failure detection. UE is not required to perform beam failure detection on a SCell on which $\bar{q}_1$ is not configured.

On each RS resource configuration in the set $\bar{q}_0$, the UE shall estimate the radio link quality and compare it to the threshold Q_{out_LR} for the purpose of accessing downlink radio link quality of the serving cell beams.

The threshold Q_{out_LR} is defined as the level at which the downlink radio level link of a given resource configuration on set $\bar{q}_0$ cannot be reliably received and shall correspond to the $BLER_{out}$ = 10% block error rate of a hypothetical PDCCH transmission. For SSB based beam failure detection, $Q_{out_LR_SSB}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5.2.1-1. For CSI-RS based beam failure detection, $Q_{out_LR_CSI\text{-}RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5.3.1-1.

Upon request the UE shall deliver configuration indexes from the set $\bar{q}_1$ as specified in TS 38.213 [3] , to higher layers, and the corresponding L1-RSRP measurement provided that the measured L1-RSRP is equal to or better than the threshold Q_{in_LR}, which is indicated by higher layer parameter *rsrp-ThresholdSSB*. The UE applies the Q_{in_LR} threshold to the L1-RSRP measurement obtained from an SSB. The UE applies the Q_{in_LR} threshold to the L1-RSRP measurement obtained for a CSI-RS resource after scaling a respective CSI-RS reception power with a value provided by higher layer parameter *powerControlOffsetSS*. The RS resource configurations in the set $\bar{q}_1$ can be periodic CSI-RS resources or SSBs or both SSB and CSI-RS resources. UE is not required to perform candidate beam detection outside the active DL BWP. UE is not required to perform candidate beam detection on a SCell on which $\bar{q}_1$ is not configured.

8.5D.2 Requirements for SSB based beam failure detection

8.5D.2.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\bar{q}_0$ configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5D.2.2.

Table 8.5D.2.1-1: Void

8.5D.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set $\bar{q}_0$ estimated over the last $T_{Evaluate_BFD_SSB}$ period becomes worse than the threshold $Q_{out_LR_SSB}$ within $T_{Evaluate_BFD_SSB}$ period.

The value of $T_{Evaluate_BFD_SSB}$ is defined in table 8.5D.2.2-1 for FR1.

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB.
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR1 ATG UE with the antenna array,

- P value for an BFD-RS resource to be measured is defined as:
  - $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
  - $N_{total} / N_{available}$ with $N_{available} > 0$
    - For a window W of duration max(T_{L1}, $MGRP_{max}$), where $MGRP_{max}$ is the maximum MGRP across all configured per-UE measurement gaps starting at the beginning of any BFD-RS resource occasion:
    - N_{total} is the total number of BFD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
    - $N_{outside_MG}$ is the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
    - $N_{available}$ is
      - If the measured carrier is the SCC with servingcellMO configured, and *neighSCellMeasSkipping* is set to 'enable' by network
        - If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams
          - the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- otherwise,
  - the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RSs resource occasions of other serving cell within the window W
- otherwise,
  - If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams
    - the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RSs resource occasions for L3 measurements of the same serving cell within the window W,
  - otherwise,
    - the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
- T_{L1} is periodicity of the target BFD-RS
- $P_{sharing\ factor} = 3$.

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

Table 8.5D.2.2-1: Evaluation period $T_{Evaluate_BFD_SSB}$ for FR1

Configuration	$T_{Evaluate_BFD_SSB}$ (ms)
no DRX	$Max(50, Ceil(5 \times P) \times T_{SSB})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(7.5 \times P) \times Max(T_{DRX}, T_{SSB}))$
DRX cycle > 320 ms	$Ceil(5 \times P) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.	

8.5D.2.3 Measurement restriction for SSB based beam failure detection

The UE is required to be capable of measuring SSB for BFD without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following clauses.

For FR1, when the SSB for BFD measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for BFD measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for BFD measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

8.5D.3 Requirements for CSI-RS based beam failure detection

8.5D.3.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\bar{q}_0$ of resource configurations for a serving cell, provided that the CSI-RS resource(s) in set $\bar{q}_0$ for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5D.3.2. UE is not expected to perform beam failure detection measurements on the CSI-RS configured for BFD if the CSI-RS is not QCL-ed, with QCL-TypeD when applicable, with the RS in the active TCI state of any CORESET configured in the UE active BWP.

Table 8.5D.3.1-1: Void

8.5D.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set $\bar{q}_0$ estimated over the last $T_{Evaluate_BFD_CSI\text{-}RS}$ period becomes worse than the threshold $Q_{out_LR_CSI\text{-}RS}$ within $T_{Evaluate_BFD_CSI\text{-}RS}$ period.

The value of $T_{Evaluate_BFD_CSI\text{-}RS}$ is defined in table 8.5D.3.2-1 for FR1.

The requirements of $T_{Evaluate_BFD_CSI\text{-}RS}$ apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS.
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR1 ATG UE with the antenna array,

- P value for an BFD-RS resource to be measured is defined as:
  - $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
  - $N_{total} / N_{available}$ with $N_{available} > 0$
    - For a window W of duration max(T_{L1}, $MGRP_{max}$), where $MGRP_{max}$ is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any RLM-RS resource occasion:
    - N_{total} is the total number of BFD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
    - $N_{outside_MG}$ is the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
    - $N_{available}$ is
      - If the measured carrier is the SCC with *servingcellMO* configured, and *neighSCellMeasSkipping* is set to 'enable' by network
        - If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams
          - the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
        - otherwise,

- the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RSs resource occasions of other serving cell within the window W

- otherwise,
  - If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams
    - the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RSs resource occasions for L3 measurements of the same serving cell within the window W,
  - otherwise,
    - the number of BFD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W

- T_{L1} is periodicity of the target BFD-RS
- $P_{sharing\ factor} = 3$.

Longer evaluation period would be expected if the combination of the BFD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

The values of M_{BFD} used in table 8.5D.3.2-1 are defined as:

- $M_{BFD} = 10$, if the CSI-RS resource(s) in set $\bar{q}_0$ used for BFD is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs.

The values of P_{BFD} used in table 8.5D.3.2-1 is defined as

For each CSI-RS resource in the set $\bar{q}_0$ configured for a SCell

- $P_{BFD} = Z$
  - Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell

Table 8.5D.3.2-1: Evaluation period $T_{Evaluate_BFD_CSI\text{-}RS}$ for FR1

Configuration	$T_{Evaluate_BFD_CSI\text{-}RS}$ (ms)
no DRX	$Max(50, Ceil(M_{BFD} \times P \times P_{BFD}) \times T_{CSI\text{-}RS})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(1.5 \times M_{BFD} \times P \times P_{BFD}) \times Max(T_{DRX}, T_{CSI\text{-}RS}))$
DRX cycle > 320 ms	$Ceil(M_{BFD} \times P \times P_{BFD}) \times T_{DRX}$
NOTE: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS resource in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.	

8.5D.3.3 Measurement restrictions for CSI-RS beam failure detection

The UE is required to be capable of measuring CSI-RS for BFD without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following clauses.

For FR1, when the CSI-RS for BFD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for BFD measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for BFD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

8.5D.4 Minimum requirement for L1 indication

The requirements in clause 8.5.4 shall apply only for UE in NR SA operation mode.

8.5D.5 Requirements for SSB based candidate beam detection

8.5D.5.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\bar{q}_1$ configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5D.5.2.

8.5D.5.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set $\bar{q}_1$ estimated over the last $T_{Evaluate_CBD_SSB}$ period becomes better than the threshold Q_{in_LR} provided SSB_RP and SSB Ês/Iot are according to annex B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 8.5D.5.2-1 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320 ms.

The value of $T_{Evaluate_CBD_SSB}$ is defined in table 8.5D.5.2-1 for FR1.

where,

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB,

- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR1 ATG UE with the antenna array,

- P value for an CBD-RS resource to be measured is defined as:

  - $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$

  - $N_{total} / N_{available}$ with $N_{available} > 0$

    - For a window W of duration max(T_{L1}, $MGRP_{max}$), where $MGRP_{max}$ is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CBD-RS resource occasion:

    - N_{total} is the total number of CBD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

    - $N_{outside_MG}$ is the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

    - $N_{available}$ is

      - If the measured carrier is the SCC with servingcellMO configured, and *neighSCellMeasSkipping* is set to ‘enable’ by network

- If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams

  - the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- otherwise,

  - the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RSs resource occasions of other serving cell within the window W

- otherwise,

  - If inter-band carrier aggregation within FR1 is configured, and UE not capable of antennaArrayType-r18 on the other serving carrier, or UE support two simultaneous separate Rx beams

    - the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RSs resource occasions for L3 measurements of the same serving cell within the window W,

  - otherwise,

    - the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W

- T_{L1} is periodicity of the target CBD-RS
- $P_{\text{sharing factor}} = 3$.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

The values of P_{CBD} used in table 8.5D.5.2-1 is defined as

For each SSB resource in the set $\bar{q}_1$ configured for a SCell

- $P_{CBD} = Z$
  - Where Z is the number of band(s) on which UE is performing candidate beam detection only for SCell

Table 8.5D.5.2-1: Evaluation period $T_{Evaluate_CBD_SSB}$ for FR1

Configuration	$T_{Evaluate_CBD_SSB}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	$\text{Max}(25, \text{Ceil}(3 \times P \times P_{CBD}) \times T_{SSB})$
DRX cycle > 320 ms	$\text{Ceil}(3 \times P \times P_{CBD}) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length.	

8.5D.5.3 Measurement restriction for SSB based candidate beam detection

For FR1, when the SSB for CBD measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for CBD measurement without any restrictions;
- If SSB and CSI-RS have different SCSs,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for CBD measurement without any restriction;

- If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

8.5D.6 Requirements for CSI-RS based candidate beam detection

8.5D.6.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\bar{q}_1$ configured for a serving cell, provided that the CSI-RS resources configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5D.6.2.

8.5D.6.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set $\bar{q}_1$ estimated over the last $T_{Evaluate_CBD_CSI\text{-}RS}$ period becomes better than the threshold Q_{in_LR} within $T_{Evaluate_CBD_CSI\text{-}RS}$ period provided CSI-RS Ês/Iot is according to annex B.2.4.2 for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in table 8.5D.6.2-1 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320 ms.

The value of $T_{Evaluate_CBD_CSI\text{-}RS}$ is defined in table 8.5D.6.2-1 for FR1.

For FR1 ATG UE with one or multiple omni-directional antenna(s),

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR1 ATG UE with the antenna array,

- P value for an CBD-RS resource to be measured is defined as:
  - $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
  - $N_{total} / N_{available}$ with $N_{available} > 0$
    - For a window W of duration max(T_{L1}, $MGRP_{max}$), where $MGRP_{max}$ is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CBD-RS resource occasion:
    - N_{total} is the total number of CBD-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
    - $N_{outside_MG}$ is the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
    - $N_{available}$ is
      - If the measured carrier is the SCC with *servingcellMO* configured, and *neighSCellMeasSkipping* is set to 'enable' by network
        - If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams
          - the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
        - otherwise,

- the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RSs resource occasions of other serving cell within the window W

- otherwise,

  - If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams

    - the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RSs resource occasions for L3 measurements of the same serving cell within the window W,

  - otherwise,

    - the number of CBD-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W

- T_{L1} is periodicity of the target CBD-RS

- $P_{\text{sharing factor}} = 3$.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM, BFD, BM-RS, or other CBD-RS, according to the measurement restrictions defined in clause 8.5D.6.3.

The values of M_{CBD} used in table 8.5D.6.2-1 are defined as:

- $M_{CBD} = 3$, if the CSI-RS resource configured in the set $\bar{q}_1$ is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs.

The values of P_{CBD} used in table 8.5D.6.2-1 is defined as

For each CSI-RS resource in the set $\bar{q}_1$ configured for a SCell

- $P_{CBD} = Z$

  - Where Z is the number of band(s) on which UE is performing candidate beam detection only for SCell

Table 8.5D.6.2-1: Evaluation period $T_{Evaluate_CBD_CSI\text{-}RS}$ for FR1

Configuration	$T_{EvaluateC_CBD_CSI\text{-}RS}$ (ms)
non-DRX, DRX cycle ≤ 320 ms	$\text{Max}(25, \text{Ceil}(M_{CBD} \times P \times P_{CBD}) \times T_{CSI\text{-}RS})$
DRX cycle > 320 ms	$\text{Ceil}(M_{CBD} \times P \times P_{CBD}) \times T_{DRX}$
NOTE: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS resource in the set $\bar{q}_1$. T_{DRX} is the DRX cycle length.	

8.5D.6.3 Measurement restriction for CSI-RS based candidate beam detection

For FR1, when the CSI-RS for CBD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for CBD measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS based CBD measurement for without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer measurement period for CSI-RS based CBD measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for CBD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for CBD measurement without any restriction.

8.5D.7 Scheduling availability of UE during beam failure detection

Scheduling availability restrictions when the UE is performing beam failure detection are described in the following clauses.

8.5D.7.1 Scheduling availability of UE performing beam failure detection with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to beam failure detection performed on SSB and CSI-RS configured for BFD with the same SCS as PDSCH or PDCCH in FR1.

8.5D.7.2 Scheduling availability of UE performing beam failure detection with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to beam failure detection when SSB is configured as BFD. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to beam failure detection when SSB is configured as BFD.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for beam failure detection.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on FR1 serving PCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) in the bands due to beam failure detection performed on FR1 serving PCell in different bands.

8.5D.8 Scheduling availability of UE during candidate beam detection

Scheduling availability restrictions when the UE is performing L1-RSRP measurement for candidate beam detection are described in the following clauses.

8.5D.8.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as link recovery detection resource with the same SCS as PDSCH or PDCCH in FR1.

8.5D.8.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as link recovery detection resource. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured as link recovery detection resource.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, TRS, CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for L1-RSRP.

When intra-band carrier aggregation in FR1 is performed, the scheduling restrictions on FR1 serving PCell applies to all serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols.

When inter-band carrier aggregation within FR1 is performed, there are no scheduling restrictions on FR1 serving cell(s) in the bands due to candidate beam detection performed on FR1 serving PCell in different bands.

8.5D.9 Minimum requirement at transitions for beam failure detection

The requirement in clause 8.5.10 shall apply.

8.5D.10 Requirements for Beam Failure Recovery in SCell

The requirement in clause 8.5.9 shall apply except that:

- $T_2 = T_{Evaluate_CBD}$ is the evaluation period specified in clause 8.5D.5 or 8.5D.6 for SSB or CSI-RS based candidate beam detection, that is $T_{Evaluate_CBD_SSB}$ or $T_{Evaluate_CBD_CSI-RS}$, depending on the applicable reference signal configured for candidate beam detection.

8.5E Link Recovery Procedures for RedCap UE with Satellite Access

8.5E.1 Introduction

The RedCap UE shall assess the downlink radio link quality of a serving cell based on the reference signal in the set $\bar{q}_0$ as specified in TS 38.213 [3] in order to detect beam failure on PCell and the UE is configured with only PCell, which is served by satellite access node (SAN).

The RS resource configurations in the set $\bar{q}_0$ on PCell can be periodic CSI-RS resources and/or SSBs. UE is not required to perform beam failure detection outside the active DL BWP. UE is not required to meet the requirements in clause 8.5E.2 and 8.5E.3 if UE does not have set $\bar{q}_0$.

On each RS resource configuration in the set $\bar{q}_0$, the UE shall estimate the radio link quality and compare it to the threshold $Q_{out_LR_RedCap}$ for the purpose of accessing downlink radio link quality of the serving cell beams.

The threshold $Q_{out_LR_RedCap}$ is defined as the level at which the downlink radio level link of a given resource configuration on set $\bar{q}_0$ cannot be reliably received and shall correspond to the $BLER_{out}$ = 10% block error rate of a hypothetical PDCCH transmission. For SSB based beam failure detection, $Q_{out_LR_SSB}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5E.2.1-1. For CSI-RS based beam failure detection, $Q_{out_LR_CSI-RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.5E.3.1-1.

Upon request the UE shall deliver configuration indexes from the set $\bar{q}_1$ as specified in TS 38.213 [3], to higher layers, and the corresponding L1-RSRP measurement provided that the measured L1-RSRP is equal to or better than the threshold $Q_{in_LR_RedCap}$, which is indicated by higher layer parameter *rsrp-ThresholdSSB*. The UE applies the $Q_{in_LR_RedCap}$ threshold to the L1-RSRP measurement obtained from an SSB. The UE applies the $Q_{in_LR_RedCap}$ threshold to the L1-RSRP measurement obtained for a CSI-RS resource after scaling a respective CSI-RS reception power with a value provided by higher layer parameter *powerControlOffsetSS*. The RS resource configurations in the set $\bar{q}_1$ can be periodic CSI-RS resources or SSBs or both SSB and CSI-RS resources. UE is not required to perform candidate beam detection outside the active DL BWP.

8.5E.2 Requirements for SSB based beam failure detection for RedCap UE with satellite access

8.5E.2.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\bar{q}_0$ configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5E.2.2.

Table 8.5E.2.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	16 for 1 Rx UE; 8 for 2 Rx UE
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	48 for 1 Rx UE; 24 for 2 Rx UE
Sub-carrier spacing (kHz)	Same as the SCS of RMSI CORESET
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed
NOTE 1: SCS=60 kHz is not applicable for FR1	

8.5E.2.2 Minimum requirement

The requirements in clause 8.5C.2.2 shall apply when RedCap UE is capable of 2 Rx. When UE is only required to support 1 Rx antenna, the requirements defined in clause 8.5C.2.2 shall apply except that:

- $T_{Evaluate_BFD_SSB_RedCap}$ as defined in table 8.5E.2.2-1 for FR1.

Table 8.5E.2.2-1: Evaluation period $T_{Evaluate_BFD_SSB_RedCap}$ for 1 Rx RedCap

Configuration	$T_{Evaluate_BFD_SSB_RedCap}$ (ms)
no DRX	$\text{Max}(50, \text{Ceil}(10 \times P) \times T_{SSB})$
DRX cycle ≤ 320 ms	$\text{Max}(50, \text{Ceil}(15 \times P) \times \text{Max}(T_{DRX}, T_{SSB}))$
DRX cycle > 320 ms	$\text{Ceil}(10 \times P) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.	

8.5E.2.3 Measurement restrictions for SSB beam failure detection

The requirements in clause 8.5C.2.3 shall apply.

8.5E.3 Requirements for CSI-RS based beam failure detection for RedCap UE with satellite access

8.5E.3.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\bar{q}_0$ of resource configurations for a serving cell, provided that the CSI-RS resource(s) in set $\bar{q}_0$ for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5E.3.2.

Table 8.5E.3.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	16 for 1 Rx UE; 8 for 2 Rx UE
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0 dB
Bandwidth (PRBs)	48 for 1 Rx UE; 24 for 2 Rx UE
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

NOTE 1: SCS=60 kHz is not applicable for FR1

8.5E.3.2 Minimum requirement

The requirements in clause 8.5C.3.2 shall apply when FD-FDD and TDD RedCap UE is capable of 2 Rx. When FD-FDD and TDD RedCap UE is only required to support 1 Rx antenna, the requirements defined in clause 8.5C.3.2 shall apply except that:

- $T_{Evaluate_BFD_SSB_RedCap}$ as defined in table 8.5E.3.2-1 for FR1.

Table 8.5E.3.2-1: Evaluation period $T_{Evaluate_BFD_CSI-RS_RedCap}$ for 1 Rx RedCap

Configuration	$T_{Evaluate_BFD_CSI-RS_RedCap}$ (ms)
no DRX	$Max(50, Ceil(2 \times M_{BFD} \times P \times P_{BFD}) \times T_{CSI-RS})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(2 \times 1.5 \times M_{BFD} \times P \times P_{BFD}) \times Max(T_{DRX}, T_{CSI-RS}))$
DRX cycle > 320 ms	$Ceil(2 \times M_{BFD} \times P \times P_{BFD}) \times T_{DRX}$
NOTE: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length.	

For HD-FDD UE indicating *CollisionHandlingOfHDFDDOperation*, the requirements in clause 8.5E.3.2 shall also apply, provided that the following conditions are met:

- there is no collision between the CSI-RS resources for BFD measurements and UL transmission, or
- in case of collision between the CSI-RS resources for BFD measurements and UL transmission except PRACH, and *ntn-PrioritizeUl-semiStatichalfDuplexRedCapcollision* is not indicated by network.

In case of collision between the CSI-RS resources to be measured and PRACH, if UE indicates *CollisionHandlingOfHDFDDOperation*, it is up to HD-FDD UE implementation to either receive the CSI-RS or transmit the PRACH, according to TS 38.213.

8.5E.3.3 Measurement restrictions for CSI-RS beam failure detection

The requirements in clause 8.5C.3.3 shall apply.

8.5E.4 Minimum requirement for L1 indication for RedCap UE with satellite access

The requirements in clause 8.5C.4 shall apply.

In addition, for HD-FDD UE, the conditions and requirements for $T_{Indication_interval_BFD_Redcap}$ apply given that for each BFD-RS configuration, at least one BFD-RS sample must fall with DL occasion within an indication period.

8.5E.5 Requirements for SSB based candidate beam detection for RedCap UE with satellite access

The requirements in clause 8.5C.5 shall apply when RedCap UE is capable of 2 Rx and 1 Rx RedCap UE.

8.5E.6 Requirements for CSI-RS based candidate beam detection for RedCap UE with satellite access

The requirements in clause 8.5C.6 shall apply when RedCap UE is capable of 2 Rx and 1 Rx FD-FDD and TDD RedCap UE.

For HD-FDD UE indicating *CollisionHandlingOfHDFDDOperation*, the requirements in clause 8.5C.3.2 shall also apply, provided that the following conditions are met:

- there is no collision between the CSI-RS resources for CBD measurements and UL transmission, or
- in case of collision between the CSI-RS resources for CBD measurements and UL transmission except PRACH, and *ntn-PrioritizeUl-semiStatichalfDuplexRedCapcollision* is not indicated by network.

In case of collision between the CSI-RS resources to be measured and PRACH, if UE indicates *CollisionHandlingOfHDFDDOperation,* it is up to HD-FDD UE implementation to either receive the CSI-RS or transmit the PRACH, according to TS 38.213.

8.5E.7 Scheduling availability of UE during beam failure detection for RedCap UE with satellite access

For FD-FDD and TDD RedCap UEs, the requirements in clause 8.5C.7 shall apply.

For HD-FDD UE, scheduling restrictions apply for transmission on PUCCH/PUSCH/SRS during beam failure detection, except when UE indicates *CollisionHandlingOfHDFDDOperation* and is indicated that UL transmission is prioritized over BFD evaluation via *ntn-PrioritizeUl-semiStatichalfDuplexRedCapcollision* in case of collision between CSI-RS resources to be measured and UL transmission.

8.5E.8 Scheduling availability of UE during candidate beam detection for RedCap UE with satellite access

For FD-FDD and TDD RedCap UEs, the requirements in clause 8.5C.8 shall apply.

For HD-FDD UE, scheduling restrictions apply for transmission on PUCCH/PUSCH/SRS during candidate beam detection, except when UE indicates *CollisionHandlingOfHDFDDOperation* and is indicated that UL transmission is prioritized over CBD evaluation via *ntn-PrioritizeUl-semiStatichalfDuplexRedCapcollision* in case of collision between CSI-RS resources to be measured and UL transmission.

8.5E.9 Minimum requirement at transitions for beam failure detection for RedCap UE with satellite access

The requirements in clause 8.5C.9 shall apply.

8.6 Active BWP switch delay

8.6.1 Introduction

The requirements in this clause apply for a UE configured PCell or any activated SCell in standalone NR or NE-DC, PCell, PSCell or any activated SCell in MCG or SCG in NR-DC, or PSCell or any activated SCell in SCG in EN-DC. The requirements in this clause also apply for a UE configured with more than one BWP on PCell or any activated SCell with CCA in standalone NR, or PSCell or any activated SCell with CCA in SCG in EN-DC. The requirements in clause 8.6.4 apply for a UE which is capable of *ul-LBT-FailureDetectionRecovery-r16* configured with more than one UL BWP on PCell with CCA in standalone NR or PSCell with CCA in EN-DC.

UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

8.6.2 DCI and timer based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with more than one BWP configurations configured.

For DCI-based BWP switch, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ + Y which starts from the beginning of DL slot n. Where,

- Y=0, if the serving cell where UE receives DCI for BWP switch request is same as the serving cell on which BWP switch occurs.

- Y equals to the length of 1 slot, if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell. In this scenario, $T_{BWPswitchDelay}$ + Y shall follow the smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change. If both scheduling cell and scheduled cell are in FR2-2, Y shall follow the SCS of 120 kHz.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths.

For timer-based BWP switch, the UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (FR1) or DL half-subframe (FR2) immediately after a BWP-inactivity timer *bwp-InactivityTimer* [2] expires on a serving cell, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ which starts from the beginning of DL slot n.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{BWPswitchDelay}$ after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

Table 8.6.2-1: BWP switch delay

μ	NR Slot length (ms)	BWP switch delay $T_{BWPswitchDelay}$ (slots)	
		Type 1[Note 1]	Type 2[Note 1]
0	1	1	3
1	0.5	2	5
2	0.25	3	9
3	0.125	6	18
5	0.03125	20	65
6	0.015625	39	129
NOTE 1: Depends on UE capability. NOTE 2: If the BWP switch involves changing of SCS, the BWP switch delay is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch.			

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in clause 8.10 in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in clause 8.10 in the new BWP.

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

If the BWP switch is triggered within or outside DRX active time, and one of the two BWPs in a BWP switching is a dormant BWP [7], UE shall be able to complete active BWP switching within the time duration of

- $T_{dormantBWPswitchDelay} = T_{BWPswitchDelay} + X$, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is receiveds, or

- $T_{dormantBWPswitchDelay} = T_{BWPswitchDelay} + X + Z$, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where

- $T_{BWPswitchDelay}$ is defined in table 8.6.2-1 corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs;

- X equals to the length of 1 slot corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs. If both scheduling cell and scheduled cell are in FR2-2, X shall follow the SCS of 120 kHz.

- Z equals to the length of 1 slot corresponding to the SCS of the serving cell where UE receives dormancy indication.

For DCI-based BWP switch, if the new BWP is a dormant BWP, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive CSI-RS (for DL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL slot occurs right after a time duration of $T_{dormantBWPswitchDelay}$ which starts from the beginning of DL slot n.

8.6.2A DCI based BWP switch delay on multiple CCs

The requirements in this clause only apply to the case when the same type of BWP switch (DCI based BWP switch) is performed on multiple CCs simultaneously or over partially overlapping time period.

8.6.2A.1 Simultaneous DCI based BWP switch delay on multiple CCs

The delay requirements for simultaneous DCI based BWP switch on multiple CCs in this clause apply only if the timing difference among the first symbol of slot carrying DCI for all CCs is received within the MRTD for inter-band CA as defined in clause 7.6.4.

For DCI-based BWP switch on multiple CCs, after the UE receives BWP switching request, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelay}$ which starts from the beginning of DL slot n, where slot n is slot which UE receives the earliest BWP switching request among CCs on which UE is performing simultaneous DCI-based BWP switching.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelay}$ which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths on any serving cell.

UE shall finish BWP switch within the time duration $T_{MultipleBWPswitchDelay} + Y$, which is defined as:

$$T_{MultipleBWPswitchDelay} = T_{BWPswitchDelay} + D*(N-1) + D1*(N1-1)$$

Where:

- $T_{BWPswitchDelay}$ is the BWP switching delay on single CC defined in table 8.6.2-1 depending on UE capability *bwp-SwitchingDelay* [2]. $T_{BWPswitchDelay}$ shall be based on the smallest SCS among SCS of all involved CCs before and after BWP switch. If the BWP switch on multiple CCs results in the change of the SCS on any CC among involved CCs, $T_{BWPswitchDelay}$ shall be based on the smallest SCS among all SCS values of all involved CCs.

- D is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability *bwp-SwitchingMultiCCs-r16* [TS 38.306, 14] for switching between non-dormant BWPs.

- D1 is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability *bwp-SwitchingMultiDormancyCCs-r16* or *bwp-SwitchingMultiDormancyCC-DCI-0-3-And-1-3-r18* for switching between dormant and non-dormant BWPs. Note: D1 shall be equal to or shorter than D.

- N, N1: for UE which is capable of per-FR gap, and no BWP switch involves SCS change, N is the number of CCs in same FR for switching between non-dormant BWPs, and N1 is the number of CCs in same FR for switching between non-dormant and dormant BWPs; For UE which is not capable of per-FR gap, or the BWP switches on any CC involves SCS changing, N is the number of CCs undergoing simultaneous BWP switch

between non-dormant BWPs, and N1 is the number of CCs undergoing simultaneous BWP switch between non-dormant and dormant BWPs.

- Y=0, if the serving cell where UE receives DCI for BWP switch is same as the serving cell on which BWP switch occurs for each involved serving cell.

  Y equals to the length of one slot at smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change,

- if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell. If both scheduling cell and scheduled cell are in FR2-2, Y shall follow the SCS of 120 kHz. .

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in clause 8.10 in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in clause 8.10 in the new BWP.

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

If the BWP switch is triggered on multiple CCs simultaneously within or outside DRX active time, and one of the two BWPs on each CC in a BWP switching is a dormant BWP [7], UE shall be able to complete active BWP switching within the time duration of

- $T_{DormantMultipleBWPswitchDelay} = T_{MultipleBWPswitchDelay}+X$, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, or

- $T_{DormantMultipleBWPswitchDelay} = T_{MultipleBWPswitchDelay} +X+Z$, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where

- $T_{MultipleBWPswitchDelay}$ is defined above corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs;

- X equals to the length of 1 slot corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs. If both scheduling cell and scheduled cell are in FR2-2, X shall follow the SCS of 120 kHz.

- Z equals to the length of 1 slot corresponding to the SCS of the serving cell where DCI for dormancy indication is received.

The number of CCs, N and/or N1, on which the UE can simultaneously switch BWPs while still meeting the requirements, if any, related to allocations on downlink, uplink, or transmission of HARQ-ACK, depends on the UE reported capabilities related to BWP switching, the network configuration and the BWP switch method.

8.6.2A.2 Non-simultaneous DCI based BWP switch delay on multiple CCs

In non-simultaneous case, the DCI-based BWP switch on multiple CCs is triggered over partially overlapping time period between CCs or multiple CCs in different Cell groups. The delay requirements for non-simultaneous DCI based BWP switch on multiple CCs in this clause apply only if:

- the timing difference among the first symbol of slot carrying DCI for all CCs involved in non-simultaneous BWP switch is received exceeds the MRTD for inter-band CA as defined in clause 7.6.4, and

- UE is operating in NR-DC (FR1+FR2), and

- UE is capable of per-FR gap, and
- BWP switch does not involve SCS change

For non-simultaneous DCI based BWP switch on multiple CCs, BWP switching delay requirements defined in clause 8.6.2 apply when BWP switching occurs on single CC in the cell group. BWP switching delay requirements defined in clause 8.6.2A.1 apply when simultaneous BWP switching occurs on multiple CCs in the cell group.

8.6.2B Timer based BWP switch delay on multiple CCs

The requirements in this clause only apply to the case when the same type of BWP switch (timer based BWP switch) is performed on multiple CCs simultaneously or over partially overlapping time period.

8.6.2B.1 Simultaneous timer based BWP switch delay on multiple CCs

The delay requirements for simultaneous timer based BWP switch on multiple CCs in this clause apply only if the timing difference among the beginning of the slot where timer based BWP switching starts for all CCs is within the MRTD for inter-band CA as defined in clause 7.6.4.

For timer-based BWP switch on multiple CCs, UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (in FR1) or DL half-subframe ((in FR2) immediately after the earliest BWP-inactivity timer *bwp-InactivityTimer* [2] expiration occurs on multiple serving cells, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelay}$ which starts from the beginning of DL slot n, where $T_{MultipleBWPswitchDelay}$ is defined in clause 8.6.2A.1.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{MultipleBWPswitchDelay}$ after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in clause 8.10 in the new BWP.
- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in clause 8.10 in the new BWP.

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

8.6.2B.2 Non-simultaneous timer based BWP switch delay on multiple CCs

In non-simultaneous case, the timer-based BWP switch on multiple CCs is triggered over partially overlapping time period.

The delay requirements for non-simultaneous timer based BWP switch on multiple CCs in this clause apply if the timing difference among the beginning of the slot where timer based BWP switching starts for all CCs is exceeds the MRTD for inter-band CA as defined in clause 7.6.4, and the BWP switch does not involve SCS change. The UE performs the non-simultaneous timer-based BWP switch on the CCs sequentially.

For non-simultaneous timer-based BWP switch, the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelayTotal}$ which starts from the beginning of DL slot n, where slot n is the first slot of a DL subframe (in FR1) or DL half-subframe (in FR2) immediately after the earliest BWP-inactivity timer *bwp-InactivityTimer* [2] expires.

$$T_{MultipleBWPswitchDelayTotal} = T_{Delay} + T_{MultipleBWPswitchDelay}$$

Where:

T_{Delay} is the time required to complete the ongoing timer-based BWP switching on other CCs.

$T_{MultipleBWPswitchDelay}$ is the timer-based BWP switch delay on current single CC defined in clause 8.6.2 or simultaneously triggered on multiple CCs defined in clause 8.6.2B.1.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{MultipleBWPswitchDelayTotal}$ after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in clause 8.10 in the new BWP.
- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in clause 8.10 in the new BWP.

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

8.6.3 RRC based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with one or more than one BWP configuration(s) configured, with

- Active BWP switch or parameter change of its active BWPs for SpCell
- Parameter change of its active BWPs except parameter *firstActiveDownlinkBWP-Id* and *firstActiveUplinkBWP-Id* for SCell

For RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWP, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch occurs on the first DL or UL slot right after a time duration of $\frac{T_{RRCprocessing\,Delay}+T_{BWPswitchDelayRRC}}{NR\ Slot\ length}$ slots which begins from the beginning of DL slot n, where

DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and

$NR\ Slot\ length$ is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch if the BWP switch involves changing of SCS.

$T_{RRCprocessing\,Delay}$ is the length of the RRC processing delay in ms as defined in Table 11.2-1 in clause 11.2 in TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the length of the RRC processing delay in ms as defined in Table 12.1-1 in clause 12 in TS 38.331 [2], and

$T_{BWPswitchDelayRRC} = 6ms$ is the time used by the UE to perform BWP switch.

The UE is not required to transmit UL signals or receive DL signals during the time defined by $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC}$ on the cell where RRC-based BWP switch occurs. When $T_{HARQ} > T_{RRCprocessingDelay}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.6.3A RRC based BWP switch delay on multiple CCs

The requirements in this clause only apply to the case when the same type of BWP switch (RRC based BWP switch) is performed on multiple CCs simultaneously or over partially overlapping time period.

The requirements in this clause shall apply:

- Active BWP switching or parameter change of its active BWPs for SpCell
- Parameter change of its active BWPs except parameter *firstActiveDownlinkBWP-Id* and *firstActiveUplinkBWP-Id* for SCells

8.6.3A.1 Simultaneous RRC based BWP switch delay on multiple CCs

Requirements in this clause apply only if RRC based BWP switching on multiple CCs for NR-CA is triggered by a single RRC command.

For RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWPs, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch occurs on the first DL or UL slot right after a time duration $\left\lceil \frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}*(N-1)}{NR\ slot\ length} \right\rceil$ slots which begins from the beginning of DL slot n, where

DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and

$NR\ Slot\ length$ is determined by the smallest SCS among all SCS values of each CC before and after BWP switch if the BWP switch involves changing of SCS, and

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3, and

$D_{RRC} = 0$ for UE which is capable of type 1 BWP switching delay depending on UE capability *bwp-SwitchingDelay* [2]. $D_{RRC} = D$ for UE which is capable of type 2 BWP switching delay depending on UE capability *bwp-SwitchingDelay* [2], where D is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability [14].

N is the number of CCs within the NR-CA configured for performing simultaneous BWP switch.

The UE is not required to transmit UL signals or receive DL signals during the time defined by $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC} + D_{RRC} * (N-1)$ on the cells where RRC-based BWP switch occurs.

8.6.3A.2 Non-simultaneous RRC based BWP switch delay on multiple CCs

In non-simultaneous case, the RRC-based BWP switch on multiple CCs is triggered over partially overlapping time period in different Cell groups. The delay requirements in this clause apply only if:

BWP switching on multiple CCs in different cell groups are triggered by separate RRC commands, and

UE is operating in NR-DC (FR1+FR2), and

UE is capable of per-FR gap, and

BWP switch does not involve SCS change.

For non-simultaneous RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWPs, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch occurs on the first DL or UL slot right after a time duration $\left\lceil \frac{T_{Waiting}+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}*(M-1)}{NR\ slot\ length} \right\rceil$ slots which begins from the beginning of DL slot n, where

DL slot n is the last slot containing the RRC command,

$NR\ Slot\ length$ is determined by the SCS value of each CC in the second CG , and

$T_{Waiting}$ is the waiting time for RRC based BWP switch which is upper bounded by the ongoing BWP switch time in the first CG defined in clause 8.6.3A.1,

M is the number of CCs within the NR-CA configured for performing simultaneous BWP switch in the second CG; M=1 if the BWP switch is performed on single CC,

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3, and

D_{RRC} is defined in clause 8.6.3A.1.

The UE is not required to transmit UL signals or receive DL signals during the time defined by $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC} + D_{RRC} * (M - 1)$ on the cells in the second CG where RRC-based BWP switch occurs.

8.6.4 BWP switch delay on Consistent UL CCA recovery

Upon detection of consistent UL CCA failure is slot#n in SpCell when UE detects *lbt-FailureInstanceMaxCount* number of CCA failure within *lbt-FailureDetectionTimer*, the UE shall switch the active UL BWP to an UL BWP configured with PRACH occasion and for which consistent CCA failure has not been triggered as defined in TS 38.321 [7] clause 5.21 . The UE shall be ready to transmit PRACH on the new UL BWP of the SpCell on the first UL slot occurs right after slot n+$T_{BWPswitchDelay}$ +1, where $T_{BWPswitchDelay}$ is defined in table 8.6.2-1. The UE shall finish the UL BWP switch within the time duration $T_{BWPswitchDelay}$ depending on UE capability *bwp-SwitchingDelay* [2].

NOTE: Additional delay in acquiring the first available RACH occasion will be derived in a way similar to that in handover in clause 6.1B.1.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{BWPswitchDelay}$ on the SpCell in the UL BWP switch. The UE is not required to follow the requirements defined in this clause when performing a UL BWP switch between the UL BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths.

8.6A Active BWP switch delay for RedCap

8.6A.1 Introduction

The requirements in this clause apply for RedCap UE. UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

8.6A.2 DCI and timer based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with more than one BWP configurations configured.

For DCI-based BWP switch, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ + Y which starts from the beginning of DL slot n. Where,

- Y=0, if the serving cell where UE receives DCI for BWP switch request is same as the serving cell on which BWP switch occurs.
- Y equals to the length of 1 slot, if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell. In this scenario, $T_{BWPswitchDelay}$ + Y shall follow the smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths.

For timer-based BWP switch, the UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (FR1) or DL half-subframe (FR2) immediately after a BWP-inactivity timer *bwp-InactivityTimer* [2] expires on a serving cell, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ which starts from the beginning of DL slot n.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{BWPswitchDelay}$ after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6A.2-1.

Table 8.6A.2-1: BWP switch delay

μ	NR Slot length (ms)	BWP switch delay $T_{BWPswitchDelay}$ (slots)	
		Type 1[Note 1]	Type 2[Note 1]
0	1	1	3
1	0.5	2	5
2	0.25	3	9
3	0.125	6	18
NOTE 1: Depends on UE capability. NOTE 2: If the BWP switch involves changing of SCS, the BWP switch delay is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch.			

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in clause 8.10B in the new BWP.
- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in clause 8.10B in the new BWP.

If the BWP switch is triggered within or outside DRX active time, and one of the two BWPs in a BWP switching is a dormant BWP [7], UE shall be able to complete active BWP switching within the time duration of

- $T_{dormantBWPswitchDelay} = T_{BWPswitchDelay} + X$, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is receiveds, or
- $T_{dormantBWPswitchDelay} = T_{BWPswitchDelay} + X + Z$, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where
- $T_{BWPswitchDelay}$ is defined in table 8.6.2-1 corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs;
- X equals to the length of 1 slot corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs.
- Z equals to the length of 1 slot corresponding to the SCS of the serving cell where UE receives dormancy indication.

For DCI-based BWP switch, if the new BWP is a dormant BWP, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive CSI-RS (for DL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL slot occurs right after a time duration of $T_{dormantBWPswitchDelay}$ which starts from the beginning of DL slot n.

8.6A.3 RRC based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with one or more than one BWP configuration(s) configured, with

Active BWP switch or parameter change of its active BWPs for PCell

For RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWP, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch occurs on the first DL or UL slot right after a time duration of $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}}{NR\ Slot\ length}$ slots which begins from the beginning of DL slot n, where

DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and

$NR\ Slot\ length$ is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch if the BWP switch involves changing of SCS.

$T_{RRCprocessingDelay}$ is the length of the RRC procedure delay in ms as defined in clause 11.2 in TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the length of the RRC procedure delay in ms as defined in clause 12 in TS 38.331 [2], and

$T_{BWPswitchDelayRRC} = 6ms$ is the time used by the UE to perform BWP switch.

The UE is not required to transmit UL signals or receive DL signals during the time defined by $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC}$ on the cell where RRC-based BWP switch occurs. When $T_{HARQ} > T_{RRCprocessingDelay}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.6C Active BWP switch delay for satellite access

8.6C.1 Introduction

The requirements in this clause apply for a UE configured with only PCell, which is served by satellite access node (SAN). The requirements in this clause also apply for a UE configured with more than one BWP on PCell.

UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

8.6C.2 DCI and timer based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with more than one BWP configurations configured.

For DCI-based BWP switch, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ + Y which starts from the beginning of DL slot n. Where,

- Y=0, if the serving cell where UE receives DCI for BWP switch request is same as the serving cell on which BWP switch occurs.
- Y equals to the length of 1 slot, if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell. In this scenario, $T_{BWPswitchDelay}$ + Y shall follow the smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths.

For timer-based BWP switch, the UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (FR1-NTN) immediately after a BWP-inactivity timer *bwp-InactivityTimer* [2] expires on a serving cell, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ which starts from the beginning of DL slot n.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{BWPswitchDelay}$ after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6C.2-1.

Table 8.6C.2-1: BWP switch delay

μ	NR Slot length (ms)	BWP switch delay $T_{BWPswitchDelay}$ (slots)	
		Type 1[Note 1]	Type 2[Note 1]
0	1	1	3
1	0.5	2	5
2	0.25	3	9
NOTE 1: Depends on UE capability. NOTE 2: If the BWP switch involves changing of SCS, the BWP switch delay is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch.			

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in clause 8.10C in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in clause 8.10C in the new BWP.

If the BWP switch is triggered within or outside DRX active time, and one of the two BWPs in a BWP switching is a dormant BWP [7], UE shall be able to complete active BWP switching within the time duration of

- $T_{dormantBWPswitchDelay} = T_{BWPswitchDelay} + X$, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is receiveds, or

- $T_{dormantBWPswitchDelay} = T_{BWPswitchDelay} + X + Z$, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where

- $T_{BWPswitchDelay}$ is defined in table 8.6C.2-1 corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs.

- X equals to the length of 1 slot corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs.

- Z equals to the length of 1 slot corresponding to the SCS of the serving cell where UE receives dormancy indication.

For DCI-based BWP switch, if the new BWP is a dormant BWP, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive CSI-RS (for DL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL slot occurs right after a time duration of $T_{dormantBWPswitchDelay}$ which starts from the beginning of DL slot n.

8.6C.3 RRC based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with one or more than one BWP configuration(s) configured, with

- Active BWP switch or parameter change of its active BWPs for PCell

For RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWP, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH

(for UL active BWP switch) on the new BWP on the serving cell on which BWP switch occurs on the first DL or UL slot right after a time duration of $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}}{NR\ Slot\ length}$ slots which begins from the beginning of DL slot n, where

DL slot n is the last slot containing the RRC command, and

$NR\ Slot\ length$ is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch if the BWP switch involves changing of SCS.

$T_{RRCprocessingDelay}$ is the length of the RRC procedure delay in ms as defined in clause 12 in TS 38.331 [2], and

$T_{BWPswitchDelayRRC} = 6ms$ is the time used by the UE to perform BWP switch.

The UE is not required to transmit UL signals or receive DL signals during the time defined by $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC}$ on the cell where RRC-based BWP switch occurs. When $T_{HARQ} > T_{RRCprocessingDelay}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.6D Active BWP switch delay for ATG

8.6D.1 Introduction

The requirements in this clause apply for an ATG UE configured PCell or any activated SCell in standalone NR. The requirements in this clause also apply for a UE configured with more than one BWP on PCell. UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

8.6D.2 DCI and timer based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with more than one BWP configurations configured.

For DCI-based BWP switch, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ + Y which starts from the beginning of DL slot n. Where,

- Y=0, if the serving cell where UE receives DCI for BWP switch request is same as the serving cell on which BWP switch occurs.
- Y equals to the length of 1 slot, if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell. In this scenario, $T_{BWPswitchDelay}$ + Y shall follow the smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths.

For timer-based BWP switch, the UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (FR1) immediately after a BWP-inactivity timer *bwp-InactivityTimer* [2] expires on a serving cell, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ which starts from the beginning of DL slot n.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{BWPswitchDelay}$ after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6D.2-1.

Table 8.6D.2-1: BWP switch delay

μ	NR Slot length (ms)	BWP switch delay $T_{BWPswitchDelay}$ (slots)	
		Type 1[Note 1]	Type 2[Note 1]
0	1	1	3
1	0.5	2	5
2	0.25	3	9
NOTE 1: Depends on UE capability. NOTE 2: If the BWP switch involves changing of SCS, the BWP switch delay is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch.			

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in clause 8.10D or 8.15D in the new BWP.
- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in clause 8.10D or 8.15D in the new BWP

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

If the BWP switch is triggered within or outside DRX active time, and one of the two BWPs in a BWP switching is a dormant BWP [7], UE shall be able to complete active BWP switching within the time duration of

- $T_{dormantBWPswitchDelay} = T_{BWPswitchDelay} + X$, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is receiveds, or
- $T_{dormantBWPswitchDelay} = T_{BWPswitchDelay} + X + Z$, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where
- $T_{BWPswitchDelay}$ is defined in table 8.6.2-1 corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs;
- X equals to the length of 1 slot corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs.
- Z equals to the length of 1 slot corresponding to the SCS of the serving cell where UE receives dormancy indication.

For DCI-based BWP switch, if the new BWP is a dormant BWP, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive CSI-RS (for DL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL slot occurs right after a time duration of $T_{dormantBWPswitchDelay}$ which starts from the beginning of DL slot n.

8.6D.2A DCI based BWP switch delay on multiple CCs

The requirements in this clause only apply to the case when the same type of BWP switch (DCI based BWP switch) is performed on multiple CCs simultaneously.

8.6D.2A.1 Simultaneous DCI based BWP switch delay on multiple CCs

The delay requirements for simultaneous DCI based BWP switch on multiple CCs in this clause apply only if the timing difference among the first symbol of slot carrying DCI for all CCs is received within the MRTD for inter-band CA as defined in clause 7.6D.2

For DCI-based BWP switch on multiple CCs, after the UE receives BWP switching request, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelay}$ which starts from the beginning of DL slot n, where slot n is slot which UE receives the earliest BWP switching request among CCs on which UE is performing simultaneous DCI-based BWP switching.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelay}$ which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths on any serving cell.

UE shall finish BWP switch within the time duration $T_{MultipleBWPswitchDelay} + Y$, which is defined as:

$$T_{MultipleBWPswitchDelay} = T_{BWPswitchDelay} + D*(N-1)+D*(N1-1)$$

Where:

- $T_{BWPswitchDelay}$ is the BWP switching delay on single CC defined in table 8.6D.2-1 depending on UE capability *bwp-SwitchingDelay* [2]. $T_{BWPswitchDelay}$ shall be based on the smallest SCS among SCS of all involved CCs before and after BWP switch. If the BWP switch on multiple CCs results in the change of the SCS on any CC among involved CCs, $T_{BWPswitchDelay}$ shall be based on the smallest SCS among all SCS values of all involved CCs.

- D is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability *bwp-SwitchingMultiCCs-r16* [14] for switching between non-dormant BWPs, and *bwp-SwitchingMultiDormancyCCs-r16* or *bwp-SwitchingMultiDormancyCC-DCI-0-3-And-1-3-r18* for switching between non-dormant and dormant BWPs.

- D1 is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability *bwp-SwitchingMultiDormancyCCs-r16* or *bwp-SwitchingMultiDormancyCC-DCI-0-3-And-1-3-r18* for switching between dormant and non-dormant BWPs. Note: D1 shall be equal to or shorter than D.

- N, N1: N is the number of CCs undergoing simultaneous BWP switch between non-dormant BWPs, and N1 is the number of CCs undergoing simultaneous BWP switch between non-dormant and dormant BWPs..

  If no BWP switch involves SCS change, N is the number of CCs in same FR; If the BWP switches on any CC involves SCS changing, N is the number of CCs undergoing simultaneous BWP switch.

- Y=0, if the serving cell where UE receives DCI for BWP switch is same as the serving cell on which BWP switch occurs for each involved serving cell.

  Y equals to the length of one slot at smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change, if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell.

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in clause 8.10D in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in clause 8.10D in the new BWP.

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

If the BWP switch is triggered on multiple CCs simultaneously within or outside DRX active time, and one of the two BWPs on each CC in a BWP switching is a dormant BWP [7], UE shall be able to complete active BWP switching within the time duration of

- $T_{DormantMultipleBWPswitchDelay} = T_{MultipleBWPswitchDelay}+X$, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, or
- $T_{DormantMultipleBWPswitchDelay} = T_{MultipleBWPswitchDelay} +X+Z$, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where
- $T_{MultipleBWPswitchDelay}$ is defined above corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs;
- X equals to the length of 1 slot corresponding to the smallest value among the SCS of the serving cell where UE receives dormancy indication and the SCSs of the dormant BWP and the active BWP immediately before or after switching the BWP of the serving cell where BWP switching occurs.
- Z equals to the length of 1 slot corresponding to the SCS of the serving cell where DCI for dormancy indication is received.

The number of CCs, N and.or N1, on which the UE can simultaneously switch BWPs while still meeting the requirements, if any, related to allocations on downlink, uplink, or transmission of HARQ-ACK, depends on the UE reported capabilities related to BWP switching, the network configuration and the BWP switch method.

8.6D.2B Timer based BWP switch delay on multiple CCs

The requirements in this clause only apply to the case when the same type of BWP switch (timer based BWP switch) is performed on multiple CCs simultaneously or over partially overlapping time period.

8.6D.2B.1 Simultaneous timer based BWP switch delay on multiple CCs

The delay requirements for simultaneous timer based BWP switch on multiple CCs in this clause apply only if the timing difference among the beginning of the slot where timer based BWP switching starts for all CCs is within the MRTD for inter-band CA as defined in clause 7.6D.42

For timer-based BWP switch on multiple CCs, UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (in FR1) immediately after the earliest BWP-inactivity timer *bwp-InactivityTimer* [2] expiration occurs on multiple serving cells, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelay}$ which starts from the beginning of DL slot n, where $T_{MultipleBWPswitchDelay}$ is defined in clause 8.6D.2A.1.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{MultipleBWPswitchDelay}$ after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in clause 8.10 in the new BWP.
- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in clause 8.10 in the new BWP.

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

8.6D.2B.2 Non-simultaneous timer based BWP switch delay on multiple CCs

In non-simultaneous case, the timer-based BWP switch on multiple CCs is triggered over partially overlapping time period.

The delay requirements for non-simultaneous timer based BWP switch on multiple CCs in this clause apply if the timing difference among the beginning of the slot where timer based BWP switching starts for all CCs exceeds the MRTD for inter-band CA as defined in clause 7.6D.2, and the BWP switch does not involve SCS change. The UE performs the non-simultaneous timer-based BWP switch on the CCs sequentially.

For non-simultaneous timer-based BWP switch, the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelayTotal}$ which starts from the beginning of DL slot n, where slot n is the first slot of a DL subframe (in FR1) immediately after the earliest BWP-inactivity timer *bwp-InactivityTimer* [2] expires.

$$T_{MultipleBWPswitchDelayTotal} = T_{Delay} + T_{MultipleBWPswitchDelay}$$

Where:

T_{Delay} is the time required to complete the ongoing timer-based BWP switching on other CCs.

$T_{MultipleBWPswitchDelay}$ is the timer-based BWP switch delay on current single CC defined in clause 8.6D.2 or simultaneously triggered on multiple CCs defined in clause 8.6D.2B.1.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{MultipleBWPswitchDelayTotal}$ after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in clause 8.10D in the new BWP.
- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in clause 8.10D in the new BWP.

Provided the UE does not have the required activated TCI-state(s) information to receive PDCCH/ PDSCH and to transmit PUSCH/PUCCH/SRS in the new BWP, the UE shall use old TCI-state(s) before the BWP switch until a new MAC CE updating the required activated TCI-state(s) information is received after the BWP switch.

8.6D.3 RRC based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with one or more than one BWP configuration(s) configured, with

- Active BWP switch or parameter change of its active BWPs for PCell
- Parameter change of its active BWPs except parameter *firstActiveDownlinkBWP-Id* for SCell

For RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWP, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch occurs on the first DL or UL slot right after a time duration of $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}}{NR\ Slot\ length}$ slots which begins from the beginning of DL slot n, where

DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and

$NR\ Slot\ length$ is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch if the BWP switch involves changing of SCS.

$T_{RRCprocessingDelay}$ is the length of the RRC procedure delay in ms as defined in clause 12 in TS 38.331 [2], and

$T_{BWPswitchDelayRRC} = 6ms$ is the time used by the UE to perform BWP switch.

The UE is not required to transmit UL signals or receive DL signals during the time defined by $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC}$ on the cell where RRC-based BWP swithing occurs. When $T_{HARQ} > T_{RRCprocessingDelay}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.6D.3A RRC based BWP switch delay on multiple CCs

The requirements in this clause only apply to the case when the same type of BWP switch (RRC based BWP switch) is performed on multiple CCs simultaneously.

The requirements in this clause shall apply:

- Active BWP switching or parameter change of its active BWPs for Pcell
- Parameter change of its active BWPs except parameter *firstActiveDownlinkBWP-Id* for SCells

8.6D.3A.1 Simultaneous RRC based BWP switch delay on multiple CCs

Requirements in this clause apply only if RRC based BWP switching on multiple CCs for NR-CA is triggered by a single RRC command.

For RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWPs, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch occurs on the first DL or UL slot right after a time duration of $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}*(N-1)}{NR\ slot\ length}$slots which begins from the beginning of DL slot n, where

DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and

$NR\ Slot\ length$ is determined by the smallest SCS among all SCS values of each CC before and after BWP switch if the BWP switch involves changing of SCS, and

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6D.3, and

$D_{RRC} = 0$ for UE which is capable of type 1 BWP switching delay depending on UE capability *bwp-SwitchingDelay* [2]. $D_{RRC} = D$ for UE which is capable of type 2 BWP switching delay depending on UE capability *bwp-SwitchingDelay* [2], where D is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability [14].

N is the number of CCs within the NR-CA configured for performing simultaneous BWP switch.

The UE is not required to transmit UL signals or receive DL signals during the time defined by $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC} + D_{RRC} * (N-1)$ on the cells where RRC-based BWP switch occurs.

8.6E Active BWP switch delay for RedCap UE with satellite access

8.6E.1 Introduction

The requirements in this clause apply for a RedCap UE configured with only PCell, which is served by satellite access node (SAN). The requirements in this clause also apply for a UE configured with more than one BWP on PCell.

UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

8.6E.2 DCI and timer based BWP switch delay on a single CC

The requirements in clause 8.6C.2 shall apply.

8.6E.3 RRC based BWP switch delay on a single CC

The requirements in clause 8.6C.3 shall apply.

8.7 Void

8.8 NE-DC: E-UTRAN PSCell Addition and Release Delay

8.8.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to configure an E-UTRAN PSCell in NR - E-UTRA dual connectivity. The requirements are applicable to an NR - E-UTRA dual connectivity capable UE.

8.8.2 E-UTRAN PSCell Addition Delay Requirement

The requirements in this clause shall apply for the UE, which is configured with PCell, and may also be configured with one or more SCells.

Upon receiving E-UTRAN PSCell addition in subframe *n*, the UE shall be capable to transmit PRACH preamble towards E-UTRAN PSCell no later than in subframe $n + T_{config_EUTRAN\text{-}PSCell}$:

Where:

$T_{config_EUTRAN\text{-}PSCell} = T_{RRC_delay} + T_{activation_time} + 50\ ms + T_{E\text{-}UTRAN\text{-}PSCell_DU}$

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

$T_{activation_time}$ is the E-UTRAN PSCell activation delay. If the E-UTRAN PSCell is known, then $T_{activation_time}$ is 20 ms. If the E-UTRAN PSCell is unknown, then $T_{activation_time}$ is 30 ms provided the E-UTRAN PSCell can be successfully detected on the first attempt.

$T_{E\text{-}UTRAN\text{-}PSCell_DU}$ is the delay uncertainty in acquiring the first available PRACH occasion in the E-UTRAN PSCell. $T_{E\text{-}UTRAN\text{-}PSCell_DU}$ is up to 30 ms.

E-UTRAN PSCell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the E-UTRAN PSCell configuration command:
  - the UE has sent a valid measurement report for the E-UTRAN PSCell being configured and
  - the E-UTRAN PSCell being configured remains detectable according to the cell identification conditions specified in clause 8.8 of TS 36.133 [15],
- E-UTRAN PSCell being configured also remains detectable during the E-UTRAN PSCell configuration delay $T_{config_EUTRAN\text{-}PSCell}$ according to the cell identification conditions specified in clause 8.8 of TS 36.133 [15].

Otherwise it is unknown.

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.8.3 E-UTRAN PSCell Release Delay Requirement

also be configured with one or more SCells and/or E-UTRAN SCells.

Upon receiving E-UTRAN PSCell release in subframe *n*, the UE shall accomplish the release actions specified in TS 38.331 [2] no later than in subframe $n + T_{RRC_delay}$:

Where

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.9 NR-DC: PSCell Addition and Release Delay

8.9.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to configure an PSCell in NR dual connectivity. The requirements are applicable to an NR dual connectivity capable UE.

8.9.2 PSCell Addition Delay Requirement

The requirements in this clause shall apply for the UE configured with only PCell in FR1.

Upon receiving PSCell addition in subframe *n*, the UE shall be capable to transmit PRACH preamble towards PSCell in FR1 or FR2 no later than in slot n + $\frac{T_{config_PSCell}}{NR\ slot\ length}$:

where:

$T_{config_PSCell} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell_DU} + 2$ ms

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

$T_{processing}$ is the SW processing time needed by UE, including RF warm up period. $T_{processing}$ = 20 ms when target cell is in FR1 and $T_{processing}$ = 40 ms when target cell is in FR2.

T_{search} is the time for AGC settling and PSS/SSS detection. If the target cell is known, T_{search} = 0 ms. If the target cell is unknown and the target cell $\hat{E}s/Iot \geq$ -2 dB, T_{search} = 3*N* Trs ms. N = 1 when target cell is in FR1, N = 8 when the target cell is in FR2-1, and N = 12 when the target cell is in FR2-2

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = 3*T_{rs}$ ms for target PSCell operating with 12 PRB SSB BW. Otherwise, $T_{\Delta} = 1*T_{rs}$ ms.

T_{PSCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. T_{PSCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

Trs is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

In FR1 and FR2, the PSCell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the PSCell configuration command:
  - the UE has sent a valid measurement report for the PSCell being configured and
  - One of the SSBs measured from the PSCell being configured remains detectable according to the cell identification conditions specified in clause 9.3.
- One of the SSBs measured from PSCell being configured also remains detectable during the PSCell configuration delay T_{config_PSCell} according to the cell identification conditions specified in clause 9.3.

Otherwise it is unknown.

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.9.3 PSCell Release Delay Requirement

The requirements in this clause shall apply for a UE which is configured with PCell and one PSCell.

Upon receiving PSCell release in subframe *n*, the UE shall accomplish the release actions specified in TS 38.331 [2] no later than in slot n + $\frac{T_{RRC_delay}}{NR\ slot\ length}$:

where

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.9A Conditional PSCell Addition Delay

8.9A.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to perform conditional PSCell addition in EN-DC or NR-DC. The requirements in this clause are applicable to EN-DC and NR-DC.

8.9A.2 Conditional PSCell Addition Delay Requirement

The requirements in this clause shall apply for the UE configured with only PCell in FR1.

Upon receiving conditional PSCell addition in subframe *n*, the UE shall be capable to transmit PRACH preamble towards PSCell no later than in subframe *n* + $T_{config_PSCell_Addition_Conditional}$:

Where:

$T_{config_PSCell_Addition_Conditional} = T_{RRC_delay} + T_{Event_DU} + T_{measure} + T_{UE_preparation} + T_{processing} + T_{\Delta} + T_{PSCell_DU} + 2$ ms

T_{RRC_delay} is the RRC processing delay defined in clause 11.2 in TS 36.331 [16] which is the corresponding RRC message embedded in E-UTRA RRC message, otherwise it is the RRC procedure delay defined in clause 12 in TS 38.331 [2] for processing the conditional PSCell addition command.

T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional PSCell addition command until a condition exists at the measurement reference point which will trigger the conditional PSCell addition.

$T_{measure}$ is the measurements time stated in clause 8.9A.2.1.

$T_{UE_preparation}$ is the UE preparation time for conditional PSCell addition, and starts after UE realizes the condition of PSCell addition is met and identity of the PSCell is determined. $T_{UE_preparation}$ is up to 10 ms.

$T_{processing}$ is the SW processing time needed by UE, including RF warm up period. $T_{processing}$ = 20 ms when PSCell is in FR1, and $T_{processing}$ = 40 ms when PSCell is in FR2.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = 3*T_{rs}$ ms for target PSCell operating with 12 PRB SSB BW. Otherwise, $T_{\Delta} = 1*$Trs ms.

T_{PSCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. T_{PSCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

Trs is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

The PCell interruption specified in clause 8.2 is allowed only after the UE starts to execute a conditional PSCell addition.

8.9A.2.1 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE executes a PSCell addition and interruption time starts.

The measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ defined in clause 9.3.4. When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for PSCell addition. If a cell, which has been detectable at least for the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for PSCell addition, becomes undetectable for a period and then the cell becomes detectable again and triggers a PSCell addition, the measurement time delay shall be less than $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

8.9B NR-DC: PSCell Addition and Release Delay in Carriers with CCA

8.9B.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to configure an PSCell in FR2-2 with CCA in NR dual connectivity. The requirements are applicable to an NR dual connectivity capable UE.

8.9B.2 PSCell Addition Delay Requirement

The requirements in this clause shall apply for the UE configured with only PCell in FR1.

Upon receiving PSCell addition in subframe *n*, the UE shall be capable to transmit PRACH preamble towards PSCell in FR2-2 no later than in slot n + $\frac{T_{config_PSCell_CCA}}{NR\ slot\ length}$:

where:

$T_{config_PSCell_CCA} = T_{RRC_delay} + T_{processing} + T_{search_CCA} + T_{\Delta_CCA} + T_{PSCell_DU} + 2$ ms

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

$T_{processing}$ is the SW processing time needed by UE, including RF warm up period. $T_{processing}$ = 40 ms.

T_{search_CCA} is the time for AGC settling and PSS/SSS detection. If the target cell is known, T_{search} = 0 ms. If the target cell is unknown and the target cell $\hat{E}s/Iot \geq$ -2 dB, $T_{search} = (3*N+L_1*N) * Trs$ ms, where L_1 is the number of SMTC occasions groups with at least one SSB/SMTC occasion in the group is not transmitted by the gNB during the AGC settling and PSS/SSS detection. N is the Rx beam sweeping factor for FR2-2.

T_{Δ_CCA} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = (1+L_2) * Trs$ ms for a known or unknown PSCell, where L_2 is the number of SMTC occasions not avaible at the UE during the time tracking period.

T_{PSCell_DU} is the interruption uncertainty due to the random access procedure when sending PRACH to the new cell. T_{PSCell_DU} can be up to: $(1+ L_3) * T_{SSB,RO}$ + 10 ms where $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined in table 8.1-1 of TS 38.213 [3] and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. L_3 = 0 for Type 3 UL channel access procedure as defined in TS 37.213 [33]. L_3 = 0 if *ra-ChannelAccess-r17* is not configured in FR2-2.

T_{rs} is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise T_{rs} is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

NOTE 1: The interruption time considering the potential extensions caused by L_1, L_2, L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2].

In FR2-2, the PSCell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the PSCell configuration command:
  - the UE has sent a valid measurement report for the PSCell being configured and
  - One of the SSBs measured from the PSCell being configured remains detectable according to the cell identification conditions specified in clause 9.3A.
- One of the SSBs measured from PSCell being configured also remains detectable during the PSCell configuration delay $T_{config_PSCell_CCA}$ according to the cell identification conditions specified in clause 9.3A.

Otherwise it is unknown.

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.9B.3 PSCell Release Delay Requirement

The requirements in this clause shall apply for a UE which is configured with PCell in FR1 and one PSCell in FR2-2.

Upon receiving PSCell release in subframe *n*, the UE shall accomplish the release actions specified in TS 38.331 [2] no later than in slot $n + \frac{T_{RRC_delay}}{NR\ slot\ length}$:

where

- T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.9C Subsequent Conditional PSCell Addition Delay

8.9C.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to perform subsequent conditional PSCell addition in NR-DC. The requirements in this clause are applicable to NR-DC.

8.9C.2 Subsequent Conditional PSCell Addition Delay Requirement

The requirements in this clause shall apply for the UE configured with only PCell in FR1.

Upon receiving RRC Command containing MR-DCRelease configuration and sending an *RRCReconfigurationComplete* message confirming the release in subframe *n*, the UE shall be capable to transmit PRACH preamble towards PSCell no later than in subframe $n + T_{config_PSCell_Addition_Conditional}$:

Where:

- $T_{config_PSCell_Addition_Conditional} = T_{Event_DU} + T_{measure} + T_{UE_preparation} + T_{processing} + T_{\Delta} + T_{PSCell_DU} + 2$ ms
  - T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully transmits an *RRCReconfigurationComplete* message confirming the release of SCG configuration until a condition exists at the measurement reference point which will trigger the conditional PSCell addition.
  - $T_{measure}$ is the measurements time stated in clause 8.9C.2.1.
  - $T_{UE_preparation}$ is the UE preparation time for conditional PSCell addition, and starts after UE realizes the condition of PSCell addition is met and identity of the PSCell is determined. $T_{UE_preparation}$ is up to 10 ms.

- $T_{processing}$ is the SW processing time needed by UE, including RF warm up period. $T_{processing}$ = 20 ms when PSCell is in FR1, and $T_{processing}$ = 40 ms when PSCell is in FR2.

- T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = 3*T_{rs}$ ms for target PSCell operating with 12 PRB SSB BW. Otherwise, $T_{\Delta} = 1*Trs$ ms.

    - Trs is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise Trs is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

- T_{PSCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. T_{PSCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

The PCell interruption specified in clause 8.2 is allowed only after the UE starts to execute a conditional PSCell addition.

8.9C.2.1 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE executes a PSCell addition and interruption time starts.

The measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ defined in clause 9.3.4. When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for PSCell addition. If a cell, which has been detectable at least for the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for PSCell addition, becomes undetectable for a period and then the cell becomes detectable again and triggers a PSCell addition, the measurement time delay shall be less than $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

8.10 Active TCI state switching delay

8.10.1 Introduction

The requirements in this clause apply for a UE configured with one or more TCI state configurations on serving cell in MR-DC or standalone NR. UE shall complete the switch of active TCI state within the delay defined in this clause.

8.10.2 Known conditions for TCI state

The TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of active TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state

    - TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement

    - The UE has sent at least 1 L1-RSRP report for the target TCI state before the TCI state switch command

    - The TCI state remains detectable during the TCI state switching period

    - The SSB associated with the TCI state remain detectable during the TCI switching period

        - SNR of the TCI state $\geq$ -3 dB

Otherwise, the TCI state is unknown.

8.10.2A Known conditions for TCI state with beam prediction

The TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource in *resourcesForChannelMeasurement* to the completion of active TCI state switch, where the target TCI state is either
  - RS resource in *resourcesForChannelMeasurement* or QCLed to RS resource in *resourcesForChannelMeasurement* or QCLed to RS resource in *resourcesForChannelMeasurement* not configured for prediction

  or

  - one of RS resource in *resourcesForChannelPrediction-r19* or QCLed to one of RS resource in *resourcesForChannelPrediction-r19* but not in the RS resource in *resourcesForChannelMeasurement* and UE supports [FG 59-1]
- TCI state switch command is received within 1280 ms upon the last transmission of the RS resource in *resourcesForChannelMeasurement*.
- The UE has sent at least 1 L1-RSRP report for the predicted RS quantities for the target TCI state before the TCI state switch command
- The TCI state remains detectable during the TCI state switching period
- The SSB associated with the TCI state remain detectable during the TCI switching period
  - SNR of the TCI state ≥ -3 dB

Otherwise, the TCI state is unknown.

8.10.3 MAC-CE based TCI state switch delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$ + TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$ .Where T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];

- $T_{first\text{-}SSB}$ is
  - if the UE supports LB-CA via switching, time to first available SSB reception based on *LBCA-SwitchingPattern* after MAC CE command is decoded by the UE
  - otherwise, time to first SSB transmission after MAC CE command is decoded by the UE;
  - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state
- $T_{SSB\text{-}proc}$ = 2 ms;
- TO_k = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} +$3N_{slot}^{subframe,\mu}$ + $T_{L1\text{-}RSRP}$ +TO_{uk}*($T_{first\text{-}SSB}$+ $T_{SSB\text{-}proc}$) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$.

Where

- $T_{L1\text{-}RSRP}$ = 0 in FR1 or when the TCI state switching not involving QCL-TypeD in FR2. Otherwise,

- $T_{L1\text{-}RSRP}$ is the time for Rx beam refinement in FR2, defined as
- $T_{L1\text{-}RSPR_Measurement_Period_SSB}$ for SSB as specified in clause 9.5.4.1,
  - with the assumption of M=1
  - with $T_{Report} = 0$
- $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ for CSI-RS as specified in clause 9.5.4.2
  - configured with higher layer parameter *repetition* set to ON
  - with the assumption of M=1 for periodic CSI-RS
  - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*
  - with $T_{Report} = 0$
- $TO_{uk} = 1$ for CSI-RS based L1-RSRP measurement, and 0 for SSB based L1-RSRP measurement when TCI state switching involves QCL-TypeD
- $TO_{uk} = 1$ when TCI state switching involves other QCL types only
- $T_{first\text{-}SSB}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;
- $T_{first\text{-}SSB}$ is
  - if the UE supports LB-CA via switching, time to first available SSB reception based on *LBCA-SwitchingPattern* after MAC CE command is decoded by the UE for other QCL types
  - otherwise, time to first SSB transmission after MAC CE command is decoded by the UE for other QCL types;
- The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

8.10.3A MAC-CE based TCI state switch delay in HST FR2 scenarios

For FR2 power class 6 UE, if the target TCI state is known, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the symbol m of the first slot that is after slot n+ $T_{HARQ} + 3N_{slot}^{subframe,\mu} + TO_k*(T_{first\text{-}SSB} + T_{SSB\text{-}proc} + T_{rs} + T_{rs\text{-}proc}) / \textit{NR slot length}$. The UE shall be able to receive PDCCH with the old TCI state until slot n+ $T_{HARQ} + 3N_{slot}^{subframe,\mu}$ .Where T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];

- $T_{first\text{-}SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE;
- $T_{SSB\text{-}proc} = 2$ ms;
- T_{rs} is time to the first TRS or SSB transmission after the SSB transmission in the definition of $T_{first\text{-}SSB}$ is processed by the UE;
- $T_{rs\text{-}proc} = 2$ ms;
- $TO_k = 1$, m = 0 if target TCI state is not in the active TCI state list for PDSCH; otherwise $TO_k = 0$, m = 1.

For FR2 power class 6 UE, if the target TCI state is unknown, the same requirement for unknown target TCI state case specified in clause 8.10.3 applies.

For FR2 power class 6 UE if the UE indicates to support *tci-StateSwitchInd-r18* and *cross-RRH TCI state indicator for UE-specific PDCCH MAC-CE* as specified in Clause 6.1.3.77 of TS 38.321 [7] is indicated as ‘0’ for the TCI state switch, the same requirement specified in clause 8.10.3 applies.

8.10.4 DCI based TCI state switch delay

If the target TCI state is known, when a UE is configured with the higher layer parameter *tci-PresentInDCI* which is set as 'enabled' for the CORESET scheduling PDSCH at slot n, UE shall be able to receive PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+*timeDurationForQCL*, where, *timeDurationForQCL* is the time required by the UE to perform PDCCH reception and applying spatial QCL information received in DCI for PDSCH processing as described in TS 38.214 [26], the value of *timeDurationForQCL* is defined in TS 38.331 [2].

The known condition for TCI state defined in clause 8.10.2 or clause 8.10.2A is applied.

8.10.5 RRC based TCI state switch delay

If the target TCI state is known, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ ($T_{RRC_processing}$ +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$)) / *NR slot length*, The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.
- $T_{RRC_processing}$ is the RRC processing delay defined in clause 11.2 of TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in clause 12 of TS 38.331 [2].
- $T_{first\text{-}SSB}$ is
  - if the UE supports LB-CA via switching, time to first available SSB reception based on *LBCA-SwitchingPattern* after RRC processing by the UE
  - otherwise, time to first SSB transmission after RRC processing by the UE;
  - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state.
- $T_{SSB\text{-}proc}$ and TO_k are defined in clause 8.10.3.

If the target TCI state is unknown, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ ($T_{RRC_processing}$ +$T_{L1\text{-}RSRP}$ +TO_{uk}*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$)) / *NR slot length*, The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.
- $T_{RRC_processing}$ is the RRC processing delay defined in clause 11.2 of TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in clause 12 of TS 38.331 [2].
- $T_{first\text{-}SSB}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;
- $T_{first\text{-}SSB}$ is
  - if the UE supports LB-CA via switching, time to first available SSB reception based on *LBCA-SwitchingPattern* after RRC processing time at the UE for other QCL types
  - otherwise, time to first SSB transmission after RRC processing time at the UE for other QCL types;
  - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state
- $T_{L1\text{-}RSRP}$, TO_{uk} and $T_{SSB\text{-}proc}$ are defined in clause 8.10.3.

The requirements for RRC based TCI state switch delay apply when only 1 TCI state is configured in RRC TCI state list. When $T_{HARQ} > T_{RRC_processing}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.10.6 Active TCI state list update delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE for activation/deactivation of UE-specific PDSCH TCI state as defined in clause 6.1.3.14 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH to schedule PDSCH with the new target TCI state at the first slot that is after n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$ +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. Where T_{HARQ}, $T_{first\text{-}SSB,}$ $T_{SSB\text{-}proc}$ and TO_k are defined in clause 8.10.3.

8.10A Active TCI state switching delay with CCA

8.10A.1 Introduction

The requirements in this clause apply for a UE configured with one or more TCI state configurations on serving cell in EN-DC with PSCell on a carrier frequency with CCA or SA NR with PCell on a carrier frequency with CCA. UE shall complete the switch of active TCI state within the delay defined in this clause.

In the requirements of clause 8.10A, the term SSB occasion not available at the UE refers to when the SSB is configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding period; otherwise the SSB occasion is considered as available at the UE.

8.10A.2 Known conditions for TCI state

The TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of active TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state
  - TCI state switch command is received within 1280 ms of the last transmission of the RS resource for beam reporting or measurement
  - The UE has sent at least 1 L1-RSRP report for the target TCI state before the TCI state switch command
  - The TCI state remain detectable during the TCI state switching period in the SSB occasions available at the UE
  - The SSB associated with the TCI state remain detectable during the TCI switching period in the SSB occasions available at the UE
    - SNR of the TCI state is ≥ -3 dB

Otherwise, the TCI state is unknown.

8.10A.3 MAC-CE based TCI state switch delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ $3N_{slot}^{subframe,\mu}$ +(T_{HARQ} +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$+T_{SSB}*$L_{MAC,known}$)) */NR slot length*. The UE shall be able to receive on the old TCI state until slot n + $3N_{slot}^{subframe,\mu}$ + (T_{HARQ} +TO_k*($T_{first\text{-}SSB}$+ T_{SSB}*$L_{MAC,known}$)) / *NR slot length*, where

- T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]. In the event of UE not being able to transmit the acknowledgment due to UL CCA failures: T_{HARQ} is extended to also include the time to all next HARQ feedback transmissions and retransmission opportunities, until the time

of its successful transmission, as specified in TS 38.213 [3]; no extension of T_{HARQ} due to UL CCA failures is allowed for Type 2C UL channel access in TS 37.213 [33];

- $T_{first\text{-}SSB}$ is time to first SSB transmission occasion after MAC CE command is decoded by the UE, during which some SSB occasions may not be available at the UE due to DL CCA failures;
- The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state;
- $T_{SSB\text{-}proc}$ = 2 ms;
- TO_k = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise;
- T_{SSB} = ssb-periodicityServingCell;
- $L_{MAC,known} \leq L_{MAC,known,max}$ is the corresponding number of SSB occasions not available at the UE;
- $L_{MAC,known,max}$ =2 for $T_{SSB} \leq 40$ ms, $L_{MAC,known,max}$ =1 for $T_{SSB} > 40$ ms.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot $n+ 3N_{slot}^{subframe,\mu} + (T_{HARQ}+ T_{L1\text{-}RSRP} + TO_{uk}*(T_{first\text{-}SSB}+ T_{SSB\text{-}proc}+T_{SSB}*L_{MAC,unknown}))$ / *NR slot length* . The UE shall be able to receive on the old TCI state until slot $n+ 3N_{slot}^{subframe,\mu} + (T_{HARQ}+TO_{uk}*(T_{first\text{-}SSB}+ T_{SSB}*L_{MAC,unknown}))$ / *NR slot length*,

Where:

- $L_{MAC,unknown} \leq L_{MAC,unknown,max}$ is the corresponding number of SSB occasions groups not available at the UE;
- $L_{MAC,unknown,max}$ = 2 for $T_{SSB} \leq 40$ ms, $L_{MAC,unknown,max}$ = 1 for $T_{SSB} > 40$ ms;
- TO_{uk} = 1.
- $T_{L1\text{-}RSRP}$ = 0 in FR1 or when the TCI state switching not involving QCL-TypeD in FR2-2. Otherwise,
- $T_{L1\text{-}RSRP}$ is the time for Rx beam refinement in FR2-2, defined as
- $T_{L1\text{-}RSPR_Measurement_Period_SSB_CCA}$ for SSB as specified in clause 9.5A.4.1,
  - with the assumption of M=1
  - with T_{Report} = 0
- TO_{uk} = 0 for SSB based L1-RSRP measurement when TCI state switching involves QCL-TypeD
- TO_{uk} = 1 when TCI state switching involves other QCL types only
- $T_{first\text{-}SSB}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;
- $T_{first\text{-}SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE for other QCL types;
  - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

8.10A.4 DCI based TCI state switch delay

If the target TCI state is known, when a UE is configured with the higher layer parameter *tci-PresentInDCI* which is set as 'enabled' for the CORESET scheduling the PDSCH at slot n, UE shall be able to receive PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+*timeDurationForQCL*, where, *timeDurationForQCL* is the time required by the UE to perform PDCCH reception and applying spatial QCL information received in DCI for PDSCH processing as described in TS 38.214 [26], the value of *timeDurationForQCL* is defined in TS 38.306 [14].

The known condition for TCI state defined in clause 8.10A.2 is applied.

8.10A.5 RRC based TCI state switch delay

If the target TCI state is known, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ ($T_{RRC_processing}$ +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$+ T_{SSB}*$L_{RRC,known}$)) / *NR slot length*. The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

Where

- Slot n is last slot overlapping with the PDSCH carrying RRC activation command.
- $T_{RRC_processing}$ is the RRC processing delay defined in Clause 11.2 of TS 36.331 [16] is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in Clause 12 of TS 38.331 [2]
- $T_{first\text{-}SSB}$ is time to first SSB transmission occasion after RRC processing by the UE, during which some of the SSB occasions may not be availabledue to DL CCA failures;
  - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state;
- $L_{RRC,known} \leq L_{RRC,known,max}$ is the corresponding number of SSB occasions not available at the UE;
  - $L_{RRC,known,max}$ =2 for $T_{SSB} \leq$ 40 ms, $L_{RRC,known,max}$ =1 for T_{SSB}>40 ms.
- $T_{SSB\text{-}proc}$, TO_k, and T_{SSB} are as defined in clause 8.10A.3.

If the target TCI state is unknown, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ ($T_{RRC_processing}$ +$T_{L1\text{-}RSRP}$ + TO_{uk}*($T_{first\text{-}SSB}$+ $T_{SSB\text{-}proc}$+T_{SSB}*$L_{RRC,unknown}$)) / *NR slot length*. The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

Where,

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.
- $T_{RRC_processing}$ is the RRC processing delay defined in Clause 11.2 of TS 36.331 [16] is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in Clause 12 of TS 38.331 [2].
- $T_{first\text{-}SSB}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;
- $T_{first\text{-}SSB}$ is time to first SSB transmission occasion after RRC processing time at the UE for other QCL types, during which some SSB occasions may not be available at the UE due to DL CCA failures;
  - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state;
- $L_{RRC,unknown} \leq L_{RRC,unknown,max}$ is the corresponding number of SSB occasions not available at the UE;
  - $L_{RRC,unknown,max}$ = 2 for $T_{SSB} \leq$40 ms, $L_{RRC,unknown,max}$ = 1 for T_{SSB}>40 ms.
- $T_{L1\text{-}RSRP}$, TO_{uk}, $T_{SSB\text{-}proc}$, and T_{SSB} are as defined in clause 8.10A.3

The requirements for RRC based TCI state switch delay apply when only 1 TCI state is configured in RRC TCI state list. When $T_{HARQ} > T_{RRC_processing}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.10A.6 Active TCI state list update delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE for activation/deactivation of UE-specific PDSCH TCI state as defined in clause 6.1.3.14 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH to schedule PDSCH with the new target TCI state at the first slot that is after n + $3N_{slot}^{subframe,\mu}$ + (T_{HARQ} +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$+T_{SSB}*$L_{MAC,known}$)) / *NR slot length*. Where T_{HARQ}, $T_{first\text{-}SSB,}$ $T_{SSB\text{-}proc}$, T_{SSB}, $L_{MAC,known}$ and TO_k are as defined in clause 8.10A.3.

8.10B Active TCI state switching delay for RedCap

8.10B.1 Introduction

The requirements in this clause apply for a RedCap UE configured with one or more TCI state configurations on serving cell in standalone NR. UE shall complete the switch of active TCI state within the delay defined in this clause.

8.10B.2 Known conditions for TCI state

The TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of active TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state
  - TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
  - The UE has sent at least 1 L1-RSRP report for the target TCI state before the TCI state switch command
  - The TCI state remains detectable during the TCI state switching period
  - The SSB associated with the TCI state remain detectable during the TCI switching period
  - SNR of the TCI state $\geq$ -3 dB

Otherwise, the TCI state is unknown.

8.10B.3 MAC-CE based TCI state switch delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$ + TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$.

Where

- T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];
- $T_{first\text{-}SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state;
- $T_{SSB\text{-}proc}$ = 2 ms;
- TO_k = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} +$3N_{slot}^{subframe,\mu}$ + $T_{L1\text{-}RSRP}$ +TO_{uk}*($T_{first\text{-}SSB}$+ $T_{SSB\text{-}proc}$) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$.

Where

- $T_{L1\text{-}RSRP}$ = 0 in FR1 or when the TCI state switching not involving QCL-TypeD in FR2. Otherwise,
- $T_{L1\text{-}RSRP}$ is the time for Rx beam refinement in FR2, defined as
- $T_{L1\text{-}RSPR_Measurement_Period_SSB_RedCap}$ for SSB as specified in clause 9.5B.4.1,
  - with the assumption of M=1

  - with T_{Report} = 0

- $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$ for CSI-RS as specified in clause 9.5B.4.2
  - configured with higher layer parameter *repetition* set to ON
  - with the assumption of M=1 for periodic CSI-RS
  - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*
  - with T_{Report} = 0
  - TO_{uk} = 1 for CSI-RS based L1-RSRP measurement, and 0 for SSB based L1-RSRP measurement when TCI state switching involves QCL-TypeD
  - TO_{uk} = 1 when TCI state switching involves other QCL types only
  - $T_{first\text{-}SSB}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;
  - $T_{first\text{-}SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE for other QCL types;
- The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

8.10B.4 DCI based TCI state switch delay

If the target TCI state is known, when a UE is configured with the higher layer parameter *tci-PresentInDCI* which is set as 'enabled' for the CORESET scheduling PDSCH at slot n, UE shall be able to receive PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+*timeDurationForQCL*, where, *timeDurationForQCL* is the time required by the UE to perform PDCCH reception and applying spatial QCL information received in DCI for PDSCH processing as described in TS 38.214 [26], the value of *timeDurationForQCL* is defined in TS 38.331 [2].

The known condition for TCI state defined in clause 8.10.2 is applied.

8.10B.5 RRC based TCI state switch delay

If the target TCI state is known, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ $(T_{RRC_processing} + TO_k * (T_{first\text{-}SSB} + T_{SSB\text{-}proc}))$ / *NR slot length*, The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.
- $T_{RRC_processing}$ is the RRC processing delay defined in clause 11.2 of TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in clause 12 of TS 38.331 [2].
- $T_{first\text{-}SSB}$ is time to first SSB transmission after RRC processing by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state.
- $T_{SSB\text{-}proc}$ and TO_k are defined in clause 8.10B.3.

If the target TCI state is unknown, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ $(T_{RRC_processing} + T_{L1\text{-}RSRP} + TO_{uk} * (T_{first\text{-}SSB} + T_{SSB\text{-}proc}))$ / *NR slot length*, The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.

- $T_{RRC_processing}$ is the RRC processing delay defined in clause 11.2 of TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in clause 12 of TS 38.331 [2].

- $T_{first\text{-}SSB}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;

- $T_{first\text{-}SSB}$ is time to first SSB transmission after RRC processing time at the UE for other QCL types;

  - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

  - $T_{L1\text{-}RSRP}$, TO_{uk} and $T_{SSB\text{-}proc}$ are defined in clause 8.10B.3.

The requirements for RRC based TCI state switch delay apply when only 1 TCI state is configured in RRC TCI state list. When $T_{HARQ} > T_{RRC_processing}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.10B.6 Active TCI state list update delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE for activation/deactivation of UE-specific PDSCH TCI state as defined in clause 6.1.3.14 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH to schedule PDSCH with the new target TCI state at the first slot that is after n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$ +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. Where T_{HARQ}, $T_{first\text{-}SSB,}$ $T_{SSB\text{-}proc}$ and TO_k are defined in clause 8.10B.3.

8.10C Active TCI state switching delay for satellite access

8.10C.1 Introduction

The requirements in this clause apply for a UE configured with one or more TCI state configurations on PCell in satellite access. UE shall complete the switch of active TCI state within the delay defined in this clause.

8.10C.2 MAC-CE based TCI state switch delay

Upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} + 3$N_{slot}^{subframe,\mu}$+ TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ T_{HARQ} + 3$N_{slot}^{subframe,\mu}$.

Where

- T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];

- $T_{first\text{-}SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

- $T_{SSB\text{-}proc}$ = 2 ms;

- TO_k = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise.

8.10C.4 DCI based TCI state switch delay

When a UE is configured with the higher layer parameter *tci-PresentInDCI* which is set as 'enabled' for the CORESET scheduling PDSCH at slot n, UE shall be able to receive PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+*timeDurationForQCL*, where, *timeDurationForQCL* is the time required by the UE to perform PDCCH reception and applying spatial QCL information received in DCI for PDSCH processing as described in TS 38.214 [26], the value of *timeDurationForQCL* is defined in TS 38.331 [2].

8.10C.5 RRC based TCI state switch delay

UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ ($T_{RRC_processing}$ +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$)) / *NR slot length*, The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.
- $T_{RRC_processing}$ is the RRC processing delay defined in clause 12 of TS 38.331 [2].
- $T_{first\text{-}SSB}$ is time to first SSB transmission after RRC processing by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state.
- $T_{SSB\text{-}proc}$ and TO_k are defined in clause 8.10C.2.

The requirements for RRC based TCI state switch delay apply when only 1 TCI state is configured in RRC TCI state list. When $T_{HARQ} > T_{RRC_processing}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.10C.6 Active TCI state list update delay

Upon receiving PDSCH carrying MAC-CE for activation/deactivation of UE-specific PDSCH TCI state as defined in clause 6.1.3.14 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH to schedule PDSCH with the new target TCI state at the first slot that is after n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$ +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. Where T_{HARQ}, $T_{first\text{-}SSB}$, $T_{SSB\text{-}proc}$ and TO_k are defined in clause 8.10C.2.

8.10D Active TCI state switching delay for ATG

8.10D.1 Introduction

The requirements in this clause apply for an ATG UE configured with one or more TCI state configurations on PCell. The UE shall complete the switch of active TCI state within the delay defined in this clause.

8.10D.2 Void

8.10D.3 MAC-CE based TCI state switch delay

Upon receiving PDSCH carrying MAC-CE for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} + 3$N_{slot}^{subframe,\mu}$+ TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$.

Where

- T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];
- $T_{first\text{-}SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state;
- $T_{SSB\text{-}proc}$ = 2 ms;
- TO_k = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise.

8.10D.4 DCI based TCI state switch delay

When a UE is configured with the higher layer parameter *tci-PresentInDCI* which is set as 'enabled' for the CORESET scheduling PDSCH at slot n, UE shall be able to receive PDSCH with target TCI state of the serving cell on which TCI

state switch occurs at the first slot that is after slot n+*timeDurationForQCL*, where, *timeDurationForQCL* is the time required by the UE to perform PDCCH reception and applying spatial QCL information received in DCI for PDSCH processing as described in TS 38.214 [26], the value of *timeDurationForQCL* is defined in TS 38.331 [2].

8.10D.5 RRC based TCI state switch delay

UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ ($T_{RRC_processing}$ +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$)) / *NR slot length*, The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command.
- $T_{RRC_processing}$ is the RRC processing delay defined in clause 12 of TS 38.331 [2].
- $T_{first\text{-}SSB}$ is time to first SSB transmission after RRC processing by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state.
- $T_{SSB\text{-}proc}$ and TO_k are defined in clause 8.10D.3.

The requirements for RRC based TCI state switch delay apply when only 1 TCI state is configured in RRC TCI state list. When $T_{HARQ} > T_{RRC_processing}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.10D.6 Active TCI state list update delay

Upon receiving PDSCH carrying MAC-CE for activation/deactivation of UE-specific PDSCH TCI state as defined in clause 6.1.3.14 of TS 38.321 [7] at slot n, UE shall be able to receive PDCCH to schedule PDSCH with the new target TCI state at the first slot that is after n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$ +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. Where T_{HARQ}, $T_{first\text{-}SSB}$, $T_{SSB\text{-}proc}$ and TO_k are defined in clause 8.10D.3.

8.10E Active TCI state switching delay for UE operating in FR2-1 and configured with groupBasedBeamReporting-r17

8.10E.1 Introduction

The requirements in this clause apply for a UE configured with groupBasedBeamReporting-r17 and dual TCI state configurations on PCell, PSCell or SCell in standalone NR, when the UE is configured with a single serving cell (PCell, PSCell, or SCell) in FR2-1. The requirements apply when the dual target TCI states are known and the UE can receive the dual target TCI states simultaneously, where the known conditions are defined in clause 8.10E.2. UE shall complete the switch of active TCI states within the delay defined in this clause.

8.10E.2 Known conditions for TCI state

Dual TCI states will be indicated in one or two TCI state switch commands. The dual target TCI states are known if the following conditions are met:

- Dual target TCI states are QCL-ed with typeD to reference signals in a resource group in the latest Rel-17 group based beam report
- The dual target TCI states and all the RSs in the two QCL chains remain detectable during the TCI state switching period
  - SNR of the TCI state ≥ -3 dB
- RS resource group configured for dual target TCI states is reported in the last [1280] ms

Editor's note: FFS whether additional conditions are needed for tests.

8.10E.3 MAC-CE based dual DL TCI state switch delay

8.10E.3.1 MAC-CE based dual DL TCI state switching delay for sDCI

The requirement in this clause applies when UE is provided with *twoQCLTypeDforPDCCHRepetition*.

When a MAC CE command for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] indicating TCI state switch with CORESET index p are received in slot n, and if the TCI state is known, UE shall be able to receive PDCCH with the target TCI state at the first slot that is after slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ TO_k*($T_{first\text{-}SSBp,}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI states until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$,

Where:

- T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].
- $T_{first\text{-}SSBp}$ is time to first SSB transmission (associated with TCI state of CORESET p) after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state.
- $T_{SSB\text{-}proc}$ = 2 ms.
- TO_k = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise.

When UE receive TCI state switch command for CORESET index p while UE is performing TCI state switch of CORESET index q, UE shall be ready to receive PDCCH with the target TCI states of CORESET index p and q after completing both the TCI state switch of CORESET p and q.

8.10E.3.2 MAC-CE based dual DL TCI state switching delay for mDCI

The requirement in this clause applies when UE is capable of *multiDCI-MultiTRP-r16* and configured with two *CORESETPoolIndex*es.

When a MAC CE command for indication of UE-specific PDCCH TCI state as defined in clause 6.1.3.15 of TS 38.321 [7] indicating a TCI state switch for *CORESETPoolIndex p* is received at slot n, and if the TCI state is known, UE shall be able to receive PDCCH with the target TCI state at the first slot that is after slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ TO_k*($T_{first\text{-}SSBp,}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI states until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$.

Where:

- T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].
- $T_{first\text{-}SSBp}$ is time to first SSB transmission (i.e., SSB associated to *CORESETPoolIndex p*) after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state.
- $T_{SSB\text{-}proc}$ = 2 ms.
- TO_k = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise.

When UE receives TCI state switch command for *CORESETPoolIndex p* while UE is performing TCI state switch of *CORESETPoolIndex* q, UE shall be ready to receive PDCCH with the target TCI states of *CORESETPoolIndex* p and q after completing both the TCI state switch of *CORESETPoolIndex* p and q.

8.10E.4 DCI based dual DL TCI state switch delay for sDCI and mDCI

8.10E.4.1 DCI based dual DL TCI state switching delay for sDCI

For sDCI, if the dual target TCI states are known, when a UE is configured with the higher layer parameter *tci-PresentInDCI* from one TRP which is set as 'enabled' for the CORESET scheduling two PDSCHs at slot n, UE shall be able to receive PDSCHs with target TCI states of the serving cell on which TCI state switch occurs at the first slot that is after slot n+*timeDurationForQCL*, where, *timeDurationForQCL* is the time required by the UE to perform PDCCH

reception and apply spatial QCL information received in DCI for PDSCHs processing as described in TS 38.214 [26], the value of *timeDurationForQCL* is defined in TS 38.331 [2].

The known condition for dual target TCI states defined in clause 8.10E.2 is applied.

8.10E.4.2 DCI based dual DL TCI state switching delay for mDCI

For mDCI, if the dual target TCI states are known, when a UE is configured with the higher layer parameter *tci-PresentInDCI* from two TRPs which is set as 'enabled' for the DCIs scheduling two PDSCHs at slot n1 and n2 respectively, UE shall be able to receive PDSCHs with target TCI states of the serving cell on which TCI state switch occurs at the first slot that is after slot n1 + *timeDurationForQCL* and slot n2 + *timeDurationForQCL* respectively, where, *timeDurationForQCL* is the time required by the UE to perform PDCCH reception and apply spatial QCL information received in DCI for PDSCHs processing as described in TS 38.214 [26], the value of *timeDurationForQCL* is defined in TS 38.331 [2]. UE shall be able to simultaneously receive PDSCHs with target TCI states after slot max(n1, n2) + *timeDurationForQCL*.

For mDCI, if the dual target TCI states are known, when a UE is configured with the higher layer parameter *tci-PresentInDCI* from one TRP which is set as 'enabled' for the DCI scheduling PDSCHs at slot n1, while the indicated TCI for the other TRP remains unchanged, UE shall be able to simultaneously receive PDSCHs with target dual TCI states of the serving cell on which TCI state switch occurs at the first slot that is after slot n1 + *timeDurationForQCL*.

The known condition for dual target TCI states defined in clause 8.10E.2 is applied.

8.10E.5 RRC based dual DL TCI state switch delay

For mDCI, when there is single TCI configured by RRC for a CORESET other than a CORESET with index 0 in field *tci-StatesPDCCH-ToAddList*, and each CORESET is associated with a different value of *coresetPoolIndex*, for each known TCI state switch associated with different *coresetPoolIndex*, requirements in clause 8.10.5 apply.

8.10E.6 Active DL TCI state list update delay

8.10E.6.1 Active DL TCI state list update delay for sDCI

For sDCI, if the dual target TCI states are known, upon receiving PDSCH carrying MAC-CE for activation/deactivation of UE-specific PDSCH TCI state as defined in clause 6.1.3.14 of TS 38.321 [7] from a TRP at slot n, UE shall be ready to receive PDCCH to schedule PDSCHs from both TRPs with the new target TCI states at the first slot that is after n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$ +TO_k*(max ($T_{first\text{-}SSB1}$, $T_{first\text{-}SSB2}$)+ $T_{SSB\text{-}proc}$) / *NR slot length*. Where T_{HARQ}, $T_{first\text{-}SSB1}$, $T_{first\text{-}SSB2}$, $T_{SSB\text{-}proc}$ and TO_k are defined in clause 8.10E.3.

8.10E.6.2 Active DL TCI state list update delay for mDCI

For mDCI case, if the target TCI state is known, upon receiving PDSCH carrying MAC-CE for activation/deactivation of UE-specific PDSCH TCI state as defined in clause 6.1.3.14 of TS 38.321 [7]from a TRP at slot n, UE shall be ready to receive PDCCH to schedule PDSCH from the TRP with the new target TCI state at the first slot that is after n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$ +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. Where T_{HARQ}, $T_{first\text{-}SSB,}$ $T_{SSB\text{-}proc}$ and TO_k are defined in clause 8.10.3. Dual target TCI states can be used in the same slot for PDSCH only after both TCI states on TCI state list(s) are activated.

8.10F Active TCI state switching delay for RedCap UE with satellite access

8.10F.1 Introduction

The requirements in this clause apply for a RedCap UE configured with one or more TCI state configurations on PCell in satellite access. UE shall complete the switch of active TCI state within the delay defined in this clause.

8.10F.2 MAC-CE based TCI state switch delay

The requirements in clause 8.10C.2 shall apply.

8.10F.4 DCI based TCI state switch delay

The requirements in clause 8.10C.4 shall apply.

8.10F.5 RRC based TCI state switch delay

The requirements in clause 8.10C.5 shall apply.

8.10F.6 Active TCI state list update delay

The requirements in clause 8.10C.6 shall apply.

8.11 PSCell Change

This clause defines requirements for the delay within which the UE shall be able to change PSCell to other cell in EN-DC or NR-DC. The requirements in this clause are applicable to EN-DC and NR-DC.

The UE shall be capable of transmitting PRACH preamble towards the target PSCell no later than specified in clause 8.9.2 for the case of NR-DC and in TS 36.133 [15] clause 7.31.2 for the case of EN-DC,, where the following values for slot n, $T_{processing}$ and T_{RRC_delay} shall override the existing ones:

- Slot n is the last slot overlapping with the PDSCH containing PSCell change,
- $T_{processing}$ = 20 ms when source and target cells are in the same FR,
- $T_{processing}$ = 40 ms when source and target cells are in different FRs.
- T_{RRC_delay} is the RRC procedure delay as specified in TS 36.331 [16] if the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC procedure delay as specified in TS 38.331 [2].

If the SMTC periodicity of the target cell is not provided within the PSCell change message, and measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, T_{rs} is the periodicity of one of the SMTC which is up to UE implementation.

In the case of NR-DC PSCell change in FR1, when the UE indicating *support3MHz-ChannelBW-Symmetric-r18* is configured with a target PSCell that is with 12PRB SSB bandwidth, the UE shall transmit PRACH preamble towards the target PSCell no later than the delay requirements specified in clause 8.9.2.

The target PSCell is known if it has been meeting the conditions in clause 8.9.2 for the case of NR-DC and in TS 36.133 [15] clause 7.31.2 for the case of EN-DC.

The interruption on PCell and other serving cells specified in TS 36.133 clause 7.32.2.1 for EN-DC and in TS 38.133 [2] clause 8.2.4.2.1 for NR-DC is allowed only during the RRC reconfiguration procedure [2].

8.11A PSCell Change in Carriers with CCA

This clause defines requirements for the delay within which the UE shall be able to change PSCell in FR2-2 with CCA to other cell in NR-DC. The requirements in this clause are applicable to NR-DC.

The UE shall be capable of transmitting PRACH preamble towards the target PSCell no later than specified in clause 8.9A.2 for the case of NR-DC, where the following values for slot n, $T_{processing}$ and T_{RRC_delay} shall override the existing ones:

- Slot n is the last slot overlapping with the PDSCH containing PSCell change,
- $T_{processing}$ = 20 ms when source and target cells are in the same FR,
- $T_{processing}$ = 40 ms when source and target cells are in different FRs.

- T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

If the SMTC periodicity of the target cell is not provided within the PSCell change message, and measObjectNRs having the same SSB frequency and subcarrier spacing configured by MN and SN have different SMTC, T_{rs} is the periodicity of one of the SMTC which is up to UE implementation.

The target PSCell is known if it has been meeting the conditions in clause 8.9A.2 for the case of NR-DC.

The interruption on PCell and other serving cells specified in TS 38.133 [2] clause 8.2.4.2.1 for NR-DC is allowed only during the RRC reconfiguration procedure [2].

8.11B Conditional PSCell Change

8.11B.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to perform conditional PSCell change in EN-DC or NR-DC. The requirements in this clause are applicable to EN-DC and NR-DC.

8.11B.2 Conditional PSCell Change delay

The requirements in this clause shall apply for the UE configured with only PCell in FR1.

The UE shall be capable to transmit PRACH preamble towards the new target PSCell no later than in slot n + $T_{config_PSCell_Conditional}$:

Where:

- Slot n is the last slot overlapping with the PDSCH containing conditional PSCell change.
- $T_{config_PSCell_Conditional} = T_{RRC_delay} + T_{Event_DU} + T_{measure} + T_{UE_preparation} + T_{processing} + T_{\Delta} + T_{PSCell_DU} + 2$ ms
  - T_{RRC_delay} is the RRC processing delay defined in clause 11.2 in TS 36.331 [16] is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC procedure delay defined in clause 12 in TS 38.331 [2] for processing the conditional PSCell change command.
  - T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional PSCell change command until a condition exists at the measurement reference point which will trigger the conditional PSCell change.
  - $T_{measure}$ is the measurements time stated in clause 8.11B.2.1.
  - $T_{UE_preparation}$ is the UE preparation time for conditional PSCell change, and starts after UE realizes the condition of PSCell change is met and identity of new PSCell is determined. $T_{UE_preparation}$ is up to 10 ms.
  - $T_{processing}$ is the SW processing time needed by UE, including RF warm up period. $T_{processing}$ = 20 ms when source and target cells are in the same FR, and $T_{processing}$ = 40 ms when source and target cells are in different FRs.
  - T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = 3*T_{rs}$ ms for target PSCell operating with 12 PRB SSB BW. Otherwise, $T_{\Delta} = 1*T_{rs}$ ms.
    - T_{rs} is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.
  - T_{PSCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. T_{PSCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

The PCell interruption specified in clause 8.2 is allowed only after the UE starts to execute a conditional PSCell change.

8.11B.2.1 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE executes a PSCell change to a target cell and interruption time starts.

For intra-frequency PSCell change, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify_intra_without_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2.

For inter-frequency PSCell change, the measurement time delay measured without TTT and L3 filtering shall be less than $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ defined in clause 9.3.4. When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PSCell change or the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PSCell change. If a cell, which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PSCell change or the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PSCell change, becomes undetectable for a period and then the cell becomes detectable again and triggers a PSCell change, the measurement time delay shall be less than $T_{SSB_measurement_period_intra}$ or $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

8.11D Conditional PSCell Change in Carriers with CCA

8.11D.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to perform conditional PSCell in FR2-2 with CCA change in NR-DC. The requirements in this clause are applicable to NR-DC.

8.11D.2 Conditional PSCell Change delay

The requirements in this clause shall apply for the UE configured with only PCell in FR1.

The UE shall be capable to transmit PRACH preamble towards the new target PSCell no later than in slot $n + \frac{T_{config_PSCell_Conditional}}{NR\ slot\ length}$:

Where:

- Slot n is the last slot overlapping with the PDSCH containing conditional PSCell change.
- $T_{config_PSCell_Conditional} = T_{RRC_delay} + T_{Event_DU} + T_{measure_CCA} + T_{UE_preparation} + T_{processing} + T_{\Delta_CCA} + T_{PSCell_DU} + 2$ ms
  - T_{RRC_delay} is the RRC procedure delay defined in clause 12 in TS 38.331 [2] for processing the conditional PSCell change command.
  - T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional PSCell change command until a condition exists at the measurement reference point which will trigger the conditional PSCell change.
  - $T_{measure_CCA}$ is the measurements time stated in clause 8.11D.2.1.
  - $T_{UE_preparation}$ is the UE preparation time for conditional PSCell change, and starts after UE realizes the condition of PSCell change is met and identity of new PSCell is determined. $T_{UE_preparation}$ is up to 10 ms.
  - $T_{processing}$ is the SW processing time needed by UE, including RF warm up period. $T_{processing}$ = 20 ms when source and target cells are in the same FR, and $T_{processing}$ = 40 ms when source and target cells are in different FRs.
  - T_{Δ_CCA} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = (1+L_2) * T_{rs}$ ms, where L_2 is the number of SMTC occasions not avaible at the UE during the time tracking period.

- T_{rs} is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

- T_{PSCell_DU} is the interruption uncertainty due to the random access procedure when sending PRACH to the new cell. T_{PSCell_DU} can be up to: $(1+ L_3) * T_{SSB,RO} + 10$ ms where $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined in table 8.1-1 of TS 38.213 [3] and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. $L_3 = 0$ for Type 3 UL channel access procedure as defined in TS 37.213 [33].

NOTE 1: The interruption time considering the potential extensions caused by L_2, L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2].

The PCell interruption specified in clause 8.2 is allowed only after the UE starts to execute a conditional PSCell change.

8.11D.2.1 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE executes a PSCell change to a target cell and interruption time starts.

For intra-frequency PSCell change, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\ intra_cca\ with\ index}$ or $T_{identify_intra_cca_without_index}$ defined in clause 9.2A.5.1 or clause 9.2A.6.2.

For inter-frequency PSCell change, the measurement time delay measured without TTT and L3 filtering shall be less than $T_{identify_inter_cca_without_index}$ or $T_{identify_inter_cca_with_index}$ defined in clause 9.3A.4. When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_intra_cca_without_index}$ or $T_{identify_intra_cca_with_index}$ for intra-frequency PSCell change or the time period $T_{identify_inter_cca_without_index}$ or $T_{identify_inter_cca_with_index}$ for inter-frequency PSCell change. If a cell, which has been detectable at least for the time period $T_{identify_intra_cca_without_index}$ or $T_{identify_intra_cca_with_index}$ for intra-frequency PSCell change or the time period $T_{identify_inter_cca_without_index}$ or $T_{identify_inter_cca_with_index}$ for inter-frequency PSCell change, becomes undetectable for a period and then the cell becomes detectable again and triggers a PSCell change, the measurement time delay shall be less than $T_{SSB_measurement_period_intra_cca}$ or $T_{SSB_measurement_period_inter_cca}$ provided the timing to that cell has not changed more than ± 3200 Tc while the measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

8.11E Subsequent Conditional PSCell Change

8.11E.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to perform subsequent conditional PSCell change in NR-DC. The requirements in this clause are applicable to NR-DC.

8.11E.2 Subsequent Conditional PSCell Change delay

The requirements in this clause shall apply for the UE configured with only PCell in FR1.

The UE shall be capable to transmit PRACH preamble towards the new target PSCell no later than in slot n + $T_{config_PSCell_Subsequent_Change_Conditional}$:

Where:

- Slot n is the time when UE transmits SN *RRCReconfigurationcomplete* message for the previous PSCell addition or change.

- $T_{config_PSCell_Subsequent_Change_Conditional} = T_{Event_DU} + T_{measure} + T_{UE_preparation} + T_{processing} + T_{\Delta} + T_{PSCell_DU} + 2$ ms

  - T_{Event_DU} is the delay uncertainty which is the time from when UE transmits SN *RRCReconfigurationcomplete* message for the previous PSCell addition or change until a condition exists at the measurement reference point which will trigger the subsequent conditional PSCell change.

  - $T_{measure}$ is the measurements time stated in clause 8.11E.2.1.

  - $T_{UE_preparation}$ is the UE preparation time for subsequent conditional PSCell change, and starts after UE realizes the condition of PSCell change is met and identity of new PSCell is determined. $T_{UE_preparation}$ is up to 10 ms.

  - $T_{processing}$ is the SW processing time needed by UE, including RF warm up period. $T_{processing}$ = 20 ms when source and target cells are in the same FR, and $T_{processing}$ = 40 ms when source and target cells are in different FRs.

  - T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = 3*T_{rs}$ ms for PSCell operating with 12 PRB SSB BW. Otherwise, $T_{\Delta} = 1*T_{rs}$.

    - T_{rs} is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise T_{rs} is the SMTC configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs} = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

  - T_{PSCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. T_{PSCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

The PCell interruption specified in clause 8.2 is allowed only after the UE starts to execute a subsequent conditional PSCell change.

8.11E.2.1 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE executes a PSCell change to a target cell and interruption time starts.

For intra-frequency PSCell change, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify_intra_with_index}$ or $T_{identify_intra_without_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2.

For inter-frequency PSCell change, the measurement time delay measured without TTT and L3 filtering shall be less than $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ defined in clause 9.3.4. When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PSCell change or the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PSCell change. If a cell, which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ for intra-frequency PSCell change or the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ for inter-frequency PSCell change, becomes undetectable for a period and then the cell becomes detectable again and triggers a PSCell change, the measurement time delay shall be less than $T_{SSB_measurement_period_intra}$ or $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

8.12 Uplink spatial relation switch delay

8.12.1 Introduction

The requirements in this clause apply for a UE configured with one or more spatial relation configurations on serving cell in MR-DC or standalone NR. There is no requirement when the UE is requested to switch to a spatial relation with the higher layer parameter *spatialRelationInfo* associated to SRS. UE shall complete the switch of active spatial relation

within the delay defined in this clause when the UE is requested to switch to a spatial relation with the higher layer parameter *spatialRelationInfo* associated to a DL RS.

8.12.2 Known conditions for spatial relation when associated with DL-RS

The spatial relation associated to DL RS is known if the following conditions are met:

- During the period from the last transmission of the DL RS resource used for the L1-RSRP measurement reporting for the target spatial relation to the completion of active spatial relation switch, where the DL RS resource for L1-RSRP measurement is the DL RS in target spatial relation or QCLed to the target spatial relation with QCL type-D.
  - Spatial relation switch command is received within 1280 ms upon the last transmission of the DL RS resource for beam reporting or measurement
  - The UE has sent at least 1 L1-RSRP report for the target spatial relation before the spatial relation switch command
  - The DL RS configured in spatial relation remains detectable during the spatial relation switching period
    - SNR of the DL RS configured in spatial relation ≥ -3 dB
  - The SSB associated with the spatial relation remain detectable during the spatial relation switching period
    - SNR of the SSB associated with the spatial relation ≥ -3 dB

Otherwise, the spatial relation is unknown.

8.12.3 MAC-CE based spatial relation switch delay

If the target spatial relation associated to DL RS is known, upon receiving PDSCH carrying MAC-CE activation command in slot n, for UL spatial relation switch for PUCCH or semi-persistent SRS transmission of serving cell with a target UL spatial relation, the UE shall be able to transmit PUCCH or semi-persistent SRS with the target UL spatial relation in the slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ 1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1 where T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].

If the target spatial relation associated to DL RS is unknown, upon receiving PDSCH carrying MAC-CE activation command in slot n, for UL spatial relation switch for PUCCH or semi-persistent SRS transmission of serving cell with a target UL spatial relation, the UE shall be able to transmit PUCCH or semi-persistent SRS with the target UL spatial relation in the slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ $T_{L1\text{-}RSRP}$+1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1.

Where

- T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3],
- $T_{L1\text{-}RSRP}$ is the time for Rx beam refinement in FR2, defined as
  - $T_{L1\text{-}RSPR_Measurement_Period_SSB}$ for SSB as specified in clause 9.5.4.1,
    - with the assumption of M=1
    - with T_{Report} = 0
  - $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ for CSI-RS as specified in clause 9.5.4.2
    - configured with higher layer parameter *repetition* set to ON
    - with the assumption of M=1 for periodic CSI-RS
    - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*
    - with $_{T}$Report = 0

The UE shall be able to transmit with the old UL spatial relation until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$.

When the UL spatial relation info switch for PUCCH changes both the associated DL RS and *pucch-PathlossReferenceRS* with the same MAC-CE activation, and if both the DL RS and *pucch-PathlossReferenceRS* are known as specified in clause 8.12.2 and 8.14.2 respectively, the UE shall be able to transmit PUCCH with the target UL spatial relation after the delay specified in clause 8.14.3. If either the associated DL RS or *pucch-PathlossReferenceRS* are unknown, a longer switching delay is allowed. The UE is not required to transmit PUCCH with the target UL spatial relation until the DL RS and pathloss reference RS switch are completed.

8.12.4 DCI based spatial relation switch delay

If the target spatial relation associated to DL RS is known, when a UE receives the DCI triggering aperiodic SRS at slot n with the higher layer parameter *spatialRelationInfo*, UE shall be able to transmit aperiodic SRS with target spatial relation of the serving cell on which spatial relation switch occurs in the slot $\left\lfloor n \cdot \frac{2^{\mu_{SRS}}}{2^{\mu_{PDCCH}}} \right\rfloor + k + 1$, where, *k* is configured via higher layer parameter *slotOffset*[2] for each triggered SRS resources set and is based on the subcarrier spacing of the triggered SRS transmission, μ_{SRS} and μ_{PDCCH} are the subcarrier spacing configurations for triggered SRS and PDCCH carrying the triggering command respectively in TS 38.214 [26].

The known condition for spatial relation associated to DL RS defined in clause 8.12.2 is applied.

8.12.5 RRC based spatial relation switch delay

If the target spatial relation associated to DL RS is known, UE shall be able to transmit target periodic SRS with spatial relation of the serving cell on which periodic SRS with spatial relation reconfigured in the slot n+ $T_{RRC_processing}$ */NR slot length* +1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command,
- $T_{RRC_processing}$ is the RRC processing delay defined in TS 36.331 [16] is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in TS 38.331 [2].

If the target spatial relation associated to DL RS is unknown, UE shall be able to transmit target periodic SRS with spatial relation of the serving cell on which periodic SRS with spatial relation reconfigured in the slot n+ $T_{RRC_processing}$ */NR slot length* + $T_{L1\text{-}RSRP}$ +1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command,
- $T_{RRC_processing}$ is the RRC processing delay defined in TS 36.331 [16] is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in TS 38.331 [2].
- $T_{L1\text{-}RSRP}$ is defined in clause 8.12.3

8.12A Uplink spatial relation switch delay for RedCap

8.12A.1 Introduction

The requirements in this clause apply for a RedCap UE configured with one or more spatial relation configurations on serving cell in standalone NR. There is no requirement when the UE is requested to switch to a spatial relation with the higher layer parameter *spatialRelationInfo* associated to SRS. UE shall complete the switch of active spatial relation within the delay defined in this clause when the UE is requested to switch to a spatial relation with the higher layer parameter *spatialRelationInfo* associated to a DL RS.

8.12A.2 Known conditions for spatial relation when associated with DL-RS

The spatial relation associated to DL RS is known if the following conditions are met:

- During the period from the last transmission of the DL RS resource used for the L1-RSRP measurement reporting for the target spatial relation to the completion of active spatial relation, where the DL RS resource for L1-RSRP measurement is the DL RS in target spatial relation or QCLed to the target spatial relation with QCL type-D.
  - Spatial relation switch command is received within 1280 ms upon the last transmission of the DL RS resource for beam reporting or measurement
  - The UE has sent at least 1 L1-RSRP report for the target spatial relation before the spatial relation switch command
  - The DL RS configured in spatial relation remains detectable during the spatial relation switching period
    - SNR of the DL RS configured in spatial relation ≥ -3 dB
  - The SSB associated with the spatial relation remain detectable during the spatial relation switching period
    - SNR of the SSB associated with the spatial relation ≥ -3 dB

Otherwise, the spatial relation is unknown.

8.12A.3 MAC-CE based spatial relation switch delay

If the target spatial relation associated to DL RS is known and UE is configured with uplink resources for transmission on target spatial relation, upon receiving PDSCH carrying MAC-CE activation command in slot n, for UL spatial relation switch for PUCCH or semi-persistent SRS transmission of serving cell with a target UL spatial relation, the UE shall be able to transmit PUCCH or semi-persistent SRS with the target UL spatial relation no later than slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ 1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1 where T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].

If the target spatial relation associated to DL RS is unknown and UE is configured with uplink resources for transmission on target spatial relation, upon receiving PDSCH carrying MAC-CE activation command in slot n, for UL spatial relation switch for PUCCH or semi-persistent SRS transmission of serving cell with a target UL spatial relation, the UE shall be able to transmit PUCCH or semi-persistent SRS with the target UL spatial relation no later than slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ $T_{L1\text{-}RSRP}$+1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1.

Where

- T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3],
- $T_{L1\text{-}RSRP}$ is the time for Rx beam refinement in FR2, defined as
  - $T_{L1\text{-}RSRP_Measurement_Period_SSB_RedCap}$ for SSB as specified in clause 9.5B,
    - with the assumption of M=1
    - with T_{Report} = 0
  - $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$ for CSI-RS as specified in clause 9.5.4.2
    - configured with higher layer parameter *repetition* set to ON
    - with the assumption of M=1 for periodic CSI-RS
    - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*
    - with $_{T}$Report = 0

The UE shall be able to transmit with the old UL spatial relation until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$.

For RedCap UE in HD-FDD mode, if a downlink reception overlaps with PUCCH or semi-persistent SRS transmission of the serving cell with the target UL spatial relation then the UE is allowed to postpone the uplink transmission.

When the UL spatial relation info switch for PUCCH changes both the associated DL RS and *pucch-PathlossReferenceRS* with the same MAC-CE activation, and if both the DL RS and *pucch-PathlossReferenceRS* are known as specified in clause 8.12A.2 and 8.14.2 respectively, the UE shall be able to transmit PUCCH with the target UL spatial relation after the delay specified in clause 8.14.3. If either the associated DL RS or *pucch-PathlossReferenceRS* are unknown, a longer switching delay is allowed. The UE is not required to transmit PUCCH with the target UL spatial relation until the DL RS and pathloss reference RS switch are completed.

8.12A.4 DCI based spatial relation switch delay

If the target spatial relation associated to DL RS is known and UE is configured with uplink resources for transmission on target spatial relation, when a UE receives the DCI triggering aperiodic SRS at slot n with the higher layer parameter *spatialRelationInfo*, UE shall be able to transmit aperiodic SRS with target spatial relation of the serving cell on which spatial relation switch occurs no later than slot $\left\lfloor n \cdot \frac{2^{\mu_{SRS}}}{2^{\mu_{PDCCH}}} \right\rfloor + k + 1$, where, k is configured via higher layer parameter *slotOffset*[2] for each triggered SRS resources set and is based on the subcarrier spacing of the triggered SRS transmission, μ_{SRS} and μ_{PDCCH} are the subcarrier spacing configurations for triggered SRS and PDCCH carrying the triggering command respectively in TS 38.214 [26].

For RedCap UE in HD-FDD mode, if a downlink reception overlaps with aperiodic SRS with target spatial relation of the serving cell then the UE is allowed to postpone the uplink transmission.

The known condition for spatial relation associated to DL RS defined in clause 8.12A.2 is applied.

8.12A.5 RRC based spatial relation switch delay

If the target spatial relation associated to DL RS is known and UE is configured with uplink resources for transmission on target spatial relation, UE shall be able to transmit target periodic SRS with spatial relation of the serving cell on which periodic SRS with spatial relation reconfigured no later than slot n+ $T_{RRC_processing}$ /*NR slot length* +1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command,
- $T_{RRC_processing}$ is the RRC processing delay defined in TS 36.331 [16] is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in TS 38.331 [2].

If the target spatial relation associated to DL RS is unknown and UE is configured with uplink resources for transmission on target spatial relation, UE shall be able to transmit target periodic SRS with spatial relation of the serving cell on which periodic SRS with spatial relation reconfigured no later than slot n+ $T_{RRC_processing}$ /*NR slot length* + $T_{L1\text{-}RSRP}$ +1 when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1.

Where

- Slot n is the last slot overlapping with the PDSCH carrying RRC activation command,
- $T_{RRC_processing}$ is the RRC processing delay defined in TS 36.331 [16] is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the RRC processing delay defined in TS 38.331 [2].
- $T_{L1\text{-}RSRP}$ is defined in clause 8.12A.3

For RedCap UE in HD-FDD mode, if a downlink reception overlaps with target periodic SRS with spatial relation of the serving cell with periodic SRS with spatial relation reconfigured then the UE is allowed to postpone the uplink transmission.

8.12C Uplink spatial relation switch delay for satellite access

UL Spatial relation switch delay requirements do not apply for satellite access in FR1-NTN.

8.12C.1 Void

8.12C.2 Void

8.12C.3 Void

8.12C.4 Void

8.12C.5 Void

8.13 UE-specific CBW change

8.13.1 Introduction

The requirements in this clause apply for a UE receiving reconfiguration of *offsetToCarrier* or *carrierBandwidth* to change channel bandwidth.

8.13.2 UE-specific CBW change delay

After the UE receives RRC reconfiguration involving *offsetToCarrier* or *carrierBandwidth* change on the old CBW, UE shall be able to receive PDSCH/PDCCH on the DL BWP with BWP ID firstActiveDownlinkBWP-Id or transmit PUSCH on the UL BWP with BWP ID firstActiveUplinkBWP-Id of the new CBW right after a time duration of $\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ slots which begins from the beginning of DL slot n, where

- DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and
- $T_{RRCprocessingDelay}$ is the length of the RRC procedure delay in milliseconds as defined in clause 11.2 in TS 36.331 [16] is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the length of the RRC procedure delay in milliseconds as defined in clause 12 in TS 38.331 [2], and
- $T_{CBWchangeDelayRRC} = 6ms$ is the time used by the UE to perform CBW change.

The UE is not required to transmit UL signals or receive DL signals during the above defined time duration $\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ on the cell where UE-specific CBW change occurs. When $T_{HARQ} > T_{RRCprocessingDelay}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.13A UE-specific CBW change for RedCap

8.13A.1 Introduction

The requirements in this clause apply for a RedCap UE receiving reconfiguration of *offsetToCarrier* or *carrierBandwidth* to change channel bandwidth.

8.13A.2 UE-specific CBW change delay

After the UE receives RRC reconfiguration involving *offsetToCarrier* or *carrierBandwidth* change on the old CBW, UE shall be able to receive PDSCH/PDCCH on an active DL BWP or transmit PUSCH on an active UL BWP of the new CBW right after a time duration of $\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ slots which begins from the beginning of DL slot n, where

- DL slot n is the last slot overlapping with the PDSCH containing the RRC command, and

- $T_{RRCprocessingDelay}$ is the length of the RRC procedure delay in milliseconds as defined in clause 11.2 in TS 36.331 [16] is the corresponding RRC message is embedded in E-UTRA RRC message, otherwise it is the length of the RRC procedure delay in milliseconds as defined in clause 12 in TS 38.331 [2], and

- $T_{CBWchangeDelayRRC} = 6ms$ is the time used by the UE to perform CBW change.

The UE is not required to transmit UL signals or receive DL signals during the above defined time duration $\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ on the cell where UE-specific CBW change occurs. When $T_{HARQ} > T_{RRCprocessingDelay}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.13C UE-specific CBW change for satellite access

8.13C.1 Introduction

The requirements in this clause apply for a UE receiving reconfiguration of *offsetToCarrier* or *carrierBandwidth* to change channel bandwidth.

8.13C.2 UE-specific CBW change delay

After the UE receives RRC reconfiguration involving *offsetToCarrier* or *carrierBandwidth* change on the old CBW, UE shall be able to receive PDSCH/PDCCH on an active DL BWP or transmit PUSCH on an active UL BWP of the new CBW right after a time duration of $\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ slots which begins from the beginning of DL slot n, where

- DL slot n is the last slot containing the RRC command, and

- $T_{RRCprocessingDelay}$ is the length of the RRC procedure delay in milliseconds as defined in clause 12 in TS 38.331 [2], and

- $T_{CBWchangeDelayRRC} = 6ms$ is the time used by the UE to perform CBW change.

The UE is not required to transmit UL signals or receive DL signals during the above defined time duration $\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ on the cell where UE-specific CBW change occurs. When $T_{HARQ} > T_{RRCprocessingDelay}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.13D UE-specific CBW change for ATG

8.13D.1 Introduction

The requirements in this clause apply for an ATG UE receiving reconfiguration of *offsetToCarrier* or *carrierBandwidth* to change channel bandwidth.

8.13D.2 UE-specific CBW change delay

The requirements in clause 8.13.2 shall apply only for FR1 UE in NR SA operation mode.

8.13E UE-specific CBW change for RedCap UE with satellite access

8.13E.1 Introduction

The requirements in this clause apply for a RedCap UE with NTN receiving reconfiguration of *offsetToCarrier* or *carrierBandwidth* to change channel bandwidth.

8.13E.2 UE-specific CBW change delay

The requirements in clause 8.13C.2 shall apply.

8.14 Pathloss reference signal switching delay

8.14.1 Introduction

The requirements in this clause apply for pathloss reference signal activated or updated on serving cell in MR-DC or standalone NR in clause 7.1.1 in TS 38.213 [3].

UE shall complete the switch of pathloss reference signal within the delay defined in this clause.

8.14.2 Known conditions for pathloss reference signal

In FR2, the pathloss reference signal is known if the following conditions are met during the period between the last transmission of the RS resource used for L1-RSRP measurement reporting and the completion of pathloss reference signal switch, where the RS resource is the target pathloss reference signal or QCLed (with Type D) to the target pathloss reference signal.

- Pathloss reference signal switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
- The UE has sent at least 1 L1-RSRP report for the target pathloss reference signal before the pathloss reference signal switch command
- The target pathloss reference signal remains detectable during the pathloss reference signal switching period
  - SNR of the target pathloss reference signal≥-3 dB
- The associated SSBs with the target pathloss reference signal remain detectable during the pathloss reference signal switching period
  - SNR of the associated SSB ≥-3 dB

In FR1, the pathloss reference signal is known if the following conditions are met

- The target pathloss reference signal remains detectable during the pathloss reference signal switching period
  - SNR of the target pathloss reference signal≥-3 dB

Otherwise, the pathloss reference signal is unknown.

8.14.3 MAC-CE based pathloss reference signal switch delay

The requirements in this clause apply for a UE to update a pathloss reference signal by MAC-CE for PUCCH, PUSCH, semi-persistent SRS and aperiodic SRS.

If the target pathloss reference signal is known, upon receiving PDSCH carrying MAC-CE activation in slot n, UE shall be able to apply the target pathloss reference signal of the serving cell on which pathloss reference signal switch occurs no later than the slot $n + T_{HARQ} + 3\mathrm{N}_{\mathrm{slot}}^{\mathrm{subframe},\mu} + \mathrm{NM} * \left\lceil \frac{5 * T_{target_PL-RS} + 2\ \mathrm{ms}}{NR\ slot\ length} \right\rceil$. For a UE supporting LB-CA via

switching and the pathloss reference signal of PCell is to be updated, UE shall be able to apply the target pathloss reference signal of the PCell on which pathloss reference signal switch occurs no later than the slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + NM * \left\lceil \frac{5*Kp*T_{target_PL-RS} + 2\ ms}{NR\ slot\ length} \right\rceil$. The UE shall be able to apply old pathloss reference signals until the slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu}$. Where

- T_{HARQ} is the timing between pathloss reference MAC-CE activation command and acknowledgement as specified in TS 38.321 [7].
- NM = 1, if the target PL-RS is not maintained by the UE, 0 otherwise.

In FR2, if the target pathloss reference signal is SSB, the requirements in this clause shall apply when the target pathloss reference signal is maintained by the UE.

- T_{target_PL-RS} is the periodicity of the target pathloss reference signal which would be SSB or NZP CSI-RS.
- PL-RS is maintained provided:
  - There are no more than 4 different RS activated as PL-RS per serving cell among all active spatial relations for PUSCH/PUCCH/SRS transmissions.
  - The target pathloss reference signal remains detectable during TCI state switching period
    - SNR of the target pathloss reference signal≥-3 dB
  - The associated SSBs with the target pathloss reference signal remain detectable during the TCI state switching period.
  - SNR of the associated SSB ≥-3 dB
- K_p is the scaling factor for the pathloss reference signal of PCell to be measured for LB_CA via switching. $K_p = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

  For a window W of duration max(T_{target_PL-RS}, $P_{switch\text{-}pattern}$), where $P_{switch\text{-}pattern}$ is the periodicity of the switching pattern for LB CA via switching configured by RRC signaling, and starting from the beginning of any PL-RS occasion:

  - N_{total} is the total number of target PL-RS occasions within the window W, including those overlapped and non-overlapped with the duration of PCell to be measured based on the switching pattern ,and
  - $N_{available}$ is the number of target PL-RS occasions that are overlapped with the duration of PCell to be measured based on the switching pattern within the window W.

  No requirements apply when $N_{available} = 0$ due to fully non-overlapping between PL-RS occasions and the duration of PCell to be measured based on the switching pattern within the window W.

NOTE: longer application time is expected if measurement sample is not available due to measurement gap, DRX or other UE activities.

NOTE: longer application time is expected if the pathloss reference signal is unknown.

8.14C Pathloss reference signal switching delay for satellite access

8.14C.1 Introduction

The requirements in this clause apply for pathloss reference signal activated or updated on PCell in clause 7.1.1 in TS 38.213 [3] and the UE is configured with only PCell, which is served by satellite access node (SAN).

UE shall complete the switch of pathloss reference signal within the delay defined in this clause.

8.14C.2 Known conditions for pathloss reference signal

The pathloss reference signal is known if the following conditions are met during the period between the last transmission of the RS resource used for L1-RSRP measurement reporting and the completion of pathloss reference signal switch, where the RS resource is the target pathloss reference signal or QCLed (with Type D) to the target pathloss reference signal.

- Pathloss reference signal switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
- The UE has sent at least 1 L1-RSRP report for the target pathloss reference signal before the pathloss reference signal switch command
- The target pathloss reference signal remains detectable during the pathloss reference signal switching period
  - SNR of the target pathloss reference signal≥-3 dB
- The associated SSBs with the target pathloss reference signal remain detectable during the pathloss reference signal switching period
  - SNR of the associated SSB ≥-3 dB

Otherwise, the pathloss reference signal is unknown.

8.14C.3 MAC-CE based pathloss reference signal switch delay

The requirements in this clause apply for a UE to update a pathloss reference signal by MAC-CE for PUCCH, PUSCH, semi-persistent SRS and aperiodic SRS.

If the target pathloss reference signal is known, upon receiving PDSCH carrying MAC-CE activation in slot n, UE shall be able to apply the target pathloss reference signal of the serving cell on which pathloss reference signal switch occurs no later than the slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + NM * \left\lceil \frac{5 * T_{target_PL-RS} + 2\ ms}{NR\ slot\ length} \right\rceil$. The UE shall be able to apply old pathloss reference signals until the slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu}$. Where

- T_{HARQ} is the timing between pathloss reference MAC-CE activation command and acknowledgement as specified in TS 38.321 [7].
- NM = 1, if the target PL-RS is not maintained by the UE, 0 otherwise.
- T_{target_PL-RS} is the periodicity of the target pathloss reference signal which would be SSB or NZP CSI-RS.

NOTE: longer application time is expected if measurement sample is not available due to measurement gap, DRX or other UE activities.

NOTE: longer application time is expected if the pathloss reference signal is unknown.

8.14D Pathloss reference signal switching delay for ATG

8.14D.1 Introduction

The requirements in this clause apply for pathloss reference signal activated or updated on serving cell in clause 7.1.1 in TS 38.213 [3].

ATG UE shall complete the switch of pathloss reference signal within the delay defined in this clause.

8.14D.2 Known conditions for pathloss reference signal

In FR1, the pathloss reference signal is known if the following conditions is met

- The target pathloss reference signal remains detectable during the pathloss reference signal switching period

- SNR of the target pathloss reference signal≥-3 dB

Otherwise, the pathloss reference signal is unknown.

8.14D.3 MAC-CE based pathloss reference signal switch delay

The requirements in clause 8.14.3 shall apply only for FR1.

8.14E Pathloss reference signal switching delay for RedCap UE with satellite access

8.14E.1 Introduction

The requirements in this clause apply for pathloss reference signal activated or updated on PCell in clause 7.1.1 in TS 38.213 [3] and the RedCap UE is configured with only PCell, which is served by satellite access node (SAN).

UE shall complete the switch of pathloss reference signal within the delay defined in this clause.

8.14E.2 Known conditions for pathloss reference signal

The requirements in clause 8.14C.2 shall apply.

8.14E.3 MAC-CE based pathloss reference signal switch delay

The requirements in clause 8.14C.3 shall apply.

8.15 Active downlink TCI state switching delay for unified TCI

8.15.1 Introduction

The requirements in this clause apply for a UE configured with *dl-OrJointTCI-StateList* configurations for DL channels on a serving cell. Further the requirements also apply for all the list of serving cells in *simultaneousU-TCI-UpdateList1, simultaneousU-TCI-UpdateList2, simultaneousU-TCI-UpdateList3, simultaneousU-TCI-UpdateList4* in MR-DC or standalone NR provided all serving cells in the list are configured with the same serving cell and BWP in *unifiedTCI-StateRef-r17*. UE shall complete the switch of active downlink TCI state within the delay defined in this clause.

When the target DL TCI state refers to an additional PCI different from the serving cell PCI in which this DL TCI-State is configured, the requirements in this clause are applicable provided that following conditions are met:

- Active BWP of the serving cell and a cell with the additional PCI are the same
- Center frequency, SCS and SFN offset of a cell with the additional PCI are as the same as serving cell - The cell with the additional PCI is known to the UE.

A cell with the additional PCI is known if the following conditions are met:

- During the last 5 s before L1-RSRP measurement is configured, the UE has sent a valid L3 measurement report for the cell with the additional PCI
- Timing offset between serving cell and the cell with the additional PCI is within CP of the corresponding SCS

Otherwise, the cell with the additional PCI is unknown.

8.15.2 Known conditions for downlink TCI state

The downlink TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target downlink TCI state to the completion of active downlink TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target downlink TCI state or QCLed to the target downlink TCI state
  - Downlink TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
  - The UE has sent at least 1 L1-RSRP report for the target downlink TCI state before the downlink TCI state switch command
  - The target downlink TCI state remains detectable during the downlink TCI state switching period
  - The SSB associated with the downlink TCI state remain detectable during the downlink TCI switching period
    - SNR of the downlink TCI state $\geq$ -3 dB
    - The SSB can be associated with either the serving cell PCI or a PCI different from serving cell PCI.

Otherwise, the downlink TCI state is unknown.

8.15.3 MAC-CE based downlink TCI state switch delay

The requirements in this clause shall apply for DL TCI state switch using separate DL TCI state or joint TCI state of unified TCI state switch framework.

In case that source RS in DL TCI state or joint TCI state is associated with a PCI different from that of the serving cell, the requirements in this clause shall apply if the cell with different PCI satisfies the known cell condition defined in clause 8.15.1. If the known cell condition is not met, longer delay may be expected.

In case of joint TCI state switch, if the target PL-RS is not maintained, UE is not expected to receive on DL based on the target TCI state before UE completes the DL and UL TCI state switch.

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. The UE shall be able to receive UE-dedicated PDCCH/PDSCH with the old TCI state until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$ where T_{HARQ} (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];

- $T_{first\text{-}SSB}$ is
  - if the UE supports LB-CA via switching, time to first available SSB reception based on *LBCA-SwitchingPattern* after MAC CE command is decoded by the UE
  - otherwise, time to first SSB transmission after MAC CE command is decoded by the UE;
  - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state
- $T_{SSB\text{-}proc}$ = 2 ms;
- TO_k = 1 if target TCI state is not in the active TCI state list for PDSCH/PDCCH, 0 otherwise.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} +$3N_{slot}^{subframe,\mu}$ + ($T_{L1\text{-}RSRP}$ +TO_{uk}*($T_{first\text{-}SSB}$+ $T_{SSB\text{-}proc}$)) / *NR slot length*. The UE shall be able to receive UE-dedicated PDCCH/PDSCH with the old TCI state until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$.

Where

- $T_{L1\text{-}RSRP}$ = 0 in FR1 or when the TCI state switching not involving QCL-TypeD in FR2. Otherwise,
- $T_{L1\text{-}RSRP}$ is the time for Rx beam refinement in FR2, defined as
- $T_{L1\text{-}RSPR_Measurement_Period_SSB}$ for SSB as specified in clause 9.5.4.1,

  - with the assumption of M=1
  - with T_{Report} = 0
- $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ for CSI-RS as specified in clause 9.5.4.2
  - CSI-RS based L1-RSRP measurement only apply for TCI state switch when source RS is associated with serving cell
  - configured with higher layer parameter *repetition* set to ON
  - with the assumption of M=1 for periodic CSI-RS
  - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*
  - with T_{Report} = 0
- TO_{uk} = 1 for CSI-RS based L1-RSRP measurement, and 0 for SSB based L1-RSRP measurement when TCI state switching involves QCL-TypeD
- TO_{uk} = 1 when TCI state switching involves other QCL types only
- $T_{first\text{-}SSB}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;
- $T_{first\text{-}SSB}$ is
  - if the UE supports LB-CA via switching, time to first available SSB reception based on *LBCA-SwitchingPattern* after MAC CE command is decoded by the UE for other QCL types
  - otherwise, time to first SSB transmission after MAC CE command is decoded by the UE for other QCL types;
- The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

8.15.4 DCI based downlink TCI state switch delay

When a UE is configured with the higher layer parameter with *dl-OrJointTCI-StateList* or *TCI-UL-State*, activated with TCI states for downlink transmission by MAC CE indication of more than one codepoints, and receives DCI format 1_1/1_2 with or without DL assignment providing indicated TCI-State or TCI state pair in the active TCI list for a CC, the UE transmits a PUCCH with HARQ-ACK information corresponding to the DCI carrying the TCI-State indication.

If the target TCI state is known, the downlink TCI switching to the indicated DL TCI state or joint TCI state in the DCI format shall be completed starting from the first slot that is at least *beamAppTime-r17* symbols after the last symbol of the PUCCH carrying HARQ-ACK in response to the DCI triggering TCI state activation. The first slot and the *beamAppTime-r17* symbols are both determined on the carrier with the smallest SCS among the carrier(s) applying the beam indication. The value of *beamAppTime-r17* is defined in TS 38.331 [2]. The known condition for TCI state defined in clause 8.15.2 is applied.

8.15.5 Active Downlink TCI state list update delay

The requirements specified in this clause are applicable if

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', and a MAC CE activates more than one target separate TCIs, and at least one DL TCI is included, or
- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', and a MAC CE activates more than one target joint TCI.

If all the target TCI states in the active TCI state list are known, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + TO_k*(T_{first\text{-}SSB_List} + T_{SSB\text{-}proc}) \text{ / } \textit{NR slot length}.$$

If a subset of the target TCI states in the active TCI state list are unknown, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{L1\text{-}RSRP_list} + TO_{uk} * (T_{first\text{-}SSB_List} + T_{SSB\text{-}proc})) / \textit{NR slot length}.$$

If all target TCI states in the active TCI state list are unknown, the requirements specified in this clause are not applicable.

Where

- $T_{L1\text{-}RSRP_List}$ is the longest L1 measurement time ($T_{L1\text{-}RSRP}$) of the source RS among the unknown target TCI states, where $T_{L1\text{-}RSRP}$ is specified in clause 8.15.3
- If the number of cells associated with the target TCI states in the active TCI list is 2, and time to first SSBs associated to the TCIs are overlapped in FR2,
- $T_{first\text{-}SSB_List} = T_{first\text{-}SSB_SC} + \min(T_{SSB_SC}, T_{SSB_CDP})$.
- If the number of cells associated with the target TCI states in the active TCI list is 2, and time to first SSBs associated to the TCIs are not overlapped in FR1 or FR2,
- $T_{first\text{-}SSB_List} = \max(T_{first\text{-}SSB_SC}, T_{first\text{-}SSB_CDP})$
- Otherwise,
- $T_{first\text{-}SSB_List} = T_{first\text{-}SSB_SC}$.
- T_{SSB_SC} is the SSB periodicity of serving cell.
- T_{SSB_CDP} is the SSB periodicity of cell with different PCI from serving cell.
- $T_{first\text{-}SSB_SC}$ is the $T_{first\text{-}SSB}$ from serving cell
- $T_{first\text{-}SSB_CDP}$ is the $T_{first\text{-}SSB}$ from cell with different PCI from serving cell.
- T_{HARQ}, $T_{first\text{-}SSB}$, $T_{SSB\text{-}proc}$, TO_k, TO_{uk} are defined in clause 8.15.3. T_{SSB} is the SSB periodicity.

When UE receives PDSCH carrying MAC-CE for active TCI state list update, and

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', or
- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', while the target TCI list comprises at least one DL TCIs and at least one UL TCIs,

UE is not expected to receive on DL based on the target TCI state before UE completes the DL and UL TCI state list update.

8.15D Active downlink TCI state switching delay for unified TCI for ATG

8.15D.1 Introduction

The requirements in this clause apply for an ATG UE configured with *dl-OrJointTCI-StateList* configurations for DL channels on PCell. UE shall complete the switch of active downlink TCI state within the delay defined in this clause.

8.15D.2 Void

8.15D.3 MAC-CE based downlink TCI state switch delay

The requirements in this clause shall apply for DL TCI state switch using separate DL TCI state or joint TCI state of unified TCI state switch framework.

In case of joint TCI state switch, if the target PL-RS is not maintained, UE is not expected to receive on DL based on the target TCI state before UE completes the DL and UL TCI state switch.

Upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) / *NR slot length*. The UE shall be able to receive UE-dedicated PDCCH/PDSCH with the old TCI state until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$ where T_{HARQ} (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];

- $T_{first\text{-}SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state
- $T_{SSB\text{-}proc}$ = 2 ms;
- TO_k = 1 if target TCI state is not in the active TCI state list for PDSCH/PDCCH, 0 otherwise.

8.15D.4 DCI based downlink TCI state switch delay

When a UE is configured with the higher layer parameter with *dl-OrJointTCI-StateList* or *TCI-UL-State*, activated with TCI states for downlink transmission by MAC CE indication of more than one codepoints, and receives DCI format 1_1/1_2 with or without DL assignment providing indicated TCI-State or TCI state pair in the active TCI list for a CC, the UE transmits a PUCCH with HARQ-ACK information corresponding to the DCI carrying the TCI-State indication.

The downlink TCI switching to the indicated DL TCI state or joint TCI state in the DCI format shall be completed starting from the first slot that is at least *beamAppTime-r17* symbols after the last symbol of the PUCCH carrying HARQ-ACK in response to the DCI triggering TCI state activation. The first slot and the *beamAppTime-r17* symbols are both determined on PCell. The value of *beamAppTime-r17* is defined in TS 38.331 [2]. The known condition for TCI state defined in clause 8.15D.3 is applied.

8.15D.5 Active Downlink TCI state list update delay

The requirements specified in this clause are applicable if

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', and a MAC CE activates more than one target separate TCIs, and at least one DL TCI is included, or
- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', and a MAC CE activates more than one target joint TCI.

Upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot n} + T_{HARQ} + 3N_{slot}^{subframe,\mu} + TO_k*(T_{first\text{-}SSB} + T_{SSB\text{-}proc}) / \textit{NR slot length}.$$

Where T_{HARQ}, $T_{first\text{-}SSB}$, $T_{SSB\text{-}proc}$, TO_k are defined in clause 8.15D.3.

UE is not expected to receive on DL based on the target TCI state before UE completes the DL and UL TCI state list update.

8.16 Active uplink TCI state switching delay for unified TCI

8.16.1 Introduction

The requirements in this clause apply for a UE configured with *dl-OrJointTCI-StateList* (if unifiedTCI-StateType is indicated as *Joint*) or *TCI-UL-State* configurations for UL channels/signals on a serving cell. Further the requirements also apply for all the list of serving cells in *simultaneousU-TCI-UpdateList1*, *simultaneousU-TCI-UpdateList2*, *simultaneousU-TCI-UpdateList3*, *simultaneousU-TCI-UpdateList4* in MR-DC or standalone NR provided all serving cells in the list are configured with the same serving cell and BWP in *unifiedTCI-StateRef-r17*. There is no requirement when the UE is requested to switch to a TCI state with the higher layer parameter *TCI-UL-State* associated to SRS. UE

shall complete the switch of active uplink TCI state within the delay defined in this clause when the UE is requested to switch to a TCI state with the higher layer parameter *dl-OrJointTCI-StateList* or *TCI-UL-State* associated to a DL RS.

PL-RS may be associated with or included in UL TCI state or joint TCI state. The requirements in this clause shall apply if either of the following conditions are met:

- PL-RS is identical to source RS in UL TCI state or joint TCI state
- PL-RS and source RS in UL TCI state or joint TCI state are QCL-Type D

When the target UL TCI state refers to an additional PCI different from serving cell PCI in which this UL TCI state is configured, the requirements in this clause are applicable provided that the following conditions are met:

- Active BWP of the serving cell and a cell with the additional PCI are the same
- Center frequency, SCS and SFN offset of a cell with the additional PCI are as the same as serving cell
- The cell with the additional PCI is known to the UE.

A cell with the additional PCI is known if the following conditions are met:

- During the last 5 s before L1-RSRP measurement is configured, the UE has sent a valid L3 measurement report for the cell with the additional PCI
- Timing offset between serving cell and the cell with the additional PCI is within CP of the corresponding SCS
- The SSB from the cell with the additional PCI remains detectable according to the cell identification requirements specified in clause 9.2

Otherwise, the cell with the additional PCI is unknown.

8.16.2 Known conditions for uplink TCI state

The uplink TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target uplink TCI state to the completion of active uplink TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target uplink TCI state or QCLed to the target uplink TCI state
  - Uplink TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
  - The UE has sent at least 1 L1-RSRP report for the target uplink TCI state before the uplink TCI state switch command
  - The RS configured in target uplink TCI state remains detectable during the uplink TCI state switching period
    - SNR of the RS configured in target uplink TCI state $\geq$ -3 dB
  - The target uplink TCI state remains detectable during the uplink TCI state switching period
  - The SSB associated with the uplink TCI state remain detectable during the uplink TCI switching period
    - SNR of the uplink TCI state $\geq$ -3 dB
    - The SSB can be associated with either the serving cell PCI or a PCI different from serving cell PCI.

Otherwise, the uplink TCI state is unknown.

8.16.3 MAC-CE based uplink TCI state switch delay

The requirements in this clause shall apply for UL TCI state switch using separate UL TCI state or joint TCI state of unified TCI state switch framework.

In case that source RS in UL TCI state or joint TCI state is associated with a PCI different from that of the serving cell, the requirements in this clause shall apply if the cell with different PCI satisfies the known cell condition defined in clause 8.16.1. If the known cell condition is not met, longer delay may be expected.

In case of joint TCI state switch, UE is not expected to transmit on UL based on the target TCI state before UE completes the DL and UL TCI state switch.

For separate UL TCI state switch or joint TCI state switch for PUCCH or PUSCH, or semi-persistent/aperiodic/periodic SRS, when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1, upon receiving PDSCH carrying MAC-CE activation command in slot n on serving cell,

- If target TCI state is known,
- The UE shall be able to transmit uplink signal with the target TCI state in the slot $n+T_{HARQ} + 3N_{slot}^{subframe,\mu} + NM* (T_{first_target\text{-}PL\text{-}RS} + K_p*4*T_{target_PL\text{-}RS} + 2$ ms) / *NR slot length*.
- If target TCI state is unknown,
  - The UE shall be able to transmit uplink signal with the target TCI state in the slot $n+T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{L1\text{-}RSRP} + T_{first_target\text{-}PL\text{-}RS} + 4*T_{target_PL\text{-}RS} + 2$ ms) / *NR slot length*.
  - The UE shall be able to transmit with the old UL TCI state until slot $n+ T_{HARQ} + 3N_{slot}^{subframe,\mu}$.

Where,

- T_{HARQ} (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].
- NM = 1, if the target PL-RS is not maintained by the UE, 0 otherwise.

In FR2, in case that the target PL-RS associated with or included in the target UL or joint TCI state is SSB, the requirements in this clause shall apply when this target PL-RS is maintained by the UE.

- PL-RS is maintained provided:
  - the target PL-RS is associated with or included in the UL or joint TCI states in the active TCI list for PUSCH/PUCCH/SRS transmissions
  - There are no more than 4 different RS activated as PL-RS per serving cell among all active UL TCI states (UL or joint TCI state) for PUSCH/PUCCH/SRS transmissions
  - The target pathloss reference signal remains detectable during TCI state switching period
  - SNR of the target pathloss reference signal≥-3 dB
  - The associated SSBs with the target pathloss reference signal remain detectable during the TCI state switching period.
    - SNR of the associated SSB ≥-3 dB
- $T_{first_target\text{-}PL\text{-}RS}$:
  - When the target TCI state is unknown:
    - When the UE is configured with *LowBandCA-Switching-r19*, $T_{first_target\text{-}PL\text{-}RS}$ is time to first pathloss RS transmission overlapping with PCell active period according to *switchingPattern-r19* after L1-RSRP measurement.
    - Otherwise, $T_{first_target\text{-}PL\text{-}RS}$ is time to first pathloss RS transmission after L1-RSRP measurement.
  - When the target TCI state is known:
    - When the UE is configured with *LowBandCA-Switching-r19*, $T_{first_target\text{-}PL\text{-}RS}$ is time to first pathloss RS transmission overlapping with PCell active period according to *switchingPattern-r19* after MAC CE command is decoded by the UE.

- Otherwise, $T_{first_target\text{-}PL\text{-}RS}$ is time to first pathloss RS transmission after MAC CE command is decoded by the UE.

- $T_{target_PL\text{-}RS}$ is the periodicity of the target pathloss reference signal which would be SSB or NZP CSI-RS when PL-RS is associated with serving cell

- $T_{target_PL\text{-}RS}$ is the periodicity of the target pathloss reference signal which would be SSB when PL-RS is associated with PCI different from serving cell

- $T_{L1\text{-}RSRP}$ is the time for Rx beam refinement in FR2, defined as

  - $T_{L1\text{-}RSPR_Measurement_Period_SSB}$ for SSB as specified in clause 9.5.4.1 or 9.13.4.1,

    - with the assumption of M=1

    - with $T_{Report} = 0$

  - $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ for CSI-RS as specified in clause 9.5.4.2

    - CSI-RS based L1-RSRP measurement only apply for TCI state switch when source RS is associated with serving cell

    - configured with higher layer parameter *repetition* set to ON

    - with the assumption of M=1 for periodic CSI-RS

    - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*

    - with $T_{Report} = 0$

- K_p:

  - When the UE is configured with *LowBandCA-Switching-r19*, K_p is the scaling factor for the pathloss reference signal of PCell. $K_p = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

    - For a window W of duration max(T_{target_PL-RS}, $P_{switch\text{-}pattern}$), where $P_{switch\text{-}pattern}$ is the periodicity of the *switchingPattern-r19* configured by RRC signaling, and starting from the beginning of any PL-RS occasion:

      - N_{total} is the total number of target PL-RS occasions within the window W, including those overlapped and non-overlapped with the duration of PCell to be measured based on *switchingPattern-r19*, and

      - $N_{available}$ is the number of target PL-RS occasions that are overlapped with the duration of PCell to be measured based on the *switchingPattern-r19* within the window W.

    - No requirements apply when $N_{available} = 0$ due to fully non-overlapping between PL-RS occasions and the duration of PCell to be measured based on *switchingPattern-r19* within the window W.

  - Otherwise, $K_p = 1$.

The requirements specified in this clause are applicable if no more than 4 different RSs are activated as PL-RS per serving cell among all active UL (or joint) TCI states.

8.16.4 DCI based uplink TCI state switch delay

When a UE is configured with the higher layer parameter with *dl-OrJointTCI-StateList* or *TCI-UL-State*, activated with TCI states for uplink transmission by MAC CE indication of more than one codepoints, and receives DCI format 1_1/1_2 with or without DL assignment providing indicated TCI-State or TCI state pair in the active TCI list for a CC, the UE transmits a PUCCH with HARQ-ACK information corresponding to the DCI carrying the TCI-State indication.

The requirements in this clause are applicable only if the DCI format indicating UL TCI state or joint TCI state switch is received by UE when

- target TCI state is known, and

- target TCI state is in active TCI state list, and

- target PL-RS is maintained as defined in clause 8.16.3

If the target TCI state is known, the uplink TCI switching to the indicated UL TCI state or joint TCI state in the DCI format shall be completed starting from the first slot that is at least *beamAppTime-r17* symbols after the last symbol of the PUCCH carrying HARQ-ACK in response to the DCI triggering TCI state activation. The first slot and the *beamAppTime-r17* symbols are both determined on the carrier with the smallest SCS among the carrier(s) applying the beam indication. The value of *beamAppTime-r17* is defined in TS 38.331 [2]. The known condition for TCI state defined in clause 8.16.2 is applied.

If a PL-RS is associated with or included in UL TCI state or joint TCI state, the UL TCI switching and PL-RS switching shall be completed at the same time.

8.16.5 Active Uplink TCI state list update delay

The requirements specified in this clause are applicable if

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', and a MAC CE activates more than one target separate TCIs, and at least one UL TCI is included, or

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', and a MAC CE activates more than one target joint TCI.

If all the target TCI states in the active TCI state list are known, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + NM * (T_{first_target\text{-}PL\text{-}RS_List} + 4 * T_{target_PL\text{-}RS_List} + 2ms) / \textit{NR slot length}.$$

If a subset of target TCI states in the active TCI state list are unknown, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n+T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{L1\text{-}RSRP_List} + T_{first_target\text{-}PL\text{-}RS_List} + 4*T_{target_PL\text{-}RS_List} + 2ms) / \textit{NR slot length.}$$

If all target TCI states in the active TCI state list are unknown, the requirements specified in this clause are not applicable.

Where

- If all TCIs are known,

- if the target PL-RS associated with or included in any UL TCI is not maintained, NM = 1; Where maintained PL-RS is defined in clause 8.16.3

- if a subset of target TCI states in the active TCI state list are unknown,

- $T_{L1\text{-}RSRP_List}$ = is the longest L1 measurement time ($T_{L1\text{-}RSRP}$) of the source RS among the unknown target TCI states , where $T_{L1\text{-}RSRP}$ is specified in clause 8.16.3

- if the number of cells associated with the target TCI states in the active TCI list is 2, and time to first PL-RS associated to the TCIs are overlapped in FR2,

- $T_{first_target\text{-}PL\text{-}RS_List} = T_{first_target\text{-}PL\text{-}RS_SC} + \min(T_{target\text{-}PL\text{-}RS_SC}, T_{target\text{-}PL\text{-}RS_CDP})$;

- $T_{target\text{-}PL\text{-}RS_List} = 2 * T_{target\text{-}PL\text{-}RS_SC}$, if $T_{target\text{-}PL\text{-}RS_SC} = T_{target\text{-}PL\text{-}RS_CDP}$

- $T_{target\text{-}PL\text{-}RS_List} = \max(T_{target\text{-}PL\text{-}RS_SC}, T_{target\text{-}PL\text{-}RS_CDP})$, if $T_{target\text{-}PL\text{-}RS_SC} \neq T_{target\text{-}PL\text{-}RS_CDP}$

- if the number of cells associated with the target TCI states in the active TCI list is 2, and time to first PL-RS associated to the TCIs are not overlapped in FR2,

  - $T_{first_target\text{-}PL\text{-}RS_List} = \max (T_{first_target\text{-}PL\text{-}RS_SC,} T_{first_target\text{-}PL\text{-}RS_SC})$;

  - $T_{target\text{-}PL\text{-}RS_List} = \max(T_{target\text{-}PL\text{-}RS_SC}, T_{target\text{-}PL\text{-}RS_CDP})$

- Otherwise,

  - $T_{first_target\text{-}PL\text{-}RS_List} = T_{first_target\text{-}PL\text{-}RS_SC}$

- $T_{target\text{-}PL\text{-}RS_List} = T_{target\text{-}PL\text{-}RS_SC}$.
- $T_{first_target\text{-}PL\text{-}RS_SC}$ is $T_{first_target\text{-}PL\text{-}RS}$ for serving cell
- $T_{first_target\text{-}PL\text{-}RS_CDP}$ is $T_{first_target\text{-}PL\text{-}RS}$ for cell with different PCI from serving cell
- $T_{target\text{-}PL\text{-}RS_SC}$ is $T_{target\text{-}PL\text{-}RS}$ for serving cell

- $T_{target\text{-}PL\text{-}RS_CDP}$ is $T_{target\text{-}PL\text{-}RS}$ for cell with different PCI from serving cell- T_{HARQ}, $T_{first_target\text{-}PL\text{-}RS}$, $T_{target\text{-}PL\text{-}RS}$ are defined in clause 8.16.3.

The requirements specified in this clause do not apply if more than 4 different RSs are activated as PL-RS per serving cell among all active UL (or joint) TCI states.

When UE receives PDSCH carrying MAC-CE for active TCI state list update, and

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', or
- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', while the target TCI list comprises at least one DL TCIs and at least one UL TCIs,

UE is not expected to transmit on UL based on the target TCI before UE completes the DL and UL TCI list update.

The requirements in this clause are applicable when the source RS of the active UL TCI state is a DL-RS and this DL-RS is included as one of the source RSs in the DL active TCI list.

8.16D Active uplink TCI state switching delay for unified TCI for ATG

8.16D.1 Introduction

The requirements in this clause apply for an ATG UE configured with *dl-OrJointTCI-StateList* (if unifiedTCI-StateType is indicated as *Joint*) or *TCI-UL-State* configurations for UL channels/signals on PCell. There is no requirement when the UE is requested to switch to a TCI state with the higher layer parameter *TCI-UL-State* associated to SRS. The UE shall complete the switch of active uplink TCI state within the delay defined in this clause when the UE is requested to switch to a TCI state with the higher layer parameter *dl-OrJointTCI-StateList* or *TCI-UL-State* associated to a DL RS.

PL-RS may be associated with or included in UL TCI state or joint TCI state. The requirements in this clause shall apply if either of the following conditions are met:

- PL-RS is identical to source RS in UL TCI state or joint TCI state
- PL-RS and source RS in UL TCI state or joint TCI state are QCL-Type D

8.16D.2 Void

8.16D.3 MAC-CE based uplink TCI state switch delay

The requirements in this clause shall apply for UL TCI state switch using separate UL TCI state or joint TCI state of unified TCI state switch framework.

In case of joint TCI state switch, UE is not expected to transmit on UL based on the target TCI state before UE completes the DL and UL TCI state switch.

For separate UL TCI state switch or joint TCI state switch for PUCCH or PUSCH, or semi-persistent/aperiodic/periodic SRS, when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1, upon receiving PDSCH carrying MAC-CE activation command in slot n on serving cell,

- The UE shall be able to transmit uplink signal with the target TCI state in the slot $n+T_{HARQ} + 3N_{slot}^{subframe,\mu} + NM^* (T_{first_target\text{-}PL\text{-}RS} + 4^*T_{target_PL\text{-}RS} + 2$ ms) / *NR slot length*.

Where,

- T_{HARQ} (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].
- NM = 1, if the target PL-RS is not maintained by the UE, 0 otherwise.
- PL-RS is maintained provided:
  - the target PL-RS is associated with or included in the UL or joint TCI states in the active TCI list for PUSCH/PUCCH/SRS transmissions
  - There are no more than 4 different RS activated as PL-RS per serving cell among all active UL TCI states (UL or joint TCI state) for PUSCH/PUCCH/SRS transmissions
  - The target pathloss reference signal remains detectable during TCI state switching period
  - SNR of the target pathloss reference signal≥-3 dB
  - The associated SSBs with the target pathloss reference signal remain detectable during the TCI state switching period.
    - SNR of the associated SSB ≥-3 dB
- $T_{first_target\text{-}PL\text{-}RS}$ is time to first pathloss RS transmission after MAC CE command is decoded by the UE for known TCI State.
- $T_{target_PL\text{-}RS}$ is the periodicity of the target pathloss reference signal which would be SSB or NZP CSI-RS

The requirements specified in this clause are applicable if no more than 4 different RSs are activated as PL-RS per serving cell among all active UL (or joint) TCI states.

8.16D.4 DCI based uplink TCI state switch delay

When a UE is configured with the higher layer parameter with *dl-OrJointTCI-StateLis*tor *TCI-UL-State*, activated with TCI states for uplink transmission by MAC CE indication of more than one codepoints, and receives DCI format 1_1/1_2 with or without DL assignment providing indicated TCI-State or TCI state pair in the active TCI list for PCell, the UE transmits a PUCCH with HARQ-ACK information corresponding to the DCI carrying the TCI-State indication.

The requirements in this clause are applicable only if the DCI format indicating UL TCI state or joint TCI state switch is received by UE when

- target TCI state is in active TCI state list, and
- target PL-RS is maintained as defined in clause 8.16D.3

The uplink TCI switching to the indicated UL TCI state or joint TCI state in the DCI format shall be completed starting from the first slot that is at least *beamAppTime-r17* symbols after the last symbol of the PUCCH carrying HARQ-ACK in response to the DCI triggering TCI state activation. The value of *beamAppTime-r17*is defined in TS 38.331 [2].

If a PL-RS is associated with or included in UL TCI state or joint TCI state, the UL TCI switching and PL-RS switching shall be completed at the same time.

8.16D.5 Active Uplink TCI state list update delay

The requirements specified in this clause are applicable if

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', and a MAC CE activates more than one target separate TCIs, and at least one UL TCI is included, or
- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', and a MAC CE activates more than one target joint TCI.

Upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

slot n + T_{HARQ} + $3N_{slot}^{subframe,\mu}$ + NM * ($T_{first_target\text{-}PL\text{-}RS}$ + 4 * $T_{target_PL\text{-}RS}$ + 2 ms) / *NR slot length*,

Where T_{HARQ}, $T_{first_target\text{-}PL\text{-}RS}$, $T_{target\text{-}PL\text{-}RS}$ are defined in clause 8.16D.3.

The requirements specified in this clause do not apply if more than 4 different RSs are activated as PL-RS per serving cell among all active UL (or joint) TCI states.

When UE receives PDSCH carrying MAC-CE for active TCI state list update, and

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', or
- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', while the target TCI list comprises at least one DL TCIs and at least one UL TCIs,

UE is not expected to transmit on UL based on the target TCI before UE completes the DL and UL TCI list update.

The requirements in this clause are applicable when the source RS of the active UL TCI state is a DL-RS and this DL-RS is included as one of the source RSs in the DL active TCI list.

8.17 SCG Activation and Deactivation Delay

8.17.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to activate one SCG and deactivate on SCG.

The requirements shall apply for NR-DC with an NR PCell, PSCell or SCell.

8.17.2 SCG Activation Delay Requirement

The requirements in this clause shall apply for the UE configured with one deactivated SCG in NR-DC and when PSCell in one SCG is being activated.

The delay within which the UE shall be able to activate the deactivated SCG depends upon the specified conditions.

Upon receiving SCG activation command in slot *n*, the UE shall be capable to transmit PRACH preamble or PUCCH or PUSCH towards PSCell no later than in slot n + $\frac{T_{activation_time}}{NR\ slot\ length}$,

where:

- $T_{activation_time}$ = T_{RRC_delay} + $T_{processing}$ + T_{search} + T_{Δ} + T_{IU} + 2 ms
- T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].
- $T_{processing}$ is the SW processing time needed by UE, including RF warm up period. When PSCell is activated from deactivated state, if any PSCell parameter is modified, $T_{processing}$ = 20ms. Otherwise, $T_{processing}$ = 5 ms.
- T_{search} is the time for AGC settling and PSS/SSS detection.
- For RACH based PSCell activation, if the FR1 or FR2 PSCell is known, T_{search} = 0 ms. If the FR2 PSCell is unknown and Es/Iot ≥ -2 dB, then T_{search} = 24* T_{rs} ms. If the target cell is an unknown FR1 PSCell and Es/Iot ≥ -2 dB, then T_{search} =3* T_{rs} ms.
- For RACH-less based PSCell activation, if *bfd-and-RLM* is configured and TCI state is known, T_{search} = 0 ms. There are no requirements if TCI state is unknown.
- T_{Δ} is time for fine time tracking and acquiring full timing information of the target PSCell. T_{Δ} = 3*Trs ms for PSCell operating with 12 PRB SSB BW. Otherwise, T_{Δ} = 1*Trs ms.
- T_{IU}: When RACH based PSCell activation is configured, it is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. T_{IU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in table 8.1-1 of TS 38.213 [3].

- When RACH-less based PSCell activation is configured, it is the uncertainty in acquiring the first PUSCH transmission occasion [or SR on PUCCH].

- Trs is the SMTC periodicity of the PSCell if the UE has been provided with an SMTC configuration for the target cell in SCG activation command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5.

In FR1 and FR2, the PSCell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the SCG activation command:

  - the UE has sent a valid measurement report for the PSCell being activated and

  - One of the SSBs measured from the PSCell being activated remains detectable according to the cell identification conditions specified in clause 9.2.

- One of the SSBs measured from PSCell being activated also remains detectable during the PSCell activation delay $T_{activation_time}$ according to the cell identification conditions specified in clause 9.2.

Otherwise it is unknown.

If the UE is configured to perform *bfd-and-RLM* while the SCG is deactivated:

- The TCI state is known if all the following conditions are met:

  - During the period from receiving the tci-ActivatedConfig in the SCG configuration to the first transmission towards PSCell on PUCCH or PUSCH, or

  - During the perioc from reception of the RRC-based SCG deactivation command deactivating the PSCell to the first transmission towards PSCell on PUCCH or PUSCH:

    - UE has not detected beam failure

    - The side condition $\hat{E}s/Iot \geq -3$ dB is fulfilled for the RSs configured for *bfd-and-RLM* for the PSCell being activated

    - The SSB associated with the TCI state remains detectable according to the cell identification conditions specified in clause 9.2.

- Otherwise, the TCI state is unknown.

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.17.3 SCG Deactivation Delay Requirement

The requirements in this clause shall apply for a UE which is configured with at least PCell and PSCell.

Upon receiving RRC-based SCG deactivation command in subframe *n*, the UE shall accomplish the deactivation actions specified in TS 38.331 [2] no later than in slot $n + \frac{T_{RRC_delay}}{NR\ slot\ length}$, where:

- T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.18 TRP specific Link Recovery Procedures

8.18.1 Introduction

The UE shall assess the downlink radio link quality of a serving cell based on the reference signal provided in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ as specified in TS 38.213 [3] in order to detect beam failure on:

- PCell in SA, NR-DC, or NE-DC operation mode,
- PSCell in NR-DC and EN-DC operation mode,
- SCell in SA, NR-DC, NE-DC or EN-DC operation mode.

The RS resource configurations in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ on PCell or PSCell can be periodic CSI-RS resources and/or SSBs. RS resource configuration in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ on SCell shall be periodic CSI-RS. UE is not required to perform beam failure detection outside the active DL BWP. UE is not required to meet the requirements in clause 8.18.2 and 8.18.3 if UE does not have configured sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$. UE is not required to perform beam failure detection on a deactivated SCell, and also not required to perform beam failure detection on resources which is implicitly configured for a deactivated SCell. UE is not required to perform beam failure detection on a SCell on which $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ is not configured.

If *additionalPCIList* is configured for the serving cell, the SSBs in sets $\bar{q}_{0,1}$ and $\bar{q}_{1,1}$ can be associated to the same additional PCI other than serving cell PCI.

On each RS resource configuration in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$, the UE shall estimate the radio link quality and compare it to the threshold Q_{out_LR} for the purpose of accessing downlink radio link quality of the serving cell.

The threshold Q_{out_LR} is defined as the level at which the downlink radio level link of a given resource configuration on two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ cannot be reliably received and shall correspond to the $BLER_{out}$ = 10 % block error rate of a hypothetical PDCCH transmission. For SSB based beam failure detection, $Q_{out_LR_SSB}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.518.2.1-1. For CSI-RS based beam failure detection, $Q_{out_LR_CSI\text{-}RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in table 8.181.3.1-1.

Upon request the UE shall deliver configuration indexes from the two sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$as specified in TS 38.213 [3] , to higher layers, and the corresponding L1-RSRP measurement provided that the measured L1-RSRP is equal to or better than the threshold Q_{in_LR}, which is indicated by higher layer parameter *rsrp-ThresholdSSB*. The UE applies the Q_{in_LR} threshold to the L1-RSRP measurement obtained from an SSB. The UE applies the Q_{in_LR} threshold to the L1-RSRP measurement obtained for a CSI-RS resource after scaling a respective CSI-RS reception power with a value provided by higher layer parameter *powerControlOffsetSS*. The RS resource configurations in the two sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ can be periodic CSI-RS resources or SSBs or both SSB and CSI-RS resources. UE is not required to perform candidate beam detection outside the active DL BWP. UE is not required to perform candidate beam detection on a SCell on which $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ is not configured.

8.18.2 Requirements for TRP specific SSB based beam failure detection

8.18.2.1 Introduction

The requirements in this clause apply for each SSB resource in the set two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.18.2.2. The SSB(s) in set $\bar{q}_{0,1}$ can be associated with an additionalPCI other than serving cell PCI.

Table 8.18.2.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0 dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	Same as the SCS of RMSI CORESET
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.18.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ estimated over the last $T_{Evaluate_BFD_SSB}$ period becomes worse than the threshold $Q_{out_LR_SSB}$ within $T_{Evaluate_BFD_SSB}$ period.

The value of $T_{Evaluate_BFD_SSB}$ is defined in table 8.18.2.2-1 for FR1.

The value of $T_{Evaluate_BFD_SSB}$ is defined in table 8.18.2.2-2 for FR2 with scaling factor N, where

- N = 2, 4, or 6 in FR2-1 for UE supporting *fastBeamSweepingMultiRx-r18*, according to the conditions described in clause 3.6.19, and
- N=8 for other cases in FR2.

For UE supporting *musim-GapPreference-r17* and is configured with one or more per-UE periodic MUSIM gaps,

- P value for an BFD SSB resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0
- For a window W of duration max($T_{SSB,}$ SMTC period, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE periodic MUSIM gaps, per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any configured BFD SSB resource occasion:
  - N_{total} is the total number of configured BFD SSB resource occasions within the window, including those overlapped with MUSIM gap occasions or SMTC occasions within the window
  - $N_{outside_MG}$ is the number of configured BFD SSB resource occasions that are not overlapped with any MUSIM gap occasions within the window W,
  - $N_{available}$ is the number of configured BFD SSB resource occasions that are not overlapped with any non-dropped MUSIM gap occasions nor any SMTC occasion within the window W, and
  - T_{SSB} is periodicity of the target SSB resource for BFD.

    When the configured aperiodic MUSIM gap is overlapping with configured BFD SSB resource occasions, longer evaluation period would be expected.

    Requirements in this clause do not apply when $N_{outside\ MG}$ = 0 due to fully overlapping between target SSB resources for BFD and MUSIM gap occasions within the window W.

Otherwise, when UE is not configured with periodic MUSIM gap(s) or not supporting MUSIM gap capability,

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB.
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- $P = P_{sharing\ factor}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq MGRP$ or
  - $T_{SMTCperiod} = MGRP$ and $T_{SSB} < 0.5*T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod} = MGRP$ and $T_{SSB} = 0.5*T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap (T_{SSB} <MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} < MGRP$)

where,

- $P_{sharing\ factor} = 1$, if the BFD-RS resource outside measurement gap is
  - not overlapped with the SSB symbols indicated by SSB-ToMeasure and 1 data symbol before each consecutive SSB symbols indicated by SSB-ToMeasure and 1 data symbol after each consecutive SSB symbols indicated by SSB-ToMeasure, given that SSB-ToMeasure is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;
  - not overlapped with the RSSI symbols indicated by ss-RSSI-Measurement and 1 data symbol before each RSSI symbol indicated by ss-RSSI-Measurement and 1 data symbol after each RSSI symbol indicated by ss-RSSI-Measurement, given that ss-RSSI-Measurement is configured.
  - $P_{sharing\ factor} = 3$, otherwise.
  - If the higher layer in TS 38.331 [2] signalling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, given the SMTC offset of all CCs in FR2 provided the same offset.

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{identify_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

The value of P_{TRP} used in table 8.18.2.2-2 is defined as 2, if SSB/CSI-RS resource in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ are overlapped, else it is 1.

Table 8.18.2.2-1: Evaluation period $T_{Evaluate_BFD_SSB}$ for FR1

Configuration	$T_{Evaluate_BFD_SSB}$ (ms)
no DRX	$Max(50, Ceil(5 \times P) \times T_{SSB})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(7.5 \times P) \times Max(T_{DRX}, T_{SSB}))$
DRX cycle > 320 ms	$Ceil(5 \times P) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of SSB in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$. T_{DRX} is the DRX cycle length.	

Table 8.18.2.2-2: Evaluation period $T_{Evaluate_BFD_SSB}$ for FR2

Configuration	$T_{Evaluate_BFD_SSB}$ (ms)
no DRX	$Max(50, Ceil(5 \times P \times N^*P_{TRP}) \times T_{SSB})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(7.5 \times P \times N^*P_{TRP}) \times Max(T_{DRX}, T_{SSB}))$
DRX cycle > 320 ms	$Ceil(5 \times P \times N^*P_{TRP}) \times T_{DRX}$
NOTE: T_{SSB} is the periodicity of SSB in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$. T_{DRX} is the DRX cycle length.	

8.18.2.3 Measurement restriction for SSB based beam failure detection

The UE is required to be capable of measuring SSB for BFD without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following scenarios.

For FR1, when the SSB for BFD measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for BFD measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for BFD measurement without any restriction.
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

For FR2, when the SSB for BFD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined. When the SSB and CSI-RS for BFD measurements are from different sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$, UE shall be able to perform measure both SSB and CSI-RS for BFD measurements.

For FR2, when the SSB for BFD measurement on one CC is in the same or adjacent OFDM symbol as SSB with a different PCI for RLM, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSBs with the two different PCIs. Longer measurement period for SSB based BFD is expected, and no requirements are defined.

For FR2, if the network configures same or mixed numerology between SSB for BFD measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, UE shall be able to perform the related SSB based measurements in one band without any measurement restrictions on the other band, provided that UE is capable of independent beam management on this FR2 band pair.

For FR2, when the SSB for BFD measurement in sets $\bar{q}_{0,1}$ or $\bar{q}_{1,1}$ fully or partially overlaps with the OFDM symbol as SSB for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap on candidate LTM neighbour cell in the same band, UE is required to measure one of but not both SSBs. Longer measurement period for SSB based BFD is expected, and no requirements are defined.

8.18.3 Requirements for CSI-RS based beam failure detection

8.18.3.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$of resource configurations for a serving cell, provided that the CSI-RS resource(s) in two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.18.3.2. UE is not expected to perform beam failure detection measurements on the CSI-RS configured for BFD if the CSI-RS is not QCL-ed, with QCL-TypeD when applicable, with the RS in the active TCI state of any CORESET configured in the UE active BWP.

Table 8.18.3.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0 dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0 dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.18.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ estimated over the last $T_{Evaluate_BFD_CSI-RS}$ period becomes worse than the threshold $Q_{out_LR_CSI-RS}$ within $T_{Evaluate_BFD_CSI-RS}$ period.

The value of $T_{Evaluate_BFD_CSI-RS}$ is defined in table 8.18.3.2-1 for FR1.

The value of $T_{Evaluate_BFD_CSI-RS}$ is defined in table 8.18.3.2-2 for FR2 with N=1. The requirements of $T_{Evaluate_BFD_CSI-RS}$ apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For UE supporting *musim-GapPreference-r17* and is configured with one or more per-UE periodic MUSIM gaps,

- P value for an BFD CSI-RS resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0
- For a window W of duration max($T_{CSI-RS,}$ SMTC period, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE periodic MUSIM gaps, per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any configured BFD CSI-RS resource occasion:
  - N_{total} is the total number of configured BFD CSI-RS resource occasions within the window, including those overlapped with MUSIM gap occasions or SMTC occasions within the window,
  - $N_{outside_MG}$ is the number of configured BFD CSI-RS resource occasions that are not overlapped with any MUSIM gap occasions within the window W,
  - $N_{available}$ is the number of configured BFD CSI-RS resource occasions that are not overlapped with any non-dropped MUSIM gap occasions nor any SMTC occasion within the window W, and
  - T_{CSI-RS} is periodicity of the target CSI-RS resource for BFD.

    When the configured aperiodic MUSIM gap is overlapping with configured BFD CSI-RS resource occasions, longer evaluation period would be expected.

    Requirements in this clause do not apply when $N_{outside\ MG}$ = 0 due to fully overlapping between target CSI-RS resource for BFD and MUSIM gap occasions within the window W.

Otherwise, when UE is not configured with periodic MUSIM gap(s) or not supporting MUSIM gap capability,

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS.

- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P = 1, when the BFD-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is not overlapped with SMTC occasion ($T_{CSI-RS} < MGRP$)

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).

- $P = P_{sharing\ factor}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq MGRP$ or

  - $T_{SMTCperiod} = MGRP$ and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod} = MGRP$ and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap ($T_{CSI-RS} < MGRP$) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} < MGRP$)

where,

- $P_{sharing\ factor} = 1$, if the BFD-RS resource outside measurement gap is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;

  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

- $P_{sharing\ factor} = 3$, otherwise.

If the higher layer in TS 38.331 [2] signalling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

NOTE: The overlap between CSI-RS for BFD and SMTC means that CSI-RS for BFD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the BFD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{identify_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of M_{BFD} used in table 8.18.3.2-1 and table 8.18.3.2-2 are defined as

- M_{BFD} = 10, if the CSI-RS resource(s) in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ used for BFD is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs.

The values of P_{BFD} used in table 8.18.3.2-1 and table 8.18.3.2-2 are defined as

For each CSI-RS resource in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- P_{BFD} = 1.

For each CSI-RS resource in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ configured for PSCell in NR-DC

P_{BFD} = 2 if UE is configured for beam failure detection on SCell, 1 otherwise.

For each CSI-RS resource in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ configured for a SCell

- P_{BFD} = Z in EN-DC or NE-DC or SA.
- P_{BFD} = 2* Z in NR-DC.

Where Z is the number of band(s) on which UE is performing beam failure detection only for SCell.

For UE not supporting *schedulingMeasurementRelaxation-r18* , the values of P_{TRP} in table 8.18.3.2-2 is defined as 2, if SSB/CSI-RS resources in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ are overlapped, else it is 1.

For FR2-1, for UE supporting *schedulingMeasurementRelaxation-r18* according to the conditions described in clause 3.6.19,, the value of P_{TRP} in table 8.18.3.2-2 is defined as 1, when:

- CSI-RS resources in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ are not overlapped, or
- CSI-RS resources in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ are overlapped and the following conditions are met:
  - Both CSI-RSs are not in any CSI-RS resource set with repetition ON
  - The CSI-RS in set $\bar{q}_{0,0}$ has same QCL source as either
    - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
    - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to TS 38.214 [26] clause 5.1.5, and
  - the CSI-RS in set $\bar{q}_{0,1}$ has same QCL source as either
    - the active TCI state of a PDSCH scheduled in the same OFDM symbol or

- the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to TS 38.214 [26] clause 5.1.5, and

- Resources of the active TCI states of the two PDSCHs, or QCL sources of the default QCL assumption, or the active TCI state of PDSCH and QCL source of the default QCL assumption have been reported as a resource group in Rel-17 group-based RSRP report.

- else, the value of P_{TRP} is 2.

Table 8.18.2-1: Evaluation period $T_{Evaluate_BFD_CSI-RS}$ for FR1

Configuration	$T_{Evaluate_BFD_CSI-RS}$ (ms)
no DRX	$Max(50, Ceil(M_{BFD} \times P \times P_{BFD}) \times T_{CSI-RS})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(1.5 \times M_{BFD} \times P \times P_{BFD}) \times Max(T_{DRX}, T_{CSI-RS}))$
DRX cycle > 320 ms	$Ceil(M_{BFD} \times P \times P_{BFD}) \times T_{DRX}$
NOTE: T_{CSI-RS} is the periodicity of CSI-RS resource in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$. T_{DRX} is the DRX cycle length.	

Table 8.18.3.2-2: Evaluation period $T_{Evaluate_BFD_CSI-RS}$ for FR2

Configuration	$T_{Evaluate_BFD_CSI-RS}$ (ms)
no DRX	$Max(50, Ceil(M_{BFD} \times P \times N \times P_{BFD}*P_{TRP}) \times T_{CSI-RS})$
DRX cycle ≤ 320 ms	$Max(50, Ceil(1.5 \times M_{BFD} \times P \times N \times P_{BFD}*P_{TRP}) \times Max(T_{DRX}, T_{CSI-RS}))$
DRX cycle > 320 ms	$Ceil(M_{BFD} \times P \times N \times P_{BFD}*P_{TRP}) \times T_{DRX}$
NOTE: T_{CSI-RS} is the periodicity of CSI-RS resource in the two sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$. T_{DRX} is the DRX cycle length.	

8.18.3.3 Measurement restrictions for CSI-RS beam failure detection

The SSB mentioned in this clause can be associated with either the serving cell PCI or a PCI different from serving cell PCI or intra-frequency neighbor cell(s) configured with L1-RSRP measurement or inter-frequency neighbor cell(s) configured with L1-RSRP measurement without gap.

The UE is required to be capable of measuring CSI-RS for BFD without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following scenarios.

For both FR1 and FR2, when the CSI-RS for BFD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for BFD measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for BFD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

For FR2, when the CSI-RS for BFD measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD or L1-RSRP measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.

For both FR1 and FR2, when the CSI-RS for BFD measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, UE is not required to receive CSI-RS for BFD measurement in the PRBs that overlap with an SSB.

For FR1, when the CSI-RS for BFD measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, if CSI-RS and SSB have different SCS and UE does not support simultaneousRxDataSSB-DiffNumerology, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD is expected, and no requirements are defined.

For FR2, when the CSI-RS for BFD measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer measurement period for CSI-RS based BFD is expected, and no requirements are defined.

For FR2, when the CSI-RS for BFD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for BFD measurement and the other CSI-RS. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.
  - The CSI-RS for BFD measurement or the other CSI-RS in a resource set configured with repetition ON, or
  - The other CSI-RS is configured in two sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ and beam failure is detected, or
  - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

For FR2-1, there is no measurement restriction allowed for UE supporting *schedulingMeasurementRelaxation-r18* according to the conditions described in clause 3.6.19, and the UE is required to measure both the CSI-RS for BFD and the other CSI-RS for RLM, BFD or L1-RSRP measurement, provided the following conditions are met:

- Both CSI-RSs are not in any CSI-RS resource set with repetition ON, and
- One CSI-RS has same QCL source as either
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to TS 38.214 [26] clause 5.1.5, and
- the other CSI-RS has same QCL source as either
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to TS 38.214 [26] clause 5.1.5, and
- Resources of the active TCI states of the two PDSCHs, or QCL sources of the default QCL assumption, or the active TCI state of PDSCH and QCL source of the default QCL assumption have been reported as a resource group in Rel-17 group-based RSRP report.

When two CSI-RSs for BFD measurements are from different sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$, UE shall be able to perform measure both CSI-RSs for BFD measurements.

8.18.4 Minimum requirement for L1 indication

When more than one TRP is configured with different resource set for each TRP, requirements specified in clause 8.5.4 shall apply for each TRP.

8.18.5 Requirements for SSB based candidate beam detection

8.18.5.1 Introduction

The requirements in this clause apply for each SSB resource in the sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$configured for a serving cell, provided that the SSBs configured for candidate beam detection (CBD) are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.18.5.2. The SSB(s) in set $\bar{q}_{1,1}$ can be associated with an additional PCI other than serving PCI.

8.18.5.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in the two sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$,estimated over the last $T_{Evaluate_CBD_SSB}$ period becomes better than the threshold Q_{in_LR} provided SSB_RP and SSB Ês/Iot are according to Annex table B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 8.18.5.2-1 and 8.18.5.2-2 corresponding to the non-DRX mode, if the configured DRX cycle $\leqslant$ 320 ms.

The value of $T_{Evaluate_CBD_SSB}$ is defined in table 8.18.5.2-1 for FR1.

The value of $T_{Evaluate_CBD_SSB}$ is defined in table 8.18.5.2-2 for FR2 with scaling factor N=8.

For UE supporting *musim-GapPreference-r17* and is configured with one or more per-UE periodic MUSIM gaps,

- P value for an CBD SSB resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0
- For a window W of duration max($T_{SSB,}$ SMTC period, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE periodic MUSIM gaps, per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any configured CBD SSB resource occasion:
  - N_{total} is the total number of configured CBD SSB resource occasions within the window, including those overlapped with MUSIM gap occasions or SMTC occasions within the window,
  - $N_{outside_MG}$ is the number of configured CBD SSB resource occasions that are not overlapped with any MUSIM gap occasions within the window W,
  - $N_{available}$ is the number of configured CBD SSB resource occasions that are not overlapped with any non-dropped MUSIM gap occasions nor any SMTC occasion within the window W, and
  - T_{SSB} is periodicity of the target SSB resource for CBD.

    When the configured aperiodic MUSIM gap is overlapping with configured CBD SSB resource occasions, longer evaluation period would be expected.

    Requirements in this clause do not apply when $N_{outside\ MG}$ = 0 due to fully overlapping between target SSB resource for CBD and MUSIM gap occasions within the window W.

Otherwise, when UE is not configured with periodic MUSIM gap(s) or not supporting MUSIM gap capability,

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB,
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).

- P is $P_{sharing\ factor}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{SSB}}{Min(MGRP,T_{SMTCperiod})}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} <$ MGRP)

where,

- $P_{sharing\ factor}$ = 1, if the candidate beam detection RS outside measurement gap is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;

  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured

- $P_{sharing\ factor}$ = 3, otherwise.

  If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of P_{CBD} used in table 8.18.5.2-1 and table 8.18.5.2-2 are defined as

For each SSB resource in the sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- P_{CBD} = 1.

For each SSB resource in the sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ configured for PSCell in NR-DC

- P_{CBD} = 2 if UE is configured for candidate beam detection on SCell, 1 otherwise.

For each SSB resource in the sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ configured for a SCell

- P_{CBD} = Z in EN-DC or NE-DC or SA.
- P_{CBD} = 2* Z in NR-DC.

  Where Z is the number of band(s) on which UE is performing candidate beam detection only for SCell

- P_{CBD} is the number of band(s) on which UE is performing candidate beam detection only for SCell.

The value of P_{TRP} used in table 8.18.5.2-2 is defined as 2, if SSB/CSI-RS resource in the two sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ are overlapped, else it is 1.

Table 8.18.5.2-1: Evaluation period $T_{Evaluate_CBD_SSB}$ for FR1

Configuration	$T_{Evaluate_CBD_SSB}$ (ms)
non-DRX, DRX cycle ⩽ 320 ms	Max(25, Ceil(3 × P × P_{CBD}) × T_{SSB})
DRX cycle > 320 ms	Ceil(3 × P × P_{CBD}) × T_{DRX}
NOTE: T_{SSB} is the periodicity of SSB in the two sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$. T_{DRX} is the DRX cycle length.	

Table 8.18.5.2-2: Evaluation period $T_{Evaluate_CBD_SSB}$ for FR2

Configuration	$T_{Evaluate_CBD_SSB}$ (ms)
non-DRX, DRX cycle ⩽ 320 ms	Max(25, Ceil(3 × P × N × P_{CBD} × P_{TRP}) × T_{SSB})
DRX cycle > 320 ms	Ceil(3 × P × N × P_{CBD} × P_{TRP}) × T_{DRX}
NOTE: T_{SSB} is the periodicity of SSB in the two sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$. T_{DRX} is the DRX cycle length.	

8.18.5.3 Measurement restriction for SSB based candidate beam detection

For FR1, when the SSB for CBD measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for CBD measurement without any restrictions.
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for CBD measurement without any restriction.
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

For FR2, when the SSB for CBD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined. When the SSB and CSI-RS for CBD measurements are from different sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$, UE shall be able to measure both SSB and CSI-RS for CBD measurements.

For FR2, when the SSB for CBD measurement on one CC is in the same OFDM symbol as SSB with a different PCI for RLM, BFD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSBs with the two different PCIs. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

For FR2, if network configures same or mixed numerology between SSB for CBD measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, UE shall be able to perform the related SSB based measurements in one band without any measurement restrictions in the other band, provided that UE is capable of independent beam management on this FR2 band pair.

For FR2, when the SSB for CBD measurement in sets $\bar{q}_{0,1}$ or $\bar{q}_{1,1}$ fully or partially overlaps with the OFDM symbol as SSB for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap on candidate LTM neighbour cell on the same band, UE is required to measure one of but not both SSBs. Longer measurement period for SSB based CBD is expected, and no requirements are defined.

8.18.6 Requirements for CSI-RS based candidate beam detection

8.18.6.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ configured for a serving cell, provided that the CSI-RS resources configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.18.6.2.

8.18.6.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ estimated over the last $T_{Evaluate_CBD_CSI\text{-}RS}$ period becomes better than the threshold Q_{in_LR} within $T_{Evaluate_CBD_CSI\text{-}RS}$ period provided CSI-RS Ês/Iot is according to Annex table B.2.4.2 for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in tables 8.18.6.2-1 and 8.18.6.2-2 corresponding to the non-DRX mode, if the configured DRX cycle $\leqslant$ 320 ms.

The value of $T_{Evaluate_CBD_CSI\text{-}RS}$ is defined in table 8.18.6.2-1 for FR1.

The value of $T_{Evaluate_CBD_CSI\text{-}RS}$ is defined in table 8.18.6.2-2 for FR2 with scaling factor N=8.

For UE supporting *musim-GapPreference-r17* and is configured with one or more per-UE periodic MUSIM gaps,

- P value for an CBD CSI-RS resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0
- For a window W of duration max($T_{CSI\text{-}RS,}$ SMTC period, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE periodic MUSIM gaps, per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any configured CBD CSI-RS resource occasion:
  - N_{total} is the total number of configured CBD CSI-RS resource occasions within the window, including those overlapped with MUSIM gap occasions or SMTC occasions within the window,
  - $N_{outside_MG}$ is the number of configured CBD CSI-RS resource occasions that are not overlapped with any MUSIM gap occasions within the window W,
  - $N_{available}$ is the number of configured CBD CSI-RS resource occasions that are not overlapped with any non-dropped MUSIM gap occasions nor any SMTC occasion within the window W, and
  - $T_{CSI\text{-}RS}$ is periodicity of the target CSI-RS resource for CBD.

    When the configured aperiodic MUSIM gap is overlapping with configured CBD CSI-RS resource occasions, longer evaluation period would be expected.

    Requirements in this clause do not apply when $N_{outside\ MG}$ = 0 due to fully overlapping between target CSI-RS resource for CBD and MUSIM gap occasions within the window W.

Otherwise, when UE is not configured with periodic MUSIM gap(s) or not supporting MUSIM gap capability,

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P = 1, when candidate beam detection RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$ when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is not overlapped with SMTC occasion ($T_{CSI-RS} < MGRP$)

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).

- $P = P_{sharing\ factor}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$,, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq MGRP$ or

  - $T_{SMTCperiod} = MGRP$ and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod} = MGRP$ and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{Min(MGRP,T_{SMTCperiod})}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap

- $P = \frac{3}{1-\frac{T_{CSI-RS}}{MGRP}}$,, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} < MGRP$)

where,

- $P_{sharing\ factor} = 1$, if the candidate beam detection RS outside measurement gap is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and;

  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{sharing\ factor} = 3$, otherwise.

If the higher layer in TS 38.331 [2] signalling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

NOTE: The overlap between CSI-RS for CBD and SMTC means that CSI-RS for CBD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM, BFD, BM-RS, or other CBD-RS, according to the measurement restrictions defined in clause 8.18.6.3.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period $T_{identify_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of M_{CBD} used in table 8.18.6.2-1 and table 8.18.6.2-2 are defined as

- M_{CBD} = 3, if the CSI-RS resource configured in the sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs.

The values of P_{CBD} used in table 8.18.6.2-1 and table 8.18.6.2-2 are defined as

For each CSI-RS resource in the sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ configured for PCell or PSCell in EN-DC or NE-DC or SA; or PCell in NR-DC

- P_{CBD} = 1.

For each CSI-RS resource in the sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ configured for PSCell in NR-DC

- P_{CBD} = 2 if UE is configured for candidate beam detection on SCell, 1 otherwise.

For each CSI-RS resource in the sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ configured for a SCell

- P_{CBD} = Z in EN-DC or NE-DC or SA.
- P_{CBD} = 2* Z in NR-DC.

  Where Z is the number of band(s) on which UE is performing candidate beam detection only for SCell
- P_{CBD} is the number of band(s) on which UE is performing candidate beam detection only for SCell.

The value of P_{TRP} used in table 8.18.6.2-2 is defined as 2, if SSB/CSI-RS resource in the two sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$ are overlapped, else it is 1.

Table 8.18.6.2-1: Evaluation period $T_{Evaluate_CBD_CSI-RS}$ for FR1

Configuration	$T_{EvaluateC_CBD_CSI-RS}$ (ms)
non-DRX, DRX cycle $\leqslant$ 320 ms	$\max(25, \lceil M_{CBD} \times P \times P_{CBD} \rceil \times T_{CSI-RS})$
DRX cycle > 320 ms	$\lceil M_{CBD} \times P \times P_{CBD} \rceil \times T_{DRX}$
NOTE: T_{CSI-RS} is the periodicity of CSI-RS resource in the two sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$. T_{DRX} is the DRX cycle length.	

Table 8.18.6.2-2: Evaluation period $T_{Evaluate_CBD_CSI-RS}$ for FR2

Configuration	$T_{Evaluate_CBD_CSI-RS}$ (ms)
non-DRX, DRX cycle $\leqslant$ 320 ms	$\max(25, \lceil M_{CBD} \times P \times N \times P_{CBD} \times P_{TRP} \rceil \times T_{CSI-RS})$
DRX cycle > 320 ms	$\lceil M_{CBD} \times P \times N \times P_{CBD} \times P_{TRP} \rceil \times T_{DRX}$
NOTE: T_{CSI-RS} is the periodicity of CSI-RS resource in the two sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$. T_{DRX} is the DRX cycle length.	

8.18.6.3 Measurement restriction for CSI-RS based candidate beam detection

The SSB mentioned in this clause can be associated with either the serving cell PCI or a PCI different from serving cell PCI or intra-frequency neighbor cell(s) configured with L1-RSRP measurement or inter-frequency neighbor cell(s) configured with L1-RSRP measurement without gap.

For both FR1 and FR2, when the CSI-RS for CBD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for CBD measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS based CBD measurement for without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer measurement period for CSI-RS based CBD measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for CBD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for CBD measurement without any restriction.

For FR2, when the CSI-RS for CBD measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer evaluation period for CSI-RS based CBD measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for CBD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and the other CSI-RS. Longer evaluation period for CSI-RS based CBD measurement is expected, and no requirements are defined. When two CSI-RSs for CBD measurements are from different sets $\bar{q}_{1,0}$ and $\bar{q}_{1,1}$, UE shall be able to measure both CSI-RSs for CBD measurements.

For both FR1 and FR2, when the CSI-RS for CBD measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, UE is not required to receive CSI-RS for CBD measurement in the PRBs that overlap with an SSB.

For FR1, when the CSI-RS for CBD measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, if CSI-RS and SSB have different SCS and UE does not support simultaneousRxDataSSB-DiffNumerology, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer measurement period for CSI-RS based CBD is expected, and no requirements are defined.

For FR2, when the CSI-RS for CBD measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer measurement period for CSI-RS based CBD is expected, and no requirements are defined.

8.18.7 Requirements for TRP specific Beam Failure Recovery

8.18.7.1 Introduction

For the UE provided with a configuration of PUCCH transmission with a link recovery request (LRR) as described in clause 9.2.4 in TS 38.213 [3], if beam recovery procedure is triggered for any of the TRPs, the UE shall transmit SR for

UL resource followed by MAC CE providing beam index for the corresponding TRP whose radio link quality is worse than $Q_{out,LR}$. The index, q_{new}, provided in the TRP specific BFR MAC CE is provided by higher layer for a periodic CSI-RS configuration or for a SSB, as described in clause 5.17 of TS 38.321 [7].

For the UE not provided with a configuration of PUCCH transmission with a link recovery request (LRR) as described in clause 9.2.4 in TS 38.213 [3], if beam recovery procedure is triggered for any of TRPs, the UE shall transmit preamble for UL-SCH resource application, followed by MAC CE providing one index for the corresponding TRP whose radio link quality is worse than $Q_{out,LR}$, and the index q_{new} for a periodic CSI-RS configuration or for a SSB provided by higher layer, as described in clause 5.17 of TS 38.321 [7], if any, for a corresponding TRP.

8.18.7.2 Requirement

Provided that UE is configured by *schedulingRequestID-BFR-r17* and/or *schedulingRequestID-BFR2-r17*for BFR set 1 (i.e., TRP1) and BFR set 2 (i.e., TRP2) respectively, a configuration for LRR in a PUCCH transmission, after BFR is triggered on any of the TRPs as described in clause 5.17 of TS 38.321 [7], UE shall be capable of transmit PUCCH with a LRR within a period of T on any of the TRPs where BFR running.Where:

- $T = T_1 \times Ceil((T_2+D)/T_1)$ in which T_1, T_2 and D are defined as
  - T_1 is equal to the periodicity of PUCCH configured with *schedulingRequestID-BFR-r17 for* BFR set 1 schedulingRequestID-BFR2-r17 for BFR set 2..
  - $T_2 = T_{Evaluate_CBD}$ is the evaluation period specified in clause 8.18.5 or 8.18.6 for SSB or CSI-RS based candidate beam detection, that is $T_{Evaluate_CBD_SSB}$ or $T_{Evaluate_CBD_CSI-RS}$, depending on the applicable reference signal configured for candidate beam detection.
  - D = [2 ms] is the UE Processing time.

8.18.8 Scheduling availability of UE during TRP specific beam failure detection

Scheduling availability restrictions when the UE is performing TRP specific beam failure detection are described in the following clauses.

8.18.8.1 Scheduling availability of UE performing TRP specific beam failure detection with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to TRP specific beam failure detection performed on SSB and CSI-RS configured for BFD with the same SCS as PDSCH or PDCCH in FR1.

8.18.8.2 Scheduling availability of UE performing TRP specific beam failure detection with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to TRP specific beam failure detection when SSB is configured as BFD. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to TRP specific beam failure detection when SSB is configured as BFD.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for TRP specific beam failure detection.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which PCell or PSCell is configured.

8.18.8.3 Scheduling availability of UE performing TRP specific beam failure detection on FR2

The following scheduling restriction applies due to TRP specific beam failure detection.

- For FR2-1, for UE supporting *schedulingMeasurementRelaxation-r18* according to the conditions described in clause 3.6.19, there are no scheduling restrictions due to TRP specific beam failure detection performed based on the CSI-RS if the following conditions are met:
  - The CSI-RS is not in a CSI-RS resource set with repetition ON.
  - The CSI-RS has same QCL source as the active TCI state of one of the PDSCHs and has different QCL-TypeD from the other PDSCH.
  - The CSI-RS and both of the PDSCHs are on the same OFDM symbol(s), or the CSI-RS and one of the PDSCHs with different QCL typeD are on the same OFDM symbol(s) when partially overlapping PDSCHs are scheduled, and
  - Resources of the active TCI states for the two PDSCHs have been reported as a resource group in Rel-17 group-based RSRP report.
  - Otherwise
  - The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on BFD-RS resource symbols to be measured for TRP specific beam failure detection.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions on FR2 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to beam failure detection performed on FR2 serving cell(s) in different band(s), provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for BFD measurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for BFD measurement.

8.18.8.4 Scheduling availability of UE performing TRP specific beam failure detection on FR1 or FR2 in case of FR1-FR2 inter-band CA and NR-DC

There are no scheduling restrictions on FR1 serving cell(s) due to TRP specific beam failure detection performed on FR2 serving PCell and/or PSCell.

There are no scheduling restrictions on FR2 serving cell(s) due to TRP specific beam failure detection performed on FR1 serving PCell and/or PSCell.

8.18.9 Scheduling availability of UE during TRP specific candidate beam detection

Scheduling availability restrictions when the UE is performing L1-RSRP measurement for TRP specific candidate beam detection are described in the following clauses.

8.18.9.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as TRP specific link recovery detection resource with the same SCS as PDSCH or PDCCH in FR1.

8.18.9.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as TRP specific link recovery detection resource. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured as TRP specific link recovery detection resource.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, TRS, CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for L1-RSRP.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on one serving cell apply to all other serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands.

8.18.9.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to TRP specific candidate beam detection

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, CSI-RS for tracking or CSI-RS for CQI on reference symbols to be measured for TRP specific candidate beam detection.

When intra-band carrier aggregation in FR2 is configured, the scheduling restrictions on to one serving cell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to candidate beam detection performed on FR2 serving cell(s) in different band(s), provided that the FR2 serving cell(s) and the FR2 serving cell(s) for candidate beam detection are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE’s reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for CBD mesurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for CBD mesurement.

8.18.9.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA and NR-DC

There are no scheduling restrictions on FR1 serving cell(s) due to L1-RSRP measurement performed on FR2 serving cell(s).

There are no scheduling restrictions on FR2 serving cell(s) due to L1-RSRP measurement performed on FR1 serving cell(s).

8.19 Pre-configured measurement gap activation/deactivation delay

8.19.1 Introduction

The requirements in this clause apply for a UE configured with PCell or any activated SCell in standalone NR.

UE shall complete the activation/deactivation of pre-configured measurement gap within the delay defined in this clause.

8.19.2 Pre-configured measurement gap activation/deactivation upon DCI/timer-based BWP switch

8.19.2.1 Activation/deactivation upon DCI/timer-based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the DCI/timer-based BWP switch is performed on a single CC with more than one BWP configurations configured on the CC.

When BWP switch occurs, which results in status change of pre-configured measurement gap according to clause 9.1.7, UE shall be able to finish pre-configured measurement gap activation or deactivation within 5 ms after the completion of the active BWP switch. The active BWP switch delay for single CC is defined in clause 8.6.2. Activation/deactivation of Pre-MG takes effect from the first complete MG occasion after the activation and deactivation delay. If the end of activation/deactivation of Pre-MG is within a Pre-MG gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed prior to the next Pre-MG gap occasion.

8.19.3 Pre-configured measurement gap activation/deactivation upon SCell activation/deactivation

The requirements in this clause apply when one SCell or multiple SCells are activated/deactivated.

When one SCell or multiple SCells are activated/deactivated, which results in status change of pre-configured measurement gap according to clause 9.1.7, UE shall be able to finish pre-configured measurement gap activation or deactivation within 5 ms after the completion of SCell(s) activation/deactivation. The SCell(s) activation/deactivation delay for is defined in clause 8.3. Activation/deactivation of Pre-MG takes effect from the first complete MG occasion after the SCell(s) activation/deactivation delay. If the end of activation/deactivation of Pre-MG is within a Pre-MG gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed prior to the next Pre-MG gap occasion.

8.19.4 Pre-configured measurement gap activation/deactivation upon RRC reconfiguration

The requirements in this clause apply when UE is triggered by the RRC based events defined in clause 9.1.7.3.1 if UE supports autonomous activation/deactivation mechanism and/or in clause 9.1.7.3.2 if UE supports network-controlled activation/deactivation mechanism.

If the aforementioned RRC reconfiguration results in status change of pre-configured measurement gap according to clause 9.1.7, UE shall be able to finish pre-configured measurement gap activation or deactivation within 5 ms after RRC processing delay specified in [2]. If the end of activation/deactivation of Pre-MG is within a Pre-MG gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed prior to the next Pre-MG gap occasion.

8.19.5 Activation/deactivation delay requirements for concurrent measurement gaps with Pre-MG

The requirements in this clause apply to a UE supporting *concurrentMeasGapsPreMG-r18* and configured with concurrent measurement gaps with Pre-MG.

8.19.5.1 Activation/deactivation delay requirements for non-overlapped activation/deactivation of concurrent measurement gaps with Pre- MG

The requirements in this clause only apply when the activation/deactivation procedures of the individual pre-configured measurement gaps do not overlap in time.

When concurrent measurement gaps with Pre-MG activation/deactivation procedure are non-overlapped upon DCI/timer-based BWP switch, upon SCell activation/deactivation or upon RRC reconfiguration, for each individual pre-configured measurement gap, the requirements defined in clauses 8.19.2, 8.19.3 and 8.19.4 apply.

8.19.5.2 Activation/deactivation delay requirements for fully overlapped activation/deactivation of concurrent measurement gaps with Pre- MG

The requirements in this clause only apply when the activation/deactivation procedures of the individual pre-configured measurement gaps fully overlap in time.

Fully overlapped activation/deactivation of pre-configured measurement gaps can occur in the following cases:

- Both pre-configured measurement gaps are triggered by the same event.
- Two pre-configured measurement gaps are triggered by two events of the same type at the same time.

When concurrent measurement gaps with Pre-MG are activated/deactivated simultaneously, the activation/deactivation delay equals the delay requirements defined in clauses 8.19.2, 8.19.3, and 8.19.4 for DCI/timer-based BWP switch, SCell activation/deactivation or RRC reconfiguration triggered activation/deactivation, respectively, plus an additional 2 ms post-processing time.

8.19.5.3 Pre-MG activation/deactivation delay when colliding with a concurrent measurement gap

When the activation/deactivation procedure of a pre-configured measurement gap collides with a concurrent measurement gap occasion, the requirements defined in clause 9.1.12.4 apply.

The endpoint of Pre-MG activation/deactivation is equal to the finalization of the pre-configured measurement gap activation/deactivation as defined in clauses 8.19.2, 8.19.3 and 8.19.4 for DCI/timer-based BWP switch, SCell activation/deactivation or RRC reconfiguration triggered activation/deactivation, respectively, without overlap of the Pre-MG activation/deactivation procedure with a Pre-MG occasion.

8.19D Pre-configured measurement gap activation/deactivation delay for ATG

8.19D.1 Introduction

The requirements in this clause apply for an ATG UE configured with PCell or any activated SCell in standalone NR.

UE shall complete the activation/deactivation of pre-configured measurement gap within the delay defined in this clause.

8.19D.2 Pre-configured measurement gap activation/deactivation upon DCI/timer-based BWP switch

8.19D.2.1 Activation/deactivation upon DCI/timer-based BWP switch delay on a single CC

The requirements in this clause shall apply only for FR1 and NR SA operation mode without considering DC and inter RAT measurement.

The requirements in this clause only apply to the case that the DCI/timer-based BWP switch is performed on a single CC with more than one BWP configurations configured on the CC.

When BWP switch occurs, which results in status change of pre-configured measurement gap according to clause 9.1D.7, UE shall be able to finish pre-configured activation or deactivation within 5 ms after the completion of the active BWP switch. The active BWP switch delay for single CC is defined in clause 8.6D.2. Activation/deactivation of Pre-MG takes effect from the first complete MG occasion after the activation and deactivation delay. If the end of activation/deactivation of Pre-MG is within a gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed prior to the next gap occasion.

8.19D.3 Pre-configured measurement gap activation/deactivation upon RRC reconfiguration

The requirements in this clause shall apply only for FR1 and NR SA operation mode without considering DC and inter RAT measurement.

The requirements in this clause apply when UE capable of autonomous activation/deactivation mechanism or network-controlled activation/deactivation mechanism receives RRC reconfiguration to:

- Add/remove of any measurement object(s), or
- Switch active BWP or update parameters of its active BWP.

If the aforementioned RRC reconfiguration results in status change of pre-configured measurement gap according to clause 9.1D.7, UE shall be able to finish pre-configured activation or deactivation within 5 ms after RRC processing delay specified in [2]. If the end of activation/deactivation of Pre-MG is within a gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed prior to the next gap occasion.

8.19D.4 Pre-configured measurement gap activation/deactivation upon SCell activation/deactivation

The requirements in this clause apply when one SCell is activated/deactivated.

When one SCell is activated/deactivated, which results in status change of pre-configured measurement gap according to clause 9.1D.7, UE shall be able to finish pre-configured measurement gap activation or deactivation within 5 ms after the completion of SCell(s) activation/deactivation. The SCell(s) activation/deactivation delay is defined in clause 8.3D. Activation/deactivation of Pre-MG takes effect from the first complete MG occasion after the SCell(s) activation/deactivation delay. If the end of activation/deactivation of Pre-MG is within a Pre-MG gap occasion, the Pre-MG status shall not be changed immediately. Instead, the Pre-MG status shall be changed prior to the next Pre-MG gap occasion.

8.20 LTM PSCell Cell Switch

8.20.1 Introduction

The purpose of LTM cell switch is to switch the PCell or PSCell to another cell. The requirements in this clause are applicable to LTM PSCell switch.

The requirements in this clause are applicable to both intra-frequency and inter-frequency LTM cell switch.

The requirements for inter-frequency cell switch in this clause are only applicable, when

- network has configured UE to perform SSB based L3 measurement with beam measurement reporting or L1 measurement for the target cell before cell switch command, or
- the SFN of the serving cell from which cell switch command is received and the SFN of the target cell are the same.

The requirements in this clause are applicable to NR-DC for the following scenarios:

PSCell switch to a neighbouring LTM candidate cell

- FR1 cell to FR1 cell
- FR1 cell to FR2 cell
- FR2 cell to FR2 cell
- FR2 cell to FR1 cell

PSCell switch to an LTM candidate cell that is a serving SCell in SCG

- FR1 cell to FR1 cell
- FR2 cell to FR2 cell

The requirements in this section apply when

- the target cell is known, and
  - the target joint UL/DL TCI state or separate UL and DL TCI states in the MAC-CE LTM cell switch command are known, or
  - the target cell is an FR1 cell, and the UE has reported L3-RSRP measurement result with SSB index associated to the target TCI state within 5 seconds before receiving the LTM TCI state activation command, and SNR of the SSB associated to the target TCI state ≥ -3dB, or
  - the target cell is an FR1 cell, and the UE is configured with event-triggered L1 measurement reporting and report on leave, and the UE has sent an event-triggered L1 measurement report with RS associated to the target TCI state and has not sent report on leave for the same RS before receiving the cell switch command.
- PL-RS is QCLed with RS of the TCI state indicated by LTM cell switch command, and
- For CFRA cell switch, RS of the TCI state indicated by LTM cell switch command is QCLed with the SSB indicated for CFRA.

The definition of known LTM target cell and the definition of known target joint DL/UL TCI state or separate DL and UL TCI states are as stated in clause 6.3.1.2.

8.20.2 LTM Cell Switch delay

LTM cell switch delay D_{LTM} is the delay from the end of the last TTI containing the MAC-CE command for cell switch until the time the UE transmits the first UL message on the target cell.

LTM cell switch delay is defined as:

$$D_{LTM} = T_{cmd} + T_{LTM\text{-}RRC\text{-}processing} + T_{LTM\text{-}processing} + T_{first\text{-}RS} + T_{RS\text{-}proc} + T_{LTM\text{-}IU} \text{ ms}$$

Where:

T_{cmd}, $T_{LTM\text{-}RRC\text{-}processing}$, $T_{LTM\text{-}processing}$, $T_{first\text{-}RS}$, $T_{RS\text{-}proc}$ and $T_{LTM\text{-}IU}$ are as stated in clause 6.3.1.2.

8.20.3 Void

8.21 Active downlink TCI state switching delay for unified TCI for single-DCI mTRP

8.21.1 Introduction

The requirements in this clause apply for a UE configured with *dl-OrJointTCI-StateList* configurations for DL channels on a serving cell and UE reports its capability of S-DCI based MTRP. Further the requirements also apply for all the list of serving cells in *simultaneousU-TCI-UpdateList1, simultaneousU-TCI-UpdateList2, simultaneousU-TCI-UpdateList3,*

simultaneousU-TCI-UpdateList4 in MR-DC or standalone NR provided all serving cells in the list are configured with the same serving cell and BWP in *unifiedTCI-StateRef-r17*. UE shall complete the switch of active downlink TCI state within the delay defined in this clause.

8.21.2 Known conditions for downlink TCI state

The downlink TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target downlink TCI state to the completion of active downlink TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target downlink TCI state or QCLed to the target downlink TCI state
  - Downlink TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
  - The UE has sent at least 1 L1-RSRP report for the target downlink TCI state before the downlink TCI state switch command
  - The target downlink TCI state remains detectable during the downlink TCI state switching period
  - The SSB associated with the downlink TCI state remain detectable during the downlink TCI switching period
    - SNR of the downlink TCI state ≥ -3 dB
    - The SSB can be associated with the serving cell PCI.

Otherwise, the downlink TCI state is unknown.

8.21.3 MAC-CE based downlink TCI state switch delay

The requirements in this clause shall apply for DL TCI state switch using separate DL TCI state or joint TCI state of unified TCI state switch framework and having two indicated TCI states.

In case of joint TCI state based dual TCI state switch, if the target PL-RS is not maintained, UE is not expected to receive on DL based on the target TCI state before UE completes the DL and UL TCI state switch of both TRPs. In case of single TCI state switch requirements specified in clause 8.15.3 apply.

If both the target TCI states are known, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ max{TO_{k1}*($T_{first\text{-}SSB1}$ + AD_1*T_{SSB1} + $T_{SSB\text{-}proc}$), TO_{k2}*($T_{first\text{-}SSB2}$ + AD_2*T_{SSB2} + $T_{SSB\text{-}proc}$)} / NR slot length.

Among the dual target TCI states indicated for switch, if the one of the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot T_{HARQ} + $3N_{slot}^{subframe,\mu}$ + $T_{L1\text{-}RSRP1}$ + max {TO_{uk1}*($T_{first\text{-}SSB1}$+ AD_1*T_{SSB1} + $T_{SSB\text{-}proc}$), TO_{k2}*($T_{first\text{-}SSB2}$ + $T_{SSB\text{-}proc}$)} / *NR slot length*.

If the both of the dual target TCI state are unknown, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} +$3N_{slot}^{subframe,\mu}$ + max{$T_{L1\text{-}RSRP1}$ +TO_{uk1}*($T_{first\text{-}SSB1}$+ $T_{SSB\text{-}proc}$), $T_{L1\text{-}RSRP2}$ +TO_{uk2}*($T_{first\text{-}SSB2}$+ $T_{SSB\text{-}proc}$)} / *NR slot length*. The UE shall be able to receive UE-dedicated PDCCH/PDSCH with the old TCI state until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$.

Where

- T_{HARQ} (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];
- $T_{first\text{-}SSB1}$ is time to first SSB transmission of first TCI states of the pair of TCI states after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state; $T_{first\text{-}SSB2}$ is time to first SSB transmission of second TCI states of the pair of TCI states after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state
- $T_{SSB\text{-}proc}$ = 2 ms;

- TO_{k1} = 1 if first target TCI state is not in the active TCI state list for PDSCH/PDCCH, 0 otherwise.
- TO_{k2} = 1 if second target TCI state is not in the active TCI state list for PDSCH/PDCCH, 0 otherwise.
- AD_1 = 1 if SSBs are adjacent in FR2 and $T_{SSB1} = T_{SSB2}$; 0 otherwise
- AD_2 = 1 if SSBs are adjacent in FR2 and $T_{SSB2} = T_{SSB1}$; 0 otherwise
- $T_{L1\text{-}RSRP1}$ = 0 for the first TCI state and $T_{L1\text{-}RSRP2}$ = 0 for the second TCI state in FR1 or when the TCI state switching not involving QCL-TypeD in FR2. Otherwise,
- $T_{L1\text{-}RSRP1}$ for the first TCI state and $T_{L1\text{-}RSRP2}$ for the second TCI state are the time for Rx beam refinement in FR2, defined as
- $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ for SSB as specified in clause 9.5.4.1,
  - with the assumption of M=1
  - with T_{Report} = 0
- $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ for CSI-RS as specified in clause 9.5.4.2
  - CSI-RS based L1-RSRP measurement only apply for TCI state switch when source RS is associated with serving cell
  - configured with higher layer parameter *repetition* set to ON
  - with the assumption of M=1 for periodic CSI-RS
  - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*
  - with T_{Report} = 0
- TO_{uk1} is for the first TCI state and TO_{uk2} is for the second TCI state. TO_{uk1} and TO_{uk2} = 1 for CSI-RS based L1-RSRP measurement, and are 0 for SSB based L1-RSRP measurement when TCI state switching involves QCL-TypeD
- TO_{uk1} = 1 and TO_{uk2} = 1when TCI state switching involves QCL types other than QCL-TypeD
- $T_{first\text{-}SSB1}$ is time to first SSB transmission of first TCI states of the pair of TCI states after L1-RSRP measurement when TCI state switching involves QCL-TypeD; $T_{first\text{-}SSB2}$ is time to second SSB transmission of first TCI states of the pair of TCI states after L1-RSRP measurement when TCI state switching involves QCL-TypeD;
- $T_{first\text{-}SSB1}$ is time to first SSB transmission of first TCI states of the pair of TCI states after MAC CE command is decoded by the UE for QCL types other than QCL-TypeD; $T_{first\text{-}SSB2}$ is time to second SSB transmission of first TCI states of the pair of TCI states after MAC CE command is decoded by the UE for QCL types other than QCL-TypeD;
  - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

In FR2 if both of the target TCI states are unknown and the SSBs are adjacent, longer delay is expected.

8.21.4 DCI based downlink TCI state switch delay

When a UE is configured with the higher layer parameter with *dl-OrJointTCI-StateList* or *TCI-UL-State*, activated with TCI states for downlink transmission by MAC CE indication of more than one codepoints, and receives DCI format 1_1/1_2 with or without DL assignment providing indicated two TCI-States or TCI state pair in the active TCI list for a CC, the UE transmits a PUCCH with HARQ-ACK information corresponding to the DCI carrying the TCI-State indication. Requirements in clause 8.15.4 apply.

8.21.5 Active Downlink TCI state list update delay

The requirements specified in this clause are applicable if

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', and a MAC CE activates more than one target separate TCIs, and at least one DL TCI is included, or

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', and a MAC CE activates more than one target joint TCI.

If all the target TCI states in the active TCI state list are known, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + TO_k*(T_{first\text{-}SSB_List} + T_{SSB\text{-}proc}) / \textit{NR slot length}.$$

If a subset of the target TCI states in the active TCI state list are unknown, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{L1\text{-}RSRP_list} + TO_{uk}*(T_{first\text{-}SSB_List} + T_{SSB\text{-}proc})) / \textit{NR slot length}.$$

If all target TCI states in the active TCI state list are unknown, the requirements specified in this clause are not applicable.

Where

- $T_{L1\text{-}RSRP_List}$ is the longest L1 measurement time ($T_{L1\text{-}RSRP}$) of the source RS among the unknown target TCI states, where $T_{L1\text{-}RSRP}$ is specified in clause 8.21.3

- $T_{first\text{-}SSB_List}$ is the $T_{first\text{-}SSB}$ from serving cell

- T_{HARQ}, $T_{first\text{-}SSB}$, $T_{SSB\text{-}proc}$, TO_k, TO_{uk} are defined in clause 8.21.3. T_{SSB} is the SSB periodicity.

When UE receives PDSCH carrying MAC-CE for active TCI state list update, and

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', or

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', while the target TCI list comprises at least one DL TCIs and at least one UL TCIs,

UE is not expected to receive on DL based on the target TCI state before UE completes the DL and UL TCI state list update.

8.22 Active downlink TCI state switching delay for unified TCI for multi-DCI mTRP

8.22.1 Introduction

The requirements in this clause apply for a UE configured with two different values of *CORESETPoolIndex* in ControlResourceSet with *dl-OrJointTCI-StateList* configurations for DL channels on a serving cell. Further, the requirements apply for a UE not configured with 2 TAs or for a UE configured with 2 TAs in FR1 or for a UE configured with 2 TAs in FR2 if RTD<CP. Further the requirements also apply for all the list of serving cells in *simultaneousU-TCI-UpdateList1, simultaneousU-TCI-UpdateList2, simultaneousU-TCI-UpdateList3, simultaneousU-TCI-UpdateList4* in MR-DC or standalone NR provided all serving cells in the list are configured with the same serving cell and BWP in *unifiedTCI-StateRef-r17*. UE shall complete the switch of active downlink TCI state within the delay defined in this clause. The requirements apply when UE is not expected to receive simultaneously from two different QCL-D sources in FR2. The requirements are applicable to each TRP independently.

When the target DL TCI state refers to an additional PCI different from the serving cell PCI in which this DL TCI-State is configured, the requirements in this clause are applicable provided that following conditions are met:

- Active BWP of the serving cell and a cell with the additional PCI are the same

- Center frequency, SCS and SFN offset of a cell with the additional PCI are as the same as serving cell - The cell with the additional PCI is known to the UE.

A cell with the additional PCI is known if the following conditions are met:

- During the last 5 s before L1-RSRP measurement is configured, the UE has sent a valid L3 measurement report for the cell with the additional PCIY
- Timing offset between serving cell and the cell with the additional PCI is within CP of the corresponding SCS, except when UE supports RTD>CP with 2 TAs

Otherwise, the cell with the additional PCI is unknown.

8.22.2 Known conditions for downlink TCI state

The downlink TCI state is known if the conditions in clause 8.15.2 are met.

8.22.3 MAC-CE based downlink TCI state switch delay

If the MAC-CE from two TRPs indicating TCI state switch are not overlapped, requirements specified in clause 8.15.3 are applicable for each target TCI state switch.

The requirements in this clause shall apply for DL TCI state switch using separate DL TCI state or joint TCI state of unified TCI state switch framework.

In case that source RS in DL TCI state or joint TCI state is associated with a PCI different from that of the serving cell, the requirements in this clause shall apply if the cell with different PCI satisfies the known cell condition defined in clause 8.15.1. If the known cell condition is not met, longer delay may be expected.

In case of joint TCI state switch, if the target PL-RS is not maintained, UE is not expected to receive on DL based on the target TCI state before UE completes the DL and UL TCI state switch.

Upon receiving PDSCH carrying MAC-CE activation command in slot n, if the target TCI state is known, the UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$+ OL*T_{SSB}) / *NR slot length*.

Upon receiving PDSCH carrying MAC-CE activation command in slot n, if the target TCI state is unknown, the UE shall be able to receive UE-dedicated PDCCH/PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} +$3N_{slot}^{subframe,\mu}$ + ($T_{L1\text{-}RSRP}$ +TO_{uk}*($T_{first\text{-}SSB}$+ $T_{SSB\text{-}proc}$+ OL*T_{SSB})) / *NR slot length*.

The UE shall be able to receive UE-dedicated PDCCH/PDSCH with the old TCI state until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$.

Where

- T_{HARQ} (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];
- $T_{first\text{-}SSB}$ is the time to the first SSB transmission after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state
- $T_{SSB\text{-}proc}$ = 2 ms;
- TO_k = 0 if the target TCI state have QCL relationship with a RS of a TCI state in the active list of TCI states or if the target TCI state is in the active list of TCI states, otherwise TO_k = 1;
- -- OL = 1 if the first SSB overlaps or is adjacent to the first SSB from the other TRP in FR2 and
  - the SSB periodicity is less than the SSB periodicity of the other TRP, or
  - the SSB periodicity is the same than the SSB periodicity of the other TRP, and the SSB is associated to the TRP with the lowest coresetPoolIndex,

  0, otherwise.
- $T_{L1\text{-}RSRP}$ = 0 in FR1 or when the TCI state switching not involving QCL-TypeD in FR2. Otherwise,
- $T_{L1\text{-}RSRP}$ is the time for Rx beam refinement in FR2, defined as
- $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ for SSB as specified in clause 9.5.4.1, when receive timing difference is within CP,

- with the assumption of M=1
- with T_{Report} = 0

- $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ for CSI-RS as specified in clause 9.5.4.2, when receive timing difference is within CP
  - CSI-RS based L1-RSRP measurement only apply for TCI state switch when source RS is associated with serving cell
  - configured with higher layer parameter *repetition* set to ON
  - with the assumption of M=1 for periodic CSI-RS
  - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*
  - with T_{Report} = 0
- TO_{uk} = 1 for CSI-RS based L1-RSRP measurement, and 0 for SSB based L1-RSRP measurement when TCI state switching involves QCL-TypeD
- TO_{uk} = 1 when TCI state switching involves QCL types other than QCL-TypeD
- $T_{first\text{-}SSB}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;
- $T_{first\text{-}SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE for QCL types other than QCL-TypeD;
  - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

8.22.4 DCI based downlink TCI state switch delay

For DCI based downlink TCI state switch delay in m-DCI mode of operation, the requirements in clause 8.15.4 apply to TCI state associated with each *CORESETpoolIndex*.

8.22.5 Active Downlink TCI state list update delay

The requirements specified in this clause are applicable if

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', and a MAC CE activates more than one target separate TCIs, and at least one DL TCI is included, or
- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', and a MAC CE activates more than one target joint TCI.

If all the target TCI states in the active TCI state list are known, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + TO_k*(T_{first\text{-}SSB_List} + T_{SSB\text{-}proc}) / \textit{NR slot length}.$$

If a subset of the target TCI states in the active TCI state list are unknown, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{L1\text{-}RSRP_list} + TO_{uk}*(T_{first\text{-}SSB} + T_{SSB\text{-}proc})) / \textit{NR slot length}.$$

If all target TCI states in the active TCI state list are unknown, the requirements specified in this clause are not applicable.

Editor's note: FFS how to take into account overlapping MAC-CE based switches from two TRPs where the SSB associated to each TCI state is overlapping or adjacent to each other.

Where

- $T_{L1\text{-}RSRP_List}$ is the longest L1 measurement time ($T_{L1\text{-}RSRP}$) of the source RS among the unknown target TCI states, where $T_{L1\text{-}RSRP}$ is specified in clause 8.22.3

  Editor's note: FFS the L1-RSRP measurement requirement when RTD>CP.

- T_{HARQ}, $T_{first\text{-}SSB}$, $T_{SSB\text{-}proc}$, TO_k, TO_{uk} are defined in clause 8.22.3. T_{SSB} is the SSB periodicity.

When UE receives PDSCH carrying MAC-CE for active TCI state list update, and

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', or
- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', while the target TCI list comprises at least one DL TCIs and at least one UL TCIs,

UE is not expected to receive on DL based on the target TCI state before UE completes the DL and UL TCI state list update.

8.23 Active uplink TCI state switching delay for unified TCI for single-DCI mTRP

8.23.1 Introduction

The requirements in this clause apply for a UE configured with *dl-OrJointTCI-StateList* (if unifiedTCI-StateType is indicated as *Joint*) or *TCI-UL-State* configurations for UL channels/signals on a serving cell. Further the requirements also apply for all the list of serving cells in *simultaneousU-TCI-UpdateList1, simultaneousU-TCI-UpdateList2, simultaneousU-TCI-UpdateList3, simultaneousU-TCI-UpdateList4* in MR-DC or standalone NR. There is no requirement when the UE is requested to switch to a TCI state with the higher layer parameter *TCI-UL-State* associated to SRS. UE shall complete the switch of active uplink TCI state within the delay defined in this clause when the UE is requested to switch to a TCI state with the higher layer parameter *dl-OrJointTCI-StateList* or *TCI-UL-State* associated to a DL RS.

PL-RS may be associated with or included in UL TCI state or joint TCI state. The requirements in this clause shall apply if the following conditions are met:

- PL-RS is identical to source RS in UL TCI state or joint TCI state
- PL-RS and source RS in UL TCI state or joint TCI state are QCL-Type D

8.23.2 Known conditions for uplink TCI state

The uplink TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target uplink TCI state to the completion of active uplink TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target uplink TCI state or QCLed to the target uplink TCI state
  - Uplink TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
  - The UE has sent at least 1 L1-RSRP report for the target uplink TCI state before the uplink TCI state switch command
  - The RS configured in target uplink TCI state remains detectable during the uplink TCI state switching period
    - SNR of the RS configured in target uplink TCI state $\geq$ -3 dB
  - The target uplink TCI state remains detectable during the uplink TCI state switching period
  - The SSB associated with the uplink TCI state remain detectable during the uplink TCI switching period
    - SNR of the uplink TCI state $\geq$ -3 dB

Otherwise, the uplink TCI state is unknown.

8.23.3 MAC-CE based uplink TCI state switch delay

The requirements in this clause shall apply for UL TCI state switch using separate UL TCI state or joint TCI state of unified TCI state switch framework and having two indicated TCI-States.

In case of joint TCI state based dual TCI state switch, UE is not expected to transmit on UL before UE completes the DL and UL TCI state switch of both TRPs.

For separate UL TCI state switch or joint TCI state switch for PUCCH or PUSCH, or semi-persistent/aperiodic/periodic SRS, when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1, upon receiving PDSCH carrying MAC-CE activation command in slot n on serving cell,

If both target TCI states are known,

- The UE shall be able to transmit uplink signal with the target TCI state(s) in the slot $n+T_{HARQ} + 3N_{slot}^{subframe,\mu} + \max\{NM1^* (T_{first_target\text{-}PL\text{-}RS1} + 4^*T_{target_PL\text{-}RS1} + 2\text{ ms}), NM2^* (T_{first_target\text{-}PL\text{-}RS2} + 4^*T_{target_PL\text{-}RS\,2} + 2\text{ ms})\}$/ *NR slot length*.

If both target TCI states are unknown,

- The UE shall be able to transmit uplink signal with the target TCI state(s) in the slot $n+T_{HARQ} + 3N_{slot}^{subframe,\mu} + \max\{T_{L1\text{-}RSRP1} + T_{first_target\text{-}PL\text{-}RS1} + 4^*T_{target_PL\text{-}RS1} + 2\text{ ms}, T_{L1\text{-}RSRP2} + T_{first_target\text{-}PL\text{-}RS2} + 4^*T_{target_PL\text{-}RS\,2} + 2\text{ ms}\}$/ *NR slot length*.

If one of the target TCI states is unknown and the other TCI state is known,

- The UE shall be able to transmit uplink signal with the target TCI state(s) in the slot $n+T_{HARQ} + 3N_{slot}^{subframe,\mu} + \max\{T_{L1\text{-}RSRP1} + T_{first_target\text{-}PL\text{-}RS1} + 4^*T_{target_PL\text{-}RS1} + 2\text{ ms}, NM2^* (T_{first_target\text{-}PL\text{-}RS2} + 4^*T_{target_PL\text{-}RS\,2} + 2\text{ ms})\}$/ *NR slot length*.

Where,

- T_{HARQ} (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].
- NM1 = 1, if the target PL-RS of the first TCI state is not maintained by the UE, 0 otherwise.
- NM2 = 1, if the target PL-RS of the second first TCI is not maintained by the UE, 0 otherwise.

  In FR2, in case that the target PL-RS associated with or included in the target UL or joint TCI state is SSB, the requirements in this clause shall apply when this target PL-RS is maintained by the UE.

- PL-RS is maintained provided:
  - the target PL-RS is associated with or included in the UL or joint TCI states in the active TCI list for PUSCH/PUCCH/SRS transmissions
  - There are no more than 4 different RS activated as PL-RS per serving cell among all active UL TCI states (UL or joint TCI state) for PUSCH/PUCCH/SRS transmissions
  - The target pathloss reference signal remains detectable during TCI state switching period
    - SNR of the target pathloss reference signal≥-3 dB
  - The associated SSBs with the target pathloss reference signal remain detectable during the TCI state switching period.
    - SNR of the associated SSB ≥-3 dB
- $T_{first_target\text{-}PL\text{-}RS1}$ is time to first pathloss RS transmission of the first TCI state after L1-RSRP measurement when first target TCI state is unknown.
- $T_{first_target\text{-}PL\text{-}RS2}$ is time to first pathloss RS transmission of the second TCI state after L1-RSRP measurement when second target TCI state is unknown.
- $T_{first_target\text{-}PL\text{-}RS1}$ is time to first pathloss RS transmission of the first TCI state after MAC CE command is decoded by the UE when the first target TCI state is known.

- $T_{first_target\text{-}PL\text{-}RS2}$ is time to first pathloss RS transmission of the second TCI state after MAC CE command is decoded by the UE when the first seond TCI state is known.

- $T_{target_PL\text{-}RS1}$ is the periodicity of the target pathloss reference signal of the first TCI state which would SSB or NZP CSI-RS when PL-RS is associated with serving cell.

- $T_{target_PL\text{-}RS2}$ is the periodicity of the target pathloss reference signal of the second TCI state which would SSB or NZP CSI-RS when PL-RS is associated with serving cell.

- $T_{L1\text{-}RSRP1}$ and $T_{L1\text{-}RSRP2}$ are the time for Rx beam refinement in FR2 for the first and second TCI state, defined as

  - $T_{L1\text{-}RSPR_Measurement_Period_SSB}$ for SSB as specified in clause 9.5.4.1,

    - with the assumption of M=1

    - with $T_{Report} = 0$

  - $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ for CSI-RS as specified in clause 9.5.4.2

    - CSI-RS based L1-RSRP measurement only apply for TCI state switch when source RS is associated with serving cell

    - configured with higher layer parameter *repetition* set to ON

    - with the assumption of M=1 for periodic CSI-RS

    - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*

    - with $T_{Report} = 0$

The requirements specified in this clause are applicable if no more than 4 different RSs are activated as PL-RS per serving cell among all active UL (or joint) TCI states.

NOTE: In FR2, the requirements when the target PL-RS is not maintained in this clause apply only when PL-RS are not overlapped or adjacent to the PL-RS of the other TRP.

8.23.4 DCI based uplink TCI state switch delay

When a UE is configured with the higher layer parameter with *dl-OrJointTCI-StateList* or *TCI-UL-State*, activated with TCI states for uplink transmission by MAC CE indication of more than one codepoints, and receives DCI format 1_1/1_2 with or without DL assignment providing indicated two TCI-States in the active TCI list for a CC, the UE transmits a PUCCH with HARQ-ACK information corresponding to the DCI carrying the TCI-State indication. Requirements in clause 8.16.4 apply.

8.23.5 Active uplink TCI state list update delay

The requirements specified in this clause are applicable if

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', and a MAC CE activates more than one target separate TCIs, and at least one DL TCI is included, or

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', and a MAC CE activates more than one target joint TCI.

If all the target TCI states in the active TCI state list are known, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + NM * (T_{first_target\text{-}PL\text{-}RS} + 4 * T_{target_PL\text{-}RS} + 2\text{ms}) / \textit{NR slot length}.$$

If a subset of the target TCI states in the active TCI state list are unknown, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{L1\text{-}RSRP_List} + T_{first_target\text{-}PL\text{-}RS} + 4*T_{target_PL\text{-}RS} + 2\text{ms}) / \textit{NR slot length}.$$

If all target TCI states in the active TCI state list are unknown, the requirements specified in this clause are not applicable.

Where

- $T_{L1\text{-}RSRP_List}$ is the longest L1 measurement time ($T_{L1\text{-}RSRP}$) of the source RS among the unknown target TCI states, where $T_{L1\text{-}RSRP}$ is specified in clause 8.23.2

- T_{HARQ}, $T_{first_target\text{-}PL\text{-}RS}$, $T_{target\text{-}PL\text{-}RS}$ are defined in clause 8.23.3.

When UE receives PDSCH carrying MAC-CE for active TCI state list update, and

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', or

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', while the target TCI list comprises at least one DL TCIs and at least one UL TCIs,

UE is not expected to transmit on UL based on the target TCI before UE completes the DL and UL TCI list update.

The requirements in this clause are applicable when the source RS of the active UL TCI state is a DL-RS and this DL-RS is included as one of the source RSs in the DL active TCI list.

8.24 Active uplink TCI state switching delay for unified TCI for multi-DCI mTRP

8.24.1 Introduction

The requirements in this clause apply for a UE configured with *dl-OrJointTCI-StateList* (if unifiedTCI-StateType is indicated as *Joint*) or *TCI-UL-State* configurations for UL channels/signals on a serving cell and when UE is configured two different values of *CORESETPoolIndex* in ControlResourceSet. Further, the requirements apply for a UE not configured with 2 TAs or for a UE configured with 2 TAs in FR1 or for a UE configured with 2 TAs in FR2 if RTD<CP. Further the requirements also apply for all the list of serving cells in *simultaneousU-TCI-UpdateList1, simultaneousU-TCI-UpdateList2, simultaneousU-TCI-UpdateList3, simultaneousU-TCI-UpdateList4* in MR-DC or standalone NR provided all serving cells in the list are configured with the same serving cell and BWP in *unifiedTCI-StateRef-r17*. There is no requirement when the UE is requested to switch to a TCI state with the higher layer parameter *TCI-UL-State* associated to SRS. UE shall complete the switch of active uplink TCI state within the delay defined in this clause when the UE is requested to switch to a TCI state with the higher layer parameter *dl-OrJointTCI-StateList* or *TCI-UL-State* associated to a DL RS. The requirements apply when UE is not expected to receive simultaneously with multi-RX in FR2. The requirements are applicable to each TRP independently.

PL-RS may be associated with or included in UL TCI state or joint TCI state. The requirements in this clause shall apply if either of the following conditions are met:

- PL-RS is identical to source RS in UL TCI state or joint TCI state

- PL-RS and source RS in UL TCI state or joint TCI state are QCL-Type D

When the target UL TCI state refers to an additional PCI different from serving cell PCI in which this UL TCI state is configured, the requirements in this clause are applicable provided that the following conditions are met:

- Active BWP of the serving cell and a cell with the additional PCI are the same

- Center frequency, SCS and SFN offset of a cell with the additional PCI are as the same as serving cell

- The cell with the additional PCI is known to the UE.

A cell with the additional PCI is known if the following conditions are met:

- During the last 5 s before L1-RSRP measurement is configured, the UE has sent a valid L3 measurement report for the cell with the additional PCI

- Timing offset between serving cell and the cell with the additional PCI is within CP of the corresponding SCS, except when UE supports RTD>CP with 2 TAs

- The SSB from the cell with the additional PCI remains detectable according to the cell identification requirements specified in clause 9.2

Otherwise, the cell with the additional PCI is unknown.

8.24.2 Known conditions for uplink TCI state

The uplink TCI state is known if the conditions in clause 8.16.2 are met.

8.24.3 MAC-CE based uplink TCI state switch delay

The requirements in this clause shall apply for UL TCI state switch using separate UL TCI state or joint TCI state of unified TCI state switch framework.

In case that source RS in UL TCI state or joint TCI state is associated with a PCI different from that of the serving cell, the requirements in this clause shall apply if the cell with different PCI satisfies the known cell condition defined in clause 8.24.1. If the known cell condition is not met, longer delay may be expected.

In case of joint TCI state switch, UE is not expected to transmit on UL based on the target TCI state before UE completes the DL and UL TCI state switch.

For separate UL TCI state switch or joint TCI state switch for PUCCH or PUSCH, or semi-persistent/aperiodic/periodic SRS, when *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1, upon receiving PDSCH carrying MAC-CE activation command in slot n on serving cell,

- If target TCI state is known, the UE shall be able to transmit uplink signal with the target TCI state in the slot $n+T_{HARQ} + 3N_{slot}^{subframe,\mu} + NM* (T_{first_target\text{-}PL\text{-}RS} + 4*T_{target_PL\text{-}RS} + 2\ ms) / \textit{NR slot length}$.

- If target TCI state is unknown, the UE shall be able to transmit uplink signal with the target TCI state in the slot $n+T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{L1\text{-}RSRP} + T_{first_target\text{-}PL\text{-}RS} + 4*T_{target_PL\text{-}RS} + 2\ ms) / \textit{NR slot length}$.

The UE shall be able to transmit with the old UL TCI state until slot $n+ T_{HARQ} + 3N_{slot}^{subframe,\mu}$.

Where,

- T_{HARQ} (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].

- NM = 1, if the target PL-RS is not maintained by the UE, 0 otherwise.

In FR2, in case that the target PL-RS associated with or included in the target UL or joint TCI state is SSB, the requirements in this clause shall apply when this target PL-RS is maintained by the UE.

- PL-RS is maintained provided:

  - the target PL-RS is associated with or included in the UL or joint TCI states in the active TCI list for PUSCH/PUCCH/SRS transmissions

  - There are no more than 4 different RS activated as PL-RS per serving cell among all active UL TCI states (UL or joint TCI state) for PUSCH/PUCCH/SRS transmissions

  - The target pathloss reference signal remains detectable during TCI state switching period

  - SNR of the target pathloss reference signal≥-3 dB

  - The associated SSBs with the target pathloss reference signal remain detectable during the TCI state switching period.

    - SNR of the associated SSB ≥-3 dB

- $T_{first_target\text{-}PL\text{-}RS}$ is time to first pathloss RS transmission after L1-RSRP measurement when target TCI state is unknown.

- $T_{first_target\text{-}PL\text{-}RS}$ is time to first pathloss RS transmission after MAC CE command is decoded by the UE for known TCI State.

- $T_{target_PL\text{-}RS}$ is the periodicity of the target pathloss reference signal which would be SSB or NZP CSI-RS when PL-RS is associated with serving cell

- $T_{target_PL\text{-}RS}$ is the periodicity of the target pathloss reference signal which would be SSB when PL-RS is associated with PCI different from serving cell

- $T_{L1\text{-}RSRP}$ is the time for Rx beam refinement in FR2, defined as

  - $T_{L1\text{-}RSPR_Measurement_Period_SSB}$ for SSB as specified in clause 9.5.4.1 or 9.13.4.1, when receive timing difference of the two TRPs is within CP,

    - with the assumption of M=1

    - with $T_{Report} = 0$

  - $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ for CSI-RS as specified in clause 9.5.4.2, when receive timing difference of the two TRPs is within CP,

    - CSI-RS based L1-RSRP measurement only apply for TCI state switch when source RS is associated with serving cell

    - configured with higher layer parameter *repetition* set to ON

    - with the assumption of M=1 for periodic CSI-RS

    - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*

    - with $T_{Report} = 0$

The requirements specified in this clause are applicable if no more than 4 different RSs are activated as PL-RS per serving cell among all active UL (or joint) TCI states. For separate UL TCI state switch the requirements in the clause are not applicable if there is no active DL TCI state with the same coresetPoolIndex as the target UL TCI state.

NOTE: In FR2, the requirements when the target PL-RS is not maintained in this clause apply only when PL-RS are not overlapped or adjacent to the PL-RS of the other TRP.

8.24.4 DCI based uplink TCI state switch delay

For DCI based UL TCI state switch in multi-DCI transmission mode the requirements in clause 8.16.6 apply to TCI state associated with each coresetPoolIndex.

8.24.5 Active Uplink TCI state list update delay

The requirements specified in this clause are applicable if

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', and a MAC CE activates more than one target separate TCIs, and at least one UL TCI is included, or

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', and a MAC CE activates more than one target joint TCI.

If all the target TCI states in the active TCI state list are known, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + NM * (T_{first_target\text{-}PL\text{-}RS_List} + 4 * T_{target_PL\text{-}RS_List} + 2\text{ms}) / \textit{NR slot length}.$$

FFS on additional time tracking of DL Ref RS for 2TA

If a subset of target TCI states in the active TCI state list are unknown, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall have completed the TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{L1\text{-}RSRP_List} + T_{first_target\text{-}PL\text{-}RS_List} + 4*T_{target_PL\text{-}RS_List} + 2\text{ms}) / \textit{NR slot length}.$$

FFS on additional time tracking of DL Ref RS for 2TA

If all target TCI states in the active TCI state list are unknown, the requirements specified in this clause are not applicable.

Where

- If all TCIs are known,
- if the target PL-RS associated with or included in any UL TCI is not maintained, NM = 1; Where maintained PL-RS is defined in clause 8.16.3
- if a subset of target TCI states in the active TCI state list are unknown,
- $T_{L1\text{-}RSRP_List}$ = is the longest L1 measurement time ($T_{L1\text{-}RSRP}$) of the source RS among the unknown target TCI states , where $T_{L1\text{-}RSRP}$ is specified in clause 8.16.3
- Otherwise,
  - $T_{first_target\text{-}PL\text{-}RS_List} = T_{first_target\text{-}PL\text{-}RS_SC}$
  - $T_{target\text{-}PL\text{-}RS_List} = T_{target\text{-}PL\text{-}RS_SC}$.
  - $T_{first_target\text{-}PL\text{-}RS_SC}$ is $T_{first_target\text{-}PL\text{-}RS}$ for serving cell
  - $T_{first_target\text{-}PL\text{-}RS_CDP}$ is $T_{first_target\text{-}PL\text{-}RS}$ for cell with different PCI from serving cell
  - $T_{target\text{-}PL\text{-}RS_SC}$ is $T_{target\text{-}PL\text{-}RS}$ for serving cell
- T_{HARQ}, $T_{first_target\text{-}PL\text{-}RS}$, $T_{target\text{-}PL\text{-}RS}$ are defined in clause 8.16.3.

The requirements specified in this clause do not apply if more than 4 different RSs are activated as PL-RS per serving cell among all active UL (or joint) TCI states.

When UE receives PDSCH carrying MAC-CE for active TCI state list update, and

- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*joint*', or
- higher layer configuration '*unifiedTCI-StateType-r17*' is set to '*separate*', while the target TCI list comprises at least one DL TCIs and at least one UL TCIs,

UE is not expected to transmit on UL based on the target TCI before UE completes the DL and UL TCI list update.

The requirements in this clause are applicable when the source RS of the active UL TCI state is a DL-RS and this DL-RS is included as one of the source RSs in the DL active TCI list.

8.25 TCI state activation for LTM candidate cell

8.25.1 Introduction

The requirements in this clause apply for a UE configured with one or more joint or separate uplink/downlink TCI state configurations on LTM candidate cell. UE shall complete the activation of the target joint or separate uplink/downlink TCI states within the delay defined in this clause after receiving a MAC CE indicating LTM candidate cell TCI state activation before cell switch command as specified in clause 6.1.3.75 of TS 38.321 [7].

The requirements in this clause apply for

- Known downlink TCI state in FR1 and FR2 specified in clause 8.25.2, and
- Unknown downlink TCI state in FR1 specified in clause 8.25.2, provided the following conditions are met:
  - the UE is configured with event-triggered L1 measurement reporting and report on leave, and the UE has sent an event-triggered L1 measurement report with RS associated to the target TCI state and has not sent report on leave for the same RS before receiving the TCI state activation command, or
  - UE has reported L3 measurement result with the associated SSB index of the downlink TCI state within 5 seconds before the LTM TCI state activation command, and

- SNR of the associated SSB is above -3 dB.

8.25.2 Known TCI state conditions

The candidate downlink TCI state in the TCI state activation command is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target downlink TCI state to the completion of TCI state activation, where the RS resource for L1-RSRP measurement is the RS in target downlink TCI state or QCLed to the target downlink TCI state
  - The MAC CE command indicating the activation of the TCI state is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
  - The UE has sent at least 1 valid L1-RSRP report for the target downlink TCI state before the MAC CE command is received.
  - The target downlink TCI state remains detectable during the downlink TCI state activation period
  - The SSB associated with the downlink TCI state remain detectable during the downlink TCI activation period
    - SNR of the downlink TCI state $\geq$ -3 dB

Otherwise, the candidate downlink TCI state is unknown.

8.25.3 SSB based TCI state activation delay

In FR1, when the UE receives LTM candidate cell TCI state activation command at slot n, the UE shall have completed the LTM TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + TO_k*(T_{first\text{-}SSB} + T_{SSB\text{-}proc}) / \textit{NR slot length}.$$

In FR2, when all the target downlink TCI states in the active TCI state list are known, when the UE receives TCI state activation command at slot n, UE shall have completed the LTM TCI state list update in

$$\text{slot } n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + TO_k*(T_{first\text{-}SSB} + T_{SSB\text{-}proc}) / \textit{NR slot length}.$$

Where:

- T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].
- TO_k = 1 if the target TCI state is not in the serving cell active TCI state list or LTM candidate cell active TCI state list, 0 otherwise.
- $T_{first\text{-}SSB}$ is the time to first SSB occasion after slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu}$ when the target SSB is to be measured outside MG, upon receiving PDSCH carrying MAC-CE activation command in slot n;
- $T_{first\text{-}SSB}$ is the time to first SSB occasion overlapping with MGL after slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu}$ + 2 ms if the SSB is to be measured within MG, upon receiving PDSCH carrying MAC-CE activation command in slot n;
- $T_{SSB\text{-}proc}$ = 2 ms.

9 Measurement Procedure

9.1 General measurement requirement

9.1.1 Introduction

This clause contains general requirements on the UE regarding measurement reporting in RRC_CONNECTED state. The requirements are split in intra-frequency, inter-frequency, inter-RAT E-UTRAN FDD, inter-RAT E-UTRAN TDD, and L1-RSRP measurements requirements. These measurements may be used by the NG-RAN. The measurement quantities are defined in TS 38.215 [4], the measurement model is defined in TS 38.300 [10], TS 37.340 [17] and measurement accuracies are specified in clause 10. Control of measurement reporting is specified in TS 38.331 [2].

Unless explicitly stated otherwise, the UE shall perform RRM measurements and meet the corresponding requirements in clause 9 when the UE is provided with IDC solution.

In the requirements of clause 9, the exceptions for side conditions apply as follows:

- for the UE capable of CA but not configured with any SCell, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.1 for UE supporting CA in FR1, and clause B.3.2.3 for UE supporting CA in FR2, respectively;
- for the UE capable of CA and configured with at least one SCell, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.2 for UE configured with CA in FR1, and clause B.3.2.4 for UE supporting CA in FR2, respectively;
- for the UE capable of SUL but not configured with SUL, the applicable exceptions for side conditions are specified in Annex B, clause B.3.4.1 for UE supporting SUL in FR1;
- for the UE capable of SUL and configured with at least one SUL, the applicable exceptions for side conditions are specified in Annex B, clause B.3.4.2 for UE configured with SUL in FR1.

The SSB and SMTC in this clause apply for both CD-SSB and NCD-SSB if the UE supports *ncd-SSB-BWP-Wor-r18*.

9.1.2 Measurement gap

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE does not support independent measurement gap patterns for different frequency ranges as specified in table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply the network must provide a single per-UE measurement gap pattern for concurrent monitoring of all frequency layers.

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports independent measurement gap patterns for different frequency ranges as specified in table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply the network must provide either per-FR measurement gap patterns for frequency range where UE requires per-FR measurement gap for concurrent monitoring of all frequency layers of each frequency range independently, or a single per-UE measurement gap pattern for concurrent monitoring of all frequency layers of all frequency ranges.

If the UE is configured via LPP [34] to measure PRS for any RSTD, PRS-RSRP, UE Rx-Tx time difference measurement, PRS-RSRPP measurement, RSCP and RSCPD measurement defined in TS 38.215 [4], in order for the requirements in clauses 9.9.2, 9.9.3, 9.9.4, 9.9.6, 9.9.7 and 9.9.8 to apply, the network must provide

- a single per-UE measurement gap pattern for concurrent monitoring of all positioning frequency layers and intra-frequency, inter-frequency and/or inter-RAT frequency layers of all frequency ranges, or
- if UE supports independent measurement gap patterns for different frequency ranges for PRS measurement, i.e. supporting *independentGapConfigPRS-r17*, per-FR measurement gap pattern for the frequency range for concurrent monitoring of all positioning frequency layers and intra-frequency, inter-frequency cells and/or inter-RAT frequency layers in the corresponding frequency range.

During the per-UE measurement gaps the UE:

- is not required to conduct reception/transmission from/to the corresponding E-UTRAN PCell, E-UTRAN SCell(s) and NR serving cells for E-UTRA-NR dual connectivity except the reception of signals used for RRM measurement(s) and the signals used for random access procedure according to TS 38.321 [7].

- is not required to conduct reception/transmission from/to the corresponding NR serving cells for SA (with single carrier or CA configured) except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to [7].

- is not required to conduct reception/transmission from/to the corresponding PCell, SCell(s) and E-UTRAN serving cells for NR-E-UTRA dual connectivity except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to [7].

- is not required to conduct reception/transmission from/to the corresponding NR serving cells for NR-DC except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to [7].

During the per-FR measurement gaps the UE:

- is not required to conduct reception/transmission from/to the corresponding E-UTRAN PCell, E-UTRAN SCell(s) and NR serving cells in the corresponding frequency range for E-UTRA-NR dual connectivity except the reception of signals used for RRM measurement(s) and the signals used for random access procedure according to TS 38.321 [7].

- is not required to conduct reception/transmission from/to the corresponding NR serving cells in the corresponding frequency range for SA (with single carrier or CA configured) except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to TS 38.321 [7].

- is not required to conduct reception/transmission from/to the corresponding PCell, SCell(s) and E-UTRAN serving cells in the corresponding frequency range for NR-E-UTRA dual connectivity except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to TS 38.321 [7].

- is not required to conduct reception/transmission from/to the corresponding NR serving cells in the corresponding frequency range for NR-DC except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to TS 38.321 [7].

UEs shall support the measurement gap patterns listed in table 9.1.2-1 based on the applicability specified in tables 9.1.2-2 and 9.1.2-3. UE determines measurement gap timing based on gap offset configuration and measurement gap timing advance configuration provided by higher layer signalling as specified in TS 38.331 [2] and TS 36.331 [16].

Table 9.1.2-1: Gap Pattern Configurations

Gap Pattern Id	Measurement Gap Length (MGL, ms)	Measurement Gap Repetition Period (MGRP, ms)
0	6	40
1	6	80
2	3	40
3	3	80
4	6	20
5	6	160
6	4	20
7	4	40
8	4	80
9	4	160
10	3	20
11	3	160
12	5.5	20
13	5.5	40
14	5.5	80
15	5.5	160
16	3.5	20
17	3.5	40

18	3.5	80
19	3.5	160
20	1.5	20
21	1.5	40
22	1.5	80
23	1.5	160
24	10	80
25	20	160

Table 9.1.2-2: Applicability for Gap Pattern Configurations supported by the E-UTRA-NR dual connectivity UE or NR-E-UTRA dual connectivity UE

Measurement gap pattern configuration	Serving cell	Measurement Purpose[Note 5]	Applicable Gap Pattern Id
Per-UE Measurement gap	E-UTRA + FR1, or E-UTRA + FR2, or E-UTRA + FR1 + FR2	non-NR RAT [Note1,2]	0,1,2,3
		FR1 and/or FR2 [Note 6,7]	0-11, 24, 25
		non-NR RAT[Note1,2] and FR1 and/or FR2 [Note 6,7]	0, 1, 2, 3, 4, 6, 7, 8,10, 24
Per-FR measurement gap	E-UTRA and, FR1 if configured	non-NR RAT [Note1,2]	0,1,2,3
	FR2 if configured		No gap
	E-UTRA and, FR1 if configured	FR1 only [Note 6,7]	0-11,24,25
	FR2 if configured		No gap
	E-UTRA and, FR1 if configured	FR2 only [Note 6,7]	No gap
	FR2 if configured		12-25
	E-UTRA and, FR1 if configured	non-NR RAT [Note1,2] and FR1 [Note 6,7]	0, 1, 2, 3, 4, 6, 7, 8,10,24
	FR2 if configured		No gap
	E-UTRA and, FR1 if configured	FR1 and FR2 [Note 6,7]	0-11,24,25
	FR2 if configured		12-25
	E-UTRA and, FR1 if configured	non-NR RAT [Note1,2] and FR2 [Note 6,7]	0, 1, 2, 3, 4, 6, 7, 8,10,24
	FR2 if configured		12-25
	E-UTRA and, FR1 if configured	Non-NR RAT [Note1,2] and FR1 and FR2 [Note 6,7]	0, 1, 2, 3, 4, 6, 7, 8,10,24
	FR2 if configured		12-25

NOTE: In E-UTRA-NR dual connectivity mode, if GSM or UTRA TDD or UTRA FDD inter-RAT frequency layer is configured to be monitored, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap. In NR-E-UTRA dual connectivity mode, if UTRA FDD inter-RAT frequency layer is configured to be monitored for SRVCC, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap.

NOTE 1: In E-UTRA-NR dual connectivity mode, non-NR RAT includes E-UTRA, UTRA and/or GSM. In NR-E-UTRA dual connectivity mode, non-NR RAT means E-UTRA, and UTRA for SRVCC.

NOTE 2: Void

NOTE 3: When E-UTRA inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern #0 can be used.

NOTE 4: For UE supporting *supportedGapPattern-NRonly-NEDC* or *measGapPatterns-NRonly-ENDC-r16* but not supporting *supportedGapPattern* for the corresponding gap patterns among GP2-11, the corresponding gap patterns are not applicable to measurement of non-NR RATs as defined in NOTE 1.

NOTE 5: Inclusion of positioning measurements: Measurement purpose which includes E-UTRA measurements includes also E-UTRA RSRP and E-UTRA RSRQ measurements for E-CID.

NOTE 6: Measurement gap patterns #24 and #25 can be requested [2] only when the UE is configured at least with any of RSTD, UE Rx-Tx, PRS-RSRP, PRS-RSRPP, RSCP or RSCPD measurements requiring such gaps and can only be used during the corresponding positioning measurement period

NOTE 7: Inclusion of positioning measurements for measurement gaps: Measurement purpose which includes any of FR1 and FR2 measurements includes also RSTD, UE Rx-Tx, PRS-RSRP, PRS-RSRPP, RSCP and RSCPD measurements.

In E-UTRA-NR dual connectivity mode,

- if per-UE measurement gap is configured with MG timing advance of T_{MG} ms, the measurement gap starts at time T_{MG} ms advanced to the end of the latest E-UTRA subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- if per-FR measurement gap for FR1 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR1 starts at time T_{MG} ms advanced to the end of the latest E-UTRA subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- if per-FR measurement gap for FR2 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR2 starts at time T_{MG} ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among SCG serving cells subframes in FR2.

In NR-E-UTRA dual connectivity mode,

- if per-UE measurement gap is configured with MG timing advance of T_{MG} ms, the measurement gap starts at time T_{MG} ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- if per-FR measurement gap for FR1 is configured with MG timing advance of T_{MG} ms and UE has NR serving cell in FR1, the measurement gap for FR1 starts at time T_{MG} ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among MCG serving cells subframes in FR1.

- if per-FR measurement gap for FR1 is configured with MG timing advance of T_{MG} ms and UE does not have NR serving cell in FR1, the measurement gap for FR1 starts at time T_{MG} ms advanced to the end of the latest E-UTRA subframe occurring immediately before the configured measurement gap among SCG serving cells subframes.

- if per-FR measurement gap for FR2 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR2 starts at time T_{MG} ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among MCG serving cells subframes in FR2.

In NR-NR dual connectivity mode,

- If per-UE measurement gap is configured with MG timing advance of T_{MG} ms, the measurement gap starts at time T_{MG} ms advanced to the end of the latest MCG subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- If per-FR measurement gap for FR1 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR1 starts at time T_{MG} ms advanced to the end of the latest MCG subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- If per-FR measurement gap for FR2 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR2 starts at time T_{MG} ms advanced to the end of the latest SCG subframe occurring immediately before the configured measurement gap among SCG serving cells subframes in FR2.

T_{MG} is the MG timing advance value provided in *mgta* according to TS 38.331 [2].

In determining the measurement gap starting point, UE shall use the DL timing of the latest E-UTRA or NR subframe occurring immediately before the configured measurement gap among E-UTRA or NR serving cells.

For per-FR measurement gap capable UE configured with E-UTRA-NR dual connectivity or NR-E-UTRA dual connectivity, when serving cells are in E-UTRA and FR1, measurement objects are in both E-UTRA/FR1 and FR2,

- If MN indicates UE that the measurement gap from MN applies to E-UTRA/FR1/FR2 serving cells, UE fulfils the per-UE measurement requirements for both E-UTRA/FR1 and FR2 measurement objects based on the measurement gap pattern configured by MN;

- If MN indicates UE that the measurement gap from MN applies to only LTE/FR1 serving cell(s),

  - UE fulfils the measurement requirements for FR1/LTE measurement objects based on the configured measurement gap pattern;

  - UE fulfils the requirements for FR2 measurement objects based on effective MGRP=20 ms;

For per-FR measurement gap capable UE configured with E-UTRA-NR dual connectivity, NR-E-UTRA dual connectivity or NR-NR dual connectivity, when serving cells are in E-UTRA, FR1 and FR2, or in E-UTRA and FR2, or in FR1 and FR2, measurement objects are in both E-UTRA /FR1 and FR2,

- If MN indicates UE that the measurement gap from MN applies to E-UTRA/FR1/FR2 serving cells, UE fulfils the per-UE measurement requirements for both E-UTRA/FR1 and FR2 measurement objects based on the measurement gap pattern configured by MN.

Table 9.1.2-3: Applicability for Gap Pattern Configurations supported by the UE with NR standalone operation (with single carrier, NR CA and NR-DC configuration)

Measurement gap pattern configuration	Serving cell	Measurement Purpose NOTE 2	Applicable Gap Pattern Id
Per-UE measurement gap	FR1 NOTE5, or FR1 + FR2	non-NR RAT NOTE3,6	0,1,2,3
		FR1 and/or FR2 NOTE 8,9	0-11, 24, 25
		non-NR RAT and FR1 and/or FR2 NOTE3,6,8,9	0, 1, 2, 3, 4, 6, 7, 8,10, 24
	FR2 NOTE5	non-NR RAT only NOTE3,6	0,1,2,3
		FR1 only NOTE 8.9	0-11, 24, 25
		FR1 and FR2 NOTE 8,9	0-11, 24, 25
		non-NR RAT and FR1 and/or FR2 NOTE3,6,8,9	0, 1, 2, 3, 4, 6, 7, 8,10, 24
		FR2 only NOTE 8,9	12-25
Per-FR measurement gap	FR1 if configured	non-NR RAT only NOTE3,6	0,1,2,3
	FR2 if configured		No gap
	FR1 if configured	FR1 only NOTE 8.9	0-11,24,25
	FR2 if configured		No gap
	FR1 if configured	FR2 only NOTE 8.9	No gap
	FR2 if configured		12-25
	FR1 if configured	non-NR RAT and FR1 NOTE3,6,8,9	0, 1, 2, 3, 4, 6, 7, 8,10,24
	FR2 if configured		No gap
	FR1 if configured	FR1 and FR2 NOTE 8.9	0-11, 24,25
	FR2 if configured		12-25
	FR1 if configured	non-NR RAT and FR2 NOTE3,6,8,9	0, 1, 2, 3, 4, 6, 7, 8,10,24
	FR2 if configured		12-25
	FR1 if configured	non-NR RAT and FR1 and FR2 NOTE3,6,8,9	0, 1, 2, 3, 4, 6, 7, 8,10,24
	FR2 if configured		12-25

Measurement gap pattern configuration	Serving cell	Measurement Purpose NOTE 2	Applicable Gap Pattern Id

NOTE 1: When E-UTRA inter-RAT RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern #0 can be used.

NOTE 2: Measurement purpose which includes E-UTRA measurements includes also inter-RAT E-UTRA RSRP and RSRQ measurements for E-CID; measurement purpose which includes E-UTRA measurements includes also E-UTRA RSRP and E-UTRA RSRQ measurements for E-CID.

NOTE 3: Void

NOTE4: If per-UE measurement gap is configured with MG timing advance of T_{MG} ms, the measurement gap starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among all serving cells subframes.
If per-FR measurement gap for FR1 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR1 starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR1.
If per-FR measurement gap for FR2 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR2 starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR2.
T_{MG} is the MG timing advance value provided in *mgta* according to [2].
In determining the measurement gap starting point, UE shall use the DL timing of the latest subframe occurring immediately before the configured measurement gap among serving cells.

NOTE 5: NR-DC in Rel-15 only includes the scenarios where all serving cells in MCG in FR1 and all serving cells in SCG in FR2.

NOTE 6: In NR single carrier, NR CA, and NR-DC mode, non-NR RAT means E-UTRA, and UTRA for SRVCC. In NR single carrier, NR CA, and NR-DC mode, if UTRA FDD inter-RAT frequency layer is configured to be monitored for SRVCC, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap.

NOTE 7: For UE only supporting *supportedGapPattern-NRonly* for any gap patterns among GP2-11, the corresponding gap patterns are not applicable to measurement of non-NR RATs as defined in NOTE 6.

NOTE 8: Measurement gap patterns #24 and #25 can be requested [2] only when the UE is configured with any of RSTD, UE Rx-Tx time difference, PRS-RSRP, PRS-RSRPP, RSCP or RSCPD measurements requiring such gaps and can only be used during the corresponding positioning measurement period.

NOTE 9: Inclusion of positioning measurements for measurement gaps: Measurement purpose which includes any of FR1 and FR2 measurements includes also RSTD, UE Rx-Tx time difference, PRS-RSRP, PRS-RSRPP , RSCP and RSCPD measurements.

For per-FR measurement gap capable UE in NR standalone operation (with single carrier, NR CA and NR-DC configuration), for per-FR gap based measurement, when there is no serving cell in a particular FR, where measurement objects are configured, regardless if explicit per-FR measurement gap is configured in this FR, the effective MGRP in this FR is used to determine requirements;

- 20 ms for FR2 NR measurements
- 40 ms for FR1 NR measurements
- 40 ms for LTE measurements
- 40 ms for FR1+LTE measurements

For per-FR measurement gap capable UE in NR standalone operation (with single carrier, NR CA and NR-DC configuration), when serving cells are in FR1 or FR2, measurement objects are in both E-UTRA /FR1 and FR2,

- If MN indicates UE that the measurement gap from MN applies to E-UTRA/FR1/FR2 serving cells, UE fulfils the per-UE measurement requirements for both E-UTRA/FR1 and FR2 measurement objects based on the measurement gap pattern configured by MN;

If measurement gap is configured in one FR but measurement object is not configured in the FR, the scheduling opportunity in the FR depends on the configured measurement gap pattern.

For single carrier or CA with aligned frame boundaries,

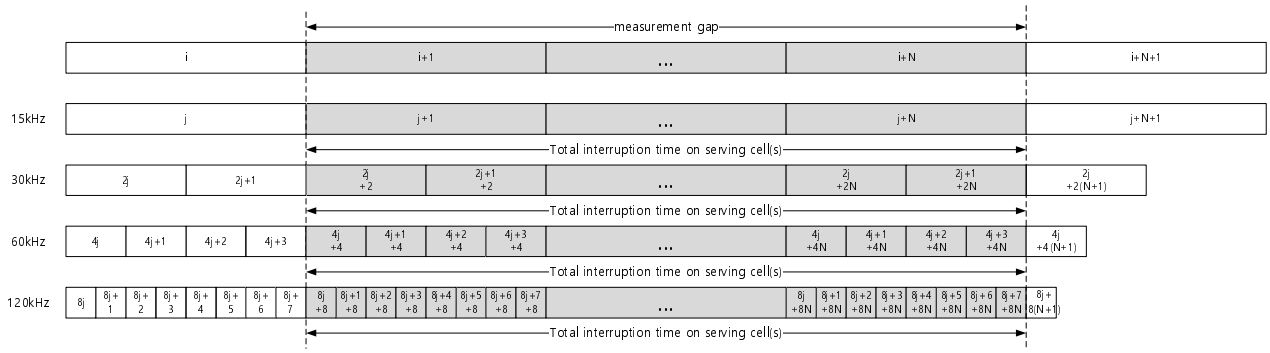
> For E-UTRA-NR dual connectivity (with NR single carrier, NR CA configuration), if UE is not capable of per-FR-gap, total interruption time on SCG during MGL is defined only when MGL(N) = 20 ms, 10 ms, 6 ms, 4 ms and 3 ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cells in SCG during MGL is defined only when MGL(N) = 20 ms, 10 ms, 6 ms, 4 ms and 3 ms, and total interruption time on FR2 serving cells in SCG during MGL is defined only when MGL(N) = 20 ms, 10 ms, 5.5 ms, 3.5 ms and 1.5 ms.

For NR standalone operation (with single carrier, NR CA and NR-DC configuration), if UE is not capable of per-FR-gap, total interruption time on a serving cell during MGL is defined when MGL(N) = 20 ms, 10 ms, 6 ms, 5.5 ms, 4 ms, 3.5 ms, 3 ms, and 1.5 ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cells during MGL is defined only when MGL(N) = 20 ms, 10 ms, 6 ms, 4 ms, and 3 ms, and total interruption time on FR2 serving cells during MGL is defined only when MGL(N) = 20 ms, 10 ms, 5.5 ms, 3.5 ms, and 1.5 ms.

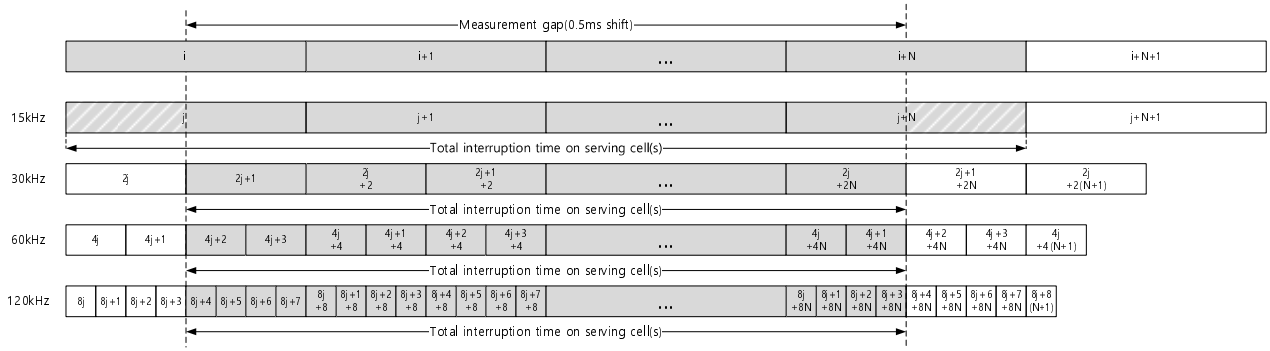
For NR-E-UTRA dual connectivity (with NR single carrier, NR CA configuration), if UE is not capable of per-FR-gap, total interruption time on MCG during MGL is defined only when MGL(N) = 20 ms, 10 ms, 6 ms, 4 ms, and 3 ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cells in MCG during MGL is defined only when MGL(N) = 20 ms, 10 ms, 6 ms, 4 ms, and 3 ms, and total interruption time on FR2 serving cells in MCG during MGL is defined only when MGL(N) = 20 ms, 10 ms, 5.5 ms, 3.5 ms, and 1.5 ms.

For CA with non-aligned frame boundaries,

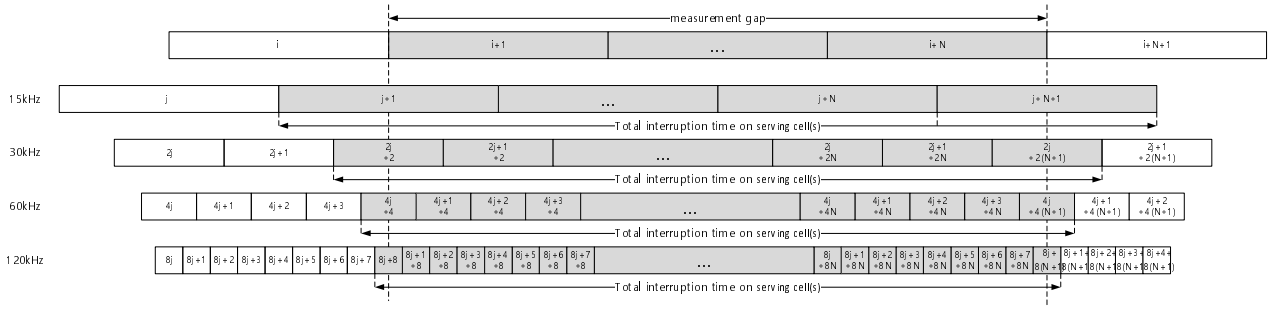
- The total interruption time on an SCC is the same as the case CA with aligned frame boundaries, if no SCC slots are partially overlapped with the measurement gap.
- The total interruption time on an SCC will be additionally extended by one SCC slot, if there exist SCC slots partially overlapped with the measurement gap.



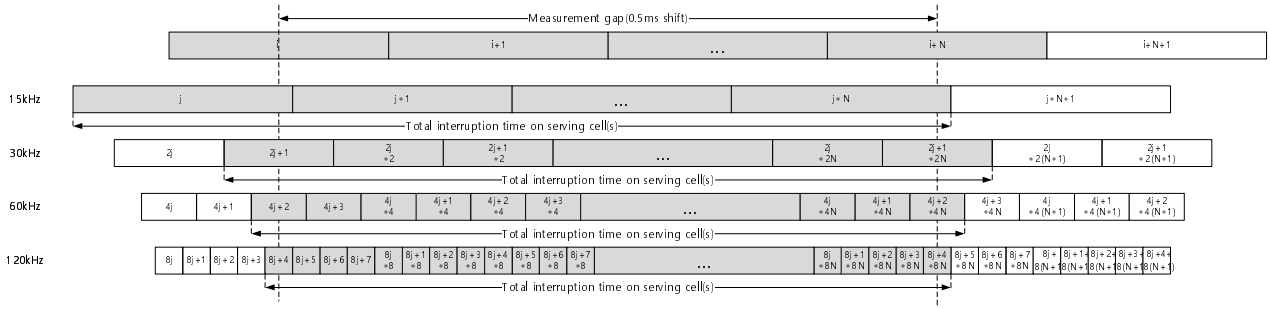
(a) Measurement gap with MGL = N(ms) with MG timing advance of 0 ms for all serving cells in synchronous EN-DC, NR standalone operation (with single carrier, NR CA and synchronous NR-DC configuration) and synchronous NE-DC, and for serving cells in MCG in NR standalone operation (with asynchronous NR-DC configuration)



(b) Measurement gap with MGL = N(ms) with MG timing advance of 0.5 ms for all serving cells in synchronous EN-DC, NR standalone operation (with single carrier, NR CA and synchronous NR-DC configuration) and synchronous NE-DC, and for serving cells in MCG in NR standalone operation (with asynchronous NR-DC configuration)



(c) Measurement gap with MGL = N(ms) with MG timing advance of 0 ms for all serving cells in asynchronous EN-DC and asynchronous NE-DC, and for serving cells in SCG in NR standalone operation (with asynchronous NR-DC configuration)



(d) Measurement gap with MGL = N(ms) with MG timing advance of 0.5 ms for all serving cells in asynchronous EN-DC and asynchronous NE-DC, and for serving cells in SCG in NR standalone operation (with asynchronous NR-DC configuration)

Figure 9.1.2-1: Measurement GAP and total interruption time on serving cells for EN-DC, NR standalone operation (with single carrier, NR CA and NR-DC configuration) and NE-DC

The corresponding total number of interrupted slots on serving cells is listed in table 9.1.2-4 for all serving cells in synchronous EN-DC, NR standalone (with single carrier, NR CA and synchronous NR-DC configuration) and NE-DC, and for serving cells in MCG in NR standalone operation (with asynchronous NR-DC configuration). The corresponding total number of interrupted slots on serving cells is listed in table 9.1.2-4a for asynchronous EN-DC, and for serving cells in SCG in NR standalone operation (with asynchronous NR-DC configuration).

Table 9.1.2-4: Total number of interrupted slots on all serving cells during MGL for Synchronous EN-DC, NR standalone operation (with single carrier, NR CA and synchronous NR-DC configuration) and NE-DC, and on all serving cells in MCG for NR standalone operation (with asynchronous NR-DC configuration) with per-UE measurement gap or per-FR measurement gap for FR1

NR SCS (kHz)	Total number of interrupted slots on serving cells									
	When MG timing advance of 0 ms is applied					When MG timing advance of 0.5 ms is applied				
	MGL=20 ms	MGL=10 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms	MGL=20 ms	MGL=10 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms
15	20	10	6	4	3	21[Note3]	11[Note3]	7[Note3]	5[Note3]	4[Note3]
30	40	20	12	8	6	40	20	12	8	6
60	80	40	24	16	12	80	40	24	16	12
120	160	80	48	32	24	160	80	48	32	24
480 Note4	640	320	192	128	96	640	320	192	128	96
480 Note5	641	321	193	129	97	641	321	193	129	97
960 Note4	1280	640	384	256	192	1280	640	384	256	192
960 Note5	1281	641	385	257	193	1281	641	385	257	193
NOTE 1: Void NOTE 2: NR SCSs of 120 kHz, 480 kHz and 960 kHz are only applicable to the case with per-UE measurement gap.										

NOTE 3: Non-overlapped half-slots occur before and after the measurement gap. Whether a Rel-15 UE can receive and/or transmit in those half-slots is up to UE implementation.
NOTE 4: For NR SCSs of 480 kHz and 960 kHz, total number of interrupted slots on all serving cells during MGL for single carrier, intra-band NR CA with per-UE measurement gap.
NOTE 5: For NR SCSs of 480 kHz and 960 kHz, total number of interrupted slots on all serving cells in SCG for inter-band NR-CA and synchronous NR-DC with per-UE measurement gap.

Table 9.1.2-4a: Total number of interrupted slots on serving cells during MGL for Asynchronous EN-DC, and on all serving cells in SCG for NR standalone operation (with asynchronous NR-DC configuration) with per-UE measurement gap or per-FR measurement gap for FR1

NR SCS (kHz)	Total number of interrupted slots on serving cells									
	When MG timing advance of 0 ms is applied					When MG timing advance of 0.5 ms is applied				
	MGL=20 ms	MGL=10 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms	MGL=20 ms	MGL=10 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms
15	21	11	7	5	4	21	11	7	5	4
30	41	21	13	9	7	41	21	13	9	7
60	81	41	25	17	13	81	41	25	17	13
120	161	81	49	33	25	161	81	49	33	25
480 Note3	641	321	193	129	97	641	321	193	129	97
960 Note3	1281	641	385	257	193	1281	641	385	257	193

NOTE 1: Void
NOTE 2: NR SCSs of 120 kHz, 480 kHz and 960 kHz are only applicable to the case with per-UE measurement gap.
NOTE 3: For NR SCSs of 480 kHz and 960 kHz, total number of interrupted slots on all serving cells in SCG for asynchronous NR-DC with per-UE measurement gap.

In case that UE capable of per-FR measurement gap is configured with per-FR measurement gap for FR2 serving cells, total number of interrupted slots on FR2 serving cells during MGL is listed in table 9.1.2-4b.

Table 9.1.2-4b: Total number of interrupted slots on FR2 serving cells during MGL for EN-DC, NR standalone operation (with single carrier, NR CA and NR-DC configuration) and NE-DC with per-UE measurement gap or per-FR measurement gap for FR2

NR SCS (kHz)	Total number of interrupted slots on FR2 serving cells									
	When MG timing advance of 0 ms is applied					When MG timing advance of 0.25 ms is applied				
	MGL= 20 ms	MGL= 10 ms	MGL= 5.5 ms	MGL= 3.5 ms	MGL= 1.5 ms	MGL= 20 ms	MGL= 10 ms	MGL= 5.5 ms	MGL= 3.5 ms	MGL= 1.5 ms
60	80	40	22	14	6	80	40	22	14	6
120	160	80	44	28	12	160	80	44	28	12
480 Note3	640	320	176	112	48	640	320	176	112	48
960 Note3	1280	640	352	224	96	1280	640	352	224	96

NOTE 1: The total number of interrupted slots is based on that SFN and subframe reference for per-FR gap in FR2 indicated by high layer parameter *refServCellIndicator* is an FR2 serving cell.
NOTE 2: Slot occurs before or after the measurement gap may be interrupted additionally if SFN and subframe reference for per-FR gap in FR2 indicated by high layer parameter refServCellIndicator is an FR1 serving cell.
NOTE 3: For NR SCSs of 480 kHz and 960 kHz, total number of interrupted slots on FR2-2 serving cells during MGL for NR standalone operation (single carrier, NR CA and NR-DC) with per-UE measurement gap or per-FR measurement gap for FR2-2.
NOTE 4: If UE is configured with per-UE measurement gap, the MG timing advance of 0.25 is applicable only for FR2 NR SA (with both single carrier and NR CA configuration).

It is up to UE implementation whether or not the UE is able to conduct transmission in the following slot(s),

- when MGTA is not applied, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after measurement gap

- when MGTA is applied and the SCS of the UL carrier is other than 15 kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after measurement gap
- when MGTA is applied and the SCS of the UL carrier is 15 kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the slot partially overlapped with measurement gap

where UL slot denotes that all the symbols in the slot are uplink symbols, and L=1 if $(N_{TA} + N_{TA\ offset}) \times T_c$ for the UL transmission is less than the length of one slot; L=2 otherwise.

Note: Network is supposed to take into account the possible difference between the estimated TA at network and actual TA at UE when scheduling UE in the above slot(s).

Table 9.1.2-5: (Void)

If a positioning measurement gap is configured via *PosGapConfig* and activated by MAC CE, the measurement requirements do not apply for RRM measurement that requires measurement gaps.

9.1.2.1 EN-DC: Measurement Gap Sharing

For E-UTRA-NR dual connectivity UE configured with per-UE measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on intra-frequency carriers for both SSB and CSI-RS based L3 measurement or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-UE measurement gaps, E-UTRA gap-needed inter-frequency carriers and inter-RAT UTRAN carriers and/or inter-RAT GSM carriers.

For E-UTRA-NR dual connectivity UE configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR1 intra-frequency carriers or when SMTC configured for FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR1 inter-frequency carriers for both SSB and CSI-RS based L3 measurement or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-FR1 measurement gaps, E-UTRA gap-needed inter-frequency carriers, inter-RAT UTRAN carriers and/or inter-RAT GSM carriers.

For E-UTRA-NR dual connectivity UE configured with per-FR2 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR2 intra-frequency carriers or when SMTC configured for FR2 intra-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR2 inter-frequency carriers for both SSB and CSI-RS based L3 measurement, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-FR2 measurement gaps.

When network signals “01”, “10” or “11” with RRC parameter *MeasGapSharingScheme* [2][16]and the value of X is defined as in table 9.1.2.1-1, and

- $K_{intra} = 1 / X * 100$,
- $K_{inter} = 1 / (100 – X) * 100$,

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1.5.2.1.

Table 9.1.2.1-1: Value of parameter X for EN-DC measurement gap sharing

measGapSharingScheme	**Value of X (%)**
‘00’	Equal splitting
‘01’	25
‘10’	50
‘11’	75

NOTE: It is left to UE implementation to determine which measurement gap sharing scheme in the table to be applied, when *MeasGapSharingScheme* is absent and there is no stored value in the field.

9.1.2.1a SA: Measurement Gap Sharing

For NR standalone UE without NR-DC operation and configured with per-UE measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on intra-frequency carriers or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers for both SSB and CSI-RS based L3 measurement, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-UE measurement gaps, and/or inter-RAT E-UTRAN carriers, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers.

For NR standalone UE without NR-DC operation and configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR1 intra-frequency carriers or when SMTC configured for FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR1 inter-frequency carriers for both SSB and CSI-RS based L3 measurement and/or inter-RAT E-UTRAN carriers, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-FR1 measurement gaps, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers in FR1.

For NR standalone UE without NR-DC operation and configured with per-FR2 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR2 intra-frequency carriers or when SMTC configured for FR2 intra-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR2 inter-frequency carriers for both SSB and CSI-RS based L3 measurement, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-FR2 measurement gaps, and when UE is configured to measure positioning frequency layers in FR2.

When network signals “01”, “10” or “11” with RRC parameter *MeasGapSharingScheme* [2] and the value of X is defined as in table 9.1.2.1a-1, and

- $K_{intra} = 1 / X * 100$,
- $K_{inter} = 1 / (100 – X) * 100$,

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1.5.2.2.

Table 9.1.2.1a-1: Value of parameter X for NR standalone measurement gap sharing

measGapSharingScheme	**Value of X (%)**
‘00’	Equal splitting
‘01’	25
‘10’	50
‘11’	75
NOTE: It is left to UE implementation to determine which measurement gap sharing scheme in the table to be applied, when *MeasGapSharingScheme* is absent and there is no stored value in the field.	

9.1.2.1b NE-DC: Measurement Gap Sharing

For NR-E-UTRA dual connectivity UE configured with per-UE measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on intra-frequency carriers or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers, E-UTRA gap-needed inter-frequency carriers for both SSB and CSI-RS based L3 measurement, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-UE measurement gaps,

and/or inter-RAT E-UTRA carriers, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers.

For NR-E-UTRA dual connectivity UE configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR1 intra-frequency carriers or when SMTC configured for FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers for both SSB and CSI-RS based L3 measurement, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-FR1 measurement gaps, E-UTRA gap-needed inter-frequency carriers, and/or inter-RAT E-UTRA carriers, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers in FR1.

For NR-E-UTRA dual connectivity UE configured with per-FR2 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR2 intra-frequency carriers or when SMTC configured for FR2 intra-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR2 inter-frequency carriers for both SSB and CSI-RS based L3 measurement, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-FR2 measurement gaps, and when UE is configured to measure positioning frequency layers in FR2.

When network signals “01”, “10” or “11” with RRC parameter *measGapSharingConfig* [2][16] and the value of X is defined as in table 9.1.2.1b-1, and

- $K_{intra} = 1 / X * 100$,
- $K_{inter} = 1 / (100 – X) * 100$,

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1.5.2.3.

Table 9.1.2.1b-1: Value of parameter X for NE-DC measurement gap sharing

measGapSharingScheme	**Value of X (%)**
‘00’	Equal splitting
‘01’	25
‘10’	50
‘11’	75
NOTE: It is left to UE implementation to determine which measurement gap sharing scheme in the table to be applied, when *MeasGapSharingScheme* is absent and there is no stored value in the field.	

9.1.2.1c NR-DC: Measurement Gap Sharing

For UE with NR-DC operation and configured with per-UE measurement gap, measurement gap sharing shall be applies when UE required measurement gaps to identify and measure cells on intra-frequency carriers or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers for both SSB and CSI-RS based L3 measurement, and/or inter-RAT E-UTRAN carriers, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-UE measurement gaps, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers.

For UE with NR-DC operation and configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR1 intra-frequency carriers or when SMTC configured for FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR1 inter-frequency carriers for both SSB and CSI-RS based L3 measurement and/or inter-RAT E-UTRAN carriers, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-FR1 measurement gaps, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers in FR1.

For UE with NR-DC operation and configured with per-FR2 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR2 intra-frequency carriers or when SMTC configured for FR2 intra-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR2 inter-frequency carriers for both SSB and CSI-RS based L3 measurement, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-FR2 measurement gaps, and when UE is configured to measure positioning frequency layers in FR2.

When network signals “01”, “10” or “11” with RRC parameter *measGapSharingConfig* [2] and the value of X is defined as in table 9.1.2.1c-1, and

- $K_{intra} = 1 / X * 100$,
- $K_{inter} = 1 / (100 – X) * 100$,

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1.5.2.4.

Table 9.1.2.1c-1: Value of parameter X for NR-DC measurement gap sharing

measGapSharingConfig	**Value of X (%)**
‘00’	Equal splitting
‘01’	25
‘10’	50
‘11’	75
NOTE: It is left to UE implementation to determine which measurement gap sharing scheme in the table to be applied, when *MeasGapSharingScheme* is absent and there is no stored value in the field.	

9.1.3 UE Measurement capability

9.1.3.1 EN-DC: Monitoring of multiple layers using gaps

The requirements in this clause are applicable for UE capable of and configured with the EN-DC operation mode.

When monitoring of multiple inter-frequency E-UTRAN, inter-RAT NR, GSM, UTRA FDD and UTRA TDD carriers as configured by E-UTRA PCell, and inter-frequency NR carriers (with or without CCA) as configured by PSCell using gaps (or without using gaps provided the UE supports such capability or the effective MGRP is applied for per-FR measurement gap capable UE) is configured, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, CSI-SINR, SFTD, E-UTRAN RSRP, E-UTRAN RSRQ, E-UTRAN RS-SINR measurements, UTRAN TDD P-CCPCH RSCP, UTRAN FDD CPICH measurements, GSM carrier RSSI, etc.) of detected cells on all the layers.

For UE configured with the EN-DC operation, the effective total number of frequencies excluding the frequencies of the PSCell, SCells, E-UTRA PCell, and E-UTRA SCells being monitored is $N_{freq, EN-DC}$, which is defined as:

$$N_{freq, EN-DC} = N_{freq, EN-DC, NR} + N_{freq, EN-DC, E-UTRA} + N_{freq, EN-DC, UTRA} + M_{EN-DC, GSM},$$

where

$N_{freq, EN-DC, E-UTRA}$ is the number of E-UTRA inter-frequency carriers being monitored (FDD and TDD) as configured by E-UTRA PCell or via LPP [22],

$N_{freq, EN-DC, NR} \leq N_{freq, EN-DC, NR, inter-RAT} + N_{freq, EN-DC, NR, inter-freq}$

where

$N_{freq, EN-DC, NR, inter-RAT}$ is the number of NR inter-RAT carriers excluding NR serving carrier(s) being monitored as configured by E-UTRA PCell [15],

$N_{freq, EN-DC, NR, inter-freq}$ is the number of NR inter-frequency carriers being monitored as configured by PSCell,

$N_{freq, EN-DC, UTRA}$ is the number of UTRA inter-RAT carriers being monitored as configured by E-UTRA PCell (FDD and TDD).

$M_{EN-DC, GSM}$ is an integer which is a function of the number of GSM inter-RAT carriers as configured by E-UTRA PCell on which measurements are being performed. $M_{EN-DC, GSM}$ is equal to 0 if no GSM carrier is being monitored. For a MGRP of 40 ms, $M_{EN-DC, GSM}$ is equal to 1 if cells on up to 32 GSM carriers are being measured. For a MGRP of 80 ms, $M_{EN-DC, GSM}$ is equal to ceil($N_{carriers,GSM}$ /20) where $N_{carriers,GSM}$ is the number of GSM carriers on which cells are being measured.

9.1.3.1a SA: Monitoring of multiple layers using gaps

The requirements in this clause are applicable for UE configured with SA NR operation mode.

When monitoring of multiple inter-RAT E-UTRAN carriers, inter-frequency NR carriers (with or without CCA) and inter-RAT UTRA FDD carriers using gaps (or without using gaps provided the UE supports such capability or the effective MGRP is applied for per-FR measurement gap capable UE) is configured by PCell, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, CSI-SINR, E-UTRAN RSRP, E-UTRAN RSRQ, E-UTRAN RS-SINR measurements, UTRAN FDD CPICH measurement, etc.) of detected cells on all the layers.

For UE configured with the NR SA operation, the effective total number of frequencies, excluding the frequencies of the PCell, PSCell and SCells being monitored, is $N_{freq, SA}$, which is defined as:

$$N_{freq, SA} = N_{freq, SA, NR} + N_{freq, SA, E-UTRA} + N_{freq, SA, UTRA},$$

where

- $N_{freq, SA, E-UTRA}$ is the number of E-UTRA inter-RAT carriers being monitored (FDD and TDD) as configured by PCell or via LPP [22],
- $N_{freq, SA, UTRA}$ is the number of UTRA FDD inter-RAT carriers being monitored as configured by PCell,
- $N_{freq, SA, NR}$ is the number of NR inter-frequency carriers being monitored as configured by PCell.

9.1.3.1b NE-DC: Monitoring of multiple layers using gaps

The requirements in this clause are applicable for UE capable of and configured with the NE-DC operation mode.

When monitoring of multiple inter-frequency E-UTRAN carriers as configured by E-UTRA PSCell, inter-RAT E-UTRAN carriers as configured by PCell, inter-RAT UTRA FDD carriers as configured by PCell, and inter-frequency NR carriers as configured by PCell using gaps (or without using gaps provided the UE supports such capability or the effective MGRP is applied for per-FR measurement gap capable UE) is configured, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, CSI-SINR, SFTD, E-UTRAN RSRP, E-UTRAN RSRQ, and E-UTRAN RS-SINR measurements, UTRAN FDD CPICH measurements, etc.) of detected cells on all the layers.

For UE configured with the NE-DC operation, the effective total number of frequencies excluding the frequencies of the PCell, SCells, E-UTRA PSCell, and E-UTRA SCells being monitored is $N_{freq, NE-DC}$, which is defined as:

$$N_{freq, NE-DC} = N_{freq, NE-DC, NR} + N_{freq, NE-DC, E-UTRA} + N_{freq, NE-DC, UTRA},$$

where

$N_{freq, NE-DC, NR}$ is the number of NR inter-frequency carriers being monitored as configured by PCell,

$N_{freq, NE-DC, UTRA}$ is the number of UTRA FDD inter-RAT carriers being monitored as configured by PCell,

$N_{freq, NE-DC, E-UTRA} \leq N_{freq, NE-DC, E-UTRA, inter-RAT} + N_{freq, NE-DC, E-UTRA, inter-freq}$

where

$N_{freq, NE-DC, E-UTRA, inter-RAT}$ is the number of E-UTRA inter-RAT carriers (FDD and TDD) excluding E-UTRA serving carrier(s) being monitored as configured by PCell or via LPP [22],

$N_{freq, NE-DC, E-UTRA, inter-freq}$ is the number of E-UTRA inter-frequency carriers (FDD and TDD) being monitored as configured by E-UTRA PSCell [15] or via LPP [22].

9.1.3.1c NR-DC: Monitoring of multiple layers using gaps

The requirements in this clause are applicable for UE configured with NR-DC operation mode.

When monitoring of multiple inter-RAT E-UTRAN carriers and inter-frequency NR carriers using gaps (or without using gaps provided the UE supports such capability or the effective MGRP is applied for per-FR measurement gap capable UE) as configured by PCell, inter-RAT UTRA FDD carriers as configured by PCell, and inter-frequency NR carriers as configured by PSCell is configured, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, CSI-SINR, E-UTRAN RSRP, E-UTRAN RSRQ, E-UTRAN RS-SINR measurements, UTRAN FDD CPICH measurements, etc.) of detected cells on all the layers.

For UE configured with the NR-DC operation, the effective total number of frequencies, excluding the frequencies of the PCell, PSCell and SCells being monitored, is $N_{freq, NR-DC}$, which is defined as:

$$N_{freq, NR-DC} = N_{freq, NR-DC, NR} + N_{freq, NR-DC, E-UTRA} + N_{freq, NR-DC, UTRA},$$

where

- $N_{freq, NR-DC, E-UTRA}$ is the number of E-UTRA inter-RAT carriers being monitored (FDD and TDD) as configured by PCell or via LPP [22].
- $N_{freq, NE-DC, UTRA}$ is the number of UTRA FDD inter-RAT carriers being monitored as configured by PCell,
- $N_{freq, NR-DC, NR}$ is the number of NR inter-frequency carriers being monitored as configured by PCell and PSCell.

9.1.3.2 EN-DC: Maximum allowed layers for multiple monitoring

If a UE is configured with EN-DC operation, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PSCell, and
- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PSCell, and
- Depending on UE capability, 7 NR SSB inter-RAT carriers excluding NR serving carrier(s) configured by E-UTRA PCell [15], and
- Depending on UE capability, 6 E-UTRA TDD inter-frequency carriers configured by E-UTRA PCell [15], and
- Depending on UE capability, 6 E-UTRA FDD inter-frequency carriers configured by E-UTRA PCell [15], and
- Depending on UE capability, 3 FDD UTRA carriers, and
- Depending on UE capability, 3 TDD UTRA carriers, and
- Depending on UE capability, 32 GSM carriers (one GSM layer corresponds to 32 carriers), and
- Depending on UE capability, 1 E-UTRA FDD inter-frequency carrier for RSTD measurements configured via LPP [22], and
- Depending on UE capability, 1 E-UTRA TDD inter-frequency carrier for RSTD measurements configured via LPP [22].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD and GSM (one GSM layer corresponds to 32 carriers) layers. The UE shall be capable of monitoring a total of at least $7 + N_{CSI}$ effective NR carrier frequency layers excluding NR serving carrier(s), comprising of any above defined combination of NR inter-RAT carriers excluding NR serving carrier(s) configured by E-UTRA PCell and NR inter-frequency carriers configured by PSCell, N_{CSI} equals 1 if UE supports CSI-RS based L3 measurement, and N_{CSI} =0 otherwise.

The number of SSB frequency layers configured by PSCell equals to the total number of MOs with

- *ssb-ConfigMobility* configured, or
- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency, smtc1, smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

The number of CSI-RS frequency layers equals to the number of MOs with *csi-rs-ResourceConfigMobility* configured assuming single MO is configured per frequency layer.

When the E-UTRA PCell and PSCell configures the same NR carrier frequency layer to be monitored by the UE in synchronous intra-band EN-DC, this layer shall be counted only once to the total number of effective carrier frequency layers provided that the SFN-s and slot boundaries are aligned, unless the configured NR carrier frequency layers to be monitored have

- different RSSI measurement resources or
- different *deriveSSB-IndexFromCell* indications or
- different SMTC configurations or
- different *ssb-PositionQCL-Common-r16* indications or cell list of *ssb-PositionQCL* on NR carrier frequency layer with CCA or
- different *rmtc-Config-r16* indication on NR carrier frequency layer with CCA.

NOTE 1: The E-UTRA-NR dual connectivity capable UE configured with PSCell shall fulfil the requirements defined in only one of clause 9.1.3.2 and clause 8.1.2.1.1b.1 of TS 36.133 [15].

9.1.3.2a SA: Maximum allowed layers for multiple monitoring

If a UE is configured with SA NR operation mode, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PCell, and
- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PCell, and
- Depending on UE capability, 7 E-UTRA TDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 7 E-UTRA FDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 3 UTRA FDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 1 E-UTRA FDD inter-RAT carrier for RSTD measurements configured via LPP [22], and
- Depending on UE capability, 1 E-UTRA TDD inter-RAT carrier for RSTD measurements configured via LPP [22].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least [13] effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, E-UTRA TDD and UTRA FDD layers.

The number of SSB frequency layers equals to the total number of MOs with

- *ssb-ConfigMobility* configured, or
- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency, smtc1, smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

The number of CSI-RS frequency layers equals to the number of MOs with *csi-rs-ResourceConfigMobility* configured assuming single MO is configured per frequency layer.

9.1.3.2b NE-DC: Maximum allowed layers for multiple monitoring

If a UE is configured with NE-DC operation mode, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PCell, and
- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PCell, and
- Depending on UE capability, 6 E-UTRA TDD inter-RAT carriers excluding E-UTRA serving carriers configured by PCell, and
- Depending on UE capability, 6 E-UTRA FDD inter-RAT carriers excluding E-UTRA serving carriers configured by PCell, and
- Depending on UE capability, 6 E-UTRA TDD inter-frequency carriers configured by E-UTRA PSCell [15], and
- Depending on UE capability, 6 E-UTRA FDD inter-frequency carriers configured by E-UTRA PSCell [15], and
- Depending on UE capability, 3 UTRA FDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 1 E-UTRA FDD inter-frequency carrier for RSTD measurements configured via LPP [22], and
- Depending on UE capability, 1 E-UTRA TDD inter-frequency carrier for RSTD measurements configured via LPP [22].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, E-UTRA TDD and UTRA FDD layers. The UE shall be capable of monitoring a total of at least 6 effective E-UTRA carrier frequency layers, excluding E-UTRA serving carrier(s), comprising of any above defined combination of E-UTRA inter-RAT carriers excluding E-UTRA serving carrier(s) configured by PCell and E-UTRA inter-frequency carriers configured by E-UTRA PSCell.

The number of SSB frequency layers configured by PCell equals to the total number of MOs with

- *ssb-ConfigMobility* configured, or
- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency, smtc1, smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

The number of CSI-RS frequency layers equals to the number of MOs with *csi-rs-ResourceConfigMobility* configured assuming single MO is configured per frequency layer.

9.1.3.2c NR-DC: Maximum allowed layers for multiple monitoring

If a UE is configured with NR-DC operation, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PCell, and
- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PCell, and
- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PSCell, and
- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PSCell, and
- Depending on UE capability, 7 E-UTRA TDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 7 E-UTRA FDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 3 UTRA FDD inter-RAT carriers configured by PCell, and

- Depending on UE capability, 1 E-UTRA FDD inter-RAT carrier for RSTD measurements configured via LPP [22], and

- Depending on UE capability, 1 E-UTRA TDD inter-RAT carrier for RSTD measurements configured via LPP [22].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, E-UTRA TDD and UTRA FDD layers. The UE shall be capable of monitoring a total of at least 7 + N_{CSI} effective NR carrier frequency layers excluding NR serving carrier(s), which are configured by PCell and PSCell, N_{CSI} equals 1 if UE supports CSI-RS based L3 measurement, and N_{CSI} =0 otherwise.

The number of SSB frequency layers equals to the total number of MOs with

- *ssb-ConfigMobility* configured, or

- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency*, *smtc1*, *smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

The number of CSI-RS frequency layers equals to the number of MOs with *csi-rs-ResourceConfigMobility* configured assuming single MO is configured per frequency layer.

When PCell and PSCell configures the same NR carrier frequency layer to be monitored by the UE in NR-DC, this layer shall be counted only once to the total number of effective carrier frequency layers provided that the SFN-s and slot boundaries are aligned, unless the configured NR carrier frequency layers to be monitored have

- different RSSI measurement resources or

- different *deriveSSB-IndexFromCell* indications or

- different SMTC configurations or

- different *ssb-PositionQCL-Common-r16* indications or cell list of *ssb-PositionQCL* on NR carrier frequency layer with CCA or

- different *rmtc-Config-r16* indication on NR carrier frequency layer with CCA.

9.1A.3.2 Void

9.1.3A UE Measurement capability under operation mode with CCA

9.1.3A.1 EN-DC: Monitoring of multiple layers using gaps under CCA

The requirements in clause 9.1.3.1 are also applicable for the UE capable of and configured with the EN-DC operation mode with CCA on PSCC.

9.1.3A.1a SA: Monitoring of multiple layers using gaps under CCA

The requirements in clause 9.1.3.1a are also applicable for UE configured with SA NR operation mode with CCA on PCC.

9.1.3A.2 EN-DC: Maximum allowed layers for multiple monitoring under CCA

If a UE is configured with EN-DC operation when CCA is used on PSCell, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR inter-frequency carriers configured by PSCell, and

- Depending on UE capability, 7 NR inter-RAT carriers excluding NR serving carrier(s) configured by E-UTRA PCell [15], and

- Depending on UE capability, 6 E-UTRA TDD inter-frequency carriers configured by E-UTRA PCell [15], and
- Depending on UE capability, 6 E-UTRA FDD inter-frequency carriers configured by E-UTRA PCell [15], and
- Depending on UE capability, 3 FDD UTRA carriers, and
- Depending on UE capability, 3 TDD UTRA carriers, and
- Depending on UE capability, 32 GSM carriers (one GSM layer corresponds to 32 carriers), and

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD and GSM (one GSM layer corresponds to 32 carriers) layers. The UE shall be capable of monitoring a total of at least 7 effective NR carrier frequency layers excluding NR serving carrier(s), comprising of any above defined combination of NR inter-RAT carriers excluding NR serving carrier(s) configured by E-UTRA PCell and NR inter-frequency carriers configured by PSCell.

When the E-UTRA PCell and PSCell configures the same NR carrier frequency layer to be monitored by the UE in synchronous intra-band EN-DC, this layer shall be counted only once to the total number of effective carrier frequency layers provided that the SFN-s and slot boundaries are aligned, unless the configured NR carrier frequency layers to be monitored have

- different RSSI measurement resources or
- different *deriveSSB-IndexFromCell* indications or
- different SMTC configurations or
- different *ssb-PositionQCL-Common-r16* indications or cell list of *ssb-PositionQCL* on NR carrier frequency layer with CCA or
- different *rmtc-Config-r16* indication on NR carrier frequency layer with CCA.

9.1.3A.2a SA: Maximum allowed layers for multiple monitoring under CCA

If a UE is configured with SA NR operation mode when CCA is used on PCell or SCell only, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR inter-frequency carriers configured by PCell, and
- Depending on UE capability, 7 E-UTRA TDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 7 E-UTRA FDD inter-RAT carriers configured by PCell, and

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least [13] effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD and E-UTRA TDD layers.

9.1.3C UE Measurement capability under operation mode with satellite access

9.1.3C.1a SA: Monitoring of multiple layers using gaps under satellite access

The requirements in this clause are applicable for UE configured with only PCell, which is served by SAN.

When monitoring of multiple SAN carriers and TN carriers using gaps (or without using gaps provided the UE supports such capability) is configured by PCell, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, CSI-SINR) of detected cells on all the layers.

NOTE: For a cell served by SAN, the UE could only be configured to measure SS-RSRP, SS-RSRQ, SS-SINR.

For the UE configured with NR SA operation mode with only PCell served by SAN, the effective total number of frequencies, excluding the frequencies of the serving cell being monitored, is $N_{freq, SA}$, which is defined as:

$$N_{freq,\ SA} = N_{freq,\ SA,\ SAN} + N_{freq,\ SA,\ TN},$$

where

- $N_{freq,\ SA,\ SAN}$ is the number of SAN carriers being monitored as configured by the serving cell served by SAN,

  $N_{freq,\ SA,\ TN}$ is the number of TN carriers being monitored as configured by the serving cell served by SAN.

9.1.3C.2a SA: Maximum allowed layers for multiple monitoring for SAN

If a UE is configured with NR SA operation mode with SAN serving cell, the UE shall be capable of monitoring at least:

- Depending on UE capability, 3 NR SAN carriers including serving carrier, and
- Depending on UE capability, 7 NR SAN and TN carriers including serving carrier,
  - The total number of NR SAN and TN carriers does not apply to VSAT UE.

FFS: the number of effective frequency layers UE shall be capable to monitor.

9.1.4 Capabilities for Support of Event Triggering and Reporting Criteria

9.1.4.1 Introduction

This clause contains requirements on UE capabilities for support of event triggering and reporting criteria. As long as the measurement configuration does not exceed the requirements stated in clause 9.1.4.2, the UE shall meet all other performance requirements defined in clause 9 and clause 10. The requirements in this clause also apply for a UE in EN-DC with PSCell on a carrier frequency with CCA or SA NR with PCell on a carrier frequency with CCA.

The UE can be requested to make measurements under different measurement identities defined in TS 38.331 [2]. Each measurement identity corresponds to either event-based reporting, periodic reporting, or no reporting. In case of event-based reporting, each measurement identity is associated with an event triggering criterion. In case of periodic reporting, a measurement identity is associated with one periodic reporting criterion. In case of no reporting, a measurement identity is associated with one no reporting criterion.

The purpose of this clause is to set some limits on the number of different event triggering, periodic, and no reporting criteria the UE may be requested to track in parallel.

9.1.4.2 Requirements

In this clause a reporting criterion corresponds to either one event (in the case of event-based reporting), or one periodic reporting criterion (in case of periodic reporting), or one no reporting criterion (in case of no reporting). For event-based reporting, each instance of event, with the same or different event identities, is counted as separate reporting criterion in table 9.1.4.2-1.

The UE shall be able to support in parallel per category up to E_{cat} reporting criteria according to table 9.1.4.2-1. For the measurement categories belonging to intra-frequency, inter-frequency, and inter-RAT measurements (i.e. without counting other categories that the UE shall always support in parallel), the UE need not support more than the total number of reporting criteria as follows:

- For UE configured with EN-DC: $E_{cat,EN-DC,NR} + E_{cat,EN-DC,E-UTRA}$, where

  $E_{cat,EN-DC,NR} = 10 + 9 \times n$ is the total number of NR reporting criteria configured by PSCell (NR intra- and inter-frequency reporting criteria) and by E-UTRA PCell on NR serving frequencies (NR intra-frequency reporting criteria) applicable for UE configured with EN-DC according to table 9.1.4.2-1, and n is the number of configured NR serving frequencies, including PSCell and SCells carrier frequencies,

  $E_{cat,EN-DC,E-UTRA}$ is the total number of reporting criteria configured by E-UTRA PCell except PSCell and SCells carrier frequencies, as specified in TS 36.133 [15] for UE configured with EN-DC.

- For UE configured with NE-DC: $E_{cat,NE-DC,NR} + E_{cat,NE-DC,E-UTRA}$, where

$E_{cat,NE-DC,NR} = 10 + 9 \times n$ is the total number of NR reporting criteria according to table 9.1.4.2-1, and n is the number of configured NR serving frequencies, including PCell and SCells carrier frequencies,

$E_{cat,NE-DC,E-UTRA} = E_{cat,NE-DC,E-UTRA,inter-RAT} + E_{cat,NE-DC,E-UTRA,intra-RAT}$, where

$E_{cat,NE-DC,E-UTRA,inter-RAT}$ is the total number of inter-RAT E-UTRA reporting criteria configured by PCell except E-UTRA PSCell and E-UTRA SCells carrier frequencies, according to table 9.1.4.2-1,

$E_{cat,NE-DC,E-UTRA,intra-RAT}$ is the total number of E-UTRA reporting criteria including E-UTRA PSCell and E-UTRA SCells carrier frequencies as specified in TS 36.133 [15] for UE configured with NE-DC.

- For UE configured with SA operation mode: $E_{cat,SA,NR} + E_{cat,SA,E-UTRA}$, where

  $E_{cat,SA,NR} = 10 + 9 \times n$ is the total number of NR reporting criteria according to table 9.1.4.2-1, and n is the number of configured NR serving frequencies, including PCell, and SCells carrier frequencies,

  $E_{cat,SA,E-UTRA}$ is the total number of inter-RAT E-UTRA reporting criteria according to table 9.1.4.2-1.

- For UE configured with NR-DC: $E_{cat,NR-DC,NR} + E_{cat,NR-DC,E-UTRA}$, where

  $E_{cat,NR-DC,NR} = 10 + 9 \times n$ is the total number of NR reporting criteria according to table 9.1.4.2-1, and n is the number of configured NR serving frequencies, including PCell, PSCell and SCells carrier frequencies,

  $E_{cat,NR-DC,E-UTRA}$ is the total number of inter-RAT E-UTRA reporting criteria according to table 9.1.4.2-1.

Table 9.1.4.2-1: Requirements for reporting criteria per measurement category

Measurement category	E_{cat}	Note
Intra-frequency Note 1,2,3,4,5	9	Events for any one or a combination of intra-frequency SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, and CSI-SINR for NG-RAN intra-frequency cells
Inter-frequency Note 2,3,4,5	10	Events for any one or a combination of inter-frequency SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, and CSI-SINR for NG-RAN inter-frequency cells
Inter-RAT (E-UTRA FDD, E-UTRA TDD) Note 2,4,5	10	Only applicable for UE with this (inter-RAT) capability. These reporting criteria apply for any E-UTRA carrier frequencies other than the carrier frequency of the E-UTRA PSCell or E-UTRA SCell.
Inter-RAT (E-UTRA FDD, E-UTRA TDD) RSTD Note 2,4,5	1	Inter-RAT RSTD measurement reporting for UE supporting OTDOA; 1 report capable of minimum 16 inter-RAT cell measurements. Only applicable for UE with this (inter-RAT RSTD via LPP [22]) capability. These reporting criteria apply for any E-UTRA carrier frequencies other than the carrier frequency of the E-UTRA PSCell or E-UTRA SCell.
Inter-RAT (E-UTRA FDD, E-UTRA TDD) RSRP and RSRQ measurements for E-CID Note 2,4,5	1	Inter-RAT RSRP and RSRQ measurements for E-CID reported to E-SMLC via LPP [22]. One report capable of at least in total 10 inter-RAT RSRP and RSRQ measurements. Applicable to UE capable of reporting inter-RAT RSRP and RSRQ to E-SMLC via LPP. These reporting criteria apply for any E-UTRA carrier frequencies other than the carrier frequency of the E-UTRA PSCell or E-UTRA SCell.
Intra-frequency RSSI and channel occupancy measurements with CCA Note 1,2,3	1	One report capable of one RSSI and one channel occupancy measurements over a channel [TS 37.213] with CCA. Applicable for UE capable of performing and reporting RSSI and channel occupancy on carrier frequencies under CCA.

Measurement category	E_{cat}	Note
Inter-frequency RSSI and channel occupancy measurements with CCA Note 2,3	1	One report capable of one RSSI and one channel occupancy measurements over a channel [TS 37.213] with CCA. Applicable for UE capable of performing and reporting RSSI and channel occupancy on carrier frequencies under CCA.
Intra-frequency SSB-based measurements for NR E-CID Note 1,2,3,4,5	1	Intra-frequency SS-RSRP and SS-RSRQ measurements for NR E-CID reported to LMF via LPP [34]. One report capable of at least in total 9 intra-frequency SS-RSRP and SS-RSRQ measurements. Applicable to UE capable of reporting at least one of SS-RSRP and SS-RSRQ to LMF via LPP.
Intra-frequency CSI-RS based measurements for NR E-CID Note 1,2,3,4,5	1	Intra-frequency CSI-RSRP and CSI-RSRQ measurements for NR E-CID reported to LMF via LPP [22]. One report capable of at least in total 9 intra-frequency CSI-RSRP and/or CSI-RSRQ measurements. Applicable to UE capable of reporting any of CSI-RSRP and CSI-RSRQ to LMF via LPP, as indicated in *nr-ECID-MeasSupported-r16*.
Inter-frequency SSB-based measurements for NR E-CID Note 2,3,4,5	1	Inter-frequency SS-RSRP and SS-RSRQ measurements for NR E-CID reported to LMF via LPP [34]. One report capable of at least in total 10 inter-frequency SS-RSRP and SS-RSRQ measurements. Applicable to UE capable of reporting at least one of SS-RSRP and SS-RSRQ to LMF via LPP.
Inter-frequency CSI-RS based measurements for NR E-CID Note 2,3,4,5	1	Inter-frequency CSI-RSRP and CSI-RSRQ measurements for NR E-CID reported to LMF via LPP [22]. One report capable of at least in total 10 inter-frequency CSI-RSRP and CSI-RSRQ measurements. Applicable to UE capable of reporting any of CSI-RSRP and CSI-RSRQ to LMF via LPP, as indicated in *nr-ECID-MeasSupported-r16*.
DL RSTD Note 2,4,5	1	DL RSTD measurement reporting; 1 report capable of multiple (within the UE PRS measurement capability, *nr-DL-TDOA-MeasCapability*, indicated via LPP [34]) DL RSTD measurements and if supported also multiple corresponding DL PRS-RSRP measurements configured for DL-TDOA. Only applicable for UE capable of reporting measurements for DL-TDOA to LMF via LPP [34].
UE Rx-Tx time difference Note 2,4,5	1	UE Rx-Tx time difference measurement reporting; 1 report capable of multiple (within the UE PRS measurement capability, *nr-DL-PRS-MeasCapability*, indicated via LPP [34] for multi-RTT) UE Rx-Tx time difference measurements and if supported also multiple corresponding DL PRS-RSRP measurements configured for multi-RTT. Only applicable for UE capable of reporting measurements for multi-RTT to LMF via LPP [34].
DL PRS-RSRP Note 2,4,5	1	DL PRS-RSRP measurement reporting; 1 report capable of multiple (within the UE PRS measurement capability, *nr-DL-PRS-MeasCapability*, indicated via LPP [34] for AoD) DL PRS-RSRP measurements configured for DL-AoD. Only applicable for UE capable of reporting measurements for DL-AoD to LMF via LPP [34].

Measurement category	E_{cat}	Note
DL PRS-RSRPP Note 2,4,5	1	DL PRS-RSRPP measurement reporting; 1 report capable of multiple (within the UE PRS measurement capability, *nr-DL-PRS-MeasCapability*, indicated via LPP [34] for AoD) DL PRS-RSRPP measurements configured for DL-AoD. Only applicable for UE capable of reporting measurements for DL-AoD to LMF via LPP [34].
SRS-RSRP Note 2,3,4,5	1	SRS-RSRP measurement reporting for CLI; 1 report capable of up to 32 SRS resources measurements. Only applicable for UE supporting *cli-SRS-RSRP-Meas-r16*.
CLI-RSSI Note 2,3,4,5	1	CLI-RSSI measurement reporting for CLI; 1 report capable of up to 64 CLi-RSSI resources measurements. Only applicable for UE supporting *cli-RSSI-Meas-r16*.
NOTE 1: When the UE is configured with PSCell and SCell carrier frequencies, E_{cat} for Intra-frequency is applied per corresponding NR serving frequency. NOTE 2: Applicable for UE configured with SA NR operation mode. NOTE 3: Applicable for UE configured with EN-DC operation mode. NOTE 4: Applicable for UE configured with NE-DC operation mode. NOTE 5: Applicable for UE configured with NR-DC operation mode.		

9.1.5 Carrier-specific scaling factor

This clause specifies the derivation of carrier-specific scaling factor (CSSF) values, which scales the measurement delay requirements given in clauses 9.2, 9.2A, 9.3, 9.3A, 9.4, and NR PRS-based positioning measurements in clause 9.9 and CSI-RS based L3 measurement in clause 9.10 when UE is configured to monitor multiple measurement objects. The CSSF values are categorized into $CSSF_{outside_gap,i}$ and $CSSF_{within_gap,i}$, for the measurements conducted outside measurement gaps and within measurement gaps, respectively.

If concurrent measurement gaps are configured by the network, subject to UE capability, the term of the union of concurrent measurement gaps in the following clauses refer to non-dropped measurement gap occasions after accounting for measurement gap collisions as specified in clause 9.1.8.3 from all the configured measurement gap patterns. The term of the associated measurement gap in concurrent measurement gaps in the following clauses refer to non-dropped measurement gap occasions associated by measurement object *i* after accounting for measurement gap collisions as specified in clause 9.1.8.3.

9.1.5.1 Monitoring of multiple layers outside gaps

For a UE supporting concurrent gaps or *concurrentMeasGapsPreMG-r18* or *concurrentMeasGapsNCSG-r18*, and when concurrent gaps are configured the carrier-specific scaling factor $CSSF_{outside_gap,i}$ for measurement object *i* derived in this chapter is applied to following measurement types :

- SSB-based intra-frequency measurement without measurement gap as defined in clauses 9.2.1 and 9.2A.1, when none of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent GAPs.

- SSB-based intra-frequency measurement with out measurement gap as defined in clauses 9.2.1 and 9.2A.1, when part of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent GAPs.

- CSI-RS based intra-frequency measurement in clause 9.10.2, when none of CSI-RS resources for L3 measurement of this intra-frequency measurement object are overlapped by the union of concurrent GAPs.

- CSI-RS based intra-frequency measurement in clause 9.10.2, when all CSI-RS resources for L3 measurement of this intra-frequency measurement object are partially overlapped by the union of concurrent GAPs.

- SSB-based inter-frequency measurement without measurement gap as defined in clause 9.3.1, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the union of concurrent GAPs, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement without measurement gap as defined in clause 9.3.1, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the union of concurrent GAPs, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

For a UE supporting MUSIM gaps or both concurrent measurement gaps and MUSIM gaps, and when periodic MUSIM gaps or both concurrent and periodic MUSIM gaps are configured the carrier-specific scaling factor $CSSF_{outside_gap,i}$ for measurement object *i* derived in this chapter is applied to following measurement types :

- SSB-based intra-frequency measurement without measurement gap as defined in clauses 9.2.1 and 9.2A.1, when none of the SMTC occasions of this intra-frequency measurement object are overlapped by MUSIM gaps or the union of concurrent measurement gaps and MUSIM gaps.

- SSB-based intra-frequency measurement without measurement gap as defined in clauses 9.2.1 and 9.2A.1, when part of the SMTC occasions of this intra-frequency measurement object are overlapped by MUSIM gaps or the union of concurrent measurement gaps and MUSIM gaps.

- CSI-RS based intra-frequency measurement in clause 9.10.2, when none of CSI-RS resources for L3 measurement of this intra-frequency measurement object are overlapped by MUSIM gaps or the union of concurrent measurement gaps and MUSIM gaps.

- CSI-RS based intra-frequency measurement in clause 9.10.2, when all CSI-RS resources for L3 measurement of this intra-frequency measurement object are partially overlapped by MUSIM gaps or the union of concurrent measurement gaps and MUSIM gaps.

- SSB-based inter-frequency measurement without measurement gap as defined in clause 9.3.1, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by MUSIM gaps or the union of concurrent measurement gaps and MUSIM gaps, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement without measurement gap as defined in clause 9.3.1, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by MUSIM gaps or the union of concurrent measurement gaps and MUSIM gaps, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

Otherwise, the carrier-specific scaling factor $CSSF_{outside_gap,i}$ for measurement object *i* derived in this chapter is applied to following measurement types:

- SSB-based intra-frequency measurement without measurement gap as defined in clauses 9.2.1 and 9.2A.1, when none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- SSB-based intra-frequency measurement without measurement gap as defined in clauses 9.2.1 and 9.2A.1, when part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- CSI-RS based intra-frequency measurement in clause 9.10.2, when none of CSI-RS resources for L3 measurement of this intra-frequency measurement object are overlapped by the measurement gap.

- CSI-RS based intra-frequency measurement in clause 9.10.2, when all CSI-RS resources for L3 measurement of this intra-frequency measurement object are partially overlapped by the measurement gap.

- SSB-based inter-frequency measurement without measurement gap as defined in clause 9.3.1, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap.

- SSB-based inter-frequency measurement without measurement gap as defined in clause 9.3.1, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap.

- SSB-based intra-frequency measurement in clause 9.2.5 for UE supporting *nr-NeedForInterruptionReport-r18* and reporting *no-gap-with-interruption* for this intra-frequency layer via *NeedForInterruptionNR-r18,* when

  - no measuremeng gap is configured by NW, or

  - measurement gap is configured by the NW and none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap

- SSB-based intra-frequency measurement in clause 9.2.5 for UE supporting *nr-NeedForInterruptionReport-r18* and reporting *no-gap-with-interruption* for this intra-frequency layer via *NeedForInterruptionNR-r18*, when
  - no measuremeng gap is configured by NW, or
  - none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap, or
  - part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap
- SSB-based inter-frequency measurement in clause 9.3.9 for UE supporting *nr-NeedForInterruptionReport-r18* and within the band reporting *no-gap-with-interruption* via *NeedForInterruptionNR-r18*, when
  - no GAP is configured by NW, or
  - measurement gap is configured by the NW and none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap
- SSB-based inter-frequency measurement in clause 9.3.9 for UE supporting *nr-NeedForInterruptionReport-r18* reporting *no-gap-with-interruption* for this inter-frequency layer via *NeedForInterruptionNR-r18*, when
  - no measuremeng gap is configured by NW, or
  - none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, or
  - part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap
- For a UE in E-UTRA-NR dual connectivity operation, NR SSB-based inter-RAT measurement object configured by the E-UTRAN PCell on an NR serving carrier
  - the SSB is completely contained in the active BWP of the UE, and
  - none or part of the SMTC occasions of this inter-RAT measurement object are overlapped by the measurement gap;
- Intra-frequency RSSI and channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping and RMTCs are not fully overlapped with measurement gap(s).
- E-UTRA inter-RAT measurement object without measurement gap as defined in clause 9.4.8, when
  - no measuremeng gap is configured by NW, or
  - none of the EMW occasions of this inter-RAT measurement object are overlapped by the measurement gap, or
  - part of the EMW occasions of this inter-RAT measurement object are overlapped by the measurement gap

The UE is expected to conduct the measurement of this measurement object *i* only outside the measurement gaps.

For a UE in E-UTRA-NR dual connectivity operation, if a measurement object configured by PSCell and an NR inter-RAT measurement object configured by E-UTRAN PCell are on the same serving carrier, they shall be counted as one intra-frequency measurement object, provided that they meet the measurement object merging conditions in clause 9.1.3.2.

The number of frequency layers for SSB measurements shall include the total number of MOs with

- *ssb-ConfigMobility* configured, or
- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency*, *smtc1*, *smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, $CSSF_{outside_gap,i}$ and requirements derived from $CSSF_{outside_gap,i}$ are not specified.

The UE cell identification and measurement periods derived based on $CSSF_{outside_gap,i}$ in clauses 9.2.5.1, 9.2.5.2 and 9.10.2 may be extended for measurement objects of which the cell identification and measurement periods are overlapped with $T_{measure_SFTD1}$ specified in clause 9.3.8 when no measurement gaps are provided.

For UE supports OD-SSB operation capability and when OD- SSB transmission is indicated,

- the SMTC for OD-SSB based intra-frequencymeasurementfor serving cell is OD-SMTC when the OD-SSB activation is indicated,
- the SMTC for OD-SSB based intra-frequency measurement for neighbor cell is the first SMTC regardless of status of OD-SSB.

The requirements in this clause apply provided that

- The SMTC on all CCs and inter-frequency layers without measurement gap in FR2 have the same offset, and one of following conditions is met
  - If *smtc2* is configured on any FR2 CC,
    - All CCs have the same configuration for *smtc1*, and
    - All CCs configured with *smtc2* have the same configuration for *smtc2*
  - If *smtc2* is not configured on any FR2 CC,
    - The total number of different SMTC periodicities on all serving CCs and inter-frequency layers without measurement gap does not exceed 4
- The starting point of the first 5 ms window for CSI-RS measurement as defined in clause 9.10.1 on all CCs in FR2 is same and one of following conditions is met
  - If any CSI-RS resource is configured in the second 5 ms window for CSI-RS measurement as defined in clause 9.10.1 on any FR2 CC,
    - All CCs with CSI-RS resources only in the first 5 ms window have the same CSI-RS resource periodcity, and
    - All CCs with CSI-RS resources both in the first and the second 5 ms window have the same CSI-RS resource periodcity
  - If no CSI-RS resource is configured in the second 5 ms window for CSI-RS measurement as defined in clause 9.10.1 on any FR2 CC,
    - The total number of different CSI-RS resources periodicities on all serving CCs does not exceed 3.

    Note: Longer delays for cell identification and measurement periods derived based on $CSSF_{outside_gap,i}$ in clauses 9.2.5.1, 9.2.5.2, can be expected, if the UE is configured with more than 4 different SMTC periodicities on FR2 serving carriers. The longer delay applies for the FR2 intra-frequency measurement objects with the longest SMTC periodicity/periodicities.

9.1.5.1.1 EN-DC mode: carrier-specific scaling factor for SSB-based, CSI-RS based L3 measurements and RSSI and channel occupancy measurements performed outside gaps

For UE configured with the E-UTRA-NR dual connectivity operation, the carrier-specific scaling factor $CSSF_{outside_gap,i}$ for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, intra-frequency CSI-RS L3 measurement and RSSI/channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping will be as specified in table 9.1.5.1.1-1.

For UE support *FR1 only EN-DC 3-searcher capability* configured with the E-UTRA-NR dual connectivity operation and none of SMTC occasions of outside gap measurement objects in one FR are overlapped with per-FR measurement GAP (if configured) in another FR, the carrier-specific scaling factor $CSSF_{outside_gap,i}$ for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, intra-frequency CSI-RS L3 measurement and RSSI/channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping will be as specified in table 9.1.5.1.1-2.

Table 9.1.5.1.1-1: $CSSF_{outside_gap,i}$ scaling factor for EN-DC mode

Scenario	$CSSF_{outside_gap,i}$ for FR1 PSCC	$CSSF_{outside_gap,i}$ for FR1 SCC	$CSSF_{outside_gap,i}$ for FR2 PSCC	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is required Note 2	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is not required	$CSSF_{outside_gap,i}$ for inter-frequency MO with no measurement gp
EN-DC with FR1 only CA	$1+N_{PSCC_CSIRS}+N_{PSCC_CCA_RSSI/CO}$	$N_{SCC_SSB}+Y+2x N_{SCC_CSIRS}+N_{SCC_CCA_RSSI/CO}-N_{SCC_OD-SSB}$	N/A	N/A	N/A	$N_{SCC_SSB}+Y+2x N_{SCC_CSIRS}+N_{SCC_CCA_RSSI/CO}$
EN-DC with FR2 only intra band CA	N/A	N/A	$1+N_{PSCC_CSIRS}$	N/A	$N_{SCC_SSB}+Y+2x N_{SCC_CSIRS}-N_{SCC_OD-SSB}$	$N_{SCC_SSB}+Y+2x N_{SCC_CSIRS}$
EN-DC with FR2 only inter band CA	N/A	N/A	$1+N_{PSCC_CSIRS}$	$2x(1+N_{SCC_CSIRS_FR2_NCM})$ Note 3,5	$2\times(N_{SCC_SSB}+Y+2x N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})-N_{SCC_OD-SSB}$	$2\times(N_{SCC_SSB}+Y+2x N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})$
EN-DC with FR1 +FR2 CA (FR1 PSCell) Note 1	$1+N_{PSCC_CSIRS}$	$2\times(N_{SCC_SSB}+Y+2xN_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})-N_{SCC_OD-SSB}$	N/A	$2x(1+N_{SCC_CSIRS_FR2_NCM})$ Note 3	$2\times(N_{SCC_SSB}+Y+2x N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})-N_{SCC_OD-SSB}$	$2\times(N_{SCC_SSB}+Y+2x N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})$
EN-DC with FR1 +FR2 CA (FR2 PSCell) Note 1	N/A	$N_{SCC_SSB}+Y+2x N_{SCC_CSIRS}-N_{SCC_OD-SSB}$	$1+N_{PSCC_CSIRS}$	N/A	$N_{SCC_SSB}+Y+2x N_{SCC_CSIRS}-N_{SCC_OD-SSB}$	$N_{SCC_SSB}+Y+2x N_{SCC_CSIRS}$

NOTE 1: Only one NR FR1 operating band and one NR FR2 operating band are included for FR1+FR2 inter-band EN-DC.
NOTE 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.
NOTE 3: $CSSF_{outside_gap,i}$ =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; $CSSF_{outside_gap,i}$ =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.
NOTE 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.
NOTE 5: Only two NR FR2 operating band are included for EN-DC with FR2 only inter-band CA
NOTE 6: N_{PSCC_CSIRS}=1 if PSCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PSCC_CSIRS} =0.
NOTE 7: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured
NOTE 8: $N_{SCC_CSIRS_FR2_NCM}$=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, $N_{SCC_CSIRS_FR2_NCM}$=0.
NOTE 9: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG. For UE supporting *CSSF enhancement for one serving CC measurement per-band* for intra-frequency measurements without MG, N_{SCC_SSB} is the number of SCCs to be measured following the principles specified in clause 9.2.3.1 and 9.2.3.2.
NOTE 10: $N_{PSCC_CCA_RSSI/CO}$= 1 if PSCC is configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping; $N_{SCC_CCA_RSSI/CO}$ = Number of MOs for SCell(s) configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping.
NOTE 11 If a measurement object configured by PSCell and an NR inter-RAT measurement object configured by E-UTRAN PCell are on the same serving carrier, they shall be counted as one intra-frequency measurement object, provided that they meet the measurement object merging conditions [in clause 9.1.3.2], otherwise they are counted separately as two measurement objects.

NOTE 12: $N_{SCC_OD\text{-}SSB}$=Number of configured OD-SSB SCell(s) when only OD-SSB is configured in the SCell and without activated OD-SSB transmission.

Table 9.1.5.1.1-2: Enhanced $CSSF_{outside_gap,i}$ scaling factor for EN-DC mode

Scenario	$CSSF_{outside_gap,i}$ for FR1 PSCC	$CSSF_{outside_gap,i}$ for FR1 SCC	$CSSF_{outside_gap,i}$ for FR2 PSCC	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is required Note 2	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is not required	$CSSF_{outside_gap,i}$ for inter-frequency MO with no measurement gap
EN-DC with FR1 only CA	$1+N_{PSCC_CSIRS}+N_{PSCC_CCA_RSSI/CO}$	$Ceil(0.5\times(N_{SCC_SSB}+2x\ N_{SCC_CSIRS}+N_{SCC_CCA_RSSI/CO}))+Y$	N/A	N/A	N/A	$Ceil(0.5\times(N_{SCC_SSB}+2x\ N_{SCC_CSIRS}+N_{SCC_CCA_RSSI/CO}))+Y$
EN-DC with FR2 only intra band CA	N/A	N/A	$1+N_{PSCC_CSIRS}$	N/A	$N_{SCC_SSB}+Y+2x\ N_{SCC_CSIRS}$	$N_{SCC_SSB}+Y+2x\ N_{SCC_CSIRS}$
EN-DC with FR2 only inter band CA	N/A	N/A	$1+N_{PSCC_CSIRS}$	$2x(1+N_{SCC_CSIRS_FR2_NCM})$ Note 3,5	$2\times(N_{SCC_SSB}+Y+2x\ N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})$	$2\times(N_{SCC_SSB}+Y+2x\ N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})$
EN-DC with FR1 +FR2 CA (FR1 PSCell) Note 1	$1+N_{PSCC_CSIRS}$	$2\times(N_{SCC_SSB}+Y+2xN_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})$	N/A	$2x(1+N_{SCC_CSIRS_FR2_NCM})$ Note 3	$2\times(N_{SCC_SSB}+Y+2x\ N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})$	$2\times(N_{SCC_SSB}+Y+2x\ N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})$
EN-DC with FR1 +FR2 CA (FR2 PSCell) Note 1	N/A	$N_{SCC_SSB}+Y+2x\ N_{SCC_CSIRS}$	$1+N_{PSCC_CSIRS}$	N/A	$N_{SCC_SSB}+Y+2x\ N_{SCC_CSIRS}$	$N_{SCC_SSB}+Y+2x\ N_{SCC_CSIRS}$

NOTE 1: Only one NR FR1 operating band and one NR FR2 operating band are included for FR1+FR2 inter-band EN-DC.
NOTE 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.
NOTE 3: $CSSF_{outside_gap,i}$ =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; $CSSF_{outside_gap,i}$ =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.

NOTE 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.
NOTE 5: Only two NR FR2 operating band are included for EN-DC with FR2 only inter-band CA
NOTE 6: N_{PSCC_CSIRS}=1 if PSCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PSCC_CSIRS} =0.
NOTE 7: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured
NOTE 8: $N_{SCC_CSIRS_FR2_NCM}$=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, $N_{SCC_CSIRS_FR2_NCM}$=0.
NOTE 9: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG.
NOTE 10: $N_{PSCC_CCA_RSSI/CO}$= 1 if PSCC is configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping; $N_{SCC_CCA_RSSI/CO}$ = Number of MOs for SCell(s) configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping.
NOTE 11: If a measurement object configured by PSCell and an NR inter-RAT measurement object configured by E-UTRAN PCell are on the same serving carrier, they shall be counted as one intra-frequency measurement object, provided that they meet the measurement object merging conditions in clause 9.1.3.2, otherwise they are counted separately as two measurement objects.

9.1.5.1.2 SA mode: carrier-specific scaling factor for SSB-based, CSI-RS based L3 measurements and RSSI and channel occupancy measurements performed outside gaps

For UE in SA operation mode, the carrier-specific scaling factor $CSSF_{outside_gap,i}$ for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, E-UTRA inter-RAT measurement object without measurement gap, intra-frequency CSI-RS L3 measurement and RSSI/channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping will be as specified in table 9.1.5.1.2-1.

For UE supporting *FR1 only CA* or *FR1+FR2 CA (PCell is FR1 only) 3-searcher capability* in SA operation mode and none of SMTC occasions of outside gap measurement objects in one FR are overlapped with per-FR measurement GAP (if configured) in another FR, the carrier-specific scaling factor $CSSF_{outside_gap,i}$ for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, E-UTRA inter-RAT measurement object without measurement gap, intra-frequency CSI-RS L3 measurement and RSSI/channel occupancy measurement with no measurement gap on a carrier subject to CCA when SMTC and RMTC are overlapping will be as specified in table 9.1.5.1.2-2.

Table 9.1.5.1.2-1: $CSSF_{outside_gap,i}$ scaling factor for SA mode

Scenario	$CSSF_{outside_gap,i}$ for FR1 PCC	$CSSF_{outside_gap,i}$ for FR1 SCC	$CSSF_{outside_gap,i}$ for FR2 PCC	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is required	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is not required	$CSSF_{outside_gap,i}$ for inter-frequency MO with no measurement gap	$CSSF_{outside_gap,i}$ for E-UTRA inter-RAT MO with no measurement gap
FR1 only CA	$1+N_{PCC_CSIRS}+N_{PCC_CCA_RSSI/CO}$	$N_{SCC_SSB}+Y+Z+2x N_{SCC_CSIRS}+N_{SCC_CCA_RSSI/CO}-N_{SCC_OD-SSB}$	N/A	N/A	N/A	$N_{SCC_SSB}+Y+Z+2x N_{SCC_CSIRS}+N_{SCC_CCA_RSSI/CO}-N_{SCC_OD-SSB}$	$N_{SCC_SSB}+Y+Z+2x N_{SCC_CSIRS}-N_{SCC_OD-SSB}$
FR2 only intra band CA	N/A	N/A	$1+N_{PCC_CSIRS}$	N/A	$N_{SCC_SSB}+Y+Z+2x N_{SCC_CSIRS}-N_{SCC_OD-SSB}$	$N_{SCC_SSB}+Y+Z+2x N_{SCC_CSIRS}-N_{SCC_OD-SSB}$	$N_{SCC_SSB}+Y+Z+2x N_{SCC_CSIRS}-N_{SCC_OD-SSB}$

FR2 only inter band CA	N/A	N/A	$1+N_{PCC_CSIRS}$	$2*(1+N_{SCC_CSIRS_FR2_NCM})$ Note 3,5	$2\times(N_{SCC_SSB}+Y+Z+2x\ N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})-N_{SCC_OD-SSB}$	$2\times(N_{SCC_SSB}+Y+Z+2x\ N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})-N_{SCC_OD-SSB}$	$2\times(N_{SCC_SSB}+Y+Z+2x\ N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})-N_{SCC_OD-SSB}$
FR1 +FR2 CA (FR1 PCell) Note 1	$1+N_{PCC_CSIRS}$	$2\times(N_{SCC_SSB}+Y+Z+2*N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})-N_{SCC_OD-SSB}$	N/A	$2x(1+N_{SCC_CSIRS_FR2_NCM})$ Note 3,5	$2\times(N_{SCC_SSB}+Y+Z+2x\ N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})-N_{SCC_OD-SSB}$	$2\times(N_{SCC_SSB}+Y+Z+2x\ N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})-N_{SCC_OD-SSB}$	$2\times(N_{SCC_SSB}+Y+Z+2x\ N_{SCC_CSIRS}-1-N_{SCC_CSIRS_FR2_NCM})-N_{SCC_OD-SSB}$
FR1 +FR2 CA (FR2 PCell) Note 1	N/A	$N_{SCC_SSB}+Y+Z+2x\ N_{SCC_CSIRS}-N_{SCC_OD-SSB}$	$1+N_{PCC_CSIRS}$	N/A	$N_{SCC_SSB}+Y+Z+2x\ N_{SCC_CSIRS}-N_{SCC_OD-SSB}$	$N_{SCC_SSB}+Y+Z+2x\ N_{SCC_CSIRS}-N_{SCC_OD-SSB}$	$N_{SCC_SSB}+Y+Z+2x\ N_{SCC_CSIRS}-N_{SCC_OD-SSB}$

NOTE 1: Only one FR1 operating band and one FR2 operating band are included for FR1+FR2 inter-band CA.
NOTE 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.
NOTE 3: $CSSF_{outside_gap,i}$ =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; $CSSF_{outside_gap,i}$ =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.
NOTE 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.
NOTE 5: Only two NR FR2 operating bands are included for FR2 inter-band CA.
NOTE 6: N_{PCC_CSIRS}=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PCC_CSIRS} =0.
NOTE 7: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured
NOTE 8: $N_{SCC_CSIRS_FR2_NCM}$=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, $N_{SCC_CSIRS_FR2_NCM}$=0.
NOTE 9: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG. For UE supporting *CSSF enhancement for one serving CC measurement per-band* for intra-frequency measurements without MG, NSCC_SSB is the number of SCCs to be measured following the principles specified in clause 9.2.3.1 and 9.2.3.2.

NOTE 10: $N_{PCC_CCA_RSSI/CO}$= 1 if PCC is configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping; $N_{SCC_CCA_RSSI/CO}$ = Number of MOs for SCell(s) configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping.
NOTE 11: Z is the number of configured E-UTRA inter-RAT MOs without MG that are being measured outside of MG; otherwise, it is 0.
NOTE 12: N_{SCC_OD-SSB}=Number of configured OD-SSB SCell(s) when only OD-SSB is configured in the SCell and without activated OD-SSB transmission.

Table 9.1.5.1.2-2: Enhanced $CSSF_{outside_gap,i}$ scaling factor for SA mode

Scenario	$CSSF_{outside_gap,i}$ for FR1 PCC	$CSSF_{outside_gap,i}$ for FR1 SCC	$CSSF_{outside_gap,i}$ for FR2 PCC	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is required	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is not required	$CSSF_{outside_gap,i}$ for inter-frequency MO with no measurement gap	$CSSF_{outside_gap,i}$ for E-UTRA inter-RAT MO with no measurement gap

FR1 only CA **Note12**	$1+N_{PCC_CSIRS}$ + $N_{PCC_CCA_RSSI/CO}$	Ceil(0.5×(N_{SCC_SSB} +2x N_{SCC_CSIRS}+ $N_{SCC_CCA_RSSI/CO}$)) +Y+Z	N/A	N/A	N/A	Ceil(0.5×(N_{SCC_SSB} +2x N_{SCC_CSIRS}+ $N_{SCC_CCA_RSSI/CO}$)) +Y+Z	(N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS}
FR2 only intra band CA	N/A	N/A	$1+N_{PCC_CSIRS}$	N/A	N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS}	N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS}	N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS}
FR2 only inter band CA	N/A	N/A	$1+N_{PCC_CSIRS}$	2*(1+ $N_{SCC_CSIRS_FR2_NCM}$) Note 3,5	2×(N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS} -1-$N_{SCC_CSIRS_FR2_NCM}$)	2×(N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS} -1-$N_{SCC_CSIRS_FR2_NCM}$)	2×(N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS} -1- $N_{SCC_CSIRS_FR2_NCM}$)
FR1 +FR2 CA (FR1 PCell) **Note 1, Note 12**	$1+N_{PCC_CSIRS}$	N_{SCC_SSB}+Y+Z +2* N_{SCC_CSIRS} -1-$N_{SCC_CSIRS_FR2_NCM}$	N/A	1+ $N_{SCC_CSIRS_FR2_NCM}$ Note 3,5	N_{SCC_SSB}+Y+Z +2x N_{SCC_CSIRS} -1-$N_{SCC_CSIRS_FR2_NCM}$	N_{SCC_SSB}+2*(Y+Z)+2x N_{SCC_CSIRS} -1- $N_{SCC_CSIRS_FR2_NCM}$	2 x (N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS} -1- $N_{SCC_CSIRS_FR2_NCM}$)
FR1 +FR2 CA (FR2 PCell) **Note 1**	N/A	N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS}	$1+N_{PCC_CSIRS}$	N/A	N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS}	N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS}	N_{SCC_SSB} +Y+Z+2x N_{SCC_CSIRS}

NOTE 1: Only one FR1 operating band and one FR2 operating band are included for FR1+FR2 inter-band CA.
NOTE 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.
NOTE 3: $CSSF_{outside_gap,i}$ =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; $CSSF_{outside_gap,i}$ =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.
NOTE 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.
NOTE 5: Only two NR FR2 operating bands are included for FR2 inter-band CA.
NOTE 6: N_{PCC_CSIRS}=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PCC_CSIRS} =0.
NOTE 7: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured
NOTE 8: $N_{SCC_CSIRS_FR2_NCM}$=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, $N_{SCC_CSIRS_FR2_NCM}$=0.
NOTE 9: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG.

NOTE 10: $N_{PCC_CCA_RSSI/CO}$= 1 if PSCC is configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping; $N_{SCC_CCA_RSSI/CO}$ = Number of MOs for SCell(s) configured with RSSI/CO measurements without MG when RMTC and SMTC are overlapping.
NOTE 11: Z is the number of configured E-UTRA inter-RAT MOs without MG that are being measured outside of MG; otherwise, it is 0.
NOTE 12: For UE supporting *FR1 only CA and FR1 only NR-DC 3-searcher capability* or *FR1+FR2 CA (PCell is FR1 only) 3-searcher capability* in SA operation mode, the Enhanced $CSSF_{outside_gap,i}$ scaling factor does not apply for the E-UTRA inter-RAT MOs without MG that are being measured outside of MG.

9.1.5.1.3 NR-DC mode: carrier-specific scaling factor for SSB-based and CSI-RS based L3 measurements performed outside gaps

For UE configured with NR-DC operation, the carrier-specific scaling factor $CSSF_{outside_gap,i}$ for intra-frequency SSB-based measurement, inter-frequency SSB-based measurements performed outside measurements gaps and intra-frequency CSI-RS based L3 measurement will be as specified in table 9.1.5.1.3-1.

For UE supporting *FR1 only NR-DC 3-searcher capability* or *FR1+FR2 NR-DC (PCell is FR1 only) 3-searcher capability* configured with NR-DC operation and none of SMTC occasions of outside gap measurement objects in one FR are overlapped with per-FR measurement GAP (if configured) in another FR, the carrier-specific scaling factor $CSSF_{outside_gap,i}$ for intra-frequency SSB-based measurement, inter-frequency SSB-based measurements performed outside measurements gaps and intra-frequency CSI-RS based L3 measurement will be as specified in table 9.1.5.1.3-2.

Table 9.1.5.1.3-1: $CSSF_{outside_gap,i}$ scaling factor for NR-DC mode

Scenario	$CSSF_{outside_gap,i}$ for FR1 PCC	$CSSF_{outside_gap,i}$ for FR1 SCC	$CSSF_{outside_gap,i}$ for FR1 PSCC	$CSSF_{outside_gap,i}$ for FR2 PSCC	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is not required	$CSSF_{outside_gap,i}$ for inter-frequency MO with no measurement gap
FR1 + FR2 NR-DC (FR1 PCell and FR2 PSCell) Note 1	$1+N_{PCC_CSIRS}$	$2\times(N_{SCC_SSB} +Y+2xN_{SCC_CSIRS}) - N_{SCC_OD-SSB}$	N/A	$2x(1+ N_{PSCC_CSIRS})$ Note 2	$2x(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS}) - N_{SCC_OD-SSB}$	$2x(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS})$
FR1 + FR1 NR-DC (FR1 PCell and FR1 PSCell)	$1+N_{PCC_CSIRS}$	$2\times(N_{SCC_SSB} +Y+2xN_{SCC_CSIRS}) - N_{SCC_OD-SSB}$	$2x(1+ N_{PSCC_CSIRS})$ Note 2	N/A	N/A	$2x(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS})$

NOTE 1: NR-DC in Rel-15 only includes the scenarios where all serving cells in MCG in FR1 and all serving cells in SCG in FR2.
NOTE 2: $CSSF_{outside_gap,i}$ =1 if no SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on PSCC; $CSSF_{outside_gap,i}$ =2 if no SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on PSCC.
NOTE 3: Y is the number of configured inter-frequency SSB based frequency layers without MG that are being measured outside of MG; otherwise, it is 0.
NOTE 4: N_{PCC_CSIRS}=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PCC_CSIRS} =0.
NOTE 5: N_{PSCC_CSIRS}=1 if PSCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PSCC_CSIRS} =0.
NOTE 6: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured
NOTE 8: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG. For UE supporting *CSSF enhancement for one CC measurement per-band* for intra-frequency measurements without MG, N_{SCC_SSB} is the number of SCCs to be measured following the principles specified in clause 9.2.3.1 and 9.2.3.2.
NOTE 9: N_{SCC_OD-SSB}=Number of configured OD-SSB SCell(s) when only OD-SSB is configured in the SCell and without activated OD-SSB transmission.

Table 9.1.5.1.3-2: Enhanced $CSSF_{outside_gap,i}$ scaling factor for NR-DC mode

Scenario	$CSSF_{outside_gap,i}$ for FR1 PCC	$CSSF_{outside_gap,i}$ for FR1 SCC	$CSSF_{outside_gap,i}$ for FR1 PSCC	$CSSF_{outside_gap,i}$ for FR2 PSCC	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is not required	$CSSF_{outside_gap,i}$ for inter-frequency MO with no measurement gap

FR1 + FR2 NR-DC (FR1 PCell and FR2 PSCell) **Note 1**	$1+N_{PCC_CSIRS}$	(N_{SCC_SSB} +Y+2xN_{SCC_CSIRS})	N/A	(1+ N_{PSCC_CSIRS}) Note 2	(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS})	(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS})
FR1 + FR1 NR-DC (FR1 PCell and FR1 PSCell)	$1+N_{PCC_CSIRS}$	(N_{SCC_SSB} +Y+2xN_{SCC_CSIRS})	(1+ N_{PSCC_CSIRS}) Note 2	N/A	N/A	(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS})
NOTE 1: NR-DC in Rel-15 only includes the scenarios where all serving cells in MCG in FR1 and all serving cells in SCG in FR2. NOTE 2: $CSSF_{outside_gap,i}$ =1 if no SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on PSCC; $CSSF_{outside_gap,i}$ =2 if no SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on PSCC. NOTE 3: Y is the number of configured inter-frequency SSB based frequency layers without MG that are being measured outside of MG; otherwise, it is 0. NOTE 4: N_{PCC_CSIRS}=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PCC_CSIRS} =0. NOTE 5: N_{PSCC_CSIRS}=1 if PSCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PSCC_CSIRS} =0. NOTE 6: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured NOTE 8: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG.						

9.1.5.1.4 NE-DC mode: carrier-specific scaling factor for SSB-based and CSI-RS based measurements performed outside gaps

For UE configured with NE-DC operation, the carrier-specific scaling factor $CSSF_{outside_gap,i}$ for intra-frequency SSB-based measurement and inter-frequency SSB-based measurements performed outside measurements gaps and intra-frequency CSI-RS based L3 measurement will be as specified in table 9.1.5.1.4-1.

Table 9.1.5.1.4-1: $CSSF_{outside_gap,i}$ scaling factor for NE-DC mode

Scenario	$CSSF_{outside_gap,i}$ for FR1 PCC	$CSSF_{outside_gap,i}$ for FR1 SCC	$CSSF_{outside_gap,i}$ for FR2 PCC	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is required	$CSSF_{outside_gap,i}$ for FR2 SCC where neighbour cell measurement is not required	$CSSF_{outside_gap,i}$ for inter-frequency MO with no measurement gap
NE-DC with FR1 only CA	$1+N_{PCC_CSIRS}$	N_{SCC_SSB} +Y+2x N_{SCC_CSIRS}- N_{SCC_OD-SSB}	N/A	N/A	N/A	N_{SCC_SSB} +Y+2x N_{SCC_CSIRS}- N_{SCC_OD-SSB}
NE-DC with FR2 only intra band CA	N/A	N/A	$1+N_{PCC_CSIRS}$	N/A	N_{SCC_SSB} +Y+2x N_{SCC_CSIRS}	N_{SCC_SSB} +Y+2x N_{SCC_CSIRS}- N_{SCC_OD-SSB}
NE-DC with FR2 only inter band CA	N/A	N/A	$1+N_{PCC_CSIRS}$	2*(1+ $N_{SCC_CSIRS_FR2_NCM}$) Note 3,5	2×(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS} -1-$N_{SCC_CSIRS_FR2_NCM}$) - N_{SCC_OD-SSB}	2×(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS} -1-$N_{SCC_CSIRS_FR2_NCM}$) - N_{SCC_OD-SSB}
NE-DC with FR1 +FR2 CA (FR1 PCell) **Note 1**	$1+N_{PCC_CSIRS}$	2×(N_{SCC_SSB} +Y+2* N_{SCC_CSIRS} -1-$N_{SCC_CSIRS_FR2_NCM}$) - N_{SCC_OD-SSB}	N/A	2x(1+ $N_{SCC_CSIRS_FR2_NCM}$) Note 3,5	2×(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS} -1-$N_{SCC_CSIRS_FR2_NCM}$) - N_{SCC_OD-SSB}	2×(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS} -1-$N_{SCC_CSIRS_FR2_NCM}$) - N_{SCC_OD-SSB}
NOTE 1: Only one FR1 operating band and one FR2 operating band are included for FR1+FR2 inter-band CA. NOTE 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.						

NOTE 3: $CSSF_{outside_gap,i}$ =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; $CSSF_{outside_gap,i}$ =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.
NOTE 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.
NOTE 5: Only two NR FR2 operating band are included for NE-DC with FR2 only inter-band CA.
NOTE 6: N_{PCC_CSIRS}=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PCC_CSIRS} =0.
NOTE 7: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured
NOTE 8: $N_{SCC_CSIRS_FR2_NCM}$=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, $N_{SCC_CSIRS_FR2_NCM}$=0.
NOTE 9: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG. For UE supporting *CSSF enhancement for one serving CC measurement per-band* for intra-frequency measurements without MG, N_{SCC_SSB} is the number of SCCs to be measured following the principles specified in clause 9.2.3.1 and 9.2.3.2.
NOTE 10: $N_{SCC_OD\text{-}SSB}$=Number of configured OD-SSB SCell(s) when only OD-SSB is configured in the SCell and without activated OD-SSB transmission.

9.1.5.2 Monitoring of multiple layers within gaps

For a UE supporting concurrent gaps or *concurrentMeasGapsPreMG-r18* or *concurrentMeasGapsNCSG-r18*, and when concurrent gaps are configured, the carrier-specific scaling factor $CSSF_{within_gap,i}$ for a measurement object *i* derived in this chapter is applied to following measurement types for the associated measurement gap:

- SSB-based intra-frequency measurement object without measurement gap as defined in clauses 9.2.1 and 9.2A.1, when
  - all of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap in concurrent GAPs, or
  - part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of concurrent GAPs.
  - part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of concurrent GAPs or with the union of concurrent concurrent GAPs and MUSIM gaps if MUSIM gaps are configured.
- SSB-based intra-frequency measurement object without measurement gap as defined in clauses 9.2.1 and 9.2A.1.
- CSI-RS based inter-frequency measurement in clause 9.10.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are overlapped by the measurement gap or the associated measurement gap in concurrent GAPs.
- CSI-RS based inter-frequency measurement in clause 9.10.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are partially overlapped by the measurement gap or the associated measurement gap in concurrent GAPs.
- CSI-RS based intra-frequency measurement in clause 9.10.2, when all CSI-RS resources for L3 measurement of this intra-frequency measurement object are partially overlapped with the associated measurement gap and all CSI-RS resources for L3 measurement of this intra-frequency measurement object are overlapped with the union of the configured concurrent GAPs.
- SSB-based inter-frequency measurement object with measurement gap as defined in clause 9.3.1.
- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap* as defined in clause 9.3.1, when
  - all of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent GAPs, or
  - part of the SMTC occasions of this inter-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this inter-frequency measurement object are overlapped with the union of concurrent GAPs, or
  - part of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent GAPs and the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network.
- NR PRS-based measurements for positioning in clause 9.9.
- E-UTRA Inter-RAT measurement object in clauses 9.4.2 and 9.4.3.

Otherwise, the carrier-specific scaling factor $CSSF_{within_gap,i}$ for a measurement object *i* derived in this chapter is applied to following measurement types:

- SSB-based intra-frequency measurement object without measurement gap as defined in clauses 9.2.1 and 9.2A.1, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- SSB-based intra-frequency measurement object without measurement gap as defined in clauses 9.2.1 and 9.2A.1, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap or the union of measurement gaps and MUSIM gaps.

- SSB-based intra-frequency measurement object without measurement gap as defined in clauses 9.2.1 and 9.2A.1.

- SSB-based intra-frequency measurement as defined in clause 9.2.1 for UE supporting *nr-NeedForInterruptionReport-r18*, and reporting *no-gap-with-interruption* for this intra-frequency layer via *NeedForInterruptionNR-r18*, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- SSB-based intra-frequency measurement as defined in clause 9.2.1 for UE supporting *nr-NeedForInterruptionReport-r18* and reporting *no-gap-with-interruption* for this intra-frequency layer via *NeedForInterruptionNR-r18*, when

  - all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap, or

  - part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- CSI-RS based inter-frequency measurement in clause 9.10.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are overlapped by the measurement gap.

- CSI-RS based inter-frequency measurement in clause 9.10.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are partially overlapped by the measurement gap.

- SSB-based inter-frequency measurement object with measurement gap as defined in clause 9.3.1.

- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap* as defined in clause 9.3.1, when

  - all of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, or

  - part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, but the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network.

- SSB-based inter-frequency measurement as defined in clause 9.3.1 for UE supporting *nr-NeedForInterruptionReport-r18* and reporting *no-gap-with-interruption* for this inter-frequency layer via *NeedForInterruptionNR-r18*, when all of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap.

- SSB-based inter-frequency measurement as defined in clause 9.3.1 for UE supporting *nr-NeedForInterruptionReport-r18* and reporting *no-gap-with-interruption* for this inter-frequency layer via *NeedForInterruptionNR-r18*, when

  - all of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, or

  - part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap.

- Intra-frequency RSSI/CO measurement with measurement gap in clause 9.2A.7.

- Intra-frequency RSSI/CO measurement without measurement gap in clause 9.2A.7 when all of the RMTC occasions of this intra-frequency RSSI/CO measurement are overlapped by the measurement gap(s).

- Inter-frequency RSSI/CO measurement in clauses 9.3A.8 and 9.3A.9.

- E-UTRA inter-RAT measurement object causing scheduling restriction in clauses 9.4.8, when

  - EMW is configured and fully overlapped with measurement gap, and the periodicity of measurement gap and EMW is the same, or

  - EMW is not configured.

- E-UTRA Inter-RAT measurement object in clauses 9.4.2 and 9.4.3.
- NR PRS-based measurements for positioning in clause 9.9.
- E-UTRA Inter-RAT RSTD and E-CID measurements in clauses 9.4.4 and 9.4.5.
- For a UE in E-UTRA-NR dual connectivity operation, NR SSB-based Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.4) on an NR serving carrier
  - the SSB is not completely contained in the active BWP of the UE, or
  - all of the SMTC occasions of this inter-RAT measurement object are overlapped by the measurement gap;
- NR SSB-based Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.4) on an NR non-serving carrier.
- E-UTRAN Inter-frequency measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.3) and by the E-UTRAN PSCell (TS 36.133 [15] clause 8.19.3).
- E-UTRAN Inter-frequency RSTD measurement configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.15).
- UTRA Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clauses 8.17.5 to 8.17.12).
- GSM Inter-RAT measurements configured by the E-UTRAN PCell (TS 36.133 [15] clauses 8.17.13 and 8.17.14).
- Note: The derivation of $CSSF_{within_gap,i}$ additionally considers the impact of SSB-based inter-frequency L1-RSRP measurement with measurement gap in clause 9.15.5.

The UE is expected to conduct the measurement of this measurement object *i* only within the measurement gap or the associated measurement gap if concurrent measurement gaps are configured. If UE is configured with concurrent measurement gaps and an association between measurement object *i* and certain measurement gap is provided, the requirements are defined assuming the UE shall conduct the measurement of this measurement object *i* within the associated measurement gap.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, $CSSF_{within_gap,i}$ and requirements derived from $CSSF_{outside_gap,i}$ are not specified.

Number of SSB layers shall include SSB for mobility and associated SSB for CSI-RS mobility. The ssbfrequency is counted only once if the ssbfrequency for mobility and associated SSB are the same, or ssbfrequency and smtc in multiple MOs are the same.

SSB-based measurement and CSI-RS based measurement for mobility configured in the same measurement object are considered as different layers.

9.1.5.2.1 EN-DC mode: carrier-specific scaling factor for SSB, CSI-RS-based L3 measurements and RSSI and channel occupancy measurements performed within gaps

The scaling value $CSSF_{within_gap,i}$ below has been derived without considering GSM inter-RAT carriers.

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within_gap,i}$ and is derived as described in this clause.

For UE supporting per-FR gap, for each measurement object *i* that are measured based on effective MGRP as defined in clause 9.1.2, $CSSF_{within_gap,i}$ used for deriving the measurement requirements is defined as $2*N_{with_CSI\text{-}RS} + N_{SSB_only}$, where

- $N_{with_CSI\text{-}RS}$ is the number of measurement objects with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured in the same FR as measurement object *i*, and

- N_{SSB_only} is the number of measurement objects with only SSB based L3 measurement configured in the same FR as measurement object *i*.

For a UE in E-UTRA-NR dual connectivity operation, if a SSB-based measurement object configured by PSCell and an NR SSB-based inter-RAT measurement object configured by E-UTRAN PCell are on the same carrier, they shall be counted as one measurement object in $M_{tot,i,j}$, provided that they meet the measurement object merging conditions in clause 9.1.3.2.

If measurement object *i* refers to an RSTD measurement with periodicity Tprs>160 ms or with periodicity Tprs=160 ms but *prs-MutingInfo-r9* is configured, $CSSF_{within_gap,i}$=1. Otherwise, the $CSSF_{within_gap,i}$ for other measurement objects (including RSTD measurement with periodicity Tprs=160 ms) participate in the gap competition are derived as below.

For each measurement gap *j* not used for an RSTD measurement with periodicity Tprs>160 ms or with periodicity Tprs=160 ms but *prs-MutingInfo-r9* is configured within an arbitrary 160 ms period, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR carriers, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.

- An NR measurement object with RSSI and channel occupancy measurement is a candidate to be measured in a gap if the RMTC duration is fully covered by MGL excluding RF switching time

- An inter-RAT UTRA measurement object configured by E-UTRA PCell [15] is a candidate to be measured in all measurement gaps.

- An inter-frequency E-UTRA measurement object configured by E-UTRA PCell [15] is a candidate to be measured in all measurement gaps.

- For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis.

- $M_{intra,i,j}$: Number of intra-frequency measurement objects, including both SSB, CSI-RS based and RSSI/CO measurement, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{intra,i,j}$ equals 0.

- $M_{inter,i,j}$: Number of NR inter-frequency layers including both SSB and CSI-RS based NR inter-RAT frequency layer and RSSI/CO measurement, configured by E-UTRA PCell, EUTRA inter-frequency measurement objects configured by E-UTRA PCell, or UTRA inter-RAT measurement objects configured by E-UTRA PCell which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{inter,i,j}$ equals 0.

- A measurement object *i* in $M_{intra,i,j}$ and in $M_{inter,i,j}$ is counted twice if the measurement object is configured with both RMTC and SMTC which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate

- $M_{tot,i,j} = M_{intra,i,j} + M_{inter,i,j}$: Total number of intra-frequency, inter-frequency and inter-RAT frequency layers which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

For each measurement gap *j* used for an RSTD measurement with periodicity Tprs>160 ms or with periodicity Tprs=160 ms but *prs-MutingInfo-r9* is configured within an arbitrary 160 ms period, $M_{intra,i,j} = M_{inter,i,j} = M_{tot,i,j} = 0$.

The carrier specific scaling factor $CSSF_{within_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within_gap,i} = \max(\text{ceil}(R_i \times M_{tot,i,j}))$, where $j=0\ldots(160/MGRP)-1$

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intra-frequency measurement object, $CSSF_{within_gap,i}$ is the maximum among

- ceil($R_i \times K_{intra} \times M_{intra,i,j}$) in gaps where $M_{inter,i,j} \neq 0$, where j=0…(160/MGRP)-1
- ceil($R_i \times M_{intra,i,j}$) in gaps where $M_{inter,i,j}=0$, where j=0…(160/MGRP)-1

- measurement object *i* is an inter-frequency or inter-RAT measurement object, $CSSF_{within_gap,i}$ is the maximum among
  - ceil($R_i \times K_{inter} \times M_{inter,i,j}$) in gaps where $M_{intra,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - ceil($R_i \times M_{inter,i,j}$) in gaps where $M_{intra,i,j}=0$, where j=0…(160/MGRP)-1

  Where R_i is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for RSTD measurement with periodicity Tprs>160 ms or with periodicity Tprs=160 ms but *prs-MutingInfo-r9* is configured within an arbitrary 1280 ms period.

9.1.5.2.2 SA mode: carrier-specific scaling factor for SSB, CSI-RS-based L3 measurements and RSSI and channel occupancy measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within_gap,i}$ and is derived as described in this clause.

For UE supporting per-FR gap, for each measurement object *i* that are measured based on effective MGRP as defined in clause 9.1.2, $CSSF_{within_gap,i}$ used for deriving the measurement requirements is defined as $2*N_{with_CSI\text{-}RS} + N_{SSB_only} + N_{L1_SSB}$, where

- $N_{with_CSI\text{-}RS}$ is the number of measurement objects with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured in the same FR as measurement object *i*, and
- N_{SSB_only} is the number of measurement objects with only SSB based L3 measurement configured in the same FR as measurement object *i*, and
- N_{L1_SSB} is the number of FR2 SSB based inter-frequency L1-RSRP measurements configured in the same FR as FR2 measurement object *i.*

If a UE capable of concurrent gaps is configured with concurrent gaps, the carrier specific scaling factor is calculated separately for each gap pattern, provided that the association between measurement objects and gap pattern is configured by network. Only the measurement objects associated to the same measurement gap pattern are counted when deriving $CSSF_{within_gap,i}$ for a target measurement object with index *i*.. In case of collision between concurrent measurement gaps, some measurement gap occasions may be dropped according to clause 9.1.8.3. The dropped gap occasions will not be used in deriving $CSSF_{within_gap,i.}$

If measurement object *i* refers to a long-periodicity measurement which is any of:

- an E-UTRA RSTD measurement with periodicity Tprs>160 ms or with periodicity Tprs=160 ms but *prs-MutingInfo-r9* is configured, or
- an NR measurement for positioning frequency layer *i* with $T_{available_PRS,i}$ >160ms, where $T_{available_PRS,i}$ is defined in clauses 9.9.2.5, 9.9.3.5, 9.9.4.5 and 9.9.6.5 for RSTD, PRS-RSRP ,UE Rx-Tx time difference and PRS-RSRPP measurements, respectively.

then $CSSF_{within_gap,i}$=1. Otherwise, the $CSSF_{within_gap,i}$ for other measurement objects (including E-UTRA RSTD measurement with periodicity Tprs=160 ms) participate in the gap competition and the $CSSF_{within_gap,i}$ are derived as below.

Table 9.1.5.2.2-1: void

When multiple positioning frequency layers are configured,

- for each positioning frequency layer i, $CSSF_{within_gap,i}$ is derived with the following steps assuming no other positioning frequency layer is configured.
- for each RRM frequency layer *i*, $CSSF_{within_gap,i}$ is derived as follows:

- an intermediate $CSSF_{within_gap,i,k}$ is derived with the following steps assuming only positioning frequency layer *k* is configured, and

- $CSSF_{within_gap,i}$= max($CSSF_{within_gap,i,k}$), where *k*=0…K-1, and K is the number of configured positioning frequency layers. For each measurement gap *j* not used for a long-periodicity measurement defined above, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and inter-frequency L1-RSRP measurement layers and NR PRS measurements on all positioning frequency layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.

- An NR measurement object with RSSI and channel occupancy measurement is a candidate to be measurement in a gap if the RMTC duration is fully covered by MGL excluding RF switching time.

- An inter-frequency SFTD measurement object, if to be measured with measurement gaps, is a candidate to be measured in all measurement gaps.

- A positioning frequency layer is counted as candidate for a MG occasion if at least one PRS resource on that positioning frequency layer is fully covered by the MGL excluding RF switching time.

- An inter-frequency L1-RSRP measurement layer is a candidate to be measured in a gap if all configured SSB resources on that frequency layer to be measured are fully covered by the MGL excluding RF switching time.

- For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis. For UEs which support and are configured with per FR gaps, the CSSF requirements do not apply when NR PRS measurement in one FR gap collides with SSB/CSI-RS/PRS measurements in the other FR gap in time domain.

- $M_{intra,i,j}$: Number of intra-frequency measurement objects, including both SSB, CSI-RS based and RSSI/CO measurements, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{intra,i,j}$ equals 0.

  $M_{inter,i,j}$: Number of NR inter-frequency layers including both SSB and CSI-RS based, E-UTRA inter-RAT and UTRA inter-RAT frequency layers, up to one positioning frequency layer, RSSI/CO measurements, inter-frequency L1-RSRP measurement layers, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{inter,i,j}$ equals 0.

  - In FR1, an inter-frequency L1-RSRP measurement layer is not counted in $M_{inter,i,j}$ if the SSB resource instance configured for L1-RSRP measurement of an inter-frequency layer is overlapped with the measurement object of this inter-frequency layer which is candidate to be measured in gap *j*.

  - In FR2, an inter-frequency L1-RSRP measurement layer in $M_{inter,i,j}$ contributes the number equal to the cell number for L1-RSRP measurement in this inter-frequency layer, which is candidate to be measured in gap *j*.

  Note: The current $M_{inter,i,j}$ assumes all cells in the same frequency layer have the same SSB periodicity.- A measurement object *i* in $M_{intra,i,j}$ and in $M_{inter,i,j}$ is counted twice if the measurement object is configured with both RMTC and SMTC which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate

- $M_{tot,i,j} = M_{intra,i,j} + M_{inter,i,j}$: Total number of intra-frequency, inter-frequency and inter-RAT frequency layers and up to one NR PRS measurement on any one positioning frequency layer, inter-frequency L1-RSRP measurement layers, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, $M_{intra,i,j} = M_{inter,i,j} = M_{tot,i,j} = 0$. The carrier specific scaling factor $CSSF_{within_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within_gap,i}$= max(ceil($R_i \times M_{tot,i,j}$)), where *j*=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intra-frequency measurement object, $CSSF_{within_gap,i}$ is the maximum among
  - $ceil(R_i \times K_{intra} \times M_{intra,i,j})$ in gaps where $M_{inter,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - $ceil(R_i \times M_{intra,i,j})$ in gaps where $M_{inter,i,j}=0$, where j=0…(160/MGRP)-1
- measurement object *i* is an inter-frequency or inter-RAT measurement object or NR PRS measurement on any one positioning frequency layer, $CSSF_{within_gap,i}$ is the maximum among
  - $ceil(R_i \times K_{inter} \times M_{inter,i,j})$ in gaps where $M_{intra,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - $ceil(R_i \times M_{inter,i,j})$ in gaps where $M_{intra,i,j}=0$, where j=0…(160/MGRP)-1

Where R_i is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for a long-periodicity measurement defined above.

$CSSF_{within_gap,k}$=1 during $T_{Detect,\ E\text{-}UTRAN\ FDD}$ specified in clause 9.4.4.1.2.2 and $T_{Detect,\ E\text{-}UTRAN\ TDD}$ specified in clause 9.4.4.2.2.2, where k is the carrier frequency where the UE is performing cell detection of the inter-RAT E-UTRA OTDOA assistance data reference cell when acquiring the subframe and slot timing of the cell according to clause 9.4.4. In this case, the UE cell identification and measurement periods derived based on $CSSF_{within_gap,i}$ in clauses 9.2.5.1, 9.2.5.2, 9.2.6.2, 9.2.6.3, 9.3.4, 9.3.5, 9.4.2.2, 9.4.2.3 and 9.10.2 may be extended for measurement objects of which the cell identification and measurement periods are overlapped with $T_{Detect,\ E\text{-}UTRAN\ FDD}$ and $T_{Detect,\ E\text{-}UTRAN\ TDD}$.

9.1.5.2.3 NE-DC: carrier-specific scaling factor for SSB-based and CSI-RS based L3 measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within_gap,i}$ and is derived as described in this clause.

For UE supporting per-FR gap, for each measurement object *i* that are measured based on effective MGRP as defined in clause 9.1.2, $CSSF_{within_gap,i}$ used for deriving the measurement requirements is defined as $2*N_{with_CSI\text{-}RS} + N_{SSB_only}$, where

- $N_{with_CSI\text{-}RS}$ is the number of measurement objects with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured in the same FR as measurement object *i*, and
- N_{SSB_only} is the number of measurement objects with only SSB based L3 measurement configured in the same FR as measurement object *i*.

If measurement object *i* refers to a long-periodicty measurement which is any of:

- an E-UTRA RSTD measurement with periodicity Tprs>160 ms or with periodicity Tprs=160 ms but *prs-MutingInfo-r9* is configured, or
- an NR measurement for positioning frequency layer *i* with $T_{available_PRS,i}$ >160 ms, where $T_{available_PRS,i}$ is defined in clauses 9.9.2.5, 9.9.3.5 ,9.9.4.5 and 9.9.6.5 for RSTD, PRS-RSRP ,UE Rx-Tx time difference and PRS-RSRPP measurements, respectively.

then $CSSF_{within_gap,i}$=1. Otherwise, the $CSSF_{within_gap,i}$ for other measurement objects (including E-UTRA RSTD measurement with periodicity Tprs=160 ms) participate in the gap competition are derived as below.

When multiple positioning frequency layers are configured,

- for each positioning frequency layer *i*, $CSSF_{within_gap,i}$ is derived with the following steps assuming no other positioning frequency layer is configured.
- for each RRM frequency layer *i*, $CSSF_{within_gap,i}$ is derived as follows:
  - an intermediate $CSSF_{within_gap,i,k}$ is derived with the following steps assuming only positioning frequency layer *k* is configured, and
  - $CSSF_{within_gap,i}$= max($CSSF_{within_gap,i,k}$), where k=0…K-1, and K is the number of configured positioning frequency layers.

For each measurement gap *j* not used for a long-periodicity measurement defined above, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and NR PRS measurements on all positioning frequency layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.

- An inter-RAT measurement object is a candidate to be measured in all measurement gaps.

- An inter-frequency E-UTRA measurement object is a candidate to be measured in all measurement gaps.

- A positioning frequency layer is counted as candidate for a MG occasion if at least one PRS resource on that positioning frequency layer is fully covered by the MGL excluding RF switching time.

  For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis. For UEs which support and are configured with per FR gaps, the CSSF requirements do not apply when NR PRS measurement in one FR gap collides with SSB/CSI-RS/PRS measurements in the other FR gap in time domain.

  If the number of configured inter-frequency and interRAT measuerement objects and NR PRS measurements on all positioning frequency layers is non-zero and the UE is configured with per UE gaps, or if the UE is configured with per FR gaps:

  FR1 and FR2 intra-frequency measurement objects belong to group A

  Inter-frequency and inter-RAT measurement objects belong to group B

  $M_{groupA,i,j}$: Sum of the number of FR1 intra-frequency measurement objects $M_{intra\text{-}FR1,i,j}$ and the number of FR2 intra-frequency measurement objects $M_{intra\text{-}FR2,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupA,i,j}$ equals 0.

  $M_{groupBi,j}$: Number of NR inter-frequency layers including both SSB and CSI-RS based, E-UTRA inter-RAT and UTRA inter-RAT measurement objects, up to one positioning frequency layer, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupB,i,j}$ equals 0.

  If the number of configured inter-frequency and inter-RAT measuerement objects and NR PRS measurements on all positioning frequency layers is zero and the UE is configured with per UE gaps:

  FR1 intra-frequency measurement objects belong to group A

  FR2 intra-frequency measurement objects belong to group B

  $M_{groupA,i,j}$: The number of FR1 intra-frequency measurement objects $M_{intra\text{-}FR1,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupA,i,j}$ equals 0.

  $M_{groupBi,j}$: The number of FR2 intra-frequency measurement objects $M_{intra\text{-}FR2,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupB,i,j}$ equals 0.

  $M_{tot,i,j} = M_{groupA,i,j} + M_{groupB,i,j}$: Total number of group A and group B measurement objects which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, $M_{intra,i,j} = M_{inter,i,j} = M_{tot,i,j} = 0$. The carrier specific scaling factor $CSSF_{within_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within_gap,i} = \max(\text{ceil}(R_i \times M_{tot,i,j}))$, where $j = 0 \ldots (160/MGRP)-1$

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is a group A measurement object, $CSSF_{within_gap,i}$ is the maximum among
  - $ceil(R_i \times K_{intra} \times M_{groupA,i,j})$ in gaps where $M_{groupB,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - $ceil(R_i \times M_{groupA,i,j})$ in gaps where $M_{groupB,i,j}=0$, where j=0…(160/MGRP)-1
- measurement object *i* is an group B measurement object, $CSSF_{within_gap,i}$ is the maximum among
  - $ceil(R_i \times K_{inter} \times M_{groupBi,j})$ in gaps where $M_{groupA,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - $ceil(R_i \times M_{groupB,i,j})$ in gaps where $M_{groupA,i,j}=0$, where j=0…(160/MGRP)-1

Where R_i is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for a long-periodicity measurement defined above.

9.1.5.2.4 NR-DC: carrier-specific scaling factor for SSB-based and CSI-RS-based L3 measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within_gap,i}$ and is derived as described in this clause.

For UE supporting per-FR gap, for each measurement object *i* that are measured based on effective MGRP as defined in clause 9.1.2, $CSSF_{within_gap,i}$ used for deriving the measurement requirements is defined as $2*N_{with_CSI\text{-}RS} + N_{SSB_only} + N_{L1_SSB}$, where

- $N_{with_CSI\text{-}RS}$ is the number of measurement objects with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured in the same FR as measurement object *i*, and
- N_{SSB_only} is the number of measurement objects with only SSB based L3 measurement configured in the same FR as measurement object *i*.
- N_{L1_SSB} is the number of FR2 SSB based inter-frequency L1-RSRP measurements configured in the same FR as FR2 measurement object *i.*

If measurement object *i* refers to a long-periodicity measurement which is any of:

- an E-UTRA RSTD measurement with periodicity Tprs>160 ms or with periodicity Tprs=160 ms but *prs-MutingInfo-r9* is configured, or
- an NR measurement for positioning frequency layer *i* with $T_{available_PRS,i}$ >160 ms, where $T_{available_PRS,i}$ is defined in clauses 9.9.2.5, 9.9.3.5 ,9.9.4.5 and 9.9.6.5 for RSTD, PRS-RSRP , UE Rx-Tx time difference and PRS-RSRPP measurements, respectively.

then $CSSF_{within_gap,i}$=1. Otherwise, the $CSSF_{within_gap,i}$ for other measurement objects (including E-UTRA RSTD measurement with periodicity Tprs=160 ms) participate in the gap competition and the $CSSF_{within_gap,i}$ are derived as below.

When multiple positioning frequency layers are configured,

- for each positioning frequency layer *i*, $CSSF_{within_gap,i}$ is derived with the following steps assuming no other positioning frequency layer is configured.
- for each RRM frequency layer *i*, $CSSF_{within_gap,i}$ is derived as follows:
  - an intermediate $CSSF_{within_gap,i,k}$ is derived with the following steps assuming only positioning frequency layer *k* is configured, and
  - $CSSF_{within_gap,i}$= max($CSSF_{within_gap,i,k}$), where k=0…K-1, and K is the number of configured positioning frequency layers.

For each measurement gap *j* not used for an RSTD measurement with periodicity Tprs>160 ms or with periodicity Tprs=160 ms but *prs-MutingInfo-r9* is configured within an arbitrary 160 ms period, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and NR PRS measurements on all

positioning frequency layers and inter-frequency L1-RSRP measurement layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.

- A positioning frequency layer is counted as candidate for a MG occasion if at least one PRS resource on that positioning frequency layer is fully covered by the MGL excluding RF switching time.

- An inter-frequency L1-RSRP measurement layer is a candidate to be measured in a gap if the window confining SSB resource is fully covered by the MGL excluding RF switching time.

  For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis. For UEs which support and are configured with per FR gaps, the CSSF requirements do not apply when NR PRS measurement in one FR gap collides with SSB/CSI-RS/PRS measurements in the other FR gap in time domain.

  If the number of configured inter-frequency and interRAT measuerement objects and NR PRS measurements on all positioning frequency layers is non-zero and the UE is configured with per UE gaps, or if the UE is configured with per FR gaps:

  FR1 and FR2 intra-frequency measurement objects belong to group A

  Inter-frequency and inter-RAT measurement objects and up to one NR PRS measurement on any one positioning frequency layer belong to group B

  $M_{groupA,i,j}$: Sum of the number of FR1 intra-frequency measurement objects $M_{intra\text{-}FR1,i,j}$ and the number of FR2 intra-frequency measurement objects $M_{intra\text{-}FR2,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupA,i,j}$ equals 0.

  $M_{groupBi,j}$: Number of NR inter-frequency layers including both SSB and CSI-RS based, E-UTRA inter-RAT and UTRA inter-RAT measurement objects and up to one positioning frequency layer, inter-frequency L1-RSRP measurement layers, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupB,i,j}$ equals 0.

  - In FR1, an inter-frequency L1-RSRP measurement layer is not counted in $M_{inter,i,j}$ if the SSB resource instance configured for L1-RSRP measurement of an inter-frequency layer is overlapped with the measurement object of this inter-frequency layer which are candidates to be measured in gap *j*.

  - In FR2, an inter-frequency L1-RSRP measurement layer in $M_{inter,i,j}$ contributes the number equal to the cell number for L1-RSRP measurement in this inter-frequency layer, which is candidate to be measured in gap *j*.

  Note: The current $M_{inter,i,j}$ assumes all cells in the same frequency layer have the same SSB periodicity.If the number of configured inter-frequency and interRAT measuerement objects and NR PRS measurements on all positioning frequency layers is zero and the UE is configured with per UE gaps:

  FR1 intra-frequency measurement objects of MCG belong to group A

  FR1 intra-frequency measurement objects of SCG belong to group B for FR1+FR1 NR-DC, or FR2 intra-frequency measurement objects of SCG belong to group B for FR1+FR2 NR-DC.

  $M_{groupA,i,j}$: The number of FR1 intra-frequency measurement objects $M_{intra\text{-}FR1,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupA,i,j}$ equals 0.

$M_{groupBi,j}$: The number of FR2 intra-frequency measurement objects $M_{intra\text{-}FR2,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupB,i,j}$ equals 0.

$M_{tot,i,j} = M_{groupA,i,j} + M_{groupB,i,j}$: Total number of group A and group B measurement objects and inter-frequency L1-RSRP measurement layers which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.For each measurement gap *j* used for a long-periodicity measurement defined above, $M_{intra,i,j} = M_{inter,i,j} = M_{tot,i,j} = 0$. The carrier specific scaling factor $CSSF_{within_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within_gap,i} = \max(\text{ceil}(R_i \times M_{tot,i,j}))$, where $j=0\ldots(160/MGRP)-1$

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is a group A measurement object, $CSSF_{within_gap,i}$ is the maximum among
  - $\text{ceil}(R_i \times K_{intra} \times M_{groupA,i,j})$ in gaps where $M_{groupB,i,j} \neq 0$, where $j=0\ldots(160/MGRP)-1$
  - $\text{ceil}(R_i \times M_{groupA,i,j})$ in gaps where $M_{groupB,i,j}=0$, where $j=0\ldots(160/MGRP)-1$
- measurement object *i* is an group B measurement object, $CSSF_{within_gap,i}$ is the maximum among
  - $\text{ceil}(R_i \times K_{inter} \times M_{groupBi,j})$ in gaps where $M_{groupA,i,j} \neq 0$, where $j=0\ldots(160/MGRP)-1$
  - $\text{ceil}(R_i \times M_{groupB,i,j})$ in gaps where $M_{groupA,i,j}=0$, where $j=0\ldots(160/MGRP)-1$

R_i is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for a long-periodicity measurement defined above.

9.1.5.2.5 SA mode: carrier-specific scaling factor for PRS-based measurements performed within gaps

The requirements in this clause apply for NR PRS-based measurements for positioning in clause 9.9.

When NR PRS-based measurements for positioning are configured on one or more positioning frequency layers within measurement gaps, the carrier specific scaling factor for a target PRS-based positioning measurement on a positioning frequency layer with index *i* is designated as $CSSF_{within_gap,i}$ and is derived as described in clause 9.1.5.2.2.

NR Positioning measurement requirements for long periodicity measurements apply in case all PRS resources in the PFL are configured with periodicity > 160 ms.

9.1.5.2.6 NE-DC: carrier-specific scaling factor for PRS-based measurements performed within gaps

The requirements in this clause apply for NR PRS-based measurements for positioning in clause 9.9.

When NR PRS-based measurements for positioning are configured on one or more positioning frequency layers within measurement gaps, the carrier specific scaling factor for a target measurement on a positioning frequency layer with index *i* is designated as $CSSF_{within_gap,i}$ and is derived as described in clause 9.1.5.2.3.

NR Positioning measurement requirements for long periodicity measurements apply in case all PRS resources in the PFL are configured with periodicity larger than 160 ms.

9.1.5.2.7 NR-DC: carrier-specific scaling factor for PRS-based measurements performed within gaps

The requirements in this clause apply for NR PRS-based measurements for positioning in clause 9.9.

When NR PRS-based measurements for positioning are configured on one or more positioning frequency layers within measurement gaps, the carrier specific scaling factor for a target measurement on a positioning frequency layer with index *i* is designated as $CSSF_{within_gap,i}$ and is derived as described in clause 9.1.5.2.4.

NR Positioning measurement requirements for long periodicity measurements apply in case all PRS resources in the PFL are configured with periodicity larger than 160 ms.

9.1.5.3 Monitoring of multiple layers within NCSG

The measurement requirements derived from $CSSF_{within_ncsg,i}$ defined in this clause are applicable provided that network provides NCSG pattern for measurement.

For a UE supporting *concurrentMeasGapsNCSG-r18* and when a gap combination including one or more NCSGs is configured, the carrier-specific scaling factor $CSSF_{within_ncsg,i}$ derived in this chapter for a measurement object *i* associated with an NCSG is applied to following measurement types:

- SSB-based intra-frequency measurement object without measurement gap as defined in clause 9.2.1 corresponding to an activated serving cell, when
  - all of the SMTC occasions of this intra-frequency measurement object are overlapped with associated NCSG in [concurrent gaps], or
  - part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated NCSG and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of all the GAPs.
- SSB-based intra-frequency measurement object with NCSG as defined in clause 9.2.1 corresponding to an activated serving cell (in non-dormancy);
- SSB-based intra-frequency measurement object corresponding to a deactivated Serving cell or to an activated Serving cell in dormancy, when all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG regardless of the UE capability reporting of *intraFreq-needForNCSG* and regardless of the the gap association.
- SSB-based inter-frequency measurement object without measurement gap as defined in clause 9.3.1, when
  - all of the SMTC occasions of this inter-frequency measurement object are overlapped with associated NCSG in [concurrent gaps], or
  - part of the SMTC occasions of this inter-frequency measurement object are overlapped with the associated NCSG and all the SMTC occasions of this inter-frequency measurement object are overlapped with the union of all the GAPs, or
- SSB-based inter-frequency measurement object with NCSG as defined in clause 9.3.1;
- E-UTRA inter-RAT measurement object with NCSG as defined in clause 9.4.1;

Otherwise, the carrier-specific scaling factor $CSSF_{within_ncsg,i}$ for a measurement object *i* derived in this clause is applied to following measurement types:

- SSB-based intra-frequency measurement object without measurement gap as defined in clause 9.2.1 corresponding to an activated serving cell, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;
-- SSB-based intra-frequency measurement object with NCSG as defined in clause 9.2.1 corresponding to an activated serving cell, when all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;
- SSB-based intra-frequency measurement object corresponding to a deactivated serving cell, or to an activated serving cell in dormancy with SSB within the dormant BWP, when all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;
- SSB-based inter-frequency measurement object without measurement gap as defined in clause 9.3.1, when all of the SMTC occasions of this inter-frequency measurement object are overlapped by the NCSG;
- SSB-based inter-frequency measurement object with NCSG as defined in clause 9.3.1;
- E-UTRA inter-RAT measurement object with NCSG as defined in clause 9.4.1;

UE is expected to conduct the measurement of this measurement object *i* only within the NCSG.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present for an intra-frequency measurement object, and *smtc1* is fully overlapping with NCSG and *smtc2* is partially overlapping with NCSG, requirements derived from $CSSF_{within_ncsg,i}$ and $CSSF_{outside_gap,i}$ are not applicable.

9.1.5.3.1 SA mode: carrier-specific scaling factor for measurements performed within NCSG

When one or more measurement objects are monitored within NCSG, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within_ncsg,i}$ and is derived as described in this clause.

If a UE capable of *concurrentMeasGapsNCSG-r18* is configured with a gap combination including one or more NCSGs, the carrier specific scaling factor is calculated separately for each gap pattern, provided that the association between measurement objects and gap pattern is configured by network. Only the measurement objects associated to the same NCSG pattern are counted when deriving $CSSF_{within_ncsg,i}$ for a target measurement object with index *i*. In case of collision between concurrent GAPs, some GAP occasions may be dropped according to clause 9.1.13.3. The dropped NCSG occasions will not be used in deriving $CSSF_{within_ncsg,i}$.

For each NCSG occasion *j*, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects which are candidates to be measured within the occaison *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in an NCSG occasion if its SMTC duration is fully covered by the ML. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An inter-RAT E-UTRA measurement object configured is a candidate to be measured in all NCSG occasions.

- $M_{intra,i,j}$: Number of intra-frequency measurement objects which are candidates to be measured in NCSG occasion *j* where the measurement object *i* is also a candidate. Otherwise $M_{intra,i,j}$ equals 0.

- $M_{inter,i,j}$: Number of NR inter-frequency measurement objects and E-UTRA inter-RAT measurement objects which are candidates to be measured in NCSG occasion *j* where the measurement object *i* is also a candidate. Otherwise $M_{inter,i,j}$ equals 0.

- $M_{tot,i,j} = M_{intra,i,j} + M_{inter,i,j}$: Total number of intra-frequency, inter-frequency and inter-RAT measurement objects which are candidates to be measured in NCSG occasion *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

For UEs which support and are configured with per FR NCSG, the above counting is done on a per FR basis, and for UEs which are configured with per UE NCSG the counting is done on a per UE basis.

The carrier specific scaling factor $CSSF_{within_ncsg,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within_ncsg,i} = \max(M_{tot,i,j})$, where $j=0\ldots(160/VIRP)-1$

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intra-frequency measurement object, $CSSF_{within_ncsg,i}$ is the maximum among
  - $ceil(K_{intra} \times M_{intra,i,j})$ in NCSG occasions where $M_{inter,i,j} \neq 0$, where $j=0\ldots(160/VIRP)-1$
  - $M_{intra,i,j}$ in NCSG occasions where $M_{inter,i,j}=0$, where $j=0\ldots(160/VIRP)-1$
- measurement object *i* is an inter-frequency or inter-RAT measurement object, $CSSF_{within_ncsg,i}$ is the maximum among
  - $ceil(K_{inter} \times M_{inter,i,j})$ in NCSG occasions where $M_{intra,i,j} \neq 0$, where $j=0\ldots(160/VIRP)-1$
  - $M_{inter,i,j}$ in NCSG occasions where $M_{intra,i,j}=0$, where $j=0\ldots(160/VIRP)-1$
- K_{intra} and K_{inter} are defined in clause 9.1.2.1a.

9.1.5.4 L1-RSRP measurements within measurement gap

The requirements in this clause apply for SSB-based L1-RSRP measurements within measurement gap for LTM in clause 9.15.5.

When SSB-based L1-RSRP measurements are configured on one or more frequecny layers within measurement gap, the carrier sepcific scaling factor for a target L1-RSRP measurement on a inter-frequency layer with index *i* is designated as $CSSF_{within_gap,i}$ and is derived in this chapter, with the consideration of the impact from the following measurement types:

- SSB-based intra-frequency measurement object with no measurement gap in clauses 9.2.5 and 9.2A.5, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.
- SSB-based intra-frequency measurement object with measurement gap in clauses 9.2.6 and 9.2A.6.
- CSI-RS based inter-frequency measurement in clause 9.10.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are overlapped by the measurement gap.
- CSI-RS based inter-frequency measurement in clause 9.10.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are partially overlapped by the measurement gap.
- SSB-based inter-frequency measurement object with measurement gap in clause 9.3.4.
- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap* in clause 9.3.9, when
  - all of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, or
  - part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, but the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network.
- Intra-frequency RSSI/CO measurement with measurement gap in clause 9.2A.7.
- Intra-frequency RSSI/CO measurement with no measurement gap in clause 9.2A.7 when all of the RMTC occasions of this intra-frequency RSSI/CO measurement are overlapped by the measurement gap(s).
- Inter-frequency RSSI/CO measurement in clauses 9.3A.8 and 9.3A.9.
- E-UTRA Inter-RAT measurement object in clauses 9.4.2 and 9.4.3.
- NR PRS-based measurements for positioning in clause 9.9.
- E-UTRA Inter-RAT RSTD and E-CID measurements in clauses 9.4.4 and 9.4.5.
- For a UE in E-UTRA-NR dual connectivity operation, NR SSB-based Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.4) on an NR serving carrier
  - the SSB is not completely contained in the active BWP of the UE, or
  - all of the SMTC occasions of this inter-RAT measurement object are overlapped by the measurement gap;
- NR SSB-based Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.4) on an NR non-serving carrier.
- E-UTRAN Inter-frequency measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.3) and by the E-UTRAN PSCell (TS 36.133 [15] clause 8.19.3).
- E-UTRAN Inter-frequency RSTD measurement configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.15).
- UTRA Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clauses 8.17.5 to 8.17.12).
- GSM Inter-RAT measurements configured by the E-UTRAN PCell (TS 36.133 [15] clauses 8.17.13 and 8.17.14).

- SSB-based inter-frequency L1-RSRP measurement with measurement gap in clause 9.15.5

The UE is expected to conduct the measurement of this inter-frequency L1-RSRP measurement layer *i* only within the measurement gap.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, $CSSF_{within_gap,i}$ and requirements derived from $CSSF_{outside_gap,i}$ are not specified.

In derivation of $CSSF_{within_gap,i}$, number of SSB layers shall include SSB for mobility and that as associated SSB for CSI-RS mobility. The *ssbfrequency* is counted only once if the ssbfrequency for mobility and associated SSB are the same, or *ssbfrequency* and *smtc* in multiple MOs are the same.

9.1.5.4.1 SA mode: carrier-specific scaling factor for L1-RSRP measurements performed within measurement gap

When one or more inter-frequency L1-RSRP measurement layers are monitored within measurement gaps, the carrier specific scaling factor for a target inter-frequency L1-RSRP measurement layer with index *i* is designated as $CSSF_{within_gap,i}$ and is derived as described in this clause.

For UE supporting per-FR gap, for each inter-frequency L1-RSRP measurement layer *i* that are measured based on effective MGRP as defined in clause 9.1.2, $CSSF_{within_gap,i}$ used for deriving the measurement requirements is defined as $2*N_{with_CSI\text{-}RS} + N_{SSB_only} + N_{L1_SSB}$, where

- $N_{with_CSI\text{-}RS}$ is the number of measurement objects with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured in the same FR as, and

- N_{SSB_only} is the number of measurement objects with only SSB based L3 measurement, and

- N_{L1_SSB} is the number of SSB based inter-frequency L1-RSRP measurements configured in the same FR as measurement object *i.*

When multiple positioning frequency layers are configured,

- for each SSB based inter-frequency L1-RSRP measurement i, $CSSF_{within_gap,i}$ is derived as follows:

  - an intermediate $CSSF_{within_gap,i,k}$ is derived with the following steps assuming only positioning frequency layer *k* is configured, and

  - $CSSF_{within_gap,i} = \max(CSSF_{within_gap,i,k})$, where $k=0\ldots K-1$, and K is the number of configured positioning frequency layers.

For each measurement gap *j* not used for a long-periodicity measurement defined above, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and NR PRS measurements on all positioning frequency layers and inter-frequency L1-RSRP measurement layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.

- An NR measurement object with RSSI and channel occupancy measurement is a candidate to be measurement in a gap if the RMTC duration is fully covered by MGL excluding RF switching time

- An inter-frequency SFTD measurement object, if to be measured with measurement gaps, is a candidate to be measured in all measurement gaps.

- A positioning frequency layer is counted as candidate for a MG occasion if at least one PRS resource on that positioning frequency layer is fully covered by the MGL excluding RF switching time.

- An inter-frequency L1-RSRP measurement layer is a candidate to be measured in a gap if all configured SSB resources on that frequency layer to be measured are fully covered by the MGL excluding RF switching time.

- For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis.

- $M_{intra,i,j}$: Number of intra-frequency measurement objects, including both SSB, CSI-RS based and RSSI/CO measurements, which are candidates to be measured in gap *j* where inter-frequency L1-RSRP measurement layer *i* is also a candidate. Otherwise $M_{intra,i,j}$ equals 0.

- $M_{inter,i,j}$: Number of NR inter-frequency layers including both SSB and CSI-RS based, EUTRA inter-RAT and UTRA inter-RAT frequency layers, up to one positioning frequency layer, RSSI/CO measurements, inter-frequency L1-RSRP measurement layers, which are candidates to be measured in gap *j* where the inter-frequency L1-RSRP measurement layer *i* is also a candidate. Otherwise $M_{inter,i,j}$ equals 0.

  - In FR1, an inter-frequency L1-RSRP measurement layer is not counted in $M_{inter,i,j}$ if the SSB resource instance configured for L1-RSRP measurement of an inter-frequency layer is overlapped with the measurement object of this inter-frequency layer which are candidates to be measured in gap *j*.

  - In FR2, an inter-frequency L1-RSRP measurement layer in $M_{inter,i,j}$ contributes the number equal to the cell number for L1-RSRP measurement in this inter-frequency layer, which is candidate to be measured in gap *j*.

Editor Note: The current $M_{inter,i,j}$ assumes all cells in the same frequency layer have the same SSB periodicity. FFS whether and how to address the case of different periodicities.

- A measurement object *i* in $M_{intra,i,j}$ and in $M_{inter,i,j}$ is counted twice if the measurement object is configured with both RMTC and SMTC which are candidates to be measured in gap *j* where the inter-frequency L1-RSRP measurement layer *i* is also a candidate

- $M_{tot,i,j} = M_{intra,i,j} + M_{inter,i,j}$: Total number of intra-frequency, inter-frequency and inter-RAT frequency layers and up to one NR PRS measurement on any one positioning frequency layer, inter-frequency L1-RSRP measurement layers, which are candidates to be measured in gap *j* where the inter-frequency L1-RSRP measurement layer *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, $M_{intra,i,j} = M_{inter,i,j} = M_{tot,i,j} = 0$. The carrier specific scaling factor $CSSF_{within_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within_gap,i} = \max(\text{ceil}(R_i \times M_{tot,i,j}))$, where $j=0\ldots(160/MGRP)-1$

[If *measGapSharingScheme* is not equal sharing and

- L1-RSRP measurement layer *i* is an SSB based inter-frequency L1-RSRP measurement layer, $CSSF_{within_gap,i}$ is the maximum among

  - $\text{ceil}(R_i \times K_{inter} \times M_{inter,i,j})$ in gaps where $M_{intra,i,j} \neq 0$, where $j=0\ldots(160/MGRP)-1$

  - $\text{ceil}(R_i \times M_{inter,i,j})$ in gaps where $M_{intra,i,j}=0$, where $j=0\ldots(160/MGRP)-1$]

Where R_i is the maximal ratio of the number of measurement gap where inter-frequency L1-RSRP measurement layer *i* is a candidate to be measured over the number of measurement gap where inter-frequency L1-RSRP measurement layer *i* is a candidate and not used for a long-periodicity measurement defined above.

9.1.5.4.2 NR-DC: carrier-specific scaling factor for L1-RSRP measurements performed within measurement gap

When one or more inter-frequency L1-RSRP measurement layers are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object or a target inter-frequency L1-RSRP measurement layer with index *i* is designated as $CSSF_{within_gap,i}$ and is derived as described in this clause.

For UE supporting per-FR gap, for each inter-frequency L1-RSRP measurement layer *i* that are measured based on effective MGRP as defined in clause 9.1.2, $CSSF_{within_gap,i}$ used for derving the measurement requirements is defined as $2*N_{with_CSI\text{-}RS} + N_{SSB_only} + N_{L1_SSB}$, where

- $N_{with_CSI\text{-}RS}$ is the number of measurement objects with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured in the same FR as, and

- N_{SSB_only} is the number of measurement objects with only SSB based L3 measurement, and
- N_{L1_SSB} is the number of SSB based inter-frequency L1-RSRP measurements configured in the same FR as measurement object *i*.

When multiple positioning frequency layers are configured,

- for each SSB based inter-frequency L1-RSRP measurement layer *i*, $CSSF_{within_gap,i}$ is derived as follows:
  - an intermediate $CSSF_{within_gap,i,k}$ is derived with the following steps assuming only positioning frequency layer *k* is configured, and
  - $CSSF_{within_gap,i}$= max($CSSF_{within_gap,i,k}$), where *k*=0…K-1, and K is the number of configured positioning frequency layers.

For each measurement gap *j* not used for an RSTD measurement with periodicity Tprs>160 ms or with periodicity Tprs=160 ms but *prs-MutingInfo-r9* is configured within an arbitrary 160 ms period, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and NR PRS measurements on all positioning frequency layers and inter-frequency L1-RSRP measurement layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.
- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.
- A positioning frequency layer is counted as candidate for a MG occasion if at least one PRS resource on that positioning frequency layer is fully covered by the MGL excluding RF switching time.
- An inter-frequency L1-RSRP measurement layer is a candidate to be measured in a gap if all configured SSB resources on that frequency layer to be measured are fully covered by the MGL excluding RF switching time.

  For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis.

  If the number of configured inter-frequency and interRAT measuerement objects and NR PRS measurements on all positioning frequency layers is non-zero and the UE is configured with per UE gaps, or if the UE is configured with per FR gaps:

  FR1 and FR2 intra-frequency measurement objects belong to group A

  Inter-frequency and inter-RAT measurement objects and up to one NR PRS measurement on any one positioning frequency layer and [inter-frequency L1-RSRP measurement layers] belong to group B

  $M_{groupA,i,j}$: Sum of the number of FR1 intra-frequency measurement objects $M_{intra\text{-}FR1,i,j}$ and the number of FR2 intra-frequency measurement objects $M_{intra\text{-}FR2,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupA,i,j}$ equals 0.

  $M_{groupBi,j}$: Number of NR inter-frequency layers including both SSB and CSI-RS based, E-UTRA inter-RAT and UTRA inter-RAT measurement objects and up to one positioning frequency layer, inter-frequency L1-RSRP measurement layers, which are candidates to be measured in gap *j* where the inter-frequency L1-RSRP measurement layer *i* is also a candidate. Otherwise $M_{groupB,i,j}$ equals 0.

  - In FR1, an inter-frequency L1-RSRP measurement layer is not counted in $M_{inter,i,j}$ if the SSB resource instance configured for L1-RSRP measurement of an inter-frequency layer is overlapped with the measurement object of this inter-frequency layer which are candidates to be measured in gap *j*.
  - In FR2, an inter-frequency L1-RSRP measurement layer in $M_{inter,i,j}$ contributes the number equal to the cell number for L1-RSRP measurement in this inter-frequency layer, which is candidate to be measured in gap *j*.

Editor Note: The current $M_{inter,i,j}$ assumes all cells in the same frequency layer have the same SSB periodicity. FFS whether and how to address the case of different periodicities.

$M_{tot,i,j} = M_{groupA,i,j} + M_{groupB,i,j}$: Total number of group A and group B measurement objects and inter-frequency L1-RSRP measurement layers which are candidates to be measured in gap *j* where the inter-frequency L1-RSRP measurement layer *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, $M_{intra,i,j} = M_{inter,i,j} = M_{tot,i,j} = 0$. The carrier specific scaling factor $CSSF_{within_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within_gap,i} = \max(\text{ceil}(R_i \times M_{tot,i,j}))$, where $j=0\ldots(160/MGRP)-1$

[If *measGapSharingScheme* is not equal sharing and

- inter-frequency L1-RSRP measurement layer *i*, is an group B L1-RSRP measurement layer, $CSSF_{within_gap,i}$ is the maximum among
  - $\text{ceil}(R_i \times K_{inter} \times M_{groupBi,j})$ in gaps where $M_{groupA,i,j} \neq 0$, where $j=0\ldots(160/MGRP)-1$
  - $\text{ceil}(R_i \times M_{groupB,i,j})$ in gaps where $M_{groupA,i,j}=0$, where $j=0\ldots(160/MGRP)-1$]

R_i is the maximal ratio of the number of measurement gap where inter-frequency L1-RSRP measurement layer *i*, is a candidate to be measured over the number of measurement gap where inter-frequency L1-RSRP measurement layer *i*, is a candidate and not used for a long-periodicity measurement defined above.

9.1.6 Minimum requirement at transitions

When the measurement on one intra-frequency measurement object transitions from measurements performed outside gaps to measurements performed within gaps or vice versa during one measurement period, the cell identification and measurement period requirements with the longer delay apply.

When the measurement on one intra-frequency measurement object transitions from measurements performed outside gaps to measurements performed within NCSG or vice versa during one measurement period, the cell identification and measurement period requirements with the longer delay apply.

The carrier-specific scaling factor specified in clause 9.1.5 that applies to the other impacted measurement objects will also apply based on the longer measurement or cell identification delay before or after the transition.

When the UE transitions between DRX and non-DRX or when DRX cycle periodicity changes, the cell identification and measurement period requirements apply based on the longer delay before or after the transition.

Subsequent to this measurement period, the cell identification and measurement period requirements on each measurement object are corresponding to the second mode after transition.

For UE supporting *ncd-SSB-BWP-Wor-r18*, when the intra-frequency measurement transitions from measurements performed on CD-SSB to measurements performed on NCD-SSB or vice versa due to BWP switching or SCG activation/deactivation during one cell identification period or measurement period, the UE shall use a cell identification period that is the maximum of the cell identification periods or measurement periods corresponding to the first SSB type and the second SSB type after the BWP switching or SCG activation/deactivation.

Subsequent to the above-mentioned measurement periods and/or cell identification periods, the cell identification and measurement period requirements on each measurement object are based on the SSB type after the BWP switch or SCG activation/deactivation.

For UE supporting *ssb-BurstPeriodicityAdaptation-r19*, when SSB periodicity changes due to SSB adaptation, the cell identification and measurement period requirements apply based on the longer period before or after the transition.

9.1.7 Pre-configured measurement gap

9.1.7.1 Introduction

A UE capable of Pre-configured measurement gap (Pre-MG) pattern can be configured with a Pre-MG pattern via RRC signalling [2].

The gap interruption requirements in clause 9.1.2 apply to Pre-MG when Pre-MG is activated, and no gap interruption is expected when Pre-MG is deactivated.

- The requirements apply for NR standalone operation with single carrier and NR CA.

9.1.7.2 Requirements applicability

The requirements related to pre-configured measurement gap apply provided:

- UE indicates support of *preconfiguredUE-AutonomousMeasGap* [2] and/or *preconfiguredNW-ControlledMeasGap* [2], and
- either a single per-UE measurement gap is pre-configured by the network, or one or two per-FR measurement gaps are pre-configured by the network, and
- one of measurement gap patterns among measurement gap patterns #0 ~ #25 is configured for pre-configured measurement gap, and
- UE is in NR SA with single carrier or with NR CA.

A measurement gap is configured as pre-configured measurement gap if *preConfigInd* is indicated by network in the configuration message of the measurement gap.

If UE indicates support of only *preconfiguredNW-ControlledMeasGap* [2], UE can expect the network to configure *preConfGapStatus*.

If a measurement gap is configured as pre-configured measurement gap, the applicability of measurement gap patterns is defined in table 9.1.2-3.

When a pre-configured measurement gap is used to perform PRS measurements, the UE will inform the network that it is going to start/stop PRS measurements with the configured pre-configured measurement gap by initiating the existing *LocationMeasurementIndication* procedure.

If the Pre-MG status changes during a measurement period of a measurement that can be performed without and within measurement gaps, the UE is allowed to restart the measurement.

If the Pre-MG status changes from activated to deactivated during a measurement period of a measurement that can only be performed within measurement gaps, the measurement requirements do not apply.

9.1.7.3 Requirements

Any of the measurement Gap pattern #0 to #25 defined in table 9.1.2-1 can be configured as Pre-MG pattern.

The UE can determine the Pre-MG status based on autonomous activation/deactivation mechanism or based on network-controlled activation/deactivation mechanism.

A UE capable of both autonomous and network-controlled mechanisms for activation/deactivation of Pre-MG pattern will not use autonomous rules to determine the activation/deactivation status of the pre-configured MG if the network provides the activation/deactivation status via RRC indication *preConfGapStatus* for all the DL BWPs of all the activated CCs, and for all the deactivated SCCs.

9.1.7.3.1 Requirements for autonomous activation/deactivation mechanism

Requirements in this clause apply when autonomous mechanism [2] is used for activation/deactivation of Pre-MG pattern.

The UE can autonomously change the Pre-MG status from activation to deactivation or vice versa based on any of the following triggering conditions listed below. The UE shall also autonomously determine the Pre-MG status based on all the concurrent triggering conditions occurring jointly:

- DCI, timer or RRC based active BWP switching,
- Activation/deactivation of SCell(s),
- Addition/removal of any measurement object(s)

- Addition/release/change of a SCell in carrier aggregation,

The UE shall autonomously determine the status of the per-UE Pre-MG pattern as deactivated immediately after the configuration of the per-UE Pre-MG pattern or when any of the triggering conditions above is satisfied provided that all the configured measurements can be performed without measurement gaps. The UE shall autonomously determine the status of the per-FR Pre-MG pattern as deactivated immediately after the configuration of the per-FR Pre-MG pattern or when any of the triggering conditions above is satisfied provided that all the configured measurements in the same FR can be performed without measurement gaps.

A measurement can be performed by the UE without measurement gaps if any of the following conditions is met:

- The UE is configured with SSB based intra-frequency measurements, and the conditions defined for SSB based intra-frequency measurement without gaps in clause 9.2.1 are met, or

- The UE is configured with SSB based inter-frequency measurements, and the conditions defined for SSB based inter-frequency measurement without gaps in clause 9.3.1 are met, or

- The UE is configured with CSI-RS based intra-frequency measurements.

The UE shall autonomously determine the status of the per-UE Pre-MG pattern as activated immediately after the configuration of the per-UE Pre-MG pattern or when any of the triggering conditions above is satisfied provided that at least one of the configured measurements cannot be performed without measurement gaps. The UE shall autonomously determine the status of the per-FR Pre-MG pattern as activated immediately after the configuration of the per-FR Pre-MG pattern or when any of the triggering conditions above is satisfied provided that at least one of the configured measurements in the same FR cannot be performed without measurement gaps.

A measurement cannot be performed by the UE without measurement gaps if any of the following conditions is met:

- The UE is configured with SSB based intra-frequency measurements, and the conditions defined for SSB based intra-frequency measurement without gaps in clause 9.2.1 are not met, or

- The UE is configured with SSB based inter-frequency measurements, and the conditions defined for SSB based inter-frequency measurement without gaps in clause 9.3.1 are not met, or

- The UE is configured with any of the following measurements:

  - CSI-RS based inter-frequency measurements, or

  - E-UTRA Inter-RAT measurements, or

  - UTRA Inter-RAT measurements.

9.1.7.3.2 Requirements for network-controlled activation/deactivation mechanism

The requirements in this clause apply when network-controlled mechanism [2] is used for activation/deactivation of Pre-MG pattern.

For per-UE Pre-configured MG,

- the UE determines that the Pre-configured MG is activated if *preConfGapStatus* is set to ‘1’ for the corresponding gap ID for the active DL BWP of any of the activated CCs, or if *preConfGapStatus* is set to ‘1’ for the corresponding gap ID for any of the deactivated SCCs,

- otherwise, the UE determines that the Pre-configured MG is deactivated

For per-FR Pre-configured MG,

- the UE determines that the Pre-configured MG is activated if *preConfGapStatus* is set to ‘1’ for the corresponding gap ID for the active DL BWP of any of the activated CCs in the corresponding FR, or if *preConfGapStatus* is set to ‘1’ for the corresponding gap ID for any of the deactivated SCCs in the corresponding FR,

- otherwise, the UE determines that the Pre-configured MG is deactivated

9.1.7.3.3 Requirements for reception/transmission during activation/deactivation

The requirements in this clause apply when autonomous mechanism or network-controlled mechanism is used for activation/deactivation [2] of Pre-MG pattern.

If per-UE Pre-MG pattern is activated then the UE is not required to conduct reception/transmission from/to the corresponding serving cells during the gap occasion according to the same principles as described for per-UE measurement gaps in clause 9.1.2. Otherwise, the UE can be scheduled for reception/transmission of signals in all the serving cells during the gap occasion.

If per-FR Pre-MG pattern is activated then the UE is not required to conduct reception/transmission from/to the corresponding serving cells during the gap occasion on the same FR according to the same principles as described for per-FR measurement gaps in clause 9.1.2. Otherwise, the UE can be scheduled for reception/transmission of signals in all the serving cells during the gap occasion in the same FR.

9.1.8 Concurrent measurement gaps

9.1.8.1 Introduction

When UE supports concurrent measurement gap pattern capability, network can provide multiple measurement gaps configured by RRC message(s) as specified in TS 38.331 [2]. Requirements in this clause apply when the UE is in SA operation mode.

9.1.8.2 Requirements

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports *concurrentPerUE-OnlyMeasGap-r17* as specified in [14], in order for the requirements in the following clauses to apply, the network can provide at most two per-UE measurement gap patterns for monitoring of all frequency layers.

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports *concurrentPerUE-PerFRCombMeasGap-r17* as specified in [14], in order for the requirements defined for concurrent measurement gaps to apply, the network can provide the measurement gap pattern combinations specified in table 9.1.8-1 for monitoring of all frequency layers.

Table 9.1.8-1: The number of Gap Combination Configurations by UE supporting both concurrent measurement gap patterns and independent measurement gap patterns

Gap Combination Configuration Id	The number of simultaneous configured measurement gap patterns		
	Per-FR1 measurement gap	Per-FR2 measurement gap	Per-UE measurement gap
0	2	1	0
1	1	2	0
2	0	0	2
3 Note 1	1	0	1
4 Note 1	0	1	1
5 Note 1	1	1	1
6	2	0	0
7	0	2	0

NOTE 1: Gap Combination Configuration Id #3, #4, #5 will be only applied when the per-UE measurement gap is associated to measure PRS for any RSTD, PRS-RSRP, UE Rx-Tx time difference, PRS-RSRPP, RSCP and RSCPD measurement defined in TS 38.215 [4].

NOTE 2: In Gap Combination Configuration Id #0, #1, #6, #7, one per-FR measurement gap in an FR can be associated to measure PRS for any RSTD, PRS-RSRP, UE Rx-Tx time difference, PRS-RSRPP, RSCP and RSCPD measurement defined in TS 38.215 [4] provided that UE supports *independentGapConfigPRS-r17*.

For UE configured in the SA operation mode, when monitoring of multiple inter-RAT E-UTRAN carrier frequency layers, intra-frequency NR carrier frequency layers and/or inter-frequency NR carrier frequency layers as configured by PCell using gaps, each monitored carrier frequency layer, including following measurement types:

- a measurement object with SSB based measurement,

- a measurement object with CSI-RS based measurement,
- E-UTRA inter-RAT measurement object,
- E-UTRAN inter-RAT RSTD measurement,
- NR PRS-based positioning measurements,

can be only associated to one measurement gap pattern. Requirements for concurrent measurement gaps apply provided that each frequency layer is only associated with one concurrent measurement gap. There can be one or more frequency layers associated with each concurrent measurement gap. Furthermore, if the UE is not capable of concurrentMeasGapEUTRA-r17 [2], all E-UTRAN measurement objects shall be associated with a single concurrent gap pattern for the requirement to apply.

When UE supports concurrent measurement gap patterns, each measurement gap pattern supported by the UE is listed in table 9.1.2-1 based on the applicability specified in table 9.1.2-3.

The requirements in clause 9.1.2 are also applicable for the UE capable of and configured with multiple concurrent measurement gap patterns within each measurement gap pattern.

When UE supports concurrent measurement gap patterns and configured with more than 1 measurement gap pattern per FR or per-UE according to table 9.1.8-1, requirements does not apply if the UE is configured with more than one measurement gap pattern (MGP) with measurement gap repetition period (MGRP) of 20 ms in an FR.

9.1.8.3 Collision between concurrent measurement gaps

Collisions between occasions of two concurrent measurement gaps may occur as specified in this clause if the two measurement gaps are

- two per-UE measurement gaps, or
- two per-FR measurement gaps in the same FR, or
- one per-UE measurement gap and one per-FR measurement gap.

When UE is configured with concurrent measurement gaps, two measurement gap occasions are considered colliding if at least one of the following conditions is met:

- the two occasions are fully or partially overlapping in time domain, or
- the distance between the two occasions is equal to or smaller than 4 ms.

The distance between two measurement gap occasions is defined as the time difference between the ending point of the first occasion and the starting point of the second occasion, where the first measurement gap occasion occurs earlier in time than the second measurement gap occasion.

In case of collision between two measurement gap occasions, the UE shall perform measurements in the occasion of the measurement gap with higher priority, and the occasion of the measurement gap with lower priority shall be dropped. The UE shall be able to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI in the corresponding NR serving cells in the slots that are not interrupted according to requirements in clause 9.1.8.4.

The requirements of concurrent measurement gaps in clause 9 shall not apply when a gap without assigned priority is configured simultaneously with any other gap(s) that affect serving carriers in the same FR and the measurement gaps are colliding with each other.

The priority for a measurement gap is configured by networks via *gapPriority* in *GapConfig*. The requirements with concurrent measurement gaps apply provided that two measurement gaps colliding with each other are configured with different priorities.

9.1.8.4 Measurement gap related requirements of concurrent measurement gaps

A slot is considered as interrupted if it is interrupted by an occasion of any of the configured concurrent measurement gaps following the measurement gap interruption requirements in clause 9.1.2, except for a dropped measurement gap occasion.

9.1.9 Network controlled small gap

9.1.9.1 Introduction

The UE capable of network controlled small gap (NCSG) pattern can be configured with a NCSG pattern via RRC signalling [2].

This clause contains the general requirements on the UE regarding to Network Controlled Small Gap (NCSG).

The requirements in this clause are applicable for UE configured with SA NR (with single carrier or NR CA) operation mode.

It is up to UE implementation whether or not the UE is able to conduct transmission in the following slot(s),

- when *mgta* is not applied, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the last each of the interrupted slots after VIL1 and VIL2.
- when *mgta* is applied and the SCS of the UL carrier is other than 15 kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the last each of the interrupted slots after VIL1 and VIL2.
- when *mgta* is applied and the SCS of the UL carrier is 15 kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the slot partially overlapped with each of the interrupted slots after VIL1 and VIL2.

where UL slot denotes that all the symbols in the slot are uplink symbols, and L=1 if $(N_{\mathrm{TA}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$ for the UL transmission is less than the length of one slot; L=2 otherwise.

NOTE: Network is supposed to take into account the possible difference between the estimated TA at network and actual TA at UE when scheduling UE in the above slot(s).

The interruptions of NCSG in number of slots are listed in table 9.1.9-1 on all serving cells when per-UE NCSG is configured with pattern #0-11 or on FR1 serving cells when per-FR FR1 NCSG is configured to *ncsg-MeasGapPerFR-r17* capable UE. The interruptions of NCSG in number of slots are listed in table 9.1.9-2 on all serving cells when per-UE NCSG is configured with pattern #12-23 or on FR2 serving cells when per-FR FR2 NCSG is configured to *ncsg-MeasGapPerFR-r17* capable UE. There are two interruptions in each NCSG occasion, VIL1 before ML and VIL2 after ML, in NR standalone (with single carrier or NR CA). Each of them has number of interrupted slots captured in table 9.1.9-1 and table 9.1.9-2.

Table 9.1.9-1: Number of interrupted slots on all serving cells for per-UE NCSG pattern #0-11 or FR1 serving cells for per-FR FR1 NCSG during each VIL in NR standalone operation (with single carrier, NR CA)

NR SCS (kHz)	Number of interrupted slots on serving cells When MG timing advance of 0 ms is applied VIL=1 ms
15	1
30	2
60	4
120	8
NOTE 1: NR SCS of 120 kHz is only applicable to the case with per-UE NCSG. NOTE 2: Void.	

Table 9.1.9-2: Number of interrupted slots on all serving cells for per-UE NCSG pattern #12-23 or FR2 serving cells for per-FR FR2 NCSG during each VIL in NR standalone operation (with single carrier, NR CA)

NR SCS (kHz)	Number of interrupted slots on serving cells	
	When MG timing advance of 0 ms is applied	When MG timing advance of 0.75 ms is applied
	VIL=0.75 ms	VIL=0.75 ms

60	3	3
120	6	6
NOTE 1: Void		

9.1.9.2 Requirements applicability

Requirements in clause 9.1.9 apply for UE capable of NCSG in standalone NR in both FR1 and FR2 (including FR1+FR2 CA), provided UE is configured with only NCSG and no other measurement gap is configured, and UE is configured with

SSB based intra-frequency measurement (including measurement on de-activated SCC and measurement on dormant SCell), and/or

SSB based inter-frequency measurement, and/or

Inter-RAT E-UTRAN measurement.

Requirements for the following measurements do not apply if UE is configured with NCSG.

CSI-RS based intra-frequency measurement when overlapped with NCSG, or

CSI-RS based inter-frequency measurement, or

Inter-RAT GSM measurement, or

Inter-RAT UTRAN measurement, or

PRS measurement.

9.1.9.3 Requirements

The UE shall support NCSG patterns defined in table 9.1.9.3-1 that are relevant to the UE's measurement capabilities. ML is the measurement length. During the VIL1 and VIL2, the UE is not expected to transmit and receive any data. Where, VIL1 is the visible interruption length before the ML and VIL2 is the visible interruption length after the ML. During ML, whether the UE shall transmit and receive data on the corresponding serving carrier(s) depends on the scheduling restriction requirements specified in clauses 9.2.7.3, 9.3.10.3, 9.4.2.5 and 9.4.3.5. The NCSG parameters VIL1, ML, VIL2 and VIRP are illustrated in figure 9.1.9.3-1. The applicability of the NCSG patterns in table 9.1.9.3-1 is specified in table 9.1.9.3-2.

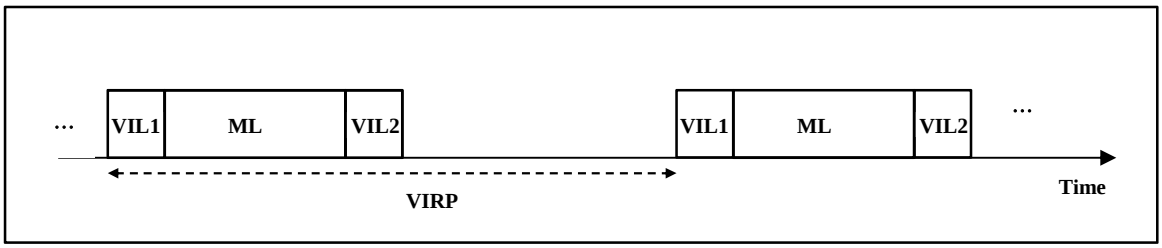


Figure 9.1.9.3-1: Illustration of NCSG parameters: VIL1, ML, VIL2 and VIRP

Table 9.1.9.3-1: NCSG Configurations supported by the UE

NCSG Pattern Id	Measurement Length during which there is no gap (ML, ms)	Visible interruption Repetition Period (VIRP, ms)
0	5	40
1	5	80
2	2	40
3	2	80
4	5	20
5	5	160
6	3	20
7	3	40

NCSG Pattern Id	Measurement Length during which there is no gap (ML, ms)	Visible interruption Repetition Period (VIRP, ms)
8	3	80
9	3	160
10	2	20
11	2	160
12	5	20
13	5	40
14	5	80
15	5	160
16	3	20
17	3	40
18	3	80
19	3	160
20	1	20
21	1	40
22	1	80
23	1	160

Table 9.1.9.3-2: Applicability for NCSG pattern configurations supported by the UE for NR standalone operation with single carrier or NR CA configuration

NCSG pattern configuration	Serving cell	Measurement Purpose NOTE 2	Applicable NCSG Pattern Id
Per-UE NCSG	FR1, or FR1 + FR2	E-UTRA	0,1,2,3
		FR1 and/or FR2	0-11
		E-UTRA and FR1 and/or FR2	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2	E-UTRA only	0,1,2,3
		FR1 only	0-11
		FR1 and FR2	0-11
		E-UTRA and FR1 and/or FR2	0, 1, 2, 3, 4, 6, 7, 8,10
		FR2 only	12-23
Per-FR NCSG	FR1 if configured	E-UTRA only	0,1,2,3
	FR2 if configured		No gap
	FR1 if configured	FR1 only	0-11
	FR2 if configured		No gap
	FR1 if configured	FR2 only	No gap
	FR2 if configured		12-23
	FR1 if configured	E-UTRA and FR1	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		No gap
	FR1 if configured	FR1 and FR2	0-11
	FR2 if configured		12-23
	FR1 if configured	E-UTRA and FR2	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		12-23
	FR1 if configured	E-UTRA and FR1 and FR2	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		12-23

NCSG pattern configuration	Serving cell	Measurement Purpose NOTE 2	Applicable NCSG Pattern Id

NOTE 1: When E-UTRA inter-RAT RSTD measurements are configured and the UE requires NCSG for performing such measurements, only NCSG Pattern #0 can be used.

NOTE 2: Measurement purpose which includes E-UTRA measurements includes also inter-RAT E-UTRA RSRP and RSRQ measurements for E-CID.

NOTE 3: If per-UE NCSG is configured with MG timing advance of T_{MG} ms, the NCSG starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured NCSG among all serving cells subframes.
If per-FR NCSG for FR1 is configured with MG timing advance of T_{MG} ms, the NCSG for FR1 starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured NCSG among serving cells subframes in FR1.
If per-FR NCSG for FR2 is configured with MG timing advance of T_{MG} ms, the NCSG for FR2 starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured NCSG among serving cells subframes in FR2.
T_{MG} is the MG timing advance value provided in *mgta* according to [2].
In determining the NCSG starting point, UE shall use the DL timing of the latest subframe occurring immediately before the configured NCSG among serving cells.

NOTE 4: For UE only supporting *ncsg-MeasGapNR-Patterns-r17* for any NCSG patterns among NCSG pattern # 2-11, the corresponding NCSG patterns are not applicable to measurement of E-UTRA.

9.1.10 MUSIM gaps

If the UE requires gap patterns for MUSIM purpose, such as cell identification and measurement, paging monitoring, SIB acquisition, and/or on-demand SI request of the target cell in the target network, then the network may provide one or more per-UE MUSIM gap pattern(s) for concurrent monitoring of all frequency layers for MUSIM via *MUSIM-GapConfig* [2]. The UE can be configured with no more than three periodic MUSIM gap patterns and/or one aperiodic MUSIM gap pattern for MUSIM via *MUSIM-GapConfig* [2]. The MUSIM gap patterns specified in table 9.1.10-1 are applicable only for MUSIM operation. The MUSIM requirements apply for the configured MUSIM gap pattern(s) requested by UE, provided UE is allocated one or more of the requested MUSIM gaps.

The UE is not required to perform cell identification and measurement, paging monitoring, SIB acquisition, and/or on-demand SI request of the target cell in the target network that is outside the MUSIM gaps.

The UE is not required to conduct reception or transmission from or to the network during MUSIM gaps that are not dropped due to collisions, as defined in clauses 9.1.10.4 and 9.1.10.5.

The UE supporting MUSIM capability may request MUSIM gap with one or more of the MUSIM gap patterns listed in table 9.1.10-1 via *MUSIM-GapPreferenceList-r17* [2], and the applicability of MUSIM gap patterns is specified in table 9.1.10-2.

The UE determines MUSIM gap timing based on MUSIM gap offset configuration from serving cell provided by higher layer signalling as specified in TS 38.331 [2].

Table 9.1.10-1: MUSIM Gap Pattern Configurations

MUSIM Gap Pattern Id	MUSIM Gap Length (MGL, ms)	MUSIM Gap Repetition Period (MGRP, ms)
0	6	40
1	6	80
2	3	40
3	3	80
4	6	20
5	6	160
6	4	20
7	4	40
8	4	80
9	4	160
10	3	20
11	3	160
12	10	80
13	20	160
14	6	320
15	6	640

MUSIM Gap Pattern Id	MUSIM Gap Length (MGL, ms)	MUSIM Gap Repetition Period (MGRP, ms)
16	6	1280
17	6	2560
18	10	320
19	10	640
20	10	1280
21	10	2560
22	20	320
23	20	640
24	20	1280
25	20	2560
26	20	5120
27	10	NA
28	20	NA
NOTE 1: Measurement gap pattern #27, #28 are the aperiodic gap pattern without MGRP.		

Table 9.1.10-2: Applicability for MUSIM Gap Pattern Configurations supported by the UE with NR standalone operation (with single carrier, NR CA configuration)

MUSIM gap pattern configuration	Serving cell	Gap Purpose	Applicable MUSIM Gap Pattern Id
Per-UE MUSIM gap	FR1, FR2, or FR1 + FR2	MUSIM [Note1]	0-13, 14-26, 27, 28
NOTE 1: Inclusion of MUSIM procedures for per-UE MUSIM gaps only in NR single carrier, NR CA mode: MUSIM purpose which includes cell identification and measurement, paging monitoring, SIB acquisition, and/or on-demand SI request of the target cell in the target network.			

9.1.10.1 Introduction

This clause contains the requirements on the UE supporting MUSIM capability, requirements in this clause are applicable for UE in NR SA (including CA) operation mode.

9.1.10.2 Priorities for MUSIM gaps

Priorities are applied for each periodic MUSIM gap. A UE shall request priorities for all requested periodic MUSIM gaps when the UE requests MUSIM gaps [2]. The UE shall request different priorities for each periodic MUSIM gap. Priorities of the configured MUSIM gaps may be configured. The configured priorities may differ from the priorities requested by the UE. The MUSIM requirements apply if the configured MUSIM gap priorities retain the same relative priorities among MUSIM gaps as requested by the UE.

The requirements in clause 9.1.10 apply provided different priorities are allocated to each periodic MUSIM gap and each measurement gap which is configured via *GapConfig-r17* without *preConfigInd-r17* or *ncsgInd-r17*.

An aperiodic MUSIM gap, when configured, is unconditionally kept in case of collisions with any other gap occasions, including MUSIM gaps and measurement gaps.

9.1.10.3 Keep solution for MUSIM gaps

The UE can request to keep all collided gaps for requested MUSIM gap(s) via *musim-GapKeepPreference* in 38.211 [2]. If the UE's request is granted, the UE shall keep all collided periodic and aperiodic MUSIM gaps irrespectively of the configured priorities of the periodic MUSIM gaps.

9.1.10.4 Collisions between different MUSIM gaps

MUSIM gap occasions are considered colliding if at least one of the following conditions is met:

- the MUSIM gap occasions are fully overlapping in time domain, or

- the MUSIM gap occasions are partially overlapping in time domain, or
- the distance between the two MUSIM gap occasions is equal to or smaller than 4 ms.

The distance between two MUSIM gap occasions is defined as the time difference between the ending point of the first MUSIM gap occasion and the starting point of the second MUSIM gap occasion, where the first MUSIM gap occasion occurs earlier in time than the second MUSIM gap occasion.

When “keep solution” in clause 9.1.10.3 is not configured:

- the periodic MUSIM gap occasion colliding with an aperiodic MUSIM gap are dropped, and
- collisions between periodic MUSIM gap occasions are resolved based on the assigned MUSIM gap priorities. Collisions are resolved sequentially in order of decreasing priority, starting with the gap that has the highest priority. For each collision, the occasion of the MUSIM gap with higher priority shall be kept and the occasion of the MUSIM gap with lower priority shall be dropped.

9.1.10.5 Collisions between MUSIM gaps and measurement gaps

MUSIM gap and measurement gap occasions are considered colliding if at least one of the following conditions is met:

- the MUSIM gap and measurement gap occasions are fully overlapping in time domain, or
- the MUSIM gap and measurement gap occasions are partially overlapping in time domain, or
- the distance between any of the MUSM gap and the measurement gap occasion is equal to or smaller than 4 ms.

The distance between two gap occasions is defined as the time difference between the ending point of the first occasion and the starting point of the second occasion, where the first gap occasion occurs earlier in time than the second gap occasion. The gap occasion can be either a MUSIM gap occasion or a measurement gap occasion.

The measurement gap occasion colliding with an aperiodic MUSIM gap shall be dropped.

Collisions between MUSIM gaps with assigned priority and measurement gaps configured via *GapConfig-r17* with assigned priority but without *preConfigInd-r17* or *ncsgInd-r17* are resolved based on their assigned priorities:

- If ‘keep solution’ in clause 9.1.10.3 is not configured, collisions are resolved sequentially in order of decreasing priority, starting with the gap that has the highest priority. For each collision, the occasion of the MUSIM gap or measurement gap with higher priority shall be kept and the occasion of the MUSIM gap or measurement gap with lower priority shall be dropped. Any collisions between MUSIM gaps shall be addressed as specified in clauses 9.1.10.3 and 9.1.10.4.
- Otherwise if ‘keep solution’ in clause 9.1.10.3 is configured, keep solution is used for the remaining collided and non-dropped MUSIM gaps, after resolving the collisions between measurement gaps and MUSIM gaps based on their priorities.

Collisions between MUSIM gaps with assigned priority and measurement gaps configured via *GapConfig* or configured via *GapConfig-r17* without assigned priority are handled based on MGRP of the colliding gaps:

- If ‘keep solution’ in clause 9.1.10.3 is not configured, collisions are resolved sequentially in order of decreasing MGRP, starting with the gap that has the longest MGRP. For each collision, the occasion of the MUSIM gap or measurement gap with longer MGRP shall be kept and the occasion of the MUSIM gap or measurement gap with shorter MGRP shall be dropped. If the colliding MUSIM gap and measurement gap have the same MGRP, the requirements in clause 9 shall not apply to these gaps. Any collisions between MUSIM gaps shall be addressed as specified in clauses 9.1.10.3 and 9.1.10.4.
- Otherwise if ‘keep solution’ in clause 9.1.10.3 is configured, keep solution is used for the remaining collided and non-dropped MUSIM gaps, after resolving the collisions between measurement gaps and MUSIM gaps based on their MGRP following the above mentioned collision rule.

9.1.10.6 MUSIM gap related requirements

A slot is interrupted by a MUSIM gap if it overlaps with any occasion of the configured MUSIM gap, except for a dropped MUSIM gap occasion.

9.1.11 UL gap for Tx power management

The UL gap patterns for TX power management are listed in table 9.1.11-1 if UE supports the UL gap for Tx power management, and the UE shall support at least one of UL MGP#1 and UL MGP#3. All other UL MGPs are optional.

Table 9.1.11-1: UL Gap Pattern Configurations

	UL Gap Length (UGL) [ms]	UL gap repetition periodicity (UGRP) [ms]
UL MGP #0	1.0	20
UL MGP #1	1.0	40
UL MGP #2	0.5	160
UL MGP #3	0.125 when SCS of active UL BWP =120 kHz 0.25 when SCS of active UL BWP =60 kHz	5

An uplink gap consists of consecutive static UL slot(s) in one or more *TDD-UL-DL-Pattern* duration, starting from the first static UL slot of an UL gap repetition period. UGL is the aggregated length of consecutive UL slots used as the UL gap within an UL gap repetition period. That means, there can be a DL slot and/or special slot but no static UL slot between the two consecutive static UL slots within the UL gap length.

When an UL gap overlaps with an uplink transmission in NR serving cells in FR2 single CC or FR2 intra-band CA or FR2 inter-band CA where UE does not support tx-Support-UL-GapFR2-r17, then the UE is not required to conduct any transmission during the UL gap on the NR serving cells other than those listed in clause 5.30 in TS 38.321 [7].

9.1.12 Concurrent measurement gaps with Pre-MG

9.1.12.1 Introduction

When the UE supports *concurrentMeasGapsPreMG-r18* capability, network can provide multiple measurement gap patterns with at least one of the measurement gaps is pre-configured measurement gap (Pre-MG) pattern configured by RRC message(s) as specified in TS 38.331 [2]. Requirements in this clause apply when the UE is in SA operation mode.

9.1.12.2 Requirements

If the UE requires measurement gaps and/or Pre-MGs to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports *concurrentMeasGapsPreMG-r18* but does not support independent measurement gap patterns for different frequency ranges as specified in table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply, the network can provide the UE with no more than two per-UE measurement gap patterns for monitoring all the frequency layers.

If the UE supports both *concurrentMeasGapsPreMG-r18* and independent measurement gap patterns for different frequency ranges as specified in table 5.1-1 in [18, 19, 20], in order for the requirements defined for concurrent measurement gaps with Pre-MG to apply, the network can provide the measurement gap pattern combinations specified in table 9.1.12.1 for monitoring of all frequency layers.

Table 9.1.12-1: The number of Gap Combination Configurations by UE supporting both *concurrentMeasGapsPreMG-r18* and independent measurement gap patterns

Gap Combination Configuration Id	The number of simultaneous configured measurement gap patterns		
	Per-FR1 measurement gap	Per-FR2 measurement gap	Per-UE measurement gap
0	2	1	0
1	1	2	0
2	0	0	2
3[Note 1]	1	0	1
4[Note 1]	0	1	1
5[Note 1]	1	1	1
6	2	0	0
7	0	2	0

NOTE 1:	Gap Combination Configuration Id #3, #4, #5 are only applicable when the per-UE measurement gap is associated to measure PRS for any RSTD, PRS-RSRP, RSCP, RSCPD, UE Rx-Tx time difference measurement and PRS-RSRPP measurement defined in TS 38.215 [4].
NOTE 2:	For UE capable of *concurrentMeasGapsPreMG-r18*, up to 2 measurement gap patterns can be configured as Pre-MG in one FR, regardless of whether they are per-UE or per-FR configuration. Otherwise, the gaps can only be configured as Gap(s) configured via *GapConfig* without suffix or Gap(s) configured via *GapConfig-r17* without *preConfigInd-r17*.
NOTE 3:	In Gap Combination Configuration Id #0, #1, #6, #7, one per-FR measurement gap in an FR can be associated to measure PRS for any RSTD, PRS-RSRP, PRS-RSRPP, RSCP, RSCPD and UE Rx-Tx time difference measurement defined in TS 38.215 [4] provided that UE supports *independentGapConfigPRS-r17*.

When the UE supports *concurrentMeasGapsPreMG-r18*, the gap association for a frequency layer is configured by the network via *associatedMeasGapSSB-r17* or *associatedMeasGapCSIRS-r17* in the corresponding MO(s) or via *gapAssociationPRS-r17* in *GapConfig-r17*. In this case the gap association rules in clause 9.1.8.2 shall also apply to either measurement gap or Pre-MG.

When autonomous mechanism [2] is used for activation/deactivation of Pre-MG pattern, the UE shall autonomously determine the Pre-MG status only based on the measurement objects associated with the concerned Pre-MG. The related Pre-MG autonomous activation/deactivation mechanism is specified in clause 9.1.7.3.1.

When network-controlled mechanism [2] is used for activation/deactivation, the requirements specified in clause 9.1.7.3.2 apply.

When UE supports *concurrentMeasGapsPreMG-r18*, where at least one of the concurrent gaps is Pre-MG, applicable measurement gap patterns are listed in table 9.1.2-1, and their applicability based on measurement and serving cell configurations is specified in table 9.1.2-3.

The requirements in clause 9.1.2 are applicable for the UE, capable of *concurrentMeasGapsPreMG-r18* and configured with multiple concurrent measurement gap patterns, within each activated Pre-MG occasion.

9.1.12.3 Collisions involving Pre-MG(s)

A collision between occasions of two measurement gaps where the higher priority gap is a Pre-MG and the lower priority gap may or may not be a Pre-MG is called as dynamic collision.

For a UE that supports *dynamicCollision-r18*:

- Collisions between a Pre-MG and a measurement gap may occur only when the Pre-MG is activated.
- Collisions between two Pre-MGs may occur only when both Pre-MGs are activated.

When the collision between a Pre-MG and a measurement gap or two Pre-MGs satisfy the collision rule defined in clause 9.1.8.3, the UE shall perform measurements in the occasion of the non-dropped gap except the scenario specified in clause 9.1.12.5.

For a UE that does not support *dynamicCollision-r18*:

- Collisions between a Pre-MG and a measurement gap or two Pre-MGs may occur when the collision rule defined in clause 9.1.8.3 is satisfied, regardless of the Pre-MG activation status. .

When the collision between a Pre-MG and a measurement gap or two Pre-MGs satisfy the collision rule defined in clause 9.1.8.3, the UE shall perform measurements in the occasion of the non-dropped gap regardless of whether it collides with the Pre-MG activation or deactivation procedure.

The requirements for the UE capable of *concurrentMeasGapsPreMG-r18* apply provided that the two measurement gaps colliding with each other are configured with different priorities.

No collisions can occur between a per-FR Pre-MG and a per-FR measurement gap when they are configured in different FRs.

No collisions can occur between per-FR Pre-MGs when they are configured in different FRs.

9.1.12.4 Collision between Pre-MG activation/deactivation and measurement gap

The requirements in this clause apply for UE that supports *dynamicCollision-r18*.

A measurement gap occasion and a Pre-MG activation/deactivation procedure collide when the ending point of the Pre-MG activation/deactivation procedure occurs anywhere within a time period starting 4 ms before the starting point of the gap occasion and ending 4 ms after the ending point of the gap occasion. The ending point of the Pre-MG activation/deactivation procedure in this collision case is defined in clause 8.19.2, 8.19.3 and 8.19.4.

- When a collision occurs between a measurement gap occasion and a Pre-MG activation procedure, and the Pre-MG is configured with higher priority, the UE shall perform measurements during the measurement gap occasion and the activation of the Pre-MG is delayed until 5 ms after the ending point of the measurement gap occasion.
- When a collision occurs between a measurement gap occasion and a Pre-MG deactivation procedure, and the Pre-MG is configured with higher priority, the measurement gap occasion shall be dropped.

9.1.12.5 Pre-MG related requirements

A slot is interrupted by a Pre-MG if it overlaps with any occasion of the configured Pre-MG, if the Pre-MG is activated and the Pre-MG occasion is not dropped.

9.1.13 Concurrent measurement gaps with NCSG

9.1.13.1 Introduction

When UE supports *concurrentMeasGapsNCSG-r18* capability, network can provide multiple measurement gaps with at least one of the measurement gaps is NCSG configured by RRC message(s) as specified in TS 38.331 [2].

Requirements in this clause apply when the UE is in SA operation mode.

9.1.13.2 Requirements

If the UE requires concurrent measurement gaps and/or NCSG to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports *concurrentMeasGapsNCSG-r18* but does not support *independentGapConfig* or *ncsg-MeasGapPerFR-r17* as specified in [14], in order for the requirements in the following clauses to apply, the network can provide one per-UE concurrent measurement gap and one per-UE NCSG or at most two per-UE NCSGs for monitoring of all frequency layers.

If the UE requires concurrent measurement gaps and/or NCSG to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports *concurrentMeasGapsNCSG-r18*, *independentGapConfig* and *ncsg-MeasGapPerFR-r17* as specified in [14], in order for the requirements defined for concurrent measurement gaps with NCSG to apply, the network can provide the concurrent measurement gap with NCSG combinations configurations specified in table 9.1.13-1 for monitoring of all frequency layers.

Table 9.1.13-1: The number of Gap Combination Configurations by UE supporting concurrent measurement gap with NCSG patterns, per-FR NCSG patterns and independent measurement gap patterns

Gap Combination Configuration Id	The number of simultaneous configured measurement gap patterns		
	Per-FR1 measurement gap/NCSG	Per-FR2 measurement gap/NCSG	Per-UE measurement gap/NCSG
0	2	1	0
1	1	2	0
2	0	0	2
3 Note 1	1	0	1
4 Note 1	0	1	1
5 Note 1	1	1	1
6	2	0	0
7	0	2	0

Note 1: Gap Combination Configuration Id #3, #4, #5 will be only applied when the per-UE measurement gap (and cannot be NCSG) is associated to measure PRS for any RSTD, PRS-RSRP, RSCP, RSCPD, UE Rx-Tx time

	difference and PRS-RSRPP measurement defined in TS 38.215 [4], and when the per-FR measurement gap in an FR is NCSG.
Note 2:	In Gap Combination Configuration Id #0, #1, #6, #7, one per-FR measurement gap in an FR (and cannot be NCSG) can be associated to measure PRS for any RSTD, PRS-RSRP, RSCP, RSCPD, UE Rx-Tx time difference and PRS-RSRPP measurement defined in TS 38.215 [4] provided that UE supports *independentGapConfigPRS-r17*.
Note 3:	In Gap Combination Configuration Id #0, #1, #2, #6, #7, one FR can be configured with up to 2 NCSGs, regardless they are per-UE or per-FR configured. Otherwise, the gaps can only be configured as Gap(s) configured via *GapConfig* without suffix or Gap(s) configured via *GapConfig-r17* without *ncsgInd-r17*.

For UE configured in the SA operation mode, when monitoring of multiple inter-RAT E-UTRAN carrier frequency layers, intra-frequency NR carrier frequency layers and/or inter-frequency NR carrier frequency layers as configured by PCell using gaps, each monitored carrier frequency layer, including following measurement types:

- a measurement object with SSB based measurement,
- E-UTRA inter-RAT measurement object,

can be associated to either one concurrent measurement gap pattern or one NCSG pattern, while the following measurement types:

- a measurement object with CSI-RS based measurement,
- E-UTRAN inter-RAT RSTD measurement,
- NR PRS-based positioning measurement,

can be only associated to one measurement gap pattern. Requirements for UE capable of *concurrentMeasGapsNCSG-r18* apply provided that each frequency layer is only associated with one concurrent measurement gap or one NCSG, and at least one of the gaps is NCSG. There can be one or more frequency layers associated with each concurrent measurement gap or each NCSG. Furthermore, if the UE is not capable of *concurrentMeasGapEUTRA-r17*[2], all E-UTRAN measurement objects shall be associated with a single concurrent measurement gap or NCSG for the requirement to apply.

When UE supports *concurrentMeasGapsNCSG-r18*, where at least one of the concurrent gaps is NCSG, supported concurrent measurement gap patterns are listed in table 9.1.2-1 based on the applicability specified in table 9.1.2-3, while supported NCSG patterns are listed in table 9.1.9.3-1 based on the applicability specified in table 9.1.9.3-2.

The requirements in clause 9.1.2 are also applicable for the UE capable of *concurrentMeasGapsNCSG-r18* and configured with multiple measurement gap or NCSG patterns within each concurrent measurement gap pattern. The requirements in clause 9.1.9 are also applicable for the UE capable of *concurrentMeasGapsNCSG-r18* and configured with multiple measurement gap or NCSG patterns within each NCSG pattern.

When the measurement of the measurement object is related to a deactivated SCell, and

- when NW configures the concurrent measurement gap and NCSG, UE shall perform the measurement of this measurement object within the NCSG if the SMTC of the measurement object is partially or fully overlapped with the NCSG regardless of the gap assoicaition.
- when NW configures two NCSGs, UE shall perform the measurement of this measurement object based on the configured gap association if the SMTC of the measurement object is partially or fully overlapped with the NCSG. If the association is not provided, UE is not expected to cause interruption outside the VIL due to measurement on any of the deactivated SCells, and the existing measurement delay requirement does not apply to this case if the SMTC of the measurement object is partially or fully overlapped with any of the NCSGs.

9.1.13.3 Collision involving NCSGs

Collisions between occasions of concurrent measurement gap and NCSG or of two NCSGs may occur as specified in this clause if the two occasions are

- two per-UE NCSGs, or
- two per-FR NCSGs in the same FR, or
- one per-UE NCSG and one per-UE measurement gap, or

- one per-FR NCSG and one per-UE measurement gap, or
- one per-UE NCSG and one per-FR measurement gap, or
- one per-FR NCSG and one per-FR measurement gap in the same FR.

and if the gap collision condition specified in clause 9.1.8.3 is met then the gap collision rule applies.

When the first occasion is NCSG, the ending point of the first occasion is the end of VIL2 and/or when the second occasion is NCSG, the starting point of the second occasion is the start of VIL1.The requirements with *concurrentMeasGapsNCSG-r18* apply provided that two gaps (at least one of the gaps is NCSG) colliding with each other are configured with different priorities.

9.1.14 Measurement gap occasion cancellation

9.1.14.1 Introduction

This clause specifies the general requirements and applicability for UE supporting cancellation of measurement gap occasions as specified in TS 38.213 [3] and indicating its capability via *enableTx-RxDuringMeasGap-r19* according to TS 38.331 [2].

9.1.14.2 Applicable measurement gap configurations

Measurement gaps configured by one of the below configurations are applicable for measurement gap occasion cancellation:

- *GapConfig* without suffix;
- *GapConfig-r17* with *gapPriority-r17* and without any of: *ncsgInd-r17* or *preConfigInd-r17* or *gapAssociationPRS;*

9.1.14.3 Applicability

The measurement gap cancellation requirements apply under the following conditions.

1> if an explicit indication is received via DCI according to TS 38.213 [3] to cancel a measurement gap occasion; and

1> if the UE is configured with NR SA (with or without CA) in FR1 or FR2-1; and

1> if the UE is not power class 6 UE in FR2-1; and

1> if the UE is not configured to do measurements for SRVCC according to clause 9.4.6; and

1> if the UE is not configured with any MUSIM measurement gap pattern via *MUSIM-GapConfig* [2]; and

1> if the UE is not configured with positioning measurements requiring measurement gaps; and

1> if the UE is configured with one of the measurement gap configurations listed in clause 9.1.14.2:

2> if the UE is configured with per-UE measurement gap pattern(s), the measurement gap occasion cancellation applies to both FR1 and FR2-1, and the requirements with measurement gap occasion cancellation in clause 9.1.14.4 apply;

2> Otherwise, if the UE is configured with per-FR measurement gap pattern(s), the measurement gap occasion cancellation only applies to the per-FR measurement gap on the same frequency range as the one or more scheduled cells associated with the DCI format and has no impacts on UE measurement behaviour in the other FR, and the requirements with measurement gap occasion cancellation in clause 9.1.14.4 apply;

9.1.14.4 Requirements for cancelling measurement gap occasions

For the measurement gap patterns configured via *gapPriority-r17* and without any of *ncsgInd-r17* or *preConfigInd-r17* or *gapAssociationPRS*, the measurement gap cancellation applies to measurement gap occasions after applying collision rules as defined in clause 9.1.8.3.

UE behaviour during cancelled measurement gap occasions is specified in TS 38.213 [3].

The UE shall cancel the gap provided that the time offset between the DCI indication of cancellation of measurement gap and the start of the measurement gap occasion including MGTA is not smaller than the UE capability indicated by *minimumTimeOffset-r19* [2].

Table 9.1.14.4-1: Void

9.1A General measurement requirement for RedCap

9.1A.1 Introduction

This clause contains general requirements on the RedCap UE regarding measurement reporting in RRC_CONNECTED state. The requirements are split in intra-frequency, inter-frequency, inter-RAT E-UTRAN FDD, inter-RAT E-UTRAN TDD, and L1-RSRP measurements requirements. These measurements may be used by the NG-RAN. The measurement quantities are defined in TS 38.215 [4], the measurement model is defined in TS 38.300 [10], TS 37.340 [17] and measurement accuracies are specified in clause 10. Control of measurement reporting is specified in TS 38.331 [2].

The SSB and SMTC in this clause apply for both CD-SSB and NCD-SSB if it is not additional specified.

9.1A.2 Measurement gap

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE does not support independent measurement gap patterns for different frequency ranges as specified in table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply the network must provide a single per-UE measurement gap pattern for concurrent monitoring of all frequency layers.

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports independent measurement gap patterns for different frequency ranges as specified in table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply the network must provide either per-FR measurement gap patterns for frequency range where UE requires per-FR measurement gap for concurrent monitoring of all frequency layers of each frequency range independently, or a single per-UE measurement gap pattern for concurrent monitoring of all frequency layers of all frequency ranges.

If the UE is configured via LPP [34] to measure PRS for any RSTD, PRS-RSRP, UE Rx-Tx time difference measurement and PRS-RSRPP measurement with or without FH defined in TS 38.215 [4], in order for the requirements in clauses 9.9A.2, 9.9A.3, 9.9A.4 and 9.9A.5 to apply, the network must provide:

- a single per-UE measurement gap pattern for concurrent monitoring of all positioning frequency layers and intra-frequency, inter-frequency and/or inter-RAT frequency layers of all frequency ranges, or
- if UE supports independent measurement gap patterns for different frequency ranges for PRS measurement, i.e. supporting *independentGapConfigPRS-r17*, per-FR measurement gap pattern for the frequency range for concurrent monitoring of all positioning frequency layers and intra-frequency, inter-frequency cells and/or inter-RAT frequency layers in the corresponding frequency range.

During the per-UE or per-FR measurement gaps the UE:

- is not required to conduct reception/transmission from/to the corresponding NR serving cell for SA (with single carrier) except the reception of signals used for RRM measurement(s), and the signals used for random access procedure according to [7].

UEs shall support the measurement gap patterns listed in table 9.1A.2-1 based on the applicability specified in table 9.1A.2-2. UE determines measurement gap timing based on gap offset configuration and measurement gap timing advance configuration provided by higher layer signalling as specified in TS 38.331 [2] and TS 36.331 [16].

Table 9.1A.2-1: Gap Pattern Configurations

Gap Pattern Id	Measurement Gap Length (MGL, ms)	Measurement Gap Repetition Period (MGRP, ms)
0	6	40
1	6	80
2	3	40
3	3	80
4	6	20
5	6	160
6	4	20
7	4	40
8	4	80
9	4	160
10	3	20
11	3	160
12	5.5	20
13	5.5	40
14	5.5	80
15	5.5	160
16	3.5	20
17	3.5	40
18	3.5	80
19	3.5	160
20	1.5	20
21	1.5	40
22	1.5	80
23	1.5	160
24	10	80
25	20	160

Table 9.1A.2-2: Applicability for Gap Pattern Configurations supported by the RedCap UE with NR standalone operation (with single carrier)

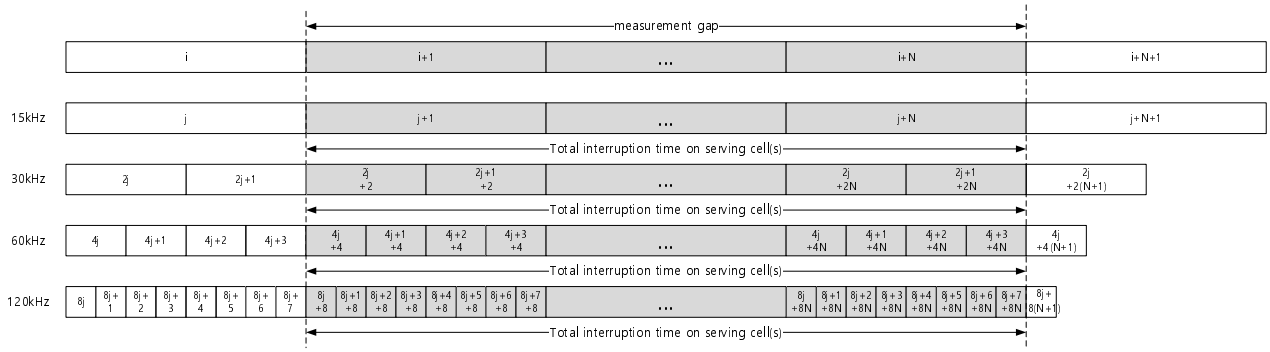
Measurement gap pattern configuration	Serving cell	Measurement Purpose	Applicable Gap Pattern Id
Per-UE measurement gap	FR1	non-NR RAT NOTE2	0,1,2,3
		FR1 and/or FR2	0-11
		non-NR RAT and FR1 and/or FR2 NOTE2	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2	non-NR RAT only NOTE2	0,1,2,3
		FR1 only	0-11
		FR1 and FR2	0-11
		non-NR RAT and FR1 and/or FR2 NOTE2	0, 1, 2, 3, 4, 6, 7, 8,10
		FR2 only	12-23
Per-FR measurement gap	FR1 if configured	non-NR RAT only NOTE2	0,1,2,3
	FR2 if configured		No gap
	FR1 if configured	FR1 only	0-11
	FR2 if configured		No gap
	FR1 if configured	FR2 only	No gap
	FR2 if configured		12-23
	FR1 if configured	non-NR RAT and FR1 NOTE2	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		No gap
	FR1 if configured	FR1 and FR2	0-11
	FR2 if configured		12-23
	FR1 if configured	non-NR RAT and FR2 NOTE2	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		12-23

Measurement gap pattern configuration	Serving cell	Measurement Purpose	Applicable Gap Pattern Id
	FR1 if configured	non-NR RAT and FR1 and FR2 NOTE2	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		12-23

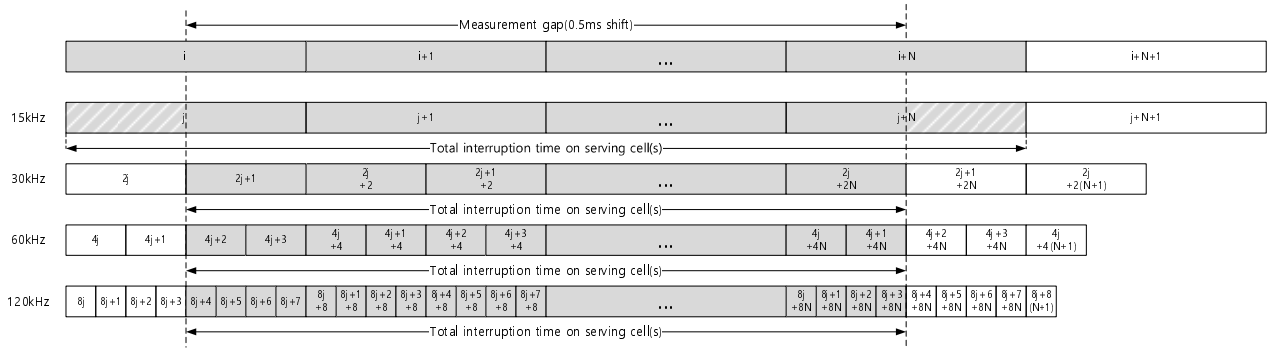
NOTE1: If per-UE measurement gap is configured with MG timing advance of T_{MG} ms, the measurement gap starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among all serving cells subframes.
If per-FR measurement gap for FR1 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR1 starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR1.
If per-FR measurement gap for FR2 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR2 starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR2.
T_{MG} is the MG timing advance value provided in *mgta* according to [2].
In determining the measurement gap starting point, UE shall use the DL timing of the latest subframe occurring immediately before the configured measurement gap among serving cells.
NOTE 2: In RedCap, non-NR RAT means E-UTRA only.
NOTE 3: For UE only supporting *supportedGapPattern-NRonly* for any gap patterns among GP2-11, the corresponding gap patterns are not applicable to measurement of non-NR RAT as defined in NOTE 2.
NOTE 4: Measurement gap patterns #24 and #25 can be requested when the UE is configured at least with any of RSTD, UE Rx-Tx time difference, PRS-RSRP or PRS-RSRPP measurements requiring such gaps and can be used during the corresponding positioning measurement period.

If measurement gap is configured in one FR but measurement object is not configured in the FR, the scheduling opportunity in the FR depends on the configured measurement gap pattern.

For NR standalone operation (with single carrier), if UE is not capable of per-FR-gap, total interruption time on a serving cell during MGL is defined when MGL(N) = 6 ms, 5.5 ms, 4 ms, 3.5 ms, 3 ms, and 1.5 ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cell during MGL is defined only when MGL(N) = 6 ms, 4 ms, and 3 ms, and total interruption time on FR2 serving cell during MGL is defined only when MGL(N) = 5.5 ms, 3.5 ms, and 1.5 ms.



(a) Measurement gap with MGL = N(ms) with MG timing advance of 0 ms for serving cell in synchronous NR standalone operation (with single carrier)



(b) Measurement gap with MGL = N(ms) with MG timing advance of 0.5 ms for serving cell in synchronous NR standalone operation (with single carrier)

Figure 9.1A.2-1: Measurement GAP and total interruption time on serving cell for NR standalone operation (with single carrier)

The corresponding total number of interrupted slots on serving cell is listed in table 9.1A.2-3 for serving cell in NR standalone (with single carrier).

Table 9.1A.2-3: Total number of interrupted slots on serving cell during MGL for NR standalone operation (with single carrier) with per-UE measurement gap or per-FR measurement gap for FR1

NR SCS (kHz)	Total number of interrupted slots on serving cell					
	When MG timing advance of 0 ms is applied			When MG timing advance of 0.5 ms is applied		
	MGL=6 ms	MGL=4 ms	MGL=3 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms
15	6	4	3	7[Note3]	5[Note3]	4[Note3]
30	12	8	6	12	8	6
60	24	16	12	24	16	12
120	48	32	24	48	32	24

NOTE 1: For Gap Pattern ID 0, 1, 2 and 3, total number of interrupted subframes on serving cell is MGL subframes when MG timing advance of 0 ms is applied, and (MGL+1) subframes when MG timing advance of 0.5 ms is applied.
NOTE 2: NR SCS of 120 kHz is only applicable to the case with per-UE measurement gap.
NOTE 3: Non-overlapped half-slots occur before and after the measurement gap. Whether a RedCap UE can receive and/or transmit in those half-slots is up to UE implementation.

In case that UE capable of per-FR measurement gap is configured with per-UE measurement gap or per-FR measurement gap for FR2 serving cell, total number of interrupted slots on FR2 serving cells during MGL is listed in table 9.1A.2-3a.

Table 9.1A.2-3a: Total number of interrupted slots on FR2 serving cell during MGL for NR standalone operation (with single carrier) with per-UE measurement gap or per-FR measurement gap for FR2

NR SCS (kHz)	Total number of interrupted slots on FR2 serving cell					
	When MG timing advance of 0 ms is applied			When MG timing advance of 0.25 ms is applied		
	MGL= 5.5 ms	MGL= 3.5 ms	MGL= 1.5 ms	MGL= 5.5 ms	MGL= 3.5 ms	MGL= 1.5 ms
60	22	14	6	22	14	6
120	44	28	12	44	28	12

NOTE 1: The total number of interrupted slots is based on that SFN and subframe reference for per-FR gap in FR2 indicated by high layer parameter *refServCellIndicator* is an FR2 serving cell.
NOTE 2: Slot occurs before or after the measurement gap may be interrupted additionally if SFN and subframe reference for per-FR gap in FR2 indicated by high layer parameter refServCellIndicator is an FR1 serving cell.

It is up to UE implementation whether or not the UE is able to conduct transmission in the following slot(s),

- when MGTA is not applied, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after measurement gap
- when MGTA is applied and the SCS of the UL carrier is other than 15 kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after measurement gap
- when MGTA is applied and the SCS of the UL carrier is 15 kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the slot partially overlapped with measurement gap

where UL slot denotes that all the symbols in the slot are uplink symbols, and L=1 if $(N_{\mathrm{TA}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$ for the UL transmission is less than the length of one slot; L=2 otherwise.

9.1A.2.1 SA: Measurement Gap Sharing

For NR standalone UE configured with per-UE measurement gap, measurement gap sharing shall be applies when UE requires measurement gaps to identify and measure cells on an intra-frequency carrier or when SMTC configured for

intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers for SSB based L3 measurement, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-UE measurement gaps or per-FR measurement gap, and/or inter-RAT E-UTRAN carriers.

For NR standalone UE configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR1 intra-frequency carriers or when SMTC configured for FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR1 inter-frequency carriers for SSB based L3 measurement and/or inter-RAT E-UTRAN carriers, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-FR1 measurement gaps.

For NR standalone UE configured with per-FR2 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR2 intra-frequency carriers or when SMTC configured for FR2 intra-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR2 inter-frequency carriers for SSB based L3 measurement, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-UE measurement gaps.

When network signals “01”, “10” or “11” with RRC parameter *MeasGapSharingScheme* [2] and the value of X is defined as in table 9.1.2.1a-1, and

- $K_{intra} = 1 / X * 100$,
- $K_{inter} = 1 / (100 – X) * 100$,

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1A.5.2.1.

9.1A.3 UE Measurement capability

9.1A.3.1 SA: Monitoring of multiple layers using gaps

The requirements in this clause are applicable for UE configured with SA NR operation mode.

When monitoring of multiple inter-RAT E-UTRAN carriers and inter-frequency NR carriers with gaps(or without using gaps provided the UE supports such capability or the effective MGRP is applied for per-FR measurement gap capable UE) is configured by PCell, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, E-UTRAN RSRP, E-UTRAN RSRQ, E-UTRAN RS-SINR measurements, etc.) of detected cells on all the layers.

For UE configured with the NR SA operation, the effective total number of frequencies, excluding the frequencies of the PCell being monitored, is $N_{freq, SA, RedCap}$, which is defined as:

$$N_{freq, SA, RedCap} = N_{freq, SA, NR, RedCap} + N_{freq, SA, E-UTRA, RedCap},$$

where

$N_{freq, SA, E-UTRA, RedCap}$ is the number of E-UTRA inter-RAT carriers being monitored (FDD and TDD) as configured by PCell,

$N_{freq, SA, NR, RedCap}$ is the number of NR inter-frequency carriers being monitored as configured by PCell.

9.1A.3.2 SA: Maximum allowed layers for multiple monitoring

If a UE is configured with SA NR operation mode, the UE shall be capable of monitoring at least:

- Depending on UE capability, 6 NR SSB inter-frequency carriers configured by PCell, and
- Depending on UE capability, 6 E-UTRA TDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 6 E-UTRA FDD inter-RAT carriers configured by PCell.

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least [10] effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, and E-UTRA TDD layers.

If *ssbfrequency*, *smtc1*, *smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

9.1A.4 Capabilities for Support of Event Triggering and Reporting Criteria

9.1A.4.1 Introduction

This clause contains requirements on UE capabilities for support of event triggering and reporting criteria. As long as the measurement configuration does not exceed the requirements stated in clause 9.1A.4.2, the UE shall meet all other performance requirements defined in clause 9 and clause 10.

The UE can be requested to make measurements under different measurement identities defined in TS 38.331 [2]. Each measurement identity corresponds to either event-based reporting, periodic reporting, or no reporting. In case of event-based reporting, each measurement identity is associated with an event triggering criterion. In case of periodic reporting, a measurement identity is associated with one periodic reporting criterion. In case of no reporting, a measurement identity is associated with one no reporting criterion.

The purpose of this clause is to set some limits on the number of different event triggering, periodic, and no reporting criteria the UE may be requested to track in parallel.

9.1A.4.2 Requirements

In this clause a reporting criterion corresponds to either one event (in the case of event-based reporting), or one periodic reporting criterion (in case of periodic reporting), or one no reporting criterion (in case of no reporting). For event-based reporting, each instance of event, with the same or different event identities, is counted as separate reporting criterion in table 9.1A.4.2-1.

The UE shall be able to support in parallel per category up to E_{cat} reporting criteria according to table [9.1A.4.2-1]. For the measurement categories belonging to intra-frequency, inter-frequency, and inter-RAT measurements (i.e. without counting other categories that the UE shall always support in parallel), the UE need not support more than the total number of reporting criteria as follows:

- For UE configured with SA operation mode: $E_{cat,SA,NR,redCap} + E_{cat,SA,E-UTRA,redCap}$, where

  $E_{cat,SA,NR,redCap} = 19$ is the total number of NR reporting criteria according to table 9.1A.4.2-1,

  $E_{cat,SA,E-UTRA,redCap}$ is the total number of inter-RAT E-UTRA reporting criteria according to table 9.1A.4.2-1.

Table 9.1A.4.2-1: Requirements for reporting criteria per measurement category

Measurement category	E_{cat}	Note
Intra-frequency Note 1	9	Events for any one or a combination of intra-frequency SS-RSRP, SS-RSRQ, and SS-SINR for NG-RAN intra-frequency cells
Inter-frequency Note 1	10	Events for any one or a combination of inter-frequency SS-RSRP, SS-RSRQ, and SS-SINRfor NG-RAN inter-frequency cells
Inter-RAT (E-UTRA FDD, E-UTRA TDD) Note 1	10	Only applicable for UE with this (inter-RAT) capability. These reporting criteria apply for any E-UTRA carrier frequencies.
NOTE 1: Applicable for UE configured with SA NR operation mode.		

9.1A.5 Carrier-specific scaling factor

This clause specifies the derivation of carrier-specific scaling factor (CSSF) values, which scales the measurement delay requirements given in clauses 9.2B, 9.3Band 9.4A when UE is configured to monitor multiple measurement objects. The CSSF values are categorized into $CSSF_{outside_gap_RedCap,i}$ and $CSSF_{within_gap_RedCap,i}$, for the measurements conducted outside measurement gaps and within measurement gaps, respectively.

9.1A.5.1 Monitoring of multiple layers outside gaps

The carrier-specific scaling factor $CSSF_{outside_gap_RedCap,i}$ for measurement object *i* derived in this chapter is applied to following measurement types:

- SSB-based intra-frequency measurement with no measurement gap in clause 9.2B.5, when none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.
- SSB-based intra-frequency measurement with no measurement gap in clause 9.2B.5, when part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.
- SSB-based inter-frequency measurement with no measurement gap in clause 9.3B.7, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement with no measurement gap in clause [9.3B.7], when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

UE is expected to conduct the measurement of this measurement object *i* only outside the measurement gaps.

If *ssbfrequency*, *smtc1*, *smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, $CSSF_{outside_gap_RedCap,i}$ and requirements derived from $CSSF_{outside_gap_RedCap,i}$ are not specified.

9.1A.5.1.1 SA mode: carrier-specific scaling factor for SSB-based measurements performed outside gaps

For UE in SA operation mode, the carrier-specific scaling factor $CSSF_{outside_gap_RedCap,i}$ for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, will be specified as follows:

$CSSF_{outside_gap\ RedCap,i}$ =1, if only one measurement object is configured to be measured outside of MG for RedCap.

$CSSF_{outside_gap\ RedCap,i}$ =2 for intra-frequency measurement, and $CSSF_{outside_gap,i}$ = 2*Y for inter-frequency measurement with no measurement gap, Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG.

If intra-frequency measurement is with measurement gap, $CSSF_{outside_gap,i}$ = Y for inter-frequency measurement with no measurement gap, Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG.

9.1A.5.2 Monitoring of multiple layers within gaps

The carrier-specific scaling factor $CSSF_{within_gap_RedCap,i}$ for a measurement object *i* derived in this chapter is applied to following measurement types:

- SSB-based intra-frequency measurement object with no measurement gap in clause 9.2B.5, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.
- SSB-based intra-frequency measurement object with measurement gap in clause 9.2B.6.

- SSB-based inter-frequency measurement object with measurement gap in clause 9.3B.4.
- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap* in clause 9.3B.7, when
  - all of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, or
  - part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap but the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network
- E-UTRA Inter-RAT measurement object in clauses 9.4A.2 and 9.4A.3.
- NR PRS-based measurements for positioning in clause 9.9A.

UE is expected to conduct the measurement of this measurement object *i* only within the measurement gaps.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, $CSSF_{within_gap_RedCap,i}$ and requirements derived from $CSSF_{outside_gap_RedCap,i}$ are not specified.

9.1A.5.2.1 SA mode: carrier-specific scaling factor for SSB measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within_gap_RedCap,i}$ and is derived as described in this clause.

If measurement object *i* refers to a long-periodicity measurement which is any of:

- an NR measurement for positioning frequency layer *i* with $T_{available_PRS,i}$ >160 ms, where $T_{available_PRS,i}$ is defined in clauses 9.9A.2.5.1, 9.9A.3.5.1, 9.9A.4.5 and 9.9A.5.5 for RSTD, PRS-RSRP ,UE Rx-Tx time difference and PRS-RSRPP measurements without frequency hopping, respectively.
- an NR measurement for positioning frequency layer *i* with $T_{available_PRS,i}$ >160 ms, where $T_{available_PRS,i}$ is defined in clauses 9.9A.2.6.1, 9.9A.3.6.1, 9.9A.4.8 and 9.9A.5.8 for RSTD, PRS-RSRP ,UE Rx-Tx time difference and PRS-RSRPP measurements with frequency hopping, respectively.

then $CSSF_{within_gap_RedCap,i}$ =1. Otherwise, the $CSSF_{within_gap_RedCap,i}$ for other measurement objects participate in the gap competition and the $CSSF_{within_gap_RedCap,i}$ are derived as below.

When multiple positioning frequency layers are configured,

- for each positioning frequency layer *i*, $CSSF_{within_gap_RedCap,i}$ is derived with the following steps assuming no other positioning frequency layer is configured.
- for each RRM frequency layer *i*, $CSSF_{within_gap_RedCap,i}$ is derived as follows:
  - an intermediate $CSSF_{within_gap_RedCap,i,k}$ is derived with the following steps assuming only positioning frequency layer *k* is configured, and
  - $CSSF_{within_gap_RedCap,i}$= max($CSSF_{within_gap_RedCap,i,k}$), where *k*=0…K-1, and K is the number of configured positioning frequency layers.

For each measurement gap *j* not used for a long-periodicity measurement defined above, count the total number of intra-frequency measurement objects, inter-frequency/inter-RAT measurement objects and NR positioning frequency layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement object, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.
- An NR positioning frequency layer is counted as candidate for a MG occasion if at least one PRS resource on that positioning frequency layer is fully covered by the MGL excluding RF switching time.

- For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis.

- For UEs which support and are configured with per FR gaps, the CSSF requirements do not apply when NR PRS measurement in one FR gap collides with SSB/CSI-RS/PRS measurements in the other FR gap in time domain.

- $M_{intra_RedCap,i,j}$: Number of intra-frequency measurement objects, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{intra\ RedCap,i,j}$ equals 0.

- $M_{inter_RedCap,i,j}$: Number of NR inter-frequency layers and E-UTRA inter-RAT, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{inter_RedCap,i,j}$ equals 0.

- $M_{tot_RedCap,i,j} = M_{intra_RedCap,i,j} + M_{inter_RedCap,i,j}$: Total number of intra-frequency, inter-frequency and inter-RAT frequency layers, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot_RedCap,i,j}$ equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, $M_{intra_RedCap,i,j} = M_{inter_RedCap,i,j} = M_{tot_RedCap,i,j} = 0$.

The carrier specific scaling factor $CSSF_{within_gap_RedCap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within_gap_RedCap,i} = \max(\text{ceil}(R_i \times M_{tot_RedCap,i,j}))$, where $j=0\ldots(160/MGRP)-1$

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intra-frequency measurement object, $CSSF_{within_gap_RedCap,i}$ is the maximum among
  - $\text{ceil}(R_i \times K_{intra} \times M_{intra_RedCap,i,j})$ in gaps where $M_{inter_RedCap,i,j} \neq 0$, where $j=0\ldots(160/MGRP)-1$
  - $\text{ceil}(R_i \times M_{intra_RedCap,i,j})$ in gaps where $M_{inter_RedCap,i,j}=0$, where $j=0\ldots(160/MGRP)-1$
- measurement object *i* is an inter-frequency or inter-RAT measurement object or NR PRS measurement on any one positioning frequency layer, $CSSF_{within_gap_RedCap,i}$ is the maximum among
  - $\text{ceil}(R_i \times K_{inter} \times M_{inter_RedCap,i,j})$ in gaps where $M_{intra_RedCap,i,j} \neq 0$, where $j=0\ldots(160/MGRP)-1$
  - $\text{ceil}(R_i \times M_{inter_RedCap,i,j})$ in gaps where $M_{intra_RedCap,i,j}=0$, where $j=0\ldots(160/MGRP)-1$

where R_i is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for a long-periodicity measurement defined above.

9.1A.6 Minimum requirement at transitions

When the measurement on one intra-frequency measurement object transitions from measurements performed outside gaps to measurements performed within gaps or vice versa during one measurement period, the cell identification and measurement period requirements with the longer delay apply.

The carrier-specific scaling factor specified in clause 9.1A.5 that applies to the other impacted measurement objects will also apply based on the longer measurement or cell identification delay before or after the transition.

When the UE transitions between DRX and non-DRX or when DRX cycle periodicity changes, the cell identification and measurement period requirements apply based on the longer delay before or after the transition.

When the intra-frequency measurement transitions from measurements performed on CD-SSB to measurements performed on NCD-SSB or vice versa due to BWP switching during one cell identification period, the UE shall use a cell identification period that is the maximum of the cell identification periods corresponding to the first SSB type and the second SSB type after the BWP switching.

When the intra-frequency measurement transitions from measurements performed on CD-SSB to measurements performed on NCD-SSB or vice versa due to BWP switching during one measurement period, the UE shall use a measurement period that is the maximum of the measurement periods corresponding to the first SSB type and the second SSB type after the BWP switching.

When the measurement on one measurement object transitions from inter-frequency measurement to intra-frequency measurement or vice versa due to BWP switching during one cell identification period, the UE shall use a cell identification period that is the maximum of the cell identification periods corresponding to the first SSB type and the second SSB type after the BWP switching.

When the measurement on one measurement object transitions from inter-frequency measurement to intra-frequency measurement or vice versa due to BWP switching during one measurement period, the UE shall use a measurement period that is the maximum of the measurement periods corresponding to the first SSB type and the second SSB type after the BWP switching.

Subsequent to the above-mentioned measurement periods and/or cell identification periods, the cell identification and measurement period requirements on each measurement object are based on the SSB type after the BWP switch.

9.1C General measurement requirement for SAN

9.1C.1 Introduction

This clause contains general requirements on the UE regarding measurement reporting in RRC_CONNECTED state. The requirements are split in intra-frequency, inter-frequency and L1-RSRP measurements requirements. These measurements may be used by the NG-RAN. The measurement quantities are defined in TS 38.215 [4], the measurement model is defined in TS 38.300 [10], TS 37.340 [17] and measurement accuracies are specified in clause 10. Control of measurement reporting is specified in TS 38.331 [2].

9.1C.2 Measurement gap

For the UE configured with only PCell, which is served by SAN, if the UE requires measurement gaps to identify and measure cells operating in satellite access network and/or TN cells, in order for the requirements in the following clauses to apply the network must provide at least one per-UE measurement gap and the number of per-UE measurement gaps provided by the network must not exceed the number of measurement gaps supported by the UE, indicated by the capability *parallelMeasurementGap*.

If the UE is configured via LPP [34] to measure PRS for UE Rx-Tx time difference measurement defined in TS 38.215 [4], in order for the requirements in clauses 9.9C.4 to apply, the network must provide at least one per-UE measurement gap pattern for concurrent monitoring of all positioning frequency layers and intra-frequency and/or inter-frequency layers. The number of per-UE measurement gaps provided by the network must not exceed the number of measurement gaps supported by the UE, indicated by the capability *parallelMeasurementGap*.

During the per-UE measurement gaps the UE:

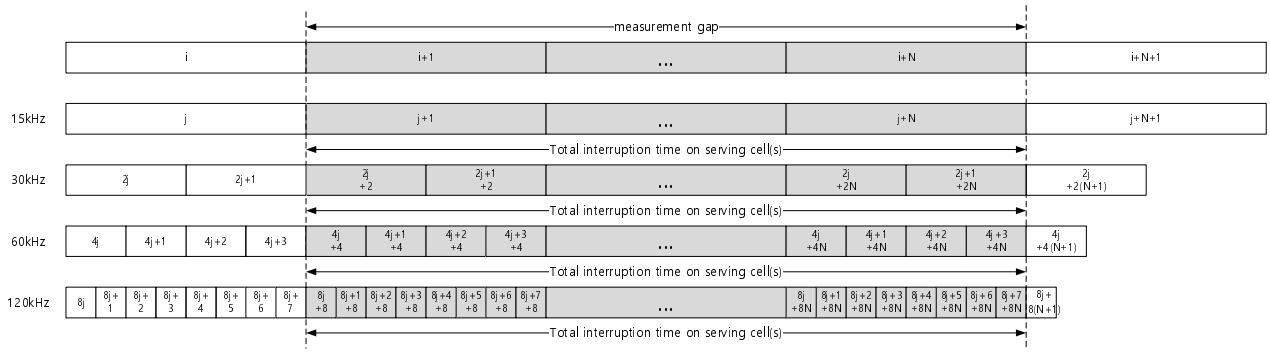
- is not required to conduct reception/transmission from/to the PCell except the reception of signals used for RRM measurement(s) and the signals used for random access procedure according to [7].

UEs shall support the measurement gap patterns listed in table 9.1C.2-1 based on the the applicability specified in table 9.1C.2-3. UE determines measurement gap timing based on gap offset configuration and measurement gap timing advance configuration provided by higher layer signalling as specified in TS 38.331 [2] and TS 36.331 [16].

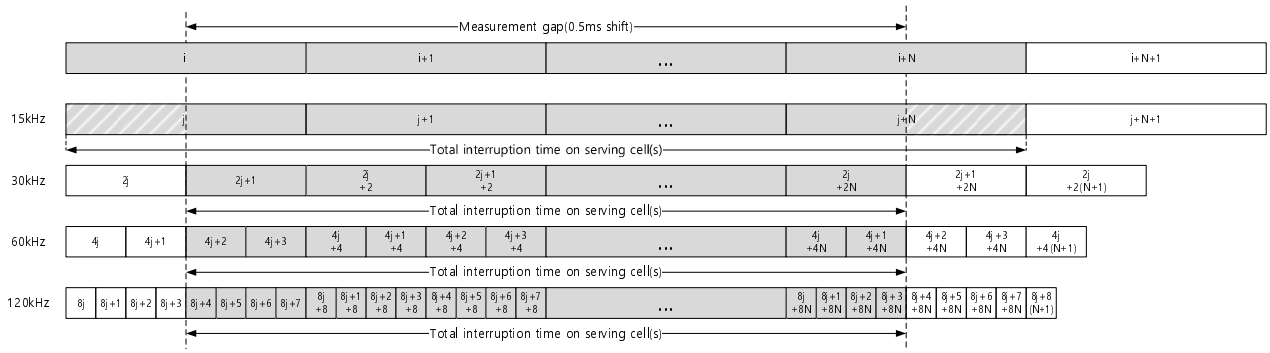
Table 9.1C.2-1: Gap Pattern Configurations

Gap Pattern Id	Measurement Gap Length (MGL, ms)	Measurement Gap Repetition Period (MGRP, ms)
0	6	40
1	6	80
2	3	40
3	3	80
4	6	20
5	6	160
6	4	20
7	4	40
8	4	80
9	4	160
10	3	20
11	3	160

Gap Pattern Id	Measurement Gap Length (MGL, ms)	Measurement Gap Repetition Period (MGRP, ms)
12	5.5	20
13	5.5	40
14	5.5	80
15	5.5	160
16	3.5	20
17	3.5	40
18	3.5	80
19	3.5	160
20	1.5	20
21	1.5	40
22	1.5	80
23	1.5	160
24	10	80
25	20	160



(a) Measurement gap with MGL = N(ms) with MG timing advance of 0 ms for NR standalone operation configured with only single carrier



(b) Measurement gap with MGL = N(ms) with MG timing advance of 0.5 ms for NR standalone operation configured with only single carrier

Figure 9.1C.2-1: Measurement GAP and total interruption time for NR standalone operation confgigured with only single carrier

In determining the measurement gap starting point, UE shall use the DL timing of the latest NR subframe occurring immediately before the configured measurement gap. If per-UE measurement gap is configured with MG timing advance of T_{MG} ms, the measurement gap starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap. T_{MG} is the MG timing advance value provided in *mgta* according to [2].

Table 9.1C.2-2: Total number of interrupted slots on PCell in NR standalone operation configured with only single carrier in FR1-NTN

NR SCS	Total number of interrupted slots on serving cells	
	When MG timing advance of 0 ms is applied	When MG timing advance of 0.5 ms is applied

(kHz)	MGL=20 ms	MGL=10 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms	MGL=20 ms	MGL=10 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms
15	20	10	6	4	3	21 Note3	11 Note3	7 Note3	5 Note3	4 Note3
30	40	20	12	8	6	40	20	12	8	6
60	80	40	24	16	12	80	40	24	16	12

NOTE 1: Void
NOTE 2: Non-overlapped half-slots occur before and after the measurement gap. Whether a UE can receive and/or transmit in those half-slots is up to UE implementation.

Table 9.1C.2-2a: Total number of interrupted slots on PCell in NR standalone operation configured with only single carrier in FR2-NTN

NR SCS (kHz)	Total number of interrupted slots on serving cells					
	When MG timing advance of 0 ms is applied			When MG timing advance of 0.25 ms is applied		
	MGL= 5.5 ms	MGL= 3.5 ms	MGL= 1.5 ms	MGL= 5.5 ms	MGL= 3.5 ms	MGL= 1.5 ms
60	22	14	6	22	14	6
120	44	28	12	44	28	12

Table 9.1C.2-3: Applicability for Gap Pattern Configurations supported by the UE with NR standalone operation (with single carrier, NR CA and NR-DC configuration)

Measurement gap pattern configuration	Serving cell	Measurement Purpose NOTE 2	Applicable Gap Pattern Id
Per-UE measurement	FR1-NTN	FR1-NTN	0-11, 24, 25 NOTE 1
	FR2-NTN	FR2-NTN	12-25 NOTE 1

NOTE 1: Measurement gap patterns #24 and #25 can be requested [2] only when the UE is configured with UE Rx-Tx measurements requiring such gaps and can only be used during the corresponding positioning measurement period.
NOTE 2: Inclusion of positioning measurements for measurement gaps: Measurement purpose which includes FR1-NTN measurements includes also UE Rx-Tx measurements.

UL slots that are fully or partially overlapping with measurement gap, taking into account TA as defined in clause 7.1C.2, are interrupted.

NOTE: Network is supposed to take into account the possible difference between the estimated TA at network and actual TA at UE when scheduling UE in the above slot(s).

9.1C.8 Concurrent measurement gaps for SAN

9.1C.8.1 Introduction

When UE supports concurrent measurement gap pattern capability, network can provide multiple measurement gaps configured by RRC message(s) as specified in TS 38.331 [2].

9.1C.8.2 Requirements

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells, and the UE supports concurrent measurement gap patterns (*parallelMeasurementGap*), in order for the requirements in the following clauses to apply the network can provide at most two per-UE measurement gap patterns for monitoring of all frequency layers.

For UE configured with the SA operation, when monitoring of multiple intra-frequency and inter-frequency NR carrier frequency layers as configured by PCell using gaps, each monitored carrier frequency layer, including following measurement types:

- a measurement object with SSB based measurement,

can be associated to one or two measurement gap pattern(s) provided the network configures the concurrent measurement gap patterns. In addition, NR PRS-based positioning measurements can be associated to one measurement gap pattern when the network configures the concurrent measurement gap patterns.

When UE supports concurrent measurement gap patterns, each measurement gap pattern supported by the UE is listed in table 9.1C.2-1.

The requirements in clause 9.1C.2 are also applicable for the UE capable of and configured with multiple concurrent measurement gap patterns within each measurement gap pattern.

When UE supports concurrent measurement gap patterns and configured with more than 1 per-UE measurement gap patterns, requirements do not apply if the UE is configured with more than one measurement gap pattern (MGP) with measurement gap repetition period (MGRP) of 20 ms.

9.1C.8.3 Collision between concurrent measurement gaps

Collisions between occasions of two concurrent measurement gaps may occur as specified in this clause if the two measurement gaps are

- two per-UE measurement gaps.

When UE is configured with concurrent measurement gaps, two measurement gap occasions are considered colliding if at least one of the following conditions is met:

- the two occasions are fully or partially overlapping in time domain, or
- the distance between the two occasions is equal to or smaller than 4 ms.

The distance between two measurement gap occasions is defined as the time difference between the ending point of the first occasion and the starting point of the second occasion, where the first measurement gap occasion occurs earlier in time than the second measurement gap occasion.

If two colliding measurement gaps are not fully overlapping, in case of collision between two measurement gap occasions, the UE shall perform measurements in the occasion of the measurement gap with higher priority, and the occasion of the measurement gap with lower priority shall be dropped. The UE shall be able to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI in the corresponding NR serving cells in the slots that are not interrupted according to requirements in clause 9.1C.8.4.

If two colliding measurement gaps are fully overlapping with MGRP=160 ms, in case of collision between two measurement gap occasions, the UE shall perform measurements in the occasion of one of the measurement gaps, and it is up to UE implementation which occasion is used for measurement, provided that UE can meet the requirements in clause 9.2C and 9.3C.

If two measurement gaps are fully overlapping with MGRP<160 ms, no measurement requirements apply.

9.1C.8.4 Measurement gap related requirements of concurrent measurement gaps

A slot is considered as interrupted if it is interrupted by an occasion of any of the configured concurrent measurement gaps following the measurement gap interruption requirements in clause 9.1C.2, except for a dropped measurement gap occasion.

9.1C.9 Collision between SMTC and measurement gap for SAN

9.1C.9.1 Introduction

This clause contains definition of collision between SMTCs and measurement gap for SAN.

9.1C.9.2 Collision between SMTCs and measurement gap

Collision between occasions of SMTC and measurement gap may occur as specified in this clause.

When UE is configured with one or more than one measurement gap pattern, an SMTC occasion outside measurement gap and a measurement gap occasion are considered colliding if at least one of the following conditions is met:

- the SMTC occasion is fully or partially overlapping in time domain with the measurement gap occasion, or
- the magnitude of the distance between the SMTC occasion and the measurement gap occasion in time domain is less than or equals to 4 ms.

The distance between a SMTC occasion and a measurement gap occasion is defined as:

- the time difference between the ending point of the SMTC occasion and the starting point of the measurement gap occasion, where the SMTC occasion occurs earlier in time than the MG occasion, or
- the time difference between the ending point of the measurement gap occasion and the starting point of the SMTC occasion, where the measurement gap occasion occurs earlier in time than the SMTC occasion.

9.1C.9.3 Collision between multiple SMTCs on a SAN carrier

Collision between occasions of multiple SMTCs may occur as specified in this clause.

When UE is configured with more than one SMTC on a SAN carrier, two SMTC occasions outside measurement gap are considered colliding if at least one of the following conditions is met:

- the two SMTC occasions are fully or partially overlapping in time domain, or
- the magnitude of the distance between two SMTC occasions in time domain is less than or equals to 4 ms.

The distance between two SMTC occasions is defined as the time difference between the ending point of the earlier SMTC occasion and the starting point of the later SMTC occasion.

9.1D General measurement requirement for ATG

9.1D.1 Introduction

This clause contains general requirements on the ATG UE regarding measurement reporting in RRC_CONNECTED state. The requirements are split in intra-frequency, inter-frequency, and L1-RSRP measurements requirements. These measurements may be used by the NG-RAN. The measurement quantities are defined in TS 38.215 [4], the measurement model is defined in TS 38.300 [10], TS 37.340 [17] and measurement accuracies are specified in clause 10. Control of measurement reporting is specified in TS 38.331 [2].

In the requirements of clause 9.1D, the exceptions for side conditions apply as follows:

- for the UE capable of CA but not configured with any SCell, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.1 for UE supporting CA in FR1;
- for the UE capable of CA and configured with one SCell, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.2 for UE configured with CA in FR1;

9.1D.2 Measurement gap

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells, and the UE does not support independent measurement gap patterns for different frequency ranges as specified in table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply the network must provide a single per-UE measurement gap pattern for concurrent monitoring of all frequency layers.

During the per-UE measurement gaps an ATG UE, operating under SA (with single carrier or CA configured), is not required to conduct reception/transmission from/to the corresponding NR serving cells except the reception of signals used for RRM measurement(s).

UEs shall support the measurement gap patterns listed in table 9.1D.2-1 based on the applicability specified in table 9.1D.2-3. UE determines measurement gap timing based on gap offset configuration and measurement gap timing advance configuration provided by higher layer signalling as specified in TS 38.331.

Table 9.1D.2-1: Gap Pattern Configurations

Gap Pattern Id	Measurement Gap Length (MGL, ms)	Measurement Gap Repetition Period (MGRP, ms)
0	6	40
1	6	80
2	3	40
3	3	80
4	6	20
5	6	160
6	4	20
7	4	40
8	4	80
9	4	160
10	3	20
11	3	160

Table 9.1D.2-2: Void

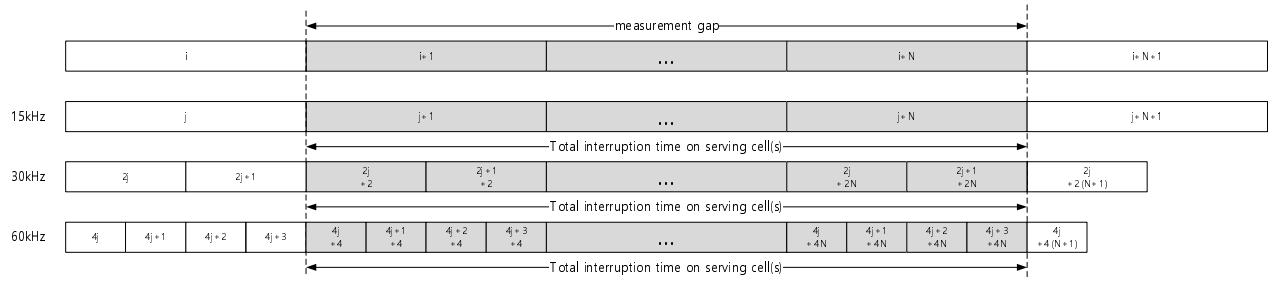
Table 9.1D.2-3: Applicability for Gap Pattern Configurations supported by the UE with NR standalone operation (with single carrier and NR CA configuration)

Measurement gap pattern configuration	Serving cell	Measurement Purpose	Applicable Gap Pattern Id
Per-UE measurement gap	FR1	FR1	0-11

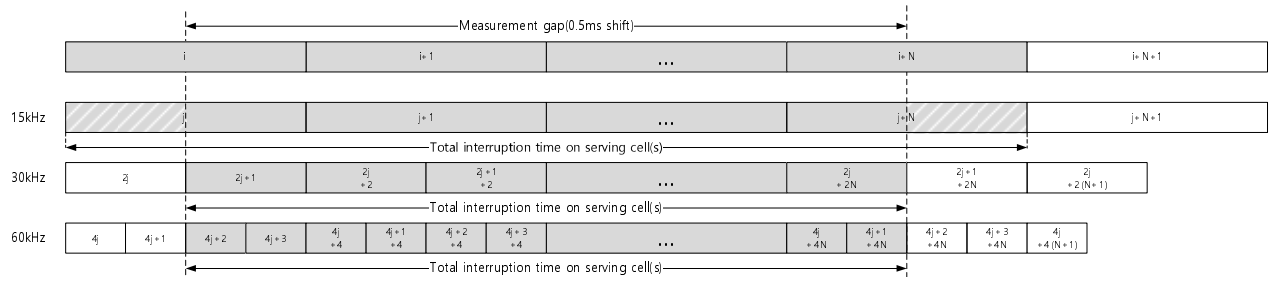
NOTE 1: Void
NOTE 2: Void
NOTE 3: Void
NOTE 4: If per-UE measurement gap is configured with MG timing advance of T_{MG} ms, the measurement gap starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among all serving cells subframes. T_{MG} is the MG timing advance value provided in *mgta* according to [2].
In determining the measurement gap starting point, UE shall use the DL timing of the latest subframe occurring immediately before the configured measurement gap among serving cells.

For single carrier or CA with aligned frame boundaries,

For NR standalone operation (with single carrier or NR CA), total interruption time on a serving cell during MGL is defined when MGL(N) = 6 ms, 4 ms, 3 ms.



(a) Measurement gap with MGL = N(ms) with MG timing advance of 0 ms for all serving cells in synchronous NR standalone operation (with single carrier and NR CA configuration)



b) Measurement gap with MGL = N(ms) with MG timing advance of 0.5 ms for all serving cells in synchronous NR standalone operation (with single carrier and NR CA configuration)

Figure 9.1D.2-1: Measurement GAP and total interruption time on serving cells for NR standalone operation (with single carrier and NR CA)

The corresponding total number of interrupted slots on serving cells is listed in table 9.1D.2-4 for all serving cells in synchronous NR standalone (with single carrier and NR CA configuration).

Table 9.1D.2-4: Total number of interrupted slots on all serving cells during MGL for Synchronous NR standalone operation (with single carrier and NR CA configuration) with per-UE measurement gap

NR SCS (kHz)	Total number of interrupted slots on serving cells					
	When MG timing advance of 0 ms is applied			When MG timing advance of 0.5 ms is applied		
	MGL=6 ms	MGL=4 ms	MGL=3 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms
15	6	4	3	7[Note3]	5[Note3]	4[Note3]
30	12	8	6	12	8	6

NOTE 1: For Gap Pattern ID 0, 1, 2 and 3, total number of interrupted subframes on the serving cell is MGL subframes when MG timing advance of 0 ms is applied, and (MGL+1) subframes when MG timing advance of 0.5 ms is applied.
NOTE 2: Void
NOTE 3: Non-overlapped half-slots occur before and after the measurement gap. Whether a Rel-15 UE can receive and/or transmit in those half-slots is up to UE implementation.

It is up to UE implementation whether or not the UE is able to conduct transmission in the following slot(s),

- when MGTA is not applied, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after measurement gap

- when MGTA is applied and the SCS of the UL carrier is other than 15 kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after measurement gap

- when MGTA is applied and the SCS of the UL carrier is 15 kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the slot partially overlapped with measurement gap

where UL slot denotes that all the symbols in the slot are uplink symbols, and L=1 if $(N_{\mathrm{TA}} + N_{\mathrm{TA\ offset}} + N_{TA,\mathrm{adj}}^{UE}) \times T_{\mathrm{c}}$ for the UL transmission is less than the length of one slot; L=2 otherwise.

NOTE: Network is supposed to take into account the possible difference between the estimated TA at network and actual TA at UE when scheduling UE in the above slot(s).

9.1D.2.1a SA: Measurement Gap Sharing

Measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on intra-frequency carriers or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers for both SSB and CSI-RS based L3 measurement, or when all of SMTC configured for inter-frequency SSB based measurement without measurement gaps are fully overlapping with per-UE measurement gaps.

When network signals “01”, “10” or “11” with RRC parameter *MeasGapSharingScheme* [2] and the value of X is defined as in table 9.1D.2.1A-1, and

- $K_{intra} = 1 / X * 100$,
- $K_{inter} = 1 / (100 – X) * 100$,

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1D.5.2.2.

Table 9.1D.2.1A-1: Value of parameter X for NR standalone measurement gap sharing

measGapSharingScheme	**Value of X (%)**
‘00’	Equal splitting
‘01’	25
‘10’	50
‘11’	75
NOTE: It is left to UE implementation to determine which measurement gap sharing scheme in the table to be applied, when *MeasGapSharingScheme* is absent and there is no stored value in the field.	

9.1D.3 UE Measurement capability

9.1D.3.1 SA: Monitoring of multiple layers using gaps

When monitoring of multiple inter-frequency NR carriers is configured by PCell, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, CSI-SINR etc.) of detected cells on all the layers configured for measurements by the PCell.

9.1D.3.2 SA: Maximum allowed layers for multiple monitoring

The UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PCell, and
- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PCell.

The number of SSB frequency layers equals to the total number of MOs with

- *ssb-ConfigMobility* configured, or
- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency, smtc1, smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

The number of CSI-RS frequency layers equals to the number of MOs with *csi-rs-ResourceConfigMobility* configured assuming single MO is configured per frequency layer.

9.1D.4 Void

9.1D.5 Carrier-specific scaling factor

This clause specifies the derivation of carrier-specific scaling factor (CSSF) values, which scales the measurement delay requirements given in clause 9.2D, 9.3D, and CSI-RS based L3 measurement in clause 9.10D when UE is configured to monitor multiple measurement objects. The CSSF values are categorized into $CSSF_{outside_gap,i}$ and $CSSF_{within_gap,i}$, for the measurements conducted outside measurement gaps and within measurement gaps, respectively.

9.1D.5.1 Monitoring of multiple layers outside gaps

The carrier-specific scaling factor $CSSF_{outside_gap,i}$ for measurement object *i* derived in this chapter is applied to following measurement types:

- SSB-based intra-frequency measurement with no measurement gap in clause 9.2D.5, when none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.
- SSB-based intra-frequency measurement with no measurement gap in clause 9.2D.5, when part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.
- CSI-RS based intra-frequency measurement in clause 9.10D.2, when none of CSI-RS resources for L3 measurement of this intra-frequency measurement object are overlapped by the measurement gap.
- CSI-RS based intra-frequency measurement in clause 9.10D.2, when all CSI-RS resources for L3 measurement of this intra-frequency measurement object are partially overlapped by the measurement gap.
- SSB-based inter-frequency measurement with no measurement gap in clause 9.3D.9, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.
- SSB-based inter-frequency measurement with no measurement gap in clause 9.3D.9, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

The UE is expected to conduct the measurement of this measurement object *i* only outside the measurement gaps.

The number of frequency layers for SSB measurements shall include the total number of MOs with

- *ssb-ConfigMobility* configured, or
- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency*, *smtc1*, *smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, $CSSF_{outside_gap,i}$ and requirements derived from $CSSF_{outside_gap,i}$ are not specified.

9.1D.5.1.1 Void

9.1D.5.1.2 SA mode: carrier-specific scaling factor for SSB-based, CSI-RS based L3 measurements performed outside gaps

The carrier-specific scaling factor $CSSF_{outside_gap,i}$ for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps, intra-frequency CSI-RS L3 measurement with no measurement gap is specified in table 9.1D.5.1.2-1.

Table 9.1D.5.1.2-1: $CSSF_{outside_gap,i}$ scaling factor for SA mode

Scenario	$CSSF_{outside_gap,i}$ for FR1 PCC	$CSSF_{outside_gap,i}$ for FR1 SCC	$CSSF_{outside_gap,i}$ for inter-frequency MO with no measurement gap

FR1 single carrier	$1+N_{PCC_CSIRS}$	N/A	Y
FR1 only CA	$1+N_{PCC_CSIRS}$	N_{SCC_SSB} +Y +2x N_{SCC_CSIRS}	N_{SCC_SSB} +Y +2x N_{SCC_CSIRS}

NOTE 1: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG; otherwise, it is 0.
NOTE 2: N_{PCC_CSIRS}=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PCC_CSIRS} =0.
NOTE 3: $CSSF_{outside_gap,i}$ =1 if only one SCell is configured and no inter-frequency MO without gap and only SSB based L3 measurement is configured on SCC; $CSSF_{outside_gap,i}$ =2 if only one SCell is configured and no inter-frequency MO without gap and either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement is configured on SCC.
NOTE 4: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured
NOTE 5: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured, which is measured without MG.

9.1D.5.2 Monitoring of multiple layers within gaps

The carrier-specific scaling factor $CSSF_{within_gap,i}$ for a measurement object *i* derived in this chapter is applied to following measurement types:

- SSB-based intra-frequency measurement object with no measurement gap in clause 9.2D.5, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.
- SSB-based intra-frequency measurement object with measurement gap in clause 9.2D.6.
- CSI-RS based inter-frequency measurement in clause 9.10D.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are overlapped by the measurement gap.
- CSI-RS based inter-frequency measurement in clause 9.10D.3, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are partially overlapped by the measurement gap.
- SSB-based inter-frequency measurement object with measurement gap in clause 9.3D.4.
- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap* in clause 9.3D.9, when
  - all of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, or
  - part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, but the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network.

The UE is expected to conduct the measurement of this measurement object *i* only within the measurement gaps.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, $CSSF_{within_gap,i}$ and requirements derived from $CSSF_{outside_gap,i}$ are not specified.

Number of SSB layers shall include SSB for mobility and that as associated SSB for CSI-RS mobility. The ssbfrequency is counted only once if the ssbfrequency for mobility and associated SSB are the same, or ssbfrequency and smtc in multiple MOs are the same.

SSB-based measurement and CSI-RS based measurement for mobility configured in the same measurement object are considered as different layers.

9.1D.5.2.1 Void

9.1D.5.2.2 SA mode: carrier-specific scaling factor for SSB, CSI-RS-based L3 measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within_gap,i}$ and is derived as described in this clause.

For each measurement gap *j*, count the total number of intra-frequency measurement objects and inter-frequency measurement objects on all frequency layers which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources is fully covered by the MGL excluding RF switching time.

- For UEs which are configured with per UE gaps the counting is done on a per UE basis.

- $M_{intra,i,j}$: Number of intra-frequency measurement objects, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{intra,i,j}$ equals 0.

- $M_{inter,i,j}$: Number of NR inter-frequency layers including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{inter,i,j}$ equals 0.

- $M_{tot,i,j} = M_{intra,i,j} + M_{inter,i,j}$: Total number of intra-frequency layers, inter-frequency, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

The carrier specific scaling factor $CSSF_{within_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within_gap,i} = \max(\text{ceil}(R_i \times M_{tot,i,j}))$, where $j=0\ldots(160/MGRP)-1$

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intra-frequency measurement object, $CSSF_{within_gap,i}$ is the maximum among
  - $\text{ceil}(R_i \times K_{intra} \times M_{intra,i,j})$ in gaps where $M_{inter,i,j} \neq 0$, where $j=0\ldots(160/MGRP)-1$
  - $\text{ceil}(R_i \times M_{intra,i,j})$ in gaps where $M_{inter,i,j}=0$, where $j=0\ldots(160/MGRP)-1$
- measurement object *i* is an inter-frequency measurement object on any one frequency layer, $CSSF_{within_gap,i}$ is the maximum among
  - $\text{ceil}(R_i \times K_{inter} \times M_{inter,i,j})$ in gaps where $M_{intra,i,j} \neq 0$, where $j=0\ldots(160/MGRP)-1$
  - $\text{ceil}(R_i \times M_{inter,i,j})$ in gaps where $M_{intra,i,j}=0$, where $j=0\ldots(160/MGRP)-1$

Where R_i is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate to be measured.

9.1D.6 Void

9.1D.7 Pre-configured measurement gap

9.1D.7.1 Introduction

A UE capable of Pre-configured measurement gap (Pre-MG) pattern can be configured with a Pre-MG pattern via RRC signalling [2].

The gap interruption requirements in clause 9.1D.2 apply to Pre-MG when Pre-MG is activated, and no gap interruption is expected when Pre-MG is deactivated.

- The requirements apply for NR standalone operation with single carrier and NR CA.

9.1D.7.2 Requirements applicability

The requirements related to pre-configured measurement gap apply provided:

- UE indicates support of *preconfiguredUE-AutonomousMeasGap* [2] and/or *preconfiguredNW-ControlledMeasGap* [2], and
- a single per-UE measurement gap is pre-configured by the network, and
- one of measurement gap patterns among measurement gap patterns #0 ~ #11 is configured for pre-configured measurement gap, and
- UE is in NR SA with single carrier or with NR CA.

A measurement gap is configured as pre-configured measurement gap if *preConfigInd* is indicated by network in the configuration message of the measurement gap.

If UE indicates support of only *preconfiguredNW-ControlledMeasGap* [2], UE can expect the network to configure *preConfGapStatus*.

If a measurement gap is configured as pre-configured measurement gap, the applicability of measurement gap patterns is defined in table 9.1D.2-3.

If the Pre-MG status changes during a measurement period of a measurement that can be performed without and within measurement gaps, the UE is allowed to restart the measurement.

If the Pre-MG status changes from activated to deactivated during a measurement period of a measurement that can only be performed within measurement gaps, the measurement requirements do not apply.

9.1D.7.3 Requirements

Any of the measurement Gap pattern defined in table 9.1D.2-1 can be configured as Pre-MG pattern.

The UE can determine the Pre-MG status based on autonomous activation/deactivation mechanism or based on network-controlled activation/deactivation mechanism.

A UE capable of both autonomous and network-controlled mechanisms for activation/deactivation of Pre-MG pattern will not use autonomous rules to determine the activation/deactivation status of the pre-configured MG if the network provides the activation/deactivation status via RRC indication *preConfGapStatus* for all the DL BWPs of all the activated CCs, and for all the deactivated SCCs.

9.1D.7.3.1 Requirements for autonomous activation/deactivation mechanism

Requirements in this clause apply when autonomous mechanism [2] is used for activation/deactivation of Pre-MG pattern.

The UE can autonomously change the Pre-MG status from activation to deactivation or vice versa based on any of the following triggering conditions listed below. The UE shall also autonomously determine the Pre-MG status based on all the concurrent triggering conditions occurring jointly:

- DCI, timer or RRC based active BWP switching,
- Activation/deactivation of SCell(s),
- Addition/removal of any measurement object(s),
- Addition/release/change of a SCell in carrier aggregation

The UE shall autonomously determine the status of the per-UE Pre-MG pattern as deactivated immediately after the configuration of the per-UE Pre-MG pattern or when any of the triggering conditions above is satisfied provided that all the configured measurements can be performed without measurement gaps.

A measurement can be performed by the UE without measurement gaps if any of the following conditions is met:

- The UE is configured with SSB based intra-frequency measurements, and the conditions defined for SSB based intra-frequency measurement without gaps in clause 9.2D.1 are met, or
- The UE is configured with SSB based inter-frequency measurements, and the conditions defined for SSB based inter-frequency measurement without gaps in clause 9.3D.1 are met, or

- The UE is configured with CSI-RS based intra-frequency measurements.

The UE shall autonomously determine the status of the per-UE Pre-MG pattern as activated immediately after the configuration of the per-UE Pre-MG pattern or when any of the triggering conditions above is satisfied provided that at least one of the configured measurements cannot be performed without measurement gaps.

A measurement cannot be performed by the UE without measurement gaps if any of the following conditions is met:

- The UE is configured with SSB based intra-frequency measurements, and the conditions defined for SSB based intra-frequency measurement without gaps in clause 9.2D.1 are not met, or
- The UE is configured with SSB based inter-frequency measurements, and the conditions defined for SSB based inter-frequency measurement without gaps in clause 9.3D.1 are not met, or
- The UE is configured with CSI-RS based inter-frequency measurements.

9.1D.7.3.2 Requirements for network-controlled activation/deactivation mechanism

The requirements in this clause apply when network-controlled mechanism [2] is used for activation/deactivation of Pre-MG pattern.

For per-UE Pre-configured MG,

- the UE determines that the Pre-configured MG is activated if *preConfGapStatus* is set to '1' for the corresponding gap ID for the active DL BWP of any of the activated CCs, or if *preConfGapStatus* is set to '1' for the corresponding gap ID for any of the deactivated SCCs,
- otherwise, the UE determines that the Pre-configured MG is deactivated

9.1D.7.3.3 Requirements for reception/transmission during activation/deactivation

The requirements in this clause apply when autonomous mechanism or network-controlled mechanism is used for activation/deactivation [2] of Pre-MG pattern.

If per-UE Pre-MG pattern is activated then the UE is not required to conduct reception/transmission from/to the corresponding serving cells during the gap occasion according to the same principles as described for per-UE measurement gaps in clause 9.1D.2. Otherwise, the UE can be scheduled for reception/transmission of signals in all the serving cells during the gap occasion.

9.1D.8 Capabilities for Support of Event Triggering and Reporting Criteria

9.1D.8.1 Introduction

This clause contains requirements on UE capabilities for support of event triggering and reporting criteria. As long as the measurement configuration does not exceed the requirements stated in clause 9.1D.8.2, the UE shall meet all other performance requirements defined in clause 9 and clause 10.

The UE can be requested to make measurements under different measurement identities defined in TS 38.331 [2]. Each measurement identity corresponds to either event-based reporting, periodic reporting, or no reporting. In case of event-based reporting, each measurement identity is associated with an event triggering criterion. In case of periodic reporting, a measurement identity is associated with one periodic reporting criterion. In case of no reporting, a measurement identity is associated with one no reporting criterion.

The purpose of this clause is to set some limits on the number of different event triggering, periodic, and no reporting criteria the UE may be requested to track in parallel.

9.1D.8.2 Requirements

In this clause a reporting criterion corresponds to either one event (in the case of event-based reporting), or one periodic reporting criterion (in case of periodic reporting), or one no reporting criterion (in case of no reporting). For event-based reporting, each instance of event, with the same or different event identities, is counted as separate reporting criterion in table 9.1D.8.2-1.

The UE shall be able to support in parallel per category up to E_{cat} reporting criteria according to table 9.1D.8.2-1. For the measurement categories belonging to intra-frequency, inter-frequency, the UE need not support more than the total number of reporting criteria as follows:

- For UE configured with SA operation mode: $E_{cat,SA,NR}$, where

  $E_{cat,SA,NR} = 10 + 9 \times n$ is the total number of NR reporting criteria according to table 9.1D.8.2-1, and n is the number of configured NR serving frequencies, including PCell and SCell carrier frequencies.

Table 9.1D.8.2-1: Requirements for reporting criteria per measurement category

Measurement category	E_{cat}	Note
Intra-frequency Note 1,2	9	Events for any one or a combination of intra-frequency SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, and CSI-SINR for NG-RAN intra-frequency cells
Inter-frequency Note 2	10	Events for any one or a combination of inter-frequency SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, and CSI-SINR for NG-RAN inter-frequency cells
NOTE 1: When the UE is configured with SCell carrier frequencies, Ecat for Intra-frequency is applied per corresponding NR serving frequency. NOTE 2: Applicable for UE configured with SA NR operation mode.		

9.1D.9 Minimum requirement at transitions

When the measurement on one intra-frequency measurement object transitions from measurements performed outside gaps to measurements performed within gaps or vice versa during one measurement period, the cell identification and measurement period requirements with the longer delay apply.

The carrier-specific scaling factor specified in clause 9.1D.5 that applies to the other impacted measurement objects will also apply based on the longer measurement or cell identification delay before or after the transition.

When the UE transitions between DRX and non-DRX or when DRX cycle periodicity changes, the cell identification and measurement period requirements apply based on the longer delay before or after the transition.

Subsequent to this measurement period, the cell identification and measurement period requirements on each measurement object are corresponding to the second mode after transition.

9.1E General measurement requirement for RedCap with satellite access

9.1E.1 Introduction

This clause contains general requirements on the RedCap UE regarding measurement reporting in RRC_CONNECTED state. The requirements are split in intra-frequency, inter-frequency and L1-RSRP measurements requirements. These measurements may be used by the NG-RAN. The measurement quantities are defined in TS 38.215 [4], the measurement model is defined in TS 38.300 [10], TS 37.340 [17] and measurement accuracies are specified in clause 10. Control of measurement reporting is specified in TS 38.331 [2].

9.1E.2 Measurement gap

The requirements in clause 9.1C.2 shall apply.

9.1E.8 Concurrent measurement gaps for RedCap with SAN

9.1E.8.1 Introduction

When UE supports concurrent measurement gap pattern capability, network can provide multiple measurement gaps configured by RRC message(s) as specified in TS 38.331 [2].

9.1E.8.2 Requirements

The requirements in clause 9.1C.8.2 shall apply.

9.1E.8.3 Collision between concurrent measurement gaps

The requirements in clause 9.1C.8.3 shall apply except that

- If UE supports *parallelMeasurementWithoutRestriction-r17,*
  - If UE is configured to measure 1 satellite in each of the SMTC occasions, the distance between the two occasions is equal to or smaller than 4 ms.
  - Otherwise, the distance between the two occasions is equal to or smaller than 5 ms.
- If UE doesn't support *parallelMeasurementWithoutRestriction-r17,*
  - The distance between the two occasions is equal to or smaller than 5 ms.

9.1E.8.4 Measurement gap related requirements of concurrent measurement gaps

The requirements in clause 9.1C.8.4 shall apply.

9.1E.9 Collision between SMTC and measurement gap for RedCap with satellite access

9.1E.9.1 Introduction

This clause contains definition of collision between SMTCs and measurement gap for SAN.

9.1E.9.2 Collision between SMTCs and measurement gap

The requirements in clause 9.1C.9.2 shall apply except that

- If UE supports *parallelMeasurementWithoutRestriction-r17,*
  - If UE is configured to measure 1 satellite in each of the SMTC occasions, the magnitude of the distance between the SMTC occasion and the measurement gap occasion in time domain is less than or equals to 4 ms.
  - Otherwise, the magnitude of the distance between the SMTC occasion and the measurement gap occasion in time domain is less than or equals to 5 ms.
- If UE doesn't support *parallelMeasurementWithoutRestriction-r17,*
  - The magnitude of the distance between the SMTC occasion and the measurement gap occasion in time domain is less than or equals to 5 ms.

9.1E.9.3 Collision between multiple SMTCs on a SAN carrier

The requirements in clause 9.1C.9.2 shall apply except that

- If UE supports *parallelMeasurementWithoutRestriction-r17,*

- If UE is configured to measure 1 satellite in each of the SMTC occasions, the magnitude of the distance between two SMTC occasions in time domain is less than or equals to 4 ms.
- Otherwise, the magnitude of the distance between two SMTC occasions in time domain is less than or equals to 5 ms.

- If UE doesn't support *parallelMeasurementWithoutRestriction-r17,*
  - The magnitude of the distance between two SMTC occasions in time domain is less than or equals to 5 ms.

9.2 NR intra-frequency measurements

9.2.1 Introduction

A measurement is defined as a SSB based intra-frequency measurement provided the SSB frequency configured in the measurement object associated with the serving cell indicated for measurement and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same.

If the UE supports *ncd-SSB-BWP-Wor-r18*, a measurement is defined as a SSB based intra-frequency measurement provided the centre frequency of the reference SSB of the serving cell and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same. The reference SSB is the SSB defined in BWP-specific *servingCellMO* under *BWP-DownlinkDedicated* of active DL BWP. If the field is absent, the reference SSB is the SSB defined in *servingCellMO* under *ServingCellConfig* [2].

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell or the PSCell, even if no explicit neighbour list with physical layer cell identities is provided.

For UE supporting *ssb-BurstPeriodicityAdaptation-r19*, SMTC is associated with SSB adaptation for RRM measurement on SCell.

The UE can perform intra-frequency SSB based measurements without measurement gaps if

- CD-SSB is within the configured UE-specific CBW provided UE supports *bwpOperationMeasWithoutInterrupt-r18*, or
- NCD-SSB is completely contained in the active downlink BWP of the UE provided the UE supports *ncd-SSB-BWP-Wor-r18* and *servingCellMO* is present in the corresponding *BWP-DownlinkDedicated*, or
- the UE indicates 'no-gap' via *intraFreq-needForGap* for intra-frequency measurement, or
- the SSB is completely contained in the active BWP of the UE, or
- the active downlink BWP is initial BWP [3].

Besides the conditions listed above,

For UE supporting *nr-NeedForGapNCSG-reporting-r17* and indicating *NeedForGapNCSG-InfoNR* for intra-frequency measurement,

- An intra-frequency SSB measurement is defined as measurement without gap if
  - the UE indicates 'nogap-noncsg' via *NeedForGapNCSG-InfoNR* for the intra-frequency measurement, and
  - the SSB is not completely contained in the active BWP of the UE, and
  - the active downlink BWP is not an initial BWP [3].
- An intra-frequency SSB measurement is defined as measurement with NCSG if
  - the UE indicates 'ncsg' via *NeedForGapNCSG-InfoNR* for the intra-frequency measurement, and
  - the SSB is not completely contained in the active BWP of the UE, and
  - the active downlink BWP is not an initial BWP [3]

- An intra-frequency SSB measurement is defined as measurement with gap if
  - the UE indicates 'gap' via *NeedForGapNCSG-InfoNR* for the intra-frequency measurement, and
  - the SSB is not completely contained in the active BWP of the UE, and
  - the active downlink BWP is not an initial BWP [3]

The UE can perform intra-frequency SSB based measurement corresponding to a deactivated SCell or dormant SCell with NCSG.

For intra-frequency SSB based measurements with NCSG, UE may cause scheduling restriction as specified in clause 9.2.7.3.

For UE supporting *nr-NeedForInterruptionReport-r18* and indicating *NeedForInterruptionInfoNR-r18* for intra-frequency measurement,

- an intra-frequency SSB measurement is defined as measurement without gap if
  - the UE indicates 'no-gap' via *intraFreq-needForGap* and the UE indicates '*no-gap-no-interruption*' or '*no-gap-with-interruption*' via *NeedForInterruptionInfoNR-r18* for the intra-frequency measurement, and- the SSB is not completely contained in the active BWP of the UE

- an intra-frequency SSB measurement is defined as measurement with gap if
  - the UE indicates 'gap' via *intraFreq-needForGap* for intra-frequency measurement.

For intra-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.2.5.3. SSB based measurements are configured along with one or two measurement timing configuration(s) (SMTC(s)) which provides periodicity, duration and offset information on a window of up to 5 ms where the measurements are to be performed. For intra-frequency connected mode measurements, up to two measurement window periodicities may be configured. A single measurement window offset and measurement duration are configured per intra-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB and measure RSSI of RSRQ which start earlier than the gap starting time + switching time, nor detect SSB and measure RSSI of RSRQ which end later than the gap end – switching time. Switching time is 0.5 ms for frequency range FR1 and 0.25 ms for frequency range FR2.

The requirements in this clause shall also apply, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

The measurement requirements defined for an activated SCell with a non-dormant active BWP defined in this clause shall also apply to an activated SCell with dormant BWP as active BWP.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

The measurement requirements defined in clause 9.2 do not apply if the UE is configured with *needForGapNCSG-ConfigNR-r17* and *needForInterruptionConfigNR-r18* at the same time.

Editor Note: FFS the scenario when deactivated SCell measurement object is fully overlapping with measurement gap

The intra-frequency measurement requirements in clause 9.2.5 applies for the following scenarios:

- SSB based intra-frequency measurements with no measurement gap,
  - for a UE supporting concurrent gaps and when concurrent gaps are configured:
    - When none of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent measurement gaps.
    - When part of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent measurement gaps.

- for a UE supporting MUSIM gaps or both concurrent measurement gaps and MUSIM gaps, and when periodic MUSIM gaps or both concurrent and periodic MUSIM gaps are configured:
  - When none of the SMTC occasions of this intra-frequency measurement object are overlapped by MUSIM gaps or the union of concurrent measurement gaps or the union of MUSIM gaps and concurrent measurement gaps.
  - When part of the SMTC occasions of this intra-frequency measurement object are overlapped by MUSIM gaps or the union of concurrent measurement gaps or the union of MUSIM gaps and concurrent measurement gaps.
- for a UE supporting MUSIM gaps and not supporting concurrent gaps or if concurrent gaps are not configured, and when periodic MUSIM gaps are configured:
  - When none of the SMTC occasions of this intra-frequency measurement object are overlapped by MUSIM gaps or the measurement gap or the union of MUSIM gaps and measurement gap.
  - When part of the SMTC occasions of this intra-frequency measurement object are overlapped by MUSIM gaps or the measurement gap or the union of MUSIM gaps and measurement gap.
- otherwise, for a UE not supporting concurrent gaps or if concurrent gaps are not configured:
  - When none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.
  - When part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.
- SSB based intra-frequency measurements object with no measurement gap for UE capable of *nr-NeedForInterruptionReport-r18*,
  - When UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement and indicates ‘*no-gap-with-interruption’* or ‘*no-gap-no-interruption’* via *NeedForInterruptionInfoNR-r18* for the intra-frequency measurement intra-frequency, and SMTC is fully non overlapping with GAP,
  - When UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement and indicates ‘*no-gap-no-interruption’* via *NeedForInterruptionInfoNR-r18* for the intra-frequency measurement, and SMTC is partially overlapping with GAP,
  - the UE is not allowed to cause interruption during intra-frequency measurement without gap when UE indicate ‘*no-gap-no-interruption’* via *NeedForInterruptionInfoNR-r18*
  - the UE is not allowed to cause interruption if the SSB is completely contained in the active BWP of the UE
  - the UE is allowed to cause interruption during intra-frequency measurement without gap when UE indicate ‘*no-gap-with-interruption’* via *NeedForInterruptionInfoNR-r18*, the interruption requirement is defined in clause 8.2.2.2.19.

The intra-frequency measurement requirements in clause 9.2.6 applies for the following scenarios:

- SSB based intra-frequency measurements with measurement gap,
- SSB based intra-frequency measurements with no measurement gap with the following condition,
  - for a UE supporting concurrent gaps and when concurrent gaps are configured:
    - when all of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap in the concurrent measurement gaps, or
    - when part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of concurrent measurement gaps.
  - for a UE supporting concurrent measurement gaps and when both concurrent and periodic MUSIM gaps are configured

- when part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap in concurrent measurement gaps and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of concurrent measurement gaps and MUSIM gaps. No requirement applies if no concurrent measurement gap is assocated with that SSB based intra-frequency measurements.

- otherwise, for a UE not supporting concurrent gaps or if concurrent gaps are not configured:

  - when all of the SMTC occasions of this intra-frequency measurement object are overlapped with the measurement gap.

  - when part of the SMTC occasions of this intra-frequency measurement object are overlapped with the measurement gap and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of the measurement gap and MUSIM gaps if MUSIM gaps are configured.

- SSB-based intra-frequency measurement object with NCSG, and measurement gap is configured.

- SSB based intra-frequency measurements object with no measurement gap for UE capable of *nr-NeedForInterruptionReport-r18*,

  - When UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement and indicates ‘*no-gap-with-interruption’* via *NeedForInterruptionInfoNR-r18* for the intra-frequency measurement, and SMTC is partially overlapping with GAP

  - When UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement and indicates ‘*no-gap-no-interruption’* or ‘*no-gap-with-interruption’* via *NeedForInterruptionInfoNR-r18* for the intra-frequency measurement, and SMTC is fully overlapping with GAP

The intra-frequency measurement requirements in clause 9.2.7 applies for the following scenarios:

- SSB based intra-frequency measurements without measurement gaps corresponding to an activated serving cell, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;

- SSB-based intra-frequency measurement object corresponding to an activated serving cell (in non-dormancy) when UE supports *nr-NeedForGapNCSG-reporting-r17* and indicates ‘ncsg’ in *NeedForGapNCSG-InfoNR* for intra-frequency measurement and all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG;

- SSB-based intra-frequency measurement object corresponding to a deactivated serving cell or to an activated serving cell in dormancy when all or part of the SMTC occasions of this intra-frequency measurement object are overlapped by the NCSG.

9.2.2 Requirements applicability

The requirements in clause 9.2 apply, provided:

- The cell being identified or measured is detectable.

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clauses 10.1.2 and 10.1.3 for FR1 and FR2, respectively, for a corresponding band,

- SS-RSRQ related side conditions given in clauses 10.1.7 and 10.1.8 for FR1 and FR2, respectively, for a corresponding band,

- SS-SINR related side conditions given in clauses 10.1.12 and 10.1.13 for FR1 and FR2, respectively, for a corresponding band,

- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding band.

9.2.3 Number of cells and number of SSB

9.2.3.1 Requirements for FR1

For each intra-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 8 identified cells, and
- 14 SSBs with different SSB index and/or PCI on the intra-frequency layer, where the number of SSBs in the serving cell (except for the SCell) is not smaller than the number of configured RLM-RS SSB resources.

9.2.3.2 Requirements for FR2

For UE supporting *CSSF enhancement for one serving CC measurement per-band*, if UE receives network indication via *enable one serving carrier measurement in a band* to enable one serving carrier measurement for an FR2 band,

For one single intra-frequency layer in a band, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 6 identified cells, and
- 24 SSBs with different SSB index and/or PCI,

where this single intra-frequency layer shall be:

- PCC, when UE is configured with SA NR or NE-DC operation mode with PCC in the band; or
- PSCC, when UE is configured with EN-DC with PSCC in the band; or
- PSCC, when UE is configured with NR-DC with PSCC in the band; or
- an SCC, if such SCC is the only one SCC on which UE is configured to report SSB based measurements when neither PCC nor PSCC is in the same band; or
- an SCC, indicated by network via *enable one serving carrier measurement in a band*, if such SCC is one of the SCCs on which UE is configured to report SSB based measurements when neither PCC nor PSCC is in the same band;
- otherwise
    - One of the SCCs on which UE is configured to report SSB based measurements when neither PCC nor PSCC is in the same band, so that the selected SCC shall be an SCC where the UE is configured with SS-RSRP measurement reporting if such SCC exists, otherwise one SCC determined by UE implementation.

UE is not required to perform SS-RSRP, SS-RSRQ, and SS-SINR measurements on both serving and neighbour cell for each of the other intra-frequency layer(s) in the same band.

For UE not supporting *CSSF enhancement for one serving CC measurement per-band*, or UE supporting *CSSF enhancement for one serving CC measurement per-band* but does not receive network indication via *enable one serving carrier measurement in a band* to enable one serving carrier measurement for each FR2 band,

For one single intra-frequency layer in a band, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 6 identified cells, and
- 24 SSBs with different SSB index and/or PCI,

where this single intra-frequency layer shall be:

- PCC when UE is configured with SA NR operation mode with PCC in the band; or
- PSCC when UE is configured with EN-DC with PSCC in the band; or

- PSCC when UE is configured with NR-DC with PSCC in the band; or
- One of the SCCs on which UE is configured to report SSB based measurements when neither PCC nor PSCC is in the same band, so that the selected SCC shall be an SCC where the UE is configured with SS-RSRP measurement reporting if such SCC exists, otherwise the selected SCC is determined by UE implementation.

The UE shall also be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least 2 SSBs on serving cell for each of the other intra-frequency layer(s) in the same band.

9.2.4 Measurement Reporting Requirements

9.2.4.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.2.1 (RSRP for FR1), 10.1.3.1 (RSRP for FR2), 10.1.7.1 (RSRQ for FR1), 10.1.8.1 (RSRQ for FR2), 10.1.12.1 (RS-SINR for FR1) and 10.1.13.1 (RS-SINR for FR2).

9.2.4.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.1.2.1 (RSRP for FR1), 10.1.3.1 (RSRP for FR2), 10.1.7.1 (RSRQ for FR1), 10.1.8.1 (RSRQ for FR2), 10.1.12.1 (RS-SINR for FR1) and 10.1.13.1 (RS-SINR for FR2).

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.2.4.3.

9.2.4.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.2.1 (RSRP for FR1), 10.1.3.1 (RSRP for FR2), 10.1.7.1 (RSRQ for FR1), 10.1.8.1 (RSRQ for FR2), 10.1.12.1 (RS-SINR for FR1) and 10.1.13.1 (RS-SINR for FR2).

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{identify_intra_with_index}$ or $T_{identify_intra_without_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2. When L3 filtering is used an additional delay can be expected. In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or an additional delay can be expected in both FR1 and FR2 if the UE is not capable of per-FR gap.

A cell is detectable only if at least one SSBs measured from the cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ as defined in clause 9.2.5.1 or clause 9.2.6.2. If a cell which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again with the same spatial reception parameter and triggers an event, the event triggered measurement reporting delay shall be less than $T_{SSB_measurement_period_intra}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu} T_c$ while the measurement gap has not been available and L3 filtering has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected. In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or an additional delay can be expected in both FR1 and FR2 if the UE is not capable of per-FR gap.

9.2.4.4 SCell activation Triggered Reporting

The requirements in this clause shall apply for the UE supporting *l3-MeasUnknownSCellActivation-r18* and reporting valid L3 measurement results after receiving the SCell activation command for unknown SCell.

Reported RSRP, RSRQ, and RS-SINR measurements contained in SCell activation triggered measurement reports shall meet the requirements in clauses 10.1.2.1 (RSRP for FR1), 10.1.3.1 (RSRP for FR2), 10.1.7.1 (RSRQ for FR1), 10.1.8.1 (RSRQ for FR2), 10.1.12.1 (RS-SINR for FR1) and 10.1.13.1 (RS-SINR for FR2).

The measurement reporting delay is defined as the time between the SCell activation command that will trigger a measurement report and the point when the UE starts to transmit the valid measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The SCell activation triggered measurement reporting delay shall be no larger than T_{HARQ} + 3 ms + 4 ms, where

- T_{HARQ} is the timing between DL data transmission and acknowledgement in ms as specified in TS 38.213 [3],
- 3 ms is the MAC CE decoding time.
- 4 ms is the processing time for preparing L3 report triggered by MAC CE.
- UE is expected to report the L3 results no earlier than 3 ms + T_{HARQ} after receiving the SCell activation command.

The SCell activation triggered report is considered as valid if it fulfils the measurement requirements for a deactivated SCell as specified in table 9.2.5.2-3 (for FR1) and table 9.2.5.2-4 (for FR2).

A cell is detectable only if at least one SSBs measured from the SCell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ as defined in clause 9.2.5.1. If a SCell which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ defined in clause 9.2.5.1 becomes undetectable for a period ≤ 5 seconds and then the SCell becomes detectable again with the same spatial reception parameter, this cell is considered as detected provided the timing to that cell has not changed more than $\pm 3200/2^{\mu} T_c$ while the measurement gap has not been available and L3 filtering has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3].

9.2.5 Intrafrequency measurements without measurement gaps

9.2.5.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index}$ if the UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise the UE shall be able to identify a new detectable intra frequency cell within $T_{identify_intra_with_index}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify_intra_without_index}$. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2 with SCS smaller or equal to 480 kHz.

$$T_{identify_intra_without_index} = (T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra} + T_{SSB_processing})\ ms$$

$$T_{identify_intra_with_index} = (T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra} + T_{SSB_time_index_intra})\ ms$$

Where:

T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection

- For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC ≤ 40ms, T_{PSS/SSS_sync_intra} is given in table 9.2.5.1-11; otherwise, T_{PSS/SSS_sync_intra} is given in table 9.2.5.1-2.
- For UE indicating *no-gap-no-interruption* via *NeedForInterruptionInfoNR-r18*, T_{PSS/SSS_sync_intra} is given in table 9.2.5.1-1 for FR1 and table 9.2.5.1-2 for FR2. For UE indicating *no-gap-with-interruption* via *NeedForInterruptionInfoNR-r18*, T_{PSS/SSS_sync_intra} is given in table 9.2.5.1-17 for FR1 and table 9.2.5.1-18 for FR2.
- Otherwise, T_{PSS/SSS_sync_intra} is given in tables 9.2.5.1-1, 9.2.5.1-2, 9.2.5.1-4 (CC with deactivated SCell) or 9.2.5.1-5 (CC with deactivated SCell) or 9.2.5.1-9 (CC with deactivated SCell) or 9.2.5.1-11 or 9.2.5.1-12 (CC with deactivated PSCell) or 9.2.5.1-13 (CC with deactivated PSCell).

$T_{SSB_time_index_intra}$: it is the time period used to acquire the index of the SSB being measured

- For UE indicating *no-gap-no-interruption* via *NeedForInterruptionInfoNR-r18*, $T_{SSB_time_index_intra}$ is given in table 9.2.5.1-3 for FR1 and table 9.2.5.1-15 for FR2-2. For UE indicating *no-gap-with-interruption* via *NeedForInterruptionInfoNR-r18*, $T_{SSB_time_index_intra}$ is given in table 9.2.5.1-19 for FR1.
- For UE indicating *support3MHz-ChannelBW-Symmetric-r18* and configured to perform measurements on a target cell or a deactivated SCell or a deactivated PSCell with 12PRB SSB in FR1, $T_{SSB_time_index_intra_less_than_5MHz}$ is given in table 9.2.5.1-23 (target cell), table 9.2.5.1-24 (deactivated SCell), table 9.2.5.1-24a (deactivated SCell with *highSpeedMeasCA-Scell-r17*) or in table 9.2.5.1-25 (deactivated PSCell).
- Otherwise, $T_{SSB_time_index_intra}$ is given in tables 9.2.5.1-3, 9.2.5.1-15 (FR2-2), 9.2.5.1-6 (CC with deactivated SCell), 9.2.5.1-10 (CC with deactivated SCell) or 9.2.5.1-14 (CC with deactivated PSCell).

$T_{SSB_measurement_period_intra}$: equal to a measurement period of SSB based measurement

- For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC ≤ 40ms, $T_{SSB_measurement_period_intra}$ is given in table 9.2.5.2-7; otherwise, $T_{SSB_measurement_period_intra}$ is given in table 9.2.5.2-2.
- For UE indicating *no-gap-no-interruption* via *NeedForInterruptionInfoNR-r18*, $T_{SSB_measurement_period_intra}$ is given in table 9.2.5.2-1 for FR1 and table 9.2.5.2-2 for FR2. For UE indicating *no-gap-with-interruption* via *NeedForInterruptionInfoNR-r18*, $T_{SSB_measurement_period_intra}$ is given in table 9.2.5.2-10 for FR1 and table table 9.2.5.2-11 for FR2.
- For power class 6 UE supporting *measEnhCAInterFreqFR2-r18* when *highSpeedMeasFlagFR2* is configured, the $T_{SSB_measurement_period_intra}$ given in table 9.2.5.2-7 (if SMTC ≤ 40ms) and table 9.2.5.2-2 (if SMTC > 40ms) shall apply for SCC.
- Otherwise, $T_{SSB_measurement_period_intra}$ is given in table 9.2.5.2-1, table 9.2.5.2-2, table 9.2.5.2-3 (CC with deactivated SCell), 9.2.5.2-4 (CC with deactivated SCell), 9.2.5.2-5 or 9.2.5.2-6 (CC with deactivated SCell), 9.2.5.2-8 (CC with deactivated PSCell) or 9.2.5.2-9 (CC with deactivated PSCell).

$T_{SSB_processing}$: it is the time period used to process multiple beams received in one SMTC. $T_{SSB_processing}$ = 2 ms for UE supporting *Rel-19 L3 fast Rx beam sweeping* when the conditions in clause 3.6.21 are fulfilled. Otherwise $T_{SSB_processing}$ = 0.

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined

- according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e.
  - when intra-frequency SMTC is fully non overlapping or partially overlapping with GAP, or
  - when intra-frequency SMTC is fully non overlapping with GAP for UE indicating *no-gap-with-interruption*, or

- when intra-frequency SMTC is fully non overlapping or partially overlapping with GAP for UE indicating *no-gap-no-interruption*, or

For a UE that supports Pre-MG, an SMTC occasion is only considered to be overlapped by Pre-MG if the Pre-MG is activated.

if the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

$M_{pss/sss_sync_w/o_gaps}$: For a UE supporting FR2-1 power class 1 or 5, $M_{pss/sss_sync_w/o_gaps}$ =40. For a UE supporting power class 2, $M_{pss/sss_sync_w/o_gaps}$ =24. For a UE supporting FR2-1 power class 3, $M_{pss/sss_sync_w/o_gaps}$ =24. For a UE supporting FR2-1 power class 4, $M_{pss/sss_sync_w/o_gaps}$ =24. For a UE supporting FR2-1 power class 6, $M_{pss/sss_sync_w/o_gaps}$ =24. For a UE supporting FR2-2 power class 1, $M_{pss/sss_sync_w/o_gaps}$ = 60. For a UE supporting FR2-2 power class 2, $M_{pss/sss_sync_w/o_gaps}$ = 36. For a UE supporting FR2-2 power class 3, $M_{pss/sss_sync_w/o_gaps}$ = 36.

$M_{meas_period_w/o_gaps}$: For a UE supporting FR2-1 power class 1 or 5, $M_{meas_period_w/o_gaps}$ =40. For a UE supporting FR2-1 power class 2, $M_{meas_period_w/o_gaps}$ =24. For a UE supporting FR2-1 power class 3, $M_{meas_period_w/o_gaps}$ =24. For a UE supporting power class 4, $M_{meas_period_w/o_gaps}$ =24. For a UE supporting power class 6, $M_{meas_period_w/o_gaps}$ =24. For a UE supporting FR2-2 power class 1, $M_{meas_period_w/o_gaps}$ = 60. For a UE supporting FR2-2 power class 2, $M_{meas_period_w/o_gaps}$ = 36. For a UE supporting FR2-2 power class 3, $M_{meas_period_w/o_gaps}$ = 36.

$M_{SSB_index_intra}$: For a UE supporting FR2-2 power class 1, $M_{SSB_index_intra}$ = 72 samples. For a UE supporting FR2-2 power class 2, $M_{SSB_index_intra}$ = 48 samples. For a UE supporting FR2 power class 3, $M_{SSB_index_intra}$ = 48 samples.

For a UE that supports *Rel-19 L3 fast Rx beam sweeping* , when the conditions in clause 3.6.21 are fulfilled and when *highSpeedMeasFlagFR2-r17* is not configured, the following values shall apply for $M_{pss/sss_sync_w/o_gaps}$ and $M_{meas_period_w/o_gaps}$:

$M_{pss/sss_sync_w/o_gaps}$: For a UE supporting FR2-1 power class 3, $M_{pss/sss_sync_w/o_gaps}$ =3* $N_{reduced_Rx_BSF}$.

$M_{meas_period_w/o_gaps}$: For a UE supporting FR2-1 power class 3, $M_{meas_period_w/o_gaps}$ =3* $N_{reduced_Rx_BSF}$.

Where,

$N_{reduced_Rx_BSF}$ is the reduced UE Rx beam sweeping factor reported by UE via *Rel-19 L3 fast Rx beam sweeping*.

When UE supports concurrent GAPs, i.e., supports the following capability or capabilities' combination:

- concurrentMeasGap-r17, or
- concurrentMeasGapsPreMG-r18, or
- concurrentMeasGapsNCSG-r18,

Or when UE supports *musim-GapPreference-r17* or both concurrent measurement GAPs and *musim-GapPreference-r17* and UE concurrent GAPs or periodic MUSIM gaps or both concurrent GAPs and periodic MUSIM gaps are configured to UE,

K_p is the scaling factor for an SSB frequency layer to be measured without GAP. $K_p = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

- For a window W of duration max(SMTC period, xRP_max, switching pattern periodicity), where xRP_max is the maximum xRP across all configured per-UE GAPs, periodic MUSIM gaps, and/or per-FR GAPs within the same FR as the SSB frequency layer, and starting from the beginning of any SMTC occasion:
  - N_{total} is the total number of SMTC occasions within the window, including those overlapped with GAP and MUSIM gap occasions and those overlapped and non-overlapped with the duration of serving CC to be measured based on the switching pattern within the window,

    For UEs supporting *LB CA via switching* and configured with low band CA via switching:

    - for the L3 measurement on PCell frequency layer, N_{total} also includes SMTC occasions that overlapped with the SCell ON duration within the window,

- for the L3 measurement on SCell frequency layer, N_{total} also includes SMTC occasions that overlapped with the PCell ON duration within the window, and

- $N_{available}$ is the number of SMTC occasions within the window W

  - that are not overlapped with any non-dropped GAP or non-dropped MUSIM gap occasions within the window W, after accounting for measurement GAP and MUSIM gap collisions by applying the collision rules for GAP and MUSIM gap in clauses 9.1.8.3, 9.1.10.4, 9.1.10.5, 9.1.12.3, and 9.1.13.3, respectively.

  - that are overlapped with PCell ON duration corresponding to the LB CA switching pattern, for the L3 measurement on PCell frequency layer for a UE supporting *LB CA via switching* and configured with low band CA via switching.

  - that are overlapped with SCell ON duration corresponding to the LB CA switching pattern, for the L3 measurement on SCell frequency layer for a UE supporting *LB CA via switching* and configured with low band CA via switching, and

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG, also xRP = MGRP for periodic MUSIM gap.

- for UEs that support LB CA via switching, switching pattern periodicity is the periodicity of the RRC configured semi-static switching pattern; otherwise, it is not applicable.

  Requirements in this clause do not apply when $N_{available}$ = 0 due to fully overlapping between SMTC occasions and MUSIM gap occasions within the window W.

  No requirements apply when $N_{available}$ = 0 due to fully non-overlapping between SMTC occasions and the duration of serving CC to be measured based on the switching pattern within the window W for a UE supporting *LB CA via switching* and configured with low band CA via switching.

When UE supports [*MUSIM-GapConfig-17]* and the SMTC occasion of the target frequency layer is overlapping with the configured aperiodic MUSIM gap, longer cell identification period for the target frequency layer is expected.

Otherwise, when the UE is not configured with or UE does not support concurrent GAPs and the UE is not configured with periodic MUSIM gaps or UE does not support MUSIM gaps:

When intra-frequency SMTC is fully non overlapping with measurement gaps or NCSG, or intra-frequency SMTC is fully overlapping with MGs or NCSG, Kp=1

When intra-frequency SMTC is partially overlapping with measurement gaps, K_p = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP. When intra-frequency SMTC is partially overlapping with NCSG, K_p = 1/(1- (SMTC period /VIRP)), where SMTC period < VIRP. For calculation of K_p, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1*. If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$

For FR2,

$K_{layer1_measurement}$=1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or

- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, where SSB symbols are indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same serving carrier which can be merged. and RSSI symbols are indicated by *SS-RSSI-Measurement*;

$K_{layer1_measurement}$=1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

If MCG DRX is in use, cell identification requirements for intra-frequency measurement in MCG specified in table 9.2.5.1-1, table 9.2.5.1-2, table 9.2.5.1-3, table 9.2.5.1-4, table 9.2.5.1-5 and table 9.2.5.1-6 shall depend on the MCG DRX cycle. If SCG DRX is in use, cell identification requirements for intra-frequency measurement in SCG specified in table 9.2.5.1-1, table 9.2.5.1-2, table 9.2.5.1-3, table 9.2.5.1-4, table 9.2.5.1-5, table 9.2.5.1-6, table 9.2.5.1-12, table 9.2.5.1-13 and table 9.2.5.1-14 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

- When the target SSB is completely contained in active BWP of UE or the active downlink BWP is initial BWP, the intra-frequency measurement shall be conducted without gap and without interruption regardless of the NeedForGaps' status reporting.

Table 9.2.5.1-1: Time period for PSS/SSS detection, (Frequency range FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(M2 [Note 2]x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms,otherwise M2=1.	
NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.	
NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1.	

Table 9.2.5.1-2: Time period for PSS/SSS detection, (Frequency range FR2)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, ceil($M_{pss/sss_sync_w/o_gaps}$ x K_{FR} x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x $M_{pss/sss_sync_w/o_gaps}$ x K_{FR} x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil($M_{pss/sss_sync_w/o_gaps}$ x K_{FR} x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: K_{FR} is a scaling factor depending on the frequency range and the SSB SCS. For FR2-1, KFR = 1. For FR2-2: K_{FR} = 1 if the SCS of the SSB of the cell being detected is 120 kHz, K_{FR} = 2 if the SCS of the SSB of the cell being detected is 480 kHz, and K_{FR} = 3 if the SCS of the SSB of the cell being detected is 960 kHz.	

Table 9.2.5.1-3: Time period for time index detection (FR1)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120 ms, ceil(3 x K_p) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil (M2 [Note 2] x 3 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(3 x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms,otherwise M2=1	
NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.	
NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1	

Table 9.2.5.1-4: Time period for PSS/SSS detection, CC with deactivated SCell (FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	Ceil(5 x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(5 x K_p) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(5 x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: The requirements also apply to CC with deactivated SCell in SCG. NOTE 2: The requirements also apply to CC with deactivated SDL SCell when UE supports *LB CA via switching*.	

Table 9.2.5.1-5: Time period for PSS/SSS detection, CC with deactivated SCell (FR2)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	Ceil($M_{pss/sss_sync_w/o_gaps}$ x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil($M_{pss/sss_sync_w/o_gaps}$ x K_p) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil($M_{pss/sss_sync_w/o_gaps}$ x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: The requirements also apply to CC with deactivated SCell in SCG.	

Table 9.2.5.1-6: Time period for time index detection, CC with deactivated SCell (FR1)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	Ceil(3 x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(3 x K_p) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(3 x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: The requirements also apply to CC with deactivated SCell in SCG. NOTE 2: The requirements also apply to CC with deactivated SDL SCell when UE supports *LB CA via switching*.	

Table 9.2.5.1-7: Void

Table 9.2.5.1-8: Void

Table 9.2.5.1-9: Time period for PSS/SSS detection, CC with deactivated SCell (FR1), when *highSpeedMeasCA-Scell-r17* is configured

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	Ceil(5 x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(5 x K_p) x max(measCycleSCell, M2 [Note 1]xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(5 x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1	

Table 9.2.5.1-10: Time period for time index detection, CC with deactivated SCell (FR1)，when *highSpeedMeasCA-Scell-r17* is configured

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	Ceil(3 x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(3 x K_p) x max(measCycleSCell, M2 [Note 1]xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(3 x K_p)x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1	

Table 9.2.5.1-11: Time period for PSS/SSS detection when *highSpeedMeasFlagFR2-r17* is configured, (FR2) when SMTC period ≤ 40ms

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, ceil($M1^{Note 2}$ x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 80 ms	max(600 ms, ceil($M1^{Note 2}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$

80 ms< DRX cycle≤ 320 ms	ceil(1.5 x $M_{pss/sss_sync_w/o_gaps}$ Note 3 x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle) x $CSSF_{intra}$
DRX cycle>320 ms	ceil($M_{pss/sss_sync_w/o_gaps}$ Note 3 x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: For UE supporting power class 6, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2	
NOTE 3: Void	

Table 9.2.5.1-12: Time period for PSS/SSS detection, CC with deactivated PSCell (FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	Ceil(5 x K_p) x measCyclePSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(5 x K_p) x max(measCyclePSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(5 x K_p) x max(measCyclePSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.5.1-13: Time period for PSS/SSS detection, CC with deactivated PSCell (FR2)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	Ceil($M_{pss/sss_sync_w/o_gaps}$ x K_p) x measCyclePSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil($M_{pss/sss_sync_w/o_gaps}$ x K_p) x max(measCyclePSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil($M_{pss/sss_sync_w/o_gaps}$ x K_p) x max(measCyclePSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.5.1-14: Time period for time index detection, CC with deactivated PSCell (FR1)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	Ceil(3 x K_p) x measCyclePSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(3 x K_p) x max(measCyclePSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(3 x K_p) x max(measCyclePSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.5.1-15: Time period for time index detection (Frequency range FR2-2)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(200 ms, ceil($M_{SSB_index_intra}$ x K_p x SMTC period) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5 x $M_{SSB_index_intra}$ x K_p) x max(SMTC period, DRX cycle) x $CSSF_{intra}$)
DRX cycle>320 ms	Ceil($M_{SSB_index_intra}$ x K_p)x DRX cycle x $CSSF_{intra}$

Table 9.2.5.1-16: Void

Table 9.2.5.1-17: Time period for PSS/SSS detection for UE indicating *no-gap-with-interruption*, (Frequency range FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, 5 x max (80 ms, SMTC period))Note 1 x $CSSF_{intra}$
[DRX cycle≤ 320 ms]	max(600 ms, ceil(M2 Note 2x 5) x [max(80 ms, SMTC period,DRX cycle)]) x $CSSF_{intra}$
[DRX cycle>320 ms]	5 x [DRX cycle x] $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1.	
NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.	
NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1.	
NOTE 5: Requirements only apply when measurement gap is not configured, or measurement gap is fully non-overlapped with SMTC on any carrier on which UE indicates *no-gap-with-interruption*.	

Table 9.2.5.1-18: Time period for PSS/SSS detection for UE indicating *no-gap-with-interruption*, (Frequency range FR2)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, ceil($M_{pss/sss_sync_w/o_gaps}$ x K_{FR} x $K_{layer1_measurement}$) x max (80 ms, SMTC period))$^{Note\ 1}$ x $CSSF_{intra}$
[DRX cycle≤ 320 ms]	max(600 ms, ceil(1.5 x $M_{pss/sss_sync_w/o_gaps}$ x K_{FR} x $K_{layer1_measurement}$) x [max(80 ms, SMTC period,DRX cycle)]) x $CSSF_{intra}$
[DRX cycle>320 ms]	[ceil($M_{pss/sss_sync_w/o_gaps}$ x K_{FR} x $K_{layer1_measurement}$) x DRX cycle] x $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified
NOTE 2: K_{FR} is a scaling factor depending on the frequency range and the SSB SCS. For FR2-1, KFR = 1.
NOTE 3: Requirements only apply when measurement gap is not configured, or measurement gap is fully non-overlapped with SMTC on any carrier on which UE indicates *no-gap-with-interruption*.

Table 9.2.5.1-19: Time period for time index detection for UE indicating *no-gap-with-interruption* (FR1)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120 ms, 3 x max (80 ms, SMTC period))$^{Note\ 1}$ x $CSSF_{intra}$
[DRX cycle≤ 320 ms]	max(120 ms, ceil (M2 $^{Note\ 2}$ x 3) x [max(80 ms, SMTC period,DRX cycle)]) x $CSSF_{intra}$
[DRX cycle>320 ms]	3 x DRX cycle x $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified
NOTE 2: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1
NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.
NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1
NOTE 5: Requirements only apply when measurement gap is not configured, or measurement gap is fully non-overlapped with SMTC on any carrier on which UE indicates *no-gap-with-interruption*.

Table 9.2.5.1-20: Void

Table 9.2.5.1-21: Void

Table 9.2.5.1-22: Void

Table 9.2.5.1-23: Time period for time index detection, cell with 12 PRB SSB (FR1)

DRX cycle	$T_{SSB_time_index_intra_less_than_5Mhz}$
No DRX	max(120ms, ceil(7 x Kp) x SMTC period) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120ms, ceil(M2 x 7 x Kp) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(7 x Kp) x DRX cycle x $CSSF_{intra}$

NOTE 1: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1.
NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.
NOTE 3: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1.

Table 9.2.5.1-24: Time period for time index detection for a UE operating on a target cell with 12PRB SSB, deactivated SCell (FR1)

DRX cycle	$T_{SSB_time_index_intra_less_than_5MHz}$
No DRX	Ceil(7 x K_p) x measCycleSCell x $CSSF_{intra}$

DRX cycle≤ 320ms	Ceil(7 x K_p) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320ms	Ceil(7 x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: The requirements also apply to deactivated SCG SCell.	

Table 9.2.5.1-24a: Time period for time index detection for a UE operating on a target cell with 12PRB SSB, deactivated SCell (FR1), when *highSpeedMeasCA-Scell-r17* is configured

DRX cycle	$T_{SSB_time_index_intra_less_than_5MHz}$
No DRX	Ceil(7 x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320ms	Ceil(7 x K_p) x max(measCycleSCell, M2 [Note 1]xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320ms	Ceil(7 x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1	

Table 9.2.5.1-25: Time period for time index detection for a UE operating on a target cell with 12PRB SSB, deactivated PSCell (FR1)

DRX cycle	$T_{SSB_time_index_intra_less_than_5MHz}$
No DRX	Ceil(7 x K_p) x measCyclePSCell x $CSSF_{intra}$
DRX cycle≤ 320ms	Ceil(7 x K_p) x max(measCyclePSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320ms	Ceil(7 x K_p) x max(measCyclePSCell, DRX cycle) x $CSSF_{intra}$

9.2.5.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2.5.2-1, 9.2.5.2-2, 9.2.5.2-3 (CC with deactivated SCell), 9.2.5.2-4 (CC with deactivated SCell), 9.2.5.2-8 (deactivated SCG applicable for PSCell) or 9.2.5.2-9 (deactivated SCG applicable for PSCell). When *highSpeedMeasFlag-r16* is configured, $T_{SSB_measurement_period_intra}$ is specified in table 9.2.5.2-5. When UE *highSpeedMeasFlagFR2-r17* is configured, if SMTC ≤ 40ms, $T_{SSB_measurement_period_intra}$ is given in table 9.2.5.2-7; otherwise, $T_{SSB_measurement_period_intra}$ is given in table 9.2.5.2-2. For power class 6 UE supporting *measEnhCAInterFreqFR2-r18* when *highSpeedMeasFlagFR2-r17* is configured, the $T_{SSB_measurement_period_intra}$ is given in table 9.2.5.2-7 (if SMTC ≤ 40ms) and table 9.2.5.2-2 (if SMTC > 40ms) shall apply for SCC.

If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and smtc1 is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{SSB_measurement_period_intra}$

For a UE that supports Pre-MG, an SMTC occasion is only considered to be overlapped by Pre-MG if the Pre-MG is activated.

If MCG DRX is in use, measurement period requirements for intra-frequency measurement in MCG specified in table 9.2.5.2-1, table 9.2.5.2-2, table 9.2.5.2-3 and table 9.2.5.2-4 shall depend on the MCG DRX cycle. If SCG DRX is in use, measurement period requirements for intra-frequency measurement in SCG specified in table 9.2.5.2-1, table 9.2.5.2-2, table 9.2.5.2-3, table 9.2.5.2-4, table 9.2.5.2-8 and table 9.2.5.2-9, shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

For FR2, a longer measurement period is allowed, if aperiodic CSI-RS resource is measured for L1-RSRP measurement on any FR2 serving frequency in the same band, and the CSI-RS resource is outside measurement gap and overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols. If *SSB-ToMeasure* or *SS-RSSI-Measurement* is configured, the SSB symbols are indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same band which can be merged and the RSSI symbols are indicated by *SS-RSSI-Measurement*.

Table 9.2.5.2-1: Measurement period for intra-frequency measurements without gaps (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2.5.2-2: Measurement period for intra-frequency measurements without gaps (FR2)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(400 ms, ceil($M_{meas_period_w/o_gaps}$ x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5x $M_{meas_period_w/o_gaps}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil($M_{meas_period_w/o_gaps}$ xK_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2.5.2-3: Measurement period for intra-frequency measurements without gaps (CC with deactivated SCell) (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	Ceil(5 x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(5 x K_p) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(5 x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: The requirements also apply to CC with deactivated SCell in SCG NOTE 2: The requirements also apply to CC with deactivated SDL SCell when UE supports *LB CA via switching*.	

Table 9.2.5.2-4: Measurement period for intra-frequency measurements without gaps (CC with deactivated SCell) (FR2)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	Ceil($M_{meas_period_w/o_gaps}$ x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil($M_{meas_period_w/o_gaps}$ x K_p) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil($M_{meas_period_w/o_gaps}$ x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: The requirements also apply to CC with deactivated SCell in SCG.	

Table 9.2.5.2-5: $T_{SSB_measurement_period_intra}$ When *highSpeedMeasFlag-r16* and/or highSpeedMeasCA-Scell-r17 is configured (Frequency range FR1

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX[Note 2]	max(200 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 160 ms	max(200 ms, ceil(5 x M2[Note 2] x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
160 ms < DRX cycle≤ 320 ms	ceil(4 x M2[Note 2] x K_p) x DRX cycle x $CSSF_{intra}$
DRX cycle>320 ms	ceil(Y[Note 3] x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: M2 = 1.5 if SMTC period > 40 ms, otherwise M2=1 NOTE 3: Y=3 when SMTC period ≤ 40ms, Y=5 when SMTC period > 40ms NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. NOTE 5: When highSpeedMeasCA-Scell-r17 is configured, the requirements apply to measurements of secondary component carrier with active SCell.	

Table 9.2.5.2-6: Measurement period for intra-frequency measurements without gaps (deactivated SCell) (FR1), when highSpeedMeasCA-Scell-r17 is configured

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	ceil(5 x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 160 ms	ceil(5 x K_p) x max(measCycleSCell, M2 [Note 1] x DRX cycle) x $CSSF_{intra}$
160 ms < DRX cycle≤ 320 ms	ceil(4 x K_p) x max(measCycleSCell, M2 [Note 1] x DRX cycle)
DRX cycle>320 ms	ceil(Y [Note 2] x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1 NOTE 2: Y=3 when SMTC <= 40 ms, Y=5 when SMTC > 40 ms	

Table 9.2.5.2-7: Measurement period for intra-frequency measurements without gaps when *highSpeedMeasFlagFR2-r17* is configured (FR2) when SMTC period <= 40 ms

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(400 ms, ceil(M1[Note 2] x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 80 ms	max(400 ms, ceil(M1[Note 2] x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
80 ms< DRX cycle≤ 320 ms	ceil(1.5 x $M_{meas_period_w/o_gaps}$ [Note 3] x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle) x $CSSF_{intra}$
DRX cycle>320 ms	ceil($M_{meas_period_w/o_gaps}$ [Note 3] xK_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: For UE supporting power class 6, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2	

Table 9.2.5.2-8 Measurement period for intra-frequency measurements without gaps (deactivated SCG applicable for PSCell) (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	Ceil(5 x K_p) x measCyclePSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(5 x K_p) x max(measCyclePSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(5 x K_p) x max(measCyclePSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.5.2-9: Measurement period for intra-frequency measurements without gaps (deactivated SCG applicable for PSCell) (FR2)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	Ceil($M_{meas_period_w/o_gaps}$ x K_p) x measCyclePSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil($M_{meas_period_w/o_gaps}$ x K_p) x max(measCyclePSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil($M_{meas_period_w/o_gaps}$ x K_p) x max(measCyclePSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.5.2-10: Measurement period for intra-frequency measurements without gaps for UE indicating *no-gap-with-interruption* (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, 5 x (80 ms, SMTC period))[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5) x [max(80 ms, SMTC period,DRX cycle)]) x $CSSF_{intra}$
DRX cycle>320 ms	5 x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: Requirements only apply when measurement gap is not configured, or measurement gap is fully non-overlapped with SMTC on any carrier on which UE indicates '*no-gap-with-interruption*' via *NeedForInterruptionInfoNR-r18*.	

Table 9.2.5.2-11: Measurement period for intra-frequency measurements without gaps for UE indicating *no-gap-with-interruption* (FR2)

DRX cycle	$T_{SSB_measurement_period_intra}$

No DRX	max(400 ms, ceil($M_{meas_period_w/o_gaps}$ x $K_{layer1_measurement}$) x (80 ms, SMTC period))$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5x $M_{meas_period_w/o_gaps}$ x $K_{layer1_measurement}$) x [max(80, SMTC period,DRX cycle)]) x $CSSF_{intra}$
DRX cycle>320 ms	ceil($M_{meas_period_w/o_gaps}$ x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: Requirements only apply when measurement gap is not configured, or measurement gap is fully non-overlapped with SMTC on any carrier on which UE indicates *no-gap-with-interruption* via *NeedForInterruptionInfoNR-r18*.	

Table 9.2.5.2-12: $T_{SSB_measurement_period_intra}$ When *highSpeedMeasFlag-r16* and/or *highSpeedMeasCA-Scell-r17* is configured (FR1, UE indicating *no-gap-with-interruption*

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX $^{Note\ 2}$	max(200 ms, 5 x max(80 ms,SMTC period))$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 160 ms	max(200 ms, ceil(5 x M2 $^{Note\ 2}$) x [max(80 ms, SMTC period,DRX cycle)]) x $CSSF_{intra}$
160 ms < DRX cycle≤ 320 ms	ceil(4 x M2 $^{Note\ 2}$) x DRX cycle x $CSSF_{intra}$
DRX cycle>320 ms	ceil(Y $^{Note\ 3}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: M2 = 1.5 if SMTC period > 40 ms, otherwise M2=1 NOTE 3: Y=3 when SMTC period <= 40 ms, Y=5 when SMTC period > 40 ms NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. NOTE 5: When *highSpeedMeasCA-Scell-r17* is configured, the requirements apply to measurements of secondary component carrier with active SCell. NOTE 6: Requirements only apply when measurement gap is not configured, or measurement gap is fully non-overlapped with SMTC on any carrier on which UE indicates [no gap with interruption].	

Table 9.2.5.2-13: Void

9.2.5.3 Scheduling availability of UE during intra-frequency measurements

UE shall be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE, or the UE indicates *no-gap-no-interruption* for intra-frequency measurement, or the UE indicates *no-gap-with-interruption* for intra-frequency measurement. For UE configured with measurement gap cancellation according to clause 9.1.14 provided that the configuration and conditions in clause 9.1.14.3 are met, the UE is not required to perform measurement during the cancelled gap occasions, and no restrictions on the scheduling availability at the cancelled gap occasions. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of SSB-ToMeasure from all the configured measurement objects on the same serving carrier which can be merged [2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

For a UE that supports Pre-MG, the requirements in clause 9.2.5.3 also apply when a Pre-MG is deactivated.

For UE supporting concurrent measurement gaps, when concurrent gaps are configured, the requirements in clause 9.2.5.3 are also applied to the slots that are not interrupted according to requirements in clause 9.1.8.3.

[For UE supporting MUSIM gaps, when MUSIM gaps are configured, the requirements in clause 9.2.5.3 are also applied to the slots that are not interrupted according to requirements in clauses 9.1.10.5 and 9.1.10.6.]

9.2.5.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

For UE indicating *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 4"*

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 1"*

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2>else

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When TDD inter-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this band pair.

When inter-band FR1+FR1 NR-DC is performed, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this band pair.

9.2.5.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which does not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If *deriveSSB_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer signalling of *smtc2* is configured(in TS 38.331 [2]), the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If *deriveSSB_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

If the following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots

The UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and/or the corresponding PDSCH, on SSB symbols to be measured.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

For UE indicating *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 4"*

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 1"*

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2>else

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.2.5.3.3 Scheduling availability of UE performing measurements on FR2

The following scheduling restriction applies due to SS-RSRP or SS-SINR measurement on an FR2 intra-frequency cell

- If *deriveSSB-IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on K data symbol(s) before each consecutive SSB symbols to be measured and K data symbol(s) after each consecutive SSB symbols to be measured within SMTC window duration.

- If *deriveSSB-IndexFromCell* is not enabled and the SCS of data and SSB symbols are smaller than 960 kHz, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

- If *deriveSSB-IndexFromCell* is not enabled and the SCS of data or SSB symbols is 960 kHz, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI SSB symbols to be measured, and on K' data symbol(s) before each consecutive SSB symbols to be measured and K' data symbol(s) after each consecutive SSB symbols to be measured within SMTC window duration.

The following scheduling restriction applies to SS-RSRQ measurement on an FR2 intra-frequency cell

- If *deriveSSB-IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on K data symbol(s) before each consecutive SSB to be measured/RSSI symbols and K data symbol(s) after each consecutive SSB to be measured/RSSI symbols within SMTC window duration

- If *deriveSSB-IndexFromCell* is not enabled and the SCS of data and SSB symbols are smaller than 960 kHz, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

- If *deriveSSB-IndexFromCell* is not enabled and the SCS of SSB symbols is 960 kHz, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on K' data symbol(s) before each consecutive SSB to be measured/RSSI symbols and K' data symbol(s) after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

where

- If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- The signaling *deriveSSB-IndexFromCell* is always enabled for FR2-1 and FR2-2 when SSB is using 120 kHz SCS and 480 kHz SCS.

- K=1 for a serving cell with data symbols of 120 kHz SCS

- K=4 for a serving cell with data symbols of 480 kHz SCS and SSB symbols of 120 kHz or 480 kHz SCS

- K=3 for a serving cell with data symbols of 480 kHz SCS and SSB symbols of 960 kHz SCS

- K=7 for a serving cell with data symbols of 960 kHz SCS and SSB symbols of 120 kHz or 480 kHz SCS

- K=4 for a serving cell with data symbols of 960 kHz SCS and SSB symbols of 960 kHz SCS

- K'=2 for a serving cell with data symbols of 120 kHz SCS and SSB symbols of 960 kHz SCS

- K'=4 for a serving cell with data symbols of 480 kHz SCS and SSB symbols of 960 kHz SCS

- K'=7 for a serving cell with data symbols of 960 kHz SCS and SSB symbols of 960 kHz SCS

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to SS-RSRP, SS-RSRQ or SS-SINR measurement on an FR2 intra-frequency cell in different bands, provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

NOTE: When inter-band carrier aggregation in FR2 is performed, the scheduling restrictions as defined in clause 9.2.5.3.1 due to a given serving cell also apply to another serving cell in a different FR2 band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this FR2 band pair.

If following conditions are met:

- The UE has been notified about system information update through paging,
- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE shall receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

9.2.5.3.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 serving cell frequency layer. However, the scheduling restrictions as defined in clause 9.2.5.3.1 due to a given serving cell in FR2 also apply to another serving cell in an FR1 band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this FR1-FR2 band pair.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 serving cell frequency layer. However, the scheduling restrictions as defined in clause 9.2.5.3.1 due to a given serving cell in FR1 also apply to another serving cell in an FR2 band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this FR1-FR2 band pair.

9.2.5.4 SFTD Measurements between PCell and PSCell

9.2.5.4.1 Introduction

This clause contains SFTD measurement requirements for UE which supports NR-DC and is configured with a PSCell in RRC_CONNECTED state. The UE shall perform SFTD measurement between PCell and PSCell, and report the SFTD result with/without SS-RSRP after the network requests with *reportType* for the associated *reportConfig* set to *reportSFTD*. The overall delay includes RRC procedure delay defined in clause 12 in TS 38.331 [2], and SFTD measurement delay in clause 9.2.5.4.2.

9.2.5.4.2 SFTD Measurement delay

When no DRX is used in either of PCell and PSCell, the physical layer measurement period of the SFTD measurement shall be $T_{measure_SFTD1}$ = max(200, 5 x SMTC period) ms, where the SMTC period refers to the maximum between the configured SMTC period in PCell and PSCell.

When DRX is used in either of the PCell or the PSCell, or in both PCell and PSCell, the physical layer measurement period ($T_{measure_SFTD1}$) of the SFTD measurement shall be as specified in table 9.2.5.4.2-1.

Table 9.2.5.4.2-1: SFTD measurement requirement when DRX is used

DRX cycle length (s) Note 3	$T_{measure_SFTD1}$ (s)
≤0.04	max(0.2, 5 x SMTC period) (Note 2)
0.04<DRX cycle≤0.32	8 x max(DRX cycle, SMTC period)
0.32<DRX cycle≤10.24	5 x DRX cycle
NOTE 1: SMTC period in this table refers to the maximum between the configured SMTC period in PCell and PSCell. NOTE 2: Void NOTE 3: DRX cycle length in this table refers to the DRX cycle length configured for PCell or PSCell. When DRX is used in both PCell and PSCell, DRX cycle length in this table refers to the longer of the DRX cycle lengths for PCell and PSCell.	

If PSCell is changed without changing carrier frequency of PSCell, while the UE is performing SFTD measurements, the UE shall still meet SFTD measurement and accuracy requirements for the new PSCell. In this case the UE shall restart the SFTD measurement, and the total physical layer measurement period shall not exceed $T_{measure_SFTD2}$ as defined by the following expression:

$$T_{measure_SFTD2} = (M+1)*(T_{measure_SFTD1}) + M*T_{PSCell_change_NRDC}$$

where:

M is the number of times the NR PSCell is changed over the measurement period ($T_{measure_SFTD2}$), and

$T_{PSCell_change_NRDC}$ is the time necessary to change the PSCell; it can be up to 25 ms.

If PCell is changed, or if PSCell is changed with different carrier frequency from previous PSCell, the UE shall terminate SFTD measurements.

The measurement accuracy for the SFTD measurement when DRX is used as well as when no DRX is used shall be as specified in the clause 10.1.21.

9.2.5.4.3 SFTD Measurement Reporting Delay

The SFTD measurement reporting delay is defined as the time between a command that will trigger an SFTD measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes any delay caused by no UL resources available for UE to send the measurement report.

The SFTD measurement reporting delay shall be less than measurement period defined in clause 9.2.5.4.2 plus the RRC procedure delay defined in clause 12 in TS 38.331 [2].

9.2.6 Intra-frequency measurements with measurement gaps

9.2.6.1 Void

9.2.6.2 Intra-frequency cell identification

When a measurement gap is provided or an activated Pre-MG is provided without any pre-MG status changed during the measurement period, the UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_with_index.}$ The UE shall be able to identify a new detectable intra-frequency SS block of an already detected cell within $T_{identify_intra_without_index.}$ It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2 with SCS smaller or equal to 480 kHz.

$$T_{identify_intra_without_index} = T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra} + T_{SSB_processing}\ \text{ms}$$

$$T_{identify_intra_with_index} = T_{PSS/SSS_sync_ntra} + T_{SSB_measurement_period_intra} + T_{SSB_time_index_intra}\ ms$$

Where:

T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in tables 9.2.6.2-1, 9.2.6.2-2 or 9.2.6.2-9.

- For UEs supporting *Rel-19 L3 fast Rx beam sweeping*, when the conditions in clause 3.6.21 are fulfilled, $T_{SSB_processing}$ = 2 ms; otherwise, $T_{SSB_processing}$ = 0.
- For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC ≤ 40ms, T_{PSS/SSS_sync_intra} is given in table 9.2.6.2-9; otherwise, T_{PSS/SSS_sync_intra} is given in table 9.2.6.2-2.
- For UE configured with measurement gap cancellation according to clause 9.1.14 provided that the configuration and conditions in clause 9.1.14.3 are met, the T_{PSS/SSS_sync_intra} is given in table 9.2.6.2-13, 9.2.6.2-14, for FR1 and FR2-1 respectively.

$T_{SSB_time_index_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2.6.2-3 or 9.2.6.2-10 (for FR2-2).

- For UE configured with measurement gap cancellation according to clause 9.1.14 provided that the configuration and conditions in clause 9.1.14.3 are met, the $T_{SSB_time_index_intra}$ is given in table 9.2.6.2-15 for FR1.
- For UE indicating *support3MHz-ChannelBW-Symmetric-r18* and configured to operate on a target cell with 12 PRB SSB in FR1, $T_{SSB_time_index_intra_less_than_5Mhz}$ is given in table 9.2.6.2-12.

$T_{SSB_measurement_period_intra}$: equal to a measurement period of SSB based measurement given in table 9.2.6.3-1 or 9.2.6.3-2.

- For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC ≤ 40ms, $T_{SSB_measurement_period_intra}$ is given in table 9.2.6.3-4; otherwise, $T_{SSB_measurement_period_intra}$ is given in table 9.2.6.3-2.
- For power class 6 UE supporting *measEnhCAInterFreqFR2-r18* when *highSpeedMeasFlagFR2-r17* is configured, the $T_{SSB_measurement_period_intra}$ given in table 9.2.6.3-4 (if SMTC ≤ 40ms) and table 9.2.6.3-2 (if SMTC > 40ms) shall apply for SCC.
- For UE configured with measurement gap cancellation according to clause 9.1.14 provided that the configuration and conditions in clause 9.1.14.3 are met, the $T_{SSB_measurement_period_intra}$ is given in table 9.2.6.3-5, 9.2.6.3-6, for FR1 and FR2-1 respectively.

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

K_{gap} is the scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. K_{gap} = 1 when the UE is not configured with or the UE does not support concurrent GAPs or MUSIM gaps. Otherwise, $K_{gap} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

For a window W of duration max(SMTC period, xRP_max), where xRP_max is the maximum xRP across all configured per-UE GAPs, periodic MUSIM gaps and per-FR GAPs within the same FR as the SSB frequency layer, and starting from the beginning of any SMTC occasion:

- N_{total} is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other GAP and MUSIM gap occasions within the window, and

  $N_{available}$ is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W after accounting for GAP and MUSIM gap collisions by applying the collision rules for GAP and MUSIM gap in clauses 9.1.8.3, 9.1.10.4, 9.1.10.5, 9.1.12.3, and 9.1.13.3, respectively.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG, also xRP = MGRP for periodic MUSIM gap.

When concurrent GAPs are configured, requirements in this clause do not apply if $N_{available}$ =0.

When UE supports [*MUSIM-GapConfig-17*] and the configured aperiodic MUSIM gap collides with the measurement gap associated with the target frequency layer, where MUSIM gap collision rule in clause 9.1.10.4 is applied, longer cell identification period for the target intra-frequency is expected.

$M_{pss/sss_sync_with_gaps}$: For a UE supporting FR2-1 power class 1 or 5, $M_{pss/sss_sync\ with_gaps}$=40. For a UE supporting FR2-1 power class 2, $M_{pss/sss_sync\ with_gaps}$ =24. For a UE supporting FR2-1 power class 3, $M_{pss/sss_sync\ with_gaps}$ =24. For a UE supporting FR2-1 power class 4, $M_{pss/sss_sync\ with_gaps}$ =24. For a UE supporting FR2-1 power class 6, $M_{pss/sss_sync\ with_gaps}$ =24. For a UE supporting FR2-2 power class 1, $M_{pss/sss_sync\ with_gaps}$ = 60. For a UE supporting FR2-2 power class 2, $M_{pss/sss_sync\ with_gaps}$ = 36. For a UE supporting FR2-2 power class 3, $M_{pss/sss_sync\ with_gaps}$ = 36.

$M_{meas_period_with_gaps}$: For a UE supporting FR2-1 power class 1 or 5, $M_{meas_period_with_gaps}$ =40. For a UE supporting FR2-1 power class 2, $M_{meas_period_with_gaps}$ =24. For a UE supporting FR2-1 power class 3, $M_{meas_period_with_gaps}$ =24. For a UE supporting FR2-1 power class 4, $M_{meas_period\ with_gaps}$ =24. For a UE supporting FR2-1 power class 6, $M_{meas_period\ with_gaps}$ =24. For a UE supporting FR2-2 power class 1, $M_{meas_period_with_gaps}$ = 60. For a UE supporting FR2-2 power class 2, $M_{meas_period_with_gaps}$ = 36. For a UE supporting FR2-2 power class 3, $M_{meas_period_with_gaps}$ = 36.

- $M_{SSB_index_intra}$: For a UE supporting FR2-2 power class 1, $M_{SSB_index_intra}$ = 72. For a UE supporting FR2-2 power class 2, $M_{SSB_index_intra}$ = 48. For a UE supporting FR2 power class 3, $M_{SSB_index_intra}$ = 48.

  For a UE that supports *Rel-19 L3 fast Rx beam sweeping* when the conditions in clause 3.6.21 are fulfilled and when *highSpeedMeasFlagFR2-r17* is not configured, the following values shall apply for $M_{pss/sss_sync_with_gaps}$ and $M_{meas_period_with_gaps}$:

  $M_{pss/sss_sync_with_gaps}$: For a UE supporting FR2-1 power class 3, $M_{pss/sss_sync_with_gaps}$ =3* $N_{reduced_Rx_BSF}$.

  $M_{meas_period_with_gaps}$: For a UE supporting FR2-1 power class 3, $M_{meas_period_with_gaps}$ =3* $N_{reduced_Rx_BSF}$.

  Where,

  $N_{reduced_Rx_BSF}$ is the reduced UE Rx beam sweeping factor reported by UE via *Rel-19 L3 fast Rx beam sweeping* .

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$.

If MCG DRX is in use, cell identification requirements for intra-frequency measurement in MCG specified in table 9.2.6.2-1, table 9.2.6.2-2, and table 9.2.6.2-3 shall depend on the MCG DRX cycle. If SCG DRX is in use, cell identification requirements for intra-frequency measurement in SCG specified in table 9.2.6.2-1, table 9.2.6.2-2, and table 9.2.6.2-3 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 9.2.6.2-1: Time period for PSS/SSS detection (FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, 5 x K_{gap} x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil($M2^{Note\ 1}$x 5 x K_{gap}) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(5 x K_{gap}) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.	
NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.	
NOTE 3: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the activated Pre-MG or the MG pattern associated to the intra-frequency layer.	
NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured, the requirements apply to UE on measurements of secondary component carrier with active SCell.	

Table 9.2.6.2-2: Time period for PSS/SSS detection (FR2)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, $M_{pss/sss_sync_with_gaps}$ x K_{FR} x K_{gap} x max(MGRP, SMTC period)) x $CSSF_{intra}$

DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x $M_{pss/sss_sync_with_gaps}$ x K_{FR} x K_{gap}) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil($M_{pss/sss_sync_with_gaps}$ x K_{FR} x K_{gap}) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the activated Pre-MG or the MG pattern associated to the intra-frequency layer.	
NOTE 2: K_{FR} is a scaling factor depending on the frequency range and the SSB SCS. For FR2-1, K_{FR} = 1. For FR2-2: K_{FR} = 1 if the SCS of the SSB of the cell being detected is 120 kHz, K_{FR} = 2 if the SCS of the SSB of the cell being detected is 480 kHz, and K_{FR} = 3 if the SCS of the SSB of the cell being detected is 960 kHz.	

Table 9.2.6.2-3: Time period for time index detection (FR1)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120 ms, ceil(3 x K_{gap}) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil($M2^{Note\ 1}$x 3 x K_{gap}) x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320 ms	Ceil(3 x K_{gap})x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.	
NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.	
NOTE 3: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the activated Pre-MG or the MG pattern associated to the intra-frequency layer.	
NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured, the requirements apply to UE on measurements of secondary component carrier with active SCell.	

Table 9.2.6.2-7: Void

Table 9.2.6.2-8: Void

Table 9.2.6.2-8: Void

Table 9.2.6.2-9: Time period for PSS/SSS detection when *highSpeedMeasFlagFR2-r17* is configured, (FR2) when SMTC period ≤ 40ms

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, $M1^{Note\ 2}$ x K_{gap} x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 80 ms	max(600 ms, ceil($M1^{Note2}$ x K_{gap}) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{intra}$
80 ms< DRX cycle≤ 320 ms	max(600 ms, ceil($M_{pss/sss_sync_with_gaps}$ x K_{gap}) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil($M_{pss/sss_sync_with_gaps}$ x K_{gap}) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the activated Pre-MG or the MG pattern associated to the intra-frequency layer.	
NOTE 2: For UE supporting power class 6, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2	
NOTE 3: Void	

Table 9.2.6.2-10: Time period for time index detection (FR2-2)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(200 ms, ceil($M_{SSB_index_intra}$ x K_{gap} x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5 x $M_{SSB_index_intra}$ x K_{gap}) x max(MGRP, SMTC period, DRX cycle) x $CSSF_{intra}$)
DRX cycle>320 ms	Ceil($M_{SSB_index_intra}$ x K_{gap})x DRX cycle x $CSSF_{intra}$

Table 9.2.6.2-11: Void

Table 9.2.6.2-12: Time period for time index detection, cell with 12 PRB SSB (FR1)

DRX cycle	$T_{SSB_time_index_intra_less_than_5Mhz}$
No DRX	max(120 ms, 7 x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120ms, ceil(M2 x 7) x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320 ms	7 x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: Void NOTE 2: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16*. NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured, the requirements apply to UE on measurements of secondary component carrier with active SCell.	

Table 9.2.6.2-13: Time period for PSS/SSS detection (FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, ceil((5+L_{cancel}) x K_{gap}) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x (5+L_{cancel}) x K_{gap}) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil((5+L_{cancel}) x K_{gap}) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the activated Pre-MG or the MG pattern associated to the intra-frequency layer. NOTE 2: L_{cancel} is the number of cancelled gap occasions overlapping with SMTC in the measurement period.	

Table 9.2.6.2-14: Time period for PSS/SSS detection (FR2-1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, ceil(($M_{pss/sss_sync_with_gaps}$+ L_{cancel}) x K_{gap}) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x ($M_{pss/sss_sync_with_gaps}$+ L_{cancel}) x K_{gap}) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(($M_{pss/sss_sync_with_gaps}$ + L_{cancel}) x K_{gap}) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the activated Pre-MG or the MG pattern associated to the intra-frequency layer. NOTE 2: L_{cancel} is the number of cancelled gap occasions overlapping with SMTC in the measurement period.	

Table 9.2.6.2-15: Time period for time index detection (FR1)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120 ms, ceil((3+L_{cancel}) x K_{gap}) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil(1.5 x (3+L_{cancel}) x K_{gap}) x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320 ms	Ceil(3+L_{cancel}) x K_{gap} x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer. NOTE 2: L_{cancel} is the number of cancelled gap occasions overlapping with SMTC in the measurement period.	

9.2.6.3 Intra-frequency Measurement Period

The requirements in this clause apply when a measurement gap is provided or when an activated Pre-MG is provided without any pre-MG status changed during the measurement period.

The measurement period for FR1 intra-frequency measurements with gaps is as shown in table 9.2.6.3-1.

The measurement period for FR2 intra-frequency measurements with gaps is as shown in table 9.2.6.3-2.

When *highSpeedMeasFlag-r16* is configured, $T_{SSB_measurement_period_intra}$ is specified in table 9.2.6.3-3.

For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC $\leq$ 40ms, $T_{SSB_measurement_period_intra}$ is given in table 9.2.6.3-4; otherwise, $T_{SSB_measurement_period_intra}$ is given in table 9.2.6.3-2.

For power class 6 UE supporting *measEnhCAInterFreqFR2-r18* when *highSpeedMeasFlagFR2-r17* is configured, the $T_{SSB_measurement_period_intra}$ is given in table 9.2.6.3-4 (if SMTC ≤ 40ms) and table 9.2.6.3-2 (if SMTC > 40ms) shall apply for SCC.

If MCG DRX is in use, measurement period requirements for intra-frequency measurement in MCG specified in table 9.2.6.3-1 and table 9.2.6.3-2, shall depend on the MCG DRX cycle. If SCG DRX is in use, measurement period requirements for intra-frequency measurement in SCG specified in table 9.2.6.3-1and table 9.2.6.3-2, shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

For either an FR1 or FR2 serving cell, longer measurement period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For UE configured with measurement gap cancellation according to clause 9.1.14 meeting the conditions in clause 9.1.14.3, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.2, 10.1.3, 10.1.7, 10.1.8, 10.1.12 and 10.1.13 for FR1 and FR2-1, respectively, while meeting the measurement period requirements for FR1 and FR2-1 specified in tables 9.2.6.3-5 and 9.2.6.3-6, respectively.

Table 9.2.6.3-1: Measurement period for intra-frequency measurements with gaps (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, ceil(5 x K_{gap})x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x K_{gap}) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(5 x K_{gap}) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the activated Pre-MG or the MG pattern associated to the intra-frequency layer.	

Table 9.2.6.3-2: Measurement period for intra-frequency measurements with gaps (FR2)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(400 ms, ceil($M_{meas_period\ with_gaps}$ x K_{gap}) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5 x $M_{meas_period\ with_gaps}$ x K_{gap}) x max(MGRP, SMTC period, DRX cycle)) [Note 1] x $CSSF_{intra}$
DRX cycle>320 ms	Ceil($M_{meas_period\ with_gaps}$ x K_{gap}) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the activated Pre-MG or the MG pattern associated to the intra-frequency layer.	

Table 9.2.6.3-3: Measurement period When *highSpeedMeasFlag-r16* is configured (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, ceil(5 x K_{gap}) x max(MGRP, SMTC period)) [Note 1] x $CSSF_{intra}$
DRX cycle≤ 160 ms	max(200 ms, ceil(M2[Note 2] x 5 x K_{gap}) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
160 ms < DRX cycle≤ 320 ms	max(200 ms, ceil(M2[Note 2] x 4 x K_{gap}) x max(MGRP, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(Y [Note 3] x K_{gap}) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1	
NOTE 3: Y=3 when SMTC <= 40 ms, Y=5 when SMTC > 40 ms	
NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.	
NOTE 5: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the activated Pre-MG or the MG pattern associated to the intra-frequency layer.	
NOTE 6: When *highSpeedMeasCA-Scell-r17* is configured, the requirements also apply to UE on measurements of secondary component carrier with active SCell.	

Table 9.2.6.3-4: Measurement period for intra-frequency measurements with gaps when *highSpeedMeasFlagFR2-r17* is configured (FR2-1) when SMTC period≤40ms

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(400 ms, ceil($M1^{Note\ 2}$ x K_{gap}) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 80 ms	max(400 ms, ceil($M1^{Note\ 2}$ x K_{gap}) x max(MGRP, SMTC period, DRX cycle)) $^{Note\ 1}$ x $CSSF_{intra}$
80 ms< DRX cycle≤ 320 ms	max(400 ms, ceil($M_{meas_period\ with_gaps}$ x K_{gap}) x max(MGRP, SMTC period, DRX cycle)) $^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle>320 ms	Ceil($M_{meas_period\ with_gaps}$ x K_{gap}) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the activated Pre-MG or the MG pattern associated to the intra-frequency layer. NOTE 2: For UE supporting power class 6, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2 NOTE 3: Void	

Table 9.2.6.3-5: Measurement period for intra-frequency measurements with gaps (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, ceil((5+L_{cancel}) x K_{gap}) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x (5+L_{cancel}) x K_{gap}) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(5+L_{cancel}) x K_{gap} x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the activated Pre-MG or the MG pattern associated to the intra-frequency layer. NOTE 2: L_{cancel} is the number of cancelled gap occasions overlapping with SMTC in the measurement period.	

Table 9.2.6.3-6: Measurement period for intra-frequency measurements with gaps (FR2-1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(400 ms, ceil(($M_{meas_period\ with_gaps}$+$L_{cancel}$) x K_{gap}) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(400 ms, ceil((1.5 x ($M_{meas_period\ with_gaps}$+$L_{cancel}$) x K_{gap}) x max(MGRP, SMTC period, DRX cycle)) $^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(($M_{meas_period\ with_gaps}$+$L_{cancel}$) x K_{gap}) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the intra-frequency layer. NOTE 2: L_{cancel} is the number of cancelled gap occasions overlapping with SMTC in the measurement period.	

9.2.7 Intra-frequency measurements with NCSG

9.2.7.1 Intra-frequency cell identification

For the UE supporting NCSG, if NCSG is provided, the UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise, UE shall be able to identify a new detectable intra frequency cell within $T_{identify_intra_with_index.}$ The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify_intra_without_index.}$ It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

$$T_{identify_intra_without_index} = (T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra} + T_{SSB_processing})\ ms$$

$$T_{identify_intra_with_index} = (T_{PSS/SSS_sync_ntra} + T_{SSB_measurement_period_intra} + T_{SSB_time_index_intra})\ ms$$

Where:

T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in table 9.2.7.1-1, 9.2.7.1-2, 9.2.7.1-4 (deactivated Scell) or 9.2.7.1-5 (deactivated SCell).

$T_{SSB_time_index_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2.7.1-3 or 9.2.7.1-6 (deactivated SCell).

$T_{SSB_measurement_period_intra}$: equal to a measurement period of SSB based measurement given in table 9.2.7.2-1, 9.2.7.2-2, 9.2.7.2-3, 9.2.7.2-4 (deactivated SCell) or 9.2.7.2-5 (deactivated SCell).

$T_{SSB_processing}$: it is the time period used to process multiple beams received in one SMTC. $T_{SSB_processing}$ = 2 ms for UE supporting *Rel-19 L3 fast Rx beam sweeping*, when he conditions in clause 3.6.21 are fulfilled. Otherwise, $T_{SSB_processing}$ = 0

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_ncsg,i}$ in clause 9.1.5.3 for measurement conducted within NCSG.

K_{NCSG} is the scaling factor for a SSB frequency layer to be measured within an associated NCSG pattern. K_{NCSG} = 1 when the UE is not configured with concurrent GAPs. Otherwise, $K_{NCSG} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

For a window W of duration max(SMTC period, xRP_max), where xRP_max is the maximum xRP across all configured per-UE GAP and per-FR GAP within the same FR as the SSB frequency layer, and starting from the beginning of any SMTC occasion:

- N_{total} is the total number of SMTC occasions that are covered by instances of the associated NCSG within the window W, including those overlapped with other GAP occasions within the window, and
- $N_{available}$ is the number of SMTC occasions that are covered by instances of the non-dropped associated NCSG within the window W after accounting for GAP collisions by applying the GAP collision rule in clauses 9.1.8.3, 9.1.12.3, and 9.1.13.3.
- xRP = MGRP when configured GAP is MG, and xRP = VIRP when configured GAP is NCSG.

When concurrent GAPs are configured, requirements in this clause do not apply if $N_{available}$ =0.

$M_{pss/sss_sync_with_ncsg}$: For a UE supporting FR2 power class 1 or 5, $M_{pss/sss_sync\ with_ncsg}$=40. For a UE supporting FR2 power class 2, $M_{pss/sss_sync\ with_ncsg}$ =24. For a UE supporting FR2 power class 3, $M_{pss/sss_sync\ with_ncsg}$ =24. For a UE supporting power class 4, $M_{pss/sss_sync\ with_ncsg}$ =24

$M_{meas_period_with_ncsg}$: For a UE supporting power class 1 or 5, $M_{meas_period_with_ncsg}$ =40. For a UE supporting power class 2, $M_{meas_period_with_ncsg}$ =24. For a UE supporting power class 3, $M_{meas_period_with_ncsg}$ =24. For a UE supporting power class 4, $M_{meas_period\ with_ncsg}$ =24.

For a UE that supports *Rel-19 L3 fast Rx beam sweeping*, when the conditions in clause 3.6.21 are fulfilled and when *highSpeedMeasFlagFR2-r17* is not configured, the following values shall apply for $M_{pss/sss_sync_with_ncsg}$ and $M_{meas_period_with_ncsg}$:

$M_{pss/sss_sync_with_ncsg}$: For a UE supporting FR2-1 power class 3, $M_{pss/sss_sync_with_ncsg}$ =3* $N_{reduced_Rx_BSF}$.

$M_{meas_period_with_ncsg}$: For a UE supporting FR2-1 power class 3, $M_{meas_period_with_ncsg}$ =3* $N_{reduced_Rx_BSF}$.

Where,

$N_{reduced_Rx_BSF}$ is the reduced UE Rx beam sweeping factor reported by UE via *Rel-19 L3 fast Rx beam sweeping*If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and smtc1 is fully overlapping with NCSG and smtc2 is partially overlapping with NCSG, requirements are not specified for $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$.

Table 9.2.7.1-1: Time period for PSS/SSS detection with NCSG (FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, 5 x K_{NCSG} x max(VIRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil($M2^{Note\ 1}$x 5 x K_{NCSG}) x max(VIRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	5 x K_{NCSG} x max(VIRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.	
NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.	

Table 9.2.7.1-2: Time period for PSS/SSS detection with NCSG (FR2)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600ms, $M_{pss/sss_sync_with_ncsg}$ x K_{NCSG} x max(VIRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600ms, ceil(1.5x $M_{pss/sss_sync_with_ncsg}$ x K_{NCSG}) x max(VIRP, SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	$M_{pss/sss_sync_with_ncsg}$ x K_{NCSG} x max(VIRP, DRX cycle) x $CSSF_{intra}$

Table 9.2.7.1-3: Time period for time index detection with NCSG (FR1)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120 ms, 3 x K_{NCSG} x max(VIRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil($M2^{Note\ 1}$x 3 x K_{NCSG}) x max(VIRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320 ms	3 x K_{NCSG} x max(VIRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.	

Table 9.2.7.1-4: Time period for PSS/SSS detection with NCSG (deactivated SCell) (FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	5 x K_{NCSG} x measCycleSCellx $CSSF_{intra}$
DRX cycle≤ 320 ms	5 x K_{NCSG} x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	5 x K_{NCSG} x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.7.1-5: Time period for PSS/SSS detection with NCSG (deactivated SCell) (FR2)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	M_{pss/sss_with_ncsg} x K_{NCSG} x measCycleSCellx $CSSF_{intra}$
DRX cycle≤ 320 ms	M_{pss/sss_with_ncsg} x K_{NCSG} x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	M_{pss/sss_with_ncsg} x K_{NCSG} x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.7.1-6: Time period for time index detection with NCSG (deactivated SCell) (FR1)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	3 x K_{NCSG} x measCycleSCellx $CSSF_{intra}$
DRX cycle≤ 320 ms	3 x K_{NCSG} x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	3 x K_{NCSG} x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

9.2.7.2 Measurement period

When *highSpeedMeasFlag-r16* is configured, the measurement period with NCSG is specified in table 9.2.7.2-3.

For either an FR1 or FR2 serving cell, longer measurement period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

Table 9.2.7.2-1: Measurement period for intra-frequency measurements with NCSG (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, 5 x K_{NCSG} x max(VIRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x K_{NCSG}) x max(VIRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	5 x K_{NCSG} x max(VIRP, DRX cycle) x $CSSF_{intra}$

Table 9.2.7.2-2: Measurement period for intra-frequency measurements with NCSG (FR2)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(400ms, $M_{meas_period\ with_ncsg}$ x K_{NCSG} x max(VIRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(400ms, ceil(1.5 x $M_{meas_period\ with_ncsg}$ x K_{NCSG}) x max(VIRP, SMTC period, DRX cycle)) Note 1 x $CSSF_{intra}$
DRX cycle>320 ms	$M_{meas_period\ with_ncsg}$ x K_{NCSG} x max(VIRP, DRX cycle) x $CSSF_{intra}$

Table 9.2.7.2-3: Measurement period with NCSG When *highSpeedMeasFlag-r16* is configured (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, 5 x K_{NCSG} x max(VIRP, SMTC period)) Note 1 x $CSSF_{intra}$
DRX cycle≤ 160 ms	max(200 ms, ceil($M2^{Note\ 2}$ x 5 x K_{NCSG}) x max(VIRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
160 ms < DRX cycle≤ 320 ms	max(200 ms, ceil($M2^{Note\ 2}$ x 4 x K_{NCSG}) x max(VIRP, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Y Note 3 x K_{NCSG} x max(VIRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1 NOTE 3: Y=3 when SMTC ≤ 40ms, Y=5 when SMTC > 40ms NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *[intraRAT-MeasurementEnhancement-r16]* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.	

Table 9.2.7.2-4: Measurement period for intra-frequency measurements with NCSG (deactivated SCell) (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	5 x K_{NCSG} x measCycleSCellx $CSSF_{intra}$
DRX cycle≤ 320 ms	5 x K_{NCSG} x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	5 x K_{NCSG} x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.7.2-5: Measurement period for intra-frequency measurements with NCSG (deactivated SCell) (FR2)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	$M_{meas_period\ with_ncsg}$ x K_{NCSG} x measCycleSCellx $CSSF_{intra}$
DRX cycle≤ 320 ms	$M_{meas_period\ with_ncsg}$ x K_{NCSG} x measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	$M_{meas_period\ with_ncsg}$ x K_{NCSG} x measCycleSCell, DRX cycle) x $CSSF_{intra}$

NOTE: Requirements for measurement on deactivated SCC in this clause do not apply if SMTC on the deactivated SCC is fully non-overlapped with NCSG, and the requirements for measurement on deactivated SCC specified in clause 9.2.5 apply.

9.2.7.3 Scheduling availability during intra-frequency measurement with NCSG

Scheduling availability specified in clause 9.2.5.3 applies to scheduling availability during intra-frequency measurement with NCSG.

9.2A NR intra-frequency measurements with CCA

9.2A.1 Introduction

The requirements in clause 9.2.A apply for intra-frequency measurements on carrier frequency with CCA.

When the intra-frequency measurement is performed on a neighbour cell in FR2-2 with shared spectrum channel access, UE shall determine the CCA mode of the neighbour cell according to *channelAccessMode2-r17* of the cell configured in *MeasObjectNR*. If *channelAccessMode2-r17* of the cell is enabled, UE shall assume that CCA applies to the cell and

perform measurement accordingly, and the requirements in clause 9.2A shall apply; otherwise, UE shall assume that CCA does not apply to the cell and perform measurement accordingly, and requirements in clause 9.2 shall apply.

A measurement is defined as a SSB based intra-frequency measurement provided the SSB frequency configured in the measurement object associated with the serving cell indicated for measurement and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same.

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell or the PSCell, even if no explicit neighbour list with physical layer cell identities is provided.

The UE can perform intra-frequency SSB based measurements without measurement gaps if

- the SSB is completely contained in the active BWP of the UE, or
- the active downlink BWP is initial BWP[3].

For intra-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.2A.5.3.

SSB based measurements are configured along with one or two measurement timing configuration(s) (SMTC(s)) which provides periodicity, duration and offset information on a window of up to 5 ms where the measurements are to be performed. For intra-frequency connected mode measurements, up to two measurement window periodicities may be configured. A single measurement window offset and measurement duration are configured per intra-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB which start earlier than the gap starting time + switching time, nor detect SSB which end later than the gap end – switching time. Switching time is 0.5 ms for frequency range FR1 and 0.25 ms for frequency range FR2-2.

In the requirements of clause 9.2A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but N_{SSB} candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding period, where:

- For the cell detection procedure: N_{SSB} is at least one candidate SSB position (NOTE: the one candidate SSB position for the cell detection shall not be impacted by the set of candidate SSB positions which are already being measured by the UE within the current measurement period of the on-going measurements), and
- For other procedures in clause 9.2A: N_{SSB} are the first two successive candidate SSB positions when two or more candidate SSB positions are configured for this SSB index in one discovery burst transmission window, otherwise N_{SSB} is one candidate SSB position;

Otherwise, the SMTC occasion is considered as available at the UE.

For the FR2-2 requirements of clause 9.2A, an SMTC occasion group consists of N consecutive SMTC occasions, where N is the UE Rx beam sweeping scaling factor. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB.

9.2A.2 Requirements applicability

The requirements in clause 9.2A apply, provided:

- The cell being identified or measured is detectable.

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.27 and TBD for FR1 and FR2-2, respectively, for a corresponding band,
- SS-RSRQ related side conditions given in clause 10.1.29 and TBD for FR1 and FR2-2, respectively, for a corresponding band,
- SS-SINR related side conditions given in clause 10.1.31 and TBD for FR1 and FR2-2, respectively, for a corresponding band,

- SSB_RP and SSB Ês/Iot according to Annex B.2.8 for a corresponding band.

9.2A.3 Number of cells and number of SSB

9.2A.3.1 Requirements for FR1

For each intra-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 8 identified cells, and
- 14 SSBs with different SSB index and/or PCI on the intra-frequency layer, where the number of SSBs in the serving cell (except for the SCell) is not smaller than the number of configured RLM-RS SSB resources.

9.2A.3.2 Requirements for FR2-2

For one single intra-frequency layer in a band, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 6 identified cells, and
- 24 SSBs with different SSB index and/or PCI,

where this single intra-frequency layer shall be:

- PCC when UE is configured with SA NR operation mode with PCC in the band; or
- PSCC when UE is configured with NR-DC with PSCC in the band; or
- One of the SCCs on which UE is configured to report SSB based measurements when neither PCC nor PSCC is in the same band, so that the selected SCC shall be an SCC where the UE is configured with SS-RSRP measurement reporting if such SCC exists, otherwise the selected SCC is determined by UE implementation.

The UE shall also be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least 2 SSBs on serving cell for each of the other intra-frequency layer(s) in the same band.

9.2A.4 Measurement Reporting Requirements

9.2A.4.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1. 36 (RSRP for FR1), TBD (RSRP for FR2-2),10.1.29(RSRQ for FR1), TBD (RSRQ for FR2-2), 10.1.31 (RS-SINR for FR1) and TBD (RS-SINR for FR2-2), respectively.

9.2A.4.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.36 (RSRP for FR1), TBD (RSRP for FR2-2), 10.1.29 (RSRQ for FR1), TBD (RSRQ for FR2-2), 10.1.31 (RS-SINR for FR1) and TBD (RS-SINR for FR2-2), respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.2A.4.3.

9.2A.4.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.36 (RSRP for FR1), TBD (RSRP for FR2-2), 10.1.29 (RSRQ for FR1), TBD (RSRQ for FR2-2), 10.1.31 (RS-SINR for FR1) and TBD (RS-SINR for FR2-2), respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on, and all delays due to UL CCA failures until the successful transmission of the report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{identify\ intra\ with\ index_CCA}$ or $T_{identify\ intra\ without\ index_CCA}$ defined in clause 9.2A.5.1 or clause 9.2A.6.2. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period $T_{identify_intra_without_index_CCA}$ or $T_{identify_intra_with_index_CCA}$ as defined in clause 9.2A.5.1 or clause 9.2A.6.2. If a cell which has been detectable at least for the time period $T_{identify\ intra\ without\ index_CCA}$ or $T_{identify\ intra\ with\ index_CCA}$ defined in clause 9.2A.5.1 or clause 9.2A.6.2 becomes undetectable for a period$\leq$ 8 seconds and then the cell becomes detectable again with the same spatial reception parameter and triggers an event, the event triggered measurement reporting delay shall be less than $T_{SSB_measurement_period_intra_CCA}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while the measurement gap has not been available and the L3 filter has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

9.2A.5 Intra-frequency measurements without measurement gaps

9.2A.5.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index_CCA}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise, UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_with_index_CCA}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify_intra_without_index_CCA}$.

$$T_{identify_intra_without_index_CCA} = (T_{PSS/SSS_sync_intra_CCA} + T_{SSB_measurement_period_intra_CCA})\ ms$$

$$T_{identify_intra_with_index\ CCA} = (T_{PSS/SSS_sync_intra_CCA} + T_{SSB_measurement_period_intra_CCA} + T_{SSB_time_index_intra_CCA})\ ms$$

Where:

$T_{PSS/SSS_sync_intra_CCA}$: it is the time period used in PSS/SSS detection given in table 9.2A.5.1-1, 9.2A.5.1-3 (deactivated Scell) .

$T_{SSB_time_index_intra_CCA}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2A.5.1-2 or 9.2A.5.1-4 (deactivated SCell).

$T_{SSB_measurement_period_intra_CCA}$: equal to a measurement period of SSB based measurement given in table 9.2A.5.2-1, 9.2A.5.2-2 (deactivated SCell).

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined

- according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps.

- $M_{pss/sss_sync_w/o_gaps_CCA}$: For a UE supporting FR2-2 power class 1, $M_{pss/sss_sync_w/o_gaps\ CCA}$ = 60. For a UE supporting FR2-2 power class 2, $M_{pss/sss_sync_w/o_gaps\ CCA}$ = 36. For a UE supporting FR2-2 power class 3, $M_{pss/sss_sync_w/o_gaps\ CCA}$ = 36.

- $M_{meas_period_w/o_gaps_CCA}$: For a UE supporting FR2-2 power class 1, $M_{meas_period_w/o_gaps\ CCA}$ = 60. For a UE supporting FR2-2 power class 2, $M_{meas_period_w/o_gaps\ CCA}$ = 36. For a UE supporting FR2-2 power class 3, $M_{meas_period_w/o_gaps\ CCA}$ = 36.

- $M_{SSB_index_intra_CCA}$: For a UE supporting FR2-2 power class 1, $M_{SSB_index_intra\ CCA}$ = 72 samples. For a UE supporting FR2-2 power class 2, $M_{SSB_index_intra\ CCA}$ = 48 samples. For a UE supporting FR2 power class 3, $M_{SSB_index_intra\ CCA}$ = 48 samples.

  N: is the UE Rx beam sweeping scaling factor. N = 12.

  When intra-frequency SMTC is fully non overlapping with measurement gaps or intra-frequency SMTC is fully overlapping with MGs, K_p=1

  When intra-frequency SMTC is partially overlapping with measurement gaps, K_p = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP.

For FR2-2,

$K_{layer1_measurement}$=TBD

If MCG DRX is in use, intra-frequency cell identification requirements specified in table 9.2A.5.1-1, table 9.2A.5.1-2, table 9.2A.5.1-3, table 9.2A.5.1-4, table 9.2A.5.1-5 and table 9.2A.5.1-6 shall depend on the MCG DRX cycle. If SCG DRX is in use, intra-frequency cell identification requirements specified in table 9.2A.5.1-1, table 9.2A.5.1-2, table 9.2A.5.1-3, table 9.2A.5.1-4, table 9.2A.5.1-5 and table 9.2A.5.1-6 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

The requirements apply provided any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3.

Table 9.2A.5.1-1: Time period for PSS/SSS detection (FR1)

Condition	$T_{PSS/SSS_sync_intra_CCA}$
No DRX	max(600 ms, ceil((5+$L_{PSS/SSS}$) x K_p) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x (5+$L_{PSS/SSS}$) x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil((5+$L_{PSS/SSS}$) x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: When DRX is not configured, $L_{PSS/SSS}$ is the number of SMTC occasions not available at the UE during $T_{PSS/SSS_sync_intra_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS}$< $L_{PSS/SSS,max}$. When DRX is configured, $L_{PSS/SSS}$ is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{PSS/SSS_sync_intra_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS}$< $L_{PSS/SSS,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{intra}$.	
NOTE 3: $L_{PSS/SSS,max}$ =7 for Max(DRX cycle,SMTC period)≤40 ms where DRX cycle is 0 for non-DRX, $L_{PSS/SSS,max}$ =5 for 40 ms<Max(DRX cycle,SMTC period)≤320 ms, $L_{PSS/SSS,max}$ = 3 for DRX cycle>320 ms.	
NOTE 4: Upon exceeding $L_{PSS/SSS,max}$, the UE is not required to meet the requirements for PSS/SSS detection.	

Table 9.2A.5.1-2: Time period for time index detection (FR1)

Condition	$T_{SSB_time_index_intra_CCA}$
No DRX	max(120 ms, ceil((3+L_{ind}) x K_p) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil (1.5 x (3+L_{ind}) x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil((3+L_{ind}) x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: When DRX is not configured, L_{ind} is the number of SMTC occasions not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection, where $L_{ind} \le L_{ind,max}$. When DRX is configured, L_{ind} is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection, where $L_{ind} \le L_{ind,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{intra}$.	
NOTE 3: $L_{ind,max}$ = 5 for Max(DRX cycle,SMTC period)≤40 ms where DRX cycle is 0 for non-DRX, $L_{ind,max}$ = 3 for 40 ms<Max(DRX cycle,SMTC period)≤320 ms, $L_{ind,max}$ =2 for DRX cycle>320 ms.	
NOTE 4: Upon exceeding $L_{ind,max}$ over the period of time $T_{SSB_time_index_intra_CCA}$, the UE has to restart the time index detection procedure.	

Table 9.2A.5.1-3: Time period for PSS/SSS detection, deactivated SCell (FR1)

Condition	$T_{PSS/SSS_sync_intra_CCA}$
No DRX	$(5 + L_{PSS/SSS,deact})$ x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	$(5 + L_{PSS/SSS,\ deact})$ x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle>320 ms	$(5 + L_{PSS/SSS,\ deact})$ x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: When DRX is not configured, $L_{PSS/SSS,\ deact}$ is the number of SMTC occasions not available at the UE during $T_{PSS/SSS_sync_intra_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS,\ deact} < L_{PSS/SSS,\ deact,max}$. When DRX is configured, $L_{PSS/SSS,\ deact}$ is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{PSS/SSS_sync_intra_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS,\ deact} < L_{PSS/SSS,\ deact,max}$.When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement cycles, the UE is not required to determine the availability of SMTC occasions more frequent than once per measurement cycle. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{intra}$.		
NOTE 2: $L_{PSS/SSS,\ deact,max,}$ = 7 for non-DRX, $L_{PSS/SSS,\ deact,max}$ = 5 for 40 ms<Max(DRX cycle, measCycleSCell)≤320 ms, $L_{PSS/SSS,\ deact,max}$ = 3 for Max(DRX cycle, measCycleSCell)>320 ms.		
NOTE 3: Upon exceeding $L_{PSS/SSS,\ deact,max,}$, the UE is not required to meet the requirements for PSS/SSS detection.		

Table 9.2A.5.1-4: Time period for time index detection, deactivated SCell (FR1)

Condition	$T_{SSB_time_index_intra_CCA}$
No DRX	$(3+L_{ind,deact})$ x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	$(3+L_{ind,deact})$ x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle>320 ms	$(3+L_{ind,deact})$ x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: When DRX is not configured, $L_{ind,deact}$ is the number of SMTC occasions not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection, where $L_{ind,deact} < L_{ind,deact,max}$. When DRX is configured, $L_{ind,deact}$ is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection, where $L_{ind,deact} < L_{ind,deact,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement cycles, the UE is not required to determine the availability of SMTC occasions more frequent than once per measurement cycle. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{intra}$.		
NOTE 2: $L_{ind,deact,max,}$ = 5 for non-DRX, $L_{ind,deact,max}$ = 3 for 40 ms<Max(DRX cycle, measCycleSCell)≤320 ms, $L_{ind,deact,max}$ = 2 for Max(DRX cycle, measCycleSCell)>320 ms.		
NOTE 3: Upon exceeding $L_{ind,deact,max}$ over the period of time $T_{SSB_time_index_intra_CCA}$, the UE has to restart the time index detection procedure.		

Table 9.2A.5.1-5: Time period for PSS/SSS detection, (FR2-2)

Condition	$T_{PSS/SSS_sync_intra_CCA}$
No DRX	max(600 ms, ceil(($M_{pss/sss_sync_w/o_gaps_CCA}$ x K_{FR} + N x $L_{PSS/SSS}$) x K_p x $K_{layer1_measurement}$) x SMTC period)$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x ($M_{pss/sss_sync_w/o_gaps_CCA}$ x K_{FR} + N x $L_{PSS/SSS}$) x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(($M_{pss/sss_sync_w/o_gaps_CCA}$ x K_{FR} + N x $L_{PSS/SSS}$) x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: When DRX is not configured, $L_{PSS/SSS}$ is the number of SMTC occasion groups not available at the UE during $T_{PSS/SSS_sync_intra_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS} < L_{PSS/SSS,max}$. A SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. When DRX is configured, $L_{PSS/SSS}$ is the number of [DRX cycle groups] in which at least one SMTC occasion is not available at the UE during $T_{PSS/SSS_sync_intra_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS} < L_{PSS/SSS,max}$. [A [DRX occasion group consists of N consecutive DRX cycles. A DRX occasion group occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB.] When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle.	
NOTE 3: $L_{PSS/SSS,max}$ =[7] for Max(DRX cycle,SMTC period)≤40 ms where DRX cycle is 0 for non-DRX, $L_{PSS/SSS,max}$ =[5] for 40 ms<Max(DRX cycle,SMTC period)≤320 ms, $L_{PSS/SSS,max}$ = [3] for DRX cycle>320 ms.	
NOTE 4: Upon exceeding $L_{PSS/SSS,max}$, the UE is not required to meet the requirements for PSS/SSS detection.	

NOTE 5: K_{FR} is a scaling factor depending on the frequency range and SSB SCS. K_{FR} = 1 if the SCS of the SSB of the cell being detected is 120 kHz, K_{FR} = 2 if the SCS of the SSB of the cell being detected is 480 kHz, and K_{FR}= 3 if the SCS of the SSB of the cell being detected is 960 kHz.

Table 9.2A.5.1-6: Time period for PSS/SSS detection, deactivated SCell (FR2-2)

DRX cycle	$T_{PSS/SSS_sync_intra_CCA}$
No DRX	Ceil(($M_{pss/sss_sync_w/o_gaps}$ x K_{FR} + N x $L_{PSS/SSS,deact}$) x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(($M_{pss/sss_sync_w/o_gaps}$ x K_{FR} + N x $L_{PSS/SSS,deact}$) x K_p) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(($M_{pss/sss_sync_w/o_gaps}$ x K_{FR} + N x $L_{PSS/SSS,deact}$) x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

NOTE 1: When DRX is not configured, $L_{PSS/SSS,\ deact}$ is the number of SMTC occasions groups not available at the UE during $T_{PSS/SSS_sync_intra_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS,\ deact} < L_{PSS/SSS,\ deact,max}$. A SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. When DRX is configured, $L_{PSS/SSS,\ deact}$ is the number of [DRX cycle groups] in which at least one SMTC occasion is not available at the UE during $T_{PSS/SSS_sync_intra_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS,\ deact} < L_{PSS/SSS,\ deact,max}$.When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. [A DRX occasion group consists of N consecutive DRX cycles. A DRX occasion group occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB.] When configured with measurement cycles, the UE is not required to determine the availability of SMTC occasions more frequent than once per measurement cycle.

NOTE 2: $L_{PSS/SSS,\ deact,max,}$ = [7] for Max(DRX cycle, measCycleSCell)≤40 ms where DRX cycle is 0 for non-DRX, $L_{PSS/SSS,\ deact,max}$ = [5] for 40 ms<Max(DRX cycle, measCycleSCell)≤320 ms, $L_{PSS/SSS,\ deact,max}$ = [3] for DRX cycle>320 ms.

NOTE 3: Upon exceeding $L_{PSS/SSS,\ deact,max,}$, the UE is not required to meet the requirements for PSS/SSS detection.

NOTE 4: Void

NOTE 5: K_{FR} is a scaling factor depending on the frequency range and SSB SCS. K_{FR} = 1 if the SCS of the SSB of the cell being detected is 120 kHz, K_{FR} = 2 if the SCS of the SSB of the cell being detected is 480 kHz, and K_{FR}= 3 if the SCS of the SSB of the cell being detected is 960 kHz.

Table 9.2A.5.1-7: Time period for time index detection (FR2-2)

DRX cycle	$T_{SSB_time_index_intra_CCA}$
No DRX	Max(200 ms, ceil(($M_{SSB_index_intra_CCA}$ + N × L_{ind}) × K_p) × SMTC period) × $CSSF_{intra}$
DRX cycle≤ 320 ms	Max(200 ms, ceil(1.5 × (($M_{SSB_index_intra}$ + N × L_{ind}) × K_p) × Max(SMTC period, DRX cycle)) × $CSSF_{intra}$
DRX cycle> 320 ms	ceil(($M_{SSB_index_intra}$ + N × L_{ind}) × K_p) × DRX cycle × $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified

NOTE 2: When DRX is not configured, L_{ind} is the number of SMTC occasion groups not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection, where $L_{ind} \le L_{ind,max}$. When DRX is configured, L_{ind} is the number of DRX cycles groups in which at least one SMTC occasion is not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection, where $L_{ind} \le L_{ind,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle.

NOTE 3: $L_{ind,max}$ = 5 for Max(DRX cycle,SMTC period)≤40 ms where DRX cycle is 0 for non-DRX, $L_{ind,max}$ = 3 for 40 ms<Max(DRX cycle,SMTC period)≤320 ms, $L_{ind,max}$ =2 for DRX cycle>320 ms.

NOTE 4: Upon exceeding $L_{ind,max}$ over the period of time $T_{SSB_time_index_intra_CCA}$, the UE has to restart the time index detection procedure.

Table 9.2A.5.1-8: Time period for time index detection, deactivated SCell (FR2-2)

DRX cycle	$T_{SSB_time_index_intra_CCA}$
No DRX	Max(200 ms, ceil(($M_{SSB_index_intra_CCA}$ + N × $L_{ind,deact}$) × K_p) × SMTC period) × $CSSF_{intra}$
DRX cycle≤ 320 ms	Max(200 ms, ceil(1.5 × (($M_{SSB_index_intra}$ + N × $L_{ind,deact}$) × K_p) × Max(SMTC period, DRX cycle)) × $CSSF_{intra}$
DRX cycle> 320 ms	ceil(($M_{SSB_index_intra}$ + N × $L_{ind,deact}$) × K_p) × DRX cycle × $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified
NOTE 2: When DRX is not configured, Lind,deact is the number of SMTC occasion groups not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection, where $L_{ind,deact} \leq L_{ind,deact,max}$. When DRX is configured, $L_{ind,deact}$ is the number of DRX cycles groups in which at least one SMTC occasion is not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection, where $L_{ind,deact} \leq L_{ind,deact,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle.
NOTE 3: $L_{ind,deact,max}$ = 5 for Max(DRX cycle,SMTC period)≤40 ms where DRX cycle is 0 for non-DRX, $L_{ind,deact,max}$ = 3 for 40 ms<Max(DRX cycle,SMTC period)≤320 ms, $L_{ind,deact,max}$ =2 for DRX cycle>320 ms.
NOTE 4: Upon exceeding $L_{ind,deact,max}$ over the period of time $T_{SSB_time_index_intra_CCA}$, the UE has to restart the time index detection procedure.

9.2A.5.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2A.5.2-1, 9.2A.5.2-2 (deactivated SCell).

If SCG DRX is in use, intra-frequency measurement period requirements specified in table 9.2A.5.2-1, table 9.2A.5.2-2 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

The requirements apply provided any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3.

When the time period of unsuccessful measurement attempts due to exceeding the maximum number of unavailable at the UE SMTC occasions of an already identified cell exceeds the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3, UE shall stop the measurement attempts on this SSB and perform the detection procedure again like for any other SSB.

Table 9.2A.5.2-1: Measurement period for intra-frequency measurements without gaps (FR1)

Condition	$T_{SSB_measurement_period_intra_CCA}$
No DRX	max(200 ms, ceil((5+L_{meas}) x K_p) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x (5+L_{meas}) x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil((5+L_{meas}) x K_p) x DRX cycle x $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified
NOTE 2: When DRX is not configured, L_{meas} is the number of SMTC occasions not available at the UE during $T_{SSB_measurement_period_intra_CCA}$ for measurement, where $L_{meas} < L_{meas,max}$. When DRX is configured, L_{meas} is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{SSB_measurement_period_intra_CCA}$ for measurement, where $L_{meas} < L_{meas,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{intra}$.
NOTE 3: $L_{meas,max}$ = 7 for Max(DRX cycle,SMTC period)≤40 ms where DRX cycle is 0 for non-DRX, $L_{meas,max}$ = 5 for 40 ms<Max(DRX cycle,SMTC period)≤320 ms, $L_{meas,max}$ = 3 for DRX cycle>320 ms.
NOTE 4: Upon exceeding $L_{meas,max}$ over the period of time $T_{SSB_measurement_period_intra_CCA}$, the UE has to restart the measurement procedure.

Table 9.2A.5.2-2: Measurement period for intra-frequency measurements without gaps, deactivated SCell (FR1)

Condition	$T_{SSB_measurement_period_intra_CCA}$
No DRX	(5+$L_{meas,deact}$) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	(5+$L_{meas,deact}$) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle>320 ms	(5+$L_{meas,deact}$) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

NOTE 1: When DRX is not configured, $L_{meas,deact}$ is the number of SMTC occasions not available at the UE during $T_{SSB_measurement_period_intra_CCA}$ for measurement, where $L_{meas,deact} < L_{meas,,deact,max}$. When DRX is configured, $L_{meas,deact}$ is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{SSB_measurement_period_intra_CCA}$ for measurement, where $L_{meas,deact} < L_{meas,,deact,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement cycles, the UE is not required to determine the availability of SMTC occasions more frequent than once per measurement cycle. FFS:

The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{intra}$.
NOTE 2: $L_{meas,\ ,deact\ ,max,}$ = 7 for non-DRX, $L_{meas,\ ,deact\ ,max}$ = 5 for 40ms<Max(DRX cycle, measCycleSCell)≤320ms, $L_{meas,\ ,deact\ ,max}$ = 3 for Max(DRX cycle, measCycleSCell)>320ms.
NOTE 3: Upon exceeding $L_{meas,deact,max}$ over the period of time $T_{SSB_measurement_period_intra_CCA}$, the UE has to restart the measurement procedure.

Table 9.2A.5.2-3: Measurement period for intra-frequency measurements without gaps (FR2-2)

DRX cycle	$T_{SSB_measurement_period_intra_CCA}$
No DRX	max(400 ms, ceil(($M_{meas_period_w/o_gaps_CCA}$ + N x L_{meas}) x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5x ($M_{meas_period_w/o_gaps_CCA}$ + N x L_{meas}) x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(($M_{meas_period_w/o_gaps_CCA}$ + N x L_{meas}) x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified

NOTE 2: When DRX is not configured, L_{meas} is the number of SMTC occasion groups not available at the UE during $T_{SSB_measurement_period_intra_CCA}$ for measurement, where L_{meas} <$L_{meas,max}$. A SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. When DRX is configured, L_{meas} is the number of [DRX cycle groups] in which at least one SMTC occasion is not available at the UE during $T_{SSB_measurement_period_intra_CCA}$ for measurement, where L_{meas} <$L_{meas,max}$. . [A DRX occasion group consists of N consecutive DRX cycles. A DRX occasion group occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB.] When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle.

NOTE 3: $L_{meas,max}$ = [7] for Max(DRX cycle,SMTC period)≤40ms where DRX cycle is 0 for non-DRX, $L_{meas,max}$ = [5] for 40ms<Max(DRX cycle,SMTC period)≤320ms, $L_{meas,max}$ = [3] for DRX cycle>320ms.

NOTE 4: Upon exceeding $L_{meas,max}$ over the period of time $T_{SSB_measurement_period_intra_CCA}$, the UE has to restart the measurement procedure.

Table 9.2.5.2-4: Measurement period for intra-frequency measurements without gaps, deactivated Scell (FR2-2)

DRX cycle	$T_{SSB_measurement_period_intra_CCA}$
No DRX	Ceil(($M_{meas_period_w/o_gaps_CCA}$ + N x $L_{meas,deact}$) x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(($M_{meas_period_w/o_gaps_CCA}$ + N x $L_{meas,deact}$) x K_p) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(($M_{meas_period_w/o_gaps_CCA}$ + N x $L_{meas,deact}$) x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

NOTE 1: When DRX is not configured, $L_{meas,deact}$ is the number of SMTC occasion groups not available at the UE during $T_{SSB_measurement_period_intra_CCA}$ for measurement, where $L_{meas,deact}$ <$L_{meas,\ ,deact\ ,max}$. A SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. When DRX is configured, $L_{meas,deact}$ is the number of [DRX cycle groups] in which at least one SMTC occasion is not available at the UE during $T_{SSB_measurement_period_intra_CCA}$ for measurement, where $L_{meas,deact}$ <$L_{meas,\ ,deact\ ,max}$. [A DRX occasion group consists of N consecutive DRX cycles. A DRX occasion group occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB.] When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement cycles, the UE is not required to determine the availability of SMTC occasions more frequent than once per measurement cycle. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{intra}$.

NOTE 2: $L_{meas,\ ,deact\ ,max,}$ = [7] for Max(DRX cycle, measCycleSCell)≤40ms where DRX cycle is 0 for non-DRX, $L_{meas,\ ,deact\ ,max}$ = [5] for 40ms<Max(DRX cycle, measCycleSCell)≤320ms, $L_{meas,\ ,deact\ ,max}$ = [3] for DRX cycle>320ms.

NOTE 3: Upon exceeding $L_{meas,deact,max}$ over the period of time $T_{SSB_measurement_period_intra_CCA}$, the UE has to restart the measurement procedure.

9.2A.5.3 Scheduling availability of UE during intra-frequency measurements

UE shall be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same serving carrier which can be merged [2], if it is configured; otherwise, all *L* SSB symbols within SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

9.2A.5.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, and on 1 data symbol before each consecutive SSB symbols configured to be measured and 1 data symbol after each consecutive SSB symbols configured to be measured within SMTC window duration if *deriveSSB-IndexFromCell* is enabled. If the high layer in TS 38.331[2] signaling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration if *deriveSSB-IndexFromCell* is not enabled. If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB configured to be measured/RSSI symbols and 1 data symbol after each consecutive SSB configured to be measured/RSSI symbols within SMTC window duration if *deriveSSB-IndexFromCell* is enabled. If the high layer signaling of *smtc2* is configured (in TS 38.331), the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration if *deriveSSB-IndexFromCell* is not enabled. If the high layer in TS 38.331 signaling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.

When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.2A.5.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If *deriveSSB-IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If *deriveSSB-IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

9.2A.5.3.3 Scheduling availability of UE performing measurements in TDD bands on FR2-2

The requirements in clause 9.2.5.3.3 apply.

9.2A.6 Intra-frequency measurements with measurement gaps

9.2A.6.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index_CCA}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise, UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_with_index_CCA}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify_intra_without_index\ CCA}$.

$$T_{identify_intra_without_index\ CCA} = T_{PSS/SSS_sync_intra_CCA} + T_{SSB_measurement_period_intra_CCA}\ ms$$

$$T_{identify_intra_with_index_CCA} = T_{PSS/SSS_sync_intra_CCA} + T_{SSB_measurement_period_intra_CCA} + T_{SSB_time_index_intra_CCA}$$

Where:

$T_{PSS/SSS_sync_intra_CCA}$: it is the time period used in PSS/SSS detection given in table 9.2A.6.1-1.

$T_{SSB_time_index_intra_CCA}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2A.6.1-2.

$T_{SSB_measurement_period_intra_CCA}$: equal to a measurement period of SSB based measurement given in table 9.2A.6.2-1 or 9.2A.6.1-3.

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

$M_{pss/sss_sync_w/o_gaps_CCA}$: For a UE supporting FR2-2 power class 1, $M_{pss/sss_sync_w/o_gaps\ CCA} = 60$. For a UE supporting FR2-2 power class 2, $M_{pss/sss_sync_w/o_gaps\ CCA} = 36$. For a UE supporting FR2-2 power class 3, $M_{pss/sss_sync_w/o_gaps\ CCA} = 36$.

$M_{meas_period_w/o_gaps_CCA}$: For a UE supporting FR2-2 power class 1, $M_{meas_period_w/o_gaps\ CCA} = 60$. For a UE supporting FR2-2 power class 2, $M_{meas_period_w/o_gaps\ CCA} = 36$. For a UE supporting FR2-2 power class 3, $M_{meas_period_w/o_gaps\ CCA} = 36$.

- $M_{SSB_index_intra_CCA}$: For a UE supporting FR2-2 power class 1, $M_{SSB_index_intra\ CCA} = 72$ samples. For a UE supporting FR2-2 power class 2, $M_{SSB_index_intra\ CCA} = 48$ samples. For a UE supporting FR2 power class 3, $M_{SSB_index_intra\ CCA} = 48$ samples.

N: is the UE Rx beam sweeping scaling factor. N = 12.

If MCG DRX is in use, intra-frequency cell identification requirements specified in table 9.2A.6.1-1, table 9.2A.6.1-2 and table 9.2A.6.1-3 shall depend on the MCG DRX cycle. If SCG DRX is in use, intra-frequency cell identification requirements specified in table 9.2A.6.1-1, table 9.2A.6.1-2 and table 9.2A.6.1-3 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

The requirements apply provided any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3.

Table 9.2A.6.1-1: Time period for PSS/SSS detection (FR1)

Condition	$T_{PSS/SSS_sync_intra_CCA}$
No DRX	max(600 ms, (5+$L_{PSS/SSS,gaps}$) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x (5+$L_{PSS/SSS,gaps}$)) x max(DRX cycle, MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle>320ms	(5+$L_{PSS/SSS,gaps}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: When DRX is not configured, $L_{PSS/SSS,gaps}$ is the number of SMTC occasions not available at the UE during $T_{PSS/SSS_sync_intra_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS,gaps} < L_{PSS/SSS,gaps,max}$. When DRX is configured, $L_{PSS/SSS,gaps}$ is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{PSS/SSS_sync_intra_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS,gaps} < L_{PSS/SSS,gaps,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during	

MGRP. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{intra}$.

NOTE 2: $L_{PSS/SSS,gaps,max}$ =7 for Max(DRX cycle, SMTC period, MGRP)≤40ms where DRX cycle is 0 for non-DRX, $L_{PSS/SSS,gaps,max}$ =5 for 40ms<Max(DRX cycle, SMTC period, MGRP)≤320ms, $L_{PSS/SSS,gaps,max}$ =3 for DRX cycle>320ms.

NOTE 3: Upon exceeding $L_{PSS/SSS,gaps,max}$, the UE is not required to meet the requirements for PSS/SSS detection.

Table 9.2A.6.1-2: Time period for time index detection (FR1)

Condition	$T_{SSB_time_index_intra_CCA}$
No DRX	max(120 ms, (3+$L_{ind,gaps}$) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil(1.5x (3+$L_{ind,gaps}$)) x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320ms	(3+$L_{ind,gaps}$) xDRX cycle x $CSSF_{intra}$

NOTE 1: When DRX is not configured, $L_{ind,gaps}$ is the number of SMTC occasions not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection where $L_{ind,gaps} < L_{ind,gaps,max}$. When DRX is configured, $L_{ind,gaps}$ is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection where $L_{ind,gaps} < L_{ind,gaps,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{intra}$.

NOTE 2: $L_{ind,gaps,max}$ = 5 for Max(DRX cycle, SMTC period, MGRP)≤40ms where DRX cycle is 0 for non-DRX, $L_{ind,gaps,max}$ = 3 for 40ms<Max(DRX cycle, SMTC period, MGRP)≤320ms, $L_{ind,gaps,max}$ = 2 for DRX cycle>320ms.

NOTE 3: Upon exceeding $L_{ind,gaps,max}$ over the $T_{SSB_time_index_intra_CCA}$ period of time, the UE has to restart the time index detection procedure.

Table 9.2A.6.1-3: Time period for PSS/SSS detection (FR2-2)

DRX cycle	$T_{PSS/SSS_sync_intra_CCA}$
No DRX	max(600 ms, ($M_{pss/sss_sync_with_gaps_CCA}$ x K_{FR} + N x $L_{ind,gaps}$) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x ($M_{pss/sss_sync_with_gaps_CCA}$ x K_{FR} + N x $L_{ind,gaps}$)) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	($M_{pss/sss_sync_with_gaps_CCA}$ x K_{FR} + N x $L_{ind,gaps}$) x max(MGRP, DRX cycle) x $CSSF_{intra}$

NOTE 1: When DRX is not configured, $L_{ind,gaps}$ is the number of SMTC occasion groups not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection where $L_{ind,gaps} < L_{ind,gaps,max}$. A SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. When DRX is configured, $L_{ind,gaps}$ is the number of [DRX cycle groups] in which at least one SMTC occasion is not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection where $L_{ind,gaps} < L_{ind,gaps,max}$.[A DRX occasion group consists of N consecutive DRX cycles. A DRX occasion group occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB.] When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP.

NOTE 2: $L_{ind,gaps,max,}$ = [5] for Max(DRX cycle, SMTC period, MGRP)≤40 ms where DRX cycle is 0 for non-DRX, $L_{ind,gaps,max}$ = [3] for 40 ms<Max(DRX cycle, SMTC period, MGRP)≤320 ms, $L_{ind,gaps,max}$ = [2] for DRX cycle>320 ms.

NOTE 3: Upon exceeding $L_{ind,gaps,max}$ over the $T_{SSB_time_index_intra_CCA}$ period of time, the UE has to restart the time index detection procedure.

NOTE 4: K_{FR} is a scaling factor depending on the frequency range and SSB SCS. K_{FR} = 1 if the SCS of the SSB of the cell being detected is 120 kHz, K_{FR} = 2 if the SCS of the SSB of the cell being detected is 480 kHz, and K_{FR} = 3 if the SCS of the SSB of the cell being detected is 960 kHz.

Table 9.2A.5.1-7: Time period for time index detection (FR2-2)

DRX cycle	$T_{SSB_time_index_intra_CCA}$
No DRX	Max(200ms, ceil(($M_{SSB_index_intra_CCA}$ + ($L_{ind,gaps}$ × N)) × K_p) × Max(MGRP, SMTC period)) × $CSSF_{intra}$
DRX cycle≤ 320 ms	Max(200ms, ceil(1.5 × ($M_{SSB_index_intra_CCA}$ + ($L_{ind,gaps}$ × N)) × K_p) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{intra}$
DRX cycle> 320 ms	ceil(($M_{SSB_index_intra_CCA}$ + ($L_{ind,gaps}$ × N)) × K_p) × DRX cycle × $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified
NOTE 2: When DRX is not configured, L_{ind} is the number of SMTC occasion groups not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection, where $L_{ind,gaps} \leq L_{ind,gaps,max}$. When DRX is configured, $L_{ind,gaps}$ is the number of DRX cycles groups in which at least one SMTC occasion is not available at the UE during $T_{SSB_time_index_intra_CCA}$ for index detection, where $L_{ind,gaps} \leq L_{ind,gaps,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle.
NOTE 3: $L_{ind,gaps,max}$ = 5 for Max(DRX cycle,SMTC period)≤40 ms where DRX cycle is 0 for non-DRX, $L_{ind,gaps,max}$ = 3 for 40 ms<Max(DRX cycle,SMTC period)≤320 ms, $L_{ind,max}$ =2 for DRX cycle>320 ms.
NOTE 4: Upon exceeding $L_{ind,gaps,max}$ over the period of time $T_{SSB_time_index_intra_CCA}$, the UE has to restart the time index detection procedure.

9.2A.6.2 Intra-frequency Measurement Period

The measurement period for intra-frequency measurements with gaps is as shown in table 9.2A.6.2-1.

If MCG DRX is in use, intra-frequency cell identification requirements specified in table 9.2A.6.2-1 and 9.2A.6.2-2 shall depend on the MCG DRX cycle. If SCG DRX is in use, intra-frequency measurement period requirements specified in table 9.2A.6.2-1 and 9.2A.6.2-2 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

The requirements apply provided any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3.

When the time period of unsuccessful measurement attempts due to exceeding the maximum number of unavailable at the UE SMTC occasions of an already identified cell exceeds the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3, UE shall stop the measurement attempts on this SSB and perform the detection procedure again like for any other SSB.

Table 9.2A.6.2-1: Measurement period for intra-frequency measurements with gaps (FR1)

Condition	$T_{SSB_measurement_period_intra_CCA}$
No DRX	max(200 ms, $(5+L_{meas,gaps})$ x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x $(5+L_{meas,gaps})$) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	$(5+L_{meas,gaps})$ x DRX cycle x $CSSF_{intra}$

NOTE 1: When DRX is not configured, $L_{meas,gaps}$ is the number of SMTC occasions not available at the UE during $T_{SSB_measurement_period_intra_CCA}$ for measurement where $L_{meas,gaps} < L_{meas,gaps,max}$. When DRX is configured, $L_{meas,gaps}$ is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{SSB_time_index_intra_CCA}$ for measurement where $L_{meas,gaps} < L_{meas,gaps,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{intra}$.
NOTE 2: $L_{meas,gaps,max}$ = 7 for Max(DRX cycle, SMTC period, MGRP)≤40ms where DRX cycle is 0 for non-DRX, $L_{meas,gaps,max}$ = 5 for 40ms<Max(DRX cycle, SMTC period, MGRP)≤320ms, $L_{meas,gaps,max}$ = 3 for DRX cycle>320ms.
NOTE 3: Upon exceeding $L_{meas,gaps,max}$ over the $T_{SSB_measurement_period_intra_CCA}$ period of time, the UE has to restart the measurement procedure.

Table 9.2A.6.2-2: Measurement period for intra-frequency measurements with gaps (FR2-2)

DRX cycle	$T_{SSB_measurement_period_intra_CCA}$
No DRX	max(400 ms, $(M_{meas_period\ with_gaps_CCA} + N \times L_{meas,gaps})$ x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5 x $(M_{meas_period\ with_gaps_CCA} + N \times L_{meas,gaps})$) x max(MGRP, SMTC period, DRX cycle)) [Note 1] x $CSSF_{intra}$
DRX cycle>320 ms	$(M_{meas_period\ with_gaps_CCA} + N \times L_{meas,gaps})$ x max(MGRP, DRX cycle) x $CSSF_{intra}$

NOTE 1: When DRX is not configured, $L_{meas,gaps}$ is the number of SMTC occasion groups not available at the UE during $T_{SSB_time_index_intra_CCA}$ for measurement where $L_{meas,gaps} < L_{meas,gaps,max}$. A SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. When DRX is configured, $L_{meas,gaps}$ is the number of DRX cycle groups in which at least one SMTC occasion is not available at the UE during $T_{SSB_time_index_intra_CCA}$ for measurement where $L_{meas,gaps} < L_{meas,gaps,max}$. A DRX occasion group consists

	of N consecutive DRX cycles. A DRX occasion group occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP.
NOTE 2:	$L_{meas,gaps,max}$ = 7 for Max(DRX cycle, SMTC period, MGRP)≤40ms where DRX cycle is 0 for non-DRX, $L_{meas,gaps,max}$ = 5 for 40ms<Max(DRX cycle, SMTC period, MGRP)≤320ms, $L_{meas,gaps,max}$ = 3 for DRX cycle>320ms.
NOTE 3:	Upon exceeding $L_{meas,gaps,max}$ over the $T_{SSB_measurement_period_intra_CCA}$ period of time, the UE has to restart the measurement procedure.

9.2A.7 Intra-frequency RSSI and Channel occupancy measurements

9.2A.7.1 Intra-frequency RSSI measurements

An RSSI measurement is defined as an intra-frequency measurement provided that the RSSI measurement bandwidth is fully contained within the current carrier bandwidth of the UE.

The UE physical layer shall be capable of performing the RSSI measurements, defined in TS 38.215 [4] on one or more serving carriers operating with CCA, TS 37.213 [33], if the carrier(s) are indicated by higher layers [2], and report the RSSI measurements to higher layers. The UE physical layer shall provide to higher layers a single RSSI sample for each OFDM symbol within each configured RSSI measurement duration [2] occurring with a configured RSSI measurement timing configuration periodicity [2], *rmtc-Periodicity*.

The UE can perform RSSI measurements without measurement gaps if RSSI measurement bandwidth is fully within the active DL BWP of the UE.

For performing intra-frequency RSSI measurement in FR2-2, UE shall assume the configured RSSI measurement resources are QCL-ed with TypeD to the DL RS associated with the TCI state provided in the RMTC configuration. UE does not expect to be configured with an explicit TCI-state in RMTC-Config with a reference serving cell in FR1 or FR2-1. If no TCI state is provided in the RMTC configuration, UE shall assume the configured RSSI measurement resources are QCL-ed with TypeD to one of the latest received PDSCH and the latest monitored CORESET in the active BWP of the current carrier in FR2-2.

For RSSI measurement in FR2-2 with SCS of 480 kHz or 960 kHz, the RSSI measurement results shall be derived based on symbols configured by RMTC except for the first symbol and the last symbol in RMTC, and there is no requirement when *measDurationSymbols* is configured as 1.

The measurement period for intra-frequency RSSI measurements without measurement gaps is as shown in table 9.2A.7.1-1 and table 9.2A.7.1-2, for FR1, and in table 9.2A.7.4-1 and table 9.2A.7.5-1 for FR2-2. The measurement period for intra-frequency RSSI measurements with measurement gaps is as shown in table 9.2A.7.1-3, for FR1 and in table 9.2A.7.1-6 for FR2-2.

Table 9.2A.7.1-1: Measurement period for intra-frequency RSSI measurements without measurement gaps when SMTC and RMTC are overlapping (FR1)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInterval*, *rmtc-Periodicity**$CSSF_{outside_gap,i}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, DRX cycle) *$CSSF_{outside_gap,i}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	
NOTE 2: $CSSF_{outside_gap,i}$ is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gap.	

Table 9.2A.7.1-2: Measurement period for intra-frequency RSSI measurements without measurement gaps when SMTC and RMTC are not overlapping (FR1)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInt*erval, $N_{intra-MO}$**rmtc-Periodicity*)
DRX	max(*reportInt*erval, $N_{intra-MO}$*max(*rmtc-Periodicity*, DRXcycle length))
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	
NOTE 2: $N_{intra-MO}$ is defined as the number of measurement objects that can be measured without gaps	

Table 9.2A.7.1-3: Measurement period for intra-frequency RSSI measurements with measurement gaps (FR1)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x $CSSF_{intra}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle length) x $CSSF_{intra}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{intra}$ is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.	

Table 9.2A.7.1-4: Measurement period for intra-frequency RSSI measurements without measurement gaps when SMTC and RMTC are overlapping (FR2-2)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInterval*, *rmtc-Periodicity**$CSSF_{outside_gap,i}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, DRX cycle) *$CSSF_{outside_gap,i}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{outside_gap,i}$ is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gap.	

Table 9.2A.7.1-5: Measurement period for intra-frequency RSSI measurements without measurement gaps when SMTC and RMTC are not overlapping (FR2-2)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInt*erval, $N_{intra-MO}$**rmtc-Periodicity*)
DRX	max(*reportInt*erval, $N_{intra-MO}$*max(*rmtc-Periodicity*, DRX cycle))
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $N_{intra-MO}$ is defined as the number of measurement objects that can be measured without gaps	

Table 9.2A.7.1-6: Measurement period for intra-frequency RSSI measurements with measurement gaps (FR2-2)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x $CSSF_{intra}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x $CSSF_{intra}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{intra}$ is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.	

If the UE requires measurement gaps to perform intra-frequency measurements, a single measurement gap pattern is used for all concurrent intra-frequency measurements, including intra-frequency RSSI measurements. The RSSI measurement duration and the measurement gap shall be aligned, and the following additional condition shall be fulfilled:

- Entire RSSI measurement duration is contained in the measurement gap.

The RSSI measurement performed and reported according to this clause shall meet the RSSI measurement accuracy requirement in clause 10.1.34.1. The reported RSSI measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.34.3.

9.2A.7.2 Intra-frequency Channel occupancy measurements

The UE shall be capable of estimating the channel occupancy on one or more serving carrier frequencies indicated by higher layers [2], based on RSSI samples provided by the physical layer.

The UE can perform channel occupancy measurements without measurement gaps if RSSI measurement bandwidth is fully within the active DL BWP of the UE.

The measurement period for intra-frequency channel occupancy measurements without measurement gap is as shown in table 9.2A.7.2-1 and table 9.2A.7.1-2 for FR1, and in table 9.2A.7.2-4 and table 9.2A.7.1-5 for FR2-2. The

measurement period for intra-frequency RSSI measurements with measurement gaps is as shown in table 9.2A.7.2-3 for FR1, and in table 9.2A.7.2-6 for FR2-2.

Table 9.2A.7.2-1: Measurement period for intra-frequency Channel Occupancy measurements without measurement gaps when SMTC and RMTC are overlapping (FR1)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInterval*, *rmtc-Periodicity**$CSSF_{outside_gap,i}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, DRX cycle) *$CSSF_{outside_gap,i}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{outside_gap,i}$ is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gap.	

Table 9.2A.7.2-2: Measurement period for intra-frequency Channel Occupancy measurements without measurement gaps when SMTC and RMTC are not overlapping (FR1)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInt*erval, $N_{intra-MO}$**rmtc-Periodicity*)
DRX	max(*reportInt*erval, $N_{intra-MO}$*max(*rmtc-Periodicity*, DRXcycle length))
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $N_{intra-MO}$ is defined as the number of measurement objects that can be measured without gaps	

Table 9.2A.7.2-3: Measurement period for intra-frequency Channel Occupancy measurements with measurement gaps (FR1)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x $CSSF_{intra}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle length) x $CSSF_{intra}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{intra}$ is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.	

Table 9.2A.7.2-4: Measurement period for intra-frequency Channel Occupancy measurements without measurement gaps when SMTC and RMTC are overlapping (FR2-2)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInterval*, *rmtc-Periodicity**$CSSF_{outside_gap,i}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, DRX cycle) *$CSSF_{outside_gap,i}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{outside_gap,i}$ is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gap.	

Table 9.2A.7.2-5: Measurement period for intra-frequency Channel Occupancy measurements without measurement gaps when SMTC and RMTC are not overlapping (FR2-2)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInt*erval, $N_{intra-MO}$**rmtc-Periodicity*)
DRX	max(*reportInt*erval, $N_{intra-MO}$*max(*rmtc-Periodicity*, DRX cycle))
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $N_{intra-MO}$ is defined as the number of measurement objects that can be measured without gaps	

Table 9.2A.7.2-6: Measurement period for intra-frequency Channel Occupancy measurements with measurement gaps (FR2-2)

Condition NOTE1,2	$T_{RSSI_measurement_period_intra_cca}$
No DRX	max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x $CSSF_{intra}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x $CSSF_{intra}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{intra}$ is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.	

If the UE requires measurement gaps to perform intra-frequency measurements, a single measurement gap pattern is used for all concurrent intra-frequency measurements, including intra-frequency RSSI measurements. The RSSI measurement duration and the measurement gap shall be aligned, and the following additional condition shall be fulfilled:

- Entire RSSI measurement duration is contained in the measurement gap.

The channel occupancy measurement performed and reported according to this clause shall meet the channel occupancy measurement accuracy requirements in clause 10.1.35.1. The reported channel occupancy measurement values contained in measurement reports shall be based on the measurement reporting range specified in TS 38.331 [2].

9.2A.7.3 Scheduling restriction during RSSI and Channel Occupancy measurements in FR1

When the UE performs intra-frequency RSSI/CO measurements in unlicensed spectrum, the following restrictions apply due to RSSI/CO measurements:

- The UE is not expected to transmit PUCCH/PUSCH/SRS on UL symbols which are overlapping in time with the RSSI measurement symbols configured by RMTC.

When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.2A.7.4 Scheduling restriction during RSSI measurements in FR2-2

When the UE performs intra-frequency RSSI measurements in unlicensed spectrum, the following restrictions apply due to RSSI measurements:

- The UE is not expected to transmit PUCCH/PUSCH/SRS on UL symbols which are overlapping in time with the RSSI measurement symbols configured by RMTC.
- The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on symbols which are overlapping in time with RSSI measurement symbols configured by RMTC if the RSSI measurement resources are not QCL-ed with typeD to the DL RS in the active TCI state of PDCCH/PDSCH.
- For 480 kHz and 960 kHz, The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on symbols which are overlapping in time with the first and last RSSI measurement symbols configured by RMTC.

When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.2B NR intra-frequency measurements for RedCap

9.2B.1 Introduction

A measurement is defined as a SSB based intra-frequency measurement provided the centre frequency of the reference SSB of the serving cell and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same. The reference SSB is the SSB defined in BWP-specific *servingCellMO* under *BWP-DownlinkDedicated* of active DL BWP. If the field is absent, the reference SSB is the SSB defined in *servingCellMO* under *ServingCellConfig* [2].

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell, even if no explicit neighbour list with physical layer cell identities is provided.

The UE can perform intra-frequency SSB based measurements without measurement gaps if

- the SSB is completely contained in the active BWP of the UE, or

- the active downlink BWP is initial BWP [3].

For intra-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.2B.5.3.

SSB based measurements are configured along with one or two measurement timing configuration(s) (SMTC(s)) which provides periodicity, duration and offset information on a window of up to 5 ms where the measurements are to be performed. For intra-frequency connected mode measurements, up to two measurement window periodicities may be configured. A single measurement window offset and measurement duration are configured per intra-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB which start earlier than the gap starting time + switching time, nor detect SSB which end later than the gap end – switching time. Switching time is 0.5 ms for frequency range FR1 and 0.25 ms for frequency range FR2.

9.2B.2 Requirements applicability

The requirements in clause 9.2B apply, provided:

- The cell being identified or measured is detectable.

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- For 2Rx RedCap:
  - SS-RSRP related side conditions given in clauses 10.1.2 and 10.1.3 for FR1 and FR2, respectively, for a corresponding band,
  - SS-RSRQ related side conditions given in clauses 10.1.7 and 10.1.8 for FR1 and FR2, respectively, for a corresponding band,
  - SS-SINR related side conditions given in clauses 10.1.12 and 10.1.13 for FR1 and FR2, respectively, for a corresponding band,
  - SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding band.
- For 1Rx RedCap:
  - SS-RSRP related side conditions given in clauses 10.1A.2 for FR1 for a corresponding band,
  - SS-RSRQ related side conditions given in clauses 10.1A.6 for FR1 for a corresponding band,
  - SS-SINR related side conditions given in clauses 10.1A.10 for FR1 for a corresponding band,
  - SSB_RP and SSB Ês/Iot according to Annex B.2.15 for a corresponding band.

9.2B.3 Number of cells and number of SSB

9.2B.3.1 Requirements for FR1

For each intra-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 8 identified cells, and
- 14 SSBs with different SSB index and/or PCI on the intra-frequency layer, where the number of SSBs in the serving cell is not smaller than the number of configured RLM-RS SSB resources.

9.2B.3.2 Requirements for FR2

For one single intra-frequency layer in a band, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 6 identified cells, and

- 24 SSBs with different SSB index and/or PCI,

where this single intra-frequency layer shall be:

- PCC when UE is configured with SA NR operation mode with PCC in the band.

9.2B.4 Measurement Reporting Requirements

9.2B.4.1 Periodic Reporting

For 2Rx RedCap: The requirements in clause 9.2.4.1 shall apply.

For 1Rx RedCap: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1A.2.1 (SS-RSRP for FR1), 10.1A.6.1 (SS-RSRQ for FR1) and 10.1A.10.1 (SS-SINR for FR1), respectively.

9.2B.4.2 Event-triggered Periodic Reporting

For 2Rx RedCap: The requirements in clause 9.2.4.2 shall apply.

For 1Rx RedCap: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.1A.2.1 (SS-RSRP for FR1), 10.1A.6.1 (SS-RSRQ for FR1) and 10.1A.10.1 (SS-SINR for FR1), respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.2B.4.3.

9.2B.4.3 Event Triggered Reporting

For 2Rx RedCap: The requirements in clause 9.2.4.3 shall apply.

For 1Rx RedCap: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1A.2.1 (SS-RSRP for FR1), 10.1A.6.1 (SS-RSRQ for FR1) and 10.1A.10.1 (SS-SINR for FR1), respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{identify\ intra\ with\ index_RedCap}$ or $T_{identify\ intra\ without\ index_RedCap}$ defined in clause 9.2B.5.1 or clause 9.2B.6.1. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period $T_{identify_intra_without_index_RedCap}$ or $T_{identify_intra_with_index_RedCap}$ as defined in clause 9.2B.5.1 or clause 9.2B.6.1. If a cell which has been detectable at least for the time period $T_{identify\ intra\ without\ index_RedCap}$ or $T_{identify\ intra\ with\ index_RedCap}$ defined in clause 9.2B.5.1 or clause 9.2B.6.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again with the same spatial reception parameter and triggers an event, the event triggered measurement reporting delay shall be less than $T_{SSB_measurement_period_intra_RedCap}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu} T_c$ while the measurement gap has not been available and L3 filtering has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

9.2B.5 Intra-frequency measurements without measurement gaps

9.2B.5.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index_RedCap}$ if the UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within $T_{identify_intra_with_index_RedCap}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify_intra_without_index_RedCap.}$ It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

$$T_{identify_intra_without_index_RedCap} = (T_{PSS/SSS_sync_intra_RedCap} + T_{SSB_measurement_period_intra_RedCap})\ ms$$

$$T_{identify_intra_with_index_RedCap} = (T_{PSS/SSS_sync_intra_RedCap} + T_{SSB_measurement_period_intra_RedCap} + T_{SSB_time_index_intra_RedCap})\ ms$$

Where:

$T_{PSS/SSS_sync_intra_RedCap}$: it is the time period used in PSS/SSS detection given in tables 9.2B.5.1-1, 9.2B.5.1-2, 9.2B.5.1-3.

$T_{SSB_time_index_intra_RedCap}$: it is the time period used to acquire the index of the SSB being measured given in tables 9.2B.5.1-4, 9.2B.5.1-5

$T_{SSB_measurement_period_intra_RedCap}$: equal to a measurement period of SSB based measurement given in table 9.2B.5.2-1, table 9.2B.5.2-2, table 9.2B.5.2-3.

$CSSF_{intra_RedCap}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap_RedCap,i}$ in clause 9.1A.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to $CSSF_{within_gap_RedCap,i}$ in clause 9.1A.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps.

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

For 2Rx RedCap:

$M_{pss/sss_sync_w/o_gaps_RedCap}$: For a UE supporting FR2 power class 1 or 5, $M_{pss/sss_sync_w/o_gaps_RedCap}$ =40. For a UE supporting power class 2, 3, 4 or 7, $M_{pss/sss_sync_w/o_gaps_RedCap}$ =24.

$M_{meas_period_w/o_gaps_RedCap}$: For a UE supporting power class 1 or 5, $M_{meas_period_w/o_gaps_RedCap}$ =40. For a UE supporting FR2 power class 2, 3, 4, or 7, $M_{meas_period_w/o_gaps_RedCap}$ =24.

When intra-frequency SMTC is fully non overlapping with measurement gaps or intra-frequency SMTC is fully overlapping with MGs, K_p=1.

When intra-frequency SMTC is partially overlapping with measurement gaps, K_p = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP. For calculation of K_p, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1*.

If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{identify_intra_without_index_RedCap}$ or $T_{identify_intra_with_index_RedCap}$

For FR2,

$K_{layer1_measurement}$=1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or

- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, where SSB symbols are indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same serving carrier which can be merged. and RSSI symbols are indicated by *SS-RSSI-Measurement*;

$K_{layer1_measurement}$=1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

Table 9.2B.5.1-1: Time period for PSS/SSS detection, (FR1) for 2Rx RedCap UE

DRX cycle	$T_{PSS/SSS_sync_intra_RedCap}$
No DRX	max(600 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{intra_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2B.5.1-2: Time period for PSS/SSS detection, (FR2) for 2Rx RedCap UE

DRX cycle	$T_{PSS/SSS_sync_intra_RedCap}$
No DRX	max(600 ms, ceil($M_{pss/sss_sync_w/o_gaps_RedCap}$ x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x $M_{pss/sss_sync_w/o_gaps_RedCap}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	ceil($M_{pss/sss_sync_w/o_gaps_RedCap}$ x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2B.5.1-3: Time period for PSS/SSS detection, (FR1) for 1Rx RedCap UE

DRX cycle	$T_{PSS/SSS_sync_intra_RedCap}$
No DRX	max(600 ms, ceil(7 x K_p) x SMTC period)[Note 1] x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 7 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	ceil(7 x K_p) x DRX cycle x $CSSF_{intra_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2B.5.1-4: Time period for time index detection (FR1) for 2Rx RedCap UE

DRX cycle	$T_{SSB_time_index_intra_RedCap}$
No DRX	max(120 ms, ceil(3 x K_p) x SMTC period)[Note 1] x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(120 ms, ceil (1.5 x 3 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	Ceil(3 x K_p) x DRX cycle x $CSSF_{intra_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2B.5.1-5: Time period for time index detection (FR1) for 1Rx RedCap UE

DRX cycle	$T_{SSB_time_index_intra_RedCap}$
No DRX	max(160 ms, ceil(6 x K_p) x SMTC period)[Note 1] x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(160 ms, ceil (1.5 x 6 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	Ceil(6 x K_p) x DRX cycle x $CSSF_{intra_RedCap}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified

9.2B.5.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2B.5.2-1, 9.2B.5.2-2, 9.2B.5.2-3.

If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and smtc2 is partially overlapping with measurement gaps, requirements are not specified for $T_{SSB_measurement_period_intra_RedCap}$.

For FR2, a longer measurement period is allowed, if aperiodic CSI-RS resource is measured for L1-RSRP measurement on any FR2 serving frequency in the same band, and the CSI-RS resource is outside measurement gap and overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols. If *SSB-ToMeasure* or *SS-RSSI-Measurement* is configured, the SSB symbols are indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same band which can be merged and the RSSI symbols are indicated by *SS-RSSI-Measurement*.

Table 9.2B.5.2-1: Measurement period for intra-frequency measurements without gaps (FR1) for 2Rx RedCap UE

DRX cycle	$T_{SSB_measurement_period_intra_RedCap}$
No DRX	max(200 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{intra_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2B.5.2-2: Measurement period for intra-frequency measurements without gaps (FR2) for 2Rx RedCap UE

DRX cycle	$T_{SSB_measurement_period_intra_RedCap}$
No DRX	max(400 ms, ceil($M_{meas_period_w/o_gaps_RedCap}$ x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5x $M_{meas_period_w/o_gaps_RedCap}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	ceil($M_{meas_period_w/o_gaps_RedCap}$ xK_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2B.5.2-3: Measurement period for intra-frequency measurements without gaps (FR1) for 1Rx RedCap UE

DRX cycle	$T_{SSB_measurement_period_intra_RedCap}$
No DRX	max([200]ms, ceil([5] x K_p) x SMTC period)[Note 1] x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max([200]ms, ceil(1.5x [5] x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	ceil([5] x K_p) x DRX cycle x $CSSF_{intra_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

9.2B.5.3 Scheduling availability of UE during intra-frequency measurements

UE shall be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same serving carrier which can be merged

[2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

9.2B.5.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

9.2B.5.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If *deriveSSB_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If *deriveSSB_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If the following conditions are met:

  - The UE has been notified about system information update through paging,

  - The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots

- The UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and/or the corresponding PDSCH, on SSB symbols to be measured.

9.2B.5.3.3 Scheduling availability of UE performing measurements on FR2

The following scheduling restriction applies due to SS-RSRP or SS-SINR measurement on an FR2 intra-frequency cell

> The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration (The signaling *deriveSSB_IndexFromCell* is always enabled for FR2). If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

The following scheduling restriction applies to SS-RSRQ measurement on an FR2 intra-frequency cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB

to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration (The signaling *deriveSSB_IndexFromCellc* is always enabled for FR2). If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

If following conditions are met:

- The UE has been notified about system information update through paging,
- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots.

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE shall receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

9.2B.5.3.4 Scheduling availability of HD-FDD UE performing measurements on FR1

When the HD-FDD UE performs intra-frequency measurements in a FR1 band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- If *deriveSSB-IndexFromCell* is enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.
- If *deriveSSB-IndexFromCell* is not enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When the HD-FDD UE performs intra-frequency measurements in a FR1 band, the following restrictions apply due to SS-RSRQ measurement

- If *deriveSSB-IndexFromCell* is enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.
- If *deriveSSB-IndexFromCell* is not enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

9.2B.6 Intra-frequency measurements with measurement gaps

9.2B.6.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index_RedCap}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_with_index_RedCap}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify_intra_without_index_RedCap}$. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

$$T_{identify_intra_without_index_RedCap} = T_{PSS/SSS_sync_intra_RedCap} + T_{SSB_measurement_period_intra_RedCap}\ \text{ms}$$

$$T_{identify_intra_with_index_RedCap} = T_{PSS/SSS_sync_intra_RedCap} + T_{SSB_measurement_period_intra_RedCap} + T_{SSB_time_index_intra_RedCap}\ \text{ms}$$

Where:

$T_{PSS/SSS_sync_intra_RedCap}$: it is the time period used in PSS/SSS detection given in table 9.2B.6.1-1 or 9.2B.6.1-2 or 9.2B.6.1-3.

$T_{SSB_time_index_intra_RedCap}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2B.6.1-4 or 9.2B.6.1-5.

$T_{SSB_measurement_period_intra_RedCap}$: equal to a measurement period of SSB based measurement given in table 9.2B.6.2-1 or 9.2B.6.2-2 or 9.2B.6.2-3.

$CSSF_{intra_RedCap}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap_RedCap,i}$ in clause 9.1A.5.2 for measurement conducted within measurement gaps.

For 2Rx RedCap:

$M_{pss/sss_sync_with_gaps_RedCap}$: For a UE supporting FR2 power class 1 or 5, $M_{pss/sss_sync\ with_gaps_RedCap}$ =40. For a UE supporting FR2 power class 2, 3, 4 or 7, $M_{pss/sss_sync\ with_gaps_RedCap}$ =24.

$M_{meas_period_with_gaps_RedCap}$: For a UE supporting power class 1 or 5, $M_{meas_period_with_gaps_RedCap}$ =40. For a UE supporting power class 2, 3, 4, or 7, $M_{meas_period_with_gaps_RedCap}$ =24.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{identify_intra_without_index_RedCap}$ or $T_{identify_intra_with_index_RedCap}$.

Table 9.2B.6.1-1: Time period for PSS/SSS detection (FR1) for 2Rx RedCap UE

DRX cycle	$T_{PSS/SSS_sync_intra_RedCap}$
No DRX	max(600 ms, 5 x max(MGRP, SMTC period)) x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 5) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	5 x max(MGRP, DRX cycle) x $CSSF_{intra_RedCap}$

Table 9.2B.6.1-2: Time period for PSS/SSS detection (FR2) for 2Rx RedCap UE

DRX cycle	$T_{PSS/SSS_sync_intra_RedCap}$
No DRX	max(600 ms, $M_{pss/sss_sync_with_gaps_RedCap}$ x max(MGRP, SMTC period)) x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x $M_{pss/sss_sync_with_gaps_RedCap}$) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{intra_RedCap_RedCap}$
DRX cycle>320 ms	$M_{pss/sss_sync_with_gaps_RedCap}$ x max(MGRP, DRX cycle) x $CSSF_{intra_RedCap}$

Table 9.2B.6.1-3: Time period for PSS/SSS detection (FR1) for 1Rx RedCap UE

DRX cycle	$T_{PSS/SSS_sync_intra_RedCap}$
No DRX	max(600 ms, 7 x max(MGRP, SMTC period)) x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 7) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	7 x max(MGRP, DRX cycle) x $CSSF_{intra_RedCap}$

Table 9.2B.6.1-4: Time period for time index detection (FR1) for 2Rx RedCap UE

DRX cycle	$T_{SSB_time_index_intra_RedCap}$
No DRX	max(120 ms, 3 x max(MGRP, SMTC period)) x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(120 ms, ceil(1.5 x 3) x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra_RedCap}$)
DRX cycle>320 ms	3 x max(MGRP, DRX cycle) x $CSSF_{intra_RedCap}$

Table 9.2B.6.1-5: Time period for time index detection (FR1) for 1Rx RedCap UE

DRX cycle	$T_{SSB_time_index_intra_RedCap}$
No DRX	max(160 ms, 6 x max(MGRP, SMTC period)) x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(160 ms, ceil(1.5 x 6) x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra_RedCap}$)
DRX cycle>320 ms	[6] x max(MGRP, DRX cycle) x $CSSF_{intra_RedCap}$

9.2B.6.2 Intra-frequency Measurement Period

The measurement period for FR1 intra-frequency measurements with gaps is as shown in table 9.2B.6.2-1 and in table 9.2B.6.2-3.

The measurement period for FR2 intra-frequency measurements with gaps is as shown in table 9.2B.6.2-2.

For either an FR1 or FR2 serving cell, longer measurement period would be expected during the period $T_{identify_CGI_RedCap}$ when the UE is requested to decode an NR CGI.

Table 9.2B.6.2-1: Measurement period for intra-frequency measurements with gaps (FR1) for 2Rx RedCap UE

DRX cycle	$T_{SSB_measurement_period_intra_RedCap}$
No DRX	max(200 ms, 5 x max(MGRP, SMTC period)) x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	5 x max(MGRP, DRX cycle) x $CSSF_{intra_RedCap}$

Table 9.2B.6.2-2: Measurement period for intra-frequency measurements with gaps (FR2) for 2Rx RedCap UE

DRX cycle	$T_{SSB_measurement_period_intra_RedCap}$
No DRX	max(400 ms, $M_{meas_period\ with_gaps_RedCap}$ x max(MGRP, SMTC period)) x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5 x $M_{meas_period\ with_gaps_RedCap}$) x max(MGRP, SMTC period, DRX cycle)) [Note 1] x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	$M_{meas_period\ with_gaps_RedCap}$ x max(MGRP, DRX cycle) x $CSSF_{intra_RedCap}$

Table 9.2B.6.2-3: Measurement period for intra-frequency measurements with gaps (FR1) for 1Rx RedCap UE

DRX cycle	$T_{SSB_measurement_period_intra_RedCap}$
No DRX	max([200] ms, [5] x max(MGRP, SMTC period)) x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max([200] ms, ceil(1.5x [5]) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	[5] x max(MGRP, DRX cycle) x $CSSF_{intra_RedCap}$

9.2C NR intra-frequency measurements for SAN

9.2C.1 Introduction

The requirements in clause 9.2C apply for intra-frequency measurements on an SAN carrier frequency. The requirements apply provided that the valid parameters of ephemeris information, epoch time of the ephemeris, common TA, validity timer information, downlink polarization information for target NR SAN cell are send to UE.

A measurement is defined as a SSB based intra-frequency measurement provided the centre frequency of the SSB of the serving cell indicated for measurement and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same.

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell, even if no explicit neighbour list with physical layer cell identities is provided.

The UE can perform intra-frequency SSB based measurements without measurement gaps if

- the UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement, or
- the SSB is completely contained in the active BWP of the UE, or
- the active downlink BWP is initial BWP[3].

For intra-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.2C.5.3.

SSB based measurements are configured along with one or more measurement timing configuration(s) (SMTC(s)) which provides periodicity, duration and offset information on a window of up to 5 ms where the measurements are to be performed. For intra-frequency connected mode measurements,

- when *SSB-MTC4List-r17* is not configured, up to two measurement window periodicities may be configured with *SSB-MTC* and *SSB-MTC2*
- when *SSB-MTC4List-r17* is configured, multiple measurement window offsets may be configured with *SSB-MTC* and *SSB-MTC4List-r17*, and the requirements in clause 9.2C apply provided that the total number of measurement window offsets does not exceed the UE capability *parallelSMTC-r17*

When measurement gaps are needed, the UE is not expected to detect SSB which start earlier than the gap starting time + switching time, nor detect SSB which end later than the gap end – switching time. Switching time is 0.5 ms for frequency range FR1-NTN.

The intra-frequency measurement requirements in clause 9.2C.5 applies for the following scenarios:

- SSB based intra-frequency measurements with no measurement gap,
- for a UE supporting concurrent gaps and when concurrent gaps are configured:
  - When none of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent measurement gaps.
  - When part of the SMTC occasions of this intra-frequency measurement object are overlapped by the union of concurrent measurement gaps.
- otherwise, for a UE not supporting concurrent gaps or if concurrent gaps are not configured:
  - When none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.
  - When part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

The intra-frequency measurement requirements in clause 9.2C.6 applies for the following scenarios:

- SSB based intra-frequency measurements with measurement gap,
- SSB based intra-frequency measurements with no measurement gap,
- for a UE supporting concurrent gaps and when concurrent gaps are configured:
  - when all of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap in the concurrent measurement gaps, or
  - when part of the SMTC occasions of this intra-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this intra-frequency measurement object are overlapped with the union of concurrent measurement gaps.
- otherwise, for a UE not supporting concurrent gaps or if concurrent gaps are not configured:
- when all of the SMTC occasions of this intra-frequency measurement object are overlapped with the measurement gap.

The requirements in clause 9.2C.7 and 9.2C.8 apply provided that the measured NR SAN cell is served by the same satellite as the serving cell.

The requirements in clause 9.2C.6 and 9.2C.8 do not apply if the MG is fully overlapping with the serving cell SSB occasions, and the serving cell SSB is with a 160 ms periodicity.

9.2C.2 Requirements applicability

The requirements in clause 9.2C apply, provided:

- The cell being identified or measured is detectable.
- Valid information for the satellite serving the target cell has been provided

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clauses 10.1.2C for FR1-NTN and 10.1.3C for FR2-NTN, for a corresponding band,
- SS-RSRQ related side conditions given in clauses 10.1.7C for FR1-NTN and 10.1.8C for FR2-NTN, for a corresponding band,
- SS-SINR related side conditions given in clauses 10.1.12C for FR1-NTN and 10.1.13C for FR2-NTN, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.17 for a corresponding band.

9.2C.3 Number of cells and number of SSB

9.2C.3.1 Requirements for FR1-NTN

For each intra-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 8 identified cells, and
- 8 SSBs with different SSB index and/or PCI on the intra-frequency layer, where the number of SSBs in the serving cell (except for the SCell) is not smaller than the number of configured RLM-RS SSB resources.
- 4 SSBs with different SSB index and/or PCI from neighbour cells in GEO deployment.
- In NGSO deployments: cells from 2 satellites including the satellite serving the PCell if UE does not support the capability *maxNumber-NGSO-SatellitesPerCarrier-r17*; or cells from 3 or 4 satellites including the satellite serving the PCell, depending on the value indicated in *maxNumber-NGSO-SatellitesPerCarrier-r17*.

9.2C.4 Measurement Reporting Requirements

9.2C.4.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.2C.1 (RSRP for FR1-NTN) , 10.1.3C (RSRP for FR2-NTN), 10.1.7C.1 (RSRQ for FR1-NTN), 10.1.8C (RSRQ for FR2-NTN), 10.1.12C.1 (RS-SINR for FR1-NTN) and 10.1.13C (RS-SINR for FR2-NTN).

9.2C.4.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.1.2C.1 (RSRP for FR1-NTN), 10.1.3C (RSRP for FR2-NTN), 10.1.7C.1 (RSRQ for FR1-NTN), 10.1.8C (RSRQ for FR2-NTN), 10.1.12C.1 (RS-SINR for FR1-NTN) and 10.1.13C (RS-SINR for FR2-NTN).

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.2C.4.3.

9.2C.4.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.2C.1 (RSRP for FR1-NTN), 10.1.3C (RSRP for FR2-NTN), 10.1.7C.1 (RSRQ for FR1-NTN), 10.1.8C (RSRQ for FR2-NTN), 10.1.12C.1 (RS-SINR for FR1-NTN) and 10.1.13C (RS-SINR for FR2-NTN).

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify\ intra\ without\ index}$ defined in clause 9.2C.5.1 or clause 9.2C.6.2. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ as defined in clause 9.2C.5.1 or clause 9.2C.6.2. When L3 filtering is used, an additional delay can be expected.

9.2C.5 Intra-frequency measurements without measurement gaps

9.2C.5.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index}$ if the UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within $T_{identify_intra_with_index}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify_intra_without_index}$.

$$T_{identify_intra_without_index} = (T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra})\ ms$$

$$T_{identify_intra_with_index} = (T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra} + T_{SSB_time_index_intra})\ ms$$

Where:

T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in table 9.2C.5.1-1

$T_{SSB_time_index_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2C.5.1-2 , and 9.2C.5.1-3 with 12 PRB SSB BW.

$T_{SSB_measurement_period_intra}$: equal to a measurement period of SSB based measurement given in table 9.2C.5.2-1

K_{multi_SMTC} is the scaling factor for measurement of multiple SMTCs or multiple satellites, and

if SMTCs do not overlap with each other,

- $K_{multi_SMTC} = 1$, if GEO satellites are measured on the carrier;
- $K_{multi_SMTC} = \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if LEO satellites are measured on the carrier;

if SMTCs partially overlap with each other,

- $K_{multi_SMTC} = N_{SMTC,overlap}$, if only GEO satellites are measured on the carrier;
- $K_{multi_SMTC} = \sum_{i=1}^{N_{SMTC,overlap}} \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if only LEO satellites are measured on the carrier;

where

- $N_{LEO,i}$ is the number of LEO satellites to be measured within i-th SMTC,
- $N_{LEO,simul}$ is the number of LEO satellites that UE can measure in parallel within an SMTC,
- $N_{SMTC,overlap}$ is the number of SMTCs that partially overlap with each other.

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined

according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1.

if the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

K_p is the scaling factor for an SSB frequency layer to be measured without measurement gaps. $K_p = N_{total_SAN} / N_{available_SAN}$, where $N_{available_SAN}$ and N_{total_SAN} are calculated as follows:

- For a window W of duration max(SMTC period, MGRP_max), where
  - If UE supports *parallelMeasurementGap-r17* and is configured with concurrent measurement gaps, MGRP_max is the maximum MGRP across all configured per-UE measurement gap. Otherwise, MGRP_max is the MGRP of configured measurement gap.
  - Starting from the beginning of any SMTC occasion:
    - N_{total_SAN} is the total number of SMTC occasions within the window, including those overlapped and non-overlapped with measurement gap occasions within the window, and
    - $N_{available_SAN}$ is the number of SMTC occasions within the window W that do not collide with any non-dropped MG occasion within or outside the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1C.8.3. The collision rule between SMTC occasion and measurement gap occasion is defined in clause 9.1C.9.1

K_p = [1] when $N_{available_SAN}$ = 0 and measurement gap sharing in clause 9.1.2.1a shall apply.

K_p = 1 when intra-frequency SMTC is fully non overlapping with measurement gaps.

For calculation of K_p, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1*.

$K_{layer1_measurement}$: it is scaling factor for sharing between L3 and L1 measurement, and $K_{layer1_measurement}$ =1, if GEO satellites are measured on the carrier, or if LEO satellites are measured on the carrier and UE supports *parallelMeasurementWithoutRestriction-r17*, otherwise

$K_{layer1_measurement}$ =1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or
- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, and RSSI symbols are indicated by *SS-RSSI-Measurement*;

$K_{layer1_measurement}$ =1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$

Table 9.2C.5.1-1: Time period for PSS/SSS detection, (Frequency range FR1-NTN)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, ceil(5 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 5 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2C.5.1-2: Time period for time index detection (FR1-NTN)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120 ms, ceil(3 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil (1.5 x 3 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(3 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2C.5.1-3: Time period for time index detection (FR1) for a target cell with 12 PRB SSB

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120ms, ceil(7 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320ms	max(120ms, ceil (1.5 x 7 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	Ceil (7 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

The UE is allowed to skip measurements on intra-frequency cells, in the interval between *t-serviceStart* and the satellite switch completion, when it is performing soft satellite switching with resynchronization. In this case, for the measurement initiated but not completed before the beginning interval, the total time to detection can be longer.

The requirements in clause 9.2C.5.1 and 9.2C.5.2 are not applicable when the overall overhead ratio due to scheduling restriction caused by all configured SMTCs (i.e. scheduling restriction overhead of all SMTCs in one SMTC periodicity), is larger than 75%.

9.2C.5.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2C.5.2-1.

If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{SSB_measurement_period_intra}$

Table 9.2C.5.2-1: Measurement period for intra-frequency measurements without gaps (FR1-NTN)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, ceil(5 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

9.2C.5.3 Scheduling availability of UE during intra-frequency measurements

When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same serving carrier which can be merged [2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included. For UL, the scheduling restriction applies to UL symbols that fully or partially overlap with the restricted symbols as defined below.

9.2C.5.3.1 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1-NTN

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If *deriveSSB-IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer signalling of *smtc2* is configured(in TS 38.331 [2]), the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If *deriveSSB-IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

The UE is expected to receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and/or the corresponding PDSCH, on SSB symbols to be measured. if the following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots

9.2C.5.3.2 Scheduling availability of UE performing measurements on a neighbor cell served by a different satellite in LEO

For UE which does not support the capability *parallelMeasurementWithoutRestriction-r17* the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement on a neighbor cell served by a different satellite in LEO.

- If *deriveSSB-IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer signalling of *smtc2* is configured(in TS 38.331 [2]), the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If *deriveSSB-IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If the following conditions are met:

  - The UE has been notified about system information update through paging,

  - The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots

- The UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and/or the corresponding PDSCH, on SSB symbols to be measured.

9.2C.6 Intra-frequency measurements with measurement gaps

9.2C.6.1 Void

9.2C.6.2 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_with_index}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify_intra_without_index}$.

$$T_{identify_intra_without_index} = T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra} \text{ ms}$$

$$T_{identify_intra_with_index} = T_{PSS/SSS_sync_ntra} + T_{SSB_measurement_period_intra} + T_{SSB_time_index_intra} \text{ ms}$$

Where:

T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in table 9.2C.6.2-1.

$T_{SSB_time_index_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2C.6.2-2 , and 9.2C.6.2-3 with 12 PRB SSB BW..

$T_{SSB_measurement_period_intra}$: equal to a measurement period of SSB based measurement given in table 9.2C.6.3-1.

K_{gap} is the scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. K_{gap} = 1 when the UE is not configured with concurrent measurement gaps. When the UE is configured with concurrent measurement gaps and the two measurement gaps are fully overlapping with MGRP=160ms, K_{gap} = 2. Otherwise, $K_{gap} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

For a window W of duration max(SMTC period, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gap, and starting from the beginning of any SMTC occasion:

- N_{total} is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other measurement gap occasions within the window, and
- $N_{available}$ is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1.8.3.

K_{gap} is only applicable for UE supporting *parallelMeasurementGap-r17*. When concurrent measurement gaps are configured, requirements in this clause do not apply if $N_{available}$ =0, or if one SMTC overlaps more than one MGs associated to the frequency layer.

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

K_{multi_SMTC} is the scaling factor for measurement of multiple SMTCs or multiple satellites, and

if SMTCs within a measurement gap do not overlap with each other,

- $K_{multi_SMTC} = 1$, if GEO satellites are measured on the carrier;
- $K_{multi_SMTC} = \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if LEO satellites are measured on the carrier;

if SMTCs within a measurement gap partially overlap with each other,

- $K_{multi_SMTC} = N_{SMTC,overlap}$, if only GEO satellites are measured on the carrier;
- $K_{multi_SMTC} = \sum_{i=1}^{N_{SMTC,overlap}} \left\lceil \frac{N_{LEO,i}}{N_{LEO,simul}} \right\rceil$, if only LEO satellites are measured on the carrier;

where

- $N_{LEO,i}$ is the number of LEO satellites to be measured within i-th SMTC,
- $N_{LEO,simul}$ is the number of LEO satellites that UE can measure in parallel within an SMTC,
- $N_{SMTC,overlap}$ is the number of SMTCs that partially overlap with each other.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$.

Table 9.2C.6.2-1: Time period for PSS/SSS detection (FR1-NTN)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, 5 x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 5) x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	5 x K_{gap} x K_{multi_SMTC} x max(MGRP, DRX cycle) x $CSSF_{intra}$

Table 9.2C.6.2-2: Time period for time index detection (FR1-NTN)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120 ms, 3 x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil(1.5 x 3) x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320 ms	3 x K_{gap} x K_{multi_SMTC} x max(MGRP, DRX cycle) x $CSSF_{intra}$

Table 9.2C.6.2-3: Time period for time index detection (Frequency range FR1) for a target cell with 12 PRB SSB

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120ms, 7 x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(120ms, ceil(1.5 x 7) x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320ms	7 x K_{gap} x K_{multi_SMTC} x max(MGRP, DRX cycle) x $CSSF_{intra}$

9.2C.6.3 Intrafrequency Measurement Period

The measurement period for FR1 intrafrequency measurements with gaps is as shown in table 9.2C.6.3-1.

Table 9.2C.6.3-1: Measurement period for intra-frequency measurements with gaps (FR1-NTN)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, 5 x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5) x K_{multi_SMTC} x K_{gap} x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	5 x K_{gap} x K_{multi_SMTC} x max(MGRP, DRX cycle) x $CSSF_{intra}$

The UE is allowed to skip measurements on intra-frequency cells, in the interval between *t-serviceStart* and the satellite switch completion, when it is performing soft satellite switching with resynchronization. In this case, for the measurement initiated but not completed before the beginning of this interval, the total time to measure can be longer.

9.2C.7 Intra-frequency measurements without measurement gaps for NTN band above 10 GHz

9.2C.7.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index}$ if the UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_with_index}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify_intra_without_index}$.

$$T_{identify_intra_without_index} = (T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra})\ ms$$

$$T_{identify_intra_with_index} = (T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra} + T_{SSB_time_index_intra})\ ms$$

Where:

T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in table 9.2C.7.1-1

$T_{SSB_time_index_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2C.7.1-2

$T_{SSB_measurement_period_intra}$: equal to a measurement period of SSB based measurement given in table 9.2C.7.2-1

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined

according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps.

if the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

K_p is the scaling factor for an SSB frequency layer to be measured without measurement gaps. $K_p = N_{total_SAN} / N_{available_SAN}$, where $N_{available_SAN}$ and N_{total_SAN} are calculated as follows:

- For a window W of duration max(SMTC period, MGRP_max), where
  - If UE is configured with concurrent measurement gaps, MGRP max is the maximum MGRP across all configured per-UE measurement gap. Otherwise, MGRP max is the MGRP of configured measurement gap.
  - N_{total_SAN} is the total number of SMTC occasions within the window, including those overlapped and non-overlapped with measurement gap occasions within the window, and
  - $N_{available_SAN}$ is the number of SMTC occasions within the window W that do not collide with any non-dropped MG occasion within or outside the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1C.8.3. The collision rule between SMTC occasion and measurement gap occasion is defined in clause 9.1C.9.1

K_p = [1] when $N_{available_SAN} = 0$ and measurement gap sharing in clause 9.1.2.1a shall apply.

$K_p = 1$ when intra-frequency SMTC is fully non overlapping with measurement gaps.

For calculation of K_p, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1*.

$K_{layer1_measurement}$: it is scaling factor for sharing between L3 and L1 measurement, and $K_{layer1_measurement} = 1$

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and smtc2 is partially overlapping with measurement gaps, requirements are not specified for $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$

Table 9.2C.7.1-1: Time period for PSS/SSS detection

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, ceil(5 x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 5 x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2C.7.1-2: Time period for time index detection

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120 ms, ceil(3 x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil (1.5 x 3 x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(3 x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

9.2C.7.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2C.7.2-1.

If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{SSB_measurement_period_intra}$

Table 9.2C.7.2-1: Measurement period for intra-frequency measurements without gaps

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, ceil(5 x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

9.2C.7.3 Scheduling availability of UE during intra-frequency measurements

When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same serving carrier which can be merged [2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included. For UL, the scheduling restriction applies to UL symbols that fully or partially overlap with the restricted symbols as defined below.

9.2C.7.3.1 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on NTN bands above 10 GHz

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If *deriveSSB_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured within SMTC window duration. If the high layer signalling of *smtc2* is configured(in TS 38.331 [2]), the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If *deriveSSB_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

9.2C.8 Intra-frequency measurements with measurement gaps for NTN band above 10 GHz

9.2C.8.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_with_index}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify_intra_without_index}$.

$$T_{identify_intra_without_index} = T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra} \text{ ms}$$

$$T_{identify_intra_with_index} = T_{PSS/SSS_sync_ntra} + T_{SSB_measurement_period_intra} + T_{SSB_time_index_intra} \text{ ms}$$

Where:

T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in table 9.2C.8.2-1.

$T_{SSB_time_index_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2C.8.2-2.

$T_{SSB_measurement_period_intra}$: equal to a measurement period of SSB based measurement given in table 9.2C.8.3-1.

K_{gap} is the scaling factor for a SSB frequency layer to be measured within an associated a measurement gap pattern. K_{gap} = 1 when the UE is not configured with concurrent measurement gaps. When the UE is configured with concurrent measurement gaps and the two measurement gaps are fully overlapping with MGRP=160ms, K_{gap} = 2. Otherwise, $K_{gap} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

- For a window W of duration max(SMTC period, MGRP_max), where
  - If UE is configured with concurrent measurement gaps, MGRP max is the maximum MGRP across all configured per-UE measurement gap. Otherwise, MGRP max is the MGRP of configured measurement gap.
  - N_{total} is the total number of SMTC occasions within the window, including those overlapped and non-overlapped with measurement gap occasions within the window, and
  - $N_{available}$ is the number of SMTC occasions within the window W that do not collide with any non-dropped MG occasion within or outside the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1C.8.3. The collision rule between SMTC occasion and measurement gap occasion is defined in clause 9.1C.9.1

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$.

Table 9.2C.8.2-1: Time period for PSS/SSS detection

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, 5 x K_{gap} x max(MGRP, SMTC period)) x $CSSF_{intra}$

DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 5) x K_{gap} x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	5 x K_{gap} x max(MGRP, DRX cycle) x $CSSF_{intra}$

Table 9.2C.8.2-2: Time period for time index detection

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120 ms, 3 x K_{gap} x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil(1.5 x 3) x K_{gap} x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320 ms	3 x K_{gap} x max(MGRP, DRX cycle) x $CSSF_{intra}$

9.2C.8.3 Intra-frequency Measurement Period

The measurement period for intra-frequency measurements with gaps is as shown in table 9.2C.8.3-1.

Table 9.2C.8.3-1: Measurement period for intra-frequency measurements with gaps

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, 5 x K_{gap} x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5) x K_{gap} x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	5 x K_{gap} x max(MGRP, DRX cycle) x $CSSF_{intra}$

9.2D NR intra-frequency measurements for ATG

9.2D.1 Introduction

A measurement is defined as a SSB based intra-frequency measurement provided the SSB frequency configured in the measurement object associated with the serving cell indicated for measurement and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same.

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell, even if no explicit neighbour list with physical layer cell identities is provided.

The UE can perform intra-frequency SSB based measurements without measurement gaps if

- the UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement, or
- the SSB is completely contained in the active BWP of the UE, or
- the active downlink BWP is initial BWP[3].

The UE can perform intra-frequency SSB based measurement corresponding to a deactivated SCell with NCSG.

For intra-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.2D.5.3. SSB based measurements are configured along with one or two measurement timing configuration(s) (SMTC(s)) which provides periodicity, duration and offset information on a window of up to 5 ms where the measurements are to be performed. For intra-frequency connected mode measurements, up to two measurement window periodicities may be configured. A single measurement window offset and measurement duration are configured per intra-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB and measure RSSI of RSRQ which start earlier than the gap starting time + switching time, nor detect SSB and measure RSSI of RSRQ which end later than the gap end – switching time. Switching time is 0.5 ms for frequency range FR1.

The requirements in this clause shall also apply, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

The measurement requirements defined for an activated SCell with a non-dormant active BWP defined in this clause shall also apply to an activated SCell with dormant BWP as active BWP.

9.2D.2 Requirements applicability

The requirements in clause 9.2D apply, provided:

- The cell being identified or measured is detectable.

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clauses 10.1.2 for FR1, for a corresponding band,
- SS-RSRQ related side conditions given in clauses 10.1.7 for FR1, for a corresponding band,
- SS-SINR related side conditions given in clauses 10.1.12 for FR1, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding band.

9.2D.3 Number of cells and number of SSB

9.2D.3.1 Requirements for FR1

For each intra-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 8 identified cells, and
- 14 SSBs with different SSB index and/or PCI on the intra-frequency layer, where the number of SSBs in the serving cell (except for the SCell) is not smaller than the number of configured RLM-RS SSB resources.

9.2D.4 Measurement Reporting Requirements

9.2D.4.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.2.1 (RSRP for FR1), 10.1.7.1 (RSRQ for FR1) and 10.1.12.1 (RS-SINR for FR1).

9.2D.4.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.1.2.1 (RSRP for FR1), 10.1.7.1 (RSRQ for FR1) and 10.1.12.1 (RS-SINR for FR1).

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.2D.4.3.

9.2D.4.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.2.1 (RSRP for FR1), 10.1.7.1 (RSRQ for FR1) and 10.1.12.1 (RS-SINR for FR1).

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify\ intra\ without\ index}$ defined in clause 9.2D.5.1 or clause 9.2D.6.2. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ as defined in clause 9.2D.5.1 or clause 9.2D.6.2. If a cell which has been detectable at least for the time period $T_{identify\ intra\ without\ index}$ or $T_{identify\ intra\ with\ index}$ defined in clause 9.2D.5.1 or clause 9.2D.6.2 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again with the same spatial reception parameter and triggers an event, the event triggered measurement reporting delay shall be less than $T_{SSB_measurement_period_intra}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu} T_c$ while the measurement gap has not been available and L3 filtering has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

9.2D.4.4 SCell activation Triggered Reporting

The requirements in this clause shall apply for the UE supporting *l3-MeasUnknownSCellActivation-r18* and reporting valid L3 measurement results after receiving the SCell activation command for unknown SCell.

Reported RSRP, RSRQ, and RS-SINR measurements contained in SCell activation triggered measurement reports shall meet the requirements in clauses 10.1.2.1 (RSRP for FR1), 10.1.7.1 (RSRQ for FR1) and 10.1.12.1 (RS-SINR for FR1).

The measurement reporting delay is defined as the time between the SCell activation command that will trigger a measurement report and the point when the UE starts to transmit the valid measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The SCell activation triggered measurement reporting delay shall be no larger than T_{HARQ} + 3 ms + 4 ms, where

- T_{HARQ} is the timing between DL data transmission and acknowledgement in ms as specified in TS 38.213 [3],
- 3 ms is the MAC CE decoding time.
- 4 ms is the processing time for preparing L3 report triggered by MAC CE.
- UE is expected to report the L3 results no earlier than 3 ms + T_{HARQ} after receiving the SCell activation command.

The SCell activation triggered report is considered as valid if it fulfils the measurement requirements for a deactivated SCell as specified in table 9.2.5.2-3 (for FR1).

A cell is detectable only if at least one SSBs measured from the SCell being configured remains detectable during the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ as defined in clause 9.2.5.1. If a SCell which has been detectable at least for the time period $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$ defined in clause 9.2.5.1 becomes undetectable for a period ≤ 5 seconds and then the SCell becomes detectable again with the same spatial reception parameter, this cell is considered as detected provided the timing to that cell has not changed more than $\pm 3200/2^{\mu} T_c$ while the measurement gap has not been available and L3 filtering has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3].

9.2D.5 Intra-frequency measurements without measurement gaps

9.2D.5.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index}$ if the UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within $T_{identify_intra_with_index}$. The UE shall be able to identify a new detectable intra-frequency SS block of an already detected cell within $T_{identify_intra_without_index}$.

$$T_{identify_intra_without_index} = (T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra})\ ms$$

$$T_{identify_intra_with_index} = (T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra} + T_{SSB_time_index_intra})\ ms$$

Where:

T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in table 9.2D.5.1-1 or table 9.2D.5.1-2 (CC with deactivated SCell).

$T_{SSB_time_index_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2D.5.1-3 or table 9.2D.5.1-4 (CC with deactivated SCell).

$T_{SSB_measurement_period_intra}$: equal to a measurement period of SSB based measurement given in table 9.2D.5.2-1 or table 9.2D.5.2-2 (CC with deactivated SCell).

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1D.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to $CSSF_{within_gap,i}$ in clause 9.1D.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps.

For a UE that supports Pre-MG, an SMTC occasion is only considered to be overlapped by Pre-MG if the Pre-MG is activated.

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

When UE supports *concurrentMeasGap-r17* and is configured with concurrent measurement gaps,

K_p is the scaling factor for an SSB frequency layer to be measured without measurement gaps. $K_p = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

- For a window W of duration max(SMTC period, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gap, and starting from the beginning of any SMTC occasion:
  - N_{total} is the total number of SMTC occasions within the window, including those overlapped with measurement gap occasions within the window, and
  - $N_{available}$ is the number of SMTC occasions that are not overlapped with any non-dropped MG occasion within the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1.8.3.

    $K_p = 1$ when $N_{available} = 0$.
- Otherwise, when UE is not configured with or UE does not support concurrent measurement gaps:

  When intra-frequency SMTC is fully non overlapping with measurement gaps or NCSG, or intra-frequency SMTC is fully overlapping with MGs or NCSG, K_p=1

  When intra-frequency SMTC is partially overlapping with measurement gaps, K_p = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP. When intra-frequency SMTC is partially overlapping with NCSG, K_p = 1/(1- (SMTC period /VIRP)), where SMTC period < VIRP. For calculation of K_p, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1*. If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$

For UE capable of *antennaArrayType-r18* on the measured carrier,

$K_{layer1_measurement}$=1,

If inter-band carrier aggregation within FR1 is configured, and UE not capable of antennaArrayType-r18 on the other serving carrier, or UE capable of antennaArrayType-r18 on the other serving carrier and UE support two simultaneous separate Rx beams

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on one serving cell outside measurement gap are not fully overlapped by intra-frequency SMTC occasions of the same serving cell, or

- if the measured carrier is the SCC with servingcellMO configured, and the network indication *neighSCellMeasSkipping* is set to 'enable' to UE

Otherwise,

If the measured carrier is the SCC with servingcellMO configured, and the network indication *neighSCellMeasSkipping* is set to 'enable' to UE

- if SMTC occasion for PCC and SCC are not overlapped in the time domain, or
- if SMTC occasion for PCC and SCC are overlapped in the time domain, and all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any serving frequency outside measurement gap are not fully overlapped by overlapped SMTC occasions of serving cells

Otherwise,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any serving frequency outside measurement gap are not fully overlapped by intra-frequency SMTC occasions

$K_{layer1_measurement}$=1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

Otherwise, $K_{layer1_measurement}$=1

Table 9.2D.5.1-1: Time period for PSS/SSS detection, (FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, ceil(5 x K_p x N1[Note 3,4] x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 5 x K_p x N1[Note 3,4] x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x K_p x N1 [Note 3,4] x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: void.	
NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance information on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	
NOTE 4: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and inter-band carrier aggregation within FR1 is configured and UE not capable of antennaArrayType-r18 on the other serving carrier or UE support two simultaneous separate Rx beams, or when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and SMTC occasion for PCC and SCC are not overlapped in the time domain and intra-band carrier aggregation within FR1 is configured or inter-band carrier aggregation within FR1 is configured and UE support one common Rx beam. Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided.	

Table 9.2D.5.1-2: Time period for PSS/SSS detection, CC with deactivated SCell (FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	Ceil(5 x K_p x N1[Note 1,2]) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(5 x K_p x N1[Note 1,2]) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(5 x K_p x N1[Note 1,2]) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance information on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	
NOTE 2: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and inter-band carrier aggregation within FR1 is configured and UE not capable of antennaArrayType-r18 on the other serving carrier or UE support two simultaneous separate Rx beams, or when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and SMTC occasion for PCC and SCC are not overlapped in the time	

domain and intra-band carrier aggregation within FR1 is configured or inter-band carrier aggregation within FR1 is configured and UE support one common Rx beam. Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided.

Table 9.2D.5.1-3: Time period for time index detection (FR1)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120 ms, ceil(3 x K_p x N1 [Note 3,4] x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil (1.5 x 3 x K_p x N1 [Note 3,4] x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(3 x K_p x N1 [Note 3,4] x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: void	
NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	
NOTE 4: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and inter-band carrier aggregation within FR1 is configured and UE not capable of antennaArrayType-r18 on the other serving carrier or UE support two simultaneous separate Rx beams, or when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and SMTC occasion for PCC and SCC are not overlapped in the time domain and intra-band carrier aggregation within FR1 is configured or inter-band carrier aggregation within FR1 is configured and UE support one common Rx beam. Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided.	

Table 9.2D.5.1-4: Time period for time index detection, CC with deactivated SCell (FR1)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	Ceil(3 x K_p x N1[Note 1,2]) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(3 x K_p x N1[Note 1,2]) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(3 x K_p x N1[Note 1,2]) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance information on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	
NOTE 2: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and inter-band carrier aggregation within FR1 is configured and UE not capable of antennaArrayType-r18 on the other serving carrier or UE support two simultaneous separate Rx beams, or when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and SMTC occasion for PCC and SCC are not overlapped in the time domain and intra-band carrier aggregation within FR1 is configured or inter-band carrier aggregation within FR1 is configured and UE support one common Rx beam. Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided.	

9.2D.5.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2D.5.2-1, 9.2D.5.2-2(CC with deactivated SCell).

If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{SSB_measurement_period_intra}$

For a UE that supports Pre-MG, an SMTC occasion is only considered to be overlapped by Pre-MG if the Pre-MG is activated.

Table 9.2D.5.2-1: Measurement period for intra-frequency measurements without gaps (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$

No DRX	max(200 ms, ceil(5 x K_p x N1 [Note 2,3] x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x K_p x N1 [Note 2,3] x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x K_p x N1 [Note 2,3] x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	
NOTE 3: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and inter-band carrier aggregation within FR1 is configured and UE not capable of antennaArrayType-r18 on the other serving carrier or UE support two simultaneous separate Rx beams, or when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and SMTC occasion for PCC and SCC are not overlapped in the time domain and intra-band carrier aggregation within FR1 is configured or inter-band carrier aggregation within FR1 is configured and UE support one common Rx beam. Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided.	

Table 9.2D.5.2-2: Measurement period for intra-frequency measurements without gaps (CC with deactivated SCell) (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	Ceil(5 x K_p x N1 [Note 2,3]) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(1.5x 5 x K_p x N1 [Note 2,3]) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(5 x K_p x N1 [Note 2,3]) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	
NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1=1 when the network indication *skippingSCCneighbourCellMeas* is set to 'enable' to UE. Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided.	

9.2D.5.3 Scheduling availability of UE during intra-frequency measurements

UE shall be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same serving carrier which can be merged [2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

For a UE that supports Pre-MG, the requirements in clause 9.2D.5.3 also apply when a Pre-MG is deactivated.

9.2D.5.3.1 Scheduling availability of UE performing measurements on FR1

When the ATG UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- If *deriveSSB-IndexFromCell* is enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

- If *deriveSSB-IndexFromCell* is not enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When TDD inter-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this band pair.

When the ATG UE capable of *antennaArrayType-r18* performs intra-frequency neighbouring cell measurements, the following restrictions apply due to SS-RSRP or SS-SINR measurement:

- If *deriveSSB-IndexFromCell* is enabled, the UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows *smtc1*.

- If *deriveSSB-IndexFromCell* is not enabled, the UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When intra-band carrier aggregation is performed and the ATG UE is capable of *antennaArrayType-r18*, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation is performed and the ATG UE is capable of *common Rx beam between PCC band and SCC band*, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When the ATG UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- If *deriveSSB-IndexFromCell* is enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If *deriveSSB-IndexFromCell* is not enabled, the UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When TDD inter-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this band pair.

When the ATG UE capable of *antennaArrayType-r18* performs intra-frequency neighbouring cell measurements, the following restrictions apply due to SS-RSRQ measurement:

- If *deriveSSB-IndexFromCell* is enabled, the UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration. If the high layer signaling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If *deriveSSB-IndexFromCell* is not enabled, the UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When intra-band carrier aggregation is performed and the ATG UE is capable of *antennaArrayType-r18*, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation is performed and the ATG UE is capable of *common Rx beam between PCC band and SCC band*, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.2D.5.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which does not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If *deriveSSB-IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer signalling of *smtc2* is configured(in TS 38.331 [2]), the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If *deriveSSB-IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

If the following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots

The UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and/or the corresponding PDSCH, on SSB symbols to be measured.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.2D.6 Intra-frequency measurements with measurement gaps

9.2D.6.1 Void

9.2D.6.2 Intra-frequency cell identification

When a measurement gap is provided or an activated Pre-MG is provided without any pre-MG status changed during the measurement period, the UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_with_index.}$ The UE shall be able to identify a new detectable intra-frequency SS block of an already detected cell within $T_{identify_intra_without_index.}$

$$T_{identify_intra_without_index} = T_{PSS/SSS_sync_intra} + T_{SSB_measurement_period_intra}\ ms$$

$$T_{identify_intra_with_index} = T_{PSS/SSS_sync_ntra} + T_{SSB_measurement_period_intra} + T_{SSB_time_index_intra}\ ms$$

Where:

- T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in table 9.2D.6.2-1.

- $T_{SSB_time_index_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2D.6.2-3.

- $T_{SSB_measurement_period_intra}$: equal to a measurement period of SSB based measurement given in table 9.2D.6.3-1.

- $CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1D.5.2 for measurement conducted within measurement gaps.

- K_{gap} is the scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. $K_{gap} = 1$ when the UE is not configured with concurrent measurement gaps. Otherwise, $K_{gap} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

  - For a window W of duration max(SMTC period, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gap, and starting from the beginning of any SMTC occasion:

  - N_{total} is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other measurement gap occasions within the window, and

  - $N_{available}$ is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1.8.3.

  When concurrent measurement gaps are configured, requirements in this clause do not apply if $N_{available} = 0$.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{identify_intra_without_index}$ or $T_{identify_intra_with_index}$.

Table 9.2D.6.2-1: Time period for PSS/SSS detection (FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, 5 x K_{gap} x N1 [Note 2] x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 5 x K_{gap} x N1 [Note 2]) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(5 x K_{gap} x N1 [Note 2]) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: void. NOTE 2: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	

Table 9.2D.6.2-2: void

Table 9.2D.6.2-3: Time period for time index detection (Frequency range FR1)

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(120 ms, ceil(3 x K_{gap} x N1 [Note 2]) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil(1.5 x 3 x K_{gap} x N1 [Note 2]) x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320 ms	Ceil(3 x K_{gap} x N1 [Note 2])x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: void. NOTE 2: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	

9.2D.6.3 Intra-frequency Measurement Period

The requirements in this clause apply when a measurement gap is provided or when an activated Pre-MG is provided without any pre-MG status changed during the measurement period.

The measurement period for FR1 intra frequency measurements with gaps is as shown in table 9.2D.6.3-1.

Longer measurement period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

Table 9.2D.6.3-1: Measurement period for intra-frequency measurements with gaps(FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, ceil(5 x K_{gap} x N1 [Note 1])x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	Max(200 ms, ceil(1.5x 5 x K_{gap} x N1 [Note 1]) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(5 x K_{gap} x N1 [Note 1]) x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	

9.2E NR intra-frequency measurements for RedCap with SAN

9.2E.1 Introduction

The requirements in clause 9.2E apply for intra-frequency measurements for RedCap on an SAN carrier frequency. The requirements apply provided that the valid parameters of ephemeris information, epoch time of the ephemeris, common TA, validity timer information, downlink polarization information for target NR SAN cell are send to UE.

The requirements in clause 9.2C.1 shall apply except that

- clause 9.2C is replaced with clause 9.2E, and
- clause 9.2C.4 is replaced with clause 9.2E.4, and
- clause 9.2C.5 is replaced with clause 9.2E.5, and
- clause 9.2C.6 is replaced with clause 9.2E.6

9.2E.2 Requirements applicability

The requirements in clause 9.2E apply, provided:

- The cell being identified or measured is detectable.
- Valid information for the satellite serving the target cell has been provided

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- For 2Rx RedCap with NTN:
  - SS-RSRP related side conditions given in clauses 10.1.2C for FR1 and 10.1.3C for FR2-NTN, for a corresponding band,
  - SS-RSRQ related side conditions given in clauses 10.1.7C for FR1 and 10.1.8C for FR2-NTN, for a corresponding band,
  - SS-SINR related side conditions given in clauses 10.1.12C for FR1 and 10.1.13C for FR2-NTN, for a corresponding band,
  - SSB_RP and SSB Ês/Iot according to Annex B.2.17 for a corresponding band.
- For 1Rx RedCap with NTN:
  - SS-RSRP related side conditions given in clause 10.1.2D for FR1 for a corresponding band,
  - SS-RSRQ related side conditions given in clause 10.1.6D for FR1 for a corresponding band,
  - SS-SINR related side conditions given in clause 10.1.10D for FR1 for a corresponding band,

- SSB_RP and SSB Ês/Iot according to Annex B.2.15 for a corresponding band.

9.2E.3 Number of cells and number of SSB

9.2E.3.1 Requirements for FR1

The requirements in clause 9.2C.3.1 shall apply.

9.2E.4 Measurement Reporting Requirements

9.2E.4.1 Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.2D.1 (SS-RSRP for FR1), 10.1.6D.1 (SS-RSRQ for FR1) and 10.1.10D.1 (SS-SINR for FR1).

9.2E.4.2 Event-triggered Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.2D.1 (SS-RSRP for FR1), 10.1.6D.1 (SS-RSRQ for FR1) and 10.1.10D.1 (SS-SINR for FR1).

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.2E.4.3.

9.2E.4.3 Event Triggered Reporting

The requirements for FR1 in clause 9.2C.4.3 shall apply except that

- Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.2D.1 (SS-RSRP for FR1), 10.1.6D.1 (SS-RSRQ for FR1) and 10.1.10D.1 (SS-SINR for FR1), and

- clause 9.2C.5.1 is replaced with 9.2E.5.1, and

- clause 9.2C.6.2 is replaced with 9.2E.6.2.

9.2E.5 Intra-frequency measurements without measurement gaps

9.2E.5.1 Intra-frequency cell identification

The requirements in clause 9.2C.5.1 shall apply except that:

- T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in table 9.2C.5.1-1 for 2Rx RedCap UE and table 9.2E.5.1-1 for 1Rx RedCap UE, and

- $T_{SSB_time_index_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2C.5.1-2 for 2Rx RedCap UE and table 9.2E.5.1-2 for 1Rx RedCap UE, and

- $T_{SSB_measurement_period_intra}$: equal to a measurement period of SSB based measurement given in table 9.2C.5.2-1 for 2Rx RedCap UE and table 9.2E.5.2-1 for 1Rx RedCap UE, and

- $CSSF_{intra_RedCap}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap_RedCap,i}$ in clause 9.1A.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to $CSSF_{within_gap_RedCap,i}$ in clause 9.1A.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps, and

- clause 9.1C.8.3 is replaced with 9.1E.8.3, and

- clause 9.1C.9.1 is replaced with 9.1E.9.1, and
- clause 9.2C.5.1 is replaced with 9.2E.5.1, and
- clause 9.2C.5.2 is replaced with 9.2E.5.2.

Table 9.2E.5.1-1: Time period for PSS/SSS detection, (Frequency range FR1) for 1Rx RedCap UE with NTN

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, ceil(7 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x SMTC period)[Note 1] x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 7 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x max(SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	ceil(7 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x DRX cycle x $CSSF_{intra_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2E.5.1-2: Time period for time index detection (FR1) for 1Rx RedCap UE with NTN

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(160 ms, ceil(6 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x SMTC period)[Note 1] x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(160 ms, ceil (1.5 x 6 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x max(SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	Ceil(6 x K_p x $K_{layer1_measurement}$) x K_{multi_SMTC} x DRX cycle x $CSSF_{intra_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

9.2E.5.2 Measurement period

The requirements in clause 9.2C.5.2 shall apply except that:

- The measurement period for intra-frequency measurements without gaps is as shown in table 9.2C.5.2-1 for 1Rx RedCap UE and 2Rx RedCap UE.

9.2E.5.3 Scheduling availability of UE during intra-frequency measurements

The requirements in clause 9.2C.5.3 shall apply.

9.2E.5.3.1 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

The requirements in clause 9.2C.5.3.1 shall apply.

9.2E.5.3.2 Scheduling availability of UE performing measurements on a neighbor cell served by a different satellite in LEO

The requirements in clause 9.2C.5.3.1 shall apply.

9.2E.5.3.4 Scheduling availability of UE performing measurements in HD-FDD bands on FR1

The requirements in clause 9.2B.5.3.4 shall apply.

9.2E.6 Intra-frequency measurements with measurement gaps

9.2E.6.1 Intra-frequency cell identification

The requirements in clause 9.2C.6.1 shall apply except that:

- T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in table 9.2C.6.1-1 for 2Rx RedCap UE and table 9.2E.6.1-1 for 1Rx RedCap UE, and
- $T_{SSB_time_index_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2C.6.1-2 for 2Rx RedCap UE and table 9.2E.6.1-2 for 1Rx RedCap UE, and
- $T_{SSB_measurement_period_intra}$: equal to a measurement period of SSB based measurement given in table 9.2C.6.2-1 for 2Rx RedCap UE and table 9.2E.6.1-1for 1Rx RedCap UE, and
- clause 9.1.5.2 is replaced with 9.1E.5.2, and
- clause 9.1C.8.3 is replaced with 9.1E.8.3.

Table 9.2E.6.1-1: Time period for PSS/SSS detection (FR1) for 1Rx RedCap UE

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600 ms, 7 x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period)) x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x 7) x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	7 x K_{gap} x K_{multi_SMTC} x max(MGRP, DRX cycle) x $CSSF_{intra_RedCap}$

Table 9.2E.6.1-2: Time period for time index detection (FR1) for 1Rx RedCap UE

DRX cycle	$T_{SSB_time_index_intra}$
No DRX	max(160 ms, 6 x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period)) x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(160 ms, ceil(1.5 x 6) x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320 ms	6 x K_{gap} x K_{multi_SMTC} x max(MGRP, DRX cycle) x $CSSF_{intra}$

9.2E.6.2 Intra-frequency Measurement Period

The requirements in clause 9.2C.6.3 shall apply except that:

- The measurement period for intra-frequency measurements without gaps is as shown in table 9.2E.6.2-1 for 1Rx RedCap UE and 2Rx RedCap UE.Table 9.2E.6.2-1: Measurement period for intra-frequency measurements with gaps (FR1) for RedCap UE

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, 5 x K_{gap} x K_{multi_SMTC} x max(MGRP, SMTC period)) x $CSSF_{intra_RedCap}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5) x K_{multi_SMTC} x K_{gap} x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra_RedCap}$
DRX cycle>320 ms	5 x K_{gap} x K_{multi_SMTC} x max(MGRP, DRX cycle) x $CSSF_{intra_RedCap}$

9.3 NR inter-frequency measurements

9.3.1 Introduction

A measurement is defined as an SSB based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.2.

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-frequency cells if carrier frequency information is provided by PCell or PSCell, even if no explicit neighbour list with physical layer cell identities is provided.

A measurement is defined as an inter-frequency SSB based measurements without measurement gaps (either legacy measurement gap or NCSG) in active BWP, for UE capable of *interFrequencyMeas-NoGap* provided that

- the UE supports *interFrequencyMeas-Nogap-r16* [15], and
- the SSB is completely contained in the active BWP of the UE.
  - For inter-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.3.9.3.
  - Note: Non-CA capable UE is not expected to indicate support of *interFrequencyMeas-Nogap-r16* [15].

Besides the conditions listed above,

- for UE supporting *nr-NeedForGapNCSG-reporting-r17* and indicating *NeedForGapNCSG-InfoNR* for inter-frequency measurement,
  - An inter-frequency SSB measurement is defined as measurement without gap if
    - the UE indicates 'nogap-noncsg' via *NeedForGapNCSG-InfoNR* for the inter-frequency measurement, and
    - the SSB is not completely contained in the active BWP of the UE
    - For inter-frequency SSB based measurements without MG and NCSG, UE may cause scheduling restriction as specified in clause 9.3.9.4.
  - An inter-frequency SSB measurement is defined as measurement with NCSG if
    - the UE indicates 'ncsg' via *NeedForGapNCSG-InfoNR* for the inter-frequency measurement, and
    - the SSB is not completely contained in the active BWP of the UE
    - For inter-frequency SSB based measurements with NCSG, UE may cause scheduling restriction as specified in clause 9.3.10.3.
  - An inter-frequency SSB measurement is defined as measurement with gap if
    - the UE indicates 'gap' via *NeedForGapNCSG-InfoNR* for the inter-frequency measurement, and
    - the SSB is not completely contained in the active BWP of the UE
- for UE supporting *nr-NeedForInterruptionReport-r18* and indicating *NeedForInterruptionInfoNR* for inter-frequency measurement,
  - An inter-frequency SSB measurement is defined as measurement without gap if
    - the UE indicates 'no-gap' via *NeedForGapsInfoNR* and the UE indicates '*no-gap-no-interruption*' or *no-gap-with-interruption* via *NeedForInterruptionInfoNR-r18* for the inter-frequency measurement, and
    - the SSB is not completely contained in the active BWP of the UE

    During inter-frequency SSB based measurements without gap, UE may cause scheduling restriction as specified in clause 9.3.9.4.
- An inter-frequency SSB measurement is defined as measurement with gap if
  - the UE indicates 'gap' via *NeedForGap-InfoNR* for the inter-frequency measurement.

SSB based measurements are configured along with a measurement timing configuration (SMTC) per carrier, which provides periodicity, duration and offset information on a window of up to 5 ms where the measurements on the configured inter-frequency carrier are to be performed. For inter-frequency connected mode measurements, one measurement window periodicity may be configured per inter-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB and measure RSSI of RSRQ on an inter-frequency measurement object which start earlier than the gap starting time + switching time, nor detect SSB and measure RSSI of RSRQ which ends later than the gap end – switching time. When the inter-frequency cells are in FR2 and the per-FR gap is configured to the UE in EN-DC, SA NR, NE-DC and NR-DC, or the serving cells are in FR2, the inter-frequency cells are in FR2 and the per-UE gap is configured to the UE in SA NR and NR-DC, the switching time is 0.25 ms. Otherwise the switching time is 0.5 ms.

The requirements in this clause shall also apply, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

Longer measurement period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

The measurement requirements defined in clause 9.3 do not apply if the UE is configured with *needForGapNCSG-ConfigNR-r17* and *needForInterruptionConfigNR-r18* at the same time.

The inter-frequency measurement requirements in clause 9.3.4 and clause 9.3.5 applies for the following scenarios:

- SSB-based inter-frequency measurement object with measurement gap.
- SSB-based inter-frequency measurement object without measurement gap for UE capable of *interFrequencyMeas-NoGap*, when
  - all of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent measurement gaps, or
  - part of the SMTC occasions of this inter-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this inter-frequency measurement object are overlapped with the union of concurrent measurement gaps, or
  - part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or associated measurement gap in concurrent measurement gaps and the flag *interFrequencyConfig-NoGap-r16* is not configured by the Network.
- part of the SMTC occasions of this inter-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this inter-frequency measurement object are overlapped with the union of concurrent measurement gaps or the union of concurrent measurement gaps and MUSIM gaps if MUSIM gaps are configured.
  - no requirement applies if all of the SMTC occasions of this inter-frequency measurement object are overlapped with MUSIM gaps if MUSIM gaps are configured.
- SSB-based inter-frequency measurement object without measurement gap for UE capable of *NeedForInterruptionInfoNR-r18*, when
  - all of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent measurement gaps for the UE indicating 'no-gap' via *NeedForGapsInfoNR* and '*no-gap-with-interruption*' or '*no-gap-no-interruption*' via *NeedForInterruptionInfoNR-r18* for the inter-frequency measurement, or
  - part of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent measurement gaps for the UE indicates 'no-gap' via *NeedForGapsInfoNR* and '*no-gap-with-interruption*' via *NeedForInterruptionInfoNR-r18* for the inter-frequency measurement.

The inter-frequency measurement requirements in clause 9.3.9 applies for the following scenarios:

- SSB-based inter-frequency measurement with no measurement gap, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement with no measurement gap, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement with no measurement gap, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps or MUSIM gaps if MUSIM gaps are configured, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement with no measurement gap, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps or MUSIM gaps if MUSIM gaps are configured, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- for UE indicating *NeedForInterruptionInfoNR-r18*, when

  - none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps for the UE indicates 'no-gap' via *NeedForGapsInfoNR* and '*no-gap-with-interruption*' or '*no-gap-no-interruption*' via *NeedForInterruptionInfoNR* for the inter-frequency measurement.

  - part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps, for the UE indicates 'no-gap' via *NeedForGapsInfoNR* and '*no-gap-no-interruption*' via *NeedForInterruptionInfoNR* for the inter-frequency measurement.

  - none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps or MUSIM gaps if MUSIM gaps are configured, for the UE indicates 'no-gap' via *NeedForGap-InfoNR* and '*no-gap-with-interruption*' or '*no-gap-no-interruption*' via *NeedForInterruptionInfoNR-r18* for the inter-frequency measurement.

  - part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps or MUSIM gaps if MUSIM gaps are configured, for the UE indicates 'no-gap' via *NeedForGap-InfoNR* and '*no-gap-no-interruption*' via *NeedForInterruptionInfoNR* for the inter-frequency measurement.

    The interruption requirement during inter-frequency measurement without gap is defined in clause 8.2.2.2.19 when UE indicate '*no-gap-with-interruption*' via *NeedForInterruptionInfoNR-r18*.

    No interruption is allowed due to inter-frequency measurement without gap when following conditions are met:

    - the SSB is completely contained in the active BWP of the UE, or

    - UE indicates "*no-gap-no-interruption*", or

    - UE indicates "*no-gap-with-interruption*" but inter-frequency SMTC is partially or fully overlapping with measurement gaps,

The inter-frequency measurement requirements in clause 9.3.10 applies for the following scenarios:

- SSB-based inter-frequency measurement object without measurement gap, when all of the SMTC occasions of this inter-frequency measurement object are overlapped by the NCSG;

- SSB-based inter-frequency measurement object with NCSG.

9.3.2 Requirements applicability

The requirements in clause 9.3 apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clauses 10.1.4 and 10.1.5 for FR1 and FR2, respectively, for a corresponding band,
- SS-RSRQ related side conditions given in clauses 10.1.9 and 10.1.10 for FR1 and FR2, respectively, for a corresponding band,
- SS-SINR related side conditions given in clauses 10.1.14 and 10.1.15 for FR1 and FR2, respectively, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding band.

9.3.2.1 Void

9.3.2.2 Void

9.3.3 Number of cells and number of SSB

9.3.3.1 Requirements for FR1

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 4 identified cells, and
- 7 SSBs with different SSB index and/or PCI on the inter-frequency layer.

9.3.3.2 Requirements for FR2

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 4 identified cells, and
- 10 SSBs with different SSB index and/or PCI on the inter-frequency layer, and
- 1 SSB per identified cell.

9.3.4 Inter-frequency measurement with measurement gaps

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured) or *deriveSSB-IndexFromCellInter-r17* is configured for the FR1 and FR2-1 target frequency layers and UE supporting *deriveSSB-IndexFromCellInterNon-NCSG-r17*. Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. The UE shall be able to identify a new detectable inter-frequency SS block of an already detected cell within $T_{identify_inter_without_index}$.

$$T_{identify_inter_without_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter} + T_{SSB_processing}) \text{ ms}$$

$$T_{identify_inter_with_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter} + T_{SSB_time_index_inter}) \text{ ms}$$

Where:

T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3.4-1, table 9.3.4-2, table 9.3.4-5 when *highSpeedMeasInterFreq-r17* is configured and UE supports measurementEnhancementInterFreq-r17 and table 9.3.4-9 when *highSpeedMeasFlagFR2-r17* is configured and UE supports *measEnhCAInterFreqFR2-r18*. When the SCG is deactivated, table 9.3.4-7 applies for an inter-frequency carrier configured by SCG and not configured by MCG and table 9.3.4-2 applies for an inter-frequency carrier configured by both SCG and MCG. Regardless of whether the SCG is activated or deactivated, table 9.3.4-2 applies for an inter-frequency carrier configured only by MCG.

- For UE supporting power class 6 and *measEnhCAInterFreqFR2-r18* with *highSpeedMeasFlagFR2-r17* configured, if SMTC ≤ 40ms, T_{PSS/SSS_sync_inter} is given in table 9.3.4-9; otherwise, T_{PSS/SSS_sync_inter} is given in table 9.3.4-2.

- For UE configured with measurement gap cancellation according to clause 9.1.14, the T_{PSS/SSS_sync_inter} is given in tables 9.3.4-12 and 9.3.4-13, for FR1 and FR2-1, respectively, provided the configurations and conditions in clause 9.1.14.3 are met.

$T_{SSB_time_index_inter}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3.4-3, table 9.3.4-6 when *highSpeedMeasInterFreq* is configured and UE supports measurementEnhancementInterFreq-r17, and table 9.3.4-10 when *highSpeedMeasFlagFR2-r17* is configured and UE supports *measEnhCAInterFreqFR2-r18*. When the SCG is deactivated, table 9.3.4-8 applies for an inter-frequency carrier configured by SCG and not configured by MCG and table 9.3.4-4 applies for an inter-frequency carrier configured by both SCG and MCG. Regardless of whether the SCG is activated or deactivated, table 9.3.4-4 applies for an inter-frequency carrier configured only by MCG.

- For UE supporting power class 6 and *measEnhCAInterFreqFR2-r18* with *highSpeedMeasFlagFR2-r17* configured, if SMTC ≤ 40ms, $T_{SSB_measurement_period_inter}$ is given in table 9.3.5-5; otherwise, $T_{SSB_measurement_period_inter}$ is given in table 9.3.5-2.

- For UE configured with measurement gap cancellation according to clause 9.1.14, the $T_{SSB_time_index_inter}$ is given in tables 9.3.4-14 and 9.3.4-15, for FR1 and FR2-1, respectively, provided the configurations and conditions in clause 9.1.14.3 are met.

$T_{SSB_measurement_period_inter}$: equal to a measurement period of SSB based measurement given in table 9.3.5-1, table 9.3.5-2, table 9.3.5-3 when *highSpeedMeasInterFreq* is configured and UE supports measurementEnhancementInterFreq-r17, and in table 9.3.5-5 when *highSpeedMeasFlagFR2-r17* is configured and UE supports *measEnhCAInterFreqFR2-r18*. When the SCG is deactivated, table 9.3.5-4 applies for an inter-frequency carrier configured by SCG and not configured by MCG and table 9.3.5-2 applies for an inter-frequency carrier configured by both SCG and MCG. Regardless of whether the SCG is activated or deactivated, table 9.3.5-2 applies for an inter-frequency carrier configured only by MCG.

$T_{SSB_processing}$: the time period used to process multiple beams received in one SMTC. $T_{SSB_processing}$ = 2 ms for UE supporting *Rel-19 L3 fast Rx beam sweeping*, when the conditions in clause 3.6.21 are fulfilled. Otherwise, $T_{SSB_processing}$ = 0.

- For UE indicating *support3MHz-ChannelBW-Symmetric-r18* and configured to operate on a target cell with 12 PRB SSB in FR1, $T_{SSB_time_index_intra_less_than_5Mhz}$ is given in table 9.3.4-11.

- For UE supporting power class 6 and *measEnhCAInterFreqFR2-r18* with *highSpeedMeasFlagFR2-r17* configured, $T_{SSB_measurement_period_inter}$ is given in table 9.3.5-5; otherwise, $T_{SSB_measurement_period_inter}$ is given in table 9.3.5-2.

- For UE configured with measurement gap cancellation according to clause 9.1.14, the $T_{SSB_measurement_period_inter}$ is given in section 9.3.5, tables 9.3.5-6 and 9.3.5-7, for FR1 and FR2-1, respectively, provided the configurations and conditions in clause 9.1.14.3 are met.

M_{pss/sss_sync_inter}: For a UE supporting FR2-1 power class 1 or 5, M_{pss/sss_sync_inter} = 64 samples. For a UE supporting FR2-1 power class 2, M_{pss/sss_sync_inter} = 40 samples. For a UE supporting FR2-1 power class 3, M_{pss/sss_sync_inter} = 40 samples. For a UE supporting FR2-1 power class 4, M_{pss/sss_sync_inter} = 40 samples. For a UE supporting FR2-2 power class 1, M_{pss/sss_sync_inter} = 96. For a UE supporting FR2-2 power class 2, M_{pss/sss_sync_inter} = 60. For a UE supporting FR2-2 power class 3, M_{pss/sss_sync_inter} = 60.

$M_{SSB_index_inter}$: For a UE supporting FR2-1 power class 1 or 5, $M_{SSB_index_inter}$ = 40 samples. For a UE supporting FR2 power class 2, $M_{SSB_index_inter}$ = 24 samples. For a UE supporting FR2-1 power class 3, $M_{SSB_index_inter}$ = 24 samples. For a UE supporting FR2-1 power class 4, $M_{SSB_index_inter}$ = 24 samples. For a UE supporting FR2-2 power class 2 or 3, $M_{SSB_index_inter}$ = 48 samples. For a UE supporting FR2 power class 1, $M_{SSB_index_inter}$ = 72 samples.

$M_{meas_period_inter}$: For a UE supporting FR2-1 power class 1 or 5, $M_{meas_period_inter}$ =64. For a UE supporting FR2-1 power class 2, $M_{meas_period_inter}$=40. For a UE supporting FR2-1 power class 3, $M_{meas_period_inter}$ =40. For a UE supporting FR2-1 power class 4, $M_{meas_period_inter}$ = 40. For a UE supporting FR2-2 power class 1, $M_{meas_period_inter}$ =

96. For a UE supporting FR2-2 power class 2, $M_{meas_period_inter}$ = 60. For a UE supporting FR2-2 power class 3, $M_{meas_period_inter}$ = 60.

For a UE that supports *Rel-19 L3 fast Rx beam sweeping*, when the conditions in clause 3.6.21 are fulfilled and when *highSpeedMeasFlagFR2-r17* is not configured, the following values shall apply for M_{pss/sss_sync_inter}, $M_{SSB_index_inter}$ and $M_{meas_period_inter}$:

M_{pss/sss_sync_inter}: For a UE supporting FR2-1 power class 3, M_{pss/sss_sync_inter} =5* $N_{reduced_Rx_BSF}$.

$M_{SSB_index_inter}$: For a UE supporting FR2-1 power class 3, $M_{SSB_index_inter}$ = 3* $N_{reduced_Rx_BSF}$.

$M_{meas_period_inter}$: For a UE supporting FR2-1 power class 3, $M_{meas_period_inter}$ =5* $N_{reduced_Rx_BSF}$.

Where,

$N_{reduced_Rx_BSF}$ is the reduced UE Rx beam sweeping factor reported by UE via *Rel-19 L3 fast Rx beam sweeping*.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

K_{gap} is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. K_{gap} = 1 when the UE is not configured with concurrent GAPs or MUSIM gaps. Otherwise, $K_{gap} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

- For a window W of duration max(SMTC period, xRP_max), where xRP_max is the maximum xRP across all configured per-UE measurement GAPs, periodic MUSIM gaps, and/or per-FR measurement GAPs within the same FR, and starting from the beginning of any SMTC occasion:
  - N_{total} is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other GAP occasions and MUSIM gap occasions within the window, and
  - $N_{available}$ is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W, after accounting for measurement GAP and MUSIM gap collisions by applying the collision rules for the GAP and MUSIM gap in clauses 9.1.8.3, 9.1.10.5, 9.1.12.3, and 9.1.13.3, respectively.
  - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG, also xRP = MGRP for periodic MUSIM gap.

K_{gap} is only applicable for UE supporting concurrent GAPs or MUSIM gaps. When concurrent GAPs or MUSIM gaps are configured, requirements in this clause do not apply if $N_{available}$ =0.

When UE supports [*musim-GapPreference-r17*] and if the configured aperiodic MUSIM gap collides with the measurement gap associated with the target frequency layer, where MUSIM gap collision rule in clause 9.1.10.4 is applied, longer cell identification period for the target inter-frequency is expected.

Table 9.3.4-1: Time period for PSS/SSS detection (FR1)

Condition NOTE1,2	T_{PSS/SSS_sync_inter}
No DRX	Max(600 ms, Ceil(8 * K_{gap}) × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(600 ms, Ceil(8*1.5 * K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(8 * K_{gap}) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured.	

Table 9.3.4-2: Time period for PSS/SSS detection, (FR2)

Condition NOTE1,2	T_{PSS/SSS_sync_inter}

No DRX	Max(600 ms, Ceil(K_{gap} × M_{pss/sss_sync_inter} x K_{FR}) × Max(MGRP , SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(600 ms, Ceil(1.5 * K_{gap} × M_{pss/sss_sync_inter} x K_{FR}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(K_{gap} × M_{pss/sss_sync_inter} x K_{FR}) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured. NOTE 4: K_{FR} is a scaling factor depending on the frequency range and the SSB SCS. For FR2-1, K_{FR} = 1. For FR2-2: K_{FR} = 1 if the SCS of the SSB of the cell being detected is 120 kHz, K_{FR} = 2 if the SCS of the SSB of the cell being detected is 480 kHz, and K_{FR} = 3 if the SCS of the SSB of the cell being detected is 960 kHz.	

Table 9.3.4-3: Time period for time index detection (FR1)

Condition NOTE1,2	**$T_{SSB_time_index_inter}$**
No DRX	Max(120 ms, Ceil(3 * K_{gap})× Max(MGRP , SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(120 ms, Ceil(3 × 1.5 * K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(3 * K_{gap})× DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured.	

Table 9.3.4-4: Time period for time index detection (FR2)

Condition NOTE1,2	**$T_{SSB_time_index_inter}$**
No DRX	Max(200 ms, Ceil(K_{gap} × $M_{SSB_index_inter}$) × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(200 ms, Ceil(1.5 * K_{gap} × $M_{SSB_index_inter}$) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(K_{gap} ×$M_{SSB_index_inter}$) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured.	

Table 9.3.4-5: Time period for PSS/SSS detection when highSpeedMeasInterFreq-r17 is configured (FR1)

Condition NOTE1,2	**T_{PSS/SSS_sync_inter}**
No DRX	max(600 ms, N1 × Max(MGRP, SMTC period)) × $CSSF_{inter}$ N1 = 7
DRX cycle ≤ 160 ms	max(600 ms, ceil(N2) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{inter}$ N2 = 7 x M2
160 ms < DRX cycle ≤ 320 ms	ceil(N3) x DRX cycle x $CSSF_{inter}$ N3 = 7 x M2
DRX cycle>320 ms	N4 x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1 NOTE 3: N4=6 if SMTC periodicity > 40 ms, otherwise N4=5	

Table 9.3.4-6: Time period for time index detection when *highSpeedMeasInterFreq-r17* is configured (FR1)

Condition NOTE1,2	$T_{SSB_time_index_inter}$
No DRX	$\text{Max}(120\text{ ms}, 3 \times \text{Max}(\text{MGRP}, \text{SMTC period})) \times \text{CSSF}_{inter}$
DRX cycle ≤ 320 ms	$\text{Max}(120\text{ ms}, \text{Ceil}(3 \times M2^{NOTE3}) \times \text{Max}(\text{MGRP}, \text{SMTC period}, \text{DRX cycle})) \times \text{CSSF}_{inter}$
DRX cycle > 320 ms	$3 \times \text{DRX cycle} \times \text{CSSF}_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.	

Table 9.3.4-7: Time period for PSS/SSS detection when the inter-frequency carrier is configured only by SCG and the SCG is deactivated (FR2)

Condition NOTE1,2	T_{PSS/SSS_sync_inter}
No DRX	$\text{Max}(600\text{ ms}, \text{Ceil}(K_{gap} \times M_{pss/sss_sync_inter}) \times \text{Max}(\text{MGRP}, \text{measCyclePSCell})) \times \text{CSSF}_{inter}$
DRX cycle ≤ 320 ms	$\text{Max}(600\text{ ms}, \text{Ceil}(1.5 * K_{gap} \times M_{pss/sss_sync_inter}) \times \text{Max}(\text{MGRP}, \text{measCyclePSCell}, \text{DRX cycle})) \times \text{CSSF}_{inter}$
DRX cycle > 320 ms	$\text{Ceil}(K_{gap} \times M_{pss/sss_sync_inter}) \times \text{Max}(\text{measCyclePSCell}, \text{DRX cycle}) \times \text{CSSF}_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured.	

Table 9.3.4-8: Time period for time index detection when inter-frequency carrier is configured only by SCG and the SCG is deactivated (FR2)

Condition NOTE1,2	$T_{SSB_time_index_inter}$
No DRX	$\text{Max}(200\text{ ms}, \text{Ceil}(K_{gap} \times M_{SSB_index_inter}) \times \text{Max}(\text{MGRP}, \text{measCyclePSCell})) \times \text{CSSF}_{inter}$
DRX cycle ≤ 320 ms	$\text{Max}(200\text{ ms}, \text{Ceil}(1.5 * K_{gap} \times M_{SSB_index_inter}) \times \text{Max}(\text{MGRP}, \text{measCyclePSCell}, \text{DRX cycle})) \times \text{CSSF}_{inter}$
DRX cycle > 320 ms	$\text{Ceil}(K_{gap} \times M_{SSB_index_inter}) \times \text{Max}(\text{measCyclePSCell}, \text{DRX cycle}) \times \text{CSSF}_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1. NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured.	

Table 9.3.4-9: Time period for PSS/SSS detection when *highSpeedMeasFlagFR2-r17* is configured, (FR2-1) when SMTC period ≤40ms

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	$\max(600\text{ ms}, M1^{Note\ 3} \times K_{gap} \times \max(\text{MGRP}, \text{SMTC period})) \times \text{CSSF}_{inter}$
DRX cycle≤ 80 ms	$\max(600\text{ ms}, \text{ceil}(M1^{Note\ 3} \times K_{gap}) \times \max(\text{MGRP}, \text{SMTC period}, \text{DRX cycle})) \times \text{CSSF}_{inter}$
80 ms< DRX cycle≤ 320 ms	$\max(600\text{ ms}, \text{ceil}(M_{pss/sss_sync_with_gaps} \times K_{gap}) \times \max(\text{MGRP}, \text{SMTC period}, \text{DRX cycle})) \times \text{CSSF}_{inter}$
DRX cycle>320 ms	$\text{Ceil}(M_{pss/sss_sync_with_gaps} \times K_{gap}) \times \max(\text{MGRP}, \text{DRX cycle}) \times \text{CSSF}_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured. NOTE 3: For UE supporting power class 6 and *measEnhCAInterFreqFR2-r18*, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2	

Table 9.3.4-10: Time period for time index detection when when *highSpeedMeasFlagFR2-r17* is configured (Frequency range FR2-1) when SMTC period <= 40 ms

Condition NOTE1,2	$T_{SSB_time_index_inter}$
No DRX	Max(200 ms, Ceil(K_{gap} × , $M1^{Note\ 3}$) × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle≤ 80 ms	Max(200 ms, Ceil(1.5 * K_{gap} × $M1^{Note\ 3}$) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
80 ms< DRX cycle≤ 320 ms	Max(200 ms, Ceil(1.5 * K_{gap} × $M_{SSB_index_inter}$) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(K_{gap} ×$M_{SSB_index_inter}$) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: For a UE supporting concurrent GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured. NOTE 3: For UE supporting power class 6 and *measEnhCAInterFreqFR2-r18*, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2	

Table 9.3.4-11: Time period for time index detection for a UE, target cell with 12 PRB SSB (FR1)

Condition NOTE1	$T_{SSB_time_index_inter_less_than_5Mhz}$
No DRX	Max(120 ms, Ceil(6 * K_{gap})× Max(MGRP , SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(120ms, Ceil(6 × M2 * K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(6* K_{gap})× DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: When *highSpeedMeasInterFreq-r17* is not configured, M2 = 1.5; When *highSpeedMeasInterFreq-r17* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1. NOTE 3: The requirements in this table apply provided that the Ês/Iot on the target cell SSB is ≥-4 dB.	

Table 9.3.4-12: Time period for PSS/SSS detection (FR1) for UE configured with MG cancellation

Condition NOTE1	T_{PSS/SSS_sync_inter} NOTE3
No DRX	Max(600 ms, ceil((8+$L_{cancel,PSS/SSS}$) × K_{gap}) × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(600 ms, ceil((8+ $L_{cancel,PSS/SSS}$) × K_{gap} ×1.5) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	ceil((8+ $L_{cancel,PSS/SSS}$) × K_{gap}) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non-DRX requirements apply according to the conditions described in clause 3.6.1. NOTE 2: For a UE supporting concurrent gaps, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent gaps are configured. NOTE 3: $L_{cancel,PSS/SSS}$ is the the number of measurement gap occasions with SSB not available at the UE due to measurement gap occasions cancelled during T_{PSS/SSS_sync_inter}. When DRX is configured, $L_{cancel,PSS/SSS}$ is the number of DRX cycles in which at least one measurement gap occasion with SSB is not available at the UE due to measurement gap occasions cancelled during T_{PSS/SSS_sync_inter}.	

Table 9.3.4-13: Time period for PSS/SSS detection (FR2-1) for UE configured with MG cancellation

Condition NOTE1	T_{PSS/SSS_sync_inter} NOTE3
No DRX	Max(600 ms, ceil((M_{pss/sss_sync_inter} + $L_{cancel,PSS/SSS}$) × K_{gap}) × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(600 ms, ceil((M_{pss/sss_sync_inter} + $L_{cancel,PSS/SSS}$) × 1.5 × K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	ceil((M_{pss/sss_sync_inter}+ $L_{cancel,PSS/SSS}$) × K_{gap}) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non-DRX requirements apply according to the conditions described in clause 3.6.1. NOTE 2: For a UE supporting concurrent gaps, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent gaps are configured. NOTE 3: $L_{cancel,PSS/SSS}$ is the the number of measurement gap occasions with SSB not available at the UE due to measurement gap occasions cancelled during T_{PSS/SSS_sync_inter}. When DRX is configured, $L_{cancel,PSS/SSS}$ is the number of DRX cycles in which at least one measurement gap occasion with SSB is not available at the UE due to measurement gap occasions cancelled during T_{PSS/SSS_sync_inter}.	

Table 9.3.4-14: Time period for time index detection (FR1) for UE configured with MG cancellation

Condition NOTE1	$T_{SSB_time_index_inter}$ NOTE3
No DRX	Max(120 ms, ceil((3+ $L_{cancel,index}$) × K_{gap}) × Max(MGRP , SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(120 ms, ceil((3+ $L_{cancel,index}$) × 1.5 × K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	ceil((3+ $L_{cancel,index}$) × K_{gap}) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non-DRX requirements apply according to the conditions described in clause 3.6.1.	
NOTE 2: For a UE supporting concurrent gaps, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent gaps are configured.	
NOTE 3: $L_{cancel,index}$ is the the number of measurement gap occasions with SSB not available at the UE due to measurement gap occasions cancelled during $T_{SSB_time_index_inter}$. When DRX is configured, $L_{cancel,index}$ is the number of DRX cycles in which at least one measurement gap occasion with SSB is not available at the UE due to measurement gap occasions cancelled during $T_{SSB_time_index_inter}$.	

Table 9.3.4-15: Time period for time index detection (FR2-1) for UE configured with MG cancellation

Condition NOTE1	$T_{SSB_time_index_inter}$ NOTE3
No DRX	Max(200 ms, ceil(($M_{SSB_index_inter}$ + $L_{cancel,index}$) × K_{gap}) × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(200 ms, ceil(($M_{SSB_index_inter}$ + $L_{cancel,index}$) × 1.5 × K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	ceil(($M_{SSB_index_inter}$ + $L_{cancel,index}$) × K_{gap}) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1.	
NOTE 2: For a UE supporting concurrent gaps, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent gaps are configured.	
NOTE 3: $L_{cancel,index}$ is the the number of measurement gap occasions with SSB not available at the UE due to measurement gap occasions cancelled during $T_{SSB_time_index_inter}$. When DRX is configured, $L_{cancel,index}$ is the number of DRX cycles in which at least one measurement gap occasion with SSB is not available at the UE due to measurement gap occasions cancelled during $T_{SSB_time_index_inter}$.	

9.3.4.1 Void

9.3.4.2 Void

9.3.5 Inter-frequency measurements

When measurement gaps are provided for inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.5-1 and 9.3.5-2. When *highSpeedMeasInterFreq-r17* is configured, and UE supports *measurementEnhancementInterFreq-r17*, $T_{SSB_measurement_period_inter}$ is specified in table 9.3.5-3. When SCG is deactivated, $T_{SSB_measurement_period_inter}$ is specified in table 9.3.5-4 applies for inter-frequency carrier configured by SCG and not configured by MCG and table 9.3.5-2 applies for inter-frequency carrier configured by both SCG and MCG. Regardless of whether the SCG is activated or deactivated, table 9.3.5-2 applies for an inter-frequency carrier configured only by MCG.

For UE configured with measurement gap cancellation according to clause 9.1.14 meeting the conditions in clause 9.1.14.3, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15 for FR1 and FR2-1, respectively, while meeting the measurement period requirements for FR1 and FR2-1 specified in tables 9.3.5-6 and 9.3.5-7, respectively.

Table 9.3.5-1: Measurement period for inter-frequency measurements with gaps (FR1)

Condition NOTE1,2	$T_{SSB_measurement_period_inter}$
No DRX	Max(200 ms, Ceil(8 * K_{gap}) × Max(MGRP , SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(200 ms, Ceil(8 × 1.5 * K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$

DRX cycle > 320 ms	Ceil(8 * K_{gap}) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: For a UE supporting concurrent measurement GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured.	

Table 9.3.5-2: Measurement period for inter-frequency measurements with gaps (FR2)

Condition NOTE1,2	$T_{SSB_measurement_period_inter}$
No DRX	Max(400 ms, Ceil(K_{gap} × $M_{meas_period_inter}$) × Max(MGRP , SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(400 ms, Ceil(1.5 * K_{gap} × $M_{meas_period_inter}$) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(K_{gap} × $M_{meas_period_inter}$) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: For a UE supporting concurrent measurement GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured.	

Table 9.3.5-3: Measurement period for inter-frequency measurements with gaps when highSpeedMeasInterFreq-r17 is configured (FR1)

Condition NOTE1,2	$T_{SSB_measurement_period_inter}$
No DRX	max(200 ms, 7 × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 160 ms	max(200 ms, ceil(7 x M2 NOTE3) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{inter}$
160 ms < DRX cycle ≤ 320 ms	ceil(7 x M2 NOTE3) x DRX cycle x $CSSF_{inter}$
DRX cycle>320 ms	4 x M2 NOTE3 x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1	

Table 9.3.5-4: Measurement period for inter-frequency measurements with gaps when the inter-frequency carrier is configured only by SCG and the SCG is deactivated (FR2)

Condition NOTE1,2	$T_{SSB_measurement_period_inter}$
No DRX	Max(400 ms, Ceil(K_{gap} × $M_{meas_period_inter}$) × Max(MGRP, measCyclePSCell)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(400 ms, Ceil(1.5 * K_{gap} × $M_{meas_period_inter}$) × Max(MGRP, measCyclePSCell, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(K_{gap} × $M_{meas_period_inter}$) × Max(measCyclePSCell, DRX cycle) × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1. NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: For a UE supporting concurrent measurement GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured.	

Table 9.3.5-5: Measurement period for inter-frequency measurements with gaps when *highSpeedMeasFlagFR2-r17* is configured (FR2-1) when SMTC period≤40ms

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(400 ms, ceil(M1 Note 3 x K_{gap}) x max(MGRP, SMTC period)) x $CSSF_{inter}$
DRX cycle≤ 80 ms	max(400 ms, ceil(M1 Note 3 x K_{gap}) x max(MGRP, SMTC period, DRX cycle)) Note 1 x $CSSF_{inter}$
80 ms< DRX cycle≤ 320 ms	max(400 ms, ceil($M_{meas_period\ with_gaps}$ x K_{gap}) x max(MGRP, SMTC period, DRX cycle)) Note 1 x $CSSF_{inter}$

DRX cycle>320 ms	Ceil($M_{meas_period\ with_gaps}$ x K_{gap}) x max(MGRP, DRX cycle) x $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	
NOTE 2: For a UE supporting concurrent measurement GAPs, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent GAPs are configured.	
NOTE 3: For UE supporting power class 6 and *measEnhCAInterFreqFR2-r18*, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2	

Table 9.3.5-6: Measurement period for inter-frequency measurements with gaps (FR1) for UE configured with MG cancellation

Condition NOTE1	$T_{SSB_measurement_period_inter}$ NOTE3
No DRX	$Max(200\ ms, ceil((8 + L_{cancel,meas}) \times K_{gap}) \times Max(MGRP , SMTC\ period)) \times CSSF_{inter}$
DRX cycle ≤ 320 ms	$Max(200\ ms, ceil((8 + L_{cancel,meas}) \times 1.5 \times K_{gap}) \times Max(MGRP, SMTC\ period, DRX\ cycle)) \times CSSF_{inter}$
DRX cycle > 320 ms	$ceil((8 + L_{cancel,meas}) \times K_{gap}) \times DRX\ cycle \times CSSF_{inter}$
NOTE 1: DRX or non-DRX requirements apply according to the conditions described in clause 3.6.1.	
NOTE 2: For a UE supporting concurrent measurement gaps, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent gaps are configured.NOTE 3: $L_{cancel,meas}$ is the the number of measurement gap occasions with SSB not available at the UE due to measurement gap occasions cancelled during $T_{SSB_measurement_period_inter}$. When DRX is configured, $L_{cancel,meas}$ is the number of DRX cycles in which at least one measurement gap occasion with SSB is not available at the UE due to measurement gap occasions cancelled during $T_{SSB_measurement_period_inter}$.	

Table 9.3.5-7: Measurement period for inter-frequency measurements with gaps (FR2-1) for UE configured with MG cancellation

Condition NOTE1	$T_{SSB_measurement_period_inter}$ NOTE3
No DRX	$Max(400\ ms, ceil((M_{meas_period_inter} + L_{cancel,meas}) \times K_{gap}) \times Max(MGRP , SMTC\ period)) \times CSSF_{inter}$
DRX cycle ≤ 320 ms	$Max(400\ ms, ceil((M_{meas_period_inter} + L_{cancel,meas}) \times 1.5 \times K_{gap}) \times Max(MGRP, SMTC\ period, DRX\ cycle)) \times CSSF_{inter}$
DRX cycle > 320 ms	$ceil((M_{meas_period_inter} + L_{cancel,meas}) \times K_{gap}) \times DRX\ cycle \times CSSF_{inter}$
NOTE 1: DRX or non-DRX requirements apply according to the conditions described in clause 3.6.1.	
NOTE 2: For a UE supporting concurrent measurement gaps, the MGRP above is the MGRP of the activated Pre-MG or the measurement gap associated with the target frequency layer to be measured if concurrent gaps are configured.	
NOTE 3: $L_{cancel,meas}$ is the the number of measurement gap occasions with SSB not available at the UE due to measurement gap occasions cancelled during $T_{SSB_measurement_period_inter}$. When DRX is configured, $L_{cancel,meas}$ is the number of DRX cycles in which at least one measurement gap occasion with SSB is not available at the UE due to measurement gap occasions cancelled during $T_{SSB_measurement_period_inter}$.	

9.3.5.1 Void

9.3.5.2 Void

9.3.5.3 Void

9.3.6 Inter-frequency measurements reporting requirements

9.3.6.1 Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

9.3.6.2 Event-triggered Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.3.6.3.

9.3.6.3 Event-triggered Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. Both $T_{identify_inter_without_index}$ and $T_{identify_inter_with_index}$ are defined in clause 9.3.4. When L3 filtering is used an additional delay can be expected. In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or in both FR1 and FR2 if the UE is not capable of per-FR gap.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ as defined in clause 9.3.4 or clause 9.3.9.1 or clause 9.3.10.1.. If a cell which has been detectable at least for the time period $T_{identify\ inter\ without\ index}$ or $T_{identify\ inter\ with\ index}$ defined in clause 9.3.4 or clause 9.3.9.1 or clause 9.3.10.1. becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again with the same spatial reception parameter and triggers an event, the event triggered measurement reporting delay shall be less than $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu} T_c$ while the measurement gap has not been available and L3 filtering has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected. In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or an additional delay can be expected in both FR1 and FR2 if the UE is not capable of per-FR gap.

9.3.7 Void

9.3.8 Inter-frequency SFTD measurement requirements

9.3.8.1 Introduction

This clause contains requirements for a UE supporting NR inter-frequency SFTD measurement and is applicable in RRC_CONNECTED state. The UE shall, depending on network request, perform inter-frequency SFTD measurement and report SFTD result with or without SS-RSRP. The overall delay includes RRC procedure delay defined in clause 12 in TS 38.331 [2] and SFTD measurement delay in clause 9.3.8.2.

UE which fulfils the requirements in clause 9.3.8 is not supposed to fulfil the requirements defined in clause 9.2.5.4.

9.3.8.2 SFTD Measurement delay

The requirements on SFTD measurement delay defined in this clause are applicable under the side condition SCH $\hat{E}s/Iot \geq$ -3 dB for the inter-frequency neighbour cell. Depending on configuration, the SFTD measurement may be carried out with or without the support of configured measurement gaps. In the current release, indication on whether to

carry out the SFTD measurement with or without measurement gaps is implicit and depending on whether measurement gaps are configured.

The UE shall be able to detect, identify and measure SFTD of up to 3 of the strongest applicable inter-frequency neighbour cells on the carrier frequency provided in the SFTD measurement configuration. Further depending on the SFTD measurement configuration, the UE shall additionally report SS-RSRP for the one or more strongest cells. The UE may or may not be configured with *cellsForWhichToReportSFTD*. The UE does not expect *cellsForWhichToReportSFTD* to change during an ongoing SFTD measurement.

When no measurement gaps are provided, the UE shall be capable of finding the inter-frequency neighbour cell regardless of its SSB position in the SMTC period, provided that the carrier frequency where SFTD measurement is configured and the serving carrier(s) form a supported CA or NR-DC band combination of the UE. The SFTD measurement shall be conducted with sustained connection to the PCell and activated SCell(s) in MCG. Depending on capability, the UE may be allowed to cause a certain amount of interruptions for reconfiguration of the radio receiver, as specified in clause 8.2.2.2.6.

When measurement gaps are provided, the UE shall be capable of finding the inter-frequency neighbour cell under the additional condition that the SSB at least occasionally falls within the measurement gap.

When no DRX is used, the UE shall be capable of determining SFTD within a physical layer measurement period of $T_{measure_SFTD1}$ as follows:

- For SFTD measurements without measurement gaps, and without additional SS-RSRP reporting:
  - For carrier frequency in FR1: $T_{measure_SFTD1}$ = 14 SMTC periods
  - For carrier frequency in FR2: $T_{measure_SFTD1}$ = 112 SMTC periods
- For SFTD measurements in measurement gaps, and without additional SS-RSRP reporting:
  - For carrier frequency in FR1: $T_{measure_SFTD1} = CSSF_{inter} \times 8 \times$ Max(MGRP, SMTC period)
  - For carrier frequency in FR2: $T_{measure_SFTD1} = CSSF_{inter} \times 64 \times$ Max(MGRP, SMTC period))
- For SFTD measurements without measurement gaps, and with additional SS-RSRP reporting:
  - For carrier frequency in FR1: $T_{measure_SFTD1}$ = 19 SMTC periods
  - For carrier frequency in FR2: $T_{measure_SFTD1}$ = 152 SMTC periods
- For SFTD measurements in measurement gaps, and with additional SS-RSRP reporting:
  - For carrier frequency in FR1: $T_{measure_SFTD1} = CSSF_{inter} \times 13 \times$ Max(MGRP, SMTC period)
  - For carrier frequency in FR2: $T_{measure_SFTD1} = CSSF_{inter} \times 104 \times$ Max(MGRP, SMTC period)

where $CSSF_{inter}$ is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

When DRX is used, the same $T_{measure_SFTD1}$ as for non-DRX applies, but the reporting delay depends on the DRX cycle length in use.

In case PCell is changed due to handover, the UE shall terminate the inter-frequency SFTD measurement.

The measurement accuracy for the SFTD measurement shall fulfil the requirement in clause 10.1.21.3. The measurement accuracy for additionally reported SS-RSRP shall fulfil the requirement in clauses 10.1.4.1 and 10.1.5.1 for neighbour cell in FR1 and FR2, respectively.

9.3.8.3 SFTD Measurement reporting delay

The SFTD measurement reporting delay is defined as the time between a command that will trigger an SFTD measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty of $2 \times TTI_{DCCH}$ resulting when inserting the measurement report to the TTI of the uplink DCCH. This measurement reporting delay excludes any delay caused by lack of UL resources for UE to send the measurement report.

The SFTD measurement reporting delay shall be less than $T_{measure_SFTD1}$ defined in clause 9.3.8.2 plus the RRC procedure delay defined in clause 12 in TS 38.331 [2].

9.3.9 Inter-frequency measurements without measurement gaps

9.3.9.1 Inter-frequency Cell identification

UE satisfying the applicability conditions specified in clause 9.3.1 on the requirement in this clause shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured) or *deriveSSB-IndexFromCellInter-r17* is configured for the FR1 and FR2-1 target frequency layers and UE supporting *deriveSSB-IndexFromCellInterNon-NCSG-r17*. Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. The UE shall be able to identify a new detectable inter-frequency SS block of an already detected cell within $T_{identify_inter_without_index}$.

- For inter-frequency SSB based measurements without measurement gaps in active BWP, it is assumed that when UE performs inter-frequency measurements without measurement gaps in a TDD bands on FR1 and FR2, SFN and frame boundary across serving cell and inter-frequency neighbor cells is aligned

$$T_{identify_inter_without_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter})\ ms$$

$$T_{identify_inter_with_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter} + T_{SSB_time_index_inter})\ ms$$

Where:

T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection

- For inter-frequency SSB based measurements without measurement gaps in active BWP, and UE supports *interFrequencyMeas-Nogap-r16*, T_{PSS/SSS_sync_inter} is given in table 9.3.9.1-1 and table 9.3.9.1-2.
- For UE supporting measEnhCAInterFreqFR2-r18:
  - If *highSpeedMeasFlagFR2-r17* is configured, and SMTC $\leq$ 40ms, T_{PSS/SSS_sync_inter} is given in table 9.3.9.1-6.
  - If *highSpeedMeasFlagFR2-r17* is configured, and SMTC >40ms, T_{PSS/SSS_sync_inter} is given in table 9.3.9.1-2.
  - If *highSpeedMeasFlagFR2-r17* is not configured, T_{PSS/SSS_sync_inter} is given in table 9.3.9.1-2.
- For UE indicating *no-gap-no-interruption*, T_{PSS/SSS_sync_inter} is given in table 9.3.9.1-1 for FR1 and table 9.3.9.1-2 for FR2
- For UE indicating *no-gap-with-interruption*, T_{PSS/SSS_sync_inter} is given in table 9.3.9.1-1a for FR1 and table 9.3.9.1-2a for FR2.
- For UE indicating *support3MHz-ChannelBW-Symmetric-r18* and configured to operate on a target cell with 12 PRB SSB in FR1, $T_{SSB_time_index_intra_less_than_5MHz}$ is given in table 9.3.9.1-5.

- $T_{SSB_time_index_inter}$: it is the time period used to acquire the index of the SSB being measured
  - For inter-frequency SSB based measurements without measurement gaps in active BWP, and UE supports *interFrequencyMeas-Nogap-r16*, $T_{SSB_time_index_inter}$ is given in table 9.3.9.1-3 and table 9.3.9.1-4.
  - For UE supporting measEnhCAInterFreqFR2-r18:
    - If *highSpeedMeasFlagFR2-r17* is configured, and SMTC $\leq$ 40ms, $T_{SSB_time_index_inter}$ is given in table 9.3.9.1-7.
    - If *highSpeedMeasFlagFR2-r17* is configured, and SMTC >40ms, $T_{SSB_time_index_inter}$ is given in table 9.3.9.1-4.
    - If *highSpeedMeasFlagFR2-r17* is not configured, $T_{SSB_time_index_inter}$ is given in table 9.3.9.1-4.

- For UE *indicating no-gap-no-interruption*, $T_{SSB_time_index_inter}$ is given in table 9.3.9.1-3 for FR1 and table 9.3.9.1-4 for FR2

- For UE indicating *no-gap-with-interruption*, $T_{SSB_time_index_inter}$ is given in table 9.3.9.1-3a for FR1 and table 9.3.9.1-4a for FR2.

- $T_{SSB_measurement_period_inter}$: equal to a measurement period of SSB based measurement

  - For inter-frequency SSB based measurements without measurement gaps in active BWP, and UE supports *interFrequencyMeas-Nogap-r16*, $T_{SSB_measurement_period_inter}$ is given in table 9.3.9.2-1, table 9.3.9.2-2, table 9.3.9.2-3 and table 9.3.9.2-3a when *highSpeedMeasInterFreq-r17* is configured and UE supports *measurementEnhancementInterFreq-r17*, and table 9.3.9.2-4 when *highSpeedMeasFlagFR2-r17* is configured and UE supports *measEnhCAInterFreqFR2-r18*.

  - For UE indicating *no-gap-no-interruption*, $T_{SSB_measurement_period_inter}$ is given in table 9.3.9.2-1 for FR1, table 9.3.9.2-2 for FR2, and table 9.3.9.2-3 when *highSpeedMeasInterFreq-r17* is configured and UE supports *measurementEnhancementInterFreq-r17*.

  - For UE indicating *no-gap-with-interruption*, $T_{SSB_measurement_period_inter}$ is given in table 9.3.9.2-1a for FR1 and table 9.3.9.2-2a for FR2, and table 9.3.9.2-3b when *highSpeedMeasInterFreq-r17* is configured and UE supports *measurementEnhancementInterFreq-r17*.

- For UE supporting power class 6 and *measEnhCAInterFreqFR2-r18* with *highSpeedMeasFlagFR2-r17* configured, if SMTC $\leq$ 40ms, $T_{SSB_measurement_period_inter}$ is given in table 9.3.9.2-x; otherwise, $T_{SSB_measurement_period_inter}$ is given in table 9.3.9.2-2.

  $CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1 for measurement conducted outside GAP, i.e. when inter-frequency SMTC is fully non overlapping or partially overlapping with GAPs.

  - when inter-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps for UE *indicating no-gap-no-interruption* or

  - when inter-frequency SMTC is fully non overlapping with measurement gaps for UE indicating *no-gap-with-interruption*.

For inter-frequency SSB based measurements without measurement gaps in active BWP

M_{pss/sss_sync_inter}: For a UE supporting FR2-1 power class 1 or 5, M_{pss/sss_sync_inter} = 40. For a UE supporting FR2-1 power class 2, M_{pss/sss_sync_inter} = 24. For a UE supporting FR2-1 power class 3, M_{pss/sss_sync_inter} = 24. For a UE supporting FR2-1 power class 4, M_{pss/sss_sync} = 24. For a UE supporting FR2-2 power class 1, M_{pss/sss_sync_inter} = 60. For a UE supporting FR2-2 power class 2, M_{pss/sss_sync_inter} = 36. For a UE supporting FR2-2 power class 3, M_{pss/sss_sync_inter} = 36. For FR1, M_{pss/sss_sync_inter} = 5.

$M_{SSB_index_inter}$: For a UE supporting FR2-2 power class 1, $M_{SSB_index_inter}$ = 72. For a UE supporting FR2-2 power class 2, $M_{SSB_index_inter}$ = 48. For a UE supporting FR2-2 power class 3, $M_{SSB_index_inter}$ = 48. For FR1, $M_{SSB_index_inter}$ = 3.

$M_{meas_period_inter}$: For a UE supporting FR2-1 power class 1 or 5, $M_{meas_period_inter}$ = 40. For a vehicle mounted UE supporting FR2-1 power class 2, M_{pss/sss_sync_inter}=24. For a UE supporting FR2-1 power class 3, $M_{meas_period_inter}$ = 24. For a UE supporting FR2-1 power class 4, $M_{meas_period_inter}$ = 24. For a UE supporting FR2-2 power class 1, $M_{meas_period_inter}$ = 60. For a UE supporting FR2-2 power class 2, M_{pss/sss_sync_inter} = 36. For a UE supporting FR2-2 power class 3, $M_{meas_period_inter}$ = 36. For FR1, $M_{meas_period_inter}$ = 5.

If the UE indicates 'nogap-noncsg' via *NeedForGapNCSG-InfoNR* for the inter-frequency measurement or the UE indicates either *no-gap-with-interruption* or *no-gap-no-interruption* via *NeedForInterruptionInfoNR-r18*,

M_{pss/sss_sync_inter}: For a UE supporting FR2-1 power class 1 or 5, M_{pss/sss_sync_inter} = 64 samples. For a UE supporting FR2-1 power class 2, M_{pss/sss_sync_inter} = 40 samples. For a UE supporting FR2-1 power class 3, M_{pss/sss_sync_inter} = 40 samples. For a UE supporting FR2-1 power class 4, M_{pss/sss_sync_inter} = 40 samples. For a UE supporting FR2-2 power class 1, M_{pss/sss_sync_inter} = 96. For a UE supporting FR2-2 power class 2, M_{pss/sss_sync_inter} = 60. For a UE supporting FR2-2 power class 3, M_{pss/sss_sync_inter} = 60. For FR1, M_{pss/sss_sync_inter} = 8.

$M_{SSB_index_inter}$: For a UE supporting FR2-1 power class 1 or 5, $M_{SSB_index_inter}$ = 40 samples. For a UE supporting FR2 power class 2, $M_{SSB_index_inter}$ = 24 samples. For a UE supporting FR2-1 power class 3, $M_{SSB_index_inter}$ = 24

samples. For a UE supporting FR2-1 power class 4, $M_{SSB_index_inter}$ = 24 samples. For a UE supporting FR2-2 power class 2 or 3, $M_{SSB_index_inter}$ = 48 samples. For a UE supporting FR2 power class 1, $M_{SSB_index_inter}$ = 72 samples. For FR1, $M_{SSB_index_inter}$ = 3.

$M_{meas_period_inter}$: For a UE supporting FR2-1 power class 1 or 5, $M_{meas_period_inter}$ =64. For a UE supporting FR2-1 power class 2, $M_{meas_period_inter}$=40. For a UE supporting FR2-1 power class 3, $M_{meas_period_inter}$ =40. For a UE supporting FR2-1 power class 4, $M_{meas_period_inter}$ = 40. For a UE supporting FR2-2 power class 1, $M_{meas_period_inter}$ = 96. For a UE supporting FR2-2 power class 2, $M_{meas_period_inter}$ = 60. For a UE supporting FR2-2 power class 3, $M_{meas_period_inter}$ = 60. For FR1, $M_{meas_period_inter}$ = 8.

When UE supports *concurrentMeasGap-r17* or *musim-GapPreference-r17* or both concurrent measurement GAP and *musim-GapPreference-r17* and the UE is configured with concurrent GAPs or periodic MUSIM gaps or both concurrent gaps and periodic MUSIM gaps,

K_p is a scaling factor for an SSB frequency layer to be measured without GAP. $K_p = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

For a window W of duration max(SMTC period, xRP_max), where xRP_max is the maximum xRP across all configured per-UE GAPs, periodic MUSIM gaps, and per-FR GAPs within the same FR as the SSB frequency layer, and starting at the beginning of any SMTC occasion:

N_{total} is the total number of SMTC occasions within the window, including those overlapped with GAP and MUSIM gap occasions within the window, and

$N_{available}$ is the number of SMTC occasions that are not overlapped with any non-dropped GAP or non-dropped MUSIM gap occasions within the window W, after accounting for GAP and MUSIM gap collisions by applying the collision rules for the measurement GAP and MUSIM gap in clauses 9.1.8.3, 9.1.10.4 and 9.1.10.5, respectively.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG, also xRP = MGRP for periodic MUSIM gap.

Requirements in this clause do not apply when $N_{available}$ = 0 due to fully overlapping between SMTC occasions and MUSIM gap occasions within the window W.

Editor Note: FSS for the case when $N_{available}$ = 0 due to fully overlapping between SMTC occasions and the union of MUSIM gap and measurement gap occasions within the window W.

When UE supports [*musim-GapPreference-r17]* and the SMTC occasions of the target frequency layer is fully or partially overlapping with the configured aperiodic MUSIM gap, longer cell identification period for the target frequency layer is expected.

Otherwise, when UE is not configured with or UE does not support concurrent GAPs and the UE is not configured with MUSIM gaps:

When inter-frequency SMTC is fully non overlapping with measurement gaps or NCSG, or interfrequency SMTC is fully overlapping with MGs or NCSG, K_p =1.

When inter-frequency SMTC is partially overlapping with measurement gaps, K_p = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP. When inter-frequency SMTC is partially overlapping with NCSG, K_p = 1/(1- (SMTC period /VIRP)), where SMTC period < VIRP.

For FR2,

$K_{layer1_measurement}$=1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap are not fully overlapped by inter-frequency SMTC occasions, or

- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap and fully-overlapped by inter-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the

RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, where SSB symbols are indicated by *SSB-ToMeasure* and RSSI symbols are indicated by *SS-RSSI-Measurement*;

$K_{layer1_measurement}$=1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

For calculation of K_p, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1*.

Table 9.3.9.1-1: Time period for PSS/SSS detection, (FR1)

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	max(600 ms, ceil(M_{pss/sss_sync_inter} x K_p) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(600 ms, ceil(M2x M_{pss/sss_sync_inter} x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	ceil(M_{pss/sss_sync_inter} x K_p) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: Void NOTE 3: When *highSpeedMeasInterFreq-r17* is not configured, M2 = 1.5; When *highSpeedMeasInterFreq-r17* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1	

Table 9.3.9.1-1a: Time period for PSS/SSS detection, when UE indicate *no-gap-with-interruption* (FR1)

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	max(600 ms, M_{pss/sss_sync_inter} x max(80 ms, SMTC period))[Note 1] x $CSSF_{inter}$
[DRX cycle≤ 320 ms]	max(600 ms, ceil(M2 x M_{pss/sss_sync_inter}) x max(80 ms, SMTC period,DRX cycle)) x $CSSF_{inter}$
[DRX cycle>320 ms]	M_{pss/sss_sync_inter} x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: Void NOTE 3: When *highSpeedMeasInterFreq-r17* is not configured, M2 = 1.5; When *highSpeedMeasInterFreq-r17* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1	

Table 9.3.9.1-2: Time period for PSS/SSS detection, (FR2)

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	max(600 ms, ceil(M_{pss/sss_sync_inter} x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x M_{pss/sss_sync_inter} x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	ceil(M_{pss/sss_sync_inter} x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: Void	

Table 9.3.9.1-2a: Time period for PSS/SSS detection, when UE indicate no-gap-with-interruption (FR2)

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	max(600 ms, ceil(M_{pss/sss_sync_inter} x $K_{layer1_measurement}$) x max(80 ms, SMTC period))[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(600ms, ceil(1.5 x M_{pss/sss_sync_inter} x $K_{layer1_measurement}$) x max(80ms, SMTC period, DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	ceil(M_{pss/sss_sync_inter} x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: Void	

Table 9.3.9.1-3: Time period for time index detection (FR1)

DRX cycle	$T_{SSB_time_index_inter}$
No DRX	max(120 ms, ceil($M_{SSB_index_inter}$ x K_p) x SMTC period)$^{Note\ 1}$ x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(120 ms, ceil (M2 x $M_{SSB_index_inter}$ x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	Ceil($M_{SSB_index_inter}$ x K_p) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: Void NOTE 3: When *highSpeedMeasInterFreq-r17* is not configured, M2 = 1.5; When *highSpeedMeasInterFreq-r17* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1	

Table 9.3.9.1-3a: Time period for time index detection, when UE indicate *no-gap-with-interruption* (FR1)

DRX cycle	$T_{SSB_time_index_inter}$
No DRX	max(120 ms, $M_{SSB_index_inter}$ x max(80 ms, SMTC period))$^{Note\ 1}$ x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(120 ms, ceil (M2 x $M_{SSB_index_inter}$) x [max(80 ms, SMTC period, DRX cycle)]) x $CSSF_{inter}$
DRX cycle>320 ms	$M_{SSB_index_inter}$ x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: Void NOTE 3: When *highSpeedMeasInterFreq-r17* is not configured, M2 = 1.5; When *highSpeedMeasInterFreq-r17* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1	

Table 9.3.9.1-4: Time period for time index detection (FR2)

Condition NOTE1,2	$T_{SSB_time_index_inter}$
No DRX	Max(200 ms, Ceil($M_{SSB_index_inter}$ x K_p) × SMTC period) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(200 ms, Ceil(1.5 × $M_{SSB_index_inter}$ x K_p) × Max(SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil($M_{SSB_index_inter}$ x K_p) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: Kp is applicable for UE supporting *concurrentMeasGap-r17*	

Table 9.3.9.1-4a: ime period for time index detection, when UE indicate *no-gap-with-interruption* (FR2)

Condition NOTE1,2	$T_{SSB_time_index_inter}$
No DRX	Max(200 ms, $M_{SSB_index_inter}$ × max(80 ms, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(200 ms, Ceil(1.5 × $M_{SSB_index_inter}$) × Max(80 ms, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	$M_{SSB_index_inter}$ × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: Kp is applicable for UE supporting [concurrent gaps] and MUSIM gaps	

Table 9.3.9.1-5: Time period for time index detection, target cell with 12 PRB SSB (FR1)

DRX cycle	$T_{SSB_time_index_inter_less_than_5\ MHz}$
No DRX	max(120 ms, ceil(6 x K_p) x SMTC period)$^{Note\ 1}$ x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(120 ms, ceil (6 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	Ceil(6 x K_p) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: When *highSpeedMeasInterFreq-r17* is not configured, M2 = 1.5; When *highSpeedMeasInterFreq-r17* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1. NOTE 3: The requirements in this table apply provided that the Ês/Iot on the target cell SSB is ≥-4 dB.	

Table 9.3.9.1-6: Time period for PSS/SSS detection when *highSpeedMeasFlagFR2-r17* is configured (FR2-1) when SMTC period ≤ 40ms

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	max(600 ms, ceil(M1 [Note 2] x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 80 ms	max(600 ms, ceil(M1 [Note 2] x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
80 ms< DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x M_{pss/sss_sync_inter} x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	ceil(M_{pss/sss_sync_inter} x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: For UE supporting power class 6 and *measEnhCAInterFreqFR2-r18*, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2	

Table 9.3.9.1-7: Time period for time index detection when *highSpeedMeasFlagFR2-r17* is configured (FR2-1) when SMTC period ≤ 40ms

Condition [NOTE1,2]	$T_{SSB_time_index_inter}$
No DRX	Max(200 ms, Ceil(M1 [Note 3] x K_p) × SMTC period) × $CSSF_{inter}$
DRX cycle≤ 80 ms	Max(200 ms, Ceil(M1 [Note 3] x K_p) × Max(SMTC period, DRX cycle)) × $CSSF_{inter}$
80 ms< DRX cycle≤ 320 ms	Max(200 ms, Ceil(1.5 × $M_{SSB_index_inter}$ x K_p) × Max(SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle>320 ms	Ceil($M_{SSB_index_inter}$ x K_p) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: Kp is applicable for UE supporting *concurrentMeasGap-r17* NOTE 3: For UE supporting power class 6 and *measEnhCAInterFreqFR2-r18*, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2	

9.3.9.2 Measurement period

The UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.9.2-1 and 9.3.9.2-2, if UE supports inter-frequency measurement without measurement gaps. When highSpeedMeasInterFreq-r17 is configured and UE supports measurementEnhancementInterFreq-r17, $T_{SSB_measurement_period_inter}$ is specified in table 9.3.9.2-3.

Table 9.3.9.2-1: Measurement period for inter-frequency measurements without gaps ((FR1)

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(200 ms, ceil($M_{meas_period_inter}$ x K_p) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x $M_{meas_period_inter}$ x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	ceil($M_{meas_period_inter}$ x K_p) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3.9.2-1a: Measurement period for inter-frequency measurements without gaps when UE indicate *no-gap-with-interruption* (FR1)

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(200 ms, $M_{meas_period_inter}$ x max(80 ms, SMTC period))[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x $M_{meas_period_inter}$) x max(80 ms, SMTC period, DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	$M_{meas_period_inter}$ x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3.9.2-2: Measurement period for inter-frequency measurements without gaps (FR2)

DRX cycle	$T_{SSB_measurement_period_inter}$

No DRX	max(400 ms, ceil($M_{meas_period_inter}$ x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5x $M_{meas_period_inter}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	ceil($M_{meas_period_inter}$ xK_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3.9.2-2a: Measurement period for inter-frequency measurements without gaps when UE indicate no-gap-with-interruption (FR2)

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(400 ms, ceil($M_{meas_period_inter}$ x $K_{layer1_measurement}$) x max(80 ms, SMTC period))[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5x $M_{meas_period_inter}$ x $K_{layer1_measurement}$) x max(80 ms, SMTC period, DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	ceil($M_{meas_period_inter}$ x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3.9.2-3: Measurement period for inter-frequency measurements without gaps in the active BWP when *highSpeedMeasInterFreq-r17* is configured (FR1)

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(200 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 160 ms	max(200 ms, ceil(5 x M2[Note 2] x K_p) x max(SMTC period, DRX cycle)) x $CSSF_{inter}$
160 ms < DRX cycle≤ 320 ms	ceil(4 x M2[Note 2] x K_p) x max(SMTC period,DRX cycle) x $CSSF_{inter}$
DRX cycle>320 ms	ceil(Y[Note 3] x K_p) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: M2 = 1.5 if SMTC period > 40 ms, otherwise M2 = 1 NOTE 3: Y=3 when SMTC period <= 40 ms, Y=5 when SMTC period > 40 ms	

Table 9.3.9.2-3a: Measurement period for inter-frequency measurements without gaps when *highSpeedMeasInterFreq-r17* is configured (FR1), UE supporting '*nogap-noncsg*'

Condition [NOTE1,2]	$T_{SSB_measurement_period_inter}$
No DRX	max(200 ms, 7 × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 160 ms	max(200 ms, ceil(7 x M2[NOTE3]) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{inter}$
160 ms < DRX cycle ≤ 320 ms	ceil(7 x M2[NOTE3]) x DRX cycle x $CSSF_{inter}$
DRX cycle>320 ms	4 x M2[NOTE3] x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1	

Table 9.3.9.2-3b: Measurement period for inter-frequency measurements without gaps when highSpeedMeasInterFreq-r17 is configured (FR1), when UE indicate no-gap-with-interruption

Condition [NOTE1,2]	$T_{SSB_measurement_period_inter}$
No DRX	max(200 ms, 7 × Max(80 ms, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 160 ms	max(200 ms, ceil(7 x M2[NOTE3]) x max(80 ms, SMTC period, DRX cycle)) x $CSSF_{inter}$
160 ms < DRX cycle ≤ 320 ms	ceil(7 x M2[NOTE3]) x DRX cycle x $CSSF_{inter}$
DRX cycle>320 ms	4 x M2[NOTE3] x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.
NOTE 3: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1

Table 9.3.9.2-4: Measurement period for inter-frequency measurements without gaps when *highSpeedMeasFlagFR2-r17* is configured (FR2-1) when SMTC period ≤ 40ms

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(400 ms, ceil($M1^{Note\ 2}$ x K_p x $K_{layer1_measurement}$) x SMTC period)$^{Note\ 1}$ x $CSSF_{inter}$
DRX cycle≤ 80 ms	max(400 ms, ceil($M1^{Note\ 2}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
80 ms< DRX cycle≤ 320 ms	ceil(1.5 x $M_{meas_period_w/o_gaps}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle) x $CSSF_{inter}$
DRX cycle>320 ms	ceil($M_{meas_period_w/o_gaps}$ xK_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: For UE supporting power class 6 and *measEnhCAInterFreqFR2-r18*, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2	

9.3.9.3 Scheduling availability of UE during inter-frequency measurements when the SSB is completely contained in the active BWP of the UE

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE is required to be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols to be measured in the following clauses are the SSB symbols indicated by *SSB-ToMeasure* [2], if it is configured; otherwise, all L SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

For UE configured with measurement gap cancellation according to clause 9.1.14, for which the conditions in clause 9.1.14.3 are met, the UE is not required to perform measurements during the cancelled measurement gap occasions, and no restrictions on the scheduling availability during the cancelled gap occasions apply.

The scheduling availability requirements when UE performs inter-frequency measurements without measurement gaps in a TDD bands on FR1 and FR2 in clause 9.3.9.3.1~9.3.9.3.3 are valid under the following conditions:

- SFN and frame boundary across serving cell and inter-frequency neighbor cells is aligned

[For UE supporting MUSIM gaps, when MUSIM gaps are configured, the requirements in clause 9.3.9.3 are also applied to the slots that are not interrupted according to requirements in clause 9.1.10.x3.y2 and 9.1.10.x3.y3.]

9.3.9.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When UE performs inter-frequency measurements without measurement gaps in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

When UE performs inter-frequency measurements without measurement gaps in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to one serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions due to one serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided

For UE indicating *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 4"*

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 1"*

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2>else

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.3.9.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology-Inter-r16* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If UE performs inter-frequency measurements without measurement gaps in a TDD band, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If UE performs inter-frequency measurements without measurement gaps in a FDD band, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

  - serving cell symbols fully or partially overlap with SSB symbols to be measured on MO i, and $\triangle$t serving cell symbol before each consecutive SSB symbols to be measured and $\triangle$t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO i and UE supporting *deriveSSB-IndexFromCellInterNon-NCSG-r17*. $\triangle$t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9, or

  - serving cell symbols fully or partially overlap with SMTC window for MO i and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO i, or UE not supporting *deriveSSB-IndexFromCellInterNon-NCSG-r17*.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

For UE indicating *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 4"*

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 1"*

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2>else

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.3.9.3.3 Scheduling availability of UE performing measurements on FR2

The following scheduling restriction applies due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell

The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

The following scheduling restriction applies to SS-RSRQ measurement on an FR2 inter-frequency cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

If following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots.

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE shall receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

9.3.9.3.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 serving cell frequency layer.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 serving cell frequency layer.

9.3.9.4 Scheduling availability of UE during inter-frequency measurements when the SSB is not completely contained in the active BWP of the UE

If UE supports *nr-NeedForGapNCSG-reporting-r17* and indicates *nogap-noncsg* in *NeedForGapNCSG-InfoNR* for inter-frequency measurement, or if UE supports *nr-NeedForInterruptionReport-r18* and indicates *nogap* in *NeedforGap-InfoNR* and further indicates *no-gap-no-interruption* or *no-gap-with-interruption* via *NeedForInterruptionInfoNR-r18* for inter-frequency measurement, UE is required to be capable of measuring without measurement gaps when the SSB is not completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same serving carrier which can be merged [2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

The requirements in clause 9.3.9.4 based on *deriveSSB-IndexFromCell-inter* apply provided that UE supports ncsg-*SymbolLevelScheduleRestrictionInter-r17*. If UE does not support *ncsg-SymbolLevelScheduleRestrictionInter-r17*, the requirements in clause 9.3.9.4.3 apply assuming *deriveSSB-IndexFromCell-inter* is not enabled.

9.3.9.4.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When the UE performs inter-frequency measurements without MG and NCSG in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement when (1) *simultaneousRxTxInterBandCA* is not supported for the target measurement band and the serving cell's band, or (2) target measurement and the serving cell are on the same band or on the band with overlapping DL frequency with UE's serving cell(s).

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and $\triangle$t serving cell symbol before each consecutive SSB symbols to be measured and $\triangle$t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. $\triangle$t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*.

When the UE performs inter-frequency measurements without MG and NCSG in a TDD band, the following restrictions apply due to SS-RSRQ measurement when *simultaneousRxTxInterBandCA* is not supported for the target measurement band and the serving cell band

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*.

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

9.3.9.4.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement when the target inter-frequency layer to be measured is on the same band with UE's serving cell(s) or on the band with overlapping DL frequency with UE's serving cell(s).

- The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and △t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*,

  If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

9.3.9.4.3 Scheduling availability of UE performing measurements on FR2

When (1) UE does not support IBM between target measurement band and serving cell's band(s) nor *simultaneousRxTxInterBandCA*, or (2) target measurement and a serving cell are on the same band, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell without MG and NCSG:

The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and △t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*,

and due to SS-RSRQ measurement on an FR2 inter-frequency cell without MG and NCSG

The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and △t

serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*.

When UE does not support IBM between target measurement band and serving cell's band(s) but supports *simultaneousRxTxInterBandCA*, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell without MG and NCSG

The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and △t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*,

and due to SS-RSRQ measurement on an FR2 inter-frequency cell without MG and NCSG

The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*.

When UE supports IBM between target measurement band and serving cell's band(s) but not *simultaneousRxTxInterBandCA*, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell without MG and NCSG

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and △t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9..

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*,

and due to SS-RSRQ measurement on an FR2 inter-frequency cell without MG and NCSG

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols

within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*.

If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

When UE supports IBM between target measurement band and serving cell's band(s) and *simultaneousRxTxInterBandCA*, no scheduling restriction applies to the serving cell.

If following conditions are met:

- The UE has been notified about system information update through paging,
- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE shall receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

9.3.9.4.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 frequency layer.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 frequency layer.

9.3.10 Inter-frequency measurement with NCSG

9.3.10.1 Inter-frequency cell identification

For the UE supporting NCSG, if NCSG is provided, the UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured) or *deriveSSB-IndexFromCellInter-r17* is configured. Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. The UE shall be able to identify a new detectable inter-frequency SS block of an already detected cell within $T_{identify_inter_without_index}$.

$$T_{identify_inter_without_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter} + T_{SSB_processing})\ ms$$

$$T_{identify_inter_with_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter} + T_{SSB_time_index_inter})\ ms$$

Where:

T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3.10.1-1 and table 9.3.10.1-2.

$T_{SSB_time_index_inter}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3.10.1-3 and table 9.3.10.1-4.

$T_{SSB_measurement_period_inter}$: equal to a measurement period of SSB based measurement given in table 9.3.10.2-1 and table 9.3.10.2-2.

$T_{SSB_processing}$: it is the time period used to process multiple beams received in one SMTC. $T_{SSB_processing}$ = 2 ms for UE supporting *Rel-19 L3 fast Rx beam sweeping* when the conditions in clause 3.6.21 are fulfilled. Otherwise, $T_{SSB_processing}$ = 0.

M_{pss/sss_sync_inter}: For a UE supporting FR2 power class 1 or 5, M_{pss/sss_sync_inter} = 64 samples. For a UE supporting FR2 power class 2, M_{pss/sss_sync_inter} = 40 samples. For a UE supporting FR2 power class 3, M_{pss/sss_sync_inter} = 40 samples. For a UE supporting FR2 power class 4, M_{pss/sss_sync_inter} = 40 samples.

$M_{SSB_index_inter}$: For a UE supporting FR2 power class 1 or 5, $M_{SSB_index_inter}$ = 40 samples. For a UE supporting FR2 power class 2, $M_{SSB_index_inter}$ = 24 samples. For a UE supporting FR2 power class 3, $M_{SSB_index_inter}$ = 24 samples. For a UE supporting FR2 power class 4, $M_{SSB_index_inter}$ = 24 samples.

$M_{meas_period_inter}$: For a UE supporting FR2 power class 1 or 5, $M_{meas_period_inter}$ =64 samples. For a UE supporting FR2 power class 2, $M_{meas_period_inter}$=40 samples. For a UE supporting FR2 power class 3, $M_{meas_period_inter}$ =40 samples. For a UE supporting FR2 power class 4, $M_{meas_period_inter}$ = 40 samples.

For a UE that supports *Rel-19 L3 fast Rx beam sweeping*, when the conditions in clause 3.6.21 are fulfilled and when *highSpeedMeasFlagFR2-r17* is not configured, the following values shall apply for M_{pss/sss_sync_inter}, $M_{SSB_index_inter}$ and $M_{meas_period_inter}$:

M_{pss/sss_sync_inter}: For a UE supporting FR2-1 power class 3, M_{pss/sss_sync_inter} =5* $N_{reduced_Rx_BSF}$.

$M_{SSB_index_inter}$: For a UE supporting FR2-1 power class 3, $M_{SSB_index_inter}$ = 3* $N_{reduced_Rx_BSF}$.

$M_{meas_period_inter}$: For a UE supporting FR2-1 power class 3, $M_{meas_period_inter}$ =5* $N_{reduced_Rx_BSF}$.

Where,

$N_{reduced_Rx_BSF}$ is the reduced Rx beam sweeping factor reported by UE via *Rel-19 L3 fast Rx beam sweeping*.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_ncsg,i}$ in clause 9.1.5.3 for measurement conducted within NCSG.

- K_{NCSG} is the scaling factor for a SSB frequency layer to be measured within an associated NCSG pattern. K_{NCSG} = 1 when the UE is not configured with concurrent GAPs. Otherwise, $K_{NCSG} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:
  - For a window W of duration max(SMTC period, xRP_max), where xRP_max is the maximum xRP across all configured per-UE GAPs and per-FR GAPs within the same FR as the SSB frequency layer, and starting from the beginning of any SMTC occasion:
    - N_{total} is the total number of SMTC occasions that are covered by instances of the associated NCSG within the window W, including those overlapped with other GAP occasions within the window, and
    - $N_{available}$ is the number of SMTC occasions that are covered by instances of the non-dropped associated NCSG within the window W after accounting for GAP collisions by applying the GAP collision rule in clauses 9.1.8.3, 9.1.12.3, and 9.1.13.3.
    - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.
- When concurrent GAPs are configured, requirements in this clause do not apply if $N_{available}$ =0.

Table 9.3.10.1-1: Time period for PSS/SSS detection with NCSG (FR1)

Condition NOTE1,2	T_{PSS/SSS_sync_inter}
No DRX	$Max(600\ ms, 8 \times K_{NCSG} \times Max(VIRP, SMTC\ period)) \times CSSF_{inter}$
DRX cycle ≤ 320 ms	$Max(600\ ms, Ceil(8*1.5 \times K_{NCSG}) \times Max(VIRP, SMTC\ period, DRX\ cycle)) \times CSSF_{inter}$
DRX cycle > 320 ms	$8 \times K_{NCSG} \times DRX\ cycle \times CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

Table 9.3.10.1-2: Time period for PSS/SSS detection with NCSG (FR2)

Condition NOTE1,2	T_{PSS/SSS_sync_inter}
No DRX	$Max(600\ ms, M_{pss/sss_sync_inter} \times K_{NCSG} \times Max(VIRP, SMTC\ period)) \times CSSF_{inter}$
DRX cycle ≤ 320 ms	$Max(600\ ms, (1.5 \times M_{pss/sss_sync_inter} \times K_{NCSG}) \times Max(VIRP, SMTC\ period, DRX\ cycle)) \times CSSF_{inter}$

DRX cycle > 320 ms	$M_{pss/sss_sync_inter} \times K_{NCSG} \times$ DRX cycle $\times CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

Table 9.3.10.1-3: Time period for time index detection with NCSG (FR1)

Condition NOTE1,2	$T_{SSB_time_index_inter}$
No DRX	$\text{Max}(120 \text{ ms}, 3 \times K_{NCSG} \times \text{Max}(\text{VIRP}, \text{SMTC period})) \times CSSF_{inter}$
DRX cycle ≤ 320 ms	$\text{Max}(120 \text{ ms}, \text{Ceil}(3 \times 1.5 \times K_{NCSG}) \times \text{Max}(\text{VIRP}, \text{SMTC period}, \text{DRX cycle})) \times CSSF_{inter}$
DRX cycle > 320 ms	$3 \times K_{NCSG} \times$ DRX cycle $\times CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

Table 9.3.10.1-4: Time period for time index detection with NCSG (FR2)

Condition NOTE1,2	$T_{SSB_time_index_inter}$
No DRX	$\text{Max}(200 \text{ ms}, M_{SSB_index_inter} \times K_{NCSG} \times \text{Max}(\text{VIRP}, \text{SMTC period})) \times CSSF_{inter}$
DRX cycle ≤ 320 ms	$\text{Max}(200 \text{ ms}, (1.5 \times M_{SSB_index_inter} \times K_{NCSG}) \times \text{Max}(\text{VIRP}, \text{SMTC period}, \text{DRX cycle})) \times CSSF_{inter}$
DRX cycle > 320 ms	$M_{SSB_index_inter} \times K_{NCSG} \times$ DRX cycle $\times CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

9.3.10.2 Measurement period

When NCSG are provided for inter-frequency measurements, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in tables 9.3.10.2-1 and 9.3.10.2-2:

Table 9.3.10.2-1: Measurement period for inter-frequency measurements with NCSG (FR1)

Condition NOTE1,2	$T_{SSB_measurement_period_inter}$
No DRX	$\text{Max}(200 \text{ ms}, 8 \times K_{NCSG} \times \text{Max}(\text{VIRP}, \text{SMTC period})) \times CSSF_{inter}$
DRX cycle ≤ 320 ms	$\text{Max}(200 \text{ ms}, \text{Ceil}(8 \times 1.5 \times K_{NCSG}) \times \text{Max}(\text{VIRP}, \text{SMTC period}, \text{DRX cycle})) \times CSSF_{inter}$
DRX cycle > 320 ms	$8 \times K_{NCSG} \times$ DRX cycle $\times CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

Table 9.3.10.2-2: Measurement period for inter-frequency measurements with NCSG (FR2)

Condition NOTE1,2	$T_{SSB_measurement_period_inter}$
No DRX	$\text{Max}(400 \text{ ms}, M_{meas_period_inter} \times K_{NCSG} \times \text{Max}(\text{VIRP}, \text{SMTC period})) \times CSSF_{inter}$
DRX cycle ≤ 320 ms	$\text{Max}(400 \text{ ms}, (1.5 \times M_{meas_period_inter} \times K_{NCSG}) \times \text{Max}(\text{VIRP}, \text{SMTC period}, \text{DRX cycle})) \times CSSF_{inter}$
DRX cycle > 320 ms	$M_{meas_period_inter} \times K_{NCSG} \times$ DRX cycle $\times CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

9.3.10.3 Scheduling availability during inter-frequency measurement with NCSG

When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of *SSB*-

ToMeasure from all the configured measurement objects on the same serving carrier which can be merged [2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

The requirements in clause 9.3.10.3.3 based on *deriveSSB-IndexFromCell-inter* apply provided that UE supports ncsg-*SymbolLevelScheduleRestrictionInter-r17*. If UE does not support *ncsg-SymbolLevelScheduleRestrictionInter-r17*, the requirements in clause 9.3.10.3.3 apply assuming *deriveSSB-IndexFromCell-inter* is not enabled.

9.3.10.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When the UE performs inter-frequency measurements with NCSG in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement when (1) *simultaneousRxTxInterBandCA* is not supported for the target measurement band and the serving cell's band, or (2) target measurement and the serving cell are on the same band on the band with overlapping DL frequency with UE's serving cell(s).

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and $\triangle$t serving cell symbol before each consecutive SSB symbols to be measured and $\triangle$t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. $\triangle$t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*,

When the UE performs inter-frequency measurements with NCSG in a TDD band, the following restrictions apply due to SS-RSRQ measurement when *simultaneousRxTxInterBandCA* is not supported for the target measurement band and the serving cell band

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and $\triangle$t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and $\triangle$t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. $\triangle$t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*.

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

9.3.10.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement when the target inter-frequency layer to be measured is on the same band with UE's serving cell(s) or on the band with overlapping DL frequency with UE's serving cell(s).

- The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and $\triangle$t serving cell symbol before each consecutive SSB symbols to be measured and $\triangle$t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. $\triangle$t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*,

  If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

9.3.10.3.3 Scheduling availability of UE performing measurements on FR2

When (1) UE does not support IBM between target measurement band and serving cell's band(s) nor *simultaneousRxTxInterBandCA*, or (2) target measurement and a serving cell are on the same band, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell with NCSG:

The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and $\triangle$t serving cell symbol before each consecutive SSB symbols to be measured and $\triangle$t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. $\triangle$t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*,

and due to SS-RSRQ measurement on an FR2 inter-frequency cell with NCSG

The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and $\triangle$t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and $\triangle$t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. $\triangle$t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*.

When UE does not support IBM between target measurement band and serving cell's band(s) but supports *simultaneousRxTxInterBandCA*, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell with NCSG

The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and $\triangle$t serving cell symbol before each consecutive SSB symbols to be measured and $\triangle$t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. $\triangle$t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*,

and due to SS-RSRQ measurement on an FR2 inter-frequency cell with NCSG

The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.8.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*.

When UE supports IBM between target measurement band and serving cell's band(s) but not *simultaneousRxTxInterBandCA*, the following scheduling restriction applies to the serving cell due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell with NCSG

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and △t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9..

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*,

and due to SS-RSRQ measurement on an FR2 inter-frequency cell with NCSG

The UE is not expected to transmit PUCCH/PUSCH/SRS on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

- serving cell symbols fully or partially overlap with SSB symbols to be measured on MO *i*, and △t serving cell symbol before each consecutive SSB symbols to be measured and RSSI measurement symbols, and △t serving cell symbol after each consecutive SSB symbols to be measured and RSSI measurement symbols within SMTC window duration, if *deriveSSB-IndexFromCellInter-r17* is enabled for MO *i*. △t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9.

- serving cell symbols fully or partially overlap with SMTC window for MO *i* and on 1 serving cell symbol before and after the SMTC window, if *deriveSSB-IndexFromCellInter-r17* is not enabled for MO *i*.

If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

When UE supports IBM between target measurement band and serving cell's band(s) and *simultaneousRxTxInterBandCA*, no scheduling restriction applies to the serving cell.

If following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE shall receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

9.3.10.3.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 frequency layer.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 frequency layer.

9.3A NR inter-frequency measurements in carrier frequencies with CCA

9.3A.1 Introduction

The requirements in clause 9.3A apply for inter-frequency measurements on a carrier frequency with CCA. A measurement is defined as an SSB based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.2A.The UE shall be able to identify new inter-frequency cells in carrier frequencies with CCA and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-frequency cells if carrier frequency information is provided by PCell or PSCell, even if no explicit neighbour list with physical layer cell identities is provided.

When the inter-frequency measurement is performed on a neighbour cell in FR2-2 with shared spectrum channel access, UE shall determine the CCA mode of the neighbour cell according to *channelAccessMode2-r17*of the cell configured in *MeasObjectNR*. If *channelAccessMode2-r17* of the cell is enabled, UE shall assume that CCA applies to the cell and perform measurement accordingly, and the requirements in clause 9.3A shall apply; otherwise, UE shall assume that CCA does not apply to the cell and perform measurement accordingly, and requirements in clause 9.3 shall apply.

SSB based measurements are configured along with a measurement timing configuration (SMTC) per carrier, which provides periodicity, duration and offset information on a window of up to 5 ms where the measurements on the configured inter-frequency carrier are to be performed. For inter-frequency connected mode measurements, one measurement window periodicity may be configured per inter-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB on an inter-frequency measurement object which start earlier than the gap starting time + switching time, nor detect SSB which end later than the gap end – switching time.

In the requirements of clause 9.3A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but N candidate SSB positions for the same SS/PBCH block index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding evaluation or measurement period, where:

- For the cell detection procedure: N is at least one candidate SSB position (NOTE: the one candidate SSB position for the cell detection shall not be impacted by the set of candidate SSB positions which are already being measured by the UE within the current measurement period of the on-going measurements), and
- For other procedures in clause 9.3A: N are the first two successive candidate SSB positions when two or more candidate SSB positions are configured for this SSB index in one discovery burst transmission window, otherwise N is one candidate SSB position;

otherwise the SMTC occasion is considered as available at the UE.

For the FR2-2 requirements of clause 9.3A, an SMTC occasion group consists of N consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB.

9.3A.2 Requirements applicability

The requirements in clause 9.3A apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency CCA cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.28,
- SS-RSRQ related side conditions given in clause 10.1.30 and TBD for FR1 and FR2-2, respectively,
- SS-SINR related side conditions given in clause 10.1.32 and TBD for FR1 and FR2-2, respectively,
- SSB_RP and SSB Ês/Iot according to Annex B.2.9.

9.3A.3 Number of cells and number of SSB

9.3A.3.1 Requirements for FR1

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 4 identified cells, and
- 7 SSBs with different SSB indexes and/or PCI on the inter-frequency layer.

9.3A.3.2 Requirements for FR2-2

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 4 identified cells, and
- 10 SSBs with different SSB index and/or PCI on the inter-frequency layer, and
- 1 SSB per identified cell.

9.3A.4 Inter-frequency cell identification

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_cca_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-frequency cell, in carrier frequencies with CCA, within $T_{identify_inter_cca_with_index}$. The UE shall be able to identify a new detectable inter-frequency SS block, in carrier frequencies with CCA, of an already detected cell within $T_{identify_inter_cca_without_index}$.

$$T_{identify_inter_cca_without_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca}) \text{ ms}$$

$$T_{identify_inter_cca_with_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca} + T_{SSB_time_index_inter_cca}) \text{ ms}$$

Where:

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1 and table 9.3A.4-3.

$T_{SSB_time_index_inter_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2 and table 9.3A.4-4.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

$M_{pss/sss_sync_inter_CCA}$: For a UE supporting FR2-2 power class 1, $M_{pss/sss_sync_inter\ CCA} = 96$. For a UE supporting FR2-2 power class 2, $M_{pss/sss_sync_inter\ CCA} = 60$. For a UE supporting FR2-2 power class 3, $M_{pss/sss_sync_inter\ CCA} = 60$.

$M_{SSB_index_inter_CCA}$: For a UE supporting FR2-2 power class 2 or 3, $M_{SSB_index_inter\ CCA} = 48$ samples. For a UE supporting FR2 power class 1, $M_{SSB_index_inter\ CCA} = 72$ samples

$M_{meas_period_inter_CCA}$: For a UE supporting FR2-2 power class 1, $M_{meas_period_inter\ CCA} = 96$. For a UE supporting FR2-2 power class 2, $M_{meas_period_inter\ CCA} = 60$. For a UE supporting FR2-2 power class 3, $M_{meas_period_inter\ CCA} = 60$

Table 9.3A.4-1: Time period for PSS/SSS detection (FR1)

Condition NOTE1,2,3,4	$T_{PSS/SSS_sync_inter_cca}$
No DRX	max(600 ms, $(8+L_{PSS/SSS,gaps})$ x max(MGRP, SMTC period)) x $CSSF_{inter}$
DRX cycle ≤ 320 ms	max(600 ms, ceil($(8+L_{PSS/SSS,gaps})$x1.5) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{inter}$
DRX cycle > 320 ms	$(8+L_{PSS/SSS,gaps})$ x DRX cycle x $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	

NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.
NOTE 3: When DRX is not configured, $L_{PSS/SSS,gaps}$ is the number of SMTC occasions not available at the UE during $T_{PSS/SSS_sync_inter_cca}$, for PSS/SSS detection, where $L_{PSS/SSS,gaps} \leq L_{PSS/SSS,gaps,max}$. When DRX is configured, $L_{PSS/SSS,gaps}$ is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{PSS/SSS_sync_inter_cca}$, for PSS/SSS detection, where $L_{PSS/SSS,gaps} \leq L_{PSS/SSS,gaps,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{inter}$.
NOTE 4: $L_{PSS/SSS,gaps,max} = 12$ for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms $L_{PSS/SSS,gaps,max} = 8$ for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and $L_{PSS/SSS,gaps,max} = 5$ for DRX cycle > 320 ms.

Upon exceeding $L_{PSS/SSS,gaps,max}$, the UE is not required to meet the corresponding PSS/SSS detection requirement. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

Table 9.3A.4-2: Time period for time index detection (FR1)

Condition NOTE1,2,3,4	$T_{SSB_time_index_inter_cca}$
No DRX	max(120 ms, (3+ $L_{ind,gaps}$) x max(MGRP, SMTC period)) x $CSSF_{inter}$
DRX cycle ≤ 320 ms	max(120 ms, ceil((3+ $L_{ind,gaps}$) x 1.5) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{inter}$
DRX cycle > 320 ms	(3 + $L_{ind,gaps}$) x DRX cycle x $CSSF_{inter}$

NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1
NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.
NOTE 3: When DRX is not configured, $L_{ind,gaps}$ is the number of SMTC occasions not available at the UE during $T_{SSB_time_index_inter_cca}$ for time index identification, where $L_{ind,gaps} \leq L_{ind,gaps,max}$. When DRX is configured, $L_{ind,gaps}$ is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{SSB_time_index_inter_cca}$ for time index identification, where $L_{ind,gaps} \leq L_{ind,gaps,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{inter}$.
NOTE 4: $L_{ind,gaps,max} = 5$ for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, $L_{ind,gaps,max} = 3$ for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and $L_{ind,gaps,max} = 2$ for DRX cycle > 320 ms.

The UE shall restart the time index detection upon exceeding $L_{ind,gaps,max}$. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

Table 9.3A.4-3: Time period for PSS/SSS detection, (Frequency range FR2-2)

Condition NOTE	T_{PSS/SSS_sync_inter}
No DRX	Max(600 ms, ceil($M_{pss/sss_sync_inter_CCA}$+ [$N_{RxBeam}$] x $L_{PSS/SSS,gaps}$))× Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(600 ms, ceil(1.5 × $M_{pss/sss_sync_inter_CCA}$+ [$N_{RxBeam}$] x $L_{PSS/SSS,gaps}$)) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil($M_{pss/sss_sync_inter_CCA}$+ [$N_{RxBeam}$] x $L_{PSS/SSS,gaps}$)× DRX cycle × $CSSF_{inter}$

NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1
NOTE 2: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified
NOTE 3: When DRX is not configured, $L_{PSS/SSS,gaps}$ is the number of SMTC occasion groups not available at the UE during $T_{PSS/SSS_sync_inter_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS,gaps} < L_{PSS/SSS,gaps,max}$. A SMTC occasion group consists of N_{RxBeam} consecutive SMTC occasions. An SMTC occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB. When DRX is configured, $L_{PSS/SSS}$ is the number of [DRX cycle groups] in which at least one SMTC occasion is not available at the UE during $T_{PSS/SSS_sync_inter_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS,gaps} < L_{PSS/SSS,gaps,max}$. [A DRX occasion group consists of N_{RxBeam} consecutive DRX cycles. A DRX occasion group occasion group is not available, when at least one SMTC occasion in the group is not transmitted by the gNB.] When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle.

NOTE 4: $L_{PSS/SSS,gaps,max}$ = 12 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms $L_{PSS/SSS,gaps}$ = 8 for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and $L_{PSS/SSS,gaps}$ = 5 for DRX cycle > 320 ms

Upon exceeding $L_{PSS/SSS,gaps,max}$, the UE is not required to meet the corresponding PSS/SSS detection requirement. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

Table 9.3A.4-4: Time period for time index detection (FR2-2)

Condition NOTE1,2,3,4	$T_{SSB_time_index_inter_cca}$
No DRX	max(120 ms, ceil($M_{SSB_index_inter_CCA}$ + [N_{RxBeam}] x $L_{ind,gaps}$) x max(MGRP, SMTC period)) x $CSSF_{inter}$
DRX cycle ≤ 320 ms	max(120 ms, ceil($M_{SSB_index_inter_CCA}$ + [N_{RxBeam}] x $L_{ind,gaps}$) x 1.5) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{inter}$
DRX cycle > 320 ms	ceil($M_{SSB_index_inter_CCA}$ + [N_{RxBeam}] x $L_{ind,gaps}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	
NOTE 2: When DRX is not configured, $L_{ind,gaps}$ is the number of SMTC occasions not available at the UE during $T_{SSB_time_index_inter_cca, for}$ for time index identification, where $L_{ind,gaps} \leq L_{ind,gaps,max}$. When DRX is configured, $L_{ind,gaps}$ is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{SSB_time_index_inter_cca, for}$ for time index identification, where $L_{ind,gaps} \leq L_{ind,gaps,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{inter}$.	
NOTE 3: $L_{ind,gaps,max}$ = [5] for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, $L_{ind,gaps,max}$ = [3] for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and $L_{ind,gaps,max}$ = [2] for DRX cycle > 320 ms.	

The UE shall restart the time index detection upon exceeding $L_{ind,gaps,max}$. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

9.3A.5 Inter-frequency measurements

When measurement gaps are provided for inter-frequency measurements in carrier frequencies with CCA, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.28, 10.1.30, 10.1.32, respectively, as shown in table 9.3A.5-1.

Table 9.3A.5-1: Measurement period for inter-frequency measurements with gaps

Condition NOTE1,2,3,4	$T_{SSB_measurement_period_inter_cca}$
No DRX	max(200 ms, (8+ L_{meas}) x max(MGRP, SMTC period)) x $CSSF_{inter}$
DRX cycle ≤ 320 ms	max(200 ms, ceil((8+ L_{meas}) x 1.5) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{inter}$
DRX cycle > 320 ms	(8+ L_{meas}) x DRX cycle x $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	
NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	
NOTE 3: When DRX is not configured, L_{meas} is the number of SMTC occasions not available at the UE during $T_{SSB_measurement_period_inter_cca}$, for inter-frequency measurements with gaps, where $L_{meas} \leq L_{meas,max}$. When DRX is configured, L_{meas} is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{SSB_measurement_period_inter_cca}$, for inter-frequency measurements with gaps, where $L_{meas} \leq L_{meas,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP. FFS: The UE is not required to de	
NOTE 4: $L_{meas,max}$ = 12 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, $L_{meas,max}$ = 8 for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and $L_{meas,max}$ = 5 for DRX cycle > 320 ms.	

The UE shall restart the measurement upon exceeding $L_{meas,max}$. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

The UE shall stop the measurement attempts on the SSB of a cell and perform the detection procedure again, like for any other SSB, when the following conditions are met:

- $L_{meas} > L_{meas,max}$, and
- The time period of unsuccessful measurement attempts exceeds the maximum time required for the cell to remain known as defined in clause 9.3A.6.3.

Table 9.3A.5-2: Measurement period for inter-frequency measurements with gaps(FR2-2)

Condition NOTE1,2,3,4	$T_{SSB_measurement_period_inter_cca}$
No DRX	max(200 ms, ceil($M_{meas_period_inter_CCA}$ + [N_{RxBeam}] x $L_{meas,gaps}$) x max(MGRP, SMTC period)) x $CSSF_{inter}$
DRX cycle ≤ 320 ms	max(200 ms, ceil($M_{meas_period_inter_CCA}$ + [N_{RxBeam}] x $L_{meas,gaps}$) x 1.5) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{inter}$
DRX cycle > 320 ms	ceil($M_{meas_period_inter_CCA}$ + [N_{RxBeam}] x $L_{meas,gaps}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	
NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	
NOTE 3: When DRX is not configured, $L_{meas,gaps}$ is the number of SMTC occasions not available at the UE during $T_{SSB_measurement_period_inter_cca}$, for inter-frequency measurements with gaps, where $L_{meas,gaps} \leq L_{meas,gaps,max}$. When DRX is configured, $L_{meas,gaps}$ is the number of DRX cycles in which at least one SMTC occasion is not available at the UE during $T_{SSB_measurement_period_NR_cca}$, for inter-frequency measurements with gaps, where $L_{meas,gaps} \leq L_{meas,gaps,max}$. When configured with DRX, the UE is not required to determine the availability of SMTC occasions more frequent than once per DRX cycle. When configured with measurement gaps, the UE is not required to determine the availability of SMTC occasions more frequent than once during MGRP. FFS: The UE is not required to determine the availability of SMTC occasions more frequent than what is required by $CSSF_{inter}$.	
NOTE 4: $L_{meas,gaps,max}$ = [12] for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, $L_{meas,gaps,max}$ = [8] for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and $L_{meas,gaps,max}$ = [5] for DRX cycle > 320 ms.	

The UE shall restart the measurement upon exceeding $L_{meas,gap,max}$. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

9.3A.6 Inter-frequency measurements reporting requirements

9.3A.6.1 Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.28, 10.1.30, and 10.1.32, respectively.

9.3A.6.2 Event-triggered Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses 10.1.28, 10.1.30, and 10.1.32, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.3A.6.3.

9.3A.6.3 Event-triggered Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.28, 10.1.30, and 10.1.32, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report, and all delays due to UL CCA failures until the successful transmission of the report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within $T_{identify_inter_cca_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_cca_with_index}$. Both $T_{identify_inter_cca_without_index}$ and $T_{identify_inter_cca_with_index}$ are defined in clause 9.3A.4. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify_inter_cca_without_index}$ or $T_{identify_inter_cca_with_index}$ defined in clause 9.3A.4. If a cell which has been detectable at least for the time period $T_{identify_inter_cca_without_index}$ or $T_{identify_inter_cca_with_index}$ defined in clause 9.3A.4 becomes undetectable for a period ≤ 8 seconds and then the cell becomes detectable again with the same spatial reception parameter and then triggers the measurement report as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{SSB_measurement_period_inter_cca}$ defined in clause 9.3A.5 provided the timing to that cell has not changed more than $\pm 3200/2^{\mu}$ Tc while measurement gap has not been available and the L3 filtering has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used an additional delay can be expected.

9.3A.8 Inter-frequency RSSI measurements

An RSSI measurement is defined as an inter-frequency measurement provided that the RSSI measurement bandwidth is not contained within the current carrier bandwidth of the UE.

The UE physical layer shall be capable of performing the RSSI measurements, defined in TS 38.215 [4] on one or more inter-frequency carriers operating with CCA, TS 37.213 [33], if the carrier(s) are indicated by higher layers [2], and report the RSSI measurements to higher layers. The UE physical layer shall provide to higher layers a single RSSI sample for each OFDM symbol within each configured RSSI measurement duration [2] occurring with a configured RSSI measurement timing configuration periodicity [2], *rmtc-Periodicity*. The requirements apply if *rmtc-SubframeOffset* [2] is configured.

For performing inter-frequency RSSI measurement in FR2-2,

- If a UE has serving cell in FR2-2,
  - If the TCI state is provided in RMTC configuration of FR2-2, the UE shall assume the configured RSSI measurement resources are QCL-ed with TypeD to the DL RS associated with the TCI state provided in the RMTC configuration. The UE does not expect to be configured with an explicit TCI-state in RMTC-Config with a reference serving cell in FR1 or FR2-1. If no TCI state is provided in the RMTC configuration, the UE shall assume the configured RSSI measurement resources are QCL-ed with TypeD to one of the latest received PDSCH and the latest monitored CORESET in the active BWP of a serving carrier in FR2-2.
- If a UE has no serving cell in FR2-2,
  - The UE does not expect that a TCI state is provided in RMTC configuration. It is up to UE implementation how to determine the spatial domain filter for the inter-frequency RSSI measurement in FR2-2, and no requirements are defined.

For RSSI measurement in FR2-2 with SCS of 480 kHz or 960 kHz, the RSSI measurement results shall be derived based on symbols configured by RMTC except for the first symbol and the last symbol in RMTC, and there is no requirements when *measDurationSymbols* is configured as 1.

Table 9.3A.8-1: Measurement period for inter-frequency RSSI measurements with gaps

Condition NOTE1,2,3,4	$T_{RSSI_measurement_period_inter_cca}$
No DRX	max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x $CSSF_{inter}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x $CSSF_{inter}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{inter}$ is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.	

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency RSSI measurements. The RSSI measurement duration and the measurement gap shall be aligned, and the following additional condition shall be fulfilled:

- Entire RSSI measurement duration is contained in the measurement gap.

The RSSI measurement performed and reported according to this clause shall meet the RSSI measurement accuracy requirement in clause 10.1.34.2. The reported RSSI measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.34.3.

9.3A.9 Inter-frequency channel occupancy measurements

The UE shall be capable of estimating the channel occupancy on one or more carrier frequencies indicated by higher layers [2], based on RSSI samples provided by the physical layer. The requirements apply if *rmtc-SubframeOffset* [2] is configured.

Table 9.3A.9-1: Measurement period for inter-frequency Channel Occupancy measurements with gaps

Condition NOTE1,2,3,4	$T_{CO_measurement_period_inter_cca}$
No DRX	max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x $CSSF_{inter}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x $CSSF_{inter}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{inter}$ is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.	

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency channel occupancy measurements. The RSSI measurement duration used for channel occupancy measurement and the measurement gap shall be aligned, and the following additional condition shall be fulfilled:

- Entire RSSI measurement duration is contained in the measurement gap.

The channel occupancy measurement performed and reported according to this clause shall meet the channel occupancy measurement accuracy requirements in clause 10.1.35.2. The reported channel occupancy measurement values contained in measurement reports shall be based on the measurement reporting range specified in TS 38.331 [2].

9.3B NR inter-frequency measurements for RedCap

9.3B.1 Introduction

A measurement is defined as an SSB based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.2B.

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-frequency cells if carrier frequency information is provided by PCell, even if no explicit neighbour list with physical layer cell identities is provided.

A measurement is defined as an inter-frequency SSB based measurements without measurement gaps for UE capable of *interFrequencyMeas-NoGap* provided

- the UE supports *interFrequencyMeas-Nogap-r16* [15], and
- the SSB is completely contained in the active BWP of the UE.

For inter-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.3B.7.3.

SSB based measurements are configured along with a measurement timing configuration (SMTC) per carrier, which provides periodicity, duration and offset information on a window of up to 5 ms where the measurements on the

configured inter-frequency carrier are to be performed. For inter-frequency connected mode measurements, one measurement window periodicity may be configured per inter-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB on an inter-frequency measurement object which start earlier than the gap starting time + switching time, nor detect SSB which ends later than the gap end – switching time. When the serving cells are in FR2, the inter-frequency cells are in FR2 and the per-UE gap or per-FR gap is configured to the UE in SA NR, the switching time is 0.25 ms. Otherwise the switching time is 0.5 ms.

Longer measurement period would be expected during the period $T_{identify_CGI_RedCap}$ when the UE is requested to decode an NR/E-UTRA CGI.

9.3B.2 Requirements applicability

The requirements in clause 9.3B apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency cell shall be considered detectable when for each relevant SSB:

- For 2 Rx RedCap UE:
  - SS-RSRP related side conditions given in clauses 10.1.4 and 10.1.5 for FR1 and FR2, respectively, for a corresponding band,
  - SS-RSRQ related side conditions given in clauses 10.1.9 and 10.1.10 for FR1 and FR2, respectively, for a corresponding band,
  - SS-SINR related side conditions given in clauses 10.1.14 and 10.1.15 for FR1 and FR2, respectively, for a corresponding band,
  - SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding band.
- For 1 Rx RedCap UE:
  - SS-RSRP related side conditions given in clauses 10.1A.4 for FR1 for a corresponding band,
  - SS-RSRQ related side conditions given in clauses 10.1A.8 for FR1 for a corresponding band,
  - SS-SINR related side conditions given in clauses 10.1A.12 for FR1, respectively, for a corresponding band,
  - SSB_RP and SSB Ês/Iot according to Annex B.2.16 for a corresponding band.

9.3B.3 Number of cells and number of SSB

9.3B.3.1 Requirements for FR1

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 4 identified cells, and
- 7 SSBs with different SSB index and/or PCI on the inter-frequency layer.

9.3B.3.2 Requirements for FR2

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 4 identified cells, and
- 10 SSBs with different SSB index and/or PCI on the inter-frequency layer, and
- 1 SSB per identified cell.

9.3B.4 Inter-frequency measurement with measurement gaps

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_without_index_RedCap}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index_RedCap}$. The UE shall be able to identify a new detectable inter-frequency SS block of an already detected cell within $T_{identify_inter_without_index_RedCap}$.

$$T_{identify_inter_without_index_RedCap} = (T_{PSS/SSS_sync_inter_RedCap} + T_{SSB_measurement_period_inter_RedCap})\ ms$$

$$T_{identify_inter_with_index_RedCap} = (T_{PSS/SSS_sync_inter_RedCap} + T_{SSB_measurement_period_inter_RedCap} + T_{SSB_time_index_inter_RedCap})\ ms$$

Where:

$T_{PSS/SSS_sync_inter_RedCap}$: it is the time period used in PSS/SSS detection given in table 9.3B.4-1, table 9.3B.4-2, table 9.3B.4-3.

$T_{SSB_time_index_inter_RedCap}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3B.4-4, table 9.3B.4-5, table 9.3B.4-6.

$T_{SSB_measurement_period_inter_RedCap}$: equal to a measurement period of SSB based measurement given in table 9.3B.5-1, table 9.3B.5-2, table 9.3B.5-3.

For 2 Rx RedCap UE:

$M_{pss/sss_sync_inter_RedCap}$: For a UE supporting FR2 power class 1 or 5, $M_{pss/sss_sync_inter_RedCap}$ = 64 samples. For a UE supporting FR2 power class 2, 3, 4 or 7, $M_{pss/sss_sync_inter_RedCap}$ = 40 samples.

$M_{SSB_index_inter_RedCap}$: For a UE supporting FR2 power class 1 or 5, $M_{SSB_index_inter_RedCap}$ = 40 samples. For a UE supporting FR2 power class 2, 3,4 or 7, $M_{SSB_index_inter_RedCap}$ = 24 samples.

$M_{meas_period_inter_RedCap}$: For a UE supporting FR2 power class 1 or 5, $M_{meas_period_inter_RedCap}$ =64 samples. For a UE supporting FR2 power class 2, 3, 4 or 7, $M_{meas_period_inter_RedCap}$ =40 samples.

$CSSF_{inter_RedCap}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap_RedCap,i}$ in clause 9.1A.5.2 for measurement conducted within measurement gaps.

Table 9.3B.4-1: Time period for PSS/SSS detection (FR1) for 2Rx RedCap UE

Condition NOTE1	$T_{PSS/SSS_sync_inter_RedCap}$
No DRX	$Max(600\ ms, 8 \times Max(MGRP, SMTC\ period)) \times CSSF_{inter_RedCap}$
DRX cycle ≤ 320 ms	$Max(600\ ms, Ceil(8*1.5) \times Max(MGRP, SMTC\ period, DRX\ cycle)) \times CSSF_{inter_RedCap}$
DRX cycle > 320 ms	$8 \times DRX\ cycle \times CSSF_{inter_RedCap}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	

Table 9.3B.4-2: Time period for PSS/SSS detection, (FR2) for 2Rx RedCap UE

Condition NOTE1	$T_{PSS/SSS_sync_inter_RedCap}$
No DRX	$Max(600\ ms, M_{pss/sss_sync_inter_RedCap} \times Max(MGRP, SMTC\ period)) \times CSSF_{inter_RedCap}$
DRX cycle ≤ 320 ms	$Max(600\ ms, (1.5 \times M_{pss/sss_sync_inter_RedCap}) \times Max(MGRP, SMTC\ period, DRX\ cycle)) \times CSSF_{inter_RedCap}$
DRX cycle > 320 ms	$M_{pss/sss_sync_inter_RedCap} \times DRX\ cycle \times CSSF_{inter_RedCap}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	

Table 9.3B.4-3: Time period for PSS/SSS detection (Frequency range FR1) for 1Rx RedCap UE

Condition NOTE1	$T_{PSS/SSS_sync_inter_RedCap}$
No DRX	$Max(600\ ms, 10 \times Max(MGRP, SMTC\ period)) \times CSSF_{inter_RedCap}$
DRX cycle ≤ 320 ms	$Max(600\ ms, Ceil(10*1.5) \times Max(MGRP, SMTC\ period, DRX\ cycle)) \times CSSF_{inter_RedCap}$
DRX cycle > 320 ms	$10 \times DRX\ cycle \times CSSF_{inter_RedCap}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	

Table 9.3B.4-4: Time period for time index detection (FR1) for 2Rx RedCap UE

Condition NOTE1	$T_{SSB_time_index_inter_RedCap}$
No DRX	Max(120 ms, 3 × Max(MGRP, SMTC period)) × $CSSF_{inter_RedCap}$
DRX cycle ≤ 320 ms	Max(120 ms, Ceil(3 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter_RedCap}$
DRX cycle > 320 ms	3 × DRX cycle × $CSSF_{inter_RedCap}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	

Table 9.3B.4-5: Time period for time index detection (FR2) for 2Rx RedCap UE

Condition NOTE1	$T_{SSB_time_index_inter_RedCap}$
No DRX	Max(200 ms, $M_{SSB_index_inter_RedCap}$ × Max(MGRP, SMTC period)) × $CSSF_{inter_RedCap}$
DRX cycle ≤ 320 ms	Max(200 ms, (1.5 × $M_{SSB_index_inter_RedCap}$) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter_RedCap}$
DRX cycle > 320 ms	$M_{SSB_index_inter_RedCap}$ × DRX cycle × $CSSF_{inter_RedCap}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	

Table 9.3B.4-6: Time period for time index detection (FR1) for 1Rx RedCap UE

Condition NOTE1	$T_{SSB_time_index_inter_RedCap}$
No DRX	Max(160 ms, 6 × Max(MGRP, SMTC period)) × $CSSF_{inter_RedCap}$
DRX cycle ≤ 320 ms	Max(160 ms, Ceil(6 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter_RedCap}$
DRX cycle > 320 ms	6 × DRX cycle × $CSSF_{inter_RedCap}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	

9.3B.5 Inter-frequency measurements

When measurement gaps are provided for inter-frequency measurements, the RedCap UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1A.4, 10.1A.5, 10.1A.8, 10.1A.9, 10.1A.12 and 10.1A.13, respectively, as shown in table 9.3B.5-1 and 9.3B.5-2 for 2Rx RedCap and 9.3B.5-3 for 1Rx RedCap, respectively.

Table 9.3B.5-1: Measurement period for inter-frequency measurements with gaps (FR1) for 2Rx RedCap UE

Condition NOTE1	$T_{SSB_measurement_period_inter_RedCap}$
No DRX	Max(200 ms, 8 × Max(MGRP, SMTC period)) × $CSSF_{inter_RedCap}$
DRX cycle ≤ 320 ms	Max(200 ms, Ceil(8 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter_RedCap}$
DRX cycle > 320 ms	8 × DRX cycle × $CSSF_{inter_RedCap}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	

Table 9.3B.5-2: Measurement period for inter-frequency measurements with gaps (FR2) for 2Rx RedCap UE

Condition NOTE1	$T_{SSB_measurement_period_inter_RedCap}$
No DRX	Max(400 ms, $M_{meas_period_inter_RedCap}$ × Max(MGRP, SMTC period)) × $CSSF_{inter_RedCap}$
DRX cycle ≤ 320 ms	Max(400 ms, (1.5 × $M_{meas_period_inter_RedCap}$) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter_RedCap}$
DRX cycle > 320 ms	$M_{meas_period_inter_RedCap}$ × DRX cycle × $CSSF_{inter_RedCap}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	

Table 9.3B.5-3: Measurement period for inter-frequency measurements with gaps (FR1) for 1Rx RedCap UE

Condition NOTE1	$T_{SSB_measurement_period_inter_RedCap}$
No DRX	Max(400 ms, 8 × Max(MGRP, SMTC period)) × $CSSF_{inter_RedCap}$
DRX cycle ≤ 320 ms	Max(400 ms, ceil(1.5 × 8) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter_RedCap}$

DRX cycle > 320 ms	8 × DRX cycle × $CSSF_{inter_RedCap}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	

9.3B.6 Inter-frequency measurements reporting requirements

9.3B.6.1 Periodic Reporting

For 2 Rx RedCap UE: The requirements in clause 9.3.6.1 shall apply.

For 1 Rx RedCap UE: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1A.4.1, 10.1A.8.1 and 10.1A.12.1, respectively.

9.3B.6.2 Event-triggered Periodic Reporting

For 2 Rx RedCap UE: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

For 1 Rx RedCap UE: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses 10.1A.4.1, 10.1A.8.1 and 10.1A.12.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.3B.6.3.

9.3B.6.3 Event-triggered Reporting

For 2 Rx RedCap UE: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

For 1 Rx RedCap UE: Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1A.4.1, 10.1A.8.1 and 10.1A.12.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within $T_{identify_inter_without_index_RedCap}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index_RedCap}$. Both $T_{identify_inter_without_index_RedCap}$ and $T_{identify_inter_with_index_RedCap}$ are defined in clause 9.3B.4. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period $T_{identify_inter_without_index_RedCap}$ or $T_{identify_inter_with_index_RedCap}$ as defined in clause 9.3B.4 or 9.3B.7.1. If a cell which has been detectable at least for the time period $T_{identify\ inter\ without\ index_RedCap}$ or $T_{identify\ inter\ with\ index_RedCap}$ defined in clause 9.3B.4 or 9.3B.7.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again with the same spatial reception parameter and triggers an event, the event triggered measurement reporting delay shall be less than $T_{SSB_measurement_period_intra_RedCap}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu} T_c$ while the measurement gap has not been available and L3 filtering has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

9.3B.7 Inter-frequency measurements without measurement gaps

9.3B.7.1 Inter-frequency Cell identification

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_without_index_RedCap}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index_RedCap}$. The UE shall be able to identify a new detectable inter-frequency SS block of an already detected cell within $T_{identify_inter_without_index_RedCap}$. It is assumed that when UE performs inter-frequency measurements without measurement gaps in a TDD bands on FR1 and FR2, the following conditions are met:

- SFN and frame boundary across serving cell and inter-frequency neighbor cells is aligned, and
- the timing of SSBs across serving cell and inter-frequency neighbor cells are aligned

$$T_{identify_inter_without_index_RedCap} = (T_{PSS/SSS_sync_inter_RedCap} + T_{SSB_measurement_period_inter_RedCap})\ ms$$

$$T_{identify_inter_with_index_RedCap} = (T_{PSS/SSS_sync_inter_RedCap} + T_{SSB_measurement_period_inter_RedCap} + T_{SSB_time_index_inter_RedCap})\ ms$$

Where:

$T_{PSS/SSS_sync_inter_RedCap}$: it is the time period used in PSS/SSS detection given in table 9.3B.7.1-1, table 9.3B.7.1-2 and table 9.3B.7.1-3.

$T_{SSB_time_index_inter_RedCap}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3B.7.1-4 and table 9.3B.7.1-5.

$T_{SSB_measurement_period_inter_RedCap}$: equal to a measurement period of SSB based measurement given in table 9.3B.7.2-1, table 9.3B.7.2-2 and table 9.3B.7.2-3.

$CSSF_{inter_RedCap}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap_RedCap,i}$ in clause 9.1A.5.1 for measurement conducted outside measurement gaps, i.e. when inter-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps or according to $CSSF_{within_gap_RedCap,i}$ in clause 9.1A.5.2 for measurement conducted within measurement gaps, i.e. when inter-frequency SMTC is fully overlapping with measurement gaps.

$M_{pss/sss_sync_inter_RedCap}$: For a UE supporting FR2 power class 1 or 5, $M_{pss/sss_sync_inter_RedCap}$ = 40 samples. For a UE supporting FR2 power class 2, 3, 4 or 7, $M_{pss/sss_sync_inter_RedCap}$ = 24 samples.

$M_{SSB_index_inter_RedCap}$: For a UE supporting FR2 power class 1 or 5, $M_{SSB_index_inter_RedCap}$ = 40 samples. For a UE supporting FR2 power class 2, 3, 4 or 7, $M_{SSB_index_inter_RedCap}$ = 24 samples.

$M_{meas_period_inter_RedCap}$: For a UE supporting FR2 power class 1 or 5, $M_{meas_period_inter_RedCap}$ =40 samples. For a UE supporting FR2 power class 2, 3, 4 or 7, $M_{meas_period_inter_RedCap}$ =24 samples.

When inter-frequency SMTC is fully non overlapping with measurement gaps or inter-frequency SMTC is fully overlapping with MGs, K_p=1.

When inter-frequency SMTC is partially overlapping with measurement gaps, K_p = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP.

For FR2,

$K_{layer1_measurement}$ =1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap are not fully overlapped by inter-frequency SMTC occasions, or
- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap and fully-overlapped by inter-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured,

where SSB symbols are indicated by *SSB-ToMeasure* and RSSI symbols are indicated by *SS-RSSI-Measurement*;

$K_{layer1_measurement}$=1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

Table 9.3B.7.1-1: Time period for PSS/SSS detection (FR1) for 2Rx RedCap UE

DRX cycle	$T_{PSS/SSS_sync_inter_RedCap}$
No DRX	max(600 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{inter_RedCap}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter_RedCap}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{inter_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3B.7.1-2: Time period for PSS/SSS detection (FR2) for 2Rx RedCap UE

DRX cycle	$T_{PSS/SSS_sync_inter_RedCap}$
No DRX	max(600 ms, ceil($M_{pss/sss_sync_inter_RedCap}$ x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{inter_RedCap}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x $M_{pss/sss_sync_inter_RedCap}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter_RedCap}$
DRX cycle>320 ms	ceil($M_{pss/sss_sync_inter_RedCap}$ x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{inter_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3B.7.1-3: Time period for PSS/SSS detection (FR1) for 1Rx RedCap UE

DRX cycle	$T_{PSS/SSS_sync_inter_RedCap}$
No DRX	max(600 ms, ceil(7 x K_p) x SMTC period)[Note 1] x $CSSF_{inter_RedCap}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x 7 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter_RedCap}$
DRX cycle>320 ms	ceil(7 x K_p) x DRX cycle x $CSSF_{inter_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3B.7.1-4: Time period for time index detection (FR1) for 2Rx RedCap UE

DRX cycle	$T_{SSB_time_index_inter_RedCap}$
No DRX	max(120 ms, ceil(3 x K_p) x SMTC period)[Note 1] x $CSSF_{inter_RedCap}$
DRX cycle≤ 320 ms	max(120 ms, ceil (1.5 x 3 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter_RedCap}$
DRX cycle>320 ms	Ceil(3 x K_p) x DRX cycle x $CSSF_{inter_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3B.7.1-5: Time period for time index detection (FR1) for 1Rx RedCap UE

DRX cycle	$T_{SSB_time_index_inter_RedCap}$
No DRX	max(160 ms, ceil(6 x K_p) x SMTC period)[Note 1] x $CSSF_{inter_RedCap}$
DRX cycle≤ 320 ms	max(160 ms, ceil (1.5 x 6 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter_RedCap}$
DRX cycle>320 ms	Ceil(6 x K_p) x DRX cycle x $CSSF_{inter_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

9.3B.7.2 Measurement period

The RedCap UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1A.4, 10.1A.5, 10.1A.8, 10.1A.9, 10.1A.12 and 10.1A.13, respectively, as shown in table 9.3B.7.2-1 and 9.3B.7.2-2 for 2Rx RedCap and table 9.3B.7.2-3 for 1Rx RedCap respectively, if UE supports inter-frequency measurement without measurement gaps:

Table 9.3B.7.2-1: Measurement period for inter-frequency measurements without gaps ((FR1) for 2Rx RedCap UE

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(200 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{inter_RedCap}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter_RedCap}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{inter_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3B.7.2-2: Measurement period for inter-frequency measurements without gaps (FR2) for 2Rx RedCap UE

DRX cycle	$T_{SSB_measurement_period_inter_RedCap}$
No DRX	max(400 ms, ceil($M_{meas_period_inter_RedCap}$ x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{inter_RedCap}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5x $M_{meas_period_inter_RedCap}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter_RedCap}$
DRX cycle>320 ms	ceil($M_{meas_period_inter_RedCap}$ xK_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{inter_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3B.7.2-3: Measurement period for inter-frequency measurements without gaps ((FR1) for 1Rx RedCap UE

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(200 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{inter_RedCap}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter_RedCap}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{inter_RedCap}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

9.3B.7.3 Scheduling availability of UE during inter-frequency measurements

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE is required to be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols to be measured in the following clauses are the SSB symbols indicated by *SSB-ToMeasure* [2], if it is configured; otherwise, all L SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

The scheduling availability requirements when UE performs inter-frequency measurements without measurement gaps in a TDD bands on FR1 and FR2 and HD-FDD UE performs inter-frequency measurements without measurement gaps on FR1 in clause 9.3B.7.3.1~9.3B.7.3.4 are valid under the following conditions:

- SFN and frame boundary across serving cell and inter-frequency neighbor cells is aligned, and
- the timing of SSBs across serving cell and inter-frequency neighbor cells are aligned

9.3B.7.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When UE performs inter-frequency measurements without measurement gaps in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

When UE performs inter-frequency measurements without measurement gaps in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

9.3B.7.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology-Inter-r16* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If UE performs inter-frequency measurements without measurement gaps in a TDD band, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If UE performs inter-frequency measurements without measurement gaps in a FDD band, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

9.3B.7.3.3 Scheduling availability of UE performing measurements on FR2

The following scheduling restriction applies due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell

> The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

The following scheduling restriction applies to SS-RSRQ measurement on an FR2 inter-frequency cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

If following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE shall receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

9.3B.7.3.4 Scheduling availability of HD-FDD UE performing measurements on FR1

When HD-FDD UE performs inter-frequency measurements without measurement gaps in a FR1 band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

When HD-FDD UE performs inter-frequency measurements without measurement gaps in a FR1 band, the following restrictions apply due to SS-RSRQ measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

9.3C NR inter-frequency measurements for SAN

9.3C.1 Introduction

A measurement is defined as an SSB based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.2C. The requirements apply provided the valid parameters of ephemeris information, epoch time of the ephemeris, common TA, validity timer information, downlink polarization information for target NR SAN cell are send to UE.

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-frequency cells if carrier frequency information is provided by PCell, even if no explicit neighbour list with physical layer cell identities is provided.

A measurement is defined as inter-frequency SSB based measurements without measurement gaps for UE capable of *interFrequencyMeas-NoGap* provided

- the UE supports *interFrequencyMeas-Nogap-r16* [15], and
- the SSB is completely contained in the active BWP of the UE, and
- the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

For inter-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.3C.5.3.

SSB based measurements are configured along with one or more measurement timing configurations (SMTC) which provides periodicity, duration and offset information on a window of up to 5 ms where the measurements on the configured inter-frequency carrier are to be performed. For inter-frequency connected mode measurements, the measurement window periodicity may be configured per inter-frequency measurement object.

- when *SSB-MTC4List-r17* is not configured, one measurement window periodicity will be configured with *SSB-MTC*
- when *SSB-MTC4List-r17* is configured, multiple measurement window offsets may be configured with *SSB-MTC* and *SSB-MTC4List-r17*, and the requirements in 9.3C apply provided that the total number of measurement window offsets does not exceed the UE capability *parallelSMTC-r17*

When measurement gaps are needed, the UE is not expected to detect SSB on an inter-frequency measurement object which start earlier than the gap starting time + switching time, nor detect SSB which ends later than the gap end – switching time, and the switching time is 0.5 ms.

The requirements in this clause shall also apply, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

The inter-frequency measurement requirements in clause 9.3C.4 and clause 9.3C.5 apply for the following scenarios:

- SSB-based inter-frequency measurement object with measurement gap.
- SSB-based inter-frequency measurement object without measurement gap when
  - all of the SMTC occasions of this inter-frequency measurement object are overlapped with the measurement gap or associated measurement gap in concurrent measurement gaps, or
  - part of the SMTC occasions of this inter-frequency measurement object are overlapped with the associated measurement gap and all the SMTC occasions of this inter-frequency measurement object are overlapped with the union of concurrent measurement gaps, or

- part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or associated measurement gap in concurrent measurement gaps.

The inter-frequency measurement requirements in clause 9.3C.7 apply for the following scenarios:

- SSB-based inter-frequency measurement with no measurement gap, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gap.
- SSB-based inter-frequency measurement with no measurement gap, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap or the union of concurrent measurement gaps.

The requirements in clause 9.3C.8, 9.3C.9 and 9.3C.10 apply provided that the measured NR SAN cell is served by the same satellite as the serving cell.

The requirements in clause 9.3C.4, 9.3C.5, 9.3C.8 and 9.3C.9 do not apply if the MG is fully overlapping with the serving cell SSB occasions, and the serving cell SSB is with a 160 ms periodicity.

9.3C.2 Requirements applicability

The requirements in clause 9.3C apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clauses 10.1.4C for FR1-NTN and 10.1.5C for FR2-NTN, for a corresponding band,
- SS-RSRQ related side conditions given in clauses 10.1.9C for FR1-NTN and 10.1.10C for FR2-NTN, for a corresponding band,
- SS-SINR related side conditions given in clauses 10.1.14C for FR1-NTN and 10.1.15C for FR2-NTN, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.18 for a corresponding band.

9.3C.3 Number of cells and number of SSB

9.3C.3.1 Requirements for FR1-NTN

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 4 identified cells, and
- 7 SSBs with different SSB index and/or PCI on the inter-frequency layer.
- 4 SSBs with different SSB index and/or PCI from neighbour cells in GEO deployment.
- In NGSO deployments: cells from 2 satellites if UE does not support the capability *maxNumber-NGSO-SatellitesPerCarrier-r17*; or cells from 3 or 4 satellites depending on the value indicated in *maxNumber-NGSO-SatellitesPerCarrier-r17*.

9.3C.4 Inter-frequency measurement with measurement gaps

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. The UE shall be able to identify a new detectable inter-frequency SS block of an already detected cell within $T_{identify_inter_without_index.}$

$$T_{identify_inter_without_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter})\ ms$$

$$T_{identify_inter_with_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter} + T_{SSB_time_index_inter})\ ms$$

Where:

T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3C.4-1.

$T_{SSB_time_index_inter}$: it is the time period used to acquire the index of the SSB being measured given in :

- Table 9.3C.4-2 for target cells operating with 20 PRB SSB BW in FR1-NTN;

- Table 9.3C.4-3 for target cells operating with 12 PRB SSB BW in FR1-NTN

$T_{SSB_measurement_period_inter}$: equal to a measurement period of SSB based measurement given in table 9.3C.5-1.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

K_{gap} is the scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. K_{gap} = 1 when the UE is not configured with concurrent measurement gaps. When the UE is configured with concurrent measurement gaps and the two measurement gaps are fully overlapping with MGRP=160 ms, K_{gap} = 2. Otherwise, $K_{gap} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

For a window W of duration max(SMTC period, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gap, and starting from the beginning of any SMTC occasion:

- N_{total} is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other measurement gap occasions within the window, and

- $N_{available}$ is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1.8C.3.

K_{gap} is only applicable for UE supporting *parallelMeasurementGap-r17*. When concurrent measurement gaps are configured, requirements in this clause do not apply if $N_{available}$ =0, or if one SMTC overlaps more than one MGs associated to the frequency layer.

K_satellite: it is a satellite specific scaling factor.

- If SMTCs within a measurement gap do not overlap with each other, and if LEO and/or GEO satellite(s) is/are required to be measured within SMTC

  - K_satellite = 1, if GSO satellites are measured on the carrier

  - $K_satellite = \left\lceil \frac{Num\ of\ LEO\ satellites\ to\ be\ measured\ in\ the\ SMTC}{number\ of\ LEO\ satellites\ UE\ is\ capable\ to\ measure\ in\ one\ SMTC} \right\rceil$, if LEO satellites are measured on the carrier.

- If SMTCs within a measurement gap partially overlap with each other, and if LEO and/or GEO satellite(s) is/are required to be measured within overlapped SMTCs

  - $K_satellite = number\ of\ overlapped\ SMTCs$, if only GEO satellites are measured on the carrier

  - $K_satellite = \sum_i \left\lceil \frac{Num\ of\ LEO\ satellites\ to\ be\ measured\ in\ the\ SMTC\ i}{number\ of\ LEO\ satellites\ UE\ is\ capable\ to\ measure\ in\ one\ SMTC} \right\rceil$, if only LEO satellites are measured on the carrier.

Table 9.3C.4-1: Time period for PSS/SSS detection (FR1-NTN)

Condition NOTE1	T_{PSS/SSS_sync_inter}
No DRX	Max(600 ms, Ceil(8 x K_{gap}) × Max(MGRP, SMTC period NOTE2)) × $CSSF_{inter}$ × K_satellite
DRX cycle ≤ 320 ms	Max(600 ms, Ceil(8*1.5 x K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$ × K_satellite
DRX cycle > 320 ms	Ceil(8 x K_{gap}) × DRX cycle × $CSSF_{inter}$ × K_satellite
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1	

NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.

Table 9.3C.4-2: Time period for time index detection (FR1-NTN)

Condition NOTE1	$T_{SSB_time_index_inter}$
No DRX	Max(120 ms, Ceil(3 x K_{gap}) × Max(MGRP, SMTC period NOTE2)) × $CSSF_{inter}$ × K_satellite
DRX cycle ≤ 320 ms	Max(120 ms, Ceil(3 × 1.5 x K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$ × K_satellite
DRX cycle > 320 ms	Ceil(3 x K_{gap}) × DRX cycle × $CSSF_{inter}$ × K_satellite
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

Table 9.3C.4-3: Time period for time index detection for a UE operating on a target cell with 12 PRB SSB (FR1-NTN)

Condition NOTE1	$T_{SSB_time_index_inter}$
No DRX	Max(120 ms, Ceil(6 x K_{gap}) × Max(MGRP, SMTC period NOTE2)) × $CSSF_{inter}$ × K_satellite
DRX cycle ≤ 320 ms	Max(120 ms, Ceil(6 × 1.5 x K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$ × K_satellite
DRX cycle > 320 ms	Ceil(6 x K_{gap}) × DRX cycle × $CSSF_{inter}$ × K_satellite
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. NOTE 3: The requirements in this table apply provided that the Ês/Iot on the target cell SSB is ≥-4 dB.	

The UE is allowed to skip measurements on inter-frequency cells, in the interval between *t-serviceStart* and the satellite switch completion, when it is performing soft satellite switching with resynchronization. In this case, for the measurement initiated but not completed before the beginning of this interval, the total time to detection can be longer.

9.3C.5 Inter-frequency measurements

When measurement gaps are provided for inter-frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4C, 10.1.9C and 10.1.14C , respectively, as shown in table 9.3C.5-1.

Table 9.3C.5-1: Measurement period for inter-frequency measurements with gaps (FR1-NTN)

Condition NOTE1	$T_{SSB_measurement_period_inter}$
No DRX	Max(200 ms, Ceil(8 x K_{gap}) × Max(MGRP, SMTC period NOTE2)) × $CSSF_{inter}$ × K_satellite
DRX cycle ≤ 320 ms	Max(200 ms, Ceil(8 × 1.5 x K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$ × K_satellite
DRX cycle > 320 ms	Ceil(8 x K_{gap}) × DRX cycle × $CSSF_{inter}$ × K_satellite
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

The UE is allowed to skip measurements on inter-frequency cells, in the interval between *t-serviceStart* and the satellite switch completion, when it is performing soft satellite switching with resynchronization. In this case, for the measurement initiated but not completed before this interval, the total time to measure can be longer.

9.3C.6 Inter-frequency measurements reporting requirements

9.3C.6.1 Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4C, 10.1.9C and 10.1.14C, respectively.

9.3C.6.2 Event-triggered Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses 10.1.4C, 10.1.9C and 10.1.14C, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.3C.6.3.

9.3C.6.3 Event-triggered Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.4C, 10.1.9C and 10.1.14C, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. Both $T_{identify_inter_without_index}$ and $T_{identify_inter_with_index}$ are defined in clause 9.3C.4. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the Cell being configured remains detectable during the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ as defined in clause 9.3C.4 or clause 9.3C.7. If a cell which has been detectable at least for the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ defined in clause 9.3C.4 or clause 9.3C.7 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again with the same spatial reception parameter and triggers an event, the event triggered measurement reporting delay shall be less than $T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu} T_c$ while the measurement gap has not been available and L3 filtering has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

9.3C.7 Inter-frequency measurements without measurement gaps

9.3C.7.1 Inter-frequency Cell identification

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within $T_{identify_inter_without_index}$.

$T_{identify_inter_without_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter})$ ms

$T_{identify_inter_with_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter} + T_{SSB_time_index_inter})$ ms

Where:

T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3C.7.1-1.

$T_{SSB_time_index_inter}$: it is the time period used to acquire the index of the SSB being measured given in

Table 9.3C.7.1-2 for target cells operating with 20 PRB SSB BW in FR1-NTN;

Table 9.3C.7.1-3 for target cells operating with 12 PRB SSB BW in FR1-NTN.

$T_{SSB_measurement_period_inter}$: equal to a measurement period of SSB based measurement given in table 9.3C.7.2-1.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1. .

K_p is the scaling factor for a SSB frequency layer to be measured without measurement gaps. $K_p = N_{total_SAN} / N_{available_SAN}$, where $N_{available_SAN}$ and N_{total_SAN} are calculated as follows:

- For a window W of duration max(SMTC period, MGRP_max), where
  - If UE supports *parallelMeasurementGap-r17* and is configured with concurrent measurement gaps, MGRP_max is the maximum MGRP across all configured per-UE measurement gap. Otherwise, MGRP_max is the MGRP of configured measurement gap.
  - Starting from the beginning of any SMTC occasion:
    - N_{total_SAN} is the total number of SMTC occasions within the window, including those overlapped and non-overlapped with measurement gap occasions within the window, and
    - $N_{available_SAN}$ is the number of SMTC occasions within the window W that do not collide with any non-dropped MG occasion within or outside the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1C.8.3. The collision rule between SMTC occasion and measurement gap occasion is defined in clause 9.1C.9.1

K_p = [1] when $N_{available_SAN}$ = 0 and measurement gap sharing in clause 9.1.2.1a shall apply.

K_p = 1 when inter-frequency SMTC is fully non overlapping with measurement gaps.

$K_{layer1_measurement}$: it is scaling factor for sharing between L3 and L1 measurement, and $K_{layer1_measurement}$ =1, if GEO satellites are measured on the carrier, or if LEO satellites are measured on the carrier and UE supports *parallelMeasurementWithoutRestriction-r17*, otherwise

$K_{layer1_measurement}$ =1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or
- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, and RSSI symbols are indicated by *SS-RSSI-Measurement*;

$K_{layer1_measurement}$ =1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

$K_{satellite}$: it is a satellite specific scaling factor.

- If SMTCs do not overlap with each other, and if LEO and/or GEO satellite(s) is/are required to be measured within SMTC
  - $K_{satellite}$ = 1, if GSO satellite(s) is/are measured on the carrier
  - $K_{satellite} = \left\lceil \frac{Num\ of\ LEO\ satellites\ to\ be\ measured\ in\ the\ SMTC}{number\ of\ LEO\ satellites\ UE\ is\ capable\ to\ measure\ in\ one\ SMTC} \right\rceil$, if LEO satellite(s) is/are measured on the carrier.
- If SMTCs partially overlap with each other, and if LEO and/or GEO satellite(s) is/are required to be measured within overlapped SMTCs

- $K_{satellite} = number\ of\ overlapped\ SMTCs$, if only GEO satellite(s) is/are measured on the carrier
- $K_{satellite} = \sum_i \left\lceil \frac{Num\ of\ LEO\ satellites\ to\ be\ measured\ in\ the\ SMTC\ i}{number\ of\ LEO\ satellites\ UE\ is\ capable\ to\ measure\ in\ one\ SMTC} \right\rceil$, if only LEO satellite(s) is/are measured on the carrier.

Table 9.3C.7.1-1: Time period for PSS/SSS detection, (FR1-NTN)

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	max(600 ms, ceil(5 x $K_{layer1_measurement}$ x K_p) x SMTC period)[Note 1] x $CSSF_{inter} \times K_{satellite}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x 5 x $K_{layer1_measurement}$ x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter} \times K_{satellite}$
DRX cycle>320 ms	ceil(5 x $K_{layer1_measurement}$ x K_p) x DRX cycle x $CSSF_{inter} \times K_{satellite}$
NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

Table 9.3C.7.1-2: Time period for time index detection (FR1-NTN)

DRX cycle	$T_{SSB_time_index_inter}$
No DRX	max(120 ms, ceil(3 x $K_{layer1_measurement}$ x K_p) x SMTC period)[Note 1] x $CSSF_{inter} \times K_{satellite}$
DRX cycle≤ 320 ms	max(120 ms, ceil (1.5 x 3 x $K_{layer1_measurement}$ x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter} \times K_{satellite}$
DRX cycle>320 ms	Ceil(3 x $K_{layer1_measurement}$ x K_p) x DRX cycle x $CSSF_{inter} \times K_{satellite}$
NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

Table 9.3C.7.1-3: Time period for time index detection for a UE operating on a target cell with 12 PRB SSB (FR1-NTN)

DRX cycle	$T_{SSB_time_index_inter}$
No DRX	max(120 ms, ceil(6 x $K_{layer1_measurement}$ x K_p) x SMTC period)[Note 1] x $CSSF_{inter} \times K_{satellite}$
DRX cycle≤ 320 ms	max(120 ms, ceil (1.5 x 6 x $K_{layer1_measurement}$ x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter} \times K_{satellite}$
DRX cycle>320 ms	Ceil(6 x $K_{layer1_measurement}$ x K_p) x DRX cycle x $CSSF_{inter} \times K_{satellite}$
NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. NOTE 2: The requirements in this table apply provided that the Ês/Iot on the target cell SSB is ≥-4 dB.	

9.3C.7.2 Measurement period

The UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4C, 10.1.9C and 10.1.14C, respectively, as shown in table 9.3C.7.2-1, if UE supports inter-frequency measurement without measurement gaps.

Table 9.3C.7.2-1: Measurement period for inter-frequency measurements without gaps (FR1-NTN)

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(200ms, ceil(5 x $K_{layer1_measurement}$ x K_p) x SMTC period)[Note 1] x $CSSF_{inter} \times K_{satellite}$
DRX cycle≤ 320 ms	max(200ms, ceil(1.5x 5 x $K_{layer1_measurement}$ x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter} \times K_{satellite}$
DRX cycle>320 ms	ceil(5 x $K_{layer1_measurement}$ x K_p) x DRX cycle x $CSSF_{inter} \times K_{satellite}$
NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

9.3C.7.3 Scheduling availability of UE during inter-frequency measurements

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE is required to be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols to be measured in the following clauses are the SSB symbols indicated by *SSB-ToMeasure* [2], if it is configured; otherwise, all L SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included. For UL, the scheduling restriction applies to UL symbols that fully or partially overlap with the restricted symbols as defined below.

9.3C.7.3.1 Void

9.3C.7.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1-NTN

For UE which do not support *simultaneousRxDataSSB-DiffNumerology-Inter-r16* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If UE performs inter-frequency measurements without measurement gaps in a FDD band, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

9.3C.7.3.3 Scheduling availability of UE performing measurements on a neighbor cell served by a different satellite in LEO

For UE which do not support the capability *parallelMeasurementWithoutRestriction-r17* the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement on a neighbor cell served by a different satellite in LEO.

- If UE performs inter-frequency measurements without measurement gaps in a FDD band, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

9.3C.8 Inter-frequency measurement with measurement gaps for NTN band above 10 GHz

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within $T_{identify_inter_without_index}$.

$$T_{identify_inter_without_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter})\ ms$$

$$T_{identify_inter_with_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter} + T_{SSB_time_index_inter})\ ms$$

Where:

T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3C.8-1.

$T_{SSB_time_index_inter}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3C.8-2.

$T_{SSB_measurement_period_inter}$: equal to a measurement period of SSB based measurement given in table 9.3C.9-1.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

K_{gap} is the scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. $K_{gap} = 1$ when the UE is not configured with concurrent measurement gaps. When the UE is configured with concurrent measurement gaps and the two measurement gaps are fully overlapping with MGRP=160 ms, $K_{gap} = 2$. Otherwise, $K_{gap} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

For a window W of duration max(SMTC period, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gap, and starting from the beginning of any SMTC occasion:

- N_{total} is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other measurement gap occasions within the window, and

- $N_{available}$ is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1.8.3.

K_{gap} is only applicable for UE supporting *parallelMeasurementGap-r17*. When concurrent measurement gaps are configured, requirements in this clause do not apply if $N_{available}$ =0, or if one SMTC overlaps more than one MGs associated to the frequency layer.

Table 9.3C.8-1: Time period for PSS/SSS detection

Condition NOTE1	T_{PSS/SSS_sync_inter}
No DRX	Max(600 ms, Ceil(8 x K_{gap}) × Max(MGRP, SMTC period NOTE2)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(600 ms, Ceil(8*1.5 x K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(8 x K_{gap}) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

Table 9.3C.8-2: Time period for time index detection

Condition NOTE1	$T_{SSB_time_index_inter}$
No DRX	Max(120 ms, Ceil(3 x K_{gap}) × Max(MGRP, SMTC period NOTE2)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(120 ms, Ceil(3 × 1.5 x K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(3 x K_{gap}) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

9.3C.9 Inter-frequency measurements for NTN band above 10 GHz

When measurement gaps are provided for inter-frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.5C, 10.1.10C and 10.1.15C, respectively, as shown in table 9.3C.5-1.

Table 9.3C.9-1: Measurement period for inter-frequency measurements with gaps

Condition NOTE1	$T_{SSB_measurement_period_inter}$
No DRX	Max(200 ms, Ceil(8 x K_{gap}) × Max(MGRP, SMTC period NOTE2)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(200 ms, Ceil(8 × 1.5 x K_{gap}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(8 x K_{gap}) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

9.3C.10 Inter-frequency measurements without measurement gaps for NTN band above 10 GHz

9.3C.10.1 Inter-frequency Cell identification

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within $T_{identify_inter_without_index}$.

$T_{identify_inter_without_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter})$ ms

$T_{identify_inter_with_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter} + T_{SSB_time_index_inter})$ ms

Where:

T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3C.10.1-1.

$T_{SSB_time_index_inter}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3C.10.1-2.

$T_{SSB_measurement_period_inter}$: equal to a measurement period of SSB based measurement given in table 9.3C.10.2-1.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when inter-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps or according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when inter-frequency SMTC is fully overlapping with measurement gaps.

K_p is the scaling factor for a SSB frequency layer to be measured without measurement gaps. $K_p = N_{total_SAN} / N_{available_SAN}$, where $N_{available_SAN}$ and N_{total_SAN} are calculated as follows:

- For a window W of duration max(SMTC period, MGRP_max), where
  - If UE is configured with concurrent measurement gaps, MGRP_max is the maximum MGRP across all configured per-UE measurement gap. Otherwise, MGRP_max is the MGRP of configured measurement gap.
  - N_{total_SAN} is the total number of SMTC occasions within the window, including those overlapped and non-overlapped with measurement gap occasions within the window, and
  - $N_{available_SAN}$ is the number of SMTC occasions within the window W that do not collide with any non-dropped MG occasion within or outside the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1C.8.3. The collision rule between SMTC occasion and measurement gap occasion is defined in clause 9.1C.9.1

$K_p = 1$ when $N_{available_SAN} = 0$ and measurement gap sharing in clause 9.1.2.1a shall apply.

$K_p = 1$ when inter-frequency SMTC is fully non overlapping with measurement gaps.

Table 9.3C.10.1-1: Time period for PSS/SSS detection

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	max(600 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{inter}$
NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

Table 9.3C.10.1-2: Time period for time index detection

DRX cycle	$T_{SSB_time_index_inter}$
No DRX	max(120 ms, ceil(3 x K_p) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(120 ms, ceil (1.5 x 3 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	Ceil(3 x K_p) x DRX cycle x $CSSF_{inter}$

NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.

9.3C.10.2 Measurement period

The UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.5C, 10.1.10C and 10.1.15C, respectively, as shown in table 9.3C.7.2-1, if UE supports inter-frequency measurement without measurement gaps:

Table 9.3C.10.2-1: Measurement period for inter-frequency measurements without gaps

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(200 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{inter}$
NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

9.3C.10.3 Scheduling availability of UE during inter-frequency measurements

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE is required to be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols to be measured in the following clauses are the SSB symbols indicated by *SSB-ToMeasure* [2], if it is configured; otherwise, all L SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included. For UL, the scheduling restriction applies to UL symbols that fully or partially overlap with the restricted symbols as defined below.

9.3C.10.3.1 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on NTN bands above 10 GHz

For UE which do not support *simultaneousRxDataSSB-DiffNumerology-Inter-r16* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If UE performs inter-frequency measurements without measurement gaps in a TDD band, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If UE performs inter-frequency measurements without measurement gaps in a FDD band, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

9.3D NR inter-frequency measurements for ATG

9.3D.1 Introduction

A measurement is defined as an SSB based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.2D.

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-frequency cells if carrier frequency information is provided by PCell, even if no explicit neighbour list with physical layer cell identities is provided.

A measurement is defined as an inter-frequency SSB based measurements without measurement gaps for UE capable of *interFrequencyMeas-NoGap* provided

- the UE supports *interFrequencyMeas-Nogap-r16* [15], and
- the SSB is completely contained in the active BWP of the UE.

For inter-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.3D.9.3.

SSB based measurements are configured along with a measurement timing configuration (SMTC) per carrier, which provides periodicity, duration and offset information on a window of up to 5 ms where the measurements on the configured inter-frequency carrier are to be performed. For inter-frequency connected mode measurements, one measurement window periodicity may be configured per inter-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB and measure RSSI of RSRQ on an inter-frequency measurement object which start earlier than the gap starting time + switching time, nor detect SSB and measure RSSI of RSRQ which ends later than the gap end – switching time. The switching time is 0.5 ms.

The requirements in this clause shall also apply, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

Longer measurement period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

9.3D.2 Requirements applicability

The requirements in clause 9.3D apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clauses 10.1.4 for FR1, for a corresponding band,
- SS-RSRQ related side conditions given in clauses 10.1.9 for FR1, for a corresponding band,
- SS-SINR related side conditions given in clauses 10.1.14 for FR1, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding band.

9.3D.3 Number of cells and number of SSB

9.3D.3.1 Requirements for FR1

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 4 identified cells, and
- 7 SSBs with different SSB index and/or PCI on the inter-frequency layer.

9.3D.4 Inter-frequency measurement with measurement gaps

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured) or *deriveSSB-IndexFromCellInter-r17* is configured for the FR1 target frequency layers and UE supporting *deriveSSB-IndexFromCellInterNon-NCSG-r17*. Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. The UE shall be able to identify a new detectable inter-frequency SS block of an already detected cell within $T_{identify_inter_without_index.}$

$$T_{identify_inter_without_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter}) \text{ ms}$$

$$T_{identify_inter_with_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter} + T_{SSB_time_index_inter})\ ms$$

Where:

T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3D.4-1.

$T_{SSB_time_index_inter}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3D.4-2.

$T_{SSB_measurement_period_inter}$: equal to a measurement period of SSB based measurement given in table 9.3D.5-1.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1D.5.2 for measurement conducted within measurement gaps.

K_{gap} is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. K_{gap} = 1 when the UE is not configured with concurrent measurement gaps. Otherwise, $K_{gap} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

- For a window W of duration max(SMTC period, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gap(s), and starting from the beginning of any SMTC occasion:
  - N_{total} is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other measurement gap occasions within the window, and
  - $N_{available}$ is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W, after accounting for collisions between the measurement gaps by applying the measurement gap collision rule in clause 9.1.8.3.

K_{gap} is only applicable for UE supporting *concurrentMeasGap-r17*. When concurrent measurement gaps are configured, requirements in this clause do not apply if $N_{available}$ =0.

Table 9.3D.4-1: Time period for PSS/SSS detection (FR1)

Condition NOTE1	T_{PSS/SSS_sync_inter}
No DRX	$Max(600\ ms, Ceil(8 * K_{gap} \times N1^{Note\ 3}) \times Max(MGRP, SMTC\ period)) \times CSSF_{inter}$
DRX cycle ≤ 320 ms	$Max(600\ ms, Ceil(8*1.5 * K_{gap} \times N1^{Note\ 3}) \times Max(MGRP, SMTC\ period, DRX\ cycle)) \times CSSF_{inter}$
DRX cycle > 320 ms	$Ceil(8 * K_{gap} \times N1^{Note\ 3}) \times DRX\ cycle \times CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: For a UE supporting concurrent gaps, the MRGP above is the MRGP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	

Table 9.3D.4-2: Time period for time index detection (R1)

Condition NOTE1	$T_{SSB_time_index_inter}$
No DRX	$Max(120\ ms, Ceil(3 * K_{gap} \times N1^{Note\ 3}) \times Max(MGRP\ , SMTC\ period)) \times CSSF_{inter}$
DRX cycle ≤ 320 ms	$Max(120\ ms, Ceil(3 \times 1.5 * K_{gap} \times N1^{Note\ 3}) \times Max(MGRP, SMTC\ period, DRX\ cycle)) \times CSSF_{inter}$
DRX cycle > 320 ms	$Ceil(3 * K_{gap} \times N1^{Note\ 3}) \times DRX\ cycle \times CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: For a UE supporting concurrent gaps, the MRGP above is the MRGP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	

9.3D.5 Inter-frequency measurements

When measurement gaps are provided for inter-frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.9, and 10.1.14, respectively, as shown in table 9.3D.5-1.

Table 9.3D.5-1: Measurement period for inter-frequency measurements with gaps (FR1)

Condition NOTE1,2	$T_{SSB_measurement_period_inter}$
No DRX	Max(200 ms, Ceil(8 * K_{gap} x N1 Note 3) × Max(MGRP , SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320 ms	Max(200 ms, Ceil(8 × 1.5 * K_{gap} x N1 Note 3) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil(8 * K_{gap} x N1 Note 3) × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: For a UE supporting concurrent gaps, the MRGP above is the MRGP of the measurement gap associated with the target frequency layer to be measured if concurrent measurement gaps are configured. NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	

9.3D.6 Inter-frequency measurements reporting requirements

9.3D.6.1 Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.9.1, and 10.1.14.1, respectively.

9.3D.6.2 Event-triggered Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.9.1, and 10.1.14.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.3D.6.3.

9.3D.6.3 Event-triggered Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.9.1, and 10.1.14.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. Both $T_{identify_inter_without_index}$ and $T_{identify_inter_with_index}$ are defined in clause 9.3D.4. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period $T_{identify_inter_without_index}$ or $T_{identify_inter_with_index}$ as defined in clause 9.3D.4 or clause 9.3D.9.1.If a cell which has been detectable at least for the time period $T_{identify\ inter\ without\ index}$ or $T_{identify\ inter\ with\ index}$ defined in clause 9.3D.4 or clause 9.3D.9.1 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again with the same spatial reception parameter and triggers an event, the event triggered measurement reporting delay shall be less than

$T_{SSB_measurement_period_inter}$ provided the timing to that cell has not changed more than $\pm 3200/2^{\mu} T_c$ while the measurement gap has not been available and L3 filtering has not been used, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3]. When L3 filtering is used, an additional delay can be expected.

9.3D.7 Void

9.3D.8 Void

9.3D.9 Inter-frequency measurements without measurement gaps

9.3D.9.1 Inter-frequency Cell identification

UE satisfying the applicability conditions specified in clause 9.3D.1 on the requirement in this clause shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_without_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured) or *deriveSSB-IndexFromCellInter-r17* is configured for the FR1 and UE supporting *deriveSSB-IndexFromCellInterNon-NCSG-r17*. Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify_inter_with_index}$. The UE shall be able to identify a new detectable inter-frequency SS block of an already detected cell within $T_{identify_inter_without_index}$.

$$T_{identify_inter_without_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter})\ ms$$

$$T_{identify_inter_with_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter} + T_{SSB_time_index_inter})\ ms$$

Where:

- T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3D.9.1-1.
- $T_{SSB_time_index_inter}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3D.9.1-3.
- $T_{SSB_measurement_period_inter}$: equal to a measurement period of SSB based measurement given in table 9.3D.9.2-1.
- $CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1D.5.1 for measurement conducted outside measurement gaps, i.e. when inter-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps or according to $CSSF_{within_gap,i}$ in clause 9.1D.5.2 for measurement conducted within measurement gaps, i.e. when inter-frequency SMTC is fully overlapping with measurement gaps.

For inter-frequency SSB based measurements without measurement gaps in active BWP.

M_{pss/sss_sync_inter}: For FR1, $M_{pss/sss_sync_inter} = 5$.

$M_{SSB_index_inter}$: For FR1, $M_{SSB_index_inter} = 3$.

$M_{meas_period_inter}$: For FR1, $M_{meas_period_inter} = 5$.

K_p is a scaling factor for an SSB frequency layer to be measured without measurement gaps. $K_p = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

For a window W of duration max(SMTC period, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE MG, and starting at the beginning of any SMTC occasion:

N_{total} is the total number of SMTC occasions within the window, including those overlapped with MG occasions within the window, and

$N_{available}$ is the number of SMTC occasions that are not overlapped with any non-dropped MG occasion within the window W, after accounting for MG collisions by applying the selected gap collision rule provided that concurrent measurement gaps are configured.

$K_p = 1$ when $N_{available} = 0$.

Otherwise, when UE is not configured with or UE does not support concurrent measurement gaps:

When inter-frequency SMTC is fully non overlapping with measurement gaps, or inter-frequency SMTC is fully overlapping with MGs, K_p =1.

When inter-frequency SMTC is partially overlapping with measurement gaps, K_p = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP. When inter-frequency SMTC is partially overlapping with NCSG, K_p = 1/(1- (SMTC period /VIRP)), where SMTC period < VIRP.

For UE capable of *antennaArrayType-r18* on the measured carrier,

$K_{layer1_measurement}$=1,

If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE supports two simultaneous separate Rx beams

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on one serving cell outside measurement gap are not fully overlapped by inter-frequency SMTC occasions of the same serving cell

Otherwise,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any serving frequency outside measurement gap are not fully overlapped by inter-frequency SMTC occasions

$K_{layer1_measurement}$=1.5, otherwise.

Otherwise, $K_{layer1_measurement}$=1.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

For calculation of K_p, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1*.

Table 9.3D.9.1-1: Time period for PSS/SSS detection, (FR1)

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	max(600 ms, ceil(M_{pss/sss_sync_inter} x K_p x N1 [Note 4] x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x M_{pss/sss_sync_inter} x K_p x N1 [Note 4] x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	ceil(M_{pss/sss_sync_inter} x K_p x N1 [Note 4] x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: Void NOTE 3: Void NOTE 4: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	

Table 9.3D.9.1-2: void

Table 9.3D.9.1-3: Time period for time index detection (FR1)

DRX cycle	$T_{SSB_time_index_inter}$
No DRX	max(120 ms, ceil($M_{SSB_index_inter}$ x K_p x N1 [Note 4] x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(120 ms, ceil (1.5 x $M_{SSB_index_inter}$ x K_p x N1 [Note 4] x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	Ceil($M_{SSB_index_inter}$ x K_p x N1 [Note 4] x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: Void NOTE 3: Void	

NOTE 4: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4.
Otherwise, N1 = 1.

9.3D.9.2 Measurement period

The UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.9, and 10.1.14, respectively, as shown in table 9.3D.9.2-1,if UE supports inter-frequency measurement without measurement gaps.

Table 9.3D.9.2-1: Measurement period for inter-frequency measurements without gaps ((FR1)

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(200 ms, ceil($M_{meas_period_inter}$ x K_p x N1 [Note 2] x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{inter}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x $M_{meas_period_inter}$ x K_p x N1 [Note 2] x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320 ms	ceil($M_{meas_period_inter}$ x K_p x N1 [Note 2] x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: For ATG UE with the antenna array, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	

9.3D.9.3 Scheduling availability of UE during inter-frequency measurements

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE is required to be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols to be measured in the following clauses are the SSB symbols indicated by *SSB-ToMeasure* [2], if it is configured; otherwise, all L SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

9.3D.9.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When ATG UE performs inter-frequency measurements without measurement gaps in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- If *deriveSSB-IndexFromCellInter-r17* is enabled, UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If *deriveSSB-IndexFromCellInter-r17* is not enabled, UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration.

When ATG UE capable of *antennaArrayType-r18* performs inter-frequency measurements without measurement gaps, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- If *deriveSSB-IndexFromCellInter-r17* is enabled, UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If *deriveSSB-IndexFromCellInter-r17* is not enabled, UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

When ATG UE performs inter-frequency measurements without measurement gaps, the following restrictions apply due to SS-RSRQ measurement

- If *deriveSSB-IndexFromCellInter-r17* is enabled, UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be

measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

- If *deriveSSB-IndexFromCellInter-r17* is not enabled, UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When ATG UE capable of *antennaArrayType-r18* performs inter-frequency measurements without measurement gaps, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- If *deriveSSB-IndexFromCellInter-r17* is enabled, UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If *deriveSSB-IndexFromCellInter-r17* is not enabled, UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

When intra-band carrier aggregation is performed and the ATG UE is capable of *antennaArrayType-r18*, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation is performed and the ATG UE is capable of *common Rx beam between PCC band and SCC band*, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When ATG UE performs inter-frequency measurements without measurement gaps, the following restrictions apply due to SS-RSRQ measurement

- If *deriveSSB-IndexFromCellInter-r17* is enabled, UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

- If *deriveSSB-IndexFromCellInter-r17* is not enabled, UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When ATG UE capable of *antennaArrayType-r18* performs inter-frequency measurements without measurement gaps, the following restrictions apply due to SS-RSRQ measurement

- If *deriveSSB-IndexFromCellInter-r17* is enabled, UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

- If *deriveSSB-IndexFromCellInter-r17* is not enabled, UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

When intra-band carrier aggregation is performed and the ATG UE is capable of *antennaArrayType-r18*, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation is performed and the ATG UE is capable of *common Rx beam between PCC band and SCC band*, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.3D.9.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology-Inter-r16* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If UE performs inter-frequency measurements without measurement gaps, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the union of restricted serving cell symbols due to measurement of all MOs, where the restricted serving cell symbols due to measurement of MO *i* include

  - serving cell symbols fully or partially overlap with SSB symbols to be measured on MO i, and $\triangle$t serving cell symbol before each consecutive SSB symbols to be measured and $\triangle$t serving cell symbol after each consecutive SSB symbols to be measured within SMTC window duration, if deriveSSB-IndexFromCellInter-r17 is enabled for MO i and UE supporting *deriveSSB-IndexFromCellInterNon-NCSG-r17*. $\triangle$t is defined as the minimum integer number of symbols with total duration no smaller than the tolerance specified in clause 7.9D, or

  - serving cell symbols fully or partially overlap with SMTC window for MO i and on 1 serving cell symbol before and after the SMTC window, if deriveSSB-IndexFromCellInter-r17 is not enabled for MO i, or UE not supporting deriveSSB-IndexFromCellInterNon-NCSG-r17.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.3E NR inter-frequency measurements for Redcap UEs with satellite access

9.3E.1 Introduction

The requirements in clause 9.3C.1 shall apply except that:

- clause 9.2C is replaced with clause 9.2E, and
- clause 9.3C.5.3 is replaced with clause 9.3E.5.3, and
- clause 9.3C.4 is replaced with clause 9.3E.4, and
- clause 9.3C.5 is replaced with clause 9.3E.5, and
- clause 9.3C.7 is replaced with clause 9.3E.7.

The requirements in clause 9.3C.8, 9.3C.9 and 9.3C.10 can not apply.

9.3E.2 Requirements applicability

The requirements in clause 9.3E apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency cell shall be considered detectable when for each relevant SSB:

- For 2 Rx RedCap UE:
  - SS-RSRP related side conditions given in clauses 10.1.4D for FR1 for a corresponding band,
  - SS-RSRQ related side conditions given in clauses 10.1.9D for FR1 for a corresponding band,
  - SS-SINR related side conditions given in clauses 10.1.14D for FR1 for a corresponding band,
  - SSB_RP and SSB Ês/Iot according to Annex B.2.18 for a corresponding band.

- For 1 Rx RedCap UE:
  - SS-RSRP related side conditions given in clauses 10.1.4D for FR1 for a corresponding Band,
  - SS-RSRQ related side conditions given in clauses 10.1.9D for FR1 for a corresponding Band,
  - SS-SINR related side conditions given in clauses 10.1.14D for FR1 for a corresponding Band,
  - SSB_RP and SSB Ês/Iot according to Annex B.2.18 for a corresponding Band.

9.3E.3 Number of cells and number of SSB

9.3E.3.1 Requirements for FR1

The requirements in clause 9.3C.3.1 shall apply.

9.3E.4 Inter-frequency measurement with measurement gaps

The requirements in clause 9.3C.4 shall apply except that:

T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3C.4-1 for 2Rx RedCap UE and table 9.3E.4-1 for 1Rx RedCap UE, and

$T_{SSB_time_index_inter}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3C.4-2 for 2Rx RedCap UE and table 9.3E.4-2 for 1Rx RedCap UE, and

$T_{SSB_measurement_period_inter}$: equal to a measurement period of SSB based measurement given in table 9.3C.5-1 for 2Rx RedCap UE and table 9.3E.5-1 for 1Rx RedCap UE, and

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1A.5.1 for measurement conducted within measurement gaps, and

K_{gap} is the scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. K_{gap} = 1 when the UE is not configured with concurrent measurement gaps. When the UE is configured with concurrent measurement gaps and the two measurement gaps are fully overlapping with MGRP=160 ms, K_{gap} = 2. Otherwise, $K_{gap} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

For a window W of duration max(SMTC period, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gap, and starting from the beginning of any SMTC occasion:

- N_{total} is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other measurement gap occasions within the window, and
- $N_{available}$ is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1E.8.3.

Table 9.3E.4-1: Time period for PSS/SSS detection (FR1) for 1Rx RedCap UE

Condition NOTE1	T_{PSS/SSS_sync_inter}
No DRX	Max(600 ms, Ceil(10 x K_{gap}) × Max(MGRP, SMTC period NOTE2)) × $CSSF_{inter}$ × K_satellite
DRX cycle ≤ 320 ms	Max(600 ms, Ceil(10*1.5 x K_{gap}) × Max(MGRP, SMTC period NOTE2, DRX cycle)) × $CSSF_{inter}$ × K_satellite
DRX cycle > 320 ms	Ceil(10 x K_{gap}) × DRX cycle × $CSSF_{inter}$ × K_satellite
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

Table 9.3E.4-2: Time period for time index detection (FR1) for 1Rx RedCap UE

Condition NOTE1	$T_{SSB_time_index_inter}$

No DRX	Max(160 ms, Ceil(6 x K_{gap}) × Max(MGRP, SMTC period [NOTE2])) × $CSSF_{inter}$ × K_satellite
DRX cycle ≤ 320 ms	Max(160 ms, Ceil(6 × 1.5 x K_{gap}) × Max(MGRP, SMTC period[NOTE2], DRX cycle)) × $CSSF_{inter}$ × K_satellite
DRX cycle > 320 ms	Ceil(6 x K_{gap}) × DRX cycle × $CSSF_{inter}$ × K_satellite
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

9.3E.5 Inter-frequency measurements

The requirements in clause 9.3C.5 shall apply except that:

When measurement gaps are provided for inter-frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4D, 10.1.9D and 10.1.14D for 2Rx RedCap UE and clauses 10.1.4D, 10.1.9D and 10.1.14D for 1Rx RedCap UE, respectively, as shown in table 9.3C.5-1 for 2Rx RedCap UE and table 9.3E.5-1 for 1Rx RedCap UE.

Table 9.3E.5-1: Measurement period for inter-frequency measurements with gaps (FR1) for 1Rx RedCap UE

Condition [NOTE1]	$T_{SSB_measurement_period_inter}$
No DRX	Max(400 ms, Ceil(8 x K_{gap}) × Max(MGRP, SMTC period [NOTE2])) × $CSSF_{inter}$ × K_satellite
DRX cycle ≤ 320 ms	Max(400 ms, Ceil(8 × 1.5 x K_{gap}) × Max(MGRP, SMTC period[NOTE2], DRX cycle)) × $CSSF_{inter}$ × K_satellite
DRX cycle > 320 ms	Ceil(8 x K_{gap}) × DRX cycle × $CSSF_{inter}$ × K_satellite
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

9.3E.6 Inter-frequency measurements reporting requirements

9.3E.6.1 Periodic Reporting

For 2Rx RedCap UE, reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4D, 10.1.9D and 10.1.14D, respectively, and

For 1Rx RedCap UE, reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4D, 10.1.9D and 10.1.14D, respectively.

9.3E.6.2 Event-triggered Periodic Reporting

For 2Rx RedCap UE, reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses 10.1.4D, 10.1.9D and 10.1.14D, respectively, and

For 1Rx RedCap UE, reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses 10.1.4D, 10.1.9D and 10.1.14D, respectively, and

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.3E.6.3.

9.3E.6.3 Event-triggered Reporting

The requirements in clause 9.3C.6.3 shall apply except that

For 2Rx Redcap UE, reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.4D, 10.1.9D and 10.1.14D, respectively, and

For 1Rx Redcap UE, reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.4D, 10.1.9D and 10.1.14D, respectively, and

- clause 9.3C.4 is replaced with clause 9.3E.4, and
- clause 9.3C.7 is replaced with clause 9.3E.7.

9.3E.7 Inter-frequency measurements without measurement gaps

9.3E.7.1 Inter-frequency Cell identification

The requirements in clause 9.3C.7.1 shall apply except that:

- T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3C.7.1-1 for 2Rx RedCap UE and table 9.3E.7.1-1 for 1Rx RedCap UE, and
- $T_{SSB_time_index_inter}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3C.7.1-2 for 2Rx RedCap UE and table 9.3E.7.1-2 for 1Rx RedCap UE, and
- $T_{SSB_measurement_period_inter}$: equal to a measurement period of SSB based measurement given in table 9.3C.7.2-1 for 2Rx RedCap UE and table 9.3E.7.2-1 for 1Rx RedCap UE, and
- $CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1A.5.1, and
- K_p is the scaling factor for a SSB frequency layer to be measured without measurement gaps. $K_p = N_{total_SAN} / N_{available_SAN}$, where $N_{available_SAN}$ and N_{total_SAN} are calculated as follows:
  - For a window W of duration max(SMTC period, MGRP_max), where
    - If UE supports *parallelMeasurementGap-r17* and is configured with concurrent measurement gaps, MGRP_max is the maximum MGRP across all configured per-UE measurement gap. Otherwise, MGRP_max is the MGRP of configured measurement gap.
    - Starting from the beginning of any SMTC occasion:
      - N_{total_SAN} is the total number of SMTC occasions within the window, including those overlapped and non-overlapped with measurement gap occasions within the window, and
      - $N_{available_SAN}$ is the number of SMTC occasions within the window W that do not collide with any non-dropped MG occasion within or outside the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1E.8.3. The collision rule between SMTC occasion and measurement gap occasion is defined in clause 9.1E.9.1.

  $K_p = 1$ when $N_{available_SAN} = 0$ and measurement gap sharing in clause 9.1.2.1a shall apply.

  $K_p = 1$ when inter-frequency SMTC is fully non overlapping with measurement gaps.

Table 9.3E.7.1-1: Time period for PSS/SSS detection, (FR1) for 1Rx RedCap UE

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	max(600 ms, ceil(7 x K_p) x SMTC period)[Note 1] x $CSSF_{inter} \times K_{satellite}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5x 7 x K_p) x max(SMTC period,DRX cycle)[Note 1]) x $CSSF_{inter} \times K_{satellite}$
DRX cycle>320 ms	ceil(7 x K_p) x DRX cycle x $CSSF_{inter} \times K_{satellite}$
NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

Table 9.3E.7.1-2: Time period for time index detection (FR1) for 1Rx RedCap UE

DRX cycle	$T_{SSB_time_index_inter}$
No DRX	max(160 ms, ceil(6 x K_p) x SMTC period)[Note 1] x $CSSF_{inter} \times K_{satellite}$
DRX cycle≤ 320 ms	max(160 ms, ceil (1.5 x 6 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter} \times K_{satellite}$

DRX cycle>320 ms	Ceil(6 x K_p) x DRX cycle x $CSSF_{inter} \times K_{satellite}$
NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

9.3E.7.2 Measurement period

The UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4D, 10.1.9D and 10.1.14D for 2Rx RedCap UE and clauses 10.1.4D, 10.1.9D and 10.1.14D for 1Rx RedCap UE, respectively, as shown in table 9.3C.7.2-1 for 2Rx RedCap UE and table 9.3E.7.2-1 for 1Rx RedCap UE, if UE supports inter-frequency measurement without measurement gaps.

Table 9.3E.7.2-1: Measurement period for inter-frequency measurements without gaps (FR1) for 1Rx RedCap UE

DRX cycle	$T_{SSB_measurement_period_inter}$
No DRX	max(200ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{inter} \times K_{satellite}$
DRX cycle≤ 320 ms	max(200ms, ceil(1.5x 5 x K_p) x max(SMTC period,DRX cycle)[Note 1]) x $CSSF_{inter} \times K_{satellite}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{inter} \times K_{satellite}$
NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*.	

9.3E.7.3 Scheduling availability of UE during inter-frequency measurements

The requirements in clause 9.3C.7.3 shall apply.

9.3E.7.3.1 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

The requirements in clause 9.3C.7.3.1 shall apply.

9.3E.7.3.2 Scheduling availability of UE performing measurements in HD-FDD bands on FR1

When UE performs inter-frequency measurements without measurement gaps in a HD-FDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration.

When UE performs inter-frequency measurements without measurement gaps in a HD-FDD band, the following restrictions apply due to SS-RSRQ measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration.

9.4 Inter-RAT measurements

9.4.1 Introduction

The requirements in this clause are specified for NR−E-UTRAN FDD and NR−E-UTRAN TDD measurements and are applicable without an explicit E-UTRAN neighbour cell list containing physical layer cell identities, for a UE:

- in RRC_CONNECTED state, and
- configured
  - with SA or NR-DC operation mode or configured in NE-DC operation mode by PCell with NR−E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR, RSTD, or E-CID RSRP and RSRQ) on E-UTRA non-serving frequency carrier, or

- with SA operation mode on NR carrier frequencies with CCA by PCell with NR–E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR) on E-UTRA non-serving frequency carrier, and

- configured with an appropriate measurement gap pattern according to table 9.1.2-3.

The requirements in this clause for concurrent measurement gaps are only applied for UE in NR SA operation mode.

For UE supporting *eutra-NeedForGapNCSG-reporting-r17* and indicating *NeedForGapNCSG-InfoEUTRA* for inter-RAT measurement,

- An inter-RAT measurement is defined as measurement without gap if

  - the UE indicates ‘nogap-noncsg’ via *NeedForGapNCSG-InfoEUTRA* for the inter-RAT measurement

  - for UE support FG 32-4, the inter-RAT E-UTRAN measurements without gaps requirements are specified in clause 9.4.8.

- An inter-RAT measurement is defined as measurement with NCSG if

  - the UE indicates ‘ncsg’ via *NeedForGapNCSG-InfoEUTRA* for the inter-RAT measurement

  When network configures measurement gap or NCSG, the delay requirements are specified in clause 9.4.2 and 9.4.3.

- An inter-RAT measurement is defined as measurement with gap if

  - the UE indicates ‘gap’ via *NeedForGapNCSG-InfoEUTRA* for the inter-RAT measurement

  When network configures measurement gap, the delay requirements are specified in clauses 9.4.2 and 9.4.3.

- For inter-RAT measurements with NCSG, UE may cause scheduling restriction as specified in clause 9.4.2.5 and 9.4.3.5.

For UE not supporting *eutra-NeedForGapNCSG-reporting-r17*,

- An inter-RAT measurement is defined as measurement without gap if

  - the UE supports FG32-5 and the CRS is completely contained in the active BWP of the UE, and the inter-RAT EUTRAN measurements without gaps requirements are specified in clause 9.4.8.

For inter-RAT, when measurement is defined as measurement without gap the UE may cause scheduling restriction as specified in clause 9.4.8.3.5 and clause 9.4.8.4.5.

When the UE is in NE-DC operation mode and an NR–E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR, or E-CID RSRP and RSRQ) configured by NR PCell is on an E-UTRA serving frequency carrier, then the corresponding E-UTRA intra-frequency measurements requirements specified in clause 8.19 of TS 36.133 [15] shall apply.

When *highSpeedMeasFlag-r16* is configured but UE does not support either *measurementEnhancement-r16* or *interRAT-MeasurementEnhancement-r16*, the UE is not required to meet the requirements specified in table 9.4.2.3-1b and table 9.4.3.3-1b.

Parameter T_{Inter1} used in inter-RAT requirements in clause 9.4 is specified in table 9.4.1-1 when measurement gap is used, and in table 9.4.1-2 when NCSG is used.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

Table 9.4.1-1: Minimum available time for inter-RAT measurements when measurement gap is configured

Gap Pattern Id	MeasurementGap Length (MGL, ms)	Measurement Gap Repetition Period (MGRP, ms)	Minimum available time for inter-frequency and inter-RAT measurements during 480 ms period (Tinter1, ms)
0	6	40	60

1	6	80	30
2	3	40	24 Note 1
3	3	80	12 Note 1
4	6	20	120 Note 1
6	4	20	72 Note 1,3,6
7	4	40	36 Note 1,4,6
8	4	80	18 Note 1,5,6
10	3	20	48 Note 1

NOTE 1: When determining UE requirements using T_{inter1} for gap pattern IDs 2, 3, 4, 6, 7, 8, 10, T_{inter1} = 60 for gap pattern IDs 2, 4, 6, 7, 10, and T_{inter1} = 30 for gap pattern IDs 3 and 8 shall be used.
NOTE 2: Measurement gaps pattern configurations applicability is as specified in Table 9.1.2-1.
NOTE 3: When this gap pattern is used, the T_{inter1} for E-UTRA inter-frequency measurements is 48 ms corresponding to the first 3 ms of the 4 ms gap.
NOTE 4: When this gap pattern is used, the T_{inter1} for E-UTRA inter-frequency measurements is 24 ms corresponding to the first 3 ms of the 4 ms gap.
NOTE 5: When this gap pattern is used, the T_{inter1} for E-UTRA inter-frequency measurements is 12 ms corresponding to the first 3 ms of the 4 ms gap.
NOTE 6: This gap pattern is applicable for E-UTRA inter-frequency measurements only if gap based NR measurements are also configured.
NOTE 7: If multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layers.

Table 9.4.1-2: Minimum available time for inter-RAT measurements when NCSG is configured

NCSG Pattern Id	Measurement Length (ML, ms)	Visible Interruption Repetition Period (VIRP, ms)	Minimum available time for inter-frequency and inter-RAT measurements during 480 ms period (T_{inter1}, ms)
0	5	40	60
1	5	80	30
2	2	40	24 Note 1
3	2	80	12 Note 1
4	5	20	120 Note 1
6	3	20	72 Note 1,3
7	3	40	36 Note 1,3
8	3	80	18 Note 1,3
10	2	20	48 Note 1

NOTE 1: When determining UE requirements using T_{inter1} for NCSG pattern IDs 2, 3, 4, 6, 7, 8, 10, T_{inter1} = 60 for NCSG pattern IDs 2, 4, 6, 7, 10, and T_{inter1} = 30 for NCSG pattern IDs 3 and 8 shall be used.
NOTE 2: NCSG pattern configurations applicability is as specified in Table 9.1.2C-1.
NOTE 3: This NCSG pattern is applicable for E-UTRA inter-frequency measurements only if NCSG based NR measurements are also configured.

A UE configured with gap/NCSG pattern ID 2, 3 or 10 shall be able to detect a target cell, provided that

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell begins not earlier than 500 μs from the start of the measurement gap, and

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell ends not later than 500 μs before the end of the measurement gap in case of FDD and not later than 750 μs before the end of measurement gap in case of TDD.

A UE configured with gap/NCSG pattern ID 6, 7 or 8 shall be able to detect a target cell, provided that

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell begins not earlier than 500 μs from the start of the measurement gap, and

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell ends no later than 1500 μs before the end of the measurement gap in case of FDD and no later than 1750 μs before the end of measurement gap in case of TDD.

9.4.2 NR − E-UTRAN FDD measurements

9.4.2.1 Introduction

The requirements are applicable for NR−E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN FDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
- RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

9.4.2.2 Requirements when no DRX is used

When the UE requires measurement gaps or NCSG to identify and measure inter-RAT cells and an appropriate measurement gap pattern or NCSG is scheduled, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are scheduled, or an appropriate pre-MG is scheduled and activated, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable FDD cell within $T_{\text{Identify, E-UTRAN FDD}}$ according to the following expression, including UE not configured with measurement gap cancellation according to clause 9.1.14 and conditions in clause 9.1.14.3:

$$T_{\text{Identify,E-UTRAN FDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1}}} \cdot \text{CSSF}_{\text{interRAT}} \cdot \text{K}_{\text{gap}_{\text{EUTRA}}} \quad ms,$$

and for the UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3:

$$T_{\text{Identify,E-UTRAN FDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1}}} \cdot \text{CSSF}_{\text{interRAT}} \cdot \text{K}_{\text{gap}_{\text{EUTRA}}} + 480 * \text{ceil}(\text{T1} / 480) \times \text{CSSF}_{\text{interRAT}} \; ms,$$

where:

$T_{\text{BasicIdentify}}$ = 480 ms,

T_{Inter1} is defined in clause 9.4.1,

$\text{CSSF}_{\text{interRAT}} = \text{CSSF}_{\text{within_gap,i}}$ when measurement gaps are configured, or $\text{CSSF}_{\text{within_ncsg,i}}$ when NCSGs are configured, is the scaling factor for the measured inter-RAT E-UTRA carrier *i* which is calculated as specified in clause 9.1.5.2.

For a UE supporting and configured with concurrent GAPs or MUSIM gaps or both concurrent GAPs and MUSIM gaps, $K_{\text{gap_EUTRA}}$: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated GAP pattern. $K_{\text{gap_EUTRA}} = 1$ when the UE is not configured with concurrent GAPs nor MUSIM gaps. Otherwise, $K_{\text{gap_EUTRA}} = N_{\text{total}} / N_{\text{available}}$ for UE configured with concurrent GAPs.

T1 = ceil($L_{\text{cancel}} \times K_{\text{gapEUTRA}}$)×MGRP applies for the UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, L_{cancel} is the number of gap occasions cancelled during measurement period during $T_{\text{Identify,E-UTRAN FDD}}$ for PSS/SSS detection.

For a UE supporting concurrent GAPs which is configured via *GapConfig-r17* without *preConfigInd-r17* or *ncsgInd-r17*, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the inter-RAT layer. Otherwise, MGRP is the Measurement Gap Repetition Period of the configured MG.

For a window W of duration xRP_max, where xRP_max is the maximum xRP across all configured per-UE measurement GAPs, periodic MUSIM gaps, and per-FR measurement GAPs for FR1, and starting from the beginning of any associated gap occasion:

N_{total} is the total number of associated GAP occasions within the window, including those dropped and non-dropped occasions within the window, and

$N_{available}$ is the number of non-dropped associated GAP occasions after accounting for measurement GAP and MUSIM gap collisions by applying the collision rules for the GAP and MUSIM gap in clause 9.1.8.3 and 9.1.10.5, respectively.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG, also xRP = MGRP for periodic MUSIM gap.

Requirements do not apply for UE configured with concurrent GAPs or MUSIM gaps, if $N_{available}$ =0

When UE supports *musim-GapPreference-r17* and if the configured aperiodic MUSIM gap collides with the measurement gap associated with the target frequency layer, where MUSIM gap collision rule in clause 9.1.10.4 is applied, longer cell identification period for the target inter-RAT carrier is expected.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of $T_{Measure, E\text{-}UTRAN\ FDD}$ defined in table 9.4.2.2-1, including UE not configured with measurement gap cancellation according to clause 9.1.14 and conditions in clause 9.1.14.3, and table 9.4.2.2-2 for the UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3.

Table 9.4.2.2-1: M**easurement period and measurement bandwidth**

Configuration	Physical Layer Measurement period: $T_{Measure, E\text{-}UTRAN\ FDD}$ [ms]	Measurement bandwidth [RB]
0	480 x [$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA})]	6
1 (Note 1)	240 x [$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA})]	50
NOTE 1: This configuration is optional. NOTE 2: K_{gap_EUTRA} is only applicable for a UE supporting concurrent measurement gaps. Otherwise K_{gap_EUTRA} =1		

Table 9.4.2.2-2: Measurement period and measurement bandwidth with measurement gap cancellation

Configuration	Physical Layer Measurement period: $T_{Measure, E\text{-}UTRAN\ FDD}$ [ms]	Measurement bandwidth [RB]
0	480 x $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) + 480 x ceil(T1/480) x CSSFinterRAT	6
1 (Note 1)	240 x $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) + 480 x ceil(T1/480) x CSSFinterRAT	50
NOTE 1: This configuration is optional. NOTE 2: K_{gap_EUTRA} is only applicable for a UE supporting concurrent measurement gaps. Otherwise K_{gap_EUTRA} =1. NOTE 3: T1 = ceil(L_{cancel}×$K_{gapEUTRA}$)×MGRP, where L_{cancel} is the number of gap occasions cancelled during measurement period during $T_{Identify,E\text{-}UTRAN\ FDD}$ for PSS/SSS detection.		

When measurement gaps are scheduled for E-UTRAN FDD inter-RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement period $T_{Measure, E\text{-}UTRAN\ FDD}$ given by table 9.4.2.2-1.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2.
The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3.
The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.2.3 Requirements when DRX is used

When DRX is in use and an appropriate measurement gap pattern or NCSG is configured, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are configured, or an appropriate pre-MG is scheduled and activated, the UE shall be able to identify a new detectable E-UTRAN FDD cell within $T_{Identify, E\text{-}UTRAN\ FDD}$ specified in table 9.4.2.3-1. When *highSpeedMeasFlag-r16* is configured and UE supports the enhanced inter-

RAT E-UTRAN measurement requirements, the UE shall be able to identify a new detectable E-UTRAN FDD cell within $T_{Identify, E\text{-}UTRAN\ FDD}$ specified in table 9.4.2.3-1b. When the UE is configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, the UE shall be able to identify a new detectable E-UTRAN FDD cell within $T_{Identify, E\text{-}UTRAN\ FDD}$ specified in table 9.4.2.3-4.

For a UE supporting and configured with concurrent GAPs, or MUSIM gaps or both concurrent GAPs and MUSIM gaps, K_{gap_EUTRA}: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated GAP pattern. $K_{gap_EUTRA} = 1$ when the UE is not configured with concurrent GAPs nor MUSIM gaps. Otherwise, $K_{gap_EUTRA} = N_{total} / N_{available}$ for UE configured with concurrent GAPs.

For a window W of duration xRP_max, where xRP_max is the maximum xRP across all configured per-UE GAPs, periodic MUSIM gap(s), and per-FR GAPs for FR1, and starting from the beginning of any associated gap occasion:

N_{total} is the total number of associated GAP occasions within the window, including both dropped and non-dropped instances of the associated GAP within the window, and

$N_{available}$ is the number of non-dropped associated GAP occasions after accounting for measurement gap and MUSIM gap collisions by applying the collision rules for the GAP and MUSIM gap in clauses 9.1.8.3 and 9.1.10.5, respectively.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG, also xRP = MGRP for periodic MUSIM gap.

Requirements do not apply for UE configured with concurrent GAPs, or MUSIM gaps, if $N_{available} = 0$

When UE supports *musim-GapPreference-r17* and if the configured aperiodic MUSIM gap collides with the measurement gap associated with the target frequency layer, where MUSIM gap collision rule in clause 9.1.10.4 is applied, longer cell identification period for the target inter-RAT carrier is expected.

Table 9.4.2.3-1: Requirement to identify a newly detectable E-UTRAN FDD cell

DRX cycle length (s)	$T_{Identify, E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)	
	Gap/NCSG period = 40 ms, 20 ms	Gap/NCSG period = 80 ms
≤0.16	Non-DRX requirements in clause 9.4.2.2 apply	Non-DRX requirements in clause 9.4.2.2 apply
0.256	5.12* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	7.68* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) (30*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
0.32	6.4* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	7.68* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) (24*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
0.32< DRX-cycle ≤10.24	Note1 (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	Note1 (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))

NOTE 1: The time depends on the DRX cycle length.
NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2.
NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2.
NOTE 3: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs. Otherwise $K_{gap_EUTRA} = 1$
NOTE 4: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer.

Table 9.4.2.3-1b: Requirement to identify a newly detectable E-UTRAN FDD cell when *highSpeedMeasFlag-r16* is configured

DRX cycle length (s)	$T_{Identify, E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)	
	Gap/NCSG period = 40 ms, 20 ms	**Gap/NCSG period = 80 ms**
≤0.16	Non-DRX requirements in clause 9.4.2.2 apply	Non-DRX requirements in clause 9.4.2.2 apply
0.16<DRX cycle≤0.32	Note 1(15*$CSSF_{interRAT}$ x Ceil((K_{gap_EUTRA}))	
0.32<DRX cycle ≤ 0.64	Note 1(10*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	
DRX cycle = 1.024	Note 1(10*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	Note 1(10*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
DRX cycle = 1.28	Note 1(8*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	Note 1(8*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
1.28< DRX-cycle ≤10.24	Note1 (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	Note1 (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))

NOTE 1: The time depends on the DRX cycle length.
NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2.
NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *interRAT-MeasurementEnhancement-r16.*
NOTE 4: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs. Otherwise K_{gap_EUTRA} = 1
NOTE 5: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer.

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN FDD cells per E-UTRA FDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA FDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period $T_{measure,\ E\text{-}UTRAN\ FDD}$ specified in table 9.4.2.3-3, including UE not configured with measurement gap cancellation according to clause 9.1.14 and conditions in clause 9.1.14.3, and table 9.4.2.3-5 for the UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3.

Table 9.4.2.3-3: Requirement to measure E-UTRAN FDD cells

DRX cycle length (s)	$T_{measure,\ E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)
≤0.08	Non-DRX requirements in clause 9.4.2.2 apply
0.08< DRX-cycle ≤ 10.24	Note1 (5* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2. NOTE 3: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs. Otherwise K_{gap_EUTRA} =1	

Table 9.4.2.3-4: Requirement to identify a newly detectable E-UTRAN FDD cell with measurement gap cancellation

DRX cycle length (s)	$T_{Identify,\ E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)	
	Gap/NCSG period = 40 ms, 20 ms	Gap/NCSG period = 80 ms
≤0.16	Non-DRX requirements in clause 9.4.2.2 apply	Non-DRX requirements in clause 9.4.2.2 apply
0.256	(5.12+L_{cancel} *0.256)* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) ((20+L_{cancel} *0.256)*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	(7.68+L_{cancel} *0.256)* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) ((30+L_{cancel} *0.256)*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
0.32	(6.4+L_{cancel} *0.32)* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) ((20+L_{cancel} *0.32)*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	(7.68+L_{cancel} *0.32)* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) ((24+L_{cancel} *0.32)*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
0.32< DRX-cycle ≤10.24	Note1 ((20+L_{cancel} *DRX-cycle)*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	Note1 ((20+L_{cancel} *DRX-cycle)*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2. NOTE 3: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs. Otherwise K_{gap_EUTRA} = 1 NOTE 4: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. NOTE 5: L_{cancel} is the number of gap occasions cancelled during $T_{Identify,E-UTRAN\ FDD}$ for PSS/SSS detection.		

Table 9.4.2.3-5: Requirement to measure E-UTRAN FDD cells with measurement gap cancellation

DRX cycle length (s)	$T_{measure,\ E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)
≤0.08	Non-DRX requirements in clause 9.4.2.2 apply
0.08< DRX-cycle ≤ 10.24	Note1 ((5*+ L_{cancel} * DRX-cycle) $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2. NOTE 3: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs. Otherwise K_{gap_EUTRA} =1 NOTE 4: L_{cancel} is the number of gap occasions cancelled during $T_{measure,\ E\text{-}UTRAN\ FDD}$ for measurement.	

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2.
The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3.
The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.2.4 Measurement reporting requirements

9.4.2.4.1 Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

9.4.2.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.2.4.3.

9.4.2.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The UE shall not send any event-triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{Identify, E-UTRAN FDD}$ defined in clauses 9.4.2.2 and 9.4.2.3 without DRX and with DRX, respectively. When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{Identify, E-UTRAN FDD}$ becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{Measure, E-UTRAN FDD}$ provided the timing to that cell has not changed more than ± 50 Ts while measurement gap or NCSG has not been available and the L3 filter has not been used.

9.4.2.5 Scheduling Availability During NR − E-UTRAN FDD measurements with NCSG

When a serving cell and an E-UTRA FDD measurement object are in bands with overlapping frequency with different subcarrier spacings, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within NCSG ML. Otherwise, no scheduling restriction to the serving cell is allowed due to NR − E-UTRAN FDD measurements with NCSG.

9.4.3 NR − E-UTRAN TDD measurements

9.4.3.1 Introduction

The requirements are applicable for NR−E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN TDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

  RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

9.4.3.2 Requirements when no DRX is used

When the UE requires measurement gaps or NCSG to identify and measure inter-RAT cells and an appropriate measurement gap pattern or NCSG is scheduled, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are scheduled, or an appropriate pre-MG is scheduled and activated or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable TDD cell within $T_{\text{Identify, E-UTRAN TDD}}$ according to the following expression:

- When configuration 0 or configuration 1 in table 9.4.3.2-1 is applied, including UE not configured with measurement gap cancellation according to clause 9.1.14 and conditions in clause 9.1.14.3:

$$T_{\text{Identify,E-UTRAN TDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1}}} \cdot \text{CSSF}_{\text{interRAT}} \cdot \text{K}_{\text{gap}_{\text{EUTRA}}}\ ms,$$

- When configuration 2 or configuration 3 in table 9.4.3.2-1 is applied, including UE not configured with measurement gap cancellation according to clause 9.1.14 and conditions in clause 9.1.14.3:

$$T_{\text{Identify,E-UTRAN TDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1}}} \cdot \text{CSSF}_{\text{interRAT}} \cdot \text{K}_{\text{gap}_{\text{EUTRA}}} + 240 \cdot \text{CSSF}_{\text{interRAT}} \cdot \text{K}_{\text{gap}_{\text{EUTRA}}}\ \ ms,$$

- When configuration 0 or configuration 1 in table 9.4.3.2-1 is applied for UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3:

$$T_{\text{Identify,E-UTRAN TDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1}}} \cdot \text{CSSF}_{\text{interRAT}} \cdot \text{K}_{\text{gap}_{\text{EUTRA}}} + 480 * \text{ceil}(\text{T1} / 480) \times \text{CSSF}_{\text{interRAT}}\ ms,$$

- When configuration 2 or configuration 3 in table 9.4.3.2-1 is applied for UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3:

$$T_{\text{Identify,E-UTRAN TDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1}}} \cdot \text{CSSF}_{\text{interRAT}} \cdot \text{K}_{\text{gap}_{\text{EUTRA}}} + 240 \cdot \text{CSSF}_{\text{interRAT}} \cdot \text{K}_{\text{gap}_{\text{EUTRA}}} + 480 * \text{ceil}(\text{T1} / 480) \times \text{CSSF}_{\text{interRAT}}\ \ ms,$$

where:

$T_{\text{BasicIdentify}}$ = 480 ms,

T_{Inter1} is defined in clause 9.4.1,

$\text{CSSF}_{\text{interRAT}} = \text{CSSF}_{\text{within_gap,i}}$ when measurement gaps are configured, or $\text{CSSF}_{\text{within_ncsg,i}}$ when NCSGs are configured, is the scaling factor for the measured inter-RAT E-UTRA carrier *i* which is calculated as specified in clause 9.1.5.2.

$\text{T1} = \text{ceil}(\text{L}_{\text{cancel}} \times \text{K}_{\text{gapEUTRA}}) \times \text{MGRP}$, applies for the UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, L_{cancel} is the number of gap occasions cancelled during measurement period during $T_{\text{Identify,E-UTRAN TDD}}$ for PSS/SSS detection.

For a UE supporting concurrent GAPs, if multiple concurrent GAPs are configured, the MGRP is the periodicity of the MG pattern associated to the inter-RAT layer. Otherwise, MGRP is the Measurement Gap Repetition Period of the configured MG.

For a UE supporting and configured with concurrent GAPs, or MUSIM gaps or both concurrent GAPs and MUSIM gaps, $\text{K}_{\text{gap_EUTRA}}$: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated GAP

pattern. K_{gap_EUTRA} = 1 when the UE is not configured with concurrent GAPs nor MUSIM gaps. Otherwise, K_{gap_EUTRA} = N_{total} / $N_{available}$ for UE configured with concurrent GAPs or MUSIM gaps.

- For a window W of duration xRP_max , where xRP_max is the maximum xRP across all configured per-UE GAPs, periodic MUSIM gaps,and per-FR GAPs for FR1, and starting from the beginning of any associated gap occasion:
  - N_{total} is the total number of associated GAP occasions within the window, including those overlapped with other GAPs and MUSIM gap ocassions within the window, and
  - $N_{available}$ is the number of non-dropped associated GAP occasions after accounting for GAPs and MUSIM gap collisions by applying the GAP and MUSIM gap in clauses 9.1.8.3 and 9.1.10.5, respectively.
    - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG, also xRP = MGRP for periodic MUSIM gap.
- Requirements do not apply for UE configured with concurrent GAPs or MUSIM gaps, if $N_{available}$ =0

When UE supports *musim-GapPreference-r17* and if the configured aperiodic MUSIM gap collides with the measurement gap associated with the target frequency layer, where MUSIM gap collision rule in clause 9.1.10.4 is applied, longer cell identification period for the target inter-RAT carrier is expected.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of $T_{Measure, E\text{-}UTRAN\ TDD}$ defined in table 9.4.3.2-1, including UE not configured with measurement gap cancellation according to clause 9.1.14 and conditions in clause 9.1.14.3, and table 9.4.3.2-2 for the UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3.

Table 9.4.3.2-1: $T_{Measure, E\text{-}UTRAN\ TDD}$ for different configurations

Configuration	Measurement bandwidth (RB)	Number of UL/DL sub-frames per half frame (5 ms)		DwPTS		$T_{Measure, E\text{-}UTRAN\ TDD}$ (ms)
		DL	UL	Normal CP	Extended CP	
0	6	2	2	19760×T_s	20480×T_s	480 x $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA})
1 (Note 1)	50	2	2	19760×T_s	20480×T_s	240 x $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA})
2	6	1	3	19760×T_s	20480×T_s	720 x $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA})
3 (Note 1)	50	1	3	19760×T_s	20480×T_s	480 x $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA})
NOTE 1: This configuration is optional. NOTE 2: Void NOTE 3: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs and/or MUSIM gaps. Otherwise K_{gap_EUTRA} =1						

Table 9.4.3.2-2: $T_{Measure, E\text{-}UTRAN\ TDD}$ for different configurations with measurement gap cancellation

Configuration	Measurement bandwidth (RB)	Number of UL/DL sub-frames per half frame (5 ms)		DwPTS		$T_{Measure, E\text{-}UTRAN\ TDD}$ (ms)
		DL	UL	Normal CP	Extended CP	
0	6	2	2	19760×T_s	20480×T_s	480 x $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) + 480 x ceil(T1/480) x $CSSF_{interRAT}$
1 (Note 1)	50	2	2	19760×T_s	20480×T_s	240 x $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) + 480 x ceil(T1/480) x $CSSF_{interRAT}$

2	6	1	3	19760×T_s	20480×T_s	720 x $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) + 480 x ceil(T1/480) x $CSSF_{interRAT}$
3 (Note 1)	50	1	3	19760×T_s	20480×T_s	480 x $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) + 480 x ceil(T1/480) x $CSSF_{interRAT}$
NOTE 1: This configuration is optional. NOTE 2: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs. Otherwise K_{gap_EUTRA} =1. NOTE 3: T1 = ceil(L_{cancel}×$K_{gapEUTRA}$)×MGRP. L_{cancel} is the number of gap occasions cancelled during measurement period during $T_{measure,\ E\text{-}UTRAN\ TDD}$ for measurement.						

When measurement gaps are scheduled for E-UTRAN TDD inter-RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement period $T_{measure,\ E\text{-}UTRAN\ TDD}$ given by table 9.4.3.2-1.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2.
The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3.
The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.3.3 Requirements when DRX is used

When DRX is in use and an appropriate measurement gap pattern or NCSG is configured, or when the UE is capable of concurrent measurement gap patterns and concurrent measurement gap patterns are configured, or an appropriate pre-MG is scheduled and activated, the UE shall be able to identify a new detectable E-UTRAN TDD cell within $T_{Identify,\ E\text{-}UTRAN\ TDD}$ specified in table 9.4.3.3-1. When *highSpeedMeasFlag-r16* is configured and UE supports the enhanced inter-RAT E-UTRAN measurement requirements, the UE shall be able to identify a new detectable E-UTRAN TDD cell within $T_{Identify,\ E\text{-}UTRAN\ TDD}$ specified in table 9.4.3.3-1b. When the UE is configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, the UE shall be able to identify a new detectable E-UTRAN TDD cell within $T_{Identify,\ E\text{-}UTRAN\ TDD}$ specified in table 9.4.3.3-4.

For a UE supporting and configured with concurrent GAPs, or MUSIM gaps or both concurrent GAPs and MUSIM gaps, K_{gap_EUTRA}: it is the scaling factor for an E-UTRAN frequency layer to be measured within the associated GAP pattern. K_{gap_EUTRA} = 1 when the UE is not configured with concurrent GAPs nor MUSIM gaps.. Otherwise, $K_{gap_EUTRA} = N_{total} / N_{available}$ for UE configured with concurrent GAPs or MUSIM gaps.

For a window W of duration xRP_max, where xRP_max is the maximum xRP across all configured per-UE GAPs s, periodic MUSIM gap(s), and per-FR measurement GAPs for FR1, and starting from the beginning of any associated gap occasion: GAPs

N_{total} is the total number of associated GAP occasions within the window, including those overlapped with other measurement GAP and MUSIM gap instances within the window, and

$N_{available}$ is the number of non-dropped associated GAP occasions after accounting for measurement gap and MUSIM gap collisions by applying the collision rules for the GAP and MUSIM gap in clauses 9.1.8.3, 9.1.10.5, 9.1.12.3, and 9.1.13.3, respectively.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG, also xRP = MGRP for periodic MUSIM gap.

Requirements do not apply for UE configured with concurrent GAPs or MUSIM gaps, if $N_{available}$ = 0

When UE supports *musim-GapPreference-r17* and if the configured aperiodic MUSIM gap collides with the measurement gap associated with the target frequency layer, where MUSIM gap collision rule in clause 9.1.10.4 is applied, longer cell identification period for the target inter-RAT carrier is expected.

Table 9.4.3.3-1: Requirement to identify a newly detectable E-UTRAN TDD cell

DRX cycle length (s)	$T_{Identify,\ E\text{-}UTRAN\ TDD}$ (s) (DRX cycles)	
	Gap/NCSG period = 40 ms, 20 ms	Gap/NCSG period = 80 ms
≤0.16	Non-DRX requirements in clause 9.4.3.2 apply	Non-DRX requirements in clause 9.4.3.2 apply
0.256	5.12* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	7.68* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) (30*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
0.32	6.4* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	7.68* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) (24*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
0.32< DRX-cycle ≤10.24	Note1 (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	Note1 (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))

NOTE 1: The time depends on the DRX cycle length.
NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.3.2.
NOTE 3: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs and/or MUSIM gaps. Otherwise K_{gap_EUTRA} =1
NOTE 4: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer.

Table 9.4.3.3-1b: Requirement to identify a newly detectable E-UTRAN TDD cell when *highSpeedMeasFlag-r16* is configured

DRX cycle length (s)	$T_{Identify,\ E\text{-}UTRAN\ TDD}$ (s) (DRX cycles)	
	Gap/NCSG period = 40 ms, 20 ms	**Gap/NCSG period = 80 ms**
≤0.16	Non-DRX requirements in clause 9.4.3.2 apply	Non-DRX requirements in clause 9.4.3.2 apply
0.16<DRX cycle≤0.32	Note 1(15*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	
0.32<DRX cycle ≤ 0.64	Note 1(10*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	
DRX cycle = 1.024	Note 1(10*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	Note 1(10*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
DRX cycle = 1.28	Note 1(8*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	Note 1(8*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
1.28< DRX-cycle ≤10.24	Note1 (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	Note1 (20*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))

NOTE 1: The time depends on the DRX cycle length.
NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.3.2.
NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *interRAT-MeasurementEnhancement-r16.*
NOTE 4: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs and/or MUSIM gaps. Otherwise K_{gap_EUTRA} = 1
NOTE 5: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer.

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN TDD cells per E-UTRA TDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA TDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period $T_{measure,\ E\text{-}UTRAN\ TDD}$ specified in table 9.4.3.3-3, including UE not configured with measurement gap cancellation according to clause 9.1.14 and conditions in clause 9.1.14.3, and table 9.4.3.3-5 for the UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3.

Table 9.4.3.3-3: Requirement to measure E-UTRAN TDD cells

DRX cycle length (s)	$T_{measure,\ E\text{-}UTRAN\ TDD}$ (s) (DRX cycles)
≤ 0.08	Non-DRX Requirements in clause 9.4.3.2 apply
0.128	For configuration 2 [Note3], non-DRX requirements in clause 9.4.3.2 apply, Otherwise: Note1 (5*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
0.128 < DRX-cycle ≤ 10.24	Note1 (5*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))

NOTE 1: The time depends on the DRX cycle length.
NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.3.2.
NOTE 3: See Table 9.4.3.2-1.
NOTE 4: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs and/or MUSIM gaps. Otherwise K_{gap_EUTRA} = 1

Table 9.4.3.3-4: Requirement to identify a newly detectable E-UTRAN TDD cell with measurement gap cancellation

DRX cycle length (s)	$T_{Identify,\ E\text{-}UTRAN\ TDD}$ (s) (DRX cycles)	
	Gap/NCSG period = 40 ms, 20 ms	Gap/NCSG period = 80 ms
≤0.16	Non-DRX requirements in clause 9.4.3.2 apply	Non-DRX requirements in clause 9.4.3.2 apply
0.256	(5.12 +$L_{cancel,PSS/SSS}$ *0.256) * $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) ((20 +$L_{cancel,PSS/SSS}$ *0.256)*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	(7.68 +$L_{cancel,PSS/SSS}$ *0.256)* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) ((30 +$L_{cancel,PSS/SSS}$ *0.256))*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
0.32	(6.4 +$L_{cancel,PSS/SSS}$ *0.32)* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) ((20 +$L_{cancel,PSS/SSS}$ *0.32)*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	(7.68 +$L_{cancel,PSS/SSS}$ *0.32)* $CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}) ((24 +$L_{cancel,PSS/SSS}$ *0.32))*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
0.32< DRX-cycle ≤10.24	Note1 ((20 +$L_{cancel,PSS/SSS}$ * DRX-cycle)*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))	Note1 ((20 +$L_{cancel,PSS/SSS}$ * DRX-cycle))*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.3.2. NOTE 3: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs. Otherwise K_{gap_EUTRA} =1. NOTE 4: If multiple concurrent gaps are configured, the gap period is the periodicity of the MG pattern associated to the E-UTRA inter-RAT frequency layer. NOTE 5: $L_{cancel,PSS/SSS}$ is the number of gap occasions cancelled during $T_{Identify,E-UTRAN\ TDD}$ for PSS/SSS detection.		

Table 9.4.3.3-5: Requirement to measure E-UTRAN TDD cells with measurement gap cancellation

DRX cycle length (s)	$T_{measure,\ E\text{-}UTRAN\ TDD}$ (s) (DRX cycles)
≤ 0.08	Non-DRX Requirements in clause 9.4.3.2 apply
0.128	For configuration 2 [Note3], non-DRX requirements in clause 9.4.3.2 apply, Otherwise: Note1 ((5 +$L_{cancel,meas}$ * 0.128)*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
0.128 < DRX-cycle ≤ 10.24	Note1 ((5 +$L_{cancel,meas}$ * DRX-cycle)*$CSSF_{interRAT}$ x Ceil(K_{gap_EUTRA}))
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.3.2. NOTE 3: See Table 9.4.3.2-1. NOTE 4: K_{gap_EUTRA} is only applicable for a UE supporting concurrent GAPs. Otherwise K_{gap_EUTRA} = 1. NOTE 5: $L_{cancel,meas}$ is the number of gap occasions cancelled during $T_{measure,\ E\text{-}UTRAN\ TDD}$ for measurement.	

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2.
The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3.
The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.3.4 Measurement reporting requirements

9.4.3.4.1 Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

9.4.3.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.3.4.3.

9.4.3.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The UE shall not send any event-triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{Identify, E-UTRAN TDD}$ defined in clauses 9.4.3.2 and 9.4.3.3 without DRX and with DRX, respectively. When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{Identify, E-UTRAN TDD}$ becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{Measure, E-UTRAN TDD}$ provided the timing to that cell has not changed more than ± 50 Ts while measurement gap or NCSG has not been available and the L3 filter has not been used.

9.4.3.5 Scheduling Availability During NR − E-UTRAN TDD measurements with NCSG

When UE supports *simultaneousRxTxInterBandENDC* for a band combination, no scheduling restriction is applicable to NR − E-UTRAN TDD measurements with NCSG in this band combination; otherwise UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within NCSG ML.

When a serving cell and an E-UTRA TDD measurement object are in bands with overlapping frequency with different subcarrier spacings, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within NCSG ML. Otherwise, no scheduling restriction to the serving cell is allowed due to NR − E-UTRAN TDD measurements with NCSG.

9.4.4 Inter-RAT RSTD measurements

9.4.4.1 NR − E-UTRAN FDD RSTD measurements

9.4.4.1.1 Introduction

The requirements are applicable for NR−E-UTRAN FDD RSTD measurements requested via LPP [22, 27].

When the UE is in NE-DC operation mode and an NR–E-UTRAN FDD RSTD measurement configured by NR PCell is on a E-UTRA serving frequency carrier, then the corresponding E-UTRA intra-frequency measurements requirements as follows shall apply.

- Measurements configured on E-UTRA PSCC shall meet E-UTRAN OTDOA intra-frequency measurements requirements in clause 8.1.2.5. The applicable measurement accuracy requirements are in clause 9.1.10.
- Measurements configured on E-UTRA SCC shall meet all applicable requirements in clause 8.4, except that the terms PCell and primary component carrier shall be deemed to be swapped with PSCell and PSCC. The applicable measurement accuracy requirements are in clause 9.1.12, except that the terms PCell and primary component carrier shall be deemed to be swapped with PSCell and PSCC.

The requirements in clause 9.4.4.1 apply when:

- the UE is provided with the LTE timing information via LPP [27], including both *nr-LTE-SFN-Offset* and *nr-LTE-fineTiming-Offset*, or
- the UE is not provided with *nr-LTE-SFN-Offset* or *nr-LTE-fineTiming-Offset*, or

- the UE is provided with *nr-LTE-SFN-Offset* but not with *nr-LTE-fineTiming-Offset*.

When the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE may be using autonomous gaps to acquire SFN of the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA RSTD measurements before the $T_{RSTD_InterRAT,E-UTRAN_FDD}$ time period starts while meeting all the requirements in clause 9.4.4.1.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to acquire the SFN before the $T_{RSTD_InterRAT,E-UTRAN_FDD}$ starts.

When the UE is not aware of and cannot derive the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may need to request measurement gaps to perform cell detection for the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA RSTD measurements before the $T_{RSTD_InterRAT,E-UTRAN_FDD}$ time period starts while meeting all the requirements in clause 9.4.4.1.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to detect the cell before the $T_{RSTD_InterRAT,E-UTRAN_FDD}$ starts.

9.4.4.1.2 Requirements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-RAT E-UTRAN FDD RSTD, specified in TS 38.215 [4], for at least *n*=16 cells, including the reference cell, within $T_{RSTD_InterRAT,E-UTRAN_FDD}$ ms as given below:

$$T_{InterRAT,E-UTRAN_FDD} = T_{PRS} \times (M - 1) + \Delta \ ,$$

where

$T_{RSTD_InterRAT,E-UTRAN_FDD}$ is the total time for detecting and measuring at least *n* cells,
T_{PRS} is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [23], among the measured *n* cells including the reference cell,
M is the number of PRS positioning occasions as defined in table 9.4.4.1.2-1, where each PRS positioning occasion comprises of N_{PRS} ($1 \leq N_{PRS} \leq 6$) consecutive downlink positioning subframes defined in TS 36.211 [23],
$CSSF_{interRAT}=CSSF_{within_gap,i}$ is the scaling factor determined by the gap sharing scheme for the RSTD measurements on the carrier frequency *i* as defined in clause 9.1.5.2,

$\Delta = 160 \times \left\lceil \frac{n}{M} \right\rceil \Delta = 160 \cdot \left\lceil \frac{n}{M} \right\rceil$ ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two E-UTRAN FDD carrier frequencies.

Table 9.4.4.1.2-1: Number of PRS positioning occasions within $T_{RSTD_InterRAT,E-UTRAN_FDD}$

Positioning subframe configuration period, T_{PRS}	Number of PRS positioning occasions, M	
	f2 Note1	f1 and f2 Note2
160 ms	16 × $CSSF_{interRAT}$	32 × $CSSF_{interRAT}$
>160 ms	8 × $CSSF_{interRAT}$	16 × $CSSF_{interRAT}$
NOTE 1: When inter-RAT E-UTRAN FDD RSTD measurements are performed over the reference cell and neighbour cells, which belong to the E-UTRAN FDD carrier frequency f2.		
NOTE 2: When inter-RAT E-UTRAN FDD RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the E-UTRAN FDD carrier frequency f1 and the E-UTRAN FDD carrier frequency f2 respectively.		

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within $T_{RSTD_InterRAT,E-UTRAN_FDD}$ provided:

$(PRS\ \hat{E}s/Iot)_{ref} \geq -6$ dB for all Frequency Bands for the reference cell,
$(PRS\ \hat{E}s/Iot)_i \geq -13$ dB for all Frequency Bands for neighbour cell *i*,
$(PRS\ \hat{E}s/Iot)_{ref}$ and $(PRS\ \hat{E}s/Iot)_i$ conditions apply for all subframes of at least $L = \frac{M}{2}$ PRS positioning occasions,
$PRP\ 1,2|_{dBm}$ according to TS 36.133 [15, Annex B.2.6] for a corresponding band,

PRS Ês/Iot is defined as the ratio of the average received energy per PRS resource element during the useful part of the symbol to the average received power spectral density of the total noise and interference for this resource element, where the ratio is measured over all resource elements which carry PRS.

The time $T_{RSTD_InterRAT,E\text{-}UTRAN_FDD}$ starts from the first subframe of the PRS positioning occasion closest in time after both the *OTDOA-RequestLocationInformation* message and the OTDOA assistance data in the *OTDOA-ProvideAssistanceData* message via LPP as specified in TS 38.305 [22], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in clause 10.2.4.

9.4.4.1.2.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

9.4.4.1.2.2 Requirements for acquiring the timing of the E-UTRA OTDOA reference cell

When the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE supporting per-FR gaps may make autonomous gaps in downlink reception and uplink transmission of the PCell, PSCell, and each of the SCells in FR1 for acquiring SFN of the reference cell in the E-UTRA OTDOA assistance data, while no autonomous gaps in downlink reception or uplink transmission are allowed in any of the UE serving cells in FR2. The UE, which are only supporting per-UE gaps, may make autonomous gaps in downlink reception and uplink transmission of the PCell, PSCell, and each of the SCells for acquiring the SFN of the reference cell in the E-UTRA OTDOA assistance data.

When the UE is not aware of and cannot derive the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may need to request measurement gaps while indicating *eutra-FineTimingDetection* according to TS 38.331 [2] for detecting the reference cell in the E-UTRA OTDOA assistance data.

When the UE is performing one or both of SFN acquisition or cell detection as specified above, the UE shall be able to determine the timing of the E-UTRA OTDOA assistance data reference cell during the time period

$$T_{RefCell,E\text{-}UTRAN} = T_{Detect,\ E\text{-}UTRAN\ FDD} + T_{MIB} + T_{ECGI}\ ,$$

where

$T_{Detect,\ E\text{-}UTRAN\ FDD} = T_{Identify,\ E\text{-}UTRAN\ FDD} - T_{measure,\ E\text{-}UTRAN\ FDD}$ is according to clause 9.4.2 assuming $CSSF_{interRAT} = 1$ and it is the time needed to detect the E-UTRA OTDOA assistance data reference cell when the UE needs to acquire the subframe and slot timing of the cell, provided the UE is configured with measurement gaps ($T_{Detect,\ E\text{-}UTRAN\ FDD} = 0$ when both *nr-LTE-SFN-Offset* and *nr-LTE-fineTiming-Offset* are provided in the E-UTRA OTDOA assistance data or the E-UTRA OTDOA assistance data reference cell is known to the UE), and

T_{MIB} = 50 ms is the time required to acquire SFN and/or PHICH configuration of the E-UTRA OTDOA assistance data reference cell provided the OTDOA assistance data reference cell is decodable and at least all E-UTRA subframes #0 during T_{MIB} are available at the UE receiver ($T_{MIB} = 0$ when *nr-LTE-SFN-Offset* is provided in the E-UTRA OTDOA assistance data and ECGI acquisition is not needed), and

T_{ECGI} = 100 ms is the time required to acquire ECGI of the E-UTRA OTDOA assistance data reference cell when *cellGlobalId* is included in *OTDOA-ReferenceCellInfo* and the UE is not aware of the ECGI of this cell ($T_{ECGI} = 0$ when *cellGlobalId* is not included in *OTDOA-ReferenceCellInfo* or the UE is aware of the ECGI of the E-UTRA OTDOA assistance data reference cell).

When detecting the E-UTRAN OTDOA reference cell, the requirements in this clause shall be met, provided the conditions for the detectable cell are fulfilled according to clause 9.4.2.1. In addition, the MIB of the E-UTRA OTDOA reference cell whose SFN is acquired shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to TS 36.101 [25].

The requirement for acquiring the timing of the E-UTRA OTDOA reference cell within $T_{RefCell,E\text{-}UTRAN}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.

When $T_{MIB} > 0$ and UE is using autonomous gaps during T_{MIB}, the UE shall transmit at least $N_{ACK/NACK, MIB, FDD}$ ACK/NACKs on PCell, PSCell, and each of activated SCell(s) in the frequency range where the autonomous gaps are created, specified in table 9.4.4.1.2.2-1. When both $T_{MIB} > 0$ and $T_{ECGI} > 0$ and UE is using autonomous gaps during $T_{MIB} + T_{ECGI}$, the UE shall transmit on PCell, PSCell, and each of activated SCell(s) in the frequency range where autonomous gaps are created at least $N_{ACK/NACK, MIB+ECGI, FDD}$ ACK/NACKs specified in table 9.4.4.1.2.2-3, provided the OTDOA reference cell bandwidth is configured in the OTDOA assistance data [22, 27]. The requirements in Tables 9.4.4.1.2.2-1, 9.4.4.1.2.2-2, and 9.4.4.1.2.2-3 apply, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- 2 slot ACK/NACK feedback is configured,
- 20 ms SMTC period is configured,
- SSBs are transmitted in one slot within SMTC window.

Table 9.4.4.1.2.2-2: Void

Table 9.4.4.1.2.2-2: Number of ACK/NACKs transmitted by the UE during T_{ECGI}

$N_{ACK/NACK, ECGI, FDD}$	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
66	FDD	15 kHz
145	FDD	30 kHz
298	FDD	60 kHz
28	TDD Note 1	15 kHz
67	TDD Note 1	30 kHz
144	TDD Note 1	60 kHz
175	TDD Note 2	60 kHz
363	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18].		
NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

Table 9.4.4.1.2.2-3: Number of ACK/NACKs transmitted by the UE during $T_{MIB} + T_{ECGI}$

$N_{ACK/NACK, MIB+ECGI, FDD}$	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18].		
NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

9.4.4.2 NR − E-UTRAN TDD RSTD measurements

9.4.4.2.1 Introduction

The requirements are applicable for NR−E-UTRAN TDD RSTD measurements requested via LPP [22, 27].

When the UE is in NE-DC operation mode and an NR–E-UTRAN TDD RSTD measurement configured by NR PCell is on a E-UTRA serving frequency carrier, then the corresponding E-UTRA intra-frequency measurements requirements as follows shall apply.

- Measurements configured on E-UTRA PSCC shall meet E-UTRAN OTDOA intra-frequency measurements requirements in clause 8.1.2.5. The applicable measurement accuracy requirements are in clause 9.1.10.

- Measurements configured on E-UTRA SCC shall meet all applicable requirements in clause 8.4, except that the terms PCell and primary component carrier shall be deemed to be swapped with PSCell and PSCC. The applicable measurement accuracy requirements are in clause 9.1.12, except that the terms PCell and primary component carrier shall be deemed to be swapped with PSCell and PSCC.

The requirements in clause 9.4.4.1 apply when:

- the UE is provided with the LTE timing information via LPP [27], including both *nr-LTE-SFN-Offset* and *nr-LTE-fineTiming-Offset*, or

- the UE is not provided with *nr-LTE-SFN-Offset* or *nr-LTE-fineTiming-Offset*, or

- the UE is provided with *nr-LTE-SFN-Offset* but not with *nr-LTE-fineTiming-Offset*.

When the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE may be using autonomous gaps to acquire SFN of the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA RSTD measurements before the $T_{RSTD_InterRAT,E-UTRAN_TDD}$ time period starts while meeting all the requirements in clause 9.4.4.2.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to acquire the SFN before the $T_{RSTD\ InterRAT,\ E-UTRAN\ TDD}$ starts. When the UE is not aware of and cannot derive the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may need to request measurement gaps to perform cell detection for the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA RSTD measurements before the $T_{RSTD_InterRAT,E-UTRAN_TDD}$ time period starts while meeting all the requirements in clause 9.4.4.2.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to detect the cell before the $T_{RSTD_InterRAT,E-UTRAN_TDD}$ starts.

9.4.4.2.2 Requirements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-RAT -UTRAN TDD RSTD, specified in TS 38.215 [4], for at least *n*=16 cells, including the reference cell, within $T_{RSTD_InterRAT,E-UTRAN_TDD}$ ms as given below:

$$T_{InterRAT,E-UTRAN_TDD} = T_{PRS} \times (M-1) + \Delta \quad ,$$

where

$T_{RSTD_InterRAT,E-UTRAN_TDD}$ is the total time for detecting and measuring at least *n* cells,
T_{PRS} is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [23], among the measured *n* cells including the reference cell,

M is the number of PRS positioning occasions as defined in table 9.4.4.2.2-1, where a PRS positioning occasion is as defined in clause 9.4.4.1.2,

$CSSF_{interRAT}=CSSF_{within_gap,i}$ is the scaling factor determined by the gap sharing scheme for the RSTD measurements on the carrier frequency *i* as defined in clause 9.1.5.2,

$\Delta = 160 \times \frac{n}{M}$ ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two E-UTRAN TDD carrier frequencies.

Table 9.4.4.2.2-1: Number of PRS positioning occasions within $T_{RSTD_InterRAT,E-UTRAN_TDD}$

Positioning subframe T_{PRS} configuration period,	Number of PRS positioning occasions, *M*	
	f2 Note1	f1 and f2 Note2
160 ms	16 × $CSSF_{interRAT}$	32 × $CSSF_{interRAT}$

> 160 ms	8 × $CSSF_{interRAT}$	16 × $CSSF_{interRAT}$
NOTE 1: When inter-RAT E-UTRAN TDD RSTD measurements are performed over the reference cell and neighbour cells, which belong to the E-UTRAN TDD carrier frequency f2.		
NOTE 2: When inter-RAT E-UTRAN TDD RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the E-UTRAN TDD carrier frequency f1 and the E-UTRAN TDD carrier frequency f2 respectively.		

The requirements in this clause shall apply for all TDD special subframe configurations specified in TS 36.211 [23] and for the TDD uplink-downlink configurations as specified in table 9.4.4.2.2-2 for UE requiring measurement gaps for these measurements. For UEs capable of performing inter-RAT RSTD measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in table 9.4.4.2.2-3 shall apply.

Table 9.4.4.2.2-2: TDD uplink-downlink subframe configurations applicable for inter-RAT RSTD requirements

PRS Transmission Bandwidth (RB)	Applicable TDD uplink-downlink configurations
6, 15	3, 4 and 5
25	1, 2, 3, 4, 5 and 6
50, 75, 100	0, 1, 2, 3, 4, 5 and 6
NOTE 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [23].	

Table 9.4.4.2.2-3: TDD uplink-downlink subframe configurations applicable for inter-RAT RSTD requirements without gaps

PRS Transmission Bandwidth (RB)	Applicable TDD uplink-downlink configurations
6, 15	1, 2, 3, 4 and 5
25, 50, 75, 100	0, 1, 2, 3, 4, 5 and 6
NOTE 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [23].	

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within $T_{\text{RSTD InterRAT, E-UTRAN TDD}}$ provided:

$(\text{PRS } \hat{E}s/Iot)_{ref}$ $\left(\text{PRS } \hat{E}_s / \text{Iot}\right)_{ref}$ ≥-6 dB for all Frequency Bands for the reference cell,

$(\text{PRS } \hat{E}s/Iot)_i$ $\left(\text{PRS } \hat{E}_s / \text{Iot}\right)_i$ ≥-13 dB for all Frequency Bands for neighbour cell *i*,

$(\text{PRS } \hat{E}s/Iot)_{ref}$ $\left(\text{PRS } \hat{E}_s / \text{Iot}\right)_{ref}$ and $(\text{PRS } \hat{E}s/Iot)_i$ conditions apply for all subframes of at least $L = \frac{M}{2}$ PRS positioning occasions,

$PRP\ 1,2|_{dBm}$ according to TS 36.133 [15, Annex B.2.6] for a corresponding band,

PRS $\hat{E}s/Iot$ is as defined in clause 9.4.4.1.2.

The time $T_{RSTD_InterRAT,E\text{-}UTRAN_TDD}$ starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message via LPP as specified in TS 38.305 [22], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in clause 10.2.4.

9.4.4.2.2.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

9.4.4.2.2.2 Requirements for acquiring the timing of the E-UTRA OTDOA reference cell

When the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE supporting per-FR gaps may make autonomous gaps in downlink reception and uplink transmission of the PCell, PSCell, and each of the SCells in FR1 for acquiring SFN of the reference cell in the E-UTRA OTDOA assistance data, while no autonomous gaps in downlink reception or uplink transmission are allowed in any of the UE serving cells in FR2. The UE, which are only supporting per-UE gaps, may make autonomous gaps in downlink reception and uplink transmission of the PCell, PSCell, and each of the SCells for acquiring the SFN of the reference cell in the E-UTRA OTDOA assistance data.

When the UE is not aware of and cannot derive the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may need to request measurement gaps while indicating *eutra-FineTimingDetection* according to TS 38.331 [2] for detecting the reference cell in the E-UTRA OTDOA assistance data.

When the UE is performing one or both of SFN acquisition or cell detection as specified above, the UE shall be able to determine the timing of the E-UTRA OTDOA assistance data reference cell during the time period

$$T_{RefCell,E\text{-}UTRAN} = T_{Detect,\ E\text{-}UTRAN\ TDD} + T_{MIB} + T_{ECGI}\ ,$$

where

$T_{Detect,\ E\text{-}UTRAN\ TDD} = T_{Identify,\ E\text{-}UTRAN\ TDD} - T_{measure,\ E\text{-}UTRAN\ TDD}$ is according to clause 9.4.3 assuming $CSSF_{interRAT} = 1$ and it is the time needed to detect the E-UTRA OTDOA assistance data reference cell when the UE needs to acquire the subframe and slot timing of the cell, provided the UE is configured with measurement gaps ($T_{Detect,\ E\text{-}UTRAN\ TDD} = 0$ when both *nr-LTE-SFN-Offset* and *nr-LTE-fineTiming-Offset* are provided in the E-UTRA OTDOA assistance data or the E-UTRA OTDOA assistance data reference cell is known to the UE), and

T_{MIB} = 50 ms is the time required to acquire SFN and/or PHICH configuration of the E-UTRA OTDOA assistance data reference cell provided the OTDOA assistance data reference cell is decodable and at least all E-UTRA subframes #0 during T_{MIB} are available at the UE receiver ($T_{MIB} = 0$ when *nr-LTE-SFN-Offset* is provided in the E-UTRA OTDOA assistance data and ECGI acquisition is not needed), and

T_{ECGI} = 100 ms is the time required to acquire ECGI of the E-UTRA OTDOA assistance data reference cell when *cellGlobalId* is included in *OTDOA-ReferenceCellInfo* and the UE is not aware of the ECGI of this cell ($T_{ECGI} = 0$ when *cellGlobalId* is not included in *OTDOA-ReferenceCellInfo* or the UE is aware of the ECGI of the E-UTRA OTDOA assistance data reference cell).

When detecting the E-UTRAN OTDOA reference cell, the requirements in this clause shall be met, provided the conditions for the detectable cell are fulfilled according to clause 9.4.3.1. In addition, the MIB of the E-UTRA OTDOA reference cell whose SFN is acquired shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to TS 36.101 [25].

The requirement for acquiring the timing of the E-UTRA OTDOA reference cell within $T_{RefCell,E\text{-}UTRAN}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.

When $T_{MIB} > 0$ and UE is using autonomous gaps during T_{MIB}, the UE shall transmit at least $N_{ACK/NACK,\ MIB,\ TDD}$ ACK/NACKs on PCell, PSCell, and each of activated SCell(s) in the frequency range where the autonomous gaps are created, specified in table 9.4.4.2.2.2-1. When both $T_{MIB} > 0$ and $T_{ECGI} > 0$ and UE is using autonomous gaps during $T_{MIB}+T_{ECGI}$, the UE shall transmit on PCell, PSCell, and each of activated SCell(s) in the frequency range where autonomous gaps are created at least $N_{ACK/NACK,\ MIB+ECGI,\ TDD}$ ACK/NACKs specified in table 9.4.4.2.2.2-3, provided the OTDOA reference cell bandwidth is configured in the OTDOA assistance data [22, 27]. The requirements in Tables 9.4.4.2.2.2-1, and 9.4.4.2.2.2-3 apply, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- 2 slot ACK/NACK feedback is configured,
- 20 ms SMTC period is configured,
- SSBs are transmitted in one slot within SMTC window.

Table 9.4.4.2.2.2-1: Minimum number of ACK/NACKs transmitted by the UE during T_{MIB}

$N_{ACK/NACK, MIB, TDD}$	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
15	FDD	15 kHz
39	FDD	30 kHz
85	FDD	60 kHz
0	TDD Note 1	15 kHz
4	TDD Note 1	30 kHz
12	TDD Note 1	60 kHz
46	TDD Note 2	60 kHz
104	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

Table 9.4.4.2.2.2-2: Void

Table 9.4.4.2.2.2-3: Minimum number of ACK/NACKs transmitted by the UE during T_{MIB} + T_{ECGI}

$N_{ACK/NACK, MIB+ECGI, TDD}$	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

9.4.5 Inter-RAT E-CID measurements

9.4.5.1 NR−E-UTRAN FDD E-CID RSRP and RSRQ measurements

9.4.5.1.1 Introduction

The requirements in clause 9.4.5.1. shall apply provided the UE has received *ECID-RequestLocationInformation* message from LMF via LPP requesting the UE to report inter-RAT E-UTRAN FDD E-CID RSRP and RSRQ measurements [22, 27].

9.4.5.1.2 Requirements

The requirements in clause 9.4.2 also apply for this clause except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in clause 9.4.5.1.3.

9.4.5.1.3 Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2 and 10.2.3, respectively.

9.4.5.2 NR−E-UTRAN TDD E-CID RSRP and RSRQ measurements

9.4.5.2.1 Introduction

The requirements in clause 9.4.5.2. shall apply provided the UE has received *ECID-RequestLocationInformation* message from LMF via LPP requesting the UE to report inter-RAT E-UTRAN TDD E-CID RSRP and RSRQ measurements [22, 27].

9.4.5.2.2 Requirements

The requirements in clause 9.4.3 also apply for this clause except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in clause 9.4.5.2.3.

9.4.5.2.3 Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2 and 10.2.3, respectively.

9.4.6 NR − UTRAN FDD measurements

9.4.6.1 Introduction

The requirements are applicable for NR− UTRAN FDD CPICH RSCP and CPICH Ec/No measurements for SRVCC.

9.4.6.2 Requirements when no DRX is used

9.4.6.2.1 Identification of a new UTRA FDD cell

When explicit neighbour list is provided and no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within

$$T_{identify,UTRA_FDD} = T_{basic_identify_UTRA_FDD} \times \frac{480}{T_{inter1}} \times CSSF_{interRAT}\ ms$$

A cell shall be considered detectable when

- CPICH Ec/Io $\geq$ -20 dB,
- SCH_Ec/Io $\geq$ -17 dB for at least one channel tap and SCH_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

9.4.6.2.2 UE UTRA FDD CPICH measurement capability

When measurement gaps are scheduled for UTRA FDD inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting measurements to higher layers with measurement accuracy as specified in Clause 10 with measurement period given by

$$T_{Measurement_UTRA_FDD} = Max\left\{T_{Measurement_Period_UTRA_FDD} \times CSSF_{interRAT}, T_{basic_measurement_UTRA_FDD} \times \frac{480}{T_{inter1}} \times CSSF_{interRAT}\right\} m$$

The UE shall be capable of performing UTRA FDD CPICH measurements for $X_{\text{basic measurementUTRA_FDD}}$ inter-frequency cells per FDD frequency and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of $T_{\text{Measurement_ UTRA_FDD}}$.

$X_{basic\ measurement\ UTRA_FDD} = 6$

$T_{Measurement_Period\ UTRA_FDD}$ = 480 ms. The period used for calculating the measurement period $T_{measurement_UTRA_FDD}$ for UTRA FDD CPICH measurements.

$T_{basic_identify_UTRA_FDD}$ = 300 ms. This is the time period used in the inter-RAT equation in clause 9.4.6.2.1 where the maximum allowed time for the UE to identify a new UTRA FDD cell is defined.

$T_{basic_measurement_UTRA_FDD}$ = 50 ms. This is the time period used in the equation for defining the measurement period for inter-RAT CPICH measurements.

$CSSF_{interRAT} = CSSF_{within_gap,i}$ is the scaling factor for the measured inter-RAT UTRA carrier *i* which is calculated as specified in clause 9.1.5.2.

T_{inter1} is defined in clause 9.4.1.

9.4.6.2.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 10.

9.4.6.2.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 10.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{identify,\ UTRA_FDD}$ defined in clause 9.4.6.2.1 for the minimum requirements. When L3 filtering is used an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{identify,\ UTRA_FDD}$ defined in clause 9.4.6.2.1 for the minimum requirements and then triggers the measurement report as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{measurement_UTRA_FDD}$ defined in clause 9.4.6.2.2 provided the timing to that cell has not changed more than ± 32 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

9.4.6.2.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 10.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.6.2.4 Event Triggered Reporting.

9.4.6.3 Requirements when DRX is used

When explicit neighbour list is provided and DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the neighbour cell list within $T_{identify,UTRA_FDD}$ as shown in table 9.4.6.3-1

Table 9.4.6.3-1: Requirement to identify a newly detectable UTRA FDD cell

DRX cycle length (s)	$T_{identify,UTRA_FDD}$ (s) (DRX cycles)	
	Gap period = 40 ms	Gap period = 80 ms

≤ 0.04	Non DRX Requirements in clause 9.4.6.2 are applicable	Non DRX Requirements in clause 9.4.6.2 are applicable
0.064	2.56 *$CSSF_{interRAT}$ (40*$CSSF_{interRAT}$)	4.8 *$CSSF_{interRAT}$ (75 *$CSSF_{interRAT}$)
0.08	3.2 *$CSSF_{interRAT}$ (40 *$CSSF_{interRAT}$)	4.8 *$CSSF_{interRAT}$ (60* $CSSF_{interRAT}$)
0.128	3.2 *$CSSF_{interRAT}$ (25* $CSSF_{interRAT}$)	4.8 *$CSSF_{interRAT}$ (37.5* $CSSF_{interRAT}$)
0.16	3.2 *$CSSF_{interRAT}$ (20 *$CSSF_{interRAT}$)	4.8 *$CSSF_{interRAT}$ (30 *$CSSF_{interRAT}$)
0.16 < DRX-cycle ≤ 2.56	Note1 (20 *$CSSF_{interRAT}$)	Note1 (20 *$CSSF_{interRAT}$)
NOTE 1: Time depends upon the DRX cycle in use. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2.		

A cell shall be considered detectable provided following conditions are fulfilled: A cell shall be considered detectable when

- CPICH Ec/Io $\geq$ -20 dB,
- SCH_Ec/Io $\geq$ -17 dB for at least one channel tap and SCH_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

The UE shall be capable of performing RSCP and Ec/Io measurements of at least 6 UTRA cells per UTRA FDD carrier for up to 3 UTRA FDD carriers and the UE physical layer shall be capable of reporting RSCP and Ec/Io measurements to higher layers with the measurement period defined in table 9.4.6.3-2 when DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

Table 9.4.6.3-2: Requirement to measure UTRA FDD cells

DRX cycle length (s)	$T_{measurement_UTRA_FDD}$ (s) (DRX cycles)	
	Gap period = 40 ms	**Gap period = 80 ms**
≤ 0.04	Non DRX Requirements in clause 9.4.6.2 are applicable	Non DRX Requirements in clause 9.4.6.2 are applicable
0.064	0.48* $CSSF_{interRAT}$ (7.5* N_{freq}*$CSSF_{interRAT}$)	0.8 *$CSSF_{interRAT}$ (12.5 *$CSSF_{interRAT}$)
0.08	0.48 *$CSSF_{interRAT}$ (6 *$CSSF_{interRAT}$)	0. 8*$CSSF_{interRAT}$ (10 *$CSSF_{interRAT}$)
0.128	0.64 *$CSSF_{interRAT}$ (5 *$CSSF_{interRAT}$)	0. 8 *$CSSF_{interRAT}$ (6.25 *$CSSF_{interRAT}$)
0.128 < DRX-cycle ≤ 2.56	Note1 (5 *$CSSF_{interRAT}$)	Note1 (5 *$CSSF_{interRAT}$)
NOTE 1: Time depends upon the DRX cycle in use. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2.		

The measurement accuracy for all measured cells shall be as specified in the clause 10.3.

9.4.6.3.1 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 10.

9.4.6.3.2 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 10.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{identify,UTRA_FDD}$ defined in clause 9.4.6.3. When L3 filtering is used an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{identify, UTRA_FDD}$ defined in clause 9.4.6.3 and then triggers the measurement report as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{measurement_UTRA_FDD}$ defined in clause 9.4.6.3 provided the timing to that cell has not changed more than ± 32 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

9.4.6.3.3 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 10.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.6.3.2 Event Triggered Reporting.

9.4.7 NR – E-UTRAN measurements with autonomous gaps

9.4.7.1 CGI identification of an E-UTRA cell with autonomous gaps

The requirements in this clause apply when the UE is configured with standalone NR, NE-DC or NR-DC. The UE shall identify and report the CGI when requested by an NR PCell for the purpose 'reportCGI'. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 in TS 38.331 [2]. If autonomous gaps are used for measurement with the purpose of 'reportCGI', regardless of whether DRX is used or not, or regardless of whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within $T_{identify_CGI, E\text{-}UTRAN}$ = 150 ms. This is the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in clause 9.1 in [15] are fulfilled for a corresponding band,
- SCH_RP and SCH Ês/Iot according to Annex B.2.2 in [15] for a corresponding band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [25].

The requirement for identifying a new CGI of an E-UTRA cell within $T_{identify_CGI, E\text{-}UTRAN}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.

9.4.7.2 CGI reporting delay

The E-UTRA CGI reporting delay is defined as the time between a command that will trigger an E-UTRA CGI report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty of 2 x TTI_{DCCH} resulting when inserting the measurement report to the TTI of the uplink DCCH. This measurement reporting delay excludes any delay caused by lack of UL resources for UE to send the measurement report.

The CGI reporting delay shall be less than $T_{identify_CGI, E\text{-}UTRAN}$ plus RRC procedure delay defined in clause 12 in TS 38.331 [2], and an additional 30 ms margin.

9.4.8 NR – E-UTRAN measurements without measurement gaps

9.4.8.1 Introduction

The requirements in this clause are specified for NR−E-UTRAN FDD and NR−E-UTRAN TDD measurements and are applicable without an explicit E-UTRAN neighbour cell list containing physical layer cell identities, for a UE:

- in RRC_CONNECTED state, and configured with SA with NR−E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR, RSTD, or E-CID RSRP and RSRQ) on E-UTRA frequency carrier

The inter-RAT E-UTRA measurement requirements in this clause are applicable provided

- UE supports eutra-NeedForGapNCSG-reporting-r17 and indicates '*nogap-noncsg*' in the E-UTRA band in *NeedForGapNCSG-InfoEUTRA* for inter-RAT E-UTRA measurement, and UE supports 32-4, or

- UE supports [case b-2].

9.4.8.2 General requirements

If an NR – E-UTRAN measurement does not cause scheduling restriction as defined in clause 9.4.8.3.5 or 9.4.8.4.5, the measurement is performed outside measurement gaps.

If an NR – E-UTRAN measurement causes scheduling restriction as defined in clause 9.4.8.3.5 or 9.4.8.4.5, the measurement is performed within measurement gaps if one of the following conditions is met, and the requirements in clause 9.4.2 or 9.4.3 apply.

- EMW is configured and fully overlapped with measurement gap, and the periodicity of measurement gap and EMW is same, or

- EMW is not configured.

Otherwise, the measurement is performed within EMW occasions and requirements in clause 9.4.8 apply.

When UE is configured with EMW and measurement gap, EMW and measurement gap occasions are considered colliding if the two occasions are fully or partially overlapping in time domain.

When UE is configured with EMW and SMTC or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement, EMW and SMTC or SSB/CSI-RS occasions are considered colliding if the two occasions are fully or partially overlapping in time domain, provided that inter-RAT measurement during EMW would cause scheduling restriction.

In case of collision between EMW and measurement gap and EMW periodicity is smaller than MGRP, scheduling restriction specified in clause 9.4.8.2 does not apply in the EMW occasions colliding with measurement gap.

In case of collision between EMW and SMTC or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement, scheduling restriction specified in clause 9.4.8.2 does not apply in the EMW occasions colliding with SMTC or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement.

Parameter T_{Inter1} used in inter-RAT requirements in clause 9.4.8 is [60]ms if the measurement is performed outside measurement gaps without EMW configuration. If the measurement is performed with EMW configuration, T_{Inter1} is defined at table 9.4.8.2-1.

Table 9.4.8.2-1: The effective measurement window

Configuration	[Effective measurement window periodicity] [ms]	[Effective measurement window duration] [ms]	T_{inter1}
0	40	5	[60]
1	80	5	[30]
2	40	2	[60]
3	80	2	[30]
4	40	5.5	[60]
5	80	5.5	[30]

9.4.8.3 NR − E-UTRAN FDD measurements

9.4.8.3.1 Introduction

The requirements are applicable for NR−E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN FDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

- RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

9.4.8.3.2 Requirements when no DRX is used

The UE shall be able to identify a new detectable FDD cell within $T_{\text{Identify, E-UTRAN FDD}}$ according to the following expression:

$$T_{\text{Identify,E-UTRAN FDD}} = T_{\text{BasicIdentify}} \cdot \frac{[480]}{T_{\text{Inter1}}} \cdot \text{CSSF}_{\text{interRAT}} \cdot K_{\text{P}} \quad ms,$$

where:

$T_{\text{BasicIdentify}}$ = [480 ms],

T_{Inter1} is defined in clause 9.4.8.1,

$\text{CSSF}_{\text{interRAT}}$ = [$\text{CSSF}_{\text{outside_gap,i}}$ in clause 9.1.5.1].

- [K_p is the scaling factor due to overlapping between EMW and SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement. K_p =1 if the measurement is performed outside EMW or if EMW is fully non-overlapped with SMTC, SSB/CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement and measurement gap. Otherwise, $K_p = N_{\text{total}} / N_{\text{available}}$, where $N_{\text{available}}$ and N_{total} are calculated as follows:

  - For a window W of duration max(EMW period, SMTC period, MGRP, T_{SSB}, $T_{CSI\text{-}RS}$), where SMTC period follows *smtc1* if high layer in TS 38.331 [2] signaling of *smtc2* is not present on the same carrier frequency. Otherwise, SMTC period follows *smtc2*, T_{SSB}/$T_{CSI\text{-}RS}$ is the periodicity of SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement on the same carrier frequency, and starting from the beginning of any SMTC occasion.

  - N_{total} is the total number of EMW occasions within the window W, including those overlapped with SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement, and

  - $N_{\text{available}}$ is the number of EMW occasions that are not overlapped with any SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement within the window W, after accounting for EMW collisions by applying the EMW collision rule in clause 9.4.8.2.

  - No requirement applies for the measurement when $N_{\text{available}} = 0$.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of $T_{\text{measure, E-UTRAN FDD}}$ defined in table 9.4.8.3.2-1.

Table 9.4.8.3.2-1: Measurement period and measurement bandwidth configuration

Configuration	Physical Layer Measurement period: $T_{\text{measure, E-UTRAN FDD}}$ [ms]	Measurement bandwidth [RB]
0	480 x $\text{CSSF}_{\text{interRAT}}$ x K_p	6
1 (Note 1)	240 x $\text{CSSF}_{\text{interRAT}}$ x K_p	50
NOTE 1: This configuration is optional.		

The UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement period $T_{\text{measure, E-UTRAN FDD}}$ given by table 9.4.8.3.2-1.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2.
The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3.
The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.8.3.3 Requirements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable E-UTRAN FDD cell within $T_{Identify,\ E\text{-}UTRAN\ FDD}$ specified in table 9.4.8.3.3-1.

Table 9.4.8.3.3-1: Requirement to identify a newly detectable E-UTRAN FDD cell

DRX cycle length (s)	$T_{Identify,\ E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)	
	EMW period = 40 ms, or the measurement is performed without EMW	EMW period = 80 ms
≤ 0.16	Non-DRX requirements in clause 9.4.8.3.2 apply	Non-DRX requirements in clause 9.4.8.3.2 apply
0.256	$5.12*CSSF_{interRAT}*K_p$ ($20*CSSF_{interRAT}*K_p$)	$7.68*CSSF_{interRAT}*K_p$ ($30*CSSF_{interRAT}*K_p$)
0.32	$6.4*CSSF_{interRAT}*K_p$ ($20*CSSF_{interRAT}*K_p$)	$7.68*CSSF_{interRAT}*K_p$ ($24*CSSF_{interRAT}*K_p$)
0.32 < DRX-cycle ≤ 10.24	Note1 ($20*CSSF_{interRAT}*K_p$)	Note1 ($20*CSSF_{interRAT}*K_p$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.8.3.2. NOTE 3: K_p is as defined in clause 9.4.8.3.2. NOTE 4: Void		

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN FDD cells per E-UTRA FDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA FDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period $T_{measure,\ E\text{-}UTRAN\ FDD}$ specified in table 9.4.8.3.3-2.

Table 9.4.8.3.3-2: Requirement to measure E-UTRAN FDD cells

DRX cycle length (s)	$T_{measure,\ E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)
≤ 0.08	[Non-DRX requirements in clause 9.4.8.3.2 apply]
0.08 < DRX-cycle ≤ 10.24	Note1 ($5*CSSF_{interRAT}*K_p$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.8.3.2.	

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2.
The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3.
The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.8.3.4 Measurement reporting requirements

9.4.8.3.4.1 Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

9.4.8.3.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.8.3.4.3.

9.4.8.3.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The UE shall not send any event-triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{Identify, E-UTRAN FDD}$ defined in clauses 9.4.8.3.2 and 9.4.8.3.3 without DRX and with DRX, respectively. When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{Identify, E-UTRAN FDD}$ becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{Measure, E-UTRAN FDD}$ provided the timing to that cell has not changed more than ± 50 Ts while measurement gap or NCSG has not been available and the L3 filter has not been used.

9.4.8.3.5 Scheduling availability during NR − E-UTRAN FDD measurements

When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction.

9.4.8.3.5.1 Scheduling availability of UE performing inter-RAT measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

When UE performs inter-RAT measurement outside MG and the E-UTRA carrier is fully or partially overlapping with the DL active BWP of the serving cell, for UE which do not support [*FG32-7]* [14] the following restrictions apply due to RSRP/RSRQ/SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on [all symbols within EMW duration].

9.4.8.4 NR − E-UTRAN TDD measurements

9.4.8.4.1 Introduction

The requirements are applicable for NR−E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN TDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

  RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

9.4.8.4.2 Requirements when no DRX is used

The UE shall be able to identify a new detectable TDD cell within $T_{Identify, E-UTRAN TDD}$ according to the following expression:

- When configuration 0 or configuration 1 in table 9.4.8.4.2-1 is applied,

$$T_{\text{Identify,E-UTRAN TDD}} = T_{\text{BasicIdentify}} \cdot \frac{[480]}{T_{\text{Inter1}}} \cdot CSSF_{\text{interRAT}} \cdot K_{\text{P}} \quad ms,$$

- When configuration 2 or configuration 3 in table 9.4.8.4.2-1 is applied,

$$T_{\text{Identify,E-UTRAN TDD}} = T_{\text{BasicIdentify}} \cdot \frac{[480]}{T_{\text{Inter1}}} \cdot CSSF_{\text{interRAT}} \cdot K_{\text{P}} + 240 \cdot \text{CSSF}_{\text{interRAT}} \cdot K_{\text{P}} \quad ms,$$

where:

$T_{BasicIdentify}$ = [480 ms],

T_{Inter1} is defined in clause 9.4.8.1,

$CSSF_{interRAT}$ = [$CSSF_{outside_gap,i}$ in clause 9.1.5.1].

K_p is the scaling factor due to overlapping between EMW and SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement. K_p =1 if the measurement is performed outside EMW or if EMW is fully non-overlapped with SMTC, SSB/CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement and measurement gap. Otherwise, $K_p = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

- For a window W of duration max(EMW period, SMTC period, MGRP, T_{SSB}, T_{CSI-RS}), where SMTC period follows *smtc1* if high layer in TS 38.331 [2] signaling of *smtc2* is not present on the same carrier frequency. Otherwise, SMTC period follows *smtc2*, T_{SSB}/T_{CSI-RS} is the periodicity of SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement on the same carrier frequency, and starting from the beginning of any SMTC occasion

- N_{total} is the total number of EMW occasions within the window, including those overlapped with SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement, and

- $N_{available}$ is the number of EMW occasions that are not overlapped with any SMTC, measurement gap, or SSB/CSI-RS configured for RLM/BFD/CBD/L1-RSRP measurement within the window W, after accounting for EMW collisions by applying the EMW collision rule in clause 9.4.8.2.

- No requirement applies for the measurement when $N_{available}$ = 0.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of $T_{Measure, E\text{-}UTRAN\ TDD}$ defined in table 9.4.8.4.2-1.

Table 9.4.8.4.2-1: $T_{Measure, E\text{-}UTRAN\ TDD}$ for different configurations

Configuration	Measurement bandwidth (RB)	Number of UL/DL sub-frames per half frame (5 ms)		DwPTS		$T_{Measure, E\text{-}UTRAN\ TDD}$ (ms)
		DL	UL	Normal CP	Extended CP	
0	6	2	2	$19760 \cdot T_s$	$20480 \cdot T_s$	[480 x $CSSF_{interRAT}$ x K_p]
1 (Note 1)	50	2	2	$19760 \cdot T_s$	$20480 \cdot T_s$	[240 x $CSSF_{interRAT}$ x K_p]
2	6	1	3	$19760 \cdot T_s$	$20480 \cdot T_s$	[720 x $CSSF_{interRAT}$ x K_p]
3 (Note 1)	50	1	3	$19760 \cdot T_s$	$20480 \cdot T_s$	[480 x $CSSF_{interRAT}$ x K_p]
NOTE 1: This configuration is optional. NOTE 2: Void						

The UE physical layer shall be capable of reporting RSRP, RSRQ, and RS-SINR measurements to higher layers with measurement period $T_{measure, E\text{-}UTRAN\ TDD}$ given by table 9.4.8.4.2-1.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2.
The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3.
The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.8.4.3 Requirements when DRX is used

When DRX is in use the UE shall be able to identify a new detectable E-UTRAN TDD cell within $T_{Identify, E\text{-}UTRAN\ TDD}$ specified in table 9.4.8.4.3-1.

Table 9.4.8.4.3-1: Requirement to identify a newly detectable E-UTRAN TDD cell

DRX cycle length (s)	$T_{identify,\ E\text{-}UTRAN\ TDD}$ (s) (DRX cycles)	
	EMW period = 40 ms, or the measurement is performed without EMW	EMW period = 80 ms
≤ 0.16	Non-DRX requirements in clause 9.4.8.4.2 apply	Non-DRX requirements in clause 9.4.8.4.2 apply
0.256	[5.12* $CSSF_{interRAT}$*K_p (20*$CSSF_{interRAT}$*K_p)]	[7.68* $CSSF_{interRAT}$*K_p (30*$CSSF_{interRAT}$*K_p)]
0.32	[6.4* $CSSF_{interRAT}$*K_p (20*$CSSF_{interRAT}$*K_p)]	[7.68* $CSSF_{interRAT}$*K_p (24*$CSSF_{interRAT}$*K_p)]
0.32 < DRX-cycle ≤ 10.24	Note1 (20*$CSSF_{interRAT}$*K_p)	Note1 (20*$CSSF_{interRAT}$*K_p)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.8.4.2. NOTE 3: K_p is as defined in clause 9.4.8.4.2. NOTE 4: Void		

Table 9.4.8.4.3-2: Void

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN TDD cells per E-UTRA TDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA TDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period $T_{measure,\ E\text{-}UTRAN\ TDD}$ specified in table 9.4.8.4.3-3.

Table 9.4.8.4.3-3: Requirement to measure E-UTRAN TDD cells

DRX cycle length (s)	$T_{measure,\ E\text{-}UTRAN\ TDD}$ (s) (DRX cycles)
≤ 0.08	[Non-DRX Requirements in clause 9.4.8.4.2 apply]
0.128	[For configuration 2 Note3, non-DRX requirements in clause 9.4.8.4.2 apply,] Otherwise: Note1 (5*$CSSF_{interRAT}$*K_p)
0.128 < DRX-cycle ≤ 10.24	Note1 (5*$CSSF_{interRAT}$*K_p)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.8.4.2. NOTE 3: See Table 9.4.8.4.2-1.	

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2.
The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3.
The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.8.4.4 Measurement reporting requirements

9.4.8.4.4.1 Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

9.4.8.4.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.8.4.4.3.

9.4.8.4.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The UE shall not send any event-triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{Identify, E-UTRAN TDD}$ defined in clauses 9.4.8.4.2 and 9.4.8.4.3 without DRX and with DRX, respectively. When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{Identify, E-UTRAN TDD}$ becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{Measure, E-UTRAN TDD}$ provided the timing to that cell has not changed more than $\pm$ 50 Ts while measurement gap or NCSG has not been available and the L3 filter has not been used.

9.4.8.4.5 Scheduling availability during NR − E-UTRAN TDD measurements

When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction.

9.4.8.4.5.1 Scheduling availability of UE performing inter-RAT measurements in TDD bands on FR1

When the UE performs inter-RAT measurements in a TDD band outside MG and the E-UTRA carrier is within DL active BWP of the serving cell, the following restrictions apply on the NR serving cell due to RSRP, RS-SINR and RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within EMW duration.

When the UE performs inter-RAT measurement in a TDD band outside MG and the E-UTRA carrier is outside DL active BWP of the serving cell, the following restrictions apply on the NR serving cell due to RSRP/RSRQ/SINR measurement, when the NR serving cell and E-URTA carrier are in a band pair for which UE does not have the capability of supporting *simultaneousRxTxInterBandCA*

- The UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within EMW duration.

9.4.8.4.5.2 Scheduling availability of UE performing inter-RAT measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

When UE performs inter-RAT measurement outside MG and the E-UTRA carrier is fully or partially overlapping with the DL active BWP of the serving cell, for UE which do not support [*FG32-7]* [14] the following restrictions apply due to RSRP/RSRQ/SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within EMW duration.

9.4A Inter-RAT measurements for RedCap

9.4A.1 Introduction

The requirements in this clause are specified for NR−E-UTRAN FDD and NR−E-UTRAN TDD measurements and are applicable without an explicit E-UTRAN neighbour cell list containing physical layer cell identities, for a UE:

- in RRC_CONNECTED state, and
- configured
  - with SA operation mode by PCell with NR–E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR) on E-UTRA non-serving frequency carrier, and
- configured with an appropriate measurement gap pattern according to table 9.1A.2-1 and table 9.1A.2-2.

Parameter T_{Inter1_RedCap} used in inter-RAT requirements in clause 9.4A is specified in table 9.4A.1-1.

Table 9.4A.1-1: Minimum available time for inter-RAT measurements

Gap Pattern Id	MeasurementGap Length (MGL, ms)	Measurement Gap Repetition Period (MGRP, ms)	Minimum available time for inter-frequency and inter-RAT measurements during 480 ms period (T_{inter1_RedCap}, ms)
0	6	40	60
1	6	80	30
2	3	40	24 Note 1
3	3	80	12 Note 1
4	6	20	120 Note 1
6	4	20	72 Note 1,3,6
7	4	40	36 Note 1,4,6
8	4	80	18 Note 1,5,6
10	3	20	48 Note 1

NOTE 1: When determining UE requirements using T_{inter1_RedCap} for gap pattern IDs 2, 3, 4, 6, 7, 8, 10, T_{inter1_RedCap} = 60 for gap pattern IDs 2, 4, 6, 7, 10, and T_{inter1_RedCap} = 30 for gap pattern IDs 3 and 8 shall be used.
NOTE 2: Measurement gaps pattern configurations applicability is as specified in Table 9.1A.2-2.
NOTE 3: When this gap pattern is used, the T_{inter1_RedCap} for E-UTRA inter-frequency measurements is 48 ms corresponding to the first 3 ms of the 4 ms gap.
NOTE 4: When this gap pattern is used, the T_{inter1_RedCap} for E-UTRA inter-frequency measurements is 24 ms corresponding to the first 3 ms of the 4 ms gap.
NOTE 5: When this gap pattern is used, the T_{inter1_RedCap} for E-UTRA inter-frequency measurements is 12 ms corresponding to the first 3 ms of the 4 ms gap.
NOTE 6: This gap pattern is applicable for E-UTRA inter-frequency measurements only if gap based NR measurements are also configured.

A UE configured with gap pattern ID 2, 3 or 10 shall be able to detect a target cell, provided that

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell begins not earlier than 500 μs from the start of the measurement gap, and
- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell ends not later than 500 μs before the end of the measurement gap in case of FDD and not later than 750 μs before the end of measurement gap in case of TDD.

A UE configured with gap pattern ID 6, 7 or 8 shall be able to detect a target cell, provided that

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell begins not earlier than 500 μs from the start of the measurement gap, and
- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell ends no later than 1500 μs before the end of the measurement gap in case of FDD and no later than 1750 μs before the end of measurement gap in case of TDD.

In this clause, the SSB terminology applies for both CD-SSB and NCD-SSB.

9.4A.2 NR − E-UTRAN FDD measurements

9.4A.2.1 Introduction

The requirements are applicable for NR−E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN FDD cell is considered to be detectable when:

- For 2 Rx RedCap UE:
  - RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
  - RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
  - RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding band, together with the corresponding side conditions in annex B.2.3 and Annex B.3.19 of TS 36.133 [15].
- For 1 Rx RedCap UE:
  - RSRP related conditions in the accuracy requirements in clause 10.2A.2 are fulfilled for a corresponding band, together with the corresponding side conditions in annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
  - RSRQ related conditions in the accuracy requirements in clause 10.2A.3 are fulfilled for a corresponding band, together with the corresponding side conditions in annex B.2.3 and annex B.3.3 of TS 36.133 [15],

9.4A.2.2 Requirements when no DRX is used

When the UE requires measurement gaps to identify and measure inter-RAT cells and an appropriate measurement gap pattern is scheduled, the UE shall be able to identify a new detectable FDD cell within $T_{Identify_RedCap,\ E\text{-}UTRAN\ FDD}$ according to the following expression:

$$T_{\text{Identify_RedCap,E-UTRAN FDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1_RedCap}}} \cdot \text{CSSF}_{\text{interRAT_RedCap}} \quad ms,$$

where:

$T_{BasicIdentify}$ = 480 ms,

T_{Inter1_RedCap} is defined in clause 9.4A.1,

$CSSF_{interRAT_RedCap} = CSSF_{within_gap_RedCap,i}$ is the scaling factor for the measured inter-RAT E-UTRA carrier *i* which is calculated as specified in clause 9.1A.5.2.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of $T_{Measure_RedCap,\ E\text{-}UTRAN\ FDD}$ defined in table 9.4A.2.2-1 and table 9.4A.2.2-2 for 2 Rx RedCap UE and 1 Rx RedCap UE, respectively.

Table 9.4A.2.2-1: Measurement period and measurement bandwidth for 2Rx RedCap UE

Configuration	Physical Layer Measurement period: $T_{Measure_RedCap,\ E\text{-}UTRAN\ FDD}$ [ms]	Measurement bandwidth [RB]
0	480 x $CSSF_{interRAT_RedCap}$	6
1 (Note 1)	240 x $CSSF_{interRAT_RedCap}$	50
NOTE 1: This configuration is optional.		

Table 9.4A.2.2-2: Measurement period and measurement bandwidth for 1Rx RedCap UE

Configuration	Physical Layer Measurement period: $T_{Measure_RedCap,\ E\text{-}UTRAN\ FDD}$ [ms]	Measurement bandwidth [RB]
0	960 x $CSSF_{interRAT_RedCap}$	6
1 (Note 1)	480 x $CSSF_{interRAT_RedCap}$	50
NOTE 1: This configuration is optional.		

The UE shall be capable of identifying and performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN FDD cells per E-UTRA FDD carrier frequency layer during each layer 1 measurement period, for up to 7 E-UTRA FDD carrier frequency layers.

If higher layer filtering is used, an additional cell identification delay can be expected.

For 2 Rx RedCap UE:

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

For 1 Rx RedCap UE:

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2A.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2A.3.

9.4A.2.3 Requirements when DRX is used

When DRX is in use and measurement gaps are configured, the UE shall be able to identify a new detectable E-UTRAN FDD cell within $T_{Identify_RedCap,\ E\text{-}UTRAN\ FDD}$ specified in table 9.4A.2.3-1.

Table 9.4A.2.3-1: Requirement to identify a newly detectable E-UTRAN FDD cell

DRX cycle length (s)	$T_{Identify_RedCap,\ E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)	
	Gap period = 40 ms, 20 ms	Gap period = 80 ms
≤ 0.16	Non-DRX requirements in clause 9.4A.2.2 apply	Non-DRX requirements in clause 9.4A.2.2 apply
0.256	5.12* $CSSF_{interRAT_RedCap}$ (20*$CSSF_{interRAT_RedCap}$)	7.68* $CSSF_{interRAT_RedCap}$ (30*$CSSF_{interRAT_RedCap}$)
0.32	6.4* $CSSF_{interRAT_RedCap}$ (20*$CSSF_{interRAT_RedCap}$)	7.68* $CSSF_{interRAT_RedCap}$ (24*$CSSF_{interRAT_RedCap}$)
0.32 < DRX-cycle ≤ 10.24	Note1 (20*$CSSF_{interRAT_RedCap}$)	Note1 (20*$CSSF_{interRAT_RedCap}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT_RedCap}$ is as defined in clause 9.4A.2.2.		

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN FDD cells per E-UTRA FDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA FDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period $T_{measure_RedCap,\ E\text{-}UTRAN\ FDD}$ specified in table 9.4A.2.3-2 and table 9.4A.2.3-3.

Table 9.4A.2.3-2: Requirement to measure E-UTRAN FDD cells for 2Rx RedCap UE

DRX cycle length (s)	$T_{measure_RedCap,\ E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)
≤ 0.08	Non-DRX requirements in clause 9.4A.2.2 apply
0.08 < DRX-cycle ≤ 10.24	Note1 (5* $CSSF_{interRAT_RedCap}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT_RedCap}$ is as defined in clause 9.4A.2.2.	

Table 9.4A.2.3-3: Requirement to measure E-UTRAN FDD cells for 1Rx RedCap UE

DRX cycle length (s)	$T_{measure_RedCap,\ E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)
≤0.08	Non-DRX requirements in clause 9.4A.2.2 apply
0.08 < DRX-cycle ≤ 10.24	Note1 (10* $CSSF_{interRAT_RedCap}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT_RedCap}$ is as defined in clause 9.4A.2.2.	

If higher layer filtering is used, an additional cell identification delay can be expected.

For 2 Rx RedCap UE:

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

For 1 Rx RedCap UE:

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2A.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2A.3.

9.4A.2.4 Measurement reporting requirements

9.4A.2.4.1 Periodic Reporting

For 2 Rx RedCap UE: The requirements in clause 9.4.2.4.1 shall apply.

For 1 Rx RedCap UE: The reported NR – E-UTRAN FDD RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2A.2 and 10.2A.3, respectively.

9.4A.2.4.2 Event-Triggered Periodic Reporting

For 2 Rx RedCap UE: The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

For 1 Rx RedCap UE: The reported NR – E-UTRAN FDD RSRP and RSRQ measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2A.2 and 10.2A.3, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4A.2.4.3.

9.4A.2.4.3 Event-Triggered Reporting

For 2 Rx RedCap UE: The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

For 1 Rx RedCap UE: The reported NR – E-UTRAN FDD RSRP and RSRQ measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2A.2 and 10.2A.3, respectively.

The UE shall not send any event-triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{Identify_RedCap,\ E\text{-}UTRAN\ FDD}$ defined in clauses 9.4A.2.2 and 9.4A.2.3 without DRX and with DRX, respectively. When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{Identify_RedCap,\ E\text{-}UTRAN\ FDD}$ becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{Measure_RedCap,\ E\text{-}UTRAN\ FDD}$ provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used.

9.4A.3 NR − E-UTRAN TDD measurements

9.4A.3.1 Introduction

The requirements are applicable for NR−E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN TDD cell is considered to be detectable when:

- For 2 Rx RedCap UE:
  - RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
  - RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

    RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].
- For 1 Rx RedCap UE:
  - RSRP related conditions in the accuracy requirements in clause 10.2A.2 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
  - RSRQ related conditions in the accuracy requirements in clause 10.2A.3 are fulfilled for a corresponding band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

9.4A.3.2 Requirements when no DRX is used

When the UE requires measurement gaps to identify and measure inter-RAT cells and an appropriate measurement gap pattern is scheduled, the UE shall be able to identify a new detectable TDD cell within $T_{\text{Identify_RedCap, E-UTRAN TDD}}$ according to the following expression:

- When configuration 0 or configuration 1 in table 9.4A.3.2-1 is applied,

$$T_{\text{Identify_RedCap,E-UTRAN TDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1_RedCap}}} \cdot \text{CSSF}_{\text{interRAT_RedCap}} \quad ms,$$

- When configuration 2 or configuration 3 in table 9.4A.3.2-1 is applied,

$$T_{\text{Identify_RedCap,E-UTRAN TDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1_RedCap}}} \cdot \text{CSSF}_{\text{interRAT_RedCap}} + 240 \cdot \text{CSSF}_{\text{interRAT_RedCap}} \quad ms,$$

where:

$T_{\text{BasicIdentify}}$ = 480 ms,

$T_{\text{Inter1_RedCap}}$ is defined in clause 9.4A.1,

$\text{CSSF}_{\text{interRAT_RedCap}} = \text{CSSF}_{\text{within_gap_RedCap,i}}$ is the scaling factor for the measured inter-RAT E-UTRA carrier *i* which is calculated as specified in clause 9.1A.5.2.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of $T_{\text{Measure_RedCap, E-UTRAN TDD}}$ defined in table 9.4A.3.2-1 and table 9.4A.3.2-2 for 2 Rx RedCap UE and 1 Rx RedCap UE, respectively.

Table 9.4A.3.2-1: $T_{\text{Measure_RedCap, E-UTRAN TDD}}$ for different configurations for 2Rx RedCap UE

Configuration	Measurement bandwidth (RB)	Number of UL/DL sub-frames per half frame (5 ms)		DwPTS		$T_{\text{Measure_RedCap, E-UTRAN TDD}}$ (ms)
		DL	UL	Normal CP	Extended CP	
0	6	2	2	$19760 \cdot T_s$	$20480 \cdot T_s$	480 x $\text{CSSF}_{\text{interRAT_RedCap}}$
1 (Note 1)	50	2	2	$19760 \cdot T_s$	$20480 \cdot T_s$	240 x $\text{CSSF}_{\text{interRAT_RedCap}}$
2	6	1	3	$19760 \cdot T_s$	$20480 \cdot T_s$	720 x $\text{CSSF}_{\text{interRAT_RedCap}}$
3 (Note 1)	50	1	3	$19760 \cdot T_s$	$20480 \cdot T_s$	480 x $\text{CSSF}_{\text{interRAT_RedCap}}$

NOTE 1: This configuration is optional.

Table 9.4A.3.2-2: $T_{Measure_RedCap,\ E\text{-}UTRAN\ TDD}$ for different configurations for 1Rx RedCap UE

Configuration	Measurement bandwidth (RB)	Number of UL/DL sub-frames per half frame (5 ms)		DwPTS		$T_{Measure_RedCap,\ E\text{-}UTRAN\ TDD}$ (ms)
		DL	UL	Normal CP	Extended CP	
0	6	2	2	$19760 \cdot T_s$	$20480 \cdot T_s$	960 x $CSSF_{interRAT_RedCap}$
1 (Note 1)	50	2	2	$19760 \cdot T_s$	$20480 \cdot T_s$	480 x $CSSF_{interRAT_RedCap}$
2	6	1	3	$19760 \cdot T_s$	$20480 \cdot T_s$	1440 x $CSSF_{interRAT_RedCap}$
3 (Note 1)	50	1	3	$19760 \cdot T_s$	$20480 \cdot T_s$	960 x $CSSF_{interRAT_RedCap}$
NOTE 1: This configuration is optional.						

The UE shall be capable of identifying and performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN TDD cells per E-UTRA TDD carrier frequency layer during each layer 1 measurement period, for up to 7 E-UTRA TDD carrier frequency layers.

If higher layer filtering is used, an additional cell identification delay can be expected.

For 2 Rx RedCap UE:

- The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

For 1 Rx RedCap UE:

- The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2A.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2A.3.

9.4A.3.3 Requirements when DRX is used

When DRX is in use and measurement gaps are configured, the UE shall be able to identify a new detectable E-UTRAN TDD cell within $T_{Identify_RedCap,\ E\text{-}UTRAN\ TDD}$ specified in table 9.4A.3.3-1.

Table 9.4A.3.3-1: Requirement to identify a newly detectable E-UTRAN TDD cell

DRX cycle length (s)	$T_{Identify_RedCap,\ E\text{-}UTRAN\ TDD}$ (s) (DRX cycles)	
	Gap period = 40 ms, 20 ms	Gap period = 80 ms
≤ 0.16	Non-DRX requirements in clause 9.4A.3.2 apply	Non-DRX requirements in clause 9.4A.3.2 apply
0.256	5.12* $CSSF_{interRAT_RedCap}$ (20*$CSSF_{interRAT_RedCap}$)	7.68* $CSSF_{interRAT_RedCap}$ (30*$CSSF_{interRAT_RedCap}$)
0.32	6.4* $CSSF_{interRAT_RedCap}$ (20*$CSSF_{interRAT_RedCap}$)	7.68* $CSSF_{interRAT_RedCap}$ (24*$CSSF_{interRAT_RedCap}$)
0.32 < DRX-cycle ≤ 10.24	Note1 (20*$CSSF_{interRAT_RedCap}$)	Note1 (20*$CSSF_{interRAT_RedCap}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT_RedCap}$ is as defined in clause 9.4A.3.2.		

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN TDD cells per E-UTRA TDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA TDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period $T_{measure_RedCap,\ E\text{-}UTRAN\ TDD}$ specified in table 9.4A.3.3-2 and table 9.4A.3.3-3 for 2 Rx RedCap UE and 1 Rx RedCap UE, respectively.

Table 9.4A.3.3-2: Requirement to measure E-UTRAN TDD cells for 2Rx RedCap UE

DRX cycle length (s)	$T_{measure_RedCap,\ E\text{-}UTRAN\ TDD}$ (s) (DRX cycles)
≤ 0.08	Non-DRX Requirements in clause 9.4A.3.2 apply
0.128	For configuration 2 Note3, non-DRX requirements in clause 9.4A.3.2 apply, Otherwise: Note1 ($5*CSSF_{interRAT_RedCap}$)
0.128 < DRX-cycle ≤ 10.24	Note1 ($5*CSSF_{interRAT_RedCap}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT_RedCap}$ is as defined in clause 9.4A.3.2. NOTE 3: See Table 9.4A.3.2-1.	

Table 9.4A.3.3-3: Requirement to measure E-UTRAN TDD cells for 1Rx RedCap UE

DRX cycle length (s)	$T_{measure_RedCap,\ E\text{-}UTRAN\ TDD}$ (s) (DRX cycles)
≤ 0.08	Non-DRX Requirements in clause [9.4A.3.2] apply
0.128	For configuration 2 Note3, non-DRX requirements in clause [9.4A.3.2] apply, Otherwise: Note1 ($5*CSSF_{interRAT_RedCap}$)
0.128 < DRX-cycle ≤ 10.24	Note1 ($10*CSSF_{interRAT_RedCap}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT_RedCap}$ is as defined in clause 9.4A.3.2. NOTE 3: See Table 9.4A.3.2-2.	

If higher layer filtering is used, an additional cell identification delay can be expected.

For 2 Rx RedCap UE:

- The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

For 1 Rx RedCap UE:

- The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2A.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2A.3.

9.4A.3.4 Measurement reporting requirements

9.4A.3.4.1 Periodic Reporting

For 2 Rx RedCap UE: The requirements in clause 9.4.3.4.1 shall apply.

For 1 Rx RedCap UE: The reported NR – E-UTRAN TDD RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2A.2 and 10.2A.3, respectively.

9.4A.3.4.2 Event-Triggered Periodic Reporting

For 2 Rx RedCap UE: The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

For 1 Rx RedCap UE: The reported NR – E-UTRAN TDD RSRP and RSRQ measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2A.2 and 10.2A.3, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4A.3.4.3.

9.4A.3.4.3 Event-Triggered Reporting

For 2 Rx RedCap UE: The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

For 1 Rx RedCap UE: The reported NR – E-UTRAN TDD RSRP and RSRQ measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2A.2 and 10.2A.3, respectively.

The UE shall not send any event-triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{Identify_RedCap,\ E\text{-}UTRAN\ TDD}$ defined in clauses 9.4A.3.2 and 9.4A.3.3 without DRX and with DRX, respectively. When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{Identify_RedCap,\ E\text{-}UTRAN\ TDD}$ becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{Measure_RedCap,\ E\text{-}UTRAN\ TDD}$ provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used.

9.4A.4 NR – E-UTRAN measurements with autonomous gaps

9.4A.4.1 CGI identification of an E-UTRA cell with autonomous gaps

The requirements in this clause apply when the 1Rx RedCap UE or 2Rx RedCap UE is configured with standalone NR. The UE shall identify and report the CGI when requested by an NR PCell for the purpose '*reportCGI*'. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 in TS 38.331 [2].

For 2Rx RedCap UE: If autonomous gaps are used for measurement with the purpose of 'reportCGI', the UE shall be able to identify a new CGI of E-UTRA cell within $T_{identify_CGI_RedCap,\ E\text{-}UTRAN}$ = 150 ms.

For 1Rx RedCap UE: If autonomous gaps are used for measurement with the purpose of 'reportCGI', the UE shall be able to identify a new CGI of E-UTRA cell within $T_{identify_CGI_RedCap,\ E\text{-}UTRAN}$ = 190 ms.

This is the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 in [15] are fulfilled for a corresponding band,
- SCH_RP and SCH Ês/Iot according to Annex B.2.2 in [15] for a corresponding band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [25].

The requirement for identifying a new CGI of an E-UTRA cell within $T_{identify_CGI_RedCap,\ E\text{-}UTRAN}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.

9.4A.4.2 CGI reporting delay

The E-UTRA CGI reporting delay is defined as the time between a command that will trigger an E-UTRA CGI report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty of 2 x TTI_{DCCH} resulting when inserting the measurement report to the TTI of the uplink DCCH. This measurement reporting delay excludes any delay caused by lack of UL resources for UE to send the measurement report.

The CGI reporting delay shall be less than $T_{identify_CGI_RedCap,\ E\text{-}UTRAN}$ plus RRC procedure delay defined in clause 12 in TS 38.331 [2], and an additional 30 ms margin.

9.4A.4.3 CGI reporting scheduling restriction

When a UE is identifying CGI of an E-UTRA FDD cell or E-UTRA TDD cell with autonomous gaps, within time period $T_{identify_CGI_RedCap,\ E\text{-}UTRA}$ specified in clause 9.4A.4.1, the UE shall be able to transmit at least the number of ACK/NACKs specified in table 9.4A.4.3-1 on PCell in the frequency range where autonomous gaps are used, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- 2 slot ACK/NACK feedback is configured,
- 20 ms SMTC period is configured.

Table 9.4A.4.3-1: Minimum number of ACK/NACKs transmitted by the UE during $T_{identify_CGI_RedCap,\ E\text{-}UTRAN}$

Minimum number of transmitted ACK/NACKs	SCS	
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

9.5 L1-RSRP measurements for Reporting

9.5.1 Introduction

When configured by the network, the UE shall be able to perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP. The measurements shall be performed for a serving cell, including PCell, PSCell, or SCell, on the resources configured for L1-RSRP measurements within the active BWP. For UE supporting *bwpOperationMeasWithoutInterrupt-r18*, the UE shall additionally be able to perform L1-RSRP measurements for a serving cell, including PCell, PSCell, or SCell, on the configured SSB resources for L1-RSRP outside the active BWP, provided that the SSB is within the configured UE-specific CBW.

For UE supporting *ncd-SSB-BWP-Wor-r18*, the SSB and SMTC in this clause applies for both CD-SSB and NCD-SSB if it is not explicitly specified otherwise. If SSB in the active DL BWP of serving cell *i* is NCD-SSB, for serving cell *i* the requirements in clause 9.5 apply provided that serving cell *i* is PCell or activated PSCell.

The UE shall be able to measure all CSI-RS resources and/or SSB resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet* within the *CSI-ResourceConfig* settings configured for L1-RSRP for the active BWP, provided that the number of resources, including the number of SSB resources of the cell with PCI different from serving cell configured for L1-RSRP measurements in clause 9.13, does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*. If the UE supports *bwpOperationMeasWithoutInterrupt-r18*, UE shall be able to measure the SSB reources of *csi-SSB-ResourceSet* within the *CSI-ResourceConfig* configured outside active BWP, provided that the SSB is within the configured UE-specific CBW.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

For UE supporting *On-demand SSB operation* and when OD-SSB transmission is indicated, the UE shall be able to perform L1-RSRP measurements of configured SSB resources, provided the following conditions are met:

- an OD-SSB transmission in a configured DL BWP without first SSB transmission, or

- an OD-SSB transmission in a configured DL BWP with a first SSB transmission which cannot be used to obtain SIB1 have the following relations:

  - are with the same Cell ID, and

  - are in the same frequency location, and

  - are with same sub-carrier spacing, and

  - are with the same downlink transmit power, and

  - are quasi co-located with respect to Doppler shift, Doppler spread, average gain, average delay, delay spread and, when applicable, spatial RX parameters, when they have a same SSB index.

9.5.2 Requirements applicability

The requirements in clause 9.5 apply, provided:

- The CSI-RS or SSB or CSI-RS and SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP shall be considered measurable when for each relevant SSB the following conditions are met:

- L1-RSRP related side conditions given in clauses 10.1.19.1 and 10.1.20.1 for FR1 and FR2, respectively, for a corresponding band,

- SSB_RP and SSB Ês/Iot according to Annex B.2.4.1 for a corresponding band.

A CSI-RS resource configured for L1-RSRP shall be considered measurable when for each relevant CSI-RS the following conditions are met:

- L1-RSRP related side conditions given in clauses 10.1.19.2 and 10.1.20.2 for FR1 and FR2, respectively, for a corresponding band,

- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.4.2 for a corresponding band.

A CSI-RS and SSB resource configured for L1-RSRP shall be considered measurable when the measurable resource conditions are met for both CSI-RS resource and SSB resource.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

In case the SSB resources configured for L1-RSRP measurements outside SMTCs are overlapped with the PDSCH/PDCCH that is associated to a PCI different from serving cell, L1-RSRP measurement performance degradation is expected.

If *groupBasedBeamReporting-r17* is configured, the requirements in clause 9.5 apply when all SSB resources of *csi-SSB-ResourceSet* or CSI-RS resources of *NZP-CSI-RS-ResourceSet* within the CSI-Resource*Config* settings are configured for L1-RSRP for the active BWP are from a serving cell, including a single PCell, PSCell, or SCell configured for L1-RSRP measurements, when the UE is configured with a single serving cell (PCell, PSCell, or SCell) in FR2-1.

Unless otherwise stated in other sub-clauses of 9.5,

- For a UE that supports both *multiDCI-IntraCellMultiTRP-TwoTA-r18* or *multiDCI-InterCellMultiTRP-TwoTA-r18* and *rxTimingDiff-r18*, the requirements apply when Rx timing difference is up to MRTD as specified in clause 7.6.8.

- For a UE which do not support *rxTimingDiff-r18*, the requirements apply when Rx timing difference is less than CP.

9.5.3 Measurement Reporting Requirements

The UE shall send L1-RSRP reports only for report configurations configured for the active BWP, unless the UE supports *bwpOperationMeasWithoutInterrupt-r18*, provided that the SSB is within the configured UE-specific CBW.

The UE shall report the L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1 dB step size according to clause 10.1.19 for FR1 and 10.1.20 for FR2 if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, or if *groupBasedBeamReporting-r17* is configured, the UE shall use differential L1-RSRP based reporting as defined in clause 10.1.19 for FR1 and 10.1.20 for FR2. The differential L1-RSRP is quantized to a 4-bit value with 2 dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in clause 10.1.6.

In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or an additional delay can be expected in both FR1 and FR2 if the UE is not capable of per-FR gap.

9.5.3.1 Periodic Reporting

Reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively.

The UE shall only send periodic L1-RSRP measurement reports for an active BWP, unless the UE supports *bwpOperationMeasWithoutInterrupt-r18*, provided that the SSB is within the configured UE-specific CBW.

The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5.3.2 Semi-Persistent Reporting

Reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5.3.3 Aperiodic Reporting

Reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively.

The UE shall only send aperiodic L1-RSRP measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.5.3.4 Event Triggered Reporting for the UE initiated beam management

For a UE configured with a *CSI-ReportConfig* with *csi-ReportUE-IBR-r19* and with *dl-OrJointTCI-StateList*， with or without *eventCountWindow-r19* configuration, the reported L1-RSRP measurements contained in an event triggered L1-RSRP measurement report shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively.

The UE shall not send any event triggered measurement reports if no reporting criteria is fulfilled.

The event triggered L1-RSRP measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE transmits first PUCCH over the air interface.

When *eventCountWindow-r19* is not configured,

The event triggered measurement reporting delay shall be no larger than $T_{L1\text{-}meas_basic} + T_{first_UL_channel}$, where:

$T_{L1\text{-}meas_basic}$ is the maximum of L1-RSRP measurement periods of the reference signals of the beams corresponding to the event

For a UE configured with a CSI-ReportConfig with the higher layer parameter *eventTypeUE-IBR-r19* set to '*event2-r19*', UE shall perform L1-RSRP measurement based on the L1-RSRP measurement period of current beam and new beam(s), respectively.

For a UE configured with a CSI-ReportConfig with the higher layer parameter *eventTypeUE-IBR-r19* set to '*event1-r19*', UE shall perform L1-RSRP measurement based on current beam L1-RSRP measurement period.

As defined in clause 5.2.1.5.4 TS 38.214 [26], if *newBeamResourceSet* is a *CSI-SSB-ResourceSet*:

the L1-RSRP measurement period of the current beam refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ as specified in table 9.5.4.1-1 or 9.5.4.1-2 where T_{Report}. = 0, and T_{SSB} is the periodicity of the *SSB-Index* of the reference signal in the indicated TCI state or the SS/PBCH block which is QCLed with the reference signal in the indicated TCI state for the current beam.

the L1-RSRP measurement period of the new beam refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ as specified in table 9.5.4.1-1 or 9.5.4.1-2 where T_{Report}. = 0, and T_{SSB} is the periodicity of the *SSB-Index* of the reference signal configured by the *newBeamResourceSet-r19*.

As defined in clause 5.2.1.5.4 TS 38.214 [26], if *newBeamResourceSet* is a *NZP-CSI-RS-ResourceSet* configured with *repetition*:

the L1-RSRP measurement period of the current beam refers to $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ as specified in table 9.5.4.2-1 or 9.5.4.2-2 where T_{Report}. = 0, and $T_{CSI\text{-}RS}$ is the periodicity of the reference signal in the indicated TCI state for the current beam.

the L1-RSRP measurement period of the new beam refers to $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ as specified in table 9.5.4.2-1 or 9.5.4.2-2 where T_{Report}. = 0, and $T_{CSI\text{-}RS}$ is the periodicity of the the reference signal configured by the *newBeamResourceSet-r19* for new beams.

For a UE configured with a *CSI-ReportConfig* with the higher layer parameter *eventTypeUE-IBR-r19* set to '*event7-r19*', UE shall perform L1-RSRP measurement based on L1-RSRP measurement period of the beams in active TCI state list and new beams.

As defined in clause 5.2.1.5.4 TS 38.214 [26], if *newBeamResourceSet* is a *CSI-SSB-ResourceSet*:

the L1-RSRP measurement period of each beam of activated TCI states refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ as specified in table 9.5.4.1-1 or 9.5.4.1-2 where T_{Report}. = 0, and T_{SSB} is the periodicity of the *SSB-Index* of the reference signal in the activated TCI states or the SS/PBCH block which is QCLed with the reference signal in the activated TCI states.

the L1-RSRP measurement period of the new beam refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ as specified in table 9.5.4.1-1 or 9.5.4.1-2 where T_{Report}. = 0, and T_{SSB} is the periodicity of the *SSB-Index* of the reference signal configured by the *newBeamResourceSet-r19*.

As defined in clause 5.2.1.5.4 TS 38.214 [26], if *newBeamResourceSet* is a *NZP-CSI-RS-ResourceSet* configured with *repetition*:

the L1-RSRP measurement period of each beam of activated TCI states refers to $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ as specified in table 9.5.4.2-1 or 9.5.4.2-2 where T_{Report}. = 0, and $T_{CSI\text{-}RS}$ is the periodicity of the reference signal in the activated TCI states.

the L1-RSRP measurement period of the new beam refers to $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ as specified in table 9.5.4.2-1 or 9.5.4.2-2 where T_{Report}. = 0, and $T_{CSI\text{-}RS}$ is the periodicity of the the reference signal configured by the *newBeamResourceSet-r19* for new beams.

$T_{first\ UL\ channel}$ is from the time point at RS which triggered the L1 reporting to the time point at next PUCCH transmission occasion

Otherwise, if *eventCountWindow-r19* is provided, the event triggered measurement reporting delay shall be no larger than (*eventInstanceCount-r19* + L) * $T_{L1\text{-}meas_basic}$ + $T_{first\ UL\ channel,}$ where

- *eventInstanceCount-r19* is configured by the network

- $T_{L1\text{-}meas_basic}$ is the measurment period above based on the configuration,

- L is the number of measurement instances ($T_{L1\text{-}meas_basic}$) that do not satisfy the event condition, counted after the event counter is started for the window that will trigger the measurement report and before the required number of events (eventInstanceCount-r19) are detected within the specified time window (*eventDetectionTimeWindow-r19*).

- The above requriement is applicable when *eventDetectionTimeWindow-r19* is not less than (*eventInstanceCount-r19* + L-1) * $T_{L1\text{-}meas_basic}$. The requirement does not apply when *eventDetectionTimeWindow-r19* is less than (*eventInstanceCount-r19* + L-1) * $T_{L1\text{-}meas_basic}$.

9.5.4 L1-RSRP measurement requirements

9.5.4.1 SSB based L1-RSRP Reporting

When *groupBasedBeamReporting-r17* is not configured, the UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB}$.

When *groupBasedBeamReporting-r17* is configured, the UE shall be capable of performing L1-RSRP measurements based on the two configured SSB resource sets for L1-RSRP, and the UE physical layer shall be capable of reporting group-based L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB}$.

When there is no L1-RSRP measurement on LTM neighbor cell(s) to measure within active BWP, the value of $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ is defined in table 9.5.4.1-1 for FR1, the value of $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ is defined in table 9.5.4.1-2 for FR2 when *highSpeedMeasFlagFR2-r17* is not configured and if *groupBasedBeamReporting-r17* is not configured, and defined in table 9.5.4.1-2A for FR2-1 when *highSpeedMeasFlagFR2-r17* is not configured and if *groupBasedBeamReporting-r17* is configured, and defined in table 9.5.4.1-3 for FR2 power class 6 UE when *highSpeedMeasFlagFR2-r17* is configured, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

- The value of N in table 9.5.4.1-2A is 2, 4 or 6 in FR2-1 for UE supporting *fastBeamSweepingMultiRx-r18* according to the conditions described in clause 3.6.19.

- The value of N in table 9.5.4.1-2 is 8.

- The value of N in table 9.5.4.1-3 is 8.

For UE supporting *On-demand SSB operation* and when OD-SSB transmission is indicated, the EMP for L1-RSRP are

- the periodicity of OD-SSBs in the configured DL BWP if no first SSB transmission is configured or if UE supports *timec1nc2* and OD-SSB transmission is indicated with first SSB transmission and the union of the first SSB transmission and OD-SSB transmission has a non-periodic time domain pattern, or

- the periodicity of the union of OD-SSBs and first SSBs if first SSBs are transmitted and the OD-SSB activation is indicated and the union of OD-SSBs and first SSBs has a periodic time domain pattern.

For a UE supporting *LB CA via switching, or* for a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* or *musim-GapPreference-r17* or both concurrent GAP and *musim-GapPreference-r17* and when concurrent gaps or periodic MUSIM gaps or both concurrent gaps and periodic MUSIM gaps are configured,

- an SSB or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8 and 9.1.10,

- P value for SSB resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0
- For a window W of duration max($T_{L1,}$ xRP_max, switching pattern periodicity), where xRP_max is the maximum xRP across all configured per-UE GAPs , periodic MUSIM gap(s) and per-FR GAPs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any SSB resource occasion:

  N_{total} is the total number of SSB resource occasions within the window, including those overlapped with GAP occasions, MUSIM gap occasions or SMTC occasions within the window.

  For UEs supporting *LB CA via switching* and configured with low NR inter-band carrier aggregation:

  - for the PCell L1-RSRP measurement, N_{total} also includes SSB resource occasions that overlap with the SDL SCell ON duration within the window,

  - for the SCell L1-RSRP measurement, N_{total} also includes SSB resource occasions that overlap with the PCell ON duration within the window, as defined by the configured switching pattern, and

  - $N_{outside_MG}$ is the number of SSB resource occasions within the window W
    - that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion or
    - that are not overlapped with SDL SCell ON duration corresponding to the LB CA switching pattern, for the PCell L1-RSRP measurement for a UE supporting *LB CA via switching* with low NR inter-band carrier aggregation configured or
    - that are not overlapped with PCell ON duration corresponding to the LB CA switching pattern, for the SCell L1-RSRP measurement for a UE supporting *LB CA via switching* with low NR inter-band carrier aggregation configured, and
  - L1-RSRP requirement in this clause is not applied when $N_{outside_MG}$ = 0.
  - $N_{available}$ is the number of SSB resource occasions that are not overlapped with any non-dropped GAP occasion, non-dropped MUSIM gap occasion nor any SMTC occasion within the window W.
  - for UEs supporting *LB CA via switching*, switching pattern periodicity is the periodicity of the RRC configured semi-static switching pattern; otherwise, it is not applicable.
  - an SSB or an SMTC occasion is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion.

- T_{L1} is periodicity of the target SSB.
- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG(s) and UE does not support *musim-GapPreference-r17* or when no MUSIM gaps are configured,

For FR1,

- $P=\frac{1}{1-\frac{T_{SSB}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and
- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the SSB.

For FR2,

$P_1=\frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).

- P_1 is $P_{L1_sharing}*P_{sharing\ factor}$, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$).
- $P_1=\frac{1}{1-\frac{T_{SSB}}{xRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is partially overlapped with GAP and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and
  - $T_{SMTCperiod} \neq xRP$ or
  - $T_{SMTCperiod} = xRP$ and $T_{SSB} < 0.5*T_{SMTCperiod}$
- P is $\frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{xRP}}$, when SSB is partially overlapped with GAP and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod} = xRP$ and $T_{SSB} = 0.5*T_{SMTCperiod}$
- $P_1=\frac{1}{1-\frac{T_{SSB}}{min(T_{SMTCperiod},xRP)}}$, when SSB is partially overlapped with GAP ($T_{SSB} < xRP$) and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP.
- P is $P_{L1_sharing} * \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{xRP}}$, when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod} < xRP$)
- If SSB resource from the cell with different PCI is configured for L1-RSRP measurement, and P_2 is valid accoding to clause 9.13.4.1, and any symbol of the SSBs from serving cell and cell with different PCI are overlapping or adjacent (in time domain)
  - $P = \frac{P_1}{1-\frac{P_1*T_{SSB}}{P_2*T_{SSB_CDP}}}$, if $P_1*T_{SSB} < P_2*T_{SSB_CDP}$.
  - $P = P_1$, if $P_1*T_{SSB} > P_2*T_{SSB_CDP}$.
  - $P = 2*P_1$, if $P_1*T_{SSB} = P_2*T_{SSB_CDP}$.
- Otherwise, $P = P_1$

Where:

- T_{SSB} = *ssb-periodicityServingCell* of the serving cell

- $T_{SMTCperiod}$ = the configured SMTC period
- T_{SSB_CDP} = SSB periodicity of the cell with PCI different from serving cell
- $P_{sharing\ factor}$ = 1, if the SSB configured for L1-RSRP measurement outside gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
  - not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.
- $P_{sharing\ factor}$ = 3, otherwise.
- $P_{L1_sharing}$ = 2, if SSB resource from the cell with different PCI is configured for L1-RSRP measurement, and $P_{sharing_factor,CDP}$ is used in clause 9.13.4.1, and any symbol of the SSBs from serving cell and cell with different PCI are overlapping or adjacent (in time domain). $P_{L1_sharing}$ = 1, otherwise.
  - T_{SSB} = *ssb-periodicityServingCell*
  - $T_{SMTCperiod}$ = the configured SMTC period
- When a measurement gap is configured and the measurement gap is not NCSG,
  - an SSB or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and
  - xRP = MGRP
- If the UE is configured with Pre-MG, an SSB or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.
- Otherwise, when NCSG measurement gap only is configured,
  - an SSB or an SMTC occasion is considered to be overlapped with the GAP if
    - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,
- and
    - xRP = VIRP

The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ is defined in table 9.5.4.1-4 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* in FR1, table 9.5.4.1-5 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18* in FR1, table 9.5.4.1-6 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* in FR2 and table 9.5.4.1-7 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18* in FR2 when there is L1-RSRP measurement on LTM neighbor cell(s) to measure within active BWP, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise
- N= 8 in table 9.5.4.1-6 and table 9.5.4.1-7.
- P value for SSB resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0

- N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0

For a window W of duration max ($T_{L1,}$ MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any SSB resource occasion:

- N_{total} is the total number of SSB resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
- $N_{outside_MG}$ is the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W
- $N_{available}$ is the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
- T_{L1} is periodicity of the target SSB.

- $P_{sharing\ factor}$ = 1, if the SSB configured for L1-RSRP measurement outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,
- $P_{sharing\ factor}$ = 3, otherwise.
- $P_{L1_sharing}$ is defined as
  - When number of neighboring cells configured with SSB based L1-RSRP measurement is 1
    - $P_{L1_sharing}$ = 2, if any symbol of the SSBs from serving cell and neighbor cell are overlapping or adjacent (in time domain)
    - $P_{L1_sharing}$ = 1, otherwise
  - When number of neighboring cells configured with SSB based L1-RSRP measurement is more than 1
    - $P_{L1_sharing}$ = 3.

Note: RRM requirements are not applicable when L1 measurement on the cells with different PCI and LTM L1 measurement on neighbour cells are both configured.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

For UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, the UE is not required to perform SSB measurements during the cancelled gap occasions.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and GAP configurations does not meet previous conditions.

When UE is configured with aperiodic MUSIM gap and the aperiodic MUSIM gap is overlapping with SSB resource occasion for L1-RSRP, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and SSB resource occasions for L1-RSRP are fully overlapped with MUSIM gap(s) or fully overlapped with the union of MUSIM gap(s) and GAPs, no requirement applies for the SSB based L1-RSRP measurement.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer L1 RSRP measurement period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 9.5.4.1-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ for FR1

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(K*M*P)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$
Note 1: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement if UE not supporting *On-demand SSB operation* or when OD-SSB transmission is not indicated, otherwise, T_{SSB} = EMP of the SSB index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. Note 2: K = 1 when T_{SSB} ≤ 40 ms and *highSpeedMeasFlag-r16 or highSpeedMeasCA-Scell-r17* are configured; otherwise, K = 1.5. Note 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16. or measurementEnhancementCA-r17*	

Table 9.5.4.1-2: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ for FR2

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P*N)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P*N)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*M*P*N)*T_{DRX}$
Note: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement if UE not supporting *On-demand SSB operation* or when OD-SSB transmission is not indicated, otherwise, T_{SSB} = EMP of the SSB index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

Table 9.5.4.1-2A: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ configured with *groupBasedBeamReporting-r17* for FR2-1

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P*N)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P*N)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*M*P*N)*T_{DRX}$
Note1: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement if UE not supporting *On-demand SSB operation* or when OD-SSB transmission is not indicated, otherwise, T_{SSB} = EMP of the SSB index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

Table 9.5.4.1-3: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ configured with *highSpeedMeasFlagFR2-r17* for FR2-1

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P*N1^{Note2})*T_{SSB})$
DRX cycle ≤ 80 ms	$\max(T_{Report}, \text{ceil}(M*P*N1^{Note2}*M2)*\max(T_{DRX},T_{SSB}))$
80 ms< DRX ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P*N)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*M*P*N)*T_{DRX}$
Note1: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

Note 2: Scaling factor N1 = 2 when *highSpeedMeasFlagFR2-r17* = set1 or scaling factor N1 = 6 when *highSpeedMeasFlagFR2-r17* = set2, if UE does not support *simultaneousReceptionTwoQCL-r18* or when *highSpeedDeploymentTypeFR2-r17* is not configured as bidirectional. Scaling factor N1 = 1.5 when *highSpeedMeasFlagFR2-r17* is configured to set1 or scaling factor N1 = 4 when *highSpeedMeasFlagFR2-r17* is configured to set2, if UE supports *simultaneousReceptionTwoQCL-r18* and when *highSpeedDeploymentTypeFR2-r17* is configured as bidirectional.
Note 3: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1

Table 9.5.4.1-4: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ in FR1 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(K*M*P)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$
Note 1: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
Note 2: K = 1.5.	
Note 3: The requirements apply if the actual RTD between serving cell and neighbor cell is not larger than CP.	

Table 9.5.4.1-5: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ in FR1 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(K*M*P)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$
Note 1: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
Note 2: K = 1.5.	

Table 9.5.4.1-6: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ in FR2 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P*P_{L1_sharing}*N)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P*P_{L1_sharing}*N)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*M*P*P_{L1_sharing}*N)*T_{DRX}$
Note 1: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
Note 2: The requirements apply if the actual RTD between serving cell and neighbor cell is not larger than CP.	

Table 9.5.4.1-7: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ in FR2 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P*P_{L1_sharing}*N)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P*P_{L1_sharing}*N)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*M*P*P_{L1_sharing}*N)*T_{DRX}$
NOTE 1: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

9.5.4.2 CSI-RS based L1-RSRP Reporting

When *groupBasedBeamReporting-r17* is not configured, the UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$.

When *groupBasedBeamReporting-r17* is configured, the UE shall be capable of performing L1-RSRP measurements based on the two configured CSI-RS resource sets for L1-RSRP, and the UE physical layer shall be capable of reporting group-based L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$.

The value of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ is defined in table 9.5.4.2-1 for FR1 and in table 9.5.4.2-2 for FR2, where

- For periodic and semi-persistent CSI-RS resources, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise
- For aperiodic CSI-RS resources M=1
- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with
  - SSB for L1-RSRP measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res_per_set}$) for table 9.5.4.2-2, where $N_{res_per_set}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured with QCL-TypeD for all resources in the resource set.
- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource one RS has QCL-TypeD with
  - SSB for L1-RSRP measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res_per_set}$), where $N_{res_per_set}$ is number of resources in the resource set. The requirements apply provided TCI state is provided with QCL-TypeD for all resources in the resource set in the MAC CE activating the resource set.
- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource one RS has QCL-TypeD with
  - SSB for L1-RSRP measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- - For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clauses 10.1.19.2 and 10.1.20.2 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured with QCL-TypeD for all resources in the resource set.

For the value of L1,

1> If UE does not support *supportSBFD* or SBFD is not configured by the network

2> L1 is not applicable

1> else (if UE supports *supportSBFD* and SBFD is configured by the network)

2> if UE is configured to report L1-RSRP for SBFD symbols

3> When DRX is not configured, L1 is the number of occasions of the CSI-RS resource that are overlapping with dynamic UL transmission or with non-SBFD symbols during $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$

3> When DRX is configured, L1 is the number of DRX cycles in which at least one occasion of the CSI-RS resource is overlapping with dynamic UL transmission or in which all occasions of the CSI-RS resource are overalapping with non-SBFD symbols during $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$

2> if UE is configured to report L1-RSRP for non-SBFD symbols

3> When DRX is not configured, L1 is the number of occasions of the CSI-RS resource that are overlapping with SBFD symbols during $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$, when DRX is not configured

3> When DRX is configured, L1 is the number of DRX cycles in which all occasions of the CSI-RS resource are overlapping with SBFD symbols during $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$

For a UE supporting *LB CA via switching*, or for a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* or *musim-GapPreference-r17* or both concurrent measurement gap and *musim-GapPreference-r17* and when concurrent gaps or periodic MUSIM gaps or both concurrent gaps and periodic MUSIM gaps are configured,

- a CSI-RS or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clauses 9.1.8 and 9.1.10,
- P value for a CSI-RS resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0
- For a window W of duration max($T_{L1,}$ xRP_max, switching pattern periodicity), where xRP_max is the maximum xRP across all configured per-UE measurement gaps or NCSGs, MUSIM gap(s)and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any CSI-RS resource occasion:
  - N_{total} is the total number of CSI-RS resource occasions within the window W, including those overlapped with measurement gap occasions, MUSIM gap occasions or SMTC occasions within the window W.

    For UEs supporting *LB CA via switching* and configured with low NR inter-band carrier aggregation:

    - for the PCell L1-RSRP measurement, N_{total} also includes CSI-RS resource occasions that overlap with the SDL SCell ON duration within the window,

    - for the SCell L1-RSRP measurement, N_{total} also includes CSI-RS resource occasions that overlap with the PCell ON duration within the window, as defined by the configured switching pattern, and
  - $N_{outside_MG}$ is the number of CSI-RS resource occasions within the window W
    - that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion or
    - that are not overlapped with SDL SCell ON duration corresponding to the LB CA switching pattern, for the PCell L1-RSRP measurement for a UE supporting *LB CA via switching* with low NR inter-band carrier aggregation configured or
    - that are not overlapped with PCell ON duration corresponding to the LB CA switching pattern, for the SCell L1-RSRP measurement for a UE supporting *LB CA via switching* with low NR inter-band carrier aggregation configured, and
  - L1-RSRP requirement in this clause is not applied when $N_{outside_MG}$ = 0.
  - $N_{available}$ is the number of CSI-RS resource occasions that are not overlapped with any non-dropped GAP occasions, non-dropped MUSIM gap occasion nor any SMTC occasion within the window W.- for UEs supporting *LB CA via switching*, switching pattern periodicity is the periodicity of the RRC configured semi-static switching pattern; otherwise, it is not applicable.
  - a CSI-RS or an SMTC occasion is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

- T_{L1} is periodicity of the target CSI-RS.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s), and UE does not support *musim-GapPreference-r17* or when no MUSIM gaps are configured.

For FR1,

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when CSI-RS is not overlapped with a GAP and also not overlapped with SMTC occasion.

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$, when CSI-RS is partially overlapped with GAP and CSI-RS is not overlapped with SMTC occasion ($T_{CSI-RS} < xRP$)

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is not overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).

- $P=P_{sharing\ factor}$, when CSI-RS is not overlapped with GAP and CSI-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- P=1, when aperiodic CSI-RS resource is not overlapped with GAP

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{xRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is partially overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and

  - $T_{SMTCperiod} \neq xRP$ or

  - $T_{SMTCperiod} = xRP$ and $T_{CSI-RS} < 0.5*T_{SMTCperiod}$

- $P=\frac{3}{1-\frac{T_{CSI-RS}}{xRP}}$, when CSI-RS is partially overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod} = xRP$ and $T_{CSI-RS} = 0.5*T_{SMTCperiod}$

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{\min(T_{SMTCperiod},xRP)}}$, when CSI-RS is partially overlapped with GAP ($T_{CSI-RS} < xRP$) and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP.

- $P=\frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{xRP}}$, when CSI-RS is partially overlapped with GAP and CSI-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod} < xRP$)

Where:

- $P_{sharing\ factor}$ = 1, if the CSI-RS configured for L1-RSRP measurement outside gap is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{sharing\ factor}$ = 3, otherwise.

$T_{SMTCperiod}$ = the configured SMTC period.

$T_{CSI\text{-}RS}$ = the periodicity of CSI-RS configured for L1-RSRP measurement

- When a measurement gap is configured and the measurement gap is not NCSG,
  - a CSI-RS or an SMTC occasion is considered to be as overlapped with the GAP if it overlapps a measurement gap occasion, and
  - xRP = MGRP
- If the UE is configured with Pre-MG, a CSI-RS or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.
- Otherwise, when NCSG measurement gap only is configured,
  - a CSI-RS or an SMTC occasion is considered to be as overlapped with the GAP if
    - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,
  - and
    - xRP = VIRP

For UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, the UE is not required to perform CSI-RS measurements during the cancelled gap occasions.

When UE is configured with aperiodic MUSIM gap and the aperiodic MUSIM gap is overlapping with CSI-RS resource occasion for L1-RSRP, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and CSI-RS resource occasions for L1-RSRP are fully overlapped with MUSIM gap(s) or fully overlapped with the union of MUSIM gap(s) and GAPs, no requirement applies for the CSI-RS based L1-RSRP measurement.

Table 9.5.4.2-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ for FR1

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}((M+L1)*P)* \max(T_{CSI\text{-}RS}, T_{proc}))$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(K*(M+L1)*P)*\max(T_{DRX}, T_{CSI\text{-}RS}, T_{proc}))$
DRX cycle > 320 ms	$\text{ceil}((M+L1)*P)*T_{DRX}$
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.	
NOTE 3: K = 1 when $T_{CSI\text{-}RS}$ ≤ 40 ms and *highSpeedMeasFlag-r16 or highSpeedMeasCA-Scell-r17* are configured; otherwise K = 1.5.	
NOTE 4: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16 or measurementEnhancementCA-r17.*	
NOTE 5: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for CMR is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

Table 9.5.4.2-2: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ for FR2

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ (ms)

non-DRX	max(T_{Report}, ceil((M+L1)*P*N)* max(T_{CSI-RS}, T_{proc})
DRX cycle ≤ 320 ms	max(T_{Report}, ceil(1.5*(M+L1)*P*N)*max(T_{DRX},T_{CSI-RS}, T_{proc}))
DRX cycle > 320 ms	ceil((M+L1)*P*N)*T_{DRX}
NOTE 1: T_{CSI-RS} is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.	
NOTE 3: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for CMR is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

Table 9.5.4.2-2A: Void

9.5.4A Void

9.5.4A.1 Void

Table 9.5.4A.1-1: Void

9.5.5 Measurement restriction for CSI-RS and SSB for L1-RSRP measurement

The UE is required to be capable of measuring SSB and CSI-RS for L1-RSRP without measurement gaps. The UE is required to perform the SSB and CSI-RS measurements with measurement restrictions as described in the following clauses.

9.5.5.1 Measurement restriction for SSB based L1-RSRP

For FR1, if UE does not support *rxTimingDiff-r18*, when the SSB for L1-RSRP measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR1, if UE support *rxTimingDiff-r18*, when [the SSB for L1-RSRP measurement and CSI-RS for RLM, BFD, CBD or L1-RSRP measurement are overlapping or partially overlapping in OFDM symbols],

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, when the SSB for L1-RSRP measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, when the SSB for L1-RSRP measurement on one CC is in the same OFDM symbol as SSB from cell with additional PCI for BFD, CBD measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSBs. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, when the SSB for L1-RSRP measurement on one CC fully or partially overlaps with the OFDM symbol as CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement, UE is required to measure one of but not both SSB and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, if the network configures same or mixed numerology between SSB for L1-RSRP measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, UE shall be able to perform the related SSB based measurements in one band without any measurement restrictions in the other band, provided that UE is capable of independent beam management on this FR2 band pair.

For UE supporting *On-demand SSB operation*, when OD-SSB transmission is indicated without first SSB transmission, the measurement restriction is expected for OD-SSB occasions only.

For UE supporting *On-demand SSB operation*, when OD-SSB transmission is indicated with first SSB transmission, no measurement restriction is expected for first SSB occasions if UE supports *Time-C1nC2* and the union of the first SSB transmission and OD-SSB transmission has a non-periodic time domain pattern. Otherwise, the measurement restriction is expected for both first SSB and OD-SSB occasions.

9.5.5.2 Measurement restriction for CSI-RS based L1-RSRP

The SSB mentioned in this clause can be associated with either the serving cell PCI or a PCI different from serving cell PCI or intra-frequency neighbor cell(s) configured with L1-RSRP measurement or inter-frequency neighbor cell(s) configured with L1-RSRP measurement without gap.

For both FR1 and FR2, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement has same SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement has different SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

For FR2, when the CSI-RS for L1-RSRP measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD or L1-RSRP measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for L1-RSRP measurement on one CC fully or partially overlaps with the OFDM symbol as CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement, UE is required to measure one of but not both CSI-RS from serving cell and neighbor cell. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for L1-RSRP measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.
  - The CSI-RS for L1-RSRP measurement or the other CSI-RS in a resource set configured with repetition ON, or
  - The other CSI-RS is configured in q1 and beam failure is detected, or
  - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

For UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* and for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*,

- For both FR1 and FR2, when the CSI-RS for L1-RSRP measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.
- For FR1, when the CSI-RS for L1-RSRP measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, if CSI-RS and SSB have different SCS and UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP is expected, and no requirements are defined.
- For FR2, when the CSI-RS for L1-RSRP measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP is expected, and no requirements are defined.

For FR2-1, when the CSI-RS for L1-RSRP measurement on the one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD or L1-RSRP measurement on the same CC, UE supporting *schedulingMeasurementRelaxation-r18* according to the conditions described in clause 3.6.19 shall be able to measure the CSI-RS for L1-RSRP measurement without restriction when the following conditions are met:

- Both CSI-RSs are not in any CSI-RS resource set with repetition ON, and
- One CSI-RS has same QCL source as either
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to 38.214 clause 5.1.5, and
  - the other CSI-RS has same QCL source as either
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to 38.214 clause 5.1.5, and
- Resources of the active TCI states of the two PDSCHs, or QCL sources of the default QCL assumption, or the active TCI state of PDSCH and QCL source of the default QCL assumption have been reported as a resource group in Rel-17 group-based RSRP report.

9.5.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions described in the following clauses apply when the UE is performing L1-RSRP measurement on serving cell, and UE is receiving PDCCH/PDSCH from serving cell and/or cell(s) with different PCI.

For UE supporting *On-demand SSB operation*, when OD-SSB transmission is indicated without first SSB transmission, the scheduling restriction is expected for OD-SSB occasions only.

For UE supporting *On-demand SSB operation*, when OD-SSB transmission is indicated with first SSB transmission, no scheduling restriction is expected for first SSB occasions if UE supports *Time-C1nC2* and the union of the first SSB transmission and OD-SSB transmission has a non-periodic time domain pattern. Otherwise, the scheduling restriction is expected for both first SSB and OD-SSB occasions.

9.5.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

9.5.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] and do not support *rxTimingDiff-r18*, the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] but support *rxTimingDiff-r18*, the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI [on symbols that are overlapping or partially overlapping with the symbols corresponding to] the SSB indexes configured for L1-RSRP measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on serving cell where L1-RSRP measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions on serving cell where L1-RSRP measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

For UE indicating *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 4"*

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 1"*

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2>else

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-RSRP measurement is performed is configured.

When inter-band FR1+FR1 NR-DC is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-RSRP measurement is performed is configured.

9.5.6.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to L1-RSRP measurement.

- For the case where RS for L1-RSRP measurement is CSI-RS which is QCLed with active TCI state for PDCCH/PDSCH and not in a CSI-RS resource set with repetition ON, and N=1 applies as specified in clause 9.5.4.2
  - There are no scheduling restrictions due to L1-RSRP measurement performed based on the CSI-RS.
- For FR2-1 and the case where UE supporting *schedulingMeasurementRelaxation-r1*8 according to the conditions described in clause 3.6.19 is configured to receive two PDSCH transmission occasions from two different QCL sources, there are no scheduling restrictions for the PDSCHs due to L1-RSRP measurement performed based on the CSI-RS, when following conditions are met:
  - The CSI-RS configured for L1-RSRP is not in a CSI-RS resource set with repetition ON, and
  - The CSI-RS configured for L1-RSRP has same QCL source as the active TCI state of one of PDSCHs and has different QCL-TypeD from the other PDSCH, and
  - The CSI-RS configured for L1-RSRP and both PDSCHs are on the same OFDM symbol(s), or the CSI-RS and one of the PDSCHs with different QCL-typeD are on the same OFDM symbol(s) when partially overlapping PDSCHs are scheduled, and
  - Resources of the active TCI states for the two PDSCHs have been reported as a resource group in Rel-17 group-based RSRP report.
- Otherwise
  - For FR2 power class 6 UE which is not configured with *highSpeedMeasFlagFR2-r17*, and for the UE not supporting FR2 power class 6, for FR2-1 or the reference symbols to be measured for L1-RSRP is not using 480 kHz SCS or 960 kHz SCS on FR2-2, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on
    - symbols corresponding to the SSB indexes configured for L1-RSRP measurement, and/or
    - symbols corresponding to the periodic CSI-RS resource configured for L1-RSRP measurement, and/or
    - symbols corresponding to the semi-persistent CSI-RS resource configured for L1-RSRP measurement when the resource is activated, and/or
    - symbols corresponding to the aperiodic CSI-RS resource configured for L1-RSRP measurement when the reporting is triggered.
  - For FR2-2 and the reference symbols to be measured for L1-RSRP is using 480 kHz SCS or 960 kHz SCS, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on

- symbols corresponding to the SSB indexes configured for L1-RSRP measurement, and on one data symbol before and one data symbol after the symbols corresponding to the SSB indexes configured for L1-RSRP measurement, and/or

- symbols corresponding to the periodic CSI-RS resource configured for L1-RSRP measurement, and on one data symbol before and one data symbol after the symbols corresponding to the periodic CSI-RS resource configured for L1-RSRP measurement, and/or

- symbols corresponding to the semi-perssitent CSI-RS resource configured for L1-RSRP measurement when the resource is activated, and on one data symbol before and one data symbol after the symbols corresponding to the semi-perssitent CSI-RS resource configured for L1-RSRP measurement when the resource is activated, and/or

- symbols corresponding to the aperiodic CSI-RS resource configured for L1-RSRP measurement when the reporting is triggered, and on one data symbol before and one data symbol after the symbols corresponding to the aperiodic CSI-RS resource configured for L1-RSRP measurement when the reporting is triggered.

- For FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on

  - symbols corresponding to the SSB indexes configured for L1-RSRP measurement and 1 data symbol before each consecutive SSB symbols to be measured for L1-RSRP and 1 data symbol after each consecutive SSB symbols to be measured for L1-RSRP, and/or

  - symbols corresponding to the periodic CSI-RS resource configured for L1-RSRP measurement and 1 data symbol before each periodic CSI-RS resource to be measured for L1-RSRP and 1 data symbol after each periodic CSI-RS for L1-RSRP measurement symbols to be measured for L1-RSRP, and/or

  - symbols corresponding to the semi-persistent CSI-RS resource configured for L1-RSRP measurement and 1 data symbol before each semi-persistent CSI-RS resource to be measured for L1-RSRP and 1 data symbol after each semi-persistent CSI-RS resource to be measured for L1-RSRP when the resource is activated, and/or

  - symbols corresponding to the aperiodic CSI-RS resource configured for L1-RSRP measurement and 1 data symbol before each aperiodic CSI-RS resource to be measured for L1-RSRP measurement and 1 data symbol after each aperiodic CSI-RS resource to be measured for L1-RSRP measurement when the reporting is triggered.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions on serving cell where L1-RSRP measurement is performed apply to all serving cells in the band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to L1-RSRP measurement performed on FR2 serving cell(s) in different band(s), provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

If following conditions are met,

- UE has been notified about system information update through paging,

- The gap between UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for L1-RSRP measurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for L1-RSRP measurement.

9.5.6.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to L1-RSRP measurement performed on FR2 serving cell(s).

There are no scheduling restrictions on FR2 serving cell(s) due to L1-RSRP measurement performed on FR1 serving cell(s).

9.5.7 Minimum requirement at transitions

For UE supporting *ncd-SSB-BWP-Wor-r18*, when the L1-RSRP measurement transitions from measurements performed on CD-SSB to measurements performed on NCD-SSB or vice versa due to BWP switching during one measurement period, the UE shall use a L1-RSRP measurement period that is the maximum of the L1-RSRP measurement period corresponding to the first SSB type and the second SSB type after the BWP switching.

Subsequent to the above-mentioned measurement periods, the L1-RSRP measurement period requirements are based on the SSB type after the BWP switch.

For UE supporting *On-demand SSB operation*, when UE is indicated, by on-demand SSB Activation/Deactivation MAC CE, adaptation of periodicities for the activated transmission of OD-SSBs when the SCell is activated, the L1-RSRP measurement period requirements are based on the adapted OD-SSB burst periodicity which applies from the first OD-SSB burst after an additional processing time as 2ms or 5ms depending on *OD-SSB post processing time*.

For UE supporting *SSB adaptation*, when UE receives DCI format 2_9 that indicates a change in SSB burst periodicity of the SSB transmission during one mesauremnet period, the L1-RSRP measurement period requirements based on the indicated SSB burst periodicity applies from the first SSB burst after the time point as defined in TS 38.213 plus 2 ms and 3 ms for FR1 and FR2 respectively.

9.5A L1-RSRP measurements for Reporting under CCA

9.5A.1 Introduction

When configured by the network, the UE shall be able to perform L1-RSRP measurements of configured SSB resources for L1-RSRP. The measurements shall be performed for a serving cell under CCA operating mode, including PCell, PSCell, or SCell, on the resources configured for L1-RSRP measurements within the active BWP.

The UE shall be able to measure all SSB resources of the *csi-SSB-ResourceSet* within the *CSI-ResourceConfig* settings configured for L1-RSRP for the active BWP, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

During EN-DC operation in FR-1, when the UE is configured to perform E-UTRA SRS carrier-based switching, an additional delay can be expected.

The requirements in clause 9.5A apply for any *channelAccessMode* configuration [TS 38.331, 2].

In the requirements of clause 9.5A, the term SSB occasion not available at the UE refers to when the SSB is configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SS/PBCH block index within the set of configured SSB are not available at the UE due to DL CCA failures at gNB during the corresponding evaluation or measurement period; otherwise the SSB occasion is considered as available at the UE.

9.5A.2 Requirements applicability

The requirements in clause 9.5A apply, provided:

- The SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP shall be considered measurable when for each relevant SSB the following conditions are met:

- L1-RSRP related side conditions given in clause 10.1.19.1 for FR1 for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.4.1 for a corresponding band.

An SSB resource configured for L1-RSRP shall be considered measurable when the measurable resource conditions are met for SSB resource.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

9.5A.3 Measurement Reporting Requirements

The UE shall send L1-RSRP reports only for report configurations configured for the active BWP.

The UE shall report the L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1 dB step size according to clauses 10.1.19 for FR1 and 10.1.20 for FR2-2 if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-RSRP based reporting as defined in clause 10.1.19 for FR1 and 10.1.20 for FR2-2. The differential L1-RSRP is quantized to a 4-bit value with 2 dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in clause 10.1.6.

During EN-DC operation, for FR1, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected if the UE is capable of per-FR gap, or an additional delay can be expected.

9.5A.3.1 Periodic Reporting

Reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2-2, respectively.

The UE shall only send periodic L1-RSRP measurement reports for an active BWP.

The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5A.3.2 Semi-Persistent Reporting

Reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2-2, respectively. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

When CCA is used on target frequency, if UE cannot transmit HARQ-ACK for the MAC CE activation command due to UL CCA failure, the UE shall not perform MAC CE activation at the MAC action time based on the originally scheduled HARQ-ACK transmission time specified in clause 5.2.1.5.2 in TS 38.214 [26].

When CCA is used on target frequency, if UE cannot transmit HARQ-ACK for the MAC CE deactivation command due to UL CCA failure, the UE shall perform MAC CE deactivation at the MAC action time based on the originally scheduled HARQ-ACK transmission time specified in clause 5.2.1.5.2 in TS 38.214 [26].

9.5A.3.3 Aperiodic Reporting

Reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2-2, respectively.

The UE shall only send aperiodic L1-RSRP measurement reports if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.5A.4 L1-RSRP measurement requirements

9.5A.4.1 SSB based L1-RSRP Reporting

The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_CCA}$ is defined in table 9.5A.4.1-1 for FR1, and in table 9.5A.4.1-2 for FR2-2, where,

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise
- N = 8

For FR1, for a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for an SSB resource to be measured is defined as N_{total} / $N_{outside_MG}$
- For a window W of duration max(T_{L1}, xRP_max), where xRP_max is the maximum xRP across all configured per-UE measurement gaps or NCSGs and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any SSB resource occasion:
  - N_{total} is the total number of SSB resource occasions within the window W, including those overlapped with GAP occasions within the window W, and
  - $N_{outside_MG}$ is the number of SSB resource occasions that are not overlapped with any GAP occasion within the window W
  - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG(s),

For FR1,

- $P=\frac{1}{1-\frac{T_{SSB}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and
- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the SSB.

For FR2-2,

- $P=\frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$).
- $P=\frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and T_{SSB} < 0.5*$T_{SMTCperiod}$

- P is $\frac{P_{\text{sharing factor}}}{1-\frac{T_{SSB}}{MGRP}}$, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (T_{SSB} < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and T_{SSB} = 0.5*$T_{SMTCperiod}$

- P= $\frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when S SSB is partially overlapped with measurement gap (T_{SSB} <MGRP) and SSB is partially overlapped with SMTC occasion (T_{SSB} < $T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.

- P is $\frac{P_{\text{sharing factor}}}{1-\frac{T_{SSB}}{MRGP}}$, when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion (T_{SSB} = $T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

Where:

- $P_{sharing\ factor}$ = 1, if the SSB configured for L1-RSRP measurement outside measurement gap is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

- $P_{sharing\ factor}$ = 3, otherwise.

  T_{SSB} = *ssb-periodicityServingCell*

  $T_{SMTCperiod}$ = the configured SMTC1 period or SMTC2 period if configured

- When a measurement gap only is configured,

  - an SSB is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

  - xRP = MGRP

- If the UE is configured with Pre-MG, an SSB is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- When NCSG only is configured,

  - an SSB is considered to be overlapped with the GAP if it overlaps the VIL1 or VIL2 of NCSG, and

  - xRP = VIRP

- When concurrent gaps or concurrent measurement gap(s) with Pre-MG(s) or concurrent measurement gap(s) with NCSG(s) are configured, an SSB or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clause 9.1.8.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet previous conditions.

UE shall report RSRP_0 (Not valid) if L1>$L1_{max}$, where L1 and $L1_{max}$ are defined in table 9.5A.4.1-1.

Table 9.5A.4.1-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_CCA}$ for FR1

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_CCA}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}((M+L1)*P)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*(M+L1)*P)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}((M+L1)*P)*T_{DRX}$

Note 1: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement.
T_{DRX} is the DRX cycle length.
T_{Report} is configured periodicity for reporting.

Note 2: L1=0 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured. Otherwise, when DRX is not configured L1 is the number of SSBs not available at the UE during $T_{L1\text{-}RSRP_Measurement_Period_SSB_CCA}$, and when DRX is configured L1 is the number of DRX cycles in which at least one SSB is not available at the UE during $T_{L1\text{-}RSRP_Measurement_Period_SSB_CCA}$, where $L1 \le L1_{max}$. The UE is not required to determine the availability of SSB occasions more frequent than
Once per $\max(T_{Report}, P * T_{SSB})$ if no DRX is used,
Once per $\max(T_{Report}, \text{Ceil}(1.5 * P) * \max(T_{DRX}, T_{SSB}))$ if DRX cycle ≤ 320ms,
Once per $P * T_{DRX}$ if DRX cycle > 320ms.

Note 3: $L1_{max}$ =7 for $\max(T_{DRX},T_{SSB}) \le 40$ms assuming T_{DRX}=0 for non-DRX,
$L1_{max}$ =5 for 40ms < $\max(T_{DRX}, T_{SSB}) \le 320$ms,
$L1_{max}$ =3 for T_{DRX} > 320ms.

Table 9.5A.4.1-2: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_CCA}$ for FR2-2

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_CCA}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}((M+L1)*P*N)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*(M+L1)*P*N)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*(M+L1)*P*N)*T_{DRX}$

Note 1: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement.
T_{DRX} is the DRX cycle length.
T_{Report} is configured periodicity for reporting.

Note 2: L1=0 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured. Otherwise, when DRX is not configured L1 is the number of SSB occasion groups not available at the UE during $T_{L1\text{-}RSRP_Measurement_Period_SSB_CCA}$, where $L1 \le L1_{max}$. An SSB occasions group consists of N consecutive SSB occasions, and the SSB occasions group is not available at the UE when at least one SSB occasion in the group is not transmitted by the gNB. When DRX is configured, L1 is the number of DRX cycle groups in which at least one SSB occasion is not available at the UE during $T_{L1\text{-}RSRP_Measurement_Period_SSB_CCA}$, where $L1 \le L1_{max}$. A DRX group consists of N DRX cycles, and the DRX cycle group is not available when there is at least one DRX in which at least one SSB occasion is not available. The UE is not required to determine the availability of SSB occasions more frequent than once per DRX cycle length, when configured with DRX.

Note 3: $L1_{max}$ =7 for $\max(T_{DRX},T_{SSB}) \le 40$ms assuming T_{DRX}=0 for non-DRX,
$L1_{max}$ =5 for 40ms < $\max(T_{DRX}, T_{SSB}) \le 320$ms,
$L1_{max}$ =3 for T_{DRX} > 320ms.

9.5A.5 Measurement restriction for L1-RSRP measurement

The UE is required to be capable of measuring SSB for L1-RSRP without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following clauses.

9.5A.5.1 Measurement restriction for SSB based L1-RSRP

When the SSB for L1-RSRP measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure SSB for L1-RSRP measurement.

9.5A.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions when the UE is performing L1-RSRP measurement are described in the following clauses.

9.5A.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

9.5A.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on serving cell where L1-RSRP measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-RSRP measurement is performed is configured.

9.5A.6.3 Void

9.5A.6.3A Scheduling availability of UE performing L1-RSRP measurement in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR2 serving cell(s) due to L1-RSRP measurement performed on serving cell(s) under CCA.

9.5A.6.3B Scheduling availability of UE performing L1-RSRP measurement on FR2-2

The following scheduling restriction applies due to L1-RSRP measurement on an FR2-2 serving PCell and/or PSCell.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on
  - symbols corresponding to the SSB indexes configured for L1-RSRP measurement, and/or
  - symbols corresponding to the periodic CSI-RS resource configured for L1-RSRP measurement, and/or
  - symbols corresponding to the semi-persistent CSI-RS resource configured for L1-RSRP measurement when the resource is activated, and/or
  - symbols corresponding to the aperiodic CSI-RS resource configured for L1-RSRP measurement when the reporting is triggered.

When intra-band carrier aggregation in FR2-2 is performed, the scheduling restrictions on serving cell where L1-RSRP measurement is performed apply to all serving cells in the band on the symbols that fully or partially overlap with restricted symbols.

For FR2-2, if following conditions are met,

- UE has been notified about system information update through paging,

- The gap between UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for L1-RSRP measurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for L1-RSRP measurement.

9.5A.6.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to L1-RSRP measurement performed on FR2-2 serving cell(s) under CCA.

There are no scheduling restrictions on FR2 serving cell(s) due to L1-RSRP measurement performed on FR1 serving cell(s) under CCA.

9.5B L1-RSRP measurements for Reporting for RedCap

9.5B.1 Introduction

The applicability of the requirements for performing L1-RSRP measurements for reporting in subclause 9.5B is defined in clause 3.6. The SSB and SMTC in this clause applies for both CD-SSB and NCD-SSB if it is not additional specified.

When configured by the network, the UE shall be able to perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP. The measurements shall be performed for PCell, on the resources configured for L1-RSRP measurements within the active BWP.

The UE shall be able to measure all CSI-RS resources and/or SSB resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet* within the CSI-Resource*Config* settings configured for L1-RSRP for the active BWP, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

9.5B.2 Requirements applicability

The requirements in clause 9.5B apply, provided:

- The CSI-RS or SSB or CSI-RS and SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP shall be considered measurable when for each relevant SSB the following conditions are met:

For 1 Rx RedCap:

- L1-RSRP related side conditions given in clause 10.1A.14.1 for FR1, respectively, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.4.1 for a corresponding band.

For 2 Rx RedCap:

- L1-RSRP related side conditions given in clauses 10.1.19.1 and 10.1.20.1 for FR1 and FR2, respectively, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.4.1 for a corresponding band.

A CSI-RS resource configured for L1-RSRP shall be considered measurable when for each relevant CSI-RS the following conditions are met:

For 1 Rx RedCap:

- L1-RSRP related side conditions given in clause 10.1A.14.2 for FR1, respectively, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.4.2 for a corresponding band.

For 2 Rx RedCap:

- L1-RSRP related side conditions given in clauses 10.1.19.2 and 10.1.20.2 for FR1 and FR2, respectively, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.4.2 for a corresponding band.

A CSI-RS and SSB resource configured for L1-RSRP shall be considered measurable when the measurable resource conditions are met for both CSI-RS resource and SSB resource.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

9.5B.3 Measurement Reporting Requirements

The UE shall send L1-RSRP reports only for report configurations configured for the active BWP.

The UE shall report the L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1dB step size according to clause 10.1A.14 for FR1, for 1 Rx RedCap, and clause 10.1.19 for FR1 and clause 10.1.20 for FR2 for 2 Rx RedCap, if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-RSRP based reporting as defined in clause 10.1A.14 for FR1, for 1 Rx RedCap, and clause 10.1.19 for FR1 and clause10.1.20 for FR2 for 2 Rx RedCap. The differential L1-RSRP is quantized to a 4-bit value with 2dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in clause 10.1.6.

9.5B.3.1 Periodic Reporting

For 1 Rx RedCap, reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clause 10.1A.14 for FR1.

For 2 Rx RedCap, reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively.

The UE shall only send periodic L1-RSRP measurement reports for an active BWP.

The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5B.3.2 Semi-Persistent Reporting

For 1 Rx RedCap, reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clause 10.1A.14 for FR1. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

For 2 Rx RedCap, reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5B.3.3 Aperiodic Reporting

For 1 Rx RedCap, reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clause 10.1A.14.

For 2 Rx Redcap, reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively.

The UE shall only send aperiodic L1-RSRP measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.5B.4 L1-RSRP measurement requirements

9.5B.4.1 SSB based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_RedCap}$.

The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ is defined in table 9.5B.4.1-1 for FR1 and table 9.5B.4.1-2 for FR2, for 2 Rx RedCap, and table 9.5B.4.1-3 for FR1 for 1 Rx RedCap, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise.
- N= 8.

For FR1,

- $P=\frac{1}{1-\frac{T_{SSB}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P=\frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- $P=\frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$
- P is $\frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5*T_{SMTCperiod}$
- $P=\frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when S SSB is partially overlapped with measurement gap (T_{SSB} <MGRP) and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.

- P is $\frac{P_{\text{sharing factor}}}{1-\frac{T_{SSB}}{MRGP}}$, when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} < MGRP$)

- $P_{\text{sharing factor}} = 1$, if the SSB configured for L1-RSRP measurement outside measurement gap is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

- $P_{\text{sharing factor}} = 3$, otherwise.

Where:

- T_{SSB} = *ssb-periodicityServingCell*

- $T_{SMTCperiod}$ = the configured SMTC period

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer L1 RSRP measurement period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 9.5B.4.1-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_RedCap}$ (FR1) for 2 Rx RedCap

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_RedCap}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$
NOTE: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

Table 9.5B.4.1-2: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_RedCap}$ (FR2) for 2 Rx RedCap

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_RedCap}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P*N)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P*N)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*M*P*N)*T_{DRX}$
NOTE: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

Table 9.5B.4.1-3: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_RedCap}$ (FR1) for 1 Rx RedCap

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_RedCap}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$

NOTE: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.

9.5B.4.2 CSI-RS based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$.

The value of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$ is defined in table 9.5B.4.2-1 for FR1 and in table 9.5B.4.2-2 for FR2, for 2 Rx RedCap, and in table 9.5B.4.2-3 for 1 Rx RedCap, where

- For periodic and semi-persistent CSI-RS resources, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise
- For aperiodic CSI-RS resources M=1
- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with
  - SSB for L1-RSRP measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res_per_set}$), where $N_{res_per_set}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured with QCL-TypeD for all resources in the resource set.
- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource one RS has QCL-TypeD with
  - SSB for L1-RSRP measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res_per_set}$), where $N_{res_per_set}$ is number of resources in the resource set. The requirements apply provided TCI state is provided with QCL-TypeD for all resources in the resource set in the MAC CE activating the resource set.
- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource one RS has QCL-TypeD with
  - SSB for L1-RSRP measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clauses 10.1.19.2 and 10.1.20.2 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured with QCL-TypeD for all resources in the resource set.

For FR1,

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when CSI-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is not overlapped with SMTC occasion (T_{CSI-RS} < MGRP)
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is not overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion (T_{CSI-RS} < $T_{SMTCperiod}$).
- $P=P_{sharing\ factor}$, when CSI-RS is not overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion (T_{CSI-RS} = $T_{SMTCperiod}$).
- P=1, when aperiodic CSI-RS resource is not overlapped with measurement gap
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{MGRP}\cdot\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and T_{CSI-RS} < 0.5*$T_{SMTCperiod}$
- $P=\frac{3}{1-\frac{T_{CSI-RS}}{MGRP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion (T_{CSI-RS} < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and T_{CSI-RS} = 0.5*$T_{SMTCperiod}$
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is partially overlapped with measurement gap (T_{CSI-RS} < MGRP) and CSI-RS is partially overlapped with SMTC occasion (T_{CSI-RS} < $T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- $P=\frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion (T_{CSI-RS} = $T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing\ factor}$ = 1, if the CSI-RS configured for L1-RSRP measurement outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured
- $P_{sharing\ factor}$ = 3, otherwise.

Where:

$T_{SMTCperiod}$ = the configured SMTC period.

T_{CSI-RS} = the periodicity of CSI-RS configured for L1-RSRP measurement

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

NOTE: The overlap between CSI-RS for L1-RSRP measurement and SMTC means that CSI-RS for L1-RSRP measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer L1 RSRP measurement period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 9.5B.4.2-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$ (FR1) for 2 Rx RedCap

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*$T_{CSI\text{-}RS}$)
DRX cycle ≤ 320 ms	max(T_{Report}, ceil(1.5*M*P)*max(T_{DRX},$T_{CSI\text{-}RS}$))
DRX cycle > 320 ms	ceil(M*P)*T_{DRX}
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.	

Table 9.5B.4.2-2: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$ (FR2) for 2 Rx RedCap

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P*N)*$T_{CSI\text{-}RS}$)
DRX cycle ≤ 320 ms	max(T_{Report}, ceil(1.5*M*P*N)*max(T_{DRX},$T_{CSI\text{-}RS}$))
DRX cycle > 320 ms	ceil(M*P*N)*T_{DRX}
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.	

Table 9.5B.4.2-3: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$ (FR1) for 1 Rx RedCap

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*$T_{CSI\text{-}RS}$)
DRX cycle ≤ 320 ms	max(T_{Report}, ceil(1.5*M*P)*max(T_{DRX},$T_{CSI\text{-}RS}$))
DRX cycle > 320 ms	ceil(M*P)*T_{DRX}
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.	

9.5B.5 Measurement restriction for CSI-RS and SSB for L1-RSRP measurement

The UE is required to be capable of measuring SSB and CSI-RS for L1-RSRP without measurement gaps. The UE is required to perform the SSB and CSI-RS measurements with measurement restrictions as described in the following clauses.

9.5B.5.1 Measurement restriction for SSB based L1-RSRP

For FR1, when the SSB for L1-RSRP measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not *support simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, when the SSB for L1-RSRP measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

9.5B.5.2 Measurement restriction for CSI-RS based L1-RSRP

For both FR1 and FR2, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

9.5B.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions when the UE is performing L1-RSRP measurement are described in the following clauses.

9.5B.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

For FD-FDD and TDD RedCap UEs, there are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

For HD-FDD RedCap UE, scheduling restrictions apply for transmission on PUCCH/PUSCH/SRS during the CBD evaluation period, as CBD evaluation is prioritized over UL transmission. The CBD evaluation period equals the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_RedCap}$ in case L1-RSRP measurement is performed on SSB as defined in clause 9.5B.4.1, or $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$ in case L1-RSRP measurement is performed on CSI-RS and/or SSB as defined in clause 9.5B.4.1.

9.5B.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- For FD-FDD and TDD RedCap UEs, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

- For HD-FDD RedCap UE, scheduling restrictions apply for transmission on PUCCH/PUSCH/SRS during the CBD evaluation period, as CBD evaluation is prioritized over UL transmission. The CBD evaluation period equals the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_RedCap}$ in case L1-RSRP measurement is performed on SSB as defined in clause 9.5B.4.1, or $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_RedCap}$ in case L1-RSRP measurement is performed on CSI-RS and/or SSB as defined in clause 9.5B.4.1.

9.5B.6.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to L1-RSRP measurement.

- For the case where RS for L1-RSRP measurement is CSI-RS which is QCLed with active TCI state for PDCCH/PDSCH and not in a CSI-RS resource set with repetition ON, and N=1 applies as specified in clause 9.5B.4.2
  - There are no scheduling restrictions due to L1-RSRP measurement performed based on the CSI-RS.
- Otherwise
  - The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on
    - symbols corresponding to the SSB indexes configured for L1-RSRP measurement, and/or
    - symbols corresponding to the periodic CSI-RS resource configured for L1-RSRP measurement, and/or
    - symbols corresponding to the semi-persistent CSI-RS resource configured for L1-RSRP measurement when the resource is activated, and/or
    - symbols corresponding to the aperiodic CSI-RS resource configured for L1-RSRP measurement when the reporting is triggered.

If following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for L1-RSRP measurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for L1-RSRP measurement.

9.5C L1-RSRP measurements for Reporting for satellite access

9.5C.1 Introduction

When configured by the network, the UE shall be able to perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP. The measurements shall be performed for PCell on the resources configured for L1-RSRP measurements within the active BWP.

The UE shall be able to measure all CSI-RS resources and/or SSB resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet* within the *CSI-ResourceConfig* settings configured for L1-RSRP for the active BWP, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

9.5C.2 Requirements applicability

The requirements in clause 9.5C apply, provided:

- The CSI-RS or SSB or CSI-RS and SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP shall be considered measurable when for each relevant SSB the following conditions are met:

- L1-RSRP related side conditions given in clause 10.1.19C.1 for FR1-NTN, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.19.1 for a corresponding band.

A CSI-RS resource configured for L1-RSRP shall be considered measurable when for each relevant CSI-RS the following conditions are met:

- L1-RSRP related side conditions given in clauses 10.1.19C.2 for FR1-NTN, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.19.2 for a corresponding band.

A CSI-RS and SSB resource configured for L1-RSRP shall be considered measurable when the measurable resource conditions are met for both CSI-RS resource and SSB resource.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

9.5C.3 Measurement Reporting Requirements

The UE shall send L1-RSRP reports only for report configurations configured for the active BWP.

The UE shall report the L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1 dB step size according to clause 10.1.19C for FR1-NTN if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-RSRP based reporting as defined in clause 10.1.19C for FR1-NTN. The differential L1-RSRP is quantized to a 4-bit value with 2 dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in clause 10.1.6.

9.5C.3.1 Periodic Reporting

Reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clause 10.1.19C.

The UE shall only send periodic L1-RSRP measurement reports for an active BWP.

The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5C.3.2 Semi-Persistent Reporting

Reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clause 10.1.19C. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5C.3.3 Aperiodic Reporting

Reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clause 10.1.19C.

The UE shall only send aperiodic L1-RSRP measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.5C.4 L1-RSRP measurement requirements

9.5C.4.1 SSB based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_SAN}$.

The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_SAN}$ is defined in table 9.5C.4.1-1 for FR1-NTN, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise
- P value for SSB resource to be measured is defined as
  - $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
  - $N_{total} / N_{available}$ with $N_{available} > 0$
- For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any SSB resource occasion:
  - N_{total} is the total number of SSB resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
  - $N_{outside_MG}$ is the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W
  - $N_{available}$ is
    - the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W, if UE does not support *parallelMeasurementWithoutRestriction-r17* and LEO satellites are measured for intra-frequency measurement, and
    - same as $N_{outside_MG}$, otherwise
  - T_{L1} is periodicity of the target SSB.
  - $P_{sharing\ factor} = 3$.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet previous conditions.

Table 9.5C.4.1-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_SAN}$ for FR1-NTN

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_SAN}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*T_{SSB})
DRX cycle ≤ 320 ms	max(T_{Report}, ceil(1.5*M*P)*max(T_{DRX},T_{SSB}))
DRX cycle > 320 ms	ceil(M*P)*T_{DRX}
NOTE: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

9.5C.4.2 CSI-RS based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_SAN}$.

The value of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ is defined in table 9.5C.4.2-1 for FR1-NTN, where

- For periodic and semi-persistent CSI-RS resources, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise
- For aperiodic CSI-RS resources M=1
- P value for a CSI-RS resource to be measured is defined as
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ with $N_{available}$ = 0
  - N_{total} / $N_{available}$ with $N_{available}$ > 0
- For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CSI-RS resource occasion:
  - N_{total} is the total number of CSI-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
  - $N_{outside_MG}$ is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
  - $N_{available}$ is
    - the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W, if UE does not support *parallelMeasurementWithoutRestriction-r17* and LEO satellites are measured for intra-frequency measurement, and
    - same as $N_{outside_MG}$, otherwise
  - T_{L1} is periodicity of the target CSI-RS.
  - $P_{sharing\ factor}$ = 3.

NOTE: The overlap between CSI-RS for L1-RSRP measurement and SMTC means that CSI-RS for L1-RSRP measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet previous conditions.

Table 9.5C.4.2-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_SAN}$ for FR1-NTN

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_SAN}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*$T_{CSI\text{-}RS}$)
DRX cycle ≤ 320 ms	max(T_{Report}, ceil(1.5*M*P)*max(T_{DRX},$T_{CSI\text{-}RS}$))

DRX cycle > 320 ms	ceil(M*P)*T_{DRX}
NOTE 1: T_{CSI-RS} is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.	

9.5C.5 Measurement restriction for L1-RSRP measurement

The UE is required to be capable of measuring SSB and CSI-RS for L1-RSRP without measurement gaps. The UE is required to perform the SSB and CSI-RS measurements with measurement restrictions as described in the following clauses.

9.5C.5.1 Measurement restriction for SSB based L1-RSRP

For FR1-NTN, when the SSB for L1-RSRP measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

9.5C.5.2 Measurement restriction for CSI-RS based L1-RSRP

For FR1-NTN, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.

For FR1-NTN, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1-NTN, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR1-NTN, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

9.5C.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions when the UE is performing L1-RSRP measurement are described in the following clauses. For UL, the scheduling restriction applies to UL symbols that fully or partially overlap with the restricted symbols as defined below.

9.5C.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1-NTN

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1-NTN.

9.5C.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1-NTN

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

9.5C.7 L1-RSRP measurement requirements for NTN band above 10 GHz

9.5C.7.1 SSB based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_SAN}$.

The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_SAN}$ is defined in table 9.5C.7.1-1, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise
- P value for SSB resource to be measured is defined as
  - $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
  - $N_{total} / N_{available}$ with $N_{available} > 0$
- For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any SSB resource occasion:
  - N_{total} is the total number of SSB resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
  - $N_{outside_MG}$ is the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W
  - $N_{available}$ is same as $N_{outside_MG}$
  - T_{L1} is periodicity of the target SSB.
  - $P_{sharing\ factor} = 3$.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet previous conditions.

Table 9.5C.7.1-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_SAN}$

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_SAN}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*T_{SSB})
DRX cycle ≤ 320 ms	max(T_{Report}, ceil(1.5*M*P)*max(T_{DRX},T_{SSB}))
DRX cycle > 320 ms	ceil(M*P)*T_{DRX}
NOTE: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

9.5C.7.2 CSI-RS based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_SAN}$.

The value of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ is defined in table 9.5C.7.2-1, where

- For periodic and semi-persistent CSI-RS resources, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise
- For aperiodic CSI-RS resources M=1
- P value for a CSI-RS resource to be measured is defined as
  - $P_{sharing\ factor} * N_{total} / N_{outside_MG}$ with $N_{available} = 0$
  - $N_{total} / N_{available}$ with $N_{available} > 0$
- For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CSI-RS resource occasion:
  - N_{total} is the total number of CSI-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
  - $N_{outside_MG}$ is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
  - $N_{available}$ is
    - the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W, if UE does not support *parallelMeasurementWithoutRestriction-r17* and LEO satellites are measured for intra-frequency measurement, and
    - same as $N_{outside_MG}$, otherwise
  - T_{L1} is periodicity of the target CSI-RS.
  - $P_{sharing\ factor} = 3$.

NOTE: The overlap between CSI-RS for L1-RSRP measurement and SMTC means that CSI-RS for L1-RSRP measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet previous conditions.

Table 9.5C.7.2-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_SAN}$

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_SAN}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{CSI\text{-}RS})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P)*\max(T_{DRX}, T_{CSI\text{-}RS}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.	

9.5C.8 Measurement restriction for L1-RSRP measurement for NTN band above 10 GHz

The UE is required to be capable of measuring SSB and CSI-RS for L1-RSRP without measurement gaps. The UE is required to perform the SSB and CSI-RS measurements with measurement restrictions as described in the following clauses.

9.5C.8.1 Measurement restriction for SSB based L1-RSRP

L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

9.5C.8.2 Measurement restriction for CSI-RS based L1-RSRP

For NTN bands above 10 GHz, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.

For NTN bands above 10 GHz, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For NTN bands above 10 GHz, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For NTN bands above 10 GHz, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

9.5C.9 Scheduling availability of UE during L1-RSRP measurement for NTN band above 10 GHz

Scheduling availability restrictions when the UE is performing L1-RSRP measurement are described in the following clauses. For UL, the scheduling restriction applies to UL symbols that fully or partially overlap with the restricted symbols as defined below.

9.5C.9.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on NTN bands above 10 GHz

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH.

9.5C.9.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on NTN bands above 10 GHz

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

9.5D L1-RSRP measurements for Reporting for ATG

9.5D.1 Introduction

When configured by the network, the UE shall be able to perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP. The measurements shall be performed for a serving cell, including PCell or SCell, on the resources configured for L1-RSRP measurements within the active BWP.

The UE shall be able to measure all CSI-RS resources and/or SSB resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet* within the *CSI-ResourceConfig* settings configured for L1-RSRP for the active BWP, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

9.5D.2 Requirements applicability

The requirements in clause 9.5D apply, provided:

- The CSI-RS or SSB or CSI-RS and SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP shall be considered measurable when for each relevant SSB the following conditions are met:

- L1-RSRP related side conditions given in clause 10.1.19.1 for FR1, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.4.1 for a corresponding band.

A CSI-RS resource configured for L1-RSRP shall be considered measurable when for each relevant CSI-RS the following conditions are met:

- L1-RSRP related side conditions given in clause 10.1.19.2 for FR1, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.4.2 for a corresponding band.

A CSI-RS and SSB resource configured for L1-RSRP shall be considered measurable when the measurable resource conditions are met for both CSI-RS resource and SSB resource.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

9.5D.3 Measurement Reporting Requirements

The UE shall send L1-RSRP reports only for report configurations configured for the active BWP.

The UE shall report the L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1 dB step size according to clause 10.1.19 for FR1 if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-RSRP based reporting as defined in clause

10.1.19 for FR1. The differential L1-RSRP is quantized to a 4-bit value with 2 dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in clause 10.1.6.

9.5D.3.1 Periodic Reporting

Reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clause 10.1.19 for FR1.

The UE shall only send periodic L1-RSRP measurement reports for an active BWP.

The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5D.3.2 Semi-Persistent Reporting

Reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clause 10.1.19 for FR1. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5D.3.3 Aperiodic Reporting

Reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clause 10.1.19 for FR1.

The UE shall only send aperiodic L1-RSRP measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.5D.4 L1-RSRP measurement requirements

9.5D.4.1 SSB based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_ATG}$.

The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_ATG}$ is defined in table 9.5D.4.1-1 for FR1, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

For ATG UE with the capable of *antennaArrayType-r18* on the measured carrier,

P value for SSB resource to be measured is defined as

- N_{total} / $N_{available}$ with $N_{available} > 0$
- $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ with $N_{available} = 0$
- For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any SSB resource occasion:
  - N_{total} is the total number of SSB resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

- $N_{outside_MG}$ is the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W
- $N_{available}$ is
  - if the measured carrier is the SCC with *servingcellMO* configured, and the network indication *neighSCellMeasSkipping* is set to 'enable' to UE
    - if inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams
      - the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W
    - otherwise,
      - the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements of other serving cell within the window W
  - otherwise,
    - if inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams
      - the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements of same serving cell within the window W
    - otherwise,
      - the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements within the window W
- T_{L1} is periodicity of the target SSB
- $P_{sharing\ factor} = 3$.

Otherwise, for UE with one or multiple omni-directional antennas

For a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for SSB resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$
- For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any SSB resource occasion:
  - N_{total} is the total number of SSB resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
  - $N_{outside_MG}$ is the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W
  - T_{L1} is periodicity of the target SSB.

Otherwise, for a UE not supporting *concurrentMeasGap-r17* or when concurrent gaps are not configured,

- $P=\frac{1}{1-\frac{T_{SSB}}{xGP}}$, when in the monitored cell there are GAPs configured for intra-frequency or inter-frequency, which are overlapping with some but not all occasions of the SSB; and
- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the SSB.

Where:

- T_{SSB} = *ssb-periodicityServingCell* of the serving cell
- an SSB or an SMTC occasion is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and
  - xRP = MGRP

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and GAP configurations does not meet previous conditions.

Table 9.5D.4.1-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_ATG}$ for FR1

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_ATG}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$
NOTE: T_{SSB} = *ssb-periodicityServingCell* is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

9.5D.4.2 CSI-RS based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_ATG}$.

- For periodic and semi-persistent CSI-RS resources, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

- For aperiodic CSI-RS resources M=1

For ATG UE capable of *antennaArrayType-r18* on the measured carrier,

- P value for a CSI-RS resource to be measured is defined as
  - N_{total} / $N_{available}$ with $N_{available}$ > 0
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ with $N_{available}$ = 0
  - For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CSI-RS resource occasion:
    - N_{total} is the total number of CSI-RS resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
    - $N_{outside_MG}$ is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
    - $N_{available}$ is
      - if the measured carrier is the SCC with *servingcellMO* configured, and the network indication *neighSCellMeasSkipping* is set to 'enable' to UE,
        - if inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams

- the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

- otherwise,

- the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements of other serving cell within the window W

  - otherwise,

    - if inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams

- the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements of same serving cell within the window W

  - otherwise,

- the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements within the window W

  - T_{L1} is periodicity of the target CSI-RS

  - $P_{sharing\ factor} = 3$.

Otherwise, for UE with one or multiple omni-directional antenna(s)

For a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for a CSI-RS resource to be measured is defined as

  - N_{total} / $N_{outside_MG}$ in FR1

- For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CSI-RS resource occasion:

  - N_{total} is the total number of CSI-RS resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

  - $N_{outside_MG}$ is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

  T_{L1} is periodicity of the target CSI-RS.

Otherwise, for a UE not supporting *concurrentMeasGap-r17* or when concurrent gaps are not configured,

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the CSI-RS.

Where:

T_{CSI-RS} = the periodicity of CSI-RS configured for L1-RSRP measurement

- a CSI-RS or an SMTC occasion is considered to be as overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

Table 9.5D.4.2-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_ATG}$ for FR1

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_ATG}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*$T_{CSI\text{-}RS}$)
DRX cycle ≤ 320 ms	max(T_{Report}, ceil(1.5*M*P)*max(T_{DRX},$T_{CSI\text{-}RS}$))
DRX cycle > 320 ms	ceil(M*P)*T_{DRX}

NOTE 1:	T_{CSI-RS} is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.
NOTE 2:	the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.

9.5D.5 Measurement restriction for CSI-RS and SSB for L1-RSRP measurement

The UE is required to be capable of measuring SSB and CSI-RS for L1-RSRP without measurement gaps. The UE is required to perform the SSB and CSI-RS measurements with measurement restrictions as described in the following clauses.

9.5D.5.1 Measurement restriction for SSB based L1-RSRP

For FR1, when the SSB for L1-RSRP measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

9.5D.5.2 Measurement restriction for CSI-RS based L1-RSRP

The SSB mentioned in this clause can be associated with the serving cell PCI.

For FR1, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

9.5D.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions described in the following clauses apply when the UE is performing L1-RSRP measurement on serving cell, and UE is receiving PDCCH/PDSCH from serving cell and/or cell(s) with different PCI.

9.5D.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

9.5D.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on serving cell where L1-RSRP measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-RSRP measurement is performed is configured.

9.5E L1-RSRP measurements for Reporting for RedCap UEs with satellite access

9.5E.1 Introduction

The requirements in clause 9.5C.1 apply.

9.5E.2 Requirements applicability

The requirements in clause 9.5E apply, provided:

- The CSI-RS or SSB or CSI-RS and SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP shall be considered measurable when for each relevant SSB the following conditions are met:

For 1 Rx RedCap UE with NTN:

- L1-RSRP related side conditions given in clauses 10.1.19F.2 for FR1, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.19.2 for a corresponding band.

For 2 Rx RedCap UE with NTN:

- L1-RSRP related side conditions given in clauses 10.1.19F.2 for FR1, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.19.2 for a corresponding band.

A CSI-RS resource configured for L1-RSRP shall be considered measurable when for each relevant CSI-RS the following conditions are met:

For 1 Rx RedCap UE with NTN:

- L1-RSRP related side conditions given in clauses 10.1.19F.2 for FR1, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.19.2 for a corresponding band.

For 2 Rx RedCap UE with NTN:

- L1-RSRP related side conditions given in clauses 10.1.19F.2 for FR1, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.19.2 for a corresponding band.

A CSI-RS and SSB resource configured for L1-RSRP shall be considered measurable when the measurable resource conditions are met for both CSI-RS resource and SSB resource.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

9.5E.3 Measurement Reporting Requirements

The UE shall send L1-RSRP reports only for report configurations configured for the active BWP.

The UE shall report the L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1 dB step size according to clause 10.1.19F for FR1 for 2 Rx RedCap UE with NTN, and clause 10.1.19F for FR1 for 1 Rx RedCap UE with NTN, if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-RSRP based reporting as defined in clause 10.1.19F for FR1 for 2 Rx RedCap UE with NTN, and clause 10.1.19F for FR1 for 1 Rx RedCap UE with NTN. The differential L1-RSRP is quantized to a 4-bit value with 2 dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in clause 10.1.6.

9.5E.3.1 Periodic Reporting

For 1 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clause 10.1.19F for FR1.

For 2 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clause 10.1.19F.

The UE shall only send periodic L1-RSRP measurement reports for an active BWP.

The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5E.3.2 Semi-Persistent Reporting

For 1 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clause 10.1.19F. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

For 2 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clause 10.1.19F. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5E.3.3 Aperiodic Reporting

For 1 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clause 10.1.19F.

For 2 Rx RedCap UE with NTN, reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clause 10.1.19F.

The UE shall only send aperiodic L1-RSRP measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.5E.4 L1-RSRP measurement requirements

9.5E.4.1 SSB based L1-RSRP Reporting

The requirements in clause 9.5C.4.1 shall apply for both 1Rx and 2Rx RedCap UE.

9.5E.4.2 CSI-RS based L1-RSRP Reporting

For HD-FDD RedCap UE indicating *CollisionHandlingOfHDFDDOperation*, the requirements in clause 9.5C.4.2 shall apply, provided that the following conditions are met:

- there is no collision between the CSI-RS resources for L1-RSRP measurements and UL transmission when network indicates *ntn-PrioritizeUl-semiStatichalfDuplexRedCapcollision*, or
- in case of collision between the CSI-RS resources for L1-RSRP measurements and UL transmission except PRACH, and *ntn-PrioritizeUl-semiStatichalfDuplexRedCapcollision* is not indicated by network.
- there is no collision between the CSI-RS resources for L1-RSRP measurements and PRACH.

Otherwise, the requirements in clause 9.5C.4.2 shall apply.

9.5E.5 Measurement restriction for L1-RSRP measurement

The requirements in clause 9.5C.5 shall apply for both 1Rx and 2Rx RedCap UE, when the L1-RSRP measurement requirements in 9.5E.4 are applicable.

9.5E.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions when the UE is performing L1-RSRP measurement are described in the following clauses. For UL, the scheduling restriction applies to UL symbols that fully or partially overlap with the restricted symbols as defined below.

9.5E.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

For FD-FDD and TDD RedCap UEs, there are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

For HD-FDD RedCap UE, scheduling restrictions apply for transmission on PUCCH/PUSCH/SRS during L1-RSRP measurement period, except when UE indicates *CollisionHandlingOfHDFDDOperation* and is indicated that UL transmission is prioritized over L1-RSRP measurement via *ntn-PrioritizeUl-semiStatichalfDuplexRedCapcollision* in case of collision between CSI-RS resources to be measured and UL transmission. .

9.5E.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14], the requirements in clause 9.5E.6.1 shall apply.

For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement. The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

9.5F L1-RSRP measurements Reporting for Beam Prediction

9.5F.1 Introduction

For UE supporting *UE-sided RS- prediction for reportQuantity-r19 and nroftimeinstance-r19* is not configured, when configured by the network, the UE shall be able to perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP for determine the reported P-CRI. For UE supporting UE-sided RS prediction with p-cri-RSRP-r19 for *reportQuantity-r19* and *nroftimeinstance-r19* is not configured, when configured by the network, the UE shall be able to perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP for determine the reported P-CRI, and P-L1-RSRP.

For UE supporting *UE-sided RS- prediction for reportQuantity-r19 with 'p-cri-r19' or 'p-ssb-index-r19' and nroftimeinstance-r19* is configured, when configured by the network, the UE shall be able to perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP for determine the reported P-CRI, P-SSBRI. For UE supporting UE-sided RS prediction *for reportQuantity-r19* with '*p-cri-RSRP-r19*' or *'p-ssb-Index-RSRP-r19'* and *nroftimeinstance-r19* is configured, when configured by the network, the UE shall be able to perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP for determine the reported P-CRI, and P-L1-RSRP.

The measurements shall be performed for a serving cell, including PCell, on the resources configured for L1-RSRP measurements within the active BWP.

The UE shall be able to measure all CSI-RS resources and/or SSB resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet* within the CSI-Resource*Config* settings configured for L1-RSRP for the active BWP, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity-r19 set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19'*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

9.5F.2 Requirements applicability

The requirements in clause 9.5F apply, provided:

- The CSI-RS or SSB or CSI-RS and SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP shall be considered measurable when for each relevant SSB the following conditions are met:

- L1-RSRP related side conditions given in clauses 10.x for FR2 for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.4.1 for a corresponding band.

A CSI-RS resource configured for L1-RSRP shall be considered measurable when for each relevant CSI-RS the following conditions are met:

- L1-RSRP related side conditions given in clauses 10.x for FR2, respectively, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex [B.2x] for a corresponding band.

A CSI-RS and SSB resource configured for L1-RSRP shall be considered measurable when the measurable resource conditions are met for both CSI-RS resource and SSB resource.

Requirements are defined for periodic, semi-persistent and aperiodic resources, with the exception for UE sided RS prediction when *nroftimeinstance-r19* is configured, it is not applicable for aperiodic CSI-RS resources.

For UE sided RS prediction when *nroftimeinstance-r19* is not configured, there is no requirement if UE is configured with *reportQuantity-r19* set to 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19'.

For UE sided RS prediction when *nroftimeinstance-r19* is configured, there is no requirement if higher layer parameter *timeRestrictionForChannelMeasurement* is not configured.

9.5F.3 Measurement Reporting Requirements

For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-ssb-index-r19', the UE shall send P-CRI, P-SSBRI reports only for report configurations configured for the active BWP.

For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', the UE shall send P-CRI, P-SSBRI, and P-L1-RSRP reports only for report configurations configured for the active BWP. The UE shall report the P-L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1dB step size according to clause 10.x for FR2 if *nroftimeinstance-r19* is not configured or *nroftimeinstance-r19* is configured with the value set to 1, and if *nrofreportedpredictedrs-r19* is configured to be one. If *nroftimeinstance-r19* is not configured or *nroftimeinstance-r19* is configured with the value set to 1, and if *nrofreportedpredictedrs-r19* is configured to be larger than 1, the UE shall use differential L1-RSRP based reporting as defined in clause 10.x for FR2. The largest predicted value of P-L1-RSRP is quantized to a 7-bit value in the range [-140, -44] dBm with 1dB step size and the differential P-L1-RSRP value is computed with 2 dB step size with a reference to the largest P-L1-RSRP value which is part of the same P-L1-RSRP reporting instance. The mapping between the reported P-L1-RSRP value and the predicted L1-RSRP quantity is described in 10.x.

9.5F.3.1 Periodic Reporting

Reported P-CRI, P-SSBRI, and/or P-L1-RSRP contained in periodic P-CRI, P-SSBRI, and/or P-L1-RSRP reports shall meet the requirements in clauses 10.x for P-CRI, P-SSBRI, and in clause 10.x for P-L1-RSRP, respectively.

The UE shall only send periodic P-CRI, P-SSBRI, and/or P-L1-RSRP reports for an active BWP.

The UE shall transmit the periodic P-CRI, P-SSBRI, and/or P-L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5F.3.2 Semi-Persistent Reporting

Reported P-CRI, P-SSBRI, and/or P-L1-RSRP contained in a Semi-Persistent P-CRI, P-SSBRI, and/or P-L1-RSRP report shall meet the requirements in clauses 10.1.20 for FR2. This requirement applies for semi-persistent P-CRI, P-SSBRI, and/or P-L1-RSRP P reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent P-CRI, P-SSBRI, and/or P-L1-RSRP reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent P-CRI, P-SSBRI, and/or P-L1-RSRP reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent P-CRI, P-SSBRI, and/or P-L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5F.3.3 Aperiodic Reporting

Reported P-CRI, and/or P-L1-RSRP contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent reports shall meet the requirements in clauses 10.1.20 for P-CRI, and in clause 10.x for P-L1-RSRP, respectively.

The UE shall only send aperiodic P-CRI, and/or P-L1-RSRP reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic P-CRI, and/or P-L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.5F.4 L1-RSRP measurement and prediction requirements

9.5F.4.1 SSB based RS prediction reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting P-CRI, P-SSBRI, and/or P-L1-RSRP based on the L1-RSRP measurements over the prediction period of $T_{L1\text{-}RSRP_Prediction_Period_SSB}$.

The value of $T_{L1\text{-}RSRP_Prediction_Period_SSB}$ is defined in Table 9.5F.4.1-2 for FR2, where

- For UE sided RS prediction when *nroftimeinstance-r19* is not configured, M= 1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise; And for UE sided RS prediction when *nroftimeinstance-r19* is configured, M =1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured

- N= 8

- K_{BM}=1 for UE sided RS prediction when *nroftimeinstance-r19* is not configured. And for UE sided RS prediction when *nroftimeinstance-r19* is configured, K_{BM} is indicated by *UE capability on number of latest consecutive transmission occasion*.

For FR2,

- $P=\frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).

- P is $P_{sharing\ factor}$, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).

- $P=\frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$

- P is $\frac{1}{1-\frac{T_{SSB}}{MGRP}}$* $P_{sharing\ factor}$, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5*T_{SMTCperiod}$

- $P=\frac{1}{1-\frac{T_{SSB}}{\min(T_{SMTCperiod},MGRP)}}$, when SSB is partially overlapped with measurement gap (T_{SSB} <MGRP) and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.

- P is $\frac{1}{1-\frac{T_{SSB}}{MRGP}}$* $P_{sharing\ factor}$, when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} <$ MGRP)

- P is $\frac{1}{1-\frac{T_{SSB}}{MGRP}}$* $P_{sharing\ factor}$, when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} <$ MGRP)$P_{sharing\ factor}$ = 1

  - not overlapped with the SSB symbols indicated by SSB-ToMeasure and 1 data symbol before each consecutive SSB symbols indicated by SSB-ToMeasure and 1 data symbol after each consecutive SSB symbols indicated by SSB-ToMeasure, given that SSB-ToMeasure is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

  - not overlapped with the RSSI symbols indicated by ss-RSSI-Measurement and 1data symbol before each RSSI symbol indicated by ss-RSSI-Measurement and 1 data symbol after each RSSI symbol indicated by ss-RSSI-Measurement, given that ss-RSSI-Measurement is configured,

- $P_{sharing\ factor}$ = 3, otherwise.

Where:

T_{SSB} = ssb-periodicityServingCell

$T_{SMTCperiod}$ = the configured SMTC period

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer prediction period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Table 9.5F.4.1-2: Prediction period $T_{L1\text{-}RSRP_Prediction_Period_SSB}$ for FR2

Configuration	$T_{L1\text{-}RSRP_Prediction_Period_SSB}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(K_{BM}*M*P*N)*T_{SSB}+\underline{T_{inference}})$
DRX cycle ≤ 320ms	$\max(T_{Report}, \text{ceil}(1.5*K_{BM}*M*P*N)*\max(T_{DRX},T_{SSB})+\underline{T_{inference}})$
DRX cycle > 320ms	$\text{ceil}(1.5*K_{BM}*M*P*N)*T_{DRX}+\underline{T_{inference}}$
Note: T_{SSB} = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. $\underline{T_{inference}}$ is the time required for model inference, which is defined by d' as specified according to clause 5.4 in TS 38.214 [26].	

9.5F.4.2 CSI-RS based RS prediction reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting P-CRI, and/or P-L1-RSRP based on the L1-RSRP measurements measured over the prediction period of $T_{L1\text{-}RSRP_Prediction_Period_CSI\text{-}RS}$.

The value of $T_{L1\text{-}RSRP_Prediction_Period_CSI\text{-}RS}$ is defined in in Table 9.5F.4.2-2 for FR2, where

- For periodic and semi-persistent CSI-RS resources, for UE sided RS prediction when *nroftimeinstance-r19* is not configured, M= 1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise. And for UE sided RS prediction when *nroftimeinstance-r19* is configured, M= 1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured.

- For aperiodic CSI-RS resources M= 1

- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res_per_set}$), where $N_{res_per_set}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for all resources in the resource set.

  - SSB for L1-RSRP measurement, or

  - another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res_per_set}$), where $N_{res_per_set}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for with QCL-TypeD all resources in the resource set.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource one RS has QCL-TypeD with

  - SSB for L1-RSRP measurement, or

  - another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res_per_set}$), where $N_{res_per_set}$ is number of resources in the resource set. The requirements apply provided TCI state is provided with QCL-TypeD for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource one RS has QCL-TypeD with
  - SSB for L1-RSRP measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clause 10.1.19.2 and 10.1.20.2 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured with QCL-TypeD for all resources in the resource set.
- K_{BM}=1 for UE sided RS prediction when *nroftimeinstance-r19 is not configured.* And for UE sided RS prediction when *nroftimeinstance-r19 is configured*, K_{BM} is indicated by *UE capability on number of latest consecutive transmission occasion*.

For FR2,

- P=1, when CSI-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is not overlapped with SMTC occasion (T_{CSI-RS} < MGRP)
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is not overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).
- $P=P_{sharing\ factor}$, when CSI-RS is not overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).
- P=1, when aperiodic CSI-RS resource is not overlapped with measurement gap.
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{MGRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5*T_{SMTCperiod}$
- $P=\frac{3}{1-\frac{T_{CSI-RS}}{MGRP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5*T_{SMTCperiod}$
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{\min(T_{SMTCperiod},MGRP)}}$, when CSI-RS is partially overlapped with measurement gap (T_{CSI-RS} < MGRP) and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- $P=\frac{3}{1-\frac{T_{CSI-RS}}{MGRP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing\ factor}$ = 1, if the CSI-RS configured for L1-RSRP measurement outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured

- $P_{sharing\ factor} = 3$, otherwise.

Where:

$T_{SMTCperiod}$ = the configured SMTC period.

T_{CSI-RS} = the periodicity of CSI-RS configured for L1-RSRP measurement

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Note: The overlap between CSI-RS for L1-RSRP measurement and SMTC means that CSI-RS for L1-RSRP measurement is within the SMTC window duration.

Longer prediction period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Table 9.5F.4.2-2: Prediction period $T_{L1\text{-}RSRP_Prediction_Period_CSI\text{-}RS}$ for FR2

Configuration	$T_{L1\text{-}RSRP_Prediction_Period_CSI\text{-}RS}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(K_{BM}*M*P*N)*T_{CSI\text{-}RS}+\underline{T_{inference}})$
DRX cycle ≤ 320ms	$\max(T_{Report}, \text{ceil}(1.5*K_{BM}*M*P*N)*\max(T_{DRX},T_{CSI\text{-}RS}) +\underline{T_{inference}})$
DRX cycle > 320ms	$\text{ceil}(K_{BM}*M*P*N)*T_{DRX}+\underline{T_{inference}}$
Note 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. $\underline{T_{inference}}$ is the time required for model inference, which is defined by d' as specified according to clause 5.4 in TS 38.214 [26].	
Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.	

9.6 NE-DC: Measurements

9.6.1 Introduction

This clause contains requirements for UE supporting dual connectivity with NR PCell and E-UTRA FDD or TDD PSCell. The requirements apply to UEs that have been configured with NE-DC.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.6.2 SFTD Measurements

9.6.2.1 Introduction

This clause contains requirements on UE capabilities for reporting of SFN and frame time difference between NR PCell and E-UTRA PSCell in RRC_CONNECTED state. The requirements comprise measurement reporting delay and measurement accuracy. The overall measurement reporting delay includes an RRC procedure delay specified in TS 38.331 [2], and the SFTD measurement reporting delay specified below.

9.6.2.2 SFTD Measurement requirements

When no DRX is used in either of the NR PCell and E-UTRA PSCell, the physical layer measurement period of the SFTD measurement shall be $T_{measure_SFTD1}$ = max(0.2, 5 * SMTC period) s.

When DRX is used in either of the NR PCell or the E-UTRA PSCell, or in both PCell and PSCell, the physical layer measurement period ($T_{measure_SFTD1}$) of the SFTD measurement shall be as specified in table 9.6.2.2-1.

Table 9.6.2.2-1: SFTD measurement requirement when DRX is used

DRX cycle length (s)[Note2]	$T_{measure_SFTD1}$ (s)
DRX cycle≤0.04	max(0.2,5 x SMTC period) (Note1)
0.04<DRX cycle≤0.32	8 x max(DRX cycle, SMTC period)
0.32<DRX cycle≤10.24	5 x DRX cycle
Note1: Number of DRX cycles depends upon the DRX cycle in use Note2: DRX cycle length in this table refers to the DRX cycle length configured for PCell or E-UTRA PSCell. When DRX is used in both PCell and E-UTRA PSCell, DRX cycle length in this table refers to the longer of the DRX cycle lengths for PCell and E-UTRA PSCell.	

If E-UTRA PSCell is changed without changing carrier frequency of E-UTRA PSCell while the UE is performing SFTD measurements, the UE shall still meet SFTD measurement and accuracy requirements for the new E-UTRA PSCell. In this case the UE shall restart the SFTD measurement, and the total physical layer measurement period shall not exceed $T_{measure_SFTD2}$ as defined by the following expression:

$$T_{measure_SFTD2} = (M+1)*(T_{measure_SFTD1}) + M*T_{PSCell_change_NEDC}$$

where:

M is the number of times the E-UTRA PSCell is changed over the measurement period ($T_{measure_SFTD2}$), and

$T_{PSCell_change_NEDC}$ is the time necessary to change the E-UTRA PSCell; it can be up to 25 ms.

If PCell is changed, or if E-UTRA PSCell is changed to a different carrier frequency, the UE shall terminate the SFTD measurement.

The measurement accuracy for the SFTD measurement when DRX is used as well as when no DRX is used shall be as specified in clause 10.1.21.1.

9.7 Cross Link Interference measurements

9.7.1 Introduction

The UE capable of performing CLI measurements shall be able to measure SRS-RSRP and CLI-RSSI which are defined in TS 38.215 [4] within active DL BWP. The measurements requirements in this clause apply for TDD mode only.

CLI measurements are only applicable for RRC_CONNECTED intra-frequency:

- when SRS-RSRP measurement resource is fully confined within BW of DL active BWP
- when CLI-RSSI measurement resource is configured within active BWP

When the UE measures SRS-RSRP and CLI-RSSI, a constant offset relative to the downlink reference timing in the serving cell shall be applied. The constant offset value is derived by UE implementation and shall be at least $Tc*N_{TA_offset}$.

For performing CLI measurement in FR2, UE can assume the configured CLI measurement resources are QCL-ed with TypeD to one of the latest received PDSCH and the latest monitored CORESET.

CLI measurement requirements defined in clause 9.7 are applicable if

- CLI measurement is not performed on an NR carrier in the same band as E-UTRA serving carrier; and
- UE supports simultaneous Rx/Tx for inter-band CA, inter-band EN-DC, inter-band NE-DC, and NR-DC.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.7.2 SRS-RSRP measurements

9.7.2.1 Introduction

When configured by the network, the UE shall be able to perform SRS-RSRP measurements of configured *srs-ResourceConfigCLI*. The requirements apply when the subcarrier spacing for SRS-RSRP measurement resource configuration is the same as the subcarrier spacing of the active DL BWP of serving cell. The UE is not required to measure SRS using different SCS compared to the downlink active BWP SCS of the same carrier.

9.7.2.2 Requirements applicability

The requirements in clause 9.7.2 apply, provided:

- SRS resources configured for SRS-RSRP measurements are measurable.

An SRS resource configured for SRS-RSRP shall be considered measurable when for each relevant SRS the following conditions are met:

- SRS-RSRP related side conditions given in clauses 10.1.22.1 for FR1 and FR2 for a corresponding band,
- SRS_RP and SRS Ês/Iot according to Annex B.2.7 for a corresponding band.

9.7.2.3 Measurement Reporting Requirements

The UE shall send SRS-RSRP reports only for report configurations according to *reportType* which is *cliPeriodical* or *cliEventTriggered* when SRS-RSRP report is configured.

The UE shall report the SRS-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1 dB step size according to clause 10.1.22.1 for FR1 and FR2.

9.7.2.3.1 Periodic Reporting

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.1.

9.7.2.3.2 Event-triggered Periodic Reporting

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.22.1.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.7.2.3.3.

9.7.2.3.3 Event Triggered Reporting

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.1.

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report on.

9.7.2.4 Measurement capability

The UE shall be capable of performing SRS-RSRP measurements on the SRS resources configured for measurement, provided that the number of SRS to be monitored by UE does not exceed 8 within a slot, and the total number of SRSs to be monitored by the UE does not exceed 32.

9.7.2.5 SRS-RSRP measurement period

The UE shall be capable of performing SRS-RSRP measurement based on the configured SRS resource, and the UE shall be capable of reporting SRS-RSRP measured over measurement period of $T_{SRS_RSRP_measurement_period}$ for FR1 and FR2.

Table 9.7.2.5-1 Measurement period $T_{SRS_RSRP_measurement_period}$

Configuration	$T_{SRS_measurement_period}$ (ms)
No DRX	Max(60, 3 X T_{SRS})
DRX cycle ≤ 320 ms	Max(60, Ceil(1.5 X 3) X max(T_{SRS}, T_{DRX}))
DRX cycle > 320 ms	3 X T_{DRX}
NOTE: T_{SRS} is SRS measurement periodicity configured *SRS-PeriodicityAndOffset*, and T_{DRX} is the DRX cycle length.	

If the SRS resources configured for measurement are partially or fully overlapping with SMTC window, SSB or CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement or measurement gaps, requirements are not specified for $T_{SRS_RSRP_measurement_period}$.

9.7.3 CLI-RSSI measurements

9.7.3.1 Introduction

When configured by the network, the UE shall be able to perform CLI-RSSI measurement of configured *rssi-ResourceConfigCLI*. The subcarrier spacing for CLI-RSSI measurement resource configuration can be same or different from the subcarrier spacing of active BWP. UE shall perform CLI-RSSI measurement with the SCS of the active BWP.

9.7.3.2 Requirements applicability

The requirements in clause 9.7.3 apply, provided:

- The measurement resources configured for CLI-RSSI measurements are measurable.

A measurement resource configured for CLI-RSSI shall be considered measurable when for each relevant CLI-RSSI resource the following conditions are met:

- CLI-RSSI related side conditions given in clauses 10.1.22.2 for FR1 and FR2 for a corresponding band.

9.7.3.3 Measurement Reporting Requirements

The UE shall send CLI-RSSI reports only for report configurations according to *reportType* which is *cliPeriodical* or *cliEventTriggered* when CLI-RSSI report is configured.

The UE shall report the CLI-RSSI value as a 7-bit value in the range [-100, -25] dBm with 1 dB step size according to clause 10.1.22.2 for FR1 and FR2.

9.7.3.3.1 Periodic Reporting

Reported CLI-RSSI measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.2.

9.7.3.3.2 Event-triggered Periodic Reporting

Reported CLI-RSSI measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.22.2.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.7.3.3.3.

9.7.3.3.3 Event Triggered Reporting

Reported CLI-RSSI measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.2.

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report on.

9.7.3.4 Measurement capability

The UE shall be capable of performing CLI-RSSI measurement based on the configured resource, provided that the maximum number of CLI-RSSI measurement resources for the UE does not exceed 64.

9.7.3.5 CLI-RSSI measurement period

The UE shall be capable of performing CLI-RSSI measurement based on the configured measurement resource within $T_{CLI_RSSI_measurement_period}$. The UE shall be able to provide a single RSSI sample for each measurement resource configured for CLI-RSSI measurement occurring with a configured periodicity. The CLI-RSSI measurement period $T_{CLI_RSSI_measurement_period}$ corresponds to the CLI-RSSI measurement resource periodicity, which is configured for by higher layers via *RSSI-PeriodicityAndOffset*.

If the CLI-RSSI measurement resources configured for measurement are partially or fully overlapping with SMTC window, SSB or CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement or measurement gaps, requirements are not specified for $T_{CLI_RSSI_measurement_period}$.

9.7.4 Scheduling availability of UE during CLI measurements

Scheduling availability restrictions when the UE is performing CLI measurements which are SRS-RSRP and CLI-RSSI are described in the following clause.

9.7.4.1 Scheduling availability of UE performing measurement on FR1

The following scheduling restriction applies due to CLI measurements.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs CLI measurements, and on 1 data symbol before an OFDM symbol used for CLI measurements for 15 kHz and 30 kHz subcarrier spacing.

- For the UE which does not support *cli-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs SRS-RSRP measurements, and on 1 data symbol before an OFDM symbol used for SRS-RSRP measurements for 15 kHz and 30 kHz subcarrier spacing.

- For the UE which does not support *cli-RSSI-FDM-DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs CLI-RSSI measurements, and on 1 data symbol before an OFDM symbol used for CLI-RSSI measurements for 15 kHz and 30 kHz subcarrier spacing.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs CLI measurement, and on 2 data symbols before an OFDM symbol used for CLI measurements for 60 kHz subcarrier spacing.

- For the UE which does not support *cli-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs SRS-RSRP measurement, and on 2 data symbols before an OFDM symbol used for SRS-RSRP measurements for 60 kHz subcarrier spacing.

- For the UE which does not support *cli-RSSI-FDM-DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs CLI-RSSI measurement, and on 2 data symbols before an OFDM symbol used for CLI-RSSI measurements for 60 kHz subcarrier spacing.

When TDD intra-band carrier aggregation is configured, the scheduling restrictions on serving cell where CLI measurements are performed apply on all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions on serving cell where CLI measurements are performed apply on all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

For UE indicating *intraBandNR-CA-non-collocated-r19,*

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 4"*

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 1"*

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2>else

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.7.4.2 Scheduling availability of UE performing measurement on FR2

The following scheduling restriction applies due to CLI measurements.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs CLI measurements, and on 1 data symbol before an OFDM symbol used for CLI measurements for 60 kHz subcarrier spacing.

- For the UE which does not support *cli-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs SRS-

RSRP measurements, and on 1 data symbol before an OFDM symbol used for SRS-RSRP measurements for 60 kHz subcarrier spacing.

- For the UE which does not support *cli-RSSI-FDM-DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs CLI-RSSI measurements, and on 1 data symbol before an OFDM symbol used for CLI-RSSI measurements for 60 kHz subcarrier spacing.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs CLI measurements, and on 2 data symbols before an OFDM symbol used for CLI measurements for 120 kHz subcarrier spacing.

- For the UE which does not support *cli-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs SRS-RSRP measurements, and on 2 data symbols before an OFDM symbol used for SRS-RSRP measurements for 120 kHz subcarrier spacing.

- For the UE which does not support *cli-RSSI-FDM-DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs CLI-RSSI measurements, and on 2 data symbols before an OFDM symbol used for CLI-RSSI measurements for 120 kHz subcarrier spacing.

When TDD intra-band carrier aggregation is configured, the scheduling restrictions on serving cell where CLI measurements are performed apply on all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

9.8 L1-SINR measurements for Reporting

9.8.1 Introduction

When configured by the network, the UE shall be able to perform L1-SINR measurements with the measurement resources configured as the selection of:

- CSI-RS based CMR and no dedicated IMR configured;

- SSB based CMR and dedicated IMR configured;

- CSI-RS based CMR and dedicated IMR configured.

For UE supporting *On-demand SSB operation* and when OD- SSB transmission is indicated, the UE shall be able to perform L1-SINR measurements of SSB resources based CMR and dedicated IMR configured, provided the following conditions are met:

- an OD-SSB transmission in a configured DL BWP without first SSB transmission, or

- an OD-SSB transmission in a configured DL BWP with a first SSB transmission which cannot be used to obtain SIB1 have the following relations:

  - are with the same Cell ID, and

  - are in the same frequency location, and

  - are with same sub-carrier spacing, and

  - are with the same downlink transmit power, and

  - are quasi co-located with respect to Doppler shift, Doppler spread, average gain, average delay, delay spread and, when applicable, spatial RX parameters, when they have a same SSB index.

The measurements shall be performed for a serving cell, including PCell, PSCell, or SCell, on the resources configured for L1-SINR measurements within the active BWP. For UE supporting *bwpOperationMeasWithoutInterrupt-r18*, the UE shall additionally be able to perform L1-SINR measurements for a serving cell, including PCell, PSCell, or SCell, on the resources configured for L1-SINR outside the active BWP, provided that the SSB is within the configured UE-specific CBW. For UE supporting *ncd-SSB-BWP-Wor-r18*, the SSB and SMTC in this clause applies for both CD-SSB and NCD-SSB if it is not explicitly specified otherwise. If SSB in the active DL BWP of serving cell *i* is NCD-SSB, for serving cell *i* the requirements in clause 9.8 apply provided that serving cell *i* is PCell or activated PSCell. For UE

supporting *On-demand SSB operation*, the UE shall additionally be able to perform L1-SINR measurements for a SCell on the OD-SSB resources configured for L1-SINR within the active BWP.

The UE shall be able to measure all CSI-RS resources and/or SSB resources and/or CSI-IM resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet and/or CSI-IM-ResourceSet* within the *CSI-ResourceConfig* settings for L1-SINR for the active BWP, and measure interference on corresponding NZP CSI-RS or CSI-IM resources if configured, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*. If the UE supports *bwpOperationMeasWithoutInterrupt-r18*, UE shall be able to measure the SSB reources of *csi-SSB-ResourceSet* within the *CSI-ResourceConfig* configured outside active BWP, provided that the SSB is within the configured UE-specific CBW.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.8.2 Requirements applicability

The requirements in clause 9.8 apply, provided:

- CMR resources configured for L1-SINR measurements are measurable, and
- NZP-IMR resources configured for L1-SINR measurements if applicable are measurable.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

For CSI-RS based CMR and no dedicated IMR configured, a CSI-RS resource configured for L1-SINR shall be considered measurable when for each relevant CSI-RS the following conditions are met:

- L1-SINR related side conditions given in clauses 10.1.27 and 10.1.28 for FR1 and FR2, respectively, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.8.1 for a corresponding band.

For SSB based CMR and dedicated IMR configured, a SSB and a dedicated IMR configured for L1-SINR shall be considered measurable when for each relevant SSB and IMR the following conditions are met:

- L1-SINR related side conditions given in clauses 10.1.27 and 10.1.28 for FR1 and FR2, respectively, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.8.2 for a corresponding band.
- NZP-IMR Ês/Iot according to Annex B.2.8.2 for a corresponding band, if NZP-IMR is configured as dedicated IMR.

For CSI-RS based CMR and dedicated IMR configured, a CSI-RS and a dedicated IMR configured for L1-SINR shall be considered measurable when for each relevant CSI-RS and IMR the following conditions are met:

- L1-SINR related side conditions given in clauses 10.1.27 and 10.1.28 for FR1 and FR2, respectively, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.8.3 for a corresponding band
- NZP-IMR Ês/Iot according to Annex B.2.8.3 for a corresponding band, if NZP-IMR is configured as dedicated IMR.

9.8.3 Measurement Reporting Requirements

The UE shall send L1-SINR reports only for report configurations configured for the active BWP, unless the UE supports *bwpOperationMeasWithoutInterrupt-r18*, provided that the SSB is within the configured UE-specific CBW.

The UE shall report the L1-SINR value as a 7-bit value in the range [-23, 40] dB with 0.5 dB step size if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if

groupBasedBeamReporting is enabled, the UE shall use differential L1-SINR based reporting. The differential L1-SINR is quantized to a 4-bit value with 1 dB step size. The mapping between the reported L1-SINR value and the measured quantity is described in clause 10.1.16.

9.8.3.1 Periodic Reporting

Reported L1-SINR measurements contained in periodic L1-SINR measurement reports shall meet the requirements in clauses 10.1.27 for FR1 and 10.1.28 for FR2, respectively.

The UE shall transmit the periodic L1-SINR reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.8.3.2 Semi-Persistent Reporting

Reported L1-SINR measurements contained in a Semi-Persistent L1-SINR measurement report shall meet the requirements in clauses 10.1.27 for FR1 and 10.1.28 for FR2, respectively. This requirement applies for semi-persistent L1-SINR reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-SINR measurement reports on PUSCH, if a DCI for triggering report has been received.

The UE shall only send semi-persistent L1-SINR measurement reports on PUCCH, if an activation command as described in clause 6.1.3.16 in TS 38.321 [7] has been received.

The UE shall transmit the semi-persistent L1-SINR reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.8.3.3 Aperiodic Reporting

Reported L1-SINR measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-SINR reports shall meet the requirements in clauses 10.1.27 for FR1 and 10.1.28 for FR2, respectively.

The UE shall only send aperiodic L1-SINR measurement reports, if a DCI for triggering report has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-SINR reporting on PUSCH over the air interface at the time specified according to clause 5.2.1.4 in TS 38.214 [26].

9.8.4 L1-SINR measurement requirements

9.8.4.1 L1-SINR reporting with CSI-RS based CMR and no dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS resource configured as CMR and no dedicated resource configured as IMR for L1-SINR computation, and the UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only}$.

The value of $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only}$ is defined in table 9.8.4.1-1 for FR1 and in table 9.8.4.1-2 for FR2, where

For the value of M,

- For periodic and semi-persistent CSI-RS resources as CMR, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise;

- For aperiodic CSI-RS resources as CMR, M=1.

For the value of N in FR2

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or
- another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res_per_set}$), where $N_{res_per_set}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for all resources in the resource set.
- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource has QCL-TypeD with
  - SSB for L1-RSRP or L1-SINR measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res_per_set}$), where $N_{res_per_set}$ is number of resources in the resource set. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set.
- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requriements apply provided *qcl-info* is configured for all resources in the resource set and for each resource has QCL-TypeD with
  - SSB for L1-RSRP or L1-SINR measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clauses 10.1.28.1 and 10.1.28.3 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requriements apply provided *qcl-info* is configured for all resources in the resource set.

For the value of L1,

1> If UE does not support *supportSBFD* or SBFD is not configured by the network

2> L1 is not applicable

1> else (if UE supports *supportSBFD* and SBFD is configured by the network)

2> if UE is configured to report L1-SINR for SBFD symbols

3> When DRX is not configured, L1 is the number of occasions of the CSI-RS resource as CMR that are overlapping with dynamic UL transmission or with non-SBFD symbols during $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only}$

3> When DRX is configured, L1 is the number of DRX cycles in which at least one occasion of the CSI-RS resource as CMR is overlapping with dynamic UL transmission or in which all occasions of the CSI-RS resource as CMR are overalapping with non-SBFD symbols during $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only}$

2> if UE is configured to report L1-SINR for non-SBFD symbols

3> When DRX is not configured, L1 is the number of occasions of the CSI-RS resource as CMR that are overlapping with SBFD symbols during $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only}$

3> When DRX is configured, L1 is the number of DRX cycles in which all occasions of the CSI-RS resource as CMR are overlapping with SBFD symbols during $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only}$

For a UE supporting *LB CA via switching*, or for a UE supporting *concurrentMeasGapsPreMG-r18* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *concurrentMeasGapsNCSG-r18* and when concurrent GAP(s) with NCSG(s) are configured, or a UE supporting *concurrentMeasGap-r17* or *musim-GapPreference-r17* or both concurrent measurement gap and *musim-GapPreference-r17* and when concurrent GAPs or periodic MUSIM gaps or both concurrent gaps and periodic MUSIM gaps are configured,

- a CSI-RS or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to 9.1.8 and 9.1.10,

- P value for a CSI-RS resource to be measured is defined as

  - N_{total} / $N_{outside_MG}$ in FR1

  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0

  - N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0

- For a window W of duration max($T_{L1,}$ xRP_max, switching pattern periodicity), where xRP_max is the maximum xRP across all configured per-UE GAPs or periodic MUSIM gap(s) and per-FR GAPs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any CSI-RS resource occasion:

  - N_{total} is the total number of CSI-RS resource occasions within the window, including those overlapped with GAP occasions, MUSIM gap occasions or SMTC occasions within the window,

    For UEs supporting *LB CA via switching* and configured with low NR inter-band carrier aggregation:

    - for the PCell L1-SINR measurement, N_{total} also includes CSI-RS resource occasions that overlap with the SDL SCell ON duration within the window,

    - for the SCell L1-SINR measurement, N_{total} also includes CSI-RS resource occasions that overlap with the PCell ON duration within the window, as defined by the configured switching pattern, and

  - $N_{outside_MG}$ is the number of CSI-RS resource occasions within the window W

    - that are not overlapped with any non-dropped GAP occasion nor non-dropped MUSIM gap occasion or

    - that are not overlapped with SDL SCell ON duration corresponding to the LB CA switching pattern, for the PCell L1-SINR measurement for a UE supporting *LB CA via switching* with low NR inter-band carrier aggregation configured or

    - that are not overlapped with PCell ON duration corresponding to the LB CA switching pattern, for the SCell L1-SINR measurement for a UE supporting *LB CA via switching* with low NR inter-band carrier aggregation configured, and

  - L1-SINR requirement in this clause is not applied when $N_{outside_MG}$ = 0.

  - $N_{available}$ is the number of CSI-RS resource occasions that are not overlapped with any non-dropped GAP occasion, non-dropped MUSIM gap occasion nor any SMTC occasion within the window W.

  - for UEs supporting *LB CA via switching*, switching pattern periodicity is the periodicity of the RRC configured semi-static switching pattern; otherwise, it is not applicable.

  - a CSI-RS or an SMTC occasion is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion.

  - T_{L1} is periodicity of the target CSI-RS.

  - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *concurrentMeasGapsPreMG-r18* nor *concurrentMeasGapsNCSG-r18* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent GAP(s) with NCSG(s) and UE does not support *musim-GapPreference-r17* or when no MUSIM gaps are configured,

For the value of P in FR1,

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$, when in the monitored cell there are GAP configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the CSI-RS.

For the value of P in FR2,

- P=1, when CSI-RS is not overlapped with GAP and also not overlapped with SMTC occasion.
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$, when CSI-RS is partially overlapped with GAP and CSI-RS is not overlapped with SMTC occasion (T_{CSI-RS} < xRP)
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is not overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$,, when CSI-RS is not overlapped with GAP and CSI-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{xRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is partially overlapped with [measurement gap] and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and
  - $T_{SMTCperiod} \neq$ xRP or
  - $T_{SMTCperiod}$ = xRP and $T_{CSI-RS} < 0.5*T_{SMTCperiod}$
- $P=\frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{xRP}}$, when CSI-RS is partially overlapped with GAP and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod}$ = xRP and $T_{CSI-RS} = 0.5*T_{SMTCperiod}$
- $P=\frac{1}{1-\frac{T_{CSI-RS}}{\min(T_{SMTCperiod},xRP)}}$, when CSI-RS is partially overlapped with GAP (T_{CSI-RS} < xRP) and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with GAP.
- $P=\frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{xRP}}$, when CSI-RS is partially overlapped with GAP and CSI-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod}$ < xRP)

Where:

$P_{sharing\ factor}$ = 1, if the CSI-RS configured for L1-SINR measurement outside gap is

not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{sharing\ factor}$ = 3, otherwise.
  - $T_{SMTCperiod}$ = the configured SMTC1 period or SMTC2 period if configured.
  - T_{CSI-RS} = the periodicity of CSI-RS configured for L1-SINR measurement
- When a measurement gap is configured and the measurement gap is not NCSG,
  - a CSI-RS is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and
  - xRP = MGRP
- If the UE is configured with Pre-MG, a CSI-RS reourse or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,
  - a CSI-RS is considered to be overlapped with the GAP if
    - it overlaps the VIL1 or VIL2 of NCSG, or
    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,
  - and
    - xRP = VIRP

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Note: The overlap between CSI-RS for L1-SINR measurement and SMTC means that CSI-RS for L1-SINR measurement is within the SMTC window duration.

For UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, the UE is not required to perform CSI-RS measurements during the cancelled gap occasions.

When UE is configured with aperiodic MUSIM gap and the aperiodic MUSIM gap is overlapping with CSI-RS resource occasion for L1-SINR, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and CSI-RS resource occasions for L1-SINR are fully overlapped with MUSIM gap(s) or fully overlapped with the union of MUSIM gap(s) and GAPs, no requirement applies for the CSI-RS based L1-SINR measurement.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and GAP configurations does not meet previous conditions.

Table 9.8.4.1-1: Measurement period $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only}$ for FR1

Configuration	$T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}((M+L1)*P)* \max(T_{CSI\text{-}RS}, T_{proc}))$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*(M+L1)*P)*\max(T_{DRX},T_{CSI\text{-}RS}, T_{proc}))$
DRX cycle > 320 ms	$\text{ceil}((M+L1)*P)*T_{DRX}$
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3. NOTE 3: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for CMR is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

Table 9.8.4.1-2: Measurement period $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only}$ for FR2

Configuration	$T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}((M+L1)*P*N)* \max(T_{CSI\text{-}RS}, T_{proc}))$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*(M+L1)*P*N)*\max(T_{DRX},T_{CSI\text{-}RS}, T_{proc}))$
DRX cycle > 320 ms	$\text{ceil}((M+L1)*P*N)*T_{DRX}$
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3. NOTE 3: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for CMR is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

9.8.4.2 L1-SINR reporting with SSB based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the SSB configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to SSB configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$.

The requirements in this clause are not applicable if NZP-CSI-RS or CSI-IM resource configured as dedicated IMR is scheduled with different periodicity as SSB configured as CMR.

For UE supporting *On-demand SSB operation* and when OD- SSB transmission is indicated, the EMP for L1-SINR are

- the periodicity of OD-SSBs in the configured DL BWP if no first SSB transmission is configured or if UE supports *timec1nc2* and OD-SSB transmission is indicated with first SSB transmission and the union of the first SSB transmission and OD-SSB transmission has a non-periodic time domain pattern, or
- the periodicity of the union of OD-SSBs and first SSBs if first SSBs are transmitted and the OD-SSB activation is indicated and the union of OD-SSBs and first SSBs has a periodic time domain pattern.

The value of $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$ is defined in table 9.8.4.2-1 for FR1 and in table 9.8.4.2-2 for FR2 when *highSpeedMeasFlagFR2-r17* is not configured, and defined in table 9.8.4.2-3 for FR2 power class 6 UE when *highSpeedMeasFlagFR2-r17* is configured, where

For the value of M

- For periodic or semi-persistent NZP CSI-RS or CSI-IM resource as dedicated IMR, M=1 if the higher layer parameters *timeRestrictionForChannelMeasurements* and/or *timeRestrictionForInterferenceMeasurements* are configured, and M=3 otherwise;

For the value of N in FR2

- N = 2, 4 or 6 in FR2-1 for UE supporting *fastBeamSweepingMultiRx-r1*8, according to the conditions described in clause 3.6.19,
- N = 8 otherwise.

For the value of L1,

1> If UE does not support *supportSBFD* or SBFD is not configured by the network

2> L1 is not applicable

1> else (if UE supports *supportSBFD* and SBFD is configured by the network)

2> if UE is configured to report L1-SINR for SBFD symbols

3> When DRX is not configured, L1 is the number of occasions of the CSI-RS/CSI-IM resource as IMR that are overlapping with dynamic UL transmission or with non-SBFD symbols during $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$

3> When DRX is configured, L1 is the number of DRX cycles in which at least one occasion of the CSI-RS/CSI-IM resource as IMR is overlapping with dynamic UL transmission or in which all occasions of the CSI-RS/CSI-IM resource as IMR are overalapping with non-SBFD symbols during $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$

2> if UE is configured to report L1-SINR for non-SBFD symbols

3> When DRX is not configured, L1 is the number of occasions of the CSI-RS/CSI-IM resource as IMR that are overlapping with non-SBFD symbols, during $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$

3> When DRX is configured, L1 is the number of DRX cycles in which all occasions of the CSI-RS/CSI-IM resource as IMR are overlapping with non-SBFD symbols, during $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$

P is defined as the maximum value between P_{CMR} and P_{IMR}, i.e., $P = \max(P_{CMR}, P_{IMR})$, where

- the value of P_{CMR} shall be derived in the same way as the value of P used for SSB based L1-RSRP measurement in clause 9.5.4.1, in which the occasions and period of the SSB for CMR shall be used instead.

- the value of P_{IMR} shall be derived in the same way as the value of P used for CSI-RS based L1-RSRP measurement in clause 9.5.4.2, in which the occasions and period of the NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead.

For UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, the UE is not required to perform SSB measurements during the cancelled gap occasions.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet previous conditions.

For L1-SINR measurement with SSB as CMR and CSI-RS or CSI-IM as IMR, the requirement shall apply if the CSI-RS is configured as IMR with repetition field as “repetition = OFF” or CSI-IM is configured as IMR.

For L1-SINR measurement with SSB as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if SSB occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap

Table 9.8.4.2-1: Measurement period $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$ for FR1

Configuration	$T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}((M+L1)*P)* \max(T_{SSB}, T_{proc}))$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*(M+L1)*P)*\max(T_{DRX},T_{SSB}, T_{proc}))$
DRX cycle > 320 ms	$\text{ceil}((M+L1)*P)*T_{DRX}$
NOTE 1: T_{SSB} = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR channel measurement if UE not supporting *On-demand SSB operation* or when OD-SSB transmission is not indicated, otherwise, T_{SSB} = EMP of the SSB index configured for L1-SINR channel measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity. NOTE 3: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for IMR is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

Table 9.8.4.2-2: Measurement period $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$ for FR2

Configuration	$T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}((M+L1)*P*N)* \max(T_{SSB}, T_{proc}))$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*(M+L1)*P*N)*\max(T_{DRX},T_{SSB}, T_{proc}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*(M+L1)*P*N)*T_{DRX}$
NOTE 1: T_{SSB} = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR measurement if UE not supporting *On-demand SSB operation* or when OD-SSB transmission is not indicated, otherwise, T_{SSB} = EMP of the SSB index configured for L1-SINR channel measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity. NOTE 3: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for IMR is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

Table 9.8.4.2-3: Measurement period $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$ configured with *highSpeedMeasFlagFR2-r17* for FR2-1

Configuration	$T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}((M+L1)*P*N1^{Note\ 3})* \max(T_{SSB}, T_{proc}))$
DRX cycle ≤ 80 ms	$\max(T_{Report}, \text{ceil}((M+L1)*P*N1^{Note\ 3}*M2)*\max(T_{DRX},T_{SSB}, T_{proc}))$

80 ms< DRX cycle ≤ 320 ms	max(T_{Report}, ceil(1.5*(M+L1)*P*N)*max(T_{DRX},T_{SSB}))
DRX cycle > 320 ms	ceil(1.5*(M+L1)*P*N)*T_{DRX}
NOTE 1: T_{SSB} = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.	
NOTE 3: N1 = 2 when *highSpeedMeasFlagFR2-r17* = set1; N1 = 6 when *highSpeedMeasFlagFR2-r17* = set2.	
NOTE 4: M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2 = 1	
NOTE 5: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for IMR is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

9.8.4.3 L1-SINR reporting with CSI-RS based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS resource configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to CSI-RS resource configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR}$.

The requirements in this clause are not applicable if NZP-CSI-RS or CSI-IM resource configured as dedicated IMR is scheduled with different periodicity as CSI-RS resource configured as CMR.

The value of $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR}$ is defined in table 9.8.4.3-1 for FR1 and in table 9.8.4.3-2 for FR2, where

For the value of M,

- M=1 shall be applied if
  - aperiodic NZP-CSI-RS as CMR or dedicated IMR, or
  - aperiodic CSI-IM as dedicated IMR, or
  - periodic and semi-persistent NZP-CSI-RS as CMR or dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured, or
  - periodic and semi-persistent CSI-IM as dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured;
- M=3 otherwise.

For the value of N in FR2

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with
  - SSB for L1-RSRP or L1-SINR measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res_per_set}$), where $N_{res_per_set}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for all resources in the resource set.
- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource has QCL-TypeD with

- SSB for L1-RSRP or L1-SINR measurement, or
- another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res_per_set}$), where $N_{res_per_set}$ is number of resources in the resource set. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set.
- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requriements apply provided *qcl-info* is configured for all resources in the resource set and for each resource has QCL-TypeD with
  - SSB for L1-RSRP or L1-SINR measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clause 10.1.28.1 and 10.1.28.3 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requriements apply provided *qcl-info* is configured for all resources in the resource set.

For the value of L1,

1> If UE does not support *supportSBFD* or SBFD is not configured by the network

2> L1 is not applicable

1> else (if UE supports *supportSBFD* and SBFD is configured by the network)

2> if UE is configured to report L1-SINR for SBFD symbols

3> When DRX is not configured, L1 is the maximum between number of occasions of the CSI-RS resource as CMR that are overlapping with dynamic UL transmission or with non-SBFD symbols and number of occasions of the CSI-RS/CSI-IM resource as IMR that are overlapping with dynamic UL transmission or with non-SBFD symbols, during $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR}$

3> When DRX is configured, L1 is the number of DRX cycles in which at least one occasion of the CSI-RS resource as CMR or at least one occasion of the CSI-RS/CSI-IM resource as IMR is overlapping with dynamic UL transmission or in which all occasions of the CSI-RS resource as CMR or all occasions of the CSI-RS/CSI-IM resource as IMR are overalapping with non-SBFD symbols, during $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR}$

2> if UE is configured to report L1-SINR for non-SBFD symbols

3> When DRX is not configured, L1 is the maximum between number of occasions of the CSI-RS resource as CMR that are overlapping with non-SBFD symbols and number of occasions of the CSI-RS/CSI-IM resource as IMR that are overlapping with non-SBFD symbols, during $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR}$

3> When DRX is configured, L1 is the number of DRX cycles in which all occasions of the CSI-RS resource as CMR or at least one occasion of the CSI-RS/CSI-IM resource as IMR are overlapping with non-SBFD symbols, during $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR}$

P is defined as the maximum value between P_{CMR} and P_{IMR}, i.e., $P = \max(P_{CMR}, P_{IMR})$, where

- The value of P_{CMR} and P_{IMR} shall be derived in the same way as the value of P used for CSI-RS based L1-RSRP measurement in clause 9.5.4.2, in which the occasions and period of the CSI-RS for CMR and NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead respectively.

For UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, the UE is not required to perform CSI-RS measurements during the cancelled gap occasions.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet previous conditions.

For L1-SINR measurement with CSI-RS as CMR and CSI-RS as IMR, the requirement shall apply only if CSI-RS resources as CMR and IMR are configured with the same repetition field and the number of CSI-RS resources in the resource sets for CMR and IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-IM as IMR, the requirement shall apply only if the number of CSI-RS resources in the resource set for CMR and the number of CSI-IM resources in the resource set for IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if CSI-RS occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap.

Table 9.8.4.3-1: Measurement period $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR}$ for FR1

Configuration	$T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}((M+L1)*P)*\max(T_{CSI\text{-}RS}, T_{proc}))$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*(M+L1)*P)*\max(T_{DRX}, T_{CSI\text{-}RS}, T_{proc}))$
DRX cycle > 320 ms	$\text{ceil}((M+L1)*P)*T_{DRX}$
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.	
NOTE 3: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.	
NOTE 4: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for CMR or IMR is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

Table 9.8.4.3-2: Measurement period $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR}$ for FR2

Configuration	$T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}((M+L1)*P*N)*\max(T_{CSI\text{-}RS}, T_{proc})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*(M+L1)*P*N)*\max(T_{DRX}, T_{CSI\text{-}RS}, T_{proc}))$
DRX cycle > 320 ms	$\text{ceil}((M+L1)*P*N)*T_{DRX}$
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.	
NOTE 3: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.	
NOTE 4: If UE indicates *needForScaledCSIProcTimeDualDL* and the CSI-RS resource for CMR or IMR is across 2 DL subbands, T_{proc} = 8ms; otherwise T_{proc} = 0.	

9.8.5 Measurement restriction for L1-SINR measurement

The UE is required to be capable of measuring L1-SINR without measurement gaps. The UE is required to perform the SSB and CSI-RS/CSI-IM measurements with measurement restrictions as described in the following clauses.

9.8.5.1 Measurement restriction if SSB configured for L1-SINR Measurement

For FR1, when the SSB configured as CMR for L1-SINR measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-SINR measurement without any restriction;

- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-SINR measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-SINR measurement and CSI-RS. Longer measurement period for SSB based L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the SSB configured as CMR for L1-SINR measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for L1-SINR measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, there is no measurement restriction allowed when the network configures mixed numerology between SSB configured as CMR for L1-SINR measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, provided that UE is capable of independent beam management on this FR2 band pair.

For FR2, for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* and for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*,when the SSB configured as CMR for L1-SINR measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both SSB for L1-SINR measurement and SSB for L1-RSRP measurement on neighbor cell. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For UE supporting *On-demand SSB operation*, when OD-SSB transmission is indicated without first SSB transmission, the measurement restriction is expected for OD-SSB occasions only.

For UE supporting *On-demand SSB operation*, when OD-SSB transmission is indicated with first SSB transmission, no measurement restriction is expected for first SSB occasions if UE supports *Time-C1nC2* and the union of the first SSB transmission and OD-SSB transmission has a non-periodic time domain pattern. Otherwise, the measurement restriction is expected for both first SSB and OD-SSB occasions.

9.8.5.2 Measurement restriction if CSI-RS configured for L1-SINR measurement

For both FR1 and FR2, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to receive CSI-RS for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement has same SCS than CSI-RS configured for L1-SINR measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement has different SCS than CSI-RS configured for L1-SINR me

- If the UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to perform CSI-RS measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE shall be able to measure the CSI-RS for L1-SINR measurement without any restriction.

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.
  - The CSI-RS for L1-SINR measurement or the other CSI-RS in a resource set configured with repetition ON, or
  - The CSI-RS or the other CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or
  - The other CSI-RS is configured in q1 and beam failure is detected, or
  - The two CSI-RS-es are not QCL-ed with respect to QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS configured for L1-SINR measurement without any restriction.

For UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* and for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*,

- For both FR1 and FR2, when the CSI-RS configured for L1-SINR measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, UE is not required to receive CSI-RS for L1-SINR measurement in the PRBs that overlap with an SSB.
- For FR1, when the CSI-RS configured for L1-SINR measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, if CSI-RS and SSB have different SCS and UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.
- For FR2, when the CSI-RS configured for L1-SINR measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the UE is indicated with two TCI states for simultaneous PDSCH reception, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, the UE supporting *schedulingMeasurementRelaxation-r1*8 according to the conditions described in clause 3.6.19 shall be able to measure the CSI-RS configured for L1-SINR measurement without any restriction under the following conditions:

- Both CSI-RSs are not in any CSI-RS resource set with repetition ON,
- One CSI-RS has same QCL source as either,
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to 38.214 clause 5.1.5, and
- the other CSI-RS has same QCL source as either
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to 38.214 clause 5.1.5.

- Resources of the active TCI states of the two PDSCHs, and or QCL sources of the default QCL assumption, or the active TCI state of PDSCH and QCL source of the default QCL assumption have been reported as a resource group in Rel-17 group-based RSRP report.

9.8.5.3 Measurement restriction if CSI-IM configured for L1-SINR measurement

For both FR1 and FR2, when the CSI-IM configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to measure CSI-IM for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR1, UE shall be able to measure the CSI-IM configured for L1-SINR measurement without any restriction.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and SSB. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as the CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and CSI-RS. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.
  - The CSI-RS in a resource set configured with repetition ON, or
  - The CSI-IM or the CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or
  - The CSI-RS is configured in q1 and beam failure is detected, or
  - The CMR for L1-SINR measurement and the CSI-RS are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-IM configured for L1-SINR measurement without any restriction.

For UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* and for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*,

- For both FR1 and FR2, when the CSI-IM configured for L1-SINR measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, UE is not required to receive CSI-IM for L1-SINR measurement in the PRBs that overlap with an SSB.
- For FR2, when the CSI-IM configured for L1-SINR measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-IM based L1-SINR measurement is expected, and no requirements are defined.

9.8.6 Scheduling availability of UE during L1-SINR measurement

Scheduling availability restrictions when the UE is performing L1-SINR measurement are described in the following clauses.

For UE supporting On-demand SSB operation, when OD-SSB transmission is indicated without first SSB transmission, the scheduling restriction is expected for OD-SSB occasions only.

For UE supporting *On-demand SSB operation*, when OD-SSB transmission is indicated with first SSB transmission, no measurement restriction is expected for first SSB occasions if UE supports *Time-C1nC2* and the union of the first SSB transmission and OD-SSB transmission has a non-periodic time domain pattern. Otherwise, the measurement restriction is expected for both first SSB and OD-SSB occasions.

9.8.6.1 Scheduling availability of UE performing L1-SINR measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-SINR measurement performed on SSB and CSI-RS configured for L1-SINR measurement with the same SCS as PDSCH/PDCCH in FR1.

9.8.6.2 Scheduling availability of UE performing L1-SINR measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-SINR measurement based on SSB configured for L1-SINR measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-SINR measurement based on SSB configured for L1-SINR measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking /CSI-RS for CQI on SSB symbols to be measured for L1-SINR measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on serving cell where L1-SINR measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions on serving cell where L1-SINR measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided

For UE indicating *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 4"*

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 1"*

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2>else

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-SINR measurement is performed is configured.

9.8.6.3 Scheduling availability of UE performing L1-SINR measurement on FR2

The following scheduling restriction applies due to L1-SINR measurement.

- For UE not supporting *schedulingMeasurementRelaxation-r1*8, for the cases of CSI-RS used for L1-SINR measurement of CSI-RS based CMR only case and CSI-RS based CMR plus CSI-RS based ZP-IMR/NZP-IMR case and CSI-RS based CMR plus ZP-IMR case, where CSI-RS is QCLed with active TCI state for PDCCH/PDSCH and not in a CSI-RS resource set with repetition ON, and N=1 applies as specified in clause 9.8.4, or
- For FR2-1 for UE supporting *schedulingMeasurementRelaxation-r1*8 according to the conditions described in clause 3.6.19, there are no scheduling restrictions due to L1-SINR measurement performed based on the CSI-RS for the cases of CSI-RS used for L1-SINR measurement of CSI-RS based CMR only case and CSI-RS based CMR plus CSI-RS based ZP-IMR/NZP-IMR case and CSI-RS based CMR plus ZP-IMR case, where N=1 applies as specified in clause 9.8.4, and where the following additional conditions are met:
  - The CSI-RS is not in a CSI-RS resource set with repetition ON.
  - The CSI-RS has same QCL source as the active TCI state of one of the PDSCHs and has different QCL-TypeD from the other PDSCH.
  - The CSI-RS and both of the PDSCHs are on the same OFDM symbol(s), or the CSI-RS and one of the PDSCHs with different QCL-typeD are on the same OFDM symbol(s) when partially overlapping PDSCHs are scheduled, and
  - Resources of the active TCI states for the two PDSCHs have been reported as a resource group in Rel-17 group-based RSRP report.
- Otherwise
  - The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on the symbols to be measured for L1-SINR for FR2 power class 6 UE which is not configured with *highSpeedMeasFlagFR2-r17*, and for the UE not supporting FR2 power class 6;
  - The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on the symbols to be measured for L1-SINR, and on 1 data symbol before symbols to be measured for L1-SINR and 1 data symbol after symbols to be measured for L1-SINR for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*.

When intra-band carrier aggregation is performed, the scheduling restrictions on serving cell where L1-SINR measurement is performed apply to all serving cells in the band on the symbols that fully or partially overlap with restricted symbols.

If following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

for the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for L1-SINR measurement; and

for the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for L1-SINR measurement.

9.8.6.4 Scheduling availability of UE performing L1-SINR measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to L1-SINR measurement performed on FR2 serving cell(s).

There are no scheduling restrictions on FR2 serving cell(s) due to L1-SINR measurement performed on FR1 serving cell(s).

9.8.7 Minimum requirement at transitions

For UE supporting *ncd-SSB-BWP-Wor-r18*, when the L1-SINR measurement transitions from measurements performed on CD-SSB to measurements performed on NCD-SSB or vice versa due to BWP switching during one measurement period, the UE shall use a L1-SINR measurement period that is the maximum of the L1-SINR measurement period corresponding to the first SSB type and the second SSB type after the BWP switching.

Subsequent to the above-mentioned measurement periods, the L1-SINR measurement period requirements are based on the SSB type after the BWP switch.

For UE supporting OD-SSB operation, when UE is indicated by an OD-SSB parameter update MAC-CE, adaptation of periodicities for the activated transmission of OD-SSBs when the SCell is activated, the L1-RSRP measurement period requirements are based on the EMP of adapted OD-SSB burst periodicity which applies from the first OD-SSB burst after the time point as defined in TS 38.213 for adaptation of the second SS/PBCH blocks transmission plus additional processing time of OD-SSB parameter update capability.

For UE supporting *ssb-BurstPeriodicityAdaptation-r19*, when UE receives DCI format 2_9 that indicates a change in SSB burst periodicity of the SSB transmission, the L1-SINR measurement period requirements based on the indicated SSB burst periodicity apply from the first SSB burst after the time point as defined in TS 38.213 plus 2 ms and 3 ms for FR1 and FR2, respectively.

9.8D L1-SINR measurements for Reporting for ATG

9.8D.1 Introduction

When configured by the network, the UE shall be able to perform L1-SINR measurements with the measurement resources configured as the selection of:

- CSI-RS based CMR and no dedicated IMR configured;
- SSB based CMR and dedicated IMR configured;
- CSI-RS based CMR and dedicated IMR configured.

The measurements shall be performed for a serving cell including PCell, or SCell, on the resources configured for L1-SINR measurements within the active BWP.

The UE shall be able to measure all CSI-RS resources and/or SSB resources and/or CSI-IM resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet and/or CSI-IM-ResourceSet* within the *CSI-ResourceConfig* settings for L1-SINR for the active BWP and measure interference on corresponding NZP CSI-RS or CSI-IM resources if configured, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

9.8D.2 Requirements applicability

The requirements in clause 9.8D apply, provided:

- CMR resources configured for L1-SINR measurements are measurable, and
- NZP-IMR resources configured for L1-SINR measurements if applicable are measurable.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

For CSI-RS based CMR and no dedicated IMR configured, a CSI-RS resource configured for L1-SINR shall be considered measurable when for each relevant CSI-RS the following conditions are met:

- L1-SINR related side conditions given in clauses 10.1.27, respectively, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.8.1 for a corresponding band.

For SSB based CMR and dedicated IMR configured, a SSB and a dedicated IMR configured for L1-SINR shall be considered measurable when for each relevant SSB and IMR the following conditions are met:

- L1-SINR related side conditions given in clauses 10.1.27, respectively, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.8.2 for a corresponding band.
- NZP-IMR Ês/Iot according to Annex B.2.8.2 for a corresponding band, if NZP-IMR is configured as dedicated IMR.

For CSI-RS based CMR and dedicated IMR configured, a CSI-RS and a dedicated IMR configured for L1-SINR shall be considered measurable when for each relevant CSI-RS and IMR the following conditions are met:

- L1-SINR related side conditions given in clauses 10.1.27, respectively, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.8.3 for a corresponding band
- NZP-IMR Ês/Iot according to Annex B.2.8.3 for a corresponding band, if NZP-IMR is configured as dedicated IMR.

9.8D.3 Measurement Reporting Requirements

The UE shall send L1-SINR reports only for report configurations configured for the active BWP.

The UE shall report the L1-SINR value as a 7-bit value in the range [-23, 40] dB with 0.5 dB step size if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-SINR based reporting. The differential L1-SINR is quantized to a 4-bit value with 1 dB step size. The mapping between the reported L1-SINR value and the measured quantity is described in clause 10.1.16.

9.8D.3.1 Periodic Reporting

Reported L1-SINR measurements contained in periodic L1-SINR measurement reports shall meet the requirements in clauses 10.1.27.

The UE shall transmit the periodic L1-SINR reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.8D.3.2 Semi-Persistent Reporting

Reported L1-SINR measurements contained in a Semi-Persistent L1-SINR measurement report shall meet the requirements in clause 10.1.27. This requirement applies for semi-persistent L1-SINR reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-SINR measurement reports on PUSCH, if a DCI for triggering report has been received.

The UE shall only send semi-persistent L1-SINR measurement reports on PUCCH, if an activation command as described in clause 6.1.3.16 in TS 38.321 [7] has been received.

The UE shall transmit the semi-persistent L1-SINR reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.8D.3.3 Aperiodic Reporting

Reported L1-SINR measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-SINR reports shall meet the requirements in clauses 10.1.27.

The UE shall only send aperiodic L1-SINR measurement reports, if a DCI for triggering report has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-SINR reporting on PUSCH over the air interface at the time specified according to clause 5.2.1.4 in TS 38.214 [26].

9.8D.4 L1-SINR measurement requirements

9.8D.4.1 L1-SINR reporting with CSI-RS based CMR and no dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS configured as CMR and no dedicated resource configured as IMR for L1-SINR computation, and the UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only_ATG}$.

The value of $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only_ATG}$ is defined in table 9.8D.4.1-1 for FR1, where

For the value of M,

- For periodic and semi-persistent CSI-RS resources as CMR, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise;
- For aperiodic CSI-RS resources as CMR, M=1.

For ATG UE capable of *antennaArrayType-r18* on the measured carrier,

P value for a CSI-RS resource to be measured is defined as

- N_{total} / $N_{available}$ with $N_{available}$ > 0
- $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ with $N_{available}$ = 0
- For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CSI-RS resource occasion:
  - N_{total} is the total number of CSI-RS resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and
  - $N_{outside_MG}$ is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
  - $N_{available}$ is
    - If the measured carrier is the SCC with *servingcellMO* configured, and the network indication *neighSCellMeasSkipping* is set to ‘enable’ to UE,
      - If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier or UE support two simultaneous separate Rx beams,
        - the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W.
      - Otherwise,
        - the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements of other serving cell within the window W.
    - Otherwise,
      - If inter-band carrier aggregation within FR1 is configured, and UE not capable of *antennaArrayType-r18* on the other serving carrier or UE support two simultaneous separate Rx beams
        - the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements of same serving cell within the window W.
      - Otherwise,

- the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion nor CSI-RS resource occasions for L3 measurements within the window W.

- T_{L1} is periodicity of the target CSI-RS

- $P_{sharing\ factor} = 3$.

Otherwise, for UE with one or multiple omni-directional antenna(s)

For a UE supporting *concurrentMeasGap-r17* and when concurrent gaps are configured,

- P value for a CSI-RS resource to be measured is defined as

  - $N_{total} / N_{outside_MG}$

- For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gaps, and starting at the beginning of any CSI-RS resource occasion:

  - N_{total} is the total number of CSI-RS resource occasions within the window W, including those overlapped with measurement gap occasions or SMTC occasions within the window W, and

  - $N_{outside_MG}$ is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W

  - T_{L1} is periodicity of the target CSI-RS.

Otherwise, for a UE not supporting *concurrentMeasGap-r17* or when concurrent gaps are not configured,

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{xGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency or inter-frequency, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the CSI-RS.

Where:

- T_{CSI-RS} = the periodicity of CSI-RS configured for L1-SINR measurement

- a CSI-RS is considered to be overlapped with the GAP if it overlaps a measurement gap occasion, and

- xRP = MGRP

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Note: The overlap between CSI-RS for L1-SINR measurement and SMTC means that CSI-RS for L1-SINR measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and GAP configurations does not meet previous conditions.

Table 9.8D.4.1-1: Measurement period $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only_ATG}$ for FR1

Configuration	$T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_Only_ATG}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*$T_{CSI\text{-}RS}$)
DRX cycle ≤ 320 ms	max(T_{Report}, ceil(1.5*M*P)*max(T_{DRX},$T_{CSI\text{-}RS}$))
DRX cycle > 320 ms	ceil(M*P)*T_{DRX}
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.	

9.8D.4.2 L1-SINR reporting with SSB based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the SSB configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to SSB configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR_ATG}$.

The requirements in this clause are not applicable if NZP-CSI-RS or CSI-IM resource configured as dedicated IMR is scheduled with different periodicity as SSB configured as CMR.

The value of $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR_ATG}$ is defined in table 9.8D.4.2-1, where

For the value of M

- For periodic or semi-persistent NZP CSI-RS or CSI-IM resource as dedicated IMR, M=1 if the higher layer parameters *timeRestrictionForChannelMeasurements* and/or *timeRestrictionForInterferenceMeasurements* are configured, and M=3 otherwise;

P is defined as the maximum value between P_{CMR} and P_{IMR}, i.e., $P = \max(P_{CMR}, P_{IMR})$, where

- the value of P_{CMR} shall be derived in the same way as the value of P used for SSB based L1-RSRP measurement in clause 9.5D.4.1, in which the occasions and period of the SSB for CMR shall be used instead.
- the value of P_{IMR} shall be derived in the same way as the value of P used for CSI-RS based L1-RSRP measurement in clause 9.5D.4.2, in which the occasions and period of the NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet previous conditions.

For L1-SINR measurement with SSB as CMR and CSI-RS or CSI-IM as IMR, the requirement shall apply if the CSI-RS is configured as IMR with repetition field as “repetition = OFF” or CSI-IM is configured as IMR.

For L1-SINR measurement with SSB as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if SSB occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap

Table 9.8D.4.2-1: Measurement period $T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR_ATG}$ for FR1

Configuration	$T_{L1\text{-}SINR_Measurement_Period_SSB_CMR_IMR_ATG}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P)*\max(T_{DRX},T_{SSB}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$
NOTE 1: T_{SSB} = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR channel measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.	

9.8D.4.3 L1-SINR reporting with CSI-RS based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS resource configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to CSI-RS resource configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR_ATG}$.

The requirements in this clause are not applicable if NZP-CSI-RS or CSI-IM resource configured as dedicated IMR is scheduled with different periodicity as CSI-RS resource configured as CMR.

The value of $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR_ATG}$ is defined in table 9.8D.4.3-1, where

For the value of M,

- M=1 shall be applied if
  - aperiodic NZP-CSI-RS as CMR or dedicated IMR, or
  - aperiodic CSI-IMR as dedicated IMR, or
  - periodic and semi-persistent NZP-CSI-RS as CMR or dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured, or
  - periodic and semi-persistent CSI-IM as dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured;
- M=3 otherwise.

P is defined as the maximum value between P_{CMR} and P_{IMR}, i.e., $P = \max(P_{CMR}, P_{IMR})$, where

- The value of P_{CMR} and P_{IMR} shall be derived in the same way as the value of P used for CSI-RS based L1-RSRP measurement in clause 9.5D.4.2, in which the occasions and period of the CSI-RS for CMR and NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead respectively.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet previous conditions.

For L1-SINR measurement with CSI-RS as CMR and CSI-RS as IMR, the requirement shall apply only if CSI-RS resources as CMR and IMR are configured with the same repetition field and the number of CSI-RS resources in the resource sets for CMR and IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-IM as IMR, the requirement shall apply only if the number of CSI-RS resources in the resource set for CMR and the number of CSI-IM resources in the resource set for IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if CSI-RS occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap.

Table 9.8D.4.3-1: Measurement period $T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR_ATG}$ for FR1

Configuration	$T_{L1\text{-}SINR_Measurement_Period_CSI\text{-}RS_CMR_IMR_ATG}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{CSI\text{-}RS})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P)*\max(T_{DRX}, T_{CSI\text{-}RS}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3. NOTE 3: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.	

9.8D.5 Measurement restriction for L1-SINR measurement

The UE is required to be capable of measuring L1-SINR without measurement gaps. The UE is required to perform the SSB and CSI-RS/CSI-IM measurements with measurement restrictions as described in the following clauses.

9.8D.5.1 Measurement restriction if SSB configured for L1-SINR Measurement

For FR1, when the SSB configured as CMR for L1-SINR measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-SINR measurement without any restriction;

- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-SINR measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-SINR measurement and CSI-RS. Longer measurement period for SSB based L1-SINR measurement is expected, and no requirements are defined.

9.8D.5.2 Measurement restriction if CSI-RS configured for L1-SINR measurement

When the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to receive CSI-RS for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement is within the active BWP and has same SCS than CSI-RS configured for L1-SINR measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement is within the active BWP and has different SCS than CSI-RS configured for L1-SINR measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to perform CSI-RS measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE shall be able to measure the CSI-RS for L1-SINR measurement without any restriction.

9.8D.5.3 Measurement restriction if CSI-IM configured for L1-SINR measurement

When the CSI-IM configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to measure CSI-IM for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR1, UE shall be able to measure the CSI-IM configured for L1-SINR measurement without any restriction.

9.8D.6 Scheduling availability of UE during L1-SINR measurement

Scheduling availability restrictions when the UE is performing L1-SINR measurement are described in the following clauses.

9.8D.6.1 Scheduling availability of UE performing L1-SINR measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-SINR measurement performed on SSB and CSI-RS configured for L1-SINR measurement with the same SCS as PDSCH/PDCCH in FR1.

9.8D.6.2 Scheduling availability of UE performing L1-SINR measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-SINR measurement based on SSB configured for L1-SINR measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-SINR measurement based on SSB configured for L1-SINR measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking /CSI-RS for CQI on SSB symbols to be measured for L1-SINR measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on serving cell where L1-SINR measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-SINR measurement is performed is configured.

9.9 NR measurements for positioning

9.9.1 Introduction

This clause contains requirements for UE capable of performing NR positioning measurements defined in TS 38.215 [4], including RSTD, PRS-RSRP, UE Rx-Tx time difference, NR E-CID, PRS-RSRPP, RSCPD with RSTD, and RSCP with UE Rx-Tx time difference measurements.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.9.1.1 General Aspects of Gap-based Measurement

For gap-based RSTD, RSTD based on aggregated PRS resources from multiple PFLs, PRS-RSRP, UE Rx-Tx time difference, UE Rx-Tx time difference based on aggregated PRS resources and aggregated SRS resources from multiple PFLs, PRS-RSRPP, DL RSCPD reported with RSTD, DL RSCP reported with UE Rx-Tx time difference measurements, the requirements in clauses 9.9.2.5, 9.9.2.10, 9.9.3.5, 9.9.4.5, 9.9.4.9, 9.9.6.5, 9.9.7, and 9.9.8 apply provided:

- the UE is configured or pre-configured with measurement gaps or configured with concurrent measurement gaps
  - all positioning frequency layers are measured or associated with only one per-UE measurement gap, or
  - for the UE supporting *independentGapConfigPRS-r17*, all positioning frequency layers in the same FR are measured or associated with only one per-FR measurement gap in the corresponding FR.
- if the measurement gap is pre-configured, the gap must be activated throughout the measurement period, and
- if concurrent measurement gaps are configured, one of the gap combinations specified in clause 9.1.8.2 is configured, and
- if the UE does not support *independentGapConfigPRS-r17*, the configured or pre-configured gap used to perform the PRS measurements must be of per-UE type, and
- No active BWP switching occurs during the measurement gaps for PRS measurement.

All measurement requirements specified in clauses 9.9.2.5, 9.9.2.10, 9.9.3.5, 9.9.4.5, 9.9.4.9, 9.9.6.5, 9.9.7 and 9.9.8 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

UE is only required to measure PRS resources that are fully or partially overlapped with measurement gaps, and the requirements in clauses 9.9.2.5, 9.9.2.10, 9.9.3.5, 9.9.4.5, 9.9.4.9, 9.9.6.5, 9.9.7, and 9.9.8 are applicable to PRS resources that are fully or partially overlapped with measurement gaps.

A PRS resource is considered to be fully (partially) overlapped with measurement gaps if all (some) of its instances are overlapped with a measurement gap occasion. A PRS resource instance is considered to be overlapped with measurement gap occasion if the minimum number of unmuted repetitions of the instance taking into account *nr-DL-PRS-ExpectedRSTD-Uncertainty* and *nr-DL-PRS-ExpectedRSTD* is fully covered by the MGL excluding RF switching time, where the minimum number is given in the accuracy requirements in clause 10.1.23, 10.1.23A, 10.1.24, 10.1.25, 10.1.25A, and 10.1.38 for RSTD, RSTD based on aggregated PRS resources from multiple PFLs, PRS-RSRP, UE Rx-Tx time difference and UE Rx-Tx time difference based on aggregated PRS resources and aggregated SRS resources from multiple PFLs, PRS-RSRPP, respectively.

When UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

If a positioning measurement gap is configured via *PosGapConfig* and activated by MAC CE, the measurement requirements in clauses 9.9.2.5, 9.9.2.10, 9.9.3.5, 9.9.4.5, 9.9.4.9, 9.9.6.5, 9.9.7, and 9.9.8 apply provided that no other MGs are configured, and only one measurement gap configured via *PosGapConfig* is activated.

When UE supports *musim-GapPreference-r17* and if the configured aperiodic MUSIM gap collides with the measurement gap associated with PRS measurement, where MUSIM gap collision rule in clause 9.1.10.4 is applied, longer measurement period for the PRS measurement is expected than the requirements as defined in clauses 9.9.2.5, 9.9.2.10, 9.9.3.5, 9.9.4.5, 9.9.4.9, 9.9.6.5, 9.9.7, and 9.9.8.

9.9.1.2 General Aspects of Gapless Measurement

The requirements for RSTD, PRS-RSRP, UE Rx-Tx time difference, and PRS-RSRPP measurement without measurement gaps specified in clauses 9.9.2.7, 9.9.3.6, 9.9.4.6 and 9.9.6.6 shall apply provided that:

Positioning frequency layer to be measured is within an active BWP,

UE is configured with PPW, and the PPW for the active BWP containing the positioning frequency layer to be measured is activated,

No active BWP switching occurs during the measurement period specified in clauses 9.9.2.7, 9.9.3.6, 9.9.4.6, and 9.9.6.6,

PRS is within PPW and does not overlap with other signals/channels of higher priority,

- for PPW type 1A/1B, the PPW does not overlap with any symbol for SSB-based RLM/BFD/CBD/L1-RSRP/L1-SINR measurement on any CC or for SSB based RRM measurement on any MOs that are measured outside measurement gaps,
- for PPW type 2, PRS does not overlap with any symbol for SSB-based RLM/BFD/CBD/L1-RSRP/L1-SINR measurement on any CC or for SSB based RRM measurement on any MOs that are measured outside measurement gaps,

$\max |\Delta T| \leq THR$, where

ΔT is the time difference between the start of a slot containing PRS from the neighbor cell/TRP and the start of the closest slot from the serving cell;

the range of ΔT is determined by the expected RSTD and expected RSTD uncertainty in the assistance data;

THR is the threshold as reported in UE capability *prs-MeasurementWithoutMG-r17*.

SCS of PRS within PPW and SCS of DL active BWP are the same.

All measurement requirements specified in clauses 9.9.2.7, 9.9.3.6, 9.9.4.6 and 9.9.6.6 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

The UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

The UE is only required to measure PRS resources that are unmuted and fully or partially overlapped with PPW, and the requirements in clauses 9.9.2.7, 9.9.3.6, 9.9.4.6 and 9.9.6.6 are applicable to PRS resources that are unmuted and fully or partially overlapped with PPW.

A PRS resource is considered to be fully (partially) overlapped with PPW if all (some) of its instances are overlapped with a PPW occasion. A PRS resource instance is considered to be overlapped with PPW occasion if the minimum number of unmuted repetitions of the instance taking into account Rx time difference between serving and non-serving cell is fully covered by the PPW , where the minimum number is given in the accuracy requirements in clause 10.1.23, 10.1.24, 10.1.25 and 10.1.38 for RSTD, PRS-RSRP, UE Rx-Tx time difference and PRS-RSRPP, respectively.

When UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

When UE supports *MUSIM-GapConfig-17* and the PPW occasion of the target positioning frequency layer is overlapping with the configured aperiodic MUSIM gap, longer period for the PRS measurement is expected than the requirements as defined in clause 9.9.2.7, 9.9.3.6, 9.9.4.6 and 9.9.6.6.

9.9.1.3 Scheduling Availability of UE during PRS Measurement without Measurement Gaps

The requirements in this clause apply for UE performing RSTD, PRS-RSRP, UE Rx-Tx time difference and PRS-RSRPP measurement without measurement gaps.

If *prs-ProcessingWindowType1A-r17* UE capable of supporting priority options 1, 2 and 3 is configured with a *type1A* PRS processing window with priority value '*st1*' for PRS measurement, then UE is not expected to receive PDCCH/PDSCH/CSI-RS from any serving cell on all symbols within PRS processing window.

If *prs-ProcessingWindowType1A-r17* UE capable of supporting priority option 2 is configured with a *type1A* PRS processing window with priority value '*st2*' for PRS measurement, then UE is not expected to receive PDSCH/CSI-RS from any serving cell on all symbols within PRS processing window but shall receive PDCCH and URLLC PDSCH within PRS processing window.

If *prs-ProcessingWindowType1B-r17* UE capable of supporting priority options 1, 2 and 3 is configured with a *type1B* PRS processing window with priority value '*st1*' for PRS measurement, then UE is not expected to receive PDCCH/PDSCH/CSI-RS from serving cells in the same band as DL PRS on all symbols within PRS processing window.

If *prs-ProcessingWindowType1B-r17* UE capable of supporting priority option 2 is configured with a *type1B* PRS processing window with priority value '*st2*' for PRS measurement, then UE is not expected to receive PDSCH/CSI-RS from a certain band but shall receive PDCCH and URLLC PDSCH from serving cells in the same band as DL PRS on all symbols within PRS processing window.

If *prs-ProcessingWindowType2-r17* UE capable of supporting priority options 1, 2 and 3 is configured with a *type2* PRS processing window with priority value '*st1*' for PRS measurement, then the UE is not expected to receive PDCCH/PDSCH/CSI-RS from the serving cell containing DL PRS in case of FR1 or from serving cells in the same band as DL PRSi n case of FR2 on the symbols overlapped with DL PRS within PRS processing window.

If *prs-ProcessingWindowType2-r17* UE capable of supporting priority option 2 is configured with a *type2* PRS processing window with priority value '*st2*' for PRS measurement, then UE is not expected to receive PDSCH/CSI-RS on the symbols overlapped with DL PRS within PRS processing window but shall receive PDCCH and URLLC PDSCH from the serving cell containing DL PRS in case of FR1 or from serving cells in the same band as DL PRSi n case of FR2 on the symbols overlapped with DL PRS within PRS processing window.

When PRS is lower priority than the DL signals/channels the following applies when UEs have an activated PRS processing window with *type1A* or *type1B*:

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW no later than N_2 symbols, defined in clause 6.4 of TS 38.214 [26] for the subcarrier spacing μ of the DL PRS, before the start of the PPW, UE expects to receive the DL signals/channels and drop all DL PRS in the PPW.

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW later than N_2 symbols, defined in clause 6.4 of TS 38.214 [26] for the subcarrier spacing μ of the DL PRS, before the start of the PPW, UE is not required to receive the other DL signals/channels except SSB of higher priority and may receive the DL PRS in the PPW.

When PRS is lower priority than the DL signals/channels the following applies when UEs have an activated PRS processing window with *type2*:

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol no later than N_2 symbols, defined in clause 6.4 of TS 38.214 [26] for the subcarrier spacing μ of the DL PRS, before the PRS symbol, UE expects to receive the DL signals/channels and drop the PRS symbol.

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol later than N_2 symbols, defined in clause 6.4 of TS 38.214 [26] for the subcarrier spacing μ of the DL PRS, before the PRS symbol, UE is not required to receive the other DL signals/channels except SSB of higher priority and may receive the PRS symbol.

For inter-band case for FR2 for the DL signals/channels from a different FR2 band than the FR2 band of the DL PRS, if the same Rx beam is used for both FR2 bands and the DL PRS is determined to be higher priority, UEs are not expected to receive the DL signals/channels if they are expected to measurement the DL PRS in a configured DL PRS processing window with *type1B* or *type2*.

9.9.2 RSTD measurements

9.9.2.1 Introduction

The requirements in clause 9.9.2 shall apply provided the UE has received *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report DL RSTD measurements defined in TS 38.215 [4].

9.9.2.2 Requirements Applicability

The requirements in clause 9.9.2 apply for periodic and triggered RSTD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23 for FR1 and FR2 are fulfilled, for a corresponding band.

9.9.2.3 Measurement Capability

UE PRS RSTD measurement capability is as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355[34].

9.9.2.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The reported RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.1.23.3.

The RSTD measurements performed and reported according to this clause shall meet the RSTD measurement accuracy requirements in clause 10.1.23, for each measured DL PRS resource.

9.9.2.4.1 Void

9.9.2.4.2 Void

9.9.2.4.3 Void

9.9.2.5 Measurements Period Requirements

When physical layer receives last of *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE

capability specified in clause 9.9.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined as:

$$T_{RSTD,Total} = \sum_{i=1}^{L} T_{RSTD,i} + (L-1) * \max(T_{effect,i})$$

Where ,

i is the index of positioning frequency layer,

L is total number of positioning frequency layers, and

$T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i

$T_{RSTD,i}$ is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

$$T_{RSTD,i} = \left(k_{multiTEG,i} * CSSF_{PRS,i} * \text{ceil}(K_{p,PRS,i}) * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last,i},$$

where:

$N_{RxBeam,i}$ is the UE Rx beam sweeping factor. In FR1, $N_{RxBeam,i}$ = 1;

and in FR2, $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$CSSF_{PRS,i}$ is the carrier-specific scaling factor for NR PRS-based positioning measurements in positioning frequency layer i as defined in clause 9.1.5.2.

$k_{multiTEG,i}$ is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

$k_{multiTEG,i}$=1 if UE is not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*;

otherwise,

$k_{multiTEG,i}$ =$N_{TEG,i}$, if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

$k_{multiTEG,i}$ =$\left\lceil \frac{N_{TEG,i}}{k_{TEG,simul,i}} \right\rceil$ if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

$N_{TEG,i}$ is the number of Rx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*, and in case ‘n0’ is indicated, $N_{TEG,i}$ is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

$k_{TEG,simul,i}$ is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

$K_{p,PRS,i}$ is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as $K_{p,PRS,i} = N_{total} / N_{available}$ for UE configured with concurrent measurement gap or MUSIM gap or both concurrent measurement gap and MUSIM gap. $K_{p,PRS,i}$ = 1 for UE not configured with concurrent measurement gap and not configured with MUSIM gaps.

- For a window W of duration max($T_{PRS,i}$, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer and periodic MUSIM gaps, and starting at the beginning of any associated gap occasions covering the PRS occasion:

- N_{total} is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

- $N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG and MUSIM gaps collisions by applying the selected gap collision rule

- Requirements do not apply if $N_{available}$ =0.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

$L_{available_PRS,i}$ is the time duration of available PRS in the positioning frequency layer i to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only the PRS resources unmuted and fully or partially overlapped with MG are considered.

N_{sample} is the number of PRS RSTD measurement samples, where

- N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

  - PRS bandwidth is within the active BWP and

  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.

- N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

  - PRS bandwidth is within the active BWP and

  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.

- N_{sample} = 4 otherwise.

$T_{last,i}$ is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the

sampling time and processing time. If all of the PRS resources to be measured are available in the same MG occasion during $T_{availabe}$, $T_{last,i} = T_i$ +MGL. Otherwise, $T_{last,i} = T_i + T_{available_PRS,i}$,

$T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$$

Where,

T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

$T_{available_PRS,i} = LCM(T_{PRS,i}, MGRP_i)$, the least common multiple between $T_{PRS,i}$ and $MGRP_i$.

$MGRP_i$ is the repetition periodicity of the measurement gap applicable for measurement in the PRS frequency layer i.

$T_{PRS,i}$ is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the positioning frequency layer is used to derive $T_{PRS,i}$, where,

$T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource,

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where

T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$ which is given by the higher-layer parameter *NR-MutingPattern-r16* included in *DL-PRS-MutingOption1-r16*.

- Note: For the purpose of calculating $T_{PRS,i}$, only the PRS resources fully or partially covered by the MG are considered.

$\{N, T\}$ is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34].

N' is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

Except for deferred MT-LR as defined in clause 4.1a.5 TS 23.273 [44], the time $T_{RSTD,Total}$ starts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34].

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{RSTD,Total}$ starts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 TS 23.273 [44], the UE shall perform the RSTD measurement in each reporting period and activate the location report at the time when the periodic timer expires.

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the measurement period defined in clause 9.9.2.5.

When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the measurement period defined in clause 9.9.2.5.

If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{RSTD,Total}$ within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The RSTD measurement period can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.

9.9.2.6 Void

9.9.2.7 Measurements Period Requirements without Measurement Gaps

When physical layer receives last of *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined as:

$T_{RSTD,Total} = \sum_{i=1}^{L} T_{RSTD_wo_gap,i} + (L-1) * \max(T_{effect,i})$, if any of the positioning frequency layers are in Case 1, or

$T_{RSTD,Total} = \max(T_{RSTD_wo_gap,i} + T_{uncertainty,i})$, if all the positioning frequency layers are in Case 2,

Where,

i is the index of positioning frequency layer, and

L is total number of positioning frequency layers, and

$T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i, and

$T_{uncertainty,i}$ is the time from the start of the first PPW occasion for positioning frequency layer i to the start of measurement period $T_{RSTD,Total}$.

A positioning frequency layer is in Case 1 if UE reports *ppw-durationOfPRS-Processing1-r17* for the band containing the positioning frequency layer, and a positioning frequency layer is in Case 2 if UE reports *ppw-durationOfPRS-Processing2-r17* for the band containing the positioning frequency layer.

$T_{RSTD_wo_gap,i}$ is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below.

$$T_{RSTD_wo_gap,i} = \left(k_{multiTEG,i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last,i},$$

where:

$N_{RxBeam,i}$ is the UE Rx beam sweeping factor. In FR1, $N_{RxBeam,i}$ = 1; and in FR2, $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$k_{multiTEG,i}$ is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

$k_{multiTEG,i}$=1 if UE is not supported *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*;

otherwise,

$k_{multiTEG,i}$ =$N_{TEG,i}$, if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

$k_{multiTEG,i}$ =$\left\lceil \frac{N_{TEG,i}}{k_{TEG,simul,i}} \right\rceil$ if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

$N_{TEG,i}$ is the number of Rx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*, and in case ‘n0’ is indicated, $N_{TEG,i}$ is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

$k_{TEG,simul,i}$ is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

$L_{available_PRS,\mathrm{i}}$ is the time duration of available PRS in the positioning frequency layer i to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,\mathrm{i}}$,

only the PRS resources unmuted and fully or partially overlapped with PPW are considered, if positioning frequency layer i is in Case 1, or

only the PRS resources unmuted and fully or partially overlapped with the first (PPWL-T2) ms of PPW are considered, if positioning frequency layer i is in Case 2, where PPWL is the PPW length and T2 corresponds to *ppw-durationOfPRS-ProcessingSymbolsT2*.

N_{sample} is the number of PRS RSTD measurement samples, where

- N_{sample}= 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample}=2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
  - PRS bandwidth is within the active BWP and
- Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample}=4 otherwise.

$T_{last,i}$ is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time.

If positioning frequency layer *i* is in Case 1 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,\mathrm{i}} = T_{\mathrm{i}}$ +PPWL, else

if positioning frequency layer *i* is in Case 2 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,\mathrm{i}}$ = PPWL;

otherwise, $T_{last,\mathrm{i}} = T_{\mathrm{i}} + T_{available_PRS,\mathrm{i}}$.

$T_{\mathrm{effect},i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$$

Where,

T_i corresponds to *ppw-durationOfPRS-ProcessingSymbolsT* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponds to the sum of *ppw-durationOfPRS-ProcessingSymbolsT2* and *ppw*-durationOfPRS-*ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

$T_{available_PRS,\mathrm{i}} = LCM(T_{PRS,\mathrm{i}}, PPWRP_{\mathrm{i}})$, the least common multiple between $T_{PRS,\mathrm{i}}$ and $PPWRP_{\mathrm{i}}$.

$PPWRP_{\mathrm{i}}$ is the repetition periodicity of the PRS processing window applicable for measurements in the positioning frequency layer *i*.

$T_{PRS,i}$ is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the positioning frequency layer is used to derive $T_{PRS,i}$, where,

$T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource,

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*,

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

NOTE: For the purpose of calculating $T_{PRS,i}$, only the PRS resources that meet the conditions for PRS measurement outside measurement gaps as defined in clause 9.9.1.2 are considered.

N is a duration of DL PRS symbols in ms corresponding to *ppw-durationOfPRS-ProcessingSymbolsN* in TS 37.355 [34] if positioning frequency layer i is in Case 1, or corresponding to *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer i is in Case 2.

N' is UE capability for number of DL PRS resources that it can process in a slot as indicated by *ppw-maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

The time $T_{RSTD_wo_gap,i}$ starts from the first instance of the activated PPW for measurement of positioning frequency layer *i* aligned with a DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation*message are delivered from LMF to the physical layer of UE via LPP [34].

When PRS-RSRP is configured for DL-TDOA, RSTD and RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and RSRPP are performed over the same measurement period.

If during the measurement period of one or more positioning frequency layers, the PPW is re-configured or reactivated, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{RSTD_wo_gap,i}$ within PPW due to collisions with other signals; otherwise, the measurement period can be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The RSTD measurement period can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.

If any positioning frequency layer is in Case 2, the requirements in this clause apply provided that the PPWL corresponding to the positioning frequency layer is larger than (T2+X) ms.

The requirements in this clause apply provided that a single positioning frequency layer is configured for measurement in each PPW.

9.9.2.8 Void

9.9.2.9 Measurements Period Requirements with both MG and PPW

If the UE is configured with both MG applicable to positioning measurement and PPW, the UE shall measure positioning frequency layer *i* within

- MG, if PRS resources on positioning frequency layer *i* are overlapped with MG, or
- PPW, if PRS resources on positioning frequency layer *i* are overlapped with PPW.

The measurement period $T_{RSTD,Total}$ is defined as:

$$T_{RSTD,Total} = T_{RSTD,Total,MG} + T_{RSTD,Total,PPW} + T_{guard},$$

Where

- $T_{RSTD,Total,MG}$ is defined in clause 9.9.2.5 and includes all positioning frequency layers to be measured within MG,
- $T_{RSTD,Total,PPW}$ is defined in clause 9.9.2.7 and includes all positioning frequency layers to be measured within PPW,
- T_{guard} is the maximum T_{effect} defined in clauses 9.9.2.5 and 9.9.2.7 among all PFLs.

The requirements apply provided the following conditions are satisfied:

- MGs and PPWs do not overlap in time;
- Each PFL in the assistance data can be measured completely (all PRS resources) either within MG or within activated PPW.

9.9.2.10 Measurements Period Requirements with Bandwidth Aggregation

When UE physical layer receives last of *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34] with a request to perform measurement by aggregating PRS resources from multiple PFLs via *nr-DL-PRS-JointMeasurementRequestedPFL-List*, the UE shall be able to perform RSTD measurement by aggregating PRS resources from multiple PFLs (up to the UE capability specified in clause 9.9.2.3) defined in TS 38.215 [4], during the measurement period $T_{RSTD_aggregate,\ Total}$ defined as:

$$T_{RSTD_aggregate,\ Total} = T_{non_aggregate_RSTD} + T_{aggregate_RSTD} + T_{margin},$$

where,

$T_{non_aggregate_RSTD}$ is the total measurement period for RSTD measurement on PFLs that do not contain PRS resources for aggregation.

Calculation of $T_{non_aggregate_RSTD}$ is based on clause 9.9.2.5 with the following exceptions,

- only PFLs containing resource set(s) not linked to any other resource set(s) are considered in *L*
- on each PFL i, only resource set(s) not linked to any other resource set(s) are considered in $T_{available_PRS,i}$, $N_{PRS,i}^{slot}$ and $L_{available_PRS,i}$
- N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,
- $(L-1) * \max(T_{effect,i})$ is replace by $(L-1) * T'_{margin}$.

$T_{non_aggregate_RSTD}$ is equal to zero if UE is not configured to perform non-aggregated measurements by the LMF.

If UE is configured to perform positioning measurements on PFLs that contain PRS resources for aggregation and on PFLs that do not contain PRS resources for aggregation, $T_{margin} = T'_{margin}$ is delay margin to account for

delay between RSTD measurement performed by UE on PFLs that contain PRS resources for aggregation and RSTD measurement performed by UE on PFLs that do not contain PRS resources for aggregation.

If UE is only configured to perform measurements on PFLs that contain PRS resources for aggregation or if UE is only configured to perform measurements on PFLs that do not contain PRS resources for aggregation, then $T_{margin} = 0$.

$T'_{margin} = \max(Teffect, i)$, when both aggregated PFLs and non-aggregated PFLs are configured for positioning measurement.

If UE is capable of performing latency reduced positioning measurements and is configured to perform latency reduced positioning measurement by LMF via *reducedDL-PRS-ProcessingSamples-r17* [34], then $N_{sample} = 2$ shall be considered in calculations of $T_{aggregate_RSTD}$ and $T_{non\text{-}aggregate_RSTD}$.

If UE is not capable to perform latency reduced positioning measurements or is not configured to perform latency reduced positioning measurement by LMF via *reducedDL-PRS-ProcessingSamples-r17* [34], then $N_{sample} = 4$ shall be considered in calculations of $T_{aggregate_RSTD}$ and $T_{non\text{-}aggregate_RSTD}$.

$T_{aggregate_RSTD}$, total measurement period for RSTD measurements performed by UE by aggregating PRS resources from multiple PFLs as defined in TS 38.214 [26], is defined as:

$$T_{aggregate_RSTD} = \sum_{i=1}^{G} T_{RSTD_aggregate,i} + (G-1) * T'_{margin},$$

where

i is the index of effective PFL, corresponding to the group of PFLs containing linked PRS resource sets to be aggregated for RSTD measurement,

G denotes the number of effective PFLs that UE is configured to perform aggregated measurements on. G is configured by LMF and is provisioned to UE via *nr-DL-PRS-AggregationInfo*.

$T_{RSTD_aggregate,i}$ is the measurement period for PRS RSTD measurement in the effective PFL *i* as specified below:

$$T_{RSTD_aggregate,i} = \left(k_{multiTEG_agg,i} \times CSSF_{PRS_agg,i} \times ceil(K_{p,PRS_agg,i}) \times N_{RxBeam,i} \times \left\lceil \frac{N^{slot}_{PRS_agg,i}}{N'_{agg}} \right\rceil \left\lceil \frac{L_{available_PRS_agg,i}}{N_{agg}} \right\rceil \times N_{sample_agg} - 1\right) \times T_{effect_agg,i} + T_{last_agg,i},$$

where:

$N_{RxBeam,i}$ is the UE Rx beam sweeping factor.

In FR1, $N_{RxBeam,i} = 1$.

In FR2, $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing effective PFL i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$CSSF_{PRS_agg,i}$ is the carrier-specific scaling factor for NR PRS-based positioning measurements in effective PFL i as defined in clause 9.1.5.2.

$k_{multiTEG_agg,i}$ is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

$k_{multiTEG_agg,i} = 1$ if UE is not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*;

Otherwise,

$k_{multiTEG_agg,i} = N_{TEG,i}$, if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

$k_{multiTEG_{agg,i}}=\left\lceil \frac{N_{TEG,i}}{k_{TEG,simul,i}} \right\rceil$ if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

$N_{TEG,i}$ is the number of Rx TEGs with which UE is requested to measure aggregated PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*, and in case 'n0' is indicated, $N_{TEG,i}$ is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

$k_{TEG,simul,i}$ is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

$K_{p,PRS_agg,i}$ is a scaling factor for effective PFL i to be measured within the associated measurement gap pattern, which is defined as $K_{p,PRS_agg,i} = N_{total} / N_{available}$ for UE configured with concurrent measurement gap, and $K_{p,PRS_agg,i} = 1$ for UE not configured with concurrent measurement gap.

For a window W of duration max($T_{PRS_agg,i}$, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the effective PFL, and starting at the beginning of any associated gap occasions covering the PRS occasion:

- N_{total} is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and
- $N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule
- Requirements do not apply if $N_{available} = 0$.

$N^{slot}_{PRS_agg,i}$ is the maximum number of DL PRS resources in effective PFL i configured in a slot.

$L_{available_PRS_agg,i}$ is the time duration of available PRS in the effective PFL i to be measured during $T_{available_PRS_agg,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS_agg,i}$, only the PRS resources unmuted and fully or partially overlapped with MG and satisfying the conditions for PRS BW aggregation are considered.

N_{sample_agg} is the number of PRS RSTD measurement samples.

$T_{last_agg,i}$ is the measurement duration for the last PRS RSTD sample in the effective PFL i, including the sampling time and processing time. If all of the PRS resources to be measured are available in the same MG occasion during $T_{availabe_agg}$, $T_{last_agg,i} = T_{agg,i} + MGL$. Otherwise, $T_{last_agg,i} = T_{agg,i} + T_{available_PRS_agg,i}$,

$T_{effect_agg,i}$ is the periodicity of the PRS RSTD measurement in the effective PFL i defined as:

$$T_{effect_agg,i} = \left\lceil \frac{T_{agg,i}}{T_{available_PRS_agg,i}} \right\rceil \times T_{available_PRS_agg,i}$$

where,

$T_{available_PRS_agg,i} = LCM(T_{PRS_agg,i}, MGRP_i)$, the least common multiple between $T_{PRS_agg,i}$ and $MGRP_i$. $MGRP_i$ is the repetition periodicity of the measurement gap applicable for measurement in the effective PFL i.

$T_{PRS_agg,i}$ is the periodicity of DL PRS resources meeting the bandwidth aggregation conditions with muting on effective PFL i. If more than one PRS periodicities are configured in effective PFL i, the least common multiple of PRS periodicities $T^{PRS\ with\ muting}_{per_agg}$ among all DL PRS resource sets in the effective PFL is used to derive $T_{PRS_agg,i}$, where,

$T^{PRS\ with\ muting}_{per_agg} = N_{muting} \times T^{PRS}_{per_agg}$, is the PRS periodicity with muting per PRS resource configured for aggregation,

$T^{PRS}_{per_agg}$ is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS_agg} \times L_{muting}$, where $T_{muting}^{PRS_agg}$ is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

- Note: For the purpose of calculating $T_{PRS_agg,i}$, only the PRS resources fully or partially covered by the MG and PRS resources that satisfy the conditions for PRS BW aggregation are considered.

$\{N_{agg}, T_{agg,i}\}$ is UE capability combination per band to aggregate PRS resources from multiple PFLs within an effective PFL where N_{agg} is a duration of DL PRS symbols in ms corresponding to *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r18* in TS 37.355 [34] processed every $T_{agg,i}$ ms corresponding to *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *maximumOfTwoAggregatedDL-PRS-Bandwidth* or *maximumOfThreeAggregatedDL-PRS-Bandwidth* in TS 37.355 [34]

N'_{agg} is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18* for FR1 and *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18* for FR2 specified in TS 37.355 [34].

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements satisfy all the conditions specified in clause 5.1.6.5.3 in TS 38.214 [26].

Except for deferred MT-LR as defined in clause 4.1a.5 TS 23.273 [44], the time $T_{RSTD_aggregate,Total}$ starts from the first MG instance aligned with DL PRS resources in the assistance data for aggregation after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34] including a request to perform measurement by aggregating PRS resources from multiple PFLs via *nr-DL-PRS-JointMeasurementRequestedPFL-List*.

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{RSTD_aggregate,Total}$ starts from the first MG instance aligned with DL PRS resources in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 TS 23.27] [44], the UE shall perform the aggregated RSTD measurement in each reporting period and activate the location report at the time when the periodic timer expires.

When PRS-RSRP is also reported by UE together with RSTD measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRP are performed over the measurement period defined in clause 9.9.2.10.

When PRS-RSRPP is also reported by UE together with RSTD measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRPP are performed over the measurement period defined in clause 9.9.2.10.

If during the measurement period of one or more effective PFLs, the MG pattern is reconfigured, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{RSTD_aggregate,Total}$ within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for aggregated PRS resources, if the PRS resources to be aggregated are across two sampling duration of N_{agg} within duration $L_{available_PRS_agg,i}$.

The measurement requirements do not apply, if time span of the instance of the PRS resources to be aggregated (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N_{agg}.

The requirements in clause 9.9.2.10 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which aggregated PRS resources are measured, subject to UE measurement capabilities.

If handover occurs while aggregated RSTD measurements are being performed, then the UE shall continue and complete the on-going aggregated RSTD measurements. The aggregated RSTD measurement period can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23A.2.

9.9.3 PRS-RSRP measurements

9.9.3.1 Introduction

The requirements in clause 9.9.3.5 shall apply provided the UE has received a message from LMF via LPP [34] requesting the UE to measure and report PRS-RSRP measurements defined in TS 38.215 [4].

9.9.3.2 Requirements applicability

The requirements in clause 9.9.3 apply for periodic and triggered PRS-RSRP measurements, provided:

- PRS-RSRP related side conditions given in clause 10.1.24 are met for a corresponding band.

9.9.3.3 Measurement Capability

UE PRS-RSRP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

9.9.3.4 Measurement Reporting Requirements

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The reported PRS-RSRP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.1.24.3.

The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requriements specified in the clauses 10.1.24.

9.9.3.5 Measurement Period Requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within $T_{PRS-RSRP,total}$ ms.

$$T_{PRS-RSRP,\,total} = \sum_{i=1}^{L} T_{PRS-RSRP,i} + (L-1) * \max\left(T_{effect,i}\right)$$

where

i is the index of positioning frequency layer,

L is total number of positioning frequency layers,

$T_{effect,i}$ is the periodicity of the PRS-RSRP measurement in positioning frequency layer *i*.

$$T_{PRS-RSRP,i} = \left(CSSF_i * ceil(K_{p,PRS,i}) * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last}$$

where

$CSSF_i$ is the carrier specific scaling factor for PRS-RSRP measurements specified in clause 9.1.5.2,

$K_{p,PRS,i}$ is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as $K_{p,PRS,i} = N_{total} / N_{available}$ for UE configured with concurrent measurement gap or MUSIM gap or both concurrent measurement gap and MUSIM gap. $K_{p,PRS,i} = 1$ for UE not configured with concurrent measurement gap and not configured with MUSIM gaps.

For a window W of duration max($T_{PRS,i}$, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioining frequency layer and periodic MUSIM gaps, and starting at the beginning of any associated gap occasions covering the PRS occasion:

N_{total} is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

$N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG and MUSIM gaps collisions by applying the selected gap collision rule

Requirements do not apply if $N_{available}$ =0.

$N_{RxBeam,i}$ is the scaling factor for Rx beam sweeping, and $N_{RxBeam,i}$=1 if positioning frequency layer *i* is in FR1 and if positioning frequency layer *i* is in FR2, $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$L_{available_PRS,i}$ is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only the PRS resources unmuted and fully or partially overlapped with MG are considered.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

{N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

N' is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot* in clause 6.4.3 of TS 37.355 [34],

N_{sample} is the number of PRS-RSRP measurement samples, where

- N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 4 otherwise.

$T_{last,i} = T_i + T_{available_PRS,i}$ is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time, if not all PRS resources to be measured are available in the same measurement gap occasion during $T_{available_PRS,i}$, otherwise $T_{last,i} = T_i + MGL$,

$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$ is the periodicity of PRS-RSRP measurement in positioning frequency layer i,

T_i corresponds to durationOfPRS-ProcessingSymbolsInEveryTms in TS 37.355 [34],

$T_{available_PRS,i} = LCM(T_{PRS,i}, MGRP_i)$ is the least common multiple between $T_{PRS,i}$ and $MGRP_i$,

$T_{PRS,i}$ is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,

$MGRP_i$ is the measurement gap repetition period in positioning frequency layer i.

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among the DL PRS resource sets is used to derive $T_{PRS,i}$, where:

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$ which is given by the higher-layer parameter *NR-MutingPattern-r16* included in *DL-PRS-MutingOption1-r16*.

Note: For the purpose of calculating $T_{PRS,i}$, only the PRS resources fully or partially covered by the MG are considered.

When PRS-RSRP measurements are configured for DL-AoD, except for deferred MT-LR as defined in clause 4.1a.5 TS 23.273 [44], the time $T_{PRS-RSRP,total}$ starts from the first MG instance aligned with DL PRS resources in the assistance data after both the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{PRS-RSRP,total}$ starts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 TS 23.273 [44], the UE shall perform the PRS-RSRP measurement in each reporting period and activate the location report at the time when the periodic timer expires.

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 9.9.2.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement then the PRS-RSRP measurement shall meet the UE Rx-Tx time difference measurement requirements defined in clause 9.9.4.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource:

– if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or

– if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured either per UE request or not per UE request, the measurement period can be longer.

The requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{PRS-RSRP,total}$ within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

The requirements in clause 9.9.3 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If handover occurs while PRS-RSRP measurements are being performed then the UE shall complete the ongoing PRS-RSRP measurements session. The PRS-RSRP measurement period can be longer. The UE shall meet the PRS-RSRP measurement accuracy requirements in clause 10.1.24.

9.9.3.6 Measurement Period Requirements without Measurement Gaps

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.3.3) PRS-RSRP measurements as defined in TS 38.215 [4] without measurement gap, on configured positioning frequency layer *i*, within $T_{PRS-RSRP,total}$ ms.

$T_{PRS-RSRP,\ total} = \sum_{i=1}^{L} T_{PRS-RSRP,i} + (L-1) * \max(T_{effect,i})$ if any of the positioning frequency layers are in Case 1, or

$T_{PRS-RSRP,\ total} = \max(T_{PRS-RSRP,i} + T_{uncertainty,i})$, if all the positioning frequency layers are in Case 2,

Where,

i is the index of positioning frequency layer, and

L is total number of positioning frequency layers, and

$T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i, and

$T_{uncertainty,i}$ is the time from the start of the first PPW occasion for positioning frequency layer i to the start of measurement period $T_{PRS-RSRP,\ total}$.

A positioning frequency layer is in Case 1 if UE reports *ppw-durationOfPRS-Processing1-r17* for the band containing the positioning frequency layer, and a positioning frequency layer is in Case 2 if UE reports *ppw-durationOfPRS-Processing2-r17* for the band containing the positioning frequency layer.

$T_{PRS-RSRP,i}$ is the measurement period for PRS-RSRP measurement in positioning frequency layer *i* as specified below.

$$T_{PRS-RSRP,i} = \left(N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last}$$

where

$T_{effect,i}$ is the periodicity of the PRS-RSRP measurement in positioning frequency layer *i*.

$N_{RxBeam,i}$ is the scaling factor for Rx beam sweeping, and $N_{RxBeam,i}$=1 if positioning frequency layer *i* is in FR1. If positioning frequency layer *i* is in FR2, $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$L_{available_PRS,i}$ is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$,

only unmuted PRS resource instances that meet the applicability conditions and fully or partially overlapped with PRS processing window are considered, if positioning frequency layer i is in Case 1, or

only the PRS resources unmuted and fully or partially overlapped with the first (PPWL-T2) ms of PPW are considered, if positioning frequency layer i is in Case 2, where PPWL is the PPW length and T2 corresponds to *ppw-durationOfPRS-ProcessingSymbolsT2*.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

{N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *ppw-durationOfPRS-ProcessingSymbolsN* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponding to *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

N′ is UE capability for number of DL PRS resources that it can process in a slot as indicated by *ppw-maxNumOfDL-PRS-ResProcessedPerSlot* in clause 6.4.3 of TS 37.355 [34],

N_{sample} is the number of PRS RSRP measurement samples, where

- N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 4 otherwise.

T_{last} is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time.

If positioning frequency layer *i* is in Case 1 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i} = T_i$ +PPWL, else

if positioning frequency layer *i* is in Case 2 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i}$ = PPWL;

otherwise, $T_{last,i} = T_i + T_{available_PRS,i}$.

$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$ is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,

T_i corresponds to *ppw-durationOfPRS-ProcessingSymbolsT* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponds to the sum of *ppw-durationOfPRS-ProcessingSymbolsT2* and *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2

$T_{available_PRS,i} = LCM(T_{PRS,i}, PPWRP_i)$ is the least common multiple between $T_{PRS,i}$ and $PPWRP_i$,

$T_{PRS,i}$ is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,

$PPWRP_i$ is the PRS processing window repetition period in positioning frequency layer i.

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among the DL PRS resource sets is used to derive $T_{PRS,i}$, where:

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. If bitmap $\{b^1\}$ for higher-layer parameter *DL-*
N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

NOTE: For the purpose of calculating $T_{PRS,i}$, only the PRS resources that meet the applicability conditions and fully or partially covered by the PRS processing window are considered.

When PRS-RSRP measurements are configured for DL-AoD, the time $T_{PRS-RSRP,i}$ starts from the first PRS processing window instance aligned with DL PRS resources in the assistance data after both the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 9.9.2.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement then the PRS-RSRP measurement shall meet the UE Rx-Tx time difference measurement requirements defined in clause 9.9.4.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource:

if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or

if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9.3 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If during the measurement period of one or more positioning frequency layers, the PPW is reconfigured or reactivated, the PRS-RSRP measurement period can be longer.

If any positioning frequency layer is in Case 2, the requirements in this clause apply provided that the PPWL corresponding to the positioning frequency layer is larger than (T2+X) ms.

The requirements in this clause apply provided that a single positioning frequency layer is configured for measurement in each PPW.

9.9.3.7 Void

9.9.3.8 Measurements Period Requirements with both MG and PPW

If the UE is configured with both MG applicable to positioning measurement and PPW, the UE shall measure positioning frequency layer *i* within

- MG, if PRS resources on positioning frequency layer *i* are overlapped with MG, or
- PPW, if PRS resources on positioning frequency layer *i* are overlapped with PPW.

The measurement period $T_{PRS-RSRP,\ total}$ is defined as:

$$T_{PRS-RSRP,\ total} = T_{PRS-RSRP,Total,MG} + T_{PRS-RSRP,Total,PPW} + T_{guard},$$

Where

- $T_{PRS-RSRP,Total,MG}$ is defined in clause 9.9.3.5 and includes all positioning frequency layers to be measured within MG,

- $T_{PRS-RSRP,Total,PPW}$ is defined in clause 9.9.3.6 and includes all positioning frequency layers to be measured within PPW,

- T_{guard} is the maximum T_{effect} defined in clauses 9.9.3.5 and 9.9.3.6 among all PFLs.

The requirements apply provided the following conditions are satisfied:

- MGs and PPWs do not overlap in time;

- Each PFL in the assistance data can be measured completely (all PRS resources) either within MG or within activated PPW.

9.9.4 UE Rx-Tx time difference measurements

9.9.4.1 Introduction

The requirements in this clause shall apply, provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4].

9.9.4.2 Requirements Applicability

The requirements in clause 9.9.4 apply for periodic and triggered UE Rx-Tx time difference measurements, provided:

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25 are met for a corresponding band.

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25A are met for PRS aggregation from multiple PFLs.

- SRS is configured on at least one of the PCell, PSCell and SCell.

- The UE transmits SRS within the range from -160 ms to 160 ms of at least one DL PRS resource of each of the TRPs in the assistance data.

9.9.4.3 Measurement Capability

UE Rx-Tx time difference measurement capability is as indicated by the UE in *NR-Multi-RTT-ProvideCapabilities,* according to TS 37.355 [34].

9.9.4.4 Measurement Reporting Requirements

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The UE Rx-Tx time difference measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.25.

The UE Rx-Tx time difference measurement accuracy for all measured DL PRS resources shall be fulfilled according to the accuracy requirements specified in clause 10.1.25.

9.9.4.5 Measurement Period Requirements

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34], UE shall be able to measure multiple (up to the UE

capability specified in clause 9.9.4.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] in configured positioning frequency layers within the measurement period $T_{UERxTx,Total}$ ms.

$$T_{UERxTx,\ Total} = \sum_{i=1}^{L} T_{UERxTx,i} + (L-1) * \max(T_{effect,i}).$$

where i is the index of positioning frequency layer,

$T_{UERxTx,i}$ is the measurement period for UE Rx-Tx time difference measurements in positioning frequency layer i as further defined in this clause,

L is total number of positioning frequency layers, and

$T_{effect,i}$ is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer i as defined further in this clause.

$$T_{UERxTx,i} = \left(k_{multiTEG,i} * CSSF_i * \text{ceil}(K_{p,PRS,i}) * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1 \right) * T_{effect,i} + T_{last,i}$$

Where

$CSSF_i$ is the carrier-specific scaling factor for NR PRS-based measurement in the positioning frequency layer i as defined in clause 9.1.5.2,

$k_{multiTEG,i}$ is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

$k_{multiTEG,i}$=1 if UE is not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*;

otherwise,

$k_{multiTEG,i}$ =$N_{TEG,i}$, if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

$k_{multiTEG,i}$ =$\left\lceil \frac{N_{TEG,i}}{k_{TEG,simul,i}} \right\rceil$ if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

$N_{TEG,i}$ is the number of Rx TEGs or RxTx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*, and in case 'n0' is indicated, $N_{TEG,i}$ is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

$k_{TEG,simul,i}$ is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

$K_{p,PRS,i}$ is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as $K_{p,PRS,i} = N_{total} / N_{available}$ for UE configured with concurrent measurement gap or MUSIM gap or both concurrent measurement gap and MUSIM gap. $K_{p,PRS,i} = 1$ for UE not configured with concurrent measurement gap and not configured with MUSIM gaps.

For a window W of duration max($T_{PRS,i}$, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer and periodic MUSIM gaps, and starting at the beginning of any associated gap occasions covering the PRS occasion:

N_{total} is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

$N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG and MUSIM gaps collisions by applying the selected gap collision rule

Requirements do not apply if $N_{available}$ =0.

$N_{RxBeam,i}$ is the scaling factor for Rx beam sweeping, and $N_{RxBeam,i}$=1 if positioning frequency layer *i* is in FR1 and if positioning frequency layer *i* is in FR2, $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-Multi-RTT-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$L_{available_PRS,i}$ is the time duration of available PRS resources in the positioning frequency layer *i*, to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only the PRS resources unmuted and fully or partially overlapped with MG are considered.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

{N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in clause 4.2.7.2 of TS 37.355 [34],

N' is UE capability for number of DL PRS resources that it can process in a slot corresponding to *maxNumOfDL-PRS-ResProcessedPerSlot* as specified in clause 6.4.3 of TS 37.355 [34],

N_{sample} is the number of UE Rx-Tx time difference measurement samples:

- N_{sample} = 1 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* defined in [34] and LMF requests the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34] and the following conditions are met:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 2 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* defined in [34] and the LMF requests the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34] but the following conditions are not met:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 4 otherwise.

$T_{last,i}$ is the measurement duration for the last UE Rx-Tx time difference measurement sample in the positioning layer i, including the sampling time and processing time, $T_{last,i} = T_i + T_{available_PRS,i}$,

$T_{effect,i}$ is periodicity of UE Rx-Tx time difference measurement in positioning frequency layer *i*:

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$$

where

T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

$T_{available_PRS,i} = LCM(T_{PRS,i}, MGRP_i)$, the least common multiple between $T_{PRS,i}$ and $MGRP_i$

$MGRP_i$ is the measurement gap repetition periodicity in positioning frequency layer *i*.

$T_{PRS,i}$ is the PRS resource periodicity in positioning frequency layer *i*. If the positioning frequency layer *i* has more than one DL PRS resource sets with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among DL PRS resource sets is used to derive $T_{PRS,i}$, where

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$ which is given by the higher-layer parameter *NR-MutingPattern-r16* included in *DL-PRS-MutingOption1-r16*

NOTE: For the purpose of calculating $T_{PRS,i}$, only the PRS resources fully or partially covered by the MG are considered.

Except for deferred MT-LR as defined in clause 4.1a.5 TS 23.273 [44], the time $T_{UERxTx,Total}$ starts from the first MG instance aligned with DL PRS resources in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{UERxTx,Total}$ starts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 TS 23.273 [44], the UE shall perform the PRS-RSRP measurement in each reporting period and activate the location report at the time when the periodic timer expires.

NOTE: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

The UE Rx-Tx time difference measurement period is restarted if HO occurs during the measurement period and after SRS reconfiguration on the target cell is complete.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or
- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured either per UE request or not per UE request, the measurement period can be longer.

The requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{UERxTx,Total}$ within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

When PRS-RSRPP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRPP measurements are performed over the same measurement period.

The requirements in clause 9.9.4 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

When PSCell or SCell addition or release does not cause SRS reconfiguration during the measurement period, UE continues the UE Rx-Tx time difference measurement, and the measurement period requirements apply.

When PSCell or SCell addition or release causes SRS reconfiguration during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

When SRS is reconfigured without serving cell change during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration is complete.If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx time difference measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

When a serving cell change occurs during the measurement period, the UE shall continue and complete the UE Rx-Tx time difference measurement provided that the serving cell change does not impact SRS configuration for the UE Rx-Tx time difference measurement.

If UE uplink transmission timing changes due to the change in the N_{TA_offset} defined in table 7.1.2-2 during the UE Rx-Tx time difference measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1.2 during the UE Rx-Tx time difference measurement period, then:

- UE Rx-Tx time difference measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in clause 7.1.1) for SRS transmission.
- UE Rx-Tx time difference measurement period requirements in this clause shall not apply for a cell, which is not the downlink reference cell (defined in clause 7.1.1) for SRS transmission. The UE Rx-Tx time difference measurement period may be restarted in such case.

9.9.4.6 Measurement Period Requirements without Measurement Gaps

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34], UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.4.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] in configured positioning frequency layers within the measurement period $T_{UERxTx_wo_gap,Total}$ ms.

$T_{UERxTx_wo_gap,\,Total} = \sum_{i=1}^{L} T_{UERxTx_wo_gap,i} + (L-1) * \max(T_{effect,i})$, if any of the positioning frequency layers are in Case 1, or

$T_{UERxTx_wo_gap,\,Total} = \max(T_{UERxTx_wo_gap,i} + T_{uncertainty,i})$, if all the positioning frequency layers are in Case 2.

Where,

i is the index of positioning frequency layer, and

L is total number of positioning frequency layers, and

$T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i, and

$T_{uncertainty,i}$ is the time from the start of the first PPW occasion for positioning frequency layer i to the start of measurement period $T_{UERxTx_wo_gap,\,Total}$.

A positioning frequency layer is in Case 1 if UE reports *ppw-durationOfPRS-Processing1-r17* for the band containing the positioning frequency layer, and a positioning frequency layer is in Case 2 if UE reports *ppw-durationOfPRS-Processing2-r17* for the band containing the positioning frequency layer.

$T_{UERxTx_wo_gap,i}$ is the measurement period for UE Rx-Tx time difference measurement in positioning frequency layer *i* as specified below.

$$T_{UERxTx_wo_gap,i} = \left(k_{multiTEG,i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last,i}$$

Where

$T_{effect,i}$ is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer *i* as defined further in this clause.

$k_{multiTEG,i}$ is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

$k_{multiTEG,i}$=1 if UE is not supported *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*;

otherwise,

$k_{multiTEG,i}$ =$N_{TEG,i}$, if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

$k_{multiTEG,i}$ =$\left\lceil \frac{N_{TEG,i}}{k_{TEG,simul,i}} \right\rceil$ if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

$N_{TEG,i}$ is the number of Rx TEGs or RxTx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*, and in case 'n0' is indicated, $N_{TEG,i}$ is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

$k_{TEG,simul,i}$ is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

$N_{RxBeam,i}$ is the scaling factor for Rx beam sweeping, and $N_{RxBeam,i}$=1 if positioning frequency layer *i* is in FR1. If positioning frequency layer *i* is in FR2, $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-Multi-RTT-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$L_{available_PRS,i}$ is the time duration of available PRS resources in the positioning frequency layer *i*, to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$,

only the unmuted PRS resources that meet the applicability conditions and fully or partially overlapped with PRS processing window are considered, if positioning frequency layer i is in Case 1, or

only the PRS resources unmuted and fully or partially overlapped with the first (PPWL-T2) ms of PPW are considered, if positioning frequency layer i is in Case 2, where PPWL is the PPW length and T2 corresponds to *ppw-durationOfPRS-ProcessingSymbolsT2*.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

{N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *ppw-durationOfPRS-ProcessingSymbolsN* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponding to *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

- N' is UE capability for number of DL PRS resources that it can process in a slot corresponding to *ppw-maxNumOfDL-PRS-ResProcessedPerSlot* as specified in clause 6.4.3 of TS 37.355 [34],

- N_{sample} is the number of UE Rx-Tx time difference measurement samples:

  - N_{sample} = 1 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* defined in [34] and LMF requests the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34] and the following conditions are met:

    - PRS bandwidth is within the active BWP and

    - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.

- N_{sample}= 2 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* defined in [34] and the LMF requests the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34] but the following conditions are not met:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample}= 4 otherwise.

- $T_{last,i}$ is the measurement duration for the last UE Rx-Tx time difference measurement sample in the positioning layer i, including the sampling time and processing time.

  If positioning frequency layer *i* is in Case 1 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i} = T_i$ +PPWL, else

  if positioning frequency layer *i* is in Case 2 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i}$ = PPWL;

  otherwise, $T_{last,i} = T_i + T_{available_PRS,i}$.

- $T_{effect,i}$ is periodicity of UE Rx-Tx time difference measurement in positioning frequency layer *i*:

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_{PRS},i}} \right\rceil * T_{available_{PRS},i}$$

where

T_i corresponds to *ppw-durationOfPRS-ProcessingSymbolsT* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponds to the sum of *ppw-durationOfPRS-ProcessingSymbolsT2* and *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

$T_{available_PRS,i} = LCM(T_{PRS,i}, PPWRP_i)$, the least common multiple between $T_{PRS,i}$ and $PPWRP_i$

$PPWRP_i$ is the PRS processing window repetition periodicity in positioning frequency layer *i*.

$T_{PRS,i}$ is the PRS resource periodicity in positioning frequency layer *i*. If the positioning frequency layer *i* has more than one DL PRS resource sets with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among DL PRS resource sets is used to derive $T_{PRS,i}$, where

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$

NOTE: For the purpose of calculating $T_{PRS,i}$, only the PRS resources that meet the applicability conditions and fully or partially covered by the PRS processing window are considered.

The time $T_{UERxTx_wo_gap,i}$ starts from the first PRS processing window instance aligned with DL PRS resources in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

The UE Rx-Tx time difference measurement period is restarted if HO occurs during the measurement period and after SRS reconfiguration on the target cell is complete.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or
- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period of one or more positioning frequency layers, the PRS processing window is reconfigured or reactivated either per UE request or not per UE request, the measurement period can be longer.

The requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{UERxTx_wo_gap,i}$ within PRS processing window due to collisions with other signals; otherwise, a longer measurement period may be used.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

When PRS-RSRPP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRPP measurements are performed over the same measurement period.

The requirements in clause 9.9.4.6 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

When PSCell or SCell addition or release does not cause SRS reconfiguration during the measurement period, UE continues the UE Rx-Tx time difference measurement, and the measurement period requirements apply.

When PSCell or SCell addition or release causes SRS reconfiguration during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

When SRS is reconfigured without cell change during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the N_{TA_offset} defined in table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1.2 during the UE Rx-Tx time difference measurement period, then:

- UE Rx-Tx time difference measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in clause 7.1.1) for SRS transmission.
- UE Rx-Tx time difference measurement period requirements in this clause shall not apply for a cell, which is not the downlink reference cell (defined in clause 7.1.1) for SRS transmission. The UE Rx-Tx time difference measurement period may be restarted in such case.

If any positioning frequency layer is in Case 2, the requirements in this clause apply provided that the PPWL corresponding to the positioning frequency layer is larger than (T2+X) ms.

The requirements in this clause apply provided that a single positioning frequency layer is configured for measurement in each PPW.

9.9.4.7 Void

9.9.4.8 Measurements Period Requirements with both MG and PPW

If the UE is configured with both MG applicable to positioning measurement and PPW, the UE shall measure positioning frequency layer *i* within

- MG, if PRS resources on positioning frequency layer *i* are overlapped with MG, or
- PPW, if PRS resources on positioning frequency layer *i* are overlapped with PPW.

The measurement period $T_{UERxTx,\ Total}$ is defined as:

$$T_{UERxTx,\ Total} = T_{UERxTx,Total,MG} + T_{UERxTx,Total,PPW} + T_{guard},$$

Where

- $T_{UERxTx,Total,MG}$ is defined in clause 9.9.4.5 and includes all positioning frequency layers to be measured within MG,
- $T_{UERxTx,Total,PPW}$ is defined in clause 9.9.4.6 and includes all positioning frequency layers to be measured within PPW,
- T_{guard} is the maximum T_{effect} defined in clauses 9.9.4.5 and 9.9.4.6 among all PFLs.

The requirements apply provided the following conditions are satisfied:

- MGs and PPWs do not overlap in time;
- Each PFL in the assistance data can be measured completely (all PRS resources) either within MG or within activated PPW.

9.9.4.9 Measurements Period Requirements with Bandwidth Aggregation

When UE physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] with a request to perform measurement by aggregating PRS resources from multiple PFLs via *nr-DL-PRS-JointMeasurementRequestedPFL-List*, the UE shall be able to perform UE Rx-Tx time difference measurement by aggregating PRS resources from multiple PFLs (up to the UE capability specified in clause 9.9.2.3) defined in TS 38.215 [4], during the measurement period $T_{UE_RxTx_aggregated,\ Total}$ defined as:

$$T_{UE_RxTx_aggregated,\ Total} = T_{non\text{-}aggregate_RxTx} + T_{aggregated_RxTx} + T_{margin},$$

where,

$T_{non_aggregate_RxTx}$ is the total measurement period for UE Rx-Tx time difference measurement on PFLs that do not contain PRS resources for aggregation.

Calculation of $T_{non_aggregate}$ is based on clause 9.9.4.5 with the following exceptions,

- only PFLs containing resource set(s) not linked to any other resource set(s) are considered in L
- on each PFL i, only resource set(s) not linked to any other resource set(s) are considered in $T_{available_PRS,i}$, $N_{PRS,i}^{slot}$ and $L_{available_PRS,i}$
- N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,
- $(L-1) * \max(T_{effect,i})$ is replaced by $(L-1) * T'_{margin}$.

$T_{non_aggregate_RxTx}$ is equal to zero if UE is not configured to perform non-aggregated measurements by the LMF.

$T_{aggregate_RxTx}$ is the total measurement period for UE Rx-Tx time difference measurements performed by UE by aggregating PRS resources from multiple PFLs as defined in TS 38.214 [26].

If UE is configured to perform measurements on PFLs that contain PRS resources for aggregation and on PFLs that do not contain PRS resources for aggregation, $T_{margin} = T'_{margin}$ is delay margin to account for delay between Rx-Tx time difference measurement performed by UE on PFLs that contain PRS resources for aggregation and Rx-Tx time difference measurement performed by UE on PFLs that do not contain PRS resources for aggregation.

If UE is only configured to perform measurements on PFLs that contain PRS resources for aggregation or if UE is only configured to perform measurements on PFLs that do not contain PRS resources for aggregation, then $T_{margin} = 0$.

$T'_{margin} = \max(Teffect, i)$, by considering both aggregated PFLs and non-aggregated PFLs configured for positioning measurement.

If UE is capable of performing latency reduced positioning measurements and is configured to perform latency reduced positioning measurement by LMF via *reducedDL-PRS-ProcessingSamples-r17* [34], then N_{sample} = 2 shall be considered in calculations of $T_{aggregate_RxTx}$ and $T_{non\text{-}aggregate_RxTx}$.

If UE is not capable to perform latency reduced positioning measurements or is not configured to perform latency reduced positioning measurement by LMF via *reducedDL-PRS-ProcessingSamples-r17* [34], then N_{sample} = 4 shall be considered in calculations of $T_{aggregate_RxTx}$ and $T_{non\text{-}aggregate_RxTx}$.

$T_{aggregate_RxTx}$, total measurement period for UE Rx-Tx time difference measurements performed by UE by aggregating PRS resources from multiple PFLs as defined in TS 38.214 [26], is defined as:

$$T_{aggregate_RxTx} = \sum_{i=1}^{G} T_{RxTx_aggregate,i} + (G-1) * T'_{margin} \quad ,$$

where

i is the index of effective PFL, corresponding to the group of PFLs containing linked PRS resource sets to be aggregated for UE Rx-Tx time difference measurement,

G denotes the number of effective PFLs that UE is configured to perform aggregated measurements on. G is configured by LMF and is provisioned to UE via *nr-DL-PRS-AggregationInfo*.

$T_{RxTx_aggregate,i}$ is the measurement period for UE Rx-Tx time difference measurement in the effective positioning frequency layer *i* as specified below:

$$T_{RxTx_aggregate,i} = \left(k_{multiTEG_agg,i} \times CSSF_{PRS_agg,i} \times ceil(K_{p,PRS_agg,i}) \times N_{RxBeam_agg,i} \times \left\lceil \frac{N^{slot}_{PRS_agg,i}}{N'_{agg}} \right\rceil \left\lceil \frac{L_{available_PRS_agg,i}}{N_{agg}} \right\rceil \times N_{sample_agg} - 1\right) \times T_{effect_agg,i} + T_{last_agg,i} \ ,$$

where:

$N_{RxBeam,i}$ is the UE Rx beam sweeping factor.

In FR1, $N_{RxBeam,i}$ = 1.

In FR2, $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing effective positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-Multi-RTT-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$CSSF_{PRS_agg,i}$ is the carrier-specific scaling factor for NR PRS-based positioning measurements in effective positioning frequency layer i as defined in clause 9.1.5.2.

$k_{multiTEG_agg,i}$ is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

$k_{multiTEG,i}$ = 1 if UE is not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*;

Otherwise,

$k_{multiTEG,i}$ = $N_{TEG,i}$, if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

$k_{multiTEG,i} = \left\lceil \frac{N_{TEG,i}}{k_{TEG,simul,i}} \right\rceil$ if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

$N_{TEG,i}$ is the number of Rx TEGs with which UE is requested to measure aggregated PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*, and in case 'n0' is

indicated, $N_{TEG,i}$ is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

$k_{TEG,simul,i}$ is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

$K_{p,PRS_agg,i}$ is a scaling factor for effective positioning frequency layer i to be measured within the associated measurement gap pattern, which is defined as $K_{p,PRS_agg,i} = N_{total} / N_{available}$ for UE configured with concurrent measurement gap, and $K_{p,PRS_agg,i} = 1$ for UE not configured with concurrent measurement gap.

For a window W of duration max($T_{PRS_agg,i}$, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the effective positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:

- N_{total} is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and
- $N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule

- Requirements do not apply if $N_{available} = 0$.

$N^{slot}_{PRS_agg,i}$ is the maximum number of DL PRS resources in effective positioning frequency layer i configured in a slot.

$L_{available_PRS_agg,i}$ is the time duration of available PRS in the effective positioning frequency layer i to be measured during $T_{available_PRS_agg,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS_agg,i}$, only the PRS resources unmuted and fully or partially overlapped with MG and satisfying the conditions for PRS BW aggregation are considered.

N_{sample_agg} is the number of UE Rx-Tx time difference measurement samples.

$T_{last_agg,i}$ is the measurement duration for the last UE Rx-Tx time difference measurement sample in the effective positioning frequency layer i, including the sampling time and processing time. If all of the PRS resources to be measured are available in the same MG occasion during $T_{availabe_agg}$, $T_{last_agg,i} = T_{agg,i} + MGL$. Otherwise, $T_{last_agg,i} = T_{agg,i} + T_{available_PRS_agg,i}$,

$T_{effect_agg,i}$ is the periodicity of the UE Rx-Tx time difference measurement in the effective positioning frequency layer i defined as:

$$T_{effect_agg,i} = \left\lceil \frac{T_{agg,i}}{T_{available_PRS_agg,i}} \right\rceil \times T_{available_PRS_agg,i}$$

where,

$T_{available_PRS_agg,i} = LCM(T_{PRS_agg,i}, MGRP_i)$, the least common multiple between $T_{PRS_agg,i}$ and $MGRP_i$. $MGRP_i$ is the repetition periodicity of the measurement gap applicable for measurement in the effective PRS frequency layer i.

$T_{PRS_agg,i}$ is the periodicity of DL PRS resources meeting the bandwidth aggregation conditions with muting on effective positioning frequency layer i. If more than one PRS periodicities are configured in effective positioning frequency layer i, the least common multiple of PRS periodicities $T^{PRS\ with\ muting}_{per_agg}$ among all DL PRS resource sets in the effective positioning frequency layer is used to derive $T_{PRS_agg,i}$, where,

$T^{PRS\ with\ muting}_{per_agg} = N_{muting} \times T^{PRS}_{per_agg}$, is the PRS periodicity with muting per PRS resource configured for aggregation,

$T^{PRS}_{per_agg}$ is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS_agg} \times L_{muting}$, where $T_{muting}^{PRS_agg}$ is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

Note: For the purpose of calculating $T_{PRS_agg,i}$, only the PRS resources fully or partially covered by the MG and PRS resources that satisfy the conditions for PRS BW aggregation are considered.

$\{N_{agg}, T_{agg,i}\}$ is UE capability combination per band to aggregate PRS resources from multiple PFLs within an effective PFL where N_{agg} is a duration of DL PRS symbols in ms corresponding to *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN* in TS 37.355 [34] processed every $T_{agg,i}$ ms corresponding to *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *maximumOfTwoAggregatedDL-PRS-Bandwidth* or *maximumOfThreeAggregatedDL-PRS-Bandwidth* in TS 37.355 [34]

N'_{agg} is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot* specified in TS 37.355 [34].

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements satisfy all the conditions specified in clause 5.1.6.5.3 in TS 38.214 [26].

Except for deferred MT-LR as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{UE_RxTx_aggregated,Total}$ starts from the first MG instance aligned with DL PRS resources in the assistance data for aggregation after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message are delivered from LMF to the physical layer of UE via LPP [34] including a request to perform measurement by aggregating PRS resources from multiple PFLs via *nr-DL-PRS-JointMeasurementRequested*.

For deferred MT-LR with other event than "Periodic Location" as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{UE_RxTx_aggregated,Total}$ starts from the first MG instance aligned with DL PRS resources in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event "Periodic Location" as defined in clause 4.1a.5.1 TS 23.273 [44], the UE shall perform the aggregated UE Rx-Tx time difference measurement in each reporting period and activate the location report at the time when the periodic timer expires.

When PRS-RSRP is also reported by UE together with UE RX-Tx time difference measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRP are performed over the measurement period defined in 9.9.4.9.

When PRS-RSRPP is also reported by UE together with UE Rx-Tx time difference measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRPP are performed over the measurement period defined in 9.9.4.9.

If during the measurement period of one or more effective positioning frequency layers, the MG pattern is reconfigured, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{UE_RxTx_aggregated,Total}$ within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

The requirements in clause 9.9.4.9 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which aggregated PRS resources are measured, subject to UE measurement capabilities.

When PSCell or SCell addition or release does not cause SRS reconfiguration during the measurement period, UE continues the UE Rx-Tx time difference measurement, and the measurement period requirements apply.

When PSCell or SCell addition or release causes SRS reconfiguration during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

When SRS is reconfigured without serving cell change during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration is complete. If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx time difference measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

When a serving cell change occurs during the measurement period, the UE shall continue and complete the UE Rx-Tx time difference measurement provided that the serving cell change does not impact SRS configuration for the UE Rx-Tx time difference measurement.

If UE uplink transmission timing changes due to the change in the N_{TA_offset} defined in table 7.1.2-2 during the UE Rx-Tx time difference measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1.2 during the UE Rx-Tx time difference measurement period, then:

- UE Rx-Tx time difference measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in clause 7.1.1) for SRS transmission.
- UE Rx-Tx time difference measurement period requirements in this clause shall not apply for a cell, which is not the downlink reference cell (defined in clause 7.1.1) for SRS transmission. The UE Rx-Tx time difference measurement period may be restarted in such case.

The UE shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1.25A.2.

9.9.5 E-CID measurements

9.9.5.1 Introduction

The requirements in clause 9.9.5 shall apply provided the UE has received *nr-ECID-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to report one or more of the following measurements for NR E-CID positioning [22]: SS-RSRP, SS-RSRQ, CSI-RSRP, and CSI-RSRQ.

9.9.5.2 Measurement Requirements

9.9.5.2.1 Intra-frequency Measurement Requirements

The intra-frequency NR E-CID measurements shall meet the requirements in clause 9.2 and clause 9.10.2, except the measurement reporting requirements. The NR E-CID measurement reporting requirements are defined in clause 9.9.5.2.3.

The reported intra-frequency NR E-CID measurements shall also meet:

- for FR1 SS-RSRP, the accuracy requirements in clause 10.1.2.1,
- for FR1 SS-RSRQ, the accuracy requirements in clause 10.1.7.1,
- for FR1 CSI-RSRP, the accuracy requirements in clause 10.1.2.3,
- for FR1 CSI-RSRQ, the accuracy requirements in clause 10.1.7.2,
- for FR2 SS-RSRP, the accuracy requirements in clause 10.1.3.1,
- for FR2 SS-RSRQ, the accuracy requirements in clause 10.1.8.1,
- for FR2 CSI-RSRP, the accuracy requirements in clause 10.1.3.3,
- for FR2 CSI-RSRQ, the accuracy requirements in clause 10.1.8.2.

9.9.5.2.2 Inter-frequency Measurement Requirements

The inter-frequency NR E-CID measurements shall meet the requirements in clause 9.3 and 9.10.4, except the measurement reporting requirements. The NR E-CID measurement reporting requirements are defined in clause 9.9.5.2.3.

The reported inter-frequency NR E-CID measurements shall also meet:

- for FR1 SS-RSRP, the accuracy requirements in clause 10.1.4.1,
- for FR1 SS-RSRQ, the accuracy requirements in clause 10.1.9.1,
- for FR1 CSI-RSRP, the accuracy requirements in clause 10.1.4.3,
- for FR1 CSI-RSRQ, the accuracy requirements in clause 10.1.9.2,
- for FR2 SS-RSRP, the accuracy requirements in clause 10.1.5.1,
- for FR2 SS-RSRQ, the accuracy requirements in clause 10.1.10.1,
- for FR2 CSI-RSRP, the accuracy requirements in clause 10.1.5.3,
- for FR2 CSI-RSRQ, the accuracy requirements in clause 10.1.10.2.

9.9.5.2.3 Measurement Reporting Delay

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The reported NR E-CID measurement values contained in periodically triggered measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.6 for SS-RSRP and CSI-RSRP, and clause 10.1.11 for SS-RSRQ and CSI-RSRQ.

The UE shall not send any measurement reports as long as no corresponding reporting criteria specified in clause 9.1.4 are fulfilled.

9.9.6 PRS-RSRPP measurements

9.9.6.1 Introduction

The requirements in clause 9.9.6.5 shall apply when UE is performing PRS measurement in the configured MG and provided the UE has received a message from LMF via LPP requesting the UE to measure and report PRS-RSRPP measurements defined in TS 38.215 [4].

The requirements in clause 9.9.6.6 shall apply when UE is performing PRS measurement without gap and provided the UE has received a message from LMF via LPP requesting the UE to measure and report PRS-RSRPP measurements defined in TS 38.215 [4].

9.9.6.2 Requirements applicability

The requirements in clause 9.9.6 apply for periodic and triggered PRS-RSRPP measurements, provided:

- PRS-RSRPP related side conditions given in clause 10.1.38 are met for a corresponding band.

9.9.6.3 Measurement capability

UE PRS-RSRPP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

9.9.6.4 Measurement reporting requirements

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes the delay uncertainty caused by inserting the measurement report into the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot

when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The reported PRS-RSRPP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.1.38.3.

The PRS-RSRPP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requriements specified in the clauses 10.1.38.2.

9.9.6.5 Measurement period requirements

For PRS measurement within MG configured to UE, measurement period requirements for PRS-RSRP defined in clause 9.9.3.5 is re-used for PRS-RSRPP.

9.9.6.6 Measurement Period Requirements without Measurement Gaps

For PRS measurement without MG configured to UE, measurement period requirements for PRS-RSRP defined in clause 9.9.3.6 is re-used for PRS-RSRPP.

The PRS-RSRPP measurement requirements in this clause apply for the first path PRS-RSRP measurement.

9.9.6.7 Void

9.9.6.8 Measurements Period Requirements with both MG and PPW

If the UE is configured with both MG applicable to positioning measurement and PPW, the measurement period requirements for PRS-RSRP defined in clause 9.9.3.8 is re-used for PRS-RSRPP.

9.9.7 Measurement requirements for DL RSCPD reported with RSTD

9.9.7.1 Introduction

The requirements in clause 9.9.7 shall apply provided the UE has received *NR-DL-TDOA-RequestLocationInformation* message with *dl-PRS-RSCPD-Request-r18* from LMF via LPP [34] requesting the UE to measure and report RSCPD measurement together with DL RSTD measurements defined in TS 38.215 [4].

9.9.7.2 Requirements Applicability

The requirements in clause 9.9.7 apply for periodic and triggered reporting of RSCPD with RSTD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23 for FR1 and FR2 are fulfilled, for a corresponding band.
- RSCPD related side conditions given in clause 10.1.43.2 for FR1 and FR2 are fulfilled, for a corresponding band.

9.9.7.3 Measurement Capability

UE PRS RSTD and RSCPD measurement capabilities are as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355[34].

9.9.7.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot

when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The reported RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.23.3.

The reported RSCPD measurement values contained in the measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.43.3.

The RSTD measurements performed and reported according to this clause shall meet the RSTD measurement accuracy requirements in clause 10.1.23, for the measured DL PRS resource.

The RSCPD measurements performed and reported according to this clause shall meet the RSCPD measurement accuracy requirements in clause 10.1.43.2, for the measured DL PRS resource.

9.9.7.5 Measurements Period Requirements for DL RSCPD reported with RSTD

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message with *dl-PRS-RSCPD-Request-r18* from the LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.7.3) DL RSTD and RSCPD measurements, defined in TS 38.215 [4], during the time window only.

When LMF does not configure measurement time window(s):

- When a single PFL, requirements in clause 9.9.2.5 apply to both RSCPD and RSTD measurements.
- When multiple PFLs are configured for legacy measurements, the UE performs RSCPD measurement on a single PFL that is common between the reference TRP and the target TRP. The requirement in clause 9.9.2.5 apply to both RSTD and RSCPD measurements.

When LMF configures measurement time window(s), but UE does not support performing RSCPD measurement inside the indicated time window subject to *supportOfMeasurementsInTimeWindow*:

- The UE performs RSCPD measurement on the indicated PFL by the network. The requirement in clause 9.9.2.5 apply to both RSTD and RSCPD measurements.

When LMF configures measurement time window(s), but UE does not support performing RSTD measurement inside the indicated time window but supports performing RSCPD measurement inside the indicated time window subject to *supportOfMeasurementsInTimeWindow*:

- The requirements in the clause 9.9.2.5 apply to RSTD measurements.
- The requirements in clause 9.9.7.5 apply to RSCPD measurement for the PRS resource(s) that have occasions only within the measurement time window.

When LMF configures measurement time window(s), and UE supports performing both RSTD and RSCPD measurement inside the indicated time window subject to *supportOfMeasurementsInTimeWindow*:

- The requirements in Clause 9.9.7.5 apply to DL RSTD measurement and DL RSCPD measurement.

If a one-shot time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.7.3) DL RSTD and DL RSCPD measurements, defined in TS 38.215 [4], based on the indicated PRS resource sets occurring inside the one-shot time window during the measurement period $T_{RSCPD\ with\ RSTD,Total}$ defined as:

$$T_{RSCPD\ with\ RSTD,Total} = \min(L_{window}, \mathrm{MGL}) + T_i \ ,$$

and the UE shall be able to measure multiple DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total,with\ one\ shot\ window}$ defined as:

$$T_{RSTD,Total,with\ one\ shot\ window} = T_{RSCPD\ with\ RSTD,Total} + max\left(T_{effect,i}\right) + T_{RSTD,Total} \ ,$$

where:

- the start of the measurement is the start of the one-shot time window, and
- L_{window} is the length of the one-shot window, and

- $T_{effect,i}$ and T_i are defined in the following of this clause, and
- $T_{RSTD,Total}$ is defined in clause 9.9.2.5, and
- MGL is the measurement gap length.

The requirements with one-shot window assume scaling factors equal 1 for the PFLs, for which the one-shot time window is configured.

If a periodic time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.7.3) RSTD and DL RSCPD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSCPD\ with\ RSTD,Total}$ defined as:

$$T_{\text{RSCPD with RSTD,Total}} = \sum_{i=1}^{L} T_{\text{RSCPD with RSTD,i}} + (L-1) * \max\left(T_{\text{effect,i}}\right)$$

where:

- i is the index of positioning frequency layer,
- L is total number of positioning frequency layers, and
- $T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i

$T_{\text{RSCPD with RSTD,i}}$ is the measurement period for PRS RSTD with RSCPD measurement in positioning frequency layer i as specified below:

$$T_{\text{RSCPD with RSTD,i}} = \left(k_{multiTEG,i} \times \text{CSSF}_{\text{PRS,i}} \times \text{ceil}(K_{p,\text{PRS,i}}) \times N_{RxBeam,i} \times \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil \times N_{sample} - 1\right) \times T_{\text{effect,i}} + T_{\text{last,i}},$$

where:

DL-RSCPD measurement performed during $T_{\text{RSCPD with RSTD,i}}$ is a single sample measurement. The DL-RSCPD measurement of reference TRP and the target TRP is performed on the same PFL.

$N_{RxBeam,i}$, $CSSF_{PRS,i}$, $k_{multiTEG,i}$, $N_{PRS,i}^{slot}$, N, N', $T_{\text{effect,i}}$, and $T_{\text{last,i}}$ are defined in clause 9.9.2.5.

N_{sample} = 1 or 2 or 4 as defined in clause 9.9.2.5.

$L_{available_{PRS},i}$ is the time duration of available PRS in the positioning frequency layer to be measured during $T_{available_{PRS},i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26].

When periodic time window(s) are configured by the LMF and PFL i is associated with the configured time window, $T_{available_{PRS},i} = LCM(T_{prs,i}, MGRP, T_{window})$, the least common multiple between $T_{prs,i}$, $MGRP$ and T_{window}, T_{window} being the maximum periodicity of the indicated time window(s).

When the periodic time window(s) are configured by the LMF and the PFL i is not associated with the configured time window, $T_{available_{PRS},i} = LCM(T_{prs,i}, MGRP)$.

$T_{prs,i}$ and $MGRP$ are defined in clause 9.9.2.5.

$L_{available_{PRS},i}$ and $T_{prs,i}$ are calculated by only considering the PRS resources in the indicated resources sets overlapping with both the MG and the indicated time window(s).

$K_{p,\text{PRS,i}}$ is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as $K_{p,\text{PRS,i}} = N_{\text{total}} / N_{\text{available}}$ for UE configured with concurrent measurement gap, and $K_{p,\text{PRS,i}} = 1$ for UE not configured with concurrent measurement gap.

When periodic time window(s) are configured by the LMF, for a window W of duration max($T_{PRS,i}$, MGRP_max, T_{window}), where MGRP_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion and the periodic time window:

N_{total} is the total number of associated gap occasions covering PRS occasions and the periodic time window(s) within the window W, including both dropped and non-dropped instances of the associated measurement gap within the window W, and

$N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions and the periodic time window(s) within the window W, after further accounting for MG collisions by applying the selected gap collision rule.

Requirements do not apply if $N_{available}$ =0.

Otherwise, for a window W of duration max($T_{PRS,i,}$ MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:

N_{total} is the total number of associated gap occasions covering PRS occasions within the window W, including both dropped and non-dropped instances of the associated measurement gap within the window, and

$N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule

Requirements do not apply if $N_{available}$ =0.

Except for deferred MT-LR as defined in clause 4.1a.5 TS 23.273 [44], the time $T_{RSCPD\ with\ RSTD}$ starts from the first time window (T_{RSCPD}) configured by LMF within MG instance aligned with a DL PRS resource(s) in the assistance data after both the *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34].

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{RSCPD\ with\ RSTD}$ starts from the first time window (T_{RSCPD}) configured by LMF within MG instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 TS 23.273 [44], the UE shall perform the RSCPD with RSTD measurement in each reporting period within the time window(T_{RSCPD}) configured by LMF within MG instance and activate the location report at the time when the periodic timer expires.

If during the measurement period, the MG pattern is reconfigured or time window (T_{RSCPD}) for RSCPD measurement is reconfigured, the measurement period can be longer.

When PRS-RSRP is also configured to UE, RSCPD with RSTD and RSRP are performed over the same measurement period.

When PRS-RSRPP is also configured to UE, RSCPD with RSTD and RSRPP are performed over the same measurement period.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{RSCPD\ with\ RSTD,i}$ within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_{PRS,i}}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9.7 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If handover occurs while RSTD and RSCPD measurements are being performed together by UE, then the UE shall continue and complete the on-going RSTD and RSCPD measurements. The measurement period for RSCPD with

RSTD measurement can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23. The UE shall also meet the RSCPD measurement accuracy requirements in clause 10.1.43.2.

9.9.8 Measurement requirements for DL RSCP reported with UE Rx-Tx time difference

9.9.8.1 Introduction

The requirements in this clause shall apply, provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message with *dl-PRS-RSCP-Request-r18* from LMF via LPP [34] requesting the UE to measure and report one or more DL RSCP measurements together with UE Rx-Tx time difference measurements defined in TS 38.215 [4].

9.9.8.2 Requirements Applicability

The requirements in clause 9.9.8 apply for periodic and triggered UE Rx-Tx time difference measurements, provided:

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25 are met for a corresponding band.
- DL RSCP related side conditions given in clause 10.1.44.2 for FR1 and FR2 are fulfilled, for a corresponding band.
- SRS is configured on at least one of the PCell, PSCell and SCell.
- The UE transmits SRS within the range from -160 ms to 160 ms of at least one DL PRS resource of each of the TRPs in the assistance data.

9.9.8.3 Measurement Capability

UE Rx-Tx time difference and DL-RSCP measurement capabilities are as indicated by the UE in *NR-Multi-RTT-ProvideCapabilities*, according to TS 37.355 [34].

9.9.8.4 Measurement Reporting Requirements

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The UE Rx-Tx time difference measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.25.

The DL RSCP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.44.

The UE Rx-Tx time difference measurement accuracy for all measured DL PRS resources shall be fulfilled according to the accuracy requirements specified in clause 10.1.25.

The DL RSCP measurement accuracy for all measured DL PRS resources shall be fulfilled according to the accuracy requirements specified in clause 10.1.44.

9.9.8.5 Measurement Period Requirements for DL RSCP and UE Rx-Tx time difference

When the physical layer receives the last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] with *dl-PRS-RSCP-Request-r18* and is configured with a measurement time window via *nr-DL-PRS-MeasurementTimeWindowsConfig*, subject to UE capabilities *supportOfMeasurementsInTimeWindow*, the UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.8.3) UE Rx-Tx time difference and DL RSCP measurements, defined in TS 38.215 [4], during the time window only.

When LMF does not configure measurement time window(s):

- When a single PFL is configured, requirements in clause 9.9.4.5 apply to both RSCP and UE Rx-Tx time difference measurements.
- When multiple PFLs are configured for legacy measurements, the UE performs RSCP measurement on a single PFL that is common between the reference TRP and the target TRP. The requirement in clause 9.9.4.5 apply to both RSCP and UE Rx-Tx time difference measurements.

When LMF configures measurement time window(s), but UE does not support performing RSCP measurement inside the indicated time window subject to *supportOfMeasurementsInTimeWindow*:

– The UE performs RSCP measurement on the indicated PFL by the network. The requirement in clause 9.9.4.5 apply to both UE Rx-Tx and RSCP measurements.

When LMF configures measurement time window(s), but UE does not support performing UE Rx-Tx measurement inside the indicated time window but supports performing RSCP measurement inside the indicated time window subject to *supportOfMeasurementsInTimeWindow*:

The requirements in the clause 9.9.4.5 apply to UE Rx-Tx time difference measurement.

The requirements in clause 9.9.8.5 apply to RSCP measurement for the PRS resource(s) that have occasions only within the measurement time window.

When LMF configures measurement time window(s), and UE supports performing both UE Rx-Tx measurement and RSCP measurement inside the indicated time window subject to *supportOfMeasurementsInTimeWindow*:

- The requirements in Clause 9.9.8.5 apply to UE Rx-Tx time difference measurement and DL RSCP measurement.

If a one-shot time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.8.3) UE Rx-Tx time difference and DL RSCP measurements, defined in TS 38.215 [4], based on the indicated PRS resource sets occurring inside the one-shot time window during the measurement period $T_{\text{DL RSCP with UERxTx,Total}}$ defined as:

$$T_{\text{DL RSCP with UERxTx,Total}} = \min(L_{window}, \text{MGL}) + T_i \quad ,$$

and the UE shall be able to measure multiple UE Rx-Tx time difference measurements, defined in TS 38.215 [4], during the measurement period $T_{UERxTx,Total,with\ one\ shot\ window}$ defined as:

$$T_{UERxTx,Total,with\ one\ shot\ window} = T_{\text{DL RSCP with UERxTx,Total}} + max(T_{effect,i}) + T_{UERxTx,Total}$$

Where:

- the start of the measurement is the start of the one-shot time window, and
- L_{window} is the length of the one-shot window, and
- $T_{\text{effect},i}$ and T_i are defined in the following of this clause, and
- $T_{UERxTx,Total}$ is defined in clause 9.9.4.5, and
- MGL is the measurement gap length.

The requirements with one-shot window assume scaling factors equal to 1 for the PFLs, for which the one-shot time window is configured.

If a periodic time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.8.3) UE Rx-Tx and DL RSCP measurements, defined in TS 38.215 [4], during the measurement period $T_{RSCP\ with\ UERxTx,Total}$ defined as:

$$T_{\text{DL RSCP with UERxTx,Total}} = \sum_{i=1}^{L} T_{\text{DL RSCP with UERxTx,i}} + (L-1) * \max(T_{\text{effect,i}}),$$

where:

- i is the index of positioning frequency layer,

- L is total number of positioning frequency layers, and
- $T_{effect,i}$ is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer *i*.

$T_{\text{DL RSCP with UERxTx,i}}$ is the measurement period for DL RSCP with UE Rx-Tx measurement in positioning frequency layer *i* as specified below:

$$T_{\text{DL RSCP with UERxTx,i}} = \left(k_{multiTEG,i} * \text{CSSF}_{\text{PRS,i}} * \text{ceil}(K_{p,PRS,i}) * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_{PRS},i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last,i},$$

where:

- DL RSCP performed during $T_{\text{DL RSCP with UERxTx}}$ is a single sample measurement where DL RSCP and UE Rx-Tx measurements are performed on the same PFL.
- $N_{RxBeam,i}$, $CSSF_{PRS,i}$, $k_{multiTEG,i}$, N_{sample}, $N_{PRS,i}^{slot}$, N, N', $T_{effect,i}$, and $T_{last,i}$ are defined in clause 9.9.4.5.
- N_{sample} = 1 or 2 or 4 as defined in clause 9.9.4.
- $K_{p,PRS,i}$ is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as $K_{p,PRS,i} = N_{total} / N_{available}$ for UE configured with concurrent measurement gap, and $K_{p,PRS,i} = 1$ for UE not configured with concurrent measurement gap.

  When periodic time window(s) are configured by the LMF, for a window W of duration max($T_{PRS,i}$, MGRP_max, T_{window}), where MGRP_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion and the periodic time window:

  N_{total} is the total number of associated gap occasions covering PRS occasions and the periodic time window(s) within the window W, including both dropped and non-dropped instances of the associated measurement gap within the window W, and

  $N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions and the periodic time window(s) within the window W, after further accounting for MG collisions by applying the selected gap collision rule.

  Requirements do not apply if $N_{available}$ =0.

  Otherwise, for a window W of duration max($T_{PRS,i}$, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:

  N_{total} is the total number of associated gap occasions covering PRS occasions within the window W, including both dropped and non-dropped instances of the associated measurement gap within the window W, and

  $N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule

  Requirements do not apply if $N_{available}$ =0.

- $L_{available_PRS,i}$ is the time duration of available PRS resources in the positioning frequency layer, to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26].
- When periodic time window(s) are configured by the LMF and PFL *i* is associated with the configured time window, $T_{available_PRS,i} = LCM(T_{prs,i}, MGRP, T_{window})$, the least common multiple between $T_{prs,i}$, MGRP , and T_{window}, T_{window} being the maximum periodicity of the indicated time window(s).
- When periodic time window(s) are configured by the LMF and the PFL *i* is not associated with the configured time window, $T_{available_PRS,i} = LCM(T_{prs,i}, MGRP)$.
- $T_{prs,i}$ and MGRP are defined in clause 9.9.8.5.

- $L_{available_PRS,i}$ and $T_{prs,i}$ are calculated by only considering the PRS resources in the indicated resources sets overlapping with both the MG and the indicated time window(s).

Except for deferred MT-LR as defined in clause 4.1a.5 TS 23.273 [44], the time $T_{\text{DL RSCP with UERxTx}}$ starts from the first time window ($T_{\text{DL RSCP}}$) configured by LMF within MG instance aligned with DL PRS resource(s) in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

For deferred MT-LR with other event than "Periodic Location" as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{\text{DL RSCP with UERxTx}}$ starts from the first time window ($T_{\text{DL RSCP}}$) configured by LMF within MG instance aligned with DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event "Periodic Location" as defined in clause 4.1a.5.1 TS 23.273 [44], the UE shall perform the DL RSCP with UE Rx-Tx time difference measurement in each reporting period and activate the location report at the time when the periodic timer expires.

The DL RSCP with UE Rx-Tx time difference measurement period is restarted if HO occurs during the measurement period and after SRS reconfiguration on the target cell is complete.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS}$ or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period of the positioning frequency layer, the MG pattern is reconfigured either per UE request or not per UE request, the measurement period can be longer.

The requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{\text{DL RSCP with UERxTx}}$ within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

When PRS-RSRP is configured for multi-RTT,with a request to perform RSCP with UE Rx-Tx time difference measurement, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

When PRS-RSRPP is configured for multi-RTT with a request to perform RSCP with UE Rx-Tx time difference measurement, RSCP with UE Rx-Tx time difference measurements and PRS-RSRPP measurements are performed over the same measurement period.

The requirements in clause 9.9.8 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

When PSCell or SCell addition or release does not cause SRS reconfiguration during the measurement period, UE shall continue and complete the DL RSCP and UE Rx-Tx time difference measurements, and the measurement period requirements apply.

When PSCell or SCell addition or release causes SRS reconfiguration during the measurement period, UE shall restart the DL RSCP and UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

When SRS is reconfigured without serving cell change during the measurement period, UE shall restart the DL RSCP and UE Rx-Tx time difference measurement after the SRS reconfiguration is complete.

When a serving cell change occurs during the measurement period, the UE shall restart DL RSCP and UE Rx-Tx time difference measurements.

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the measurement period, then the DL RSCP with UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the DL RSCP and UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the N_{TA_offset} defined in table 7.1.2-2 during the measurement period, then the DL RSCP with UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the DL RSCP and UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1.2 during the measurement period, then:

- DL RSCP and UE Rx-Tx measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in clause 7.1.1) for SRS transmission.
- DL RSCP and UE Rx-Tx measurement period requirements in this clause shall not apply for a cell, which is not the downlink reference cell (defined in clause 7.1.1) for SRS transmission. The DL RSCP with UE Rx-Tx time difference measurement period may be restarted in such case.

9.9A NR measurements for positioning for RedCap

9.9A.1 Introduction

This clause contains requirements for RedCap UE capable of performing NR positioning measurements defined in TS 38.215 [4], including RSTD, PRS-RSRP, UE Rx-Tx time difference, and PRS-RSRPP measurements.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

This clause applies to both RedCap positioning with and without FH.

9.9A.1.1 General Aspects of Gap-based Measurement

For gap-based RSTD, PRS-RSRP, UE Rx-Tx time difference, and PRS-RSRPP measurements, the requirements in clauses 9.9A.2, 9.9A.3, 9.9A.4 and 9.9A.5 apply provided:

- the RedCap UE is configured or pre-configured with measurement gaps or configured with concurrent measurement gaps
  - all positioning frequency layers are measured or associated with only one per-UE measurement gap, or
- for the RedCap UE supporting *independentGapConfigPRS-r17*, all positioning frequency layers in the same FR are measured or associated with only one per-FR measurement gap in the corresponding FR.
- if the measurement gap is pre-configured, the gap must be activated throughout the measurement period, and
- if concurrent measurement gaps are configured, one of the gap combinations specified in clause 9.1.8.2 is configured, and
- if the RedCap UE does not support *independentGapConfigPRS-r17*, the configured or pre-configured gap used to perform the PRS measurements must be of per-UE type, and
- No active BWP switching occurs during the measurement gaps for PRS measurement, and

All measurement requirements specified in clauses 9.9A.2, 9.9A.3, 9.9A.4 and 9.9A.5 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

RedCap UE is only required to measure PRS resources that are fully or partially overlapped with measurement gaps, and the requirements in clauses 9.9A.2, 9.9A.3, 9.9A.4 and 9.9A.5 are applicable to PRS resources that are fully or partially overlapped with measurement gaps.

A PRS resource is considered to be fully (partially) overlapped with measurement gaps if all (some) of its instances are overlapped with a measurement gap occasion. A PRS resource instance is considered to be overlapped with measurement gap occasion if the minimum number of unmuted repetitions of the instance taking into account *nr-DL-PRS-ExpectedRSTD-Uncertainty* and *nr-DL-PRS-ExpectedRSTD* is fully covered by the MGL excluding RF switching time, where

- the minimum number is given in the accuracy requirements without FH for 2Rx RedCap UEs in clause 10.1.23.2 for RSTD measurement, 10.1.24.2 for PRS-RSRP measurement, 10.1.25.2 for UE Rx-Tx time difference measurement, and 10.1.38.2 for PRS-RSRPP measurement,

- the minimum number is given in the accuracy requirements without FH for 1Rx RedCap UEs in clause 10.1A.16.2.1 for RSTD measurement, 10.1A.17.2 for PRS-RSRP measurement, 10.1A.18.2.2 for UE Rx-Tx time difference measurement, and 10.1A.19.2 for PRS-RSRPP measurement,

- the minimum number is given in the accuracy requirements with FH for 2Rx RedCap UEs in clause 10.1A.16.2.2 for RSTD measurement, 10.1A.17.2 for PRS-RSRP measurement, 10.1A.18.2.3 for UE Rx-Tx time difference measurement, and 10.1A.19.2 for PRS-RSRPP measurement,and

- the minimum number is given in the accuracy requirements with FH for 1Rx RedCap UEs in clause 10.1A.16.2.2 for RSTD measurement, 10.1A.17.2 for PRS-RSRP measurement, 10.1A.18.2.4 for UE Rx-Tx time difference measurement, and 10.1A.19.2 for PRS-RSRPP measurement.

When RedCap UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when RedCap UE is configured with measurement for single positioning request.

If a positioning measurement gap is configured via *PosGapConfig* and activated by MAC CE, the measurement requirements in clauses 9.9A.2, 9.9A.3, 9.9A.4 and 9.9A.5 apply provided that no other MGs are configured, and only one measurement gap configured via *PosGapConfig* is activated.

9.9A.1.2 General Aspects of Gapless Measurement for RedCap positioning without FH

The requirements for RSTD, PRS-RSRP, UE Rx-Tx time difference, and PRS-RSRPP measurement without measurement gaps specified in clauses 9.9A.2, 9.9A.3, 9.9A.4 and 9.9A.5 shall apply provided that:

- Positioning frequency layer to be measured is within an active BWP,

- UE is configured with PPW, and the PPW for the active BWP containing the positioning frequency layer to be measured is activated,

- No active BWP switching occurs during the measurement period specified in clauses 9.9A.2, 9.9A.3, 9.9A.4 and 9.9A.5,

- PRS is within PPW and does not overlap with other signals/channels of higher priority,

  - for PPW type 1A/1B, the PPW does not overlap with any symbol for SSB-based RLM/BFD/CBD/L1-RSRP/L1-SINR measurement on any CC or for SSB based RRM measurement on any MOs that are measured outside measurement gaps,

  - for PPW type 2, PRS does not overlap with any symbol for SSB-based RLM/BFD/CBD/L1-RSRP/L1-SINR measurement on any CC or for SSB based RRM measurement on any MOs that are measured outside measurement gaps,

- $\max | \Delta T | \leq \text{THR}$, where

  - ΔT is the time difference between the start of a slot containing PRS from the neighbor cell/TRP and the start of the closest slot from the serving cell;

  - the range of ΔT is determined by the expected RSTD and expected RSTD uncertainty in the assistance data;

  - THR is the threshold as reported in UE capability *prs-MeasurementWithoutMG-r17*.

- SCS of PRS within PPW and SCS of DL active BWP are the same.

All measurement requirements specified in clauses 9.9A.2, 9.9A.3, 9.9A.4 and 9.9A.5 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

The UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

The UE is only required to measure PRS resources that are unmuted and fully or partially overlapped with PPW, and the requirements in clauses 9.9A.2, 9.9A.3, 9.9A.4 and 9.9A.5 are applicable to PRS resources that are unmuted and fully or partially overlapped with PPW.

A PRS resource is considered to be fully (partially) overlapped with PPW if all (some) of its instances are overlapped with a PPW occasion. A PRS resource instance is considered to be overlapped with PPW occasion if the minimum number of unmuted repetitions of the instance taking into account Rx time difference between serving and non-serving cell is fully covered by the PPW , where

- the minimum number is given in the accuracy requirements without FH for 2Rx RedCap UEs in clauses 10.1.23.2 for RSTD measurement, 10.1.24.2 for PRS-RSRP measurement, 10.1.25.2 for UE Rx-Tx time difference measurement, and 10.1.38.2 for PRS-RSRPP measurement, and

- the minimum number is given in the accuracy requirements without FH for 1Rx RedCap UEs in clauses 10.1A.16.2.1 for RSTD measurement, 10.1A.17.2 for PRS-RSRP measurement, 10.1A.18.2.2 for UE Rx-Tx time difference measurement, and 10.1A.19.2 for PRS-RSRPP measurement.

When UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

9.9A.1.3 Scheduling Availability of UE during PRS Measurement without Measurement Gaps for RedCap positioning without FH

The requirements in this clause apply for RedCap UE performing RSTD, PRS-RSRP, UE Rx-Tx time difference and PRS-RSRPP measurement without measurement gaps.

If *prs-ProcessingWindowType1A-r17* UE capable of supporting priority options 1, 2 and 3 is configured with a *type1A* PRS processing window with priority value '*st1*' for PRS measurement, then UE is not expected to receive PDCCH/PDSCH/CSI-RS on all symbols within PRS processing window.

If *prs-ProcessingWindowType1A-r17* UE capable of supporting priority option 2 is configured with a *type1A* PRS processing window with priority state '*st2*' for PRS measurement, then UE is not expected to receive PDSCH/CSI-RS on all symbols within PRS processing window but shall receive PDCCH and URLLC PDSCH within PRS processing window.

If *prs-ProcessingWindowType1B-r17* UE capable of supporting priority options 1, 2 and 3 is configured with a *type1B* priority value '*st1*' for PRS measurement, then UE is not expected to receive PDCCH/PDSCH/CSI-RS from serving cells in the same band as DL PRS on all symbols within PRS processing window.

If *prs-ProcessingWindowType1B-r17* UE capable of supporting priority option 2 is configured with a *type1B* PRS processing window with priority value '*st2*' for PRS measurement, then UE is not expected to receive PDSCH/CSI-RS from a certain band but shall receive PDCCH and URLLC PDSCH from serving cells in the same band as DL PRS on all symbols within PRS processing window.

If *prs-ProcessingWindowType2-r17* UE capable of supporting priority options 1, 2 and 3 is configured with a *type2* PRS processing window with priority value '*st1*' for PRS measurement, then the UE is not expected to receive PDCCH/PDSCH/CSI-RS on the symbols overlapped with DL PRS within PRS processing window.

If *prs-ProcessingWindowType2-r17* UE capable of supporting priority option 2 is configured with a *type2* PRS processing window with priority value '*st2*' for PRS measurement, then UE is not expected to receive PDSCH/CSI-RS on the symbols overlapped with DL PRS within PRS processing window but shall receive PDCCH and URLLC PDSCH on the symbols overlapped with DL PRS within PRS processing window.

When PRS is lower priority than the DL signals/channels the following applies when UEs have an activated PRS processing window with *type1A* or *type1B*:

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW no later than N_2 symbols, defined in clause 6.4 of [26], for the subcarrier spacing μ of the DL PRS, before the start of the PPW, UE expects to receive the DL signals/channels and drop all DL PRS in the PPW.

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW later than N_2 symbols, defined in clause 6.4 of [26], for the subcarrier spacing μ of the DL PRS, before the start of the PPW, UE is not required to receive the other DL signals/channels except SSB of higher priority and may receive the DL PRS in the PPW.

When PRS is lower priority than the DL signals/channels the following applies when UEs have an activated PRS processing window with *type2*:

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol no later than N_2 symbols, defined in clause 6.4 of [26] for the subcarrier spacing μ of the DL PRS, before the PRS symbol, UE expects to receive the DL signals/channels and drop the PRS symbol.

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol later than N_2 symbols, defined in clause 6.4 of [26] for the subcarrier spacing μ of the DL PRS, before the PRS symbol, UE is not required to receive the other DL signals/channels except SSB of higher priority and may receive the PRS symbol.

For inter-band case for FR2 for the DL signals/channels from a different FR2 band than the FR2 band of the DL PRS, if the same Rx beam is used for both FR2 bands and the DL PRS is determined to be higher priority, UEs are not expected to receive the DL signals/channels if they are expected to measure the DL PRS in a configured DL PRS processing window with *type1B* or *type2*.

9.9A.2 RSTD measurements for RedCap

9.9A.2.1 Introduction

The requirements in clause 9.9A.2 shall apply provided the RedCap UE has received *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34] requesting the RedCap UE to measure and report DL RSTD measurements defined in TS 38.215 [4].

The requirements in clause 9.9A.2.5 shall apply provided the RedCap UE does not support, or support but not configured, to measure PRS resources with Frequency Hopping (FH), subject to UE capability indicated via *NR-DL-AoD-ProvideCapabilities.*

The requirements in clause 9.9A.2.6 shall apply provided the RedCap UE supports and is configured to measure PRS resources with Frequency Hopping (FH), subject to UE capability indicated via *NR-DL-AoD-ProvideCapabilities*.

9.9A.2.2 Requirements Applicability

The requirements in clause 9.9A.2.5 apply for periodic and triggered RSTD measurements without FH, provided:

- PRS-RSTD related side conditions for 2 Rx RedCap UE given in clause 10.1.23.2 for FR1 and FR2 are fulfilled, for a corresponding band, or

- PRS-RSTD related side conditions for 1 Rx RedCap UE given in clause 10.1A.16.2.1 for FR1 are fulfilled, for a corresponding band.

The requirements in clause 9.9A.2.6 apply for periodic and triggered RSTD measurements with FH, provided:

- PRS-RSTD related side conditions for 2 Rx RedCap UE given in clause 10.1A.16.2.2 for FR1 and FR2 are fulfilled, for a corresponding band. or

- PRS-RSTD related side conditions for 1 Rx RedCap UE given in clause 10.1A.16.2.2 for FR1 are fulfilled, for a corresponding band.

9.9A.2.3 Measurement Capability

RedCap UE PRS RSTD measurement capability is as indicated by the RedCap UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355[34].

9.9A.2.4 Measurement Reporting Requirements

The requirements in clause 9.9.2.4 shall apply except for RSTD measurement accuracy. The RSTD measurements performed and reported according to this clause shall meet the RSTD measurement accuracy requirements in clause 10.1A.16.2 for each measured DL PRS resource.

9.9A.2.5 Measurements Period Requirements without FH

9.9A.2.5.1 Measurements Period Requirements without FH with MG

When physical layer receives last of *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34], the RedCap UE shall be able to measure multiple (up to the RedCap UE capability specified in clause 9.9A.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined as:

$$\mathrm{T_{RSTD,Total}} = \sum_{\mathrm{i=1}}^{\mathrm{L}} \mathrm{T_{RSTD,i}} + (\mathrm{L}-1) * \max\left(\mathrm{T_{effect,i}}\right),$$

where

i is the index of positioning frequency layer,

L is total number of positioning frequency layers, and

$\mathrm{T_{effect},_i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i

$\mathrm{T_{RSTD,i}}$ is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

$$\mathrm{T_{RSTD,i}} = \left(k_{multiTEG,i} * \mathrm{CSSF_{PRS_RedCap,i}} * \mathrm{ceil}(\mathrm{K_{p,PRS,i}}) * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * \mathrm{T_{effect,i}} + \mathrm{T_{last,i}},$$

where:

$N_{RxBeam,i}$ is the RedCap UE Rx beam sweeping factor. In FR1 (for 2 Rx or 1 Rx RedCap UE), $N_{RxBeam,i}$ = 1;

and in FR2 (for 2 Rx RedCap UE only), $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$CSSF_{PRS_RedCap,i}$ is the carrier-specific scaling factor for NR PRS-based positioning measurements in positioning frequency layer i as defined in clause 9.1A.5.2.

$k_{multiTEG,i}$ is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

$k_{multiTEG,i}$=1 if UE is not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*;

otherwise,

$k_{multiTEG}$=$N_{TEG,i}$, if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

$k_{multiTEG}$=$\left\lfloor \frac{N_{TEG,i}}{k_{TEG,simul,i}} \right\rfloor$ if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

$N_{TEG,i}$ is the number of Rx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-*

RequestLocationInformation, and in case 'n0' is indicated, $N_{TEG,i}$ is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

$k_{TEG,simul,i}$ is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

$K_{p,PRS,i}$ is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as $K_{p,PRS,i} = N_{total} / N_{available}$ for UE configured with concurrent measurement gap, and $K_{p,PRS,i} = 1$ for UE not configured with concurrent measurement gap.

- For a window W of duration max($T_{PRS,i}$, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:
  - N_{total} is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and
  - $N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule
  - Requirements do not apply if $N_{available}$ =0.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

$L_{available_PRS,i}$ is the time duration of available PRS in the positioning frequency layer i to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only the PRS resources unmuted and fully or partially overlapped with MG are considered.

N_{sample} is the number of PRS RSTD measurement samples, where

- N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 4 otherwise.

$T_{last,i}$ is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the

sampling time and processing time. If all of the PRS resources to be measured are available in the same MG occasion during $T_{availabe}$, $T_{last,i} = T_i$ +MGL. Otherwise, $T_{last,i} = T_i + T_{available_PRS,i}$,

$T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$$

Where,

T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

$T_{available_PRS,i} = LCM(T_{PRS,i}, MGRP_i)$, the least common multiple between $T_{PRS,i}$ and $MGRP_i$.

$MGRP_i$ is the repetition periodicity of the measurement gap applicable for measurement in the PRS frequency layer i.$T_{PRS,i}$ is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the positioning frequency layer is used to derive $T_{PRS,i}$, where,

$T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource,

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where

T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

- Note: For the purpose of calculating $T_{PRS,i}$, only the PRS resources fully or partially covered by the MG are considered.

$\{N, T\}$ is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34].

N' is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

Except for deferred MT-LR as defined in clause 4.1a.5 TS 23.273 [44], the time $T_{RSTD,Total}$ starts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34].

For deferred MT-LR with other event than "Periodic Location" as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{RSTD,Total}$ starts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event "Periodic Location" as defined in clause 4.1a.5.1 TS 23.273 [44], the UE shall perform the RSTD measurement in each reporting period and activate the location report at the time when the periodic timer expires.

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When PRS-RSRP is configured for DL-TDOA, RSTD and RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and RSRPP are performed over the same measurement period.

If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{RSTD,Total}$ within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9A.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The RSTD measurement period can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1A.16.2.

9.9A.2.5.2 Measurements Period Requirements without FH without MG

When physical layer receives last of *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34], the RedCap UE shall be able to measure multiple (up to the RedCap UE capability specified in clause 9.9A.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined as:

$T_{RSTD,Total} = \sum_{i=1}^{L} T_{RSTD_wo_gap,i} + (L-1) * \max(T_{effect,i})$, if any of the positioning frequency layers are in Case 1, or

$T_{RSTD,Total} = \max(T_{RSTD_wo_gap,i} + T_{uncertainty,i})$, if all the positioning frequency layers are in Case 2,

Where,

i is the index of positioning frequency layer, and

L is total number of positioning frequency layers, and

$T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i, and

$T_{uncertainty,i}$ is the time from the start of the first PPW occasion for positioning frequency layer i to the start of measurement period $T_{RSTD,Total}$.

A positioning frequency layer is in Case 1 if UE reports *ppw-durationOfPRS-Processing1-r17* for the band containing the positioning frequency layer, and a positioning frequency layer is in Case 2 if UE reports *ppw-durationOfPRS-Processing2-r17* for the band containing the positioning frequency layer.

$T_{RSTD_wo_gap,i}$ is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below.

$$T_{RSTD_wo_gap,i} = \left(k_{multiTEG,i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last,i},$$

where:

$N_{RxBeam,i}$ is the UE Rx beam sweeping factor. In FR1 (for 2 Rx or 1 Rx RedCap UE), $N_{RxBeam,i}$ = 1; and in FR2 (for 2 Rx RedCap UE only), $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$k_{multiTEG,i}$ is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

$k_{multiTEG,i}$=1 if UE is not supported *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*;

otherwise,

$k_{multiTEG}$=$N_{TEG,i}$, if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

$k_{multiTEG}$=$\left\lceil \frac{N_{TEG,i}}{k_{TEG,simul,i}} \right\rceil$ if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

Where

$N_{TEG,i}$ is the number of Rx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*, and in case 'n0' is indicated, $N_{TEG,i}$ is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

$k_{TEG,simul,i}$ is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

$L_{available_PRS,\mathrm{i}}$ is the time duration of available PRS in the positioning frequency layer i to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,\mathrm{i}}$,

only the PRS resources unmuted and fully or partially overlapped with PPW are considered, if positioning frequency layer i is in Case 1, or

only the PRS resources unmuted and fully or partially overlapped with the first (PPWL-T2) ms of PPW are considered, if positioning frequency layer i is in Case 2, where PPWL is the PPW length and T2 corresponds to *ppw-durationOfPRS-ProcessingSymbolsT2*.

N_{sample} is the number of PRS RSTD measurement samples, where

- N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} =2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
  - PRS bandwidth is within the active BWP and
- Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 4 otherwise.

$T_{last,i}$ is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time.

If positioning frequency layer *i* is in Case 1 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i} = T_i$ +PPWL, else

if positioning frequency layer *i* is in Case 2 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i}$ = PPWL;

otherwise, $T_{last,i} = T_i + T_{available_PRS,i}$.

$T_{effect,i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$$

Where,

T_i corresponds to *ppw-durationOfPRS-ProcessingSymbolsT* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponds to the sum of *ppw-durationOfPRS-ProcessingSymbolsT2* and *ppw*-durationOfPRS-*ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

$T_{available_PRS,\mathrm{i}} = LCM(T_{PRS,\mathrm{i}}, PPWRP_{\mathrm{i}})$, the least common multiple between $T_{PRS,\mathrm{i}}$ and $PPWRP_{\mathrm{i}}$.

$PPWRP_{\mathrm{i}}$ is the repetition periodicity of the PRS processing window applicable for measurements in the positioning frequency layer *i*.

$T_{PRS,\mathrm{i}}$ is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the positioning frequency layer is used to derive $T_{PRS,\mathrm{i}}$, where,

$T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource,

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*,

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

Note: For the purpose of calculating $T_{PRS,\mathrm{i}}$, only the PRS resources that meet the conditions for PRS measurement outside measurement gaps as defined in clause 9.9.1.2 are considered.

N is a duration of DL PRS symbols in ms corresponding to *ppw-durationOfPRS-ProcessingSymbolsN* in TS 37.355 [34] if positioning frequency layer i is in Case 1, or corresponding to *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer i is in Case 2.

N' is UE capability for number of DL PRS resources that it can process in a slot as indicated by *ppw-maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

The time $T_{\mathrm{RSTD_wo_gap,i}}$ starts from the first instance of the activated PPW for measurement of positioning frequency layer *i* aligned with a DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34].

When PRS-RSRP is configured for DL-TDOA, RSTD and RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and RSRPP are performed over the same measurement period.

If during the measurement period of one or more positioning frequency layers, the PPW is re-configured or reactivated, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{\mathrm{RSTD_wo_gap,i}}$ within PPW due to collisions with other signals; otherwise, the measurement period can be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,\mathrm{i}}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9A.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The RSTD measurement period can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1A.16.2.1.

If any positioning frequency layer is in Case 2, the requirements in this clause apply provided that the PPWL corresponding to the positioning frequency layer is larger than (T2+X) ms.

The requirements in this clause apply provided that a single positioning frequency layer is configured for measurement in each PPW.

9.9A.2.5.3 Measurements Period Requirements without FH with both MG and PPW

If the RedCap UE is configured with both MG applicable to positioning measurement and PPW, the UE shall measure positioning frequency layer *i* within

- MG, if PRS resources on positioning frequency layer *i* are overlapped with MG, or
- PPW, if PRS resources on positioning frequency layer *i* are overlapped with PPW.

The measurement period $T_{RSTD,Total}$ is defined as:

$$T_{RSTD,Total} = T_{RSTD,Total,MG} + T_{RSTD,Total,PPW} + T_{guard},$$

Where

- $T_{RSTD,Total,MG}$ is defined in clause 9.9A.2.5.1 and includes all positioning frequency layers to be measured within MG,
- $T_{RSTD,Total,PPW}$ is defined in clause 9.9A.2.5.2 and includes all positioning frequency layers to be measured within PPW,
- T_{guard} is the maximum T_{effect} defined in clauses 9.9A.2.5.1 and 9.9A.2.5.2 among all PFLs.

The requirements apply provided the following conditions are satisfied:

- MGs and PPWs do not overlap in time;
- Each PFL in the assistance data can be measured completely (all PRS resources) either within MG or within activated PPW.

9.9A.2.6 Measurements Period Requirements with FH

9.9A.2.6.1 Measurements Period Requirements with FH with MG

When UE physical layer receives last of *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message from LMF via LPP [34], requesting RedCap UE to measure DL RSTD measurement with FH, the RedCap UE shall be able to measure multiple (up to the RedCap UE capability specified in clause 9.9A.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period $T_{RSTD,Total}$ defined in clause 9.9A.2.5.1 with using the following definition for N_{sample} and $L_{available_PRS,i}$:

- N_{sample} is the number of PRS RSTD measurement samples, where
  - N_{sample} = 2 if the RedCap UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.
  - N_{sample} = 4 otherwise.
- A measurement sample with FH is defined as a PRS measurement over multiple hops within a single measurement gap occasion.
- $L_{available_PRS,i}$ is the time duration of available PRS in the positioning frequency layer i to be measured during a MG, and is calculated by:

$$L_{available_PRS,i} = \sum_{j=1}^{J} N_{hop,i,j} * L_{per-hop,i,j}$$

where,

- $N_{hop,i,j}$ is the number of hops that UE can do in an MG occasion *j* as defined in the following, and

- $L_{per-hop,i,j}$ is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured in MG instance *j* during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{per-hop,i,j}$, only the PRS resources unmuted and fully or partially overlapped with the sampling duration in each hop are considered;

- *J* is the number of MG instance during $T_{available_PRS,i}$.

The sampling window per hop is the first $T_{sample,hop}$ symbols in each hop, where $T_{sample,hop} = T_{hop} - RRT_{FH}$, T_{hop} is the applicable length per hop as defined in table 9.9A.2.6.1-1, and RRT_{FH} is the retuning time between Rx hops as reported by UE in *rf-RxRetuneTimeFR1* or *rf-RxRetuneTimeFR2* via *NR-DL-PRS-ProcessingCapability* [34]. The first hop within a MG instance starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the MG instance taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table 9.9A.2.6.1-1: Applicable number of hops per slot and applicable length of each hop

RRT_{FH}	(comb size, Number of PRS symbols)	Applicable number of hops per slot (N_{hops}^{slot})	Applicable length per hop (T_{hop}) in number of symbols
$RRT_{FH} \leq 2$ symbols	(2, 12) with SCS 15 kHz, 30 kHz, 60 kHz in FR2, 120 kHz	2	7
	All others	1	14
2 symbols $< RRT_{FH} \leq 6$ symbols	(≤ 6, any)	1	14
	(12, 12)	½	28
$RRT_{FH} > 6$ symbols	Any combination	½	28

The number of hops within a single MG occasion $N_{hop,i,j}$ is defined as

$$N_{hop,i,j} = min\left(N_{hops,effect,i,j}, \left\lfloor \frac{N3_i}{L_{per-hop,i,j}} \right\rfloor, N_{hop,max,i}\right)$$

where

- $N_{hop,max,i}$ is the maximum number of Rx hops signaled by UE in *maximumFH-Hops* via *NR-DL-PRS-ProcessingCapability* as specified in [34] for positioning frequency layer *i*

- $N3_i$ is indicated via UE capability *processingPRS-SymbolsDurationN3-r18* for positioning frequency layer *i*

- $N_{hops,effect,i,j}$ is the effective number of Rx hops within a MG instance *j*,

- $N_{hops,effect,i,j} = 2 * N_{rep}^{PRS}$, if $N_{hops}^{slot} = 2$,

- $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1$,

- $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} > 1$,

- $N_{hops,effect,i,j} = \left\lfloor \frac{(N_{rep}^{PRS}-1)}{2} \right\rfloor + 1$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} = 1$,

  - where N_{rep}^{PRS} is the number of inter-slot PRS repetitions within the MG occasion, excluding the gap retuning times, which are unmuted and fully or partially overlapped with the sampling duration within each hop. M_{rep}^{PRS} is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap*, N_{hops}^{slot} is the applicable number of hops per slot as defined in table 9.9A.2.6.1-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions (N_{rep}^{PRS}) within an MG instance and the same PRS repetition interval (M_{rep}^{PRS}), otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of BW_{total} defined as

$$BW_{total} = min\left(BW_{PRS}, N_{hop} * BW_{per-hop} - \left(N_{hop} - 1\right) * BW_{overlap}\right)$$

where

BW_{PRS} is the minimum among

- configured PRS BW, and
- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18* as specified in [34], and
- total BW of all hops requested by LMF via *nr-DL-PRS-RxHoppingTotalBandwidth-r18*.as specified in [34],

$N_{hop,i,j}$ is number of hops within a single MG occasion as define above,

$BW_{per-hop}$ is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16* as specified in [34],

$BW_{overlap}$ $BW_{overlap}$ is the UE capability on BW of the overlapping RB indicated via *numOfOverlappingPRB-r18* as specified in [34].

9.9A.3 PRS-RSRP measurements for RedCap

9.9A.3.1 Introduction

The requirements in clause 9.9A.3 shall apply provided the RedCap UE has received a message from LMF via LPP [34] requesting the RedCap UE to measure and report PRS-RSRP measurements defined in TS 38.215 [4].

The requirements in clause 9.9A.3.5 shall apply provided the RedCap UE does not support, or support but not configured, to measure PRS resources with Frequency Hopping (FH), subject to UE capability indicated in *NR-DL-AoD-ProvideCapabilities.*

The requirements in clause 9.9A.3.6 shall apply provided the RedCap UE supports and is configured to measure PRS resources with Frequency Hopping (FH), subject to UE capability indicated in *NR-DL-AoD-ProvideCapabilities*.

9.9A.3.2 Requirements applicability

The requirements in clause 9.9A.3.5 apply for periodic and triggered PRS-RSRP measurements without FH, provided:

- PRS-RSRP related side conditions for 2 Rx RedCap UE given in clause 10.1.24.2 for FR1 and FR2 are met for a corresponding band, or
- PRS-RSRP related side conditions for 1 Rx RedCap UE given in clause 10.1A.17.2 for FR1 are met for a corresponding band.

The requirements in clause 9.9A.3.6 apply for periodic and triggered PRS-RSRP measurements with FH, provided:

- PRS-RSRP related side conditions for 2 Rx RedCap UE given in clause 10.1.24.2 for FR1 and FR2 are met for a corresponding band, or
- PRS-RSRP related side conditions for 1 Rx RedCap UE given in clause 10.1A.17.2 for FR1 are met for a corresponding band.

9.9A.3.3 Measurement Capability

UE PRS-RSRP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

9.9A.3.4 Measurement Reporting Requirements

The requirements in clause 9.9.3.4 shall apply except for PRS-RSRP measurement accuracy. The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requriements specified in the clauses 10.1A.17.2.

9.9A.3.5 Measurements Period Requirements without FH

9.9A.3.5.1 Measurement Period Requirements without FH with MG

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], the RedCap UE shall be able to measure multiple (up to the RedCapUE capability specified in clause 9.9A.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within $T_{PRS-RSRP,total}$ ms.

$$T_{PRS-RSRP,\ total} = \sum_{i=1}^{L} T_{PRS-RSRP,i} + (L-1) * \max\left(T_{effect,i}\right)$$

where

i is the index of positioning frequency layer,

L is total number of positioning frequency layers,

$T_{effect,i}$ is the periodicity of the PRS-RSRP measurement in positioning frequency layer *i*.

$$T_{PRS-RSRP,i} = \left(CSSF_{PRS_RedCap,i} * \text{ceil}(K_{p,PRS,i}) * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last}$$

where

$CSSF_{PRS_RedCap,i}$ is the carrier specific scaling factor for PRS-RSRP measurements specified in clause 9.1A.5.2,

$K_{p,PRS,i}$ is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as $K_{p,PRS,i} = N_{total} / N_{available}$ for UE configured with concurrent measurement gap, and $K_{p,PRS,i} = 1$ for UE not configured with concurrent measurement gap.

For a window W of duration max($T_{PRS,i}$, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioining frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:

N_{total} is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

$N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule

Requirements do not apply if $N_{available}$ =0.

$N_{RxBeam,i}$ is the scaling factor for Rx beam sweeping, and $N_{RxBeam,i}$=1 if positioning frequency layer *i* is in FR1 (for 2 Rx or 1 Rx RedCap UE) and if positioning frequency layer *i* is in FR2 (for 2 Rx RedCap UE only), $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$L_{available_PRS,i}$ is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only the PRS resources unmuted and fully or partially overlapped with MG are considered.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

{N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

N' is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot* in clause 6.4.3 of TS 37.355 [34],

N_{sample} is the number of PRS-RSRP measurement samples, where

- N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 4 otherwise.

$T_{last,i} = T_i + T_{available_PRS,i}$ is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time, if not all PRS resources to be measured are available in the same measurement gap occasion during $T_{available_PRS,i}$, otherwise $T_{last,i} = T_i + MGL$,

$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$ is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,

T_i corresponds to durationOfPRS-ProcessingSymbolsInEveryTms in TS 37.355 [34],

$T_{available_PRS,i} = LCM(T_{PRS,i}, MGRP_i)$ is the least common multiple between $T_{PRS,i}$ and $MGRP_i$,

$T_{PRS,i}$ is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,

$MGRP_i$ is the measurement gap repetition period in positioning frequency layer i.

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among the DL PRS resource sets is used to derive $T_{PRS,i}$, where:

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

NOTE: For the purpose of calculating $T_{PRS,i}$, only the PRS resources fully or partially covered by the MG are considered.

When PRS-RSRP measurements are configured for DL-AoD, except for deferred MT-LR as defined in clause 4.1a.5 TS 23.273 [44], the time $T_{PRS-RSRP,total}$ starts from the first MG instance aligned with DL PRS resources in the assistance data after both the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

For deferred MT-LR with other event than "Periodic Location" as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{PRS-RSRP,total}$ starts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event "Periodic Location" as defined in clause 4.1a.5.1 TS 23.273 [44], the UE shall perform the PRS-RSRP measurement in each reporting period and activate the location report at the time when the periodic timer expires.

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 9.9.2.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement then the PRS-RSRP measurement shall meet the UE Rx-Tx time difference measurement requirements defined in clause 9.9.4.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource:

if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,\mathrm{i}}$ or

if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured either per UE request or not per UE request, the measurement period can be longer.

The requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $\mathrm{T}_{\mathrm{PRS-RSRP,total}}$ within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

The requirements in clause 9.9A.3 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If handover occurs while PRS-RSRP measurements are being performed then the UE shall complete the ongoing PRS-RSRP measurements session. The PRS-RSRP measurement period can be longer. The UE shall meet the PRS-RSRP measurement accuracy requirements in clause 10.1A.17.2.

9.9A.3.5.2 Measurement Period Requirements without FH without MG

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], the RedCap UE shall be able to measure multiple (up to the RedCap UE capability specified in clause 9.9A.3.3) PRS-RSRP measurements as defined in TS 38.215 [4] without measurement gap, on configured positioning frequency layer *i*, within $\mathrm{T}_{\mathrm{PRS-RSRP,total}}$ ms.

$\mathrm{T}_{\mathrm{PRS-RSRP,\,total}} = \sum_{i=1}^{L} \mathrm{T}_{\mathrm{PRS-RSRP},i} + (L-1) * \max\left(\mathrm{T}_{\mathrm{effect},i}\right)$ if any of the positioning frequency layers are in Case 1, or

$\mathrm{T}_{\mathrm{PRS-RSRP,\,total}} = \max\left(\mathrm{T}_{\mathrm{PRS-RSRP},i} + \mathrm{T}_{\mathrm{uncertainty,i}}\right)$, if all the positioning frequency layers are in Case 2,

Where,

i is the index of positioning frequency layer, and

L is total number of positioning frequency layers, and

$\mathrm{T}_{\mathrm{effect},i}$ is the periodicity of the PRS RSTD measurement in positioning frequency layer i, and

$\mathrm{T}_{\mathrm{uncertainty,i}}$ is the time from the start of the first PPW occasion for positioning frequency layer i to the start of measurement period $\mathrm{T}_{\mathrm{PRS-RSRP,\,total}}$.

A positioning frequency layer is in Case 1 if UE reports *ppw-durationOfPRS-Processing1-r17* for the band containing the positioning frequency layer, and a positioning frequency layer is in Case 2 if UE reports *ppw-durationOfPRS-Processing2-r17* for the band containing the positioning frequency layer.

$T_{PRS-RSRP,i}$ is the measurement period for PRS-RSRP measurement in positioning frequency layer *i* as specified below.

$$T_{PRS-RSRP,i} = \left(N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1\right) * T_{effect,i} + T_{last}$$

where

$T_{effect,i}$ is the periodicity of the PRS-RSRP measurement in positioning frequency layer *i*.

$N_{RxBeam,i}$ is the scaling factor for Rx beam sweeping, and $N_{RxBeam,i}$=1 if positioning frequency layer *i* is in FR1 (for 2 Rx or 1 Rx RedCap UE). If positioning frequency layer *i* is in FR2 (for 2 Rx RedCap UE only), $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

$L_{available_PRS,i}$ is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$,

only unmuted PRS resource instances that meet the applicability conditions and fully or partially overlapped with PRS processing window are considered, if positioning frequency layer i is in Case 1, or

only the PRS resources unmuted and fully or partially overlapped with the first (PPWL-T2) ms of PPW are considered, if positioning frequency layer i is in Case 2, where PPWL is the PPW length and T2 corresponds to *ppw-durationOfPRS-ProcessingSymbolsT2*.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

{N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *ppw-durationOfPRS-ProcessingSymbolsN* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponding to *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

N′ is UE capability for number of DL PRS resources that it can process in a slot as indicated by *ppw-maxNumOfDL-PRS-ResProcessedPerSlot* in clause 6.4.3 of TS 37.355 [34],

N_{sample} is the number of PRS-RSRP measurement samples, where

- N_{sample} = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample} = 4 otherwise.

T_{last} is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time.

If positioning frequency layer *i* is in Case 1 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i} = T_i$ +PPWL, else

if positioning frequency layer *i* is in Case 2 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i}$ = PPWL;

otherwise, $T_{last,i} = T_i + T_{available_PRS,i}$.

$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$ is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,

T_i corresponds to *ppw-durationOfPRS-ProcessingSymbolsT* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponds to the sum of *ppw-durationOfPRS-ProcessingSymbolsT2* and *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2

$T_{available_PRS,i} = LCM(T_{PRS,i}, PPWRP_i)$ is the least common multiple between $T_{PRS,i}$ and $PPWRP_i$,

$T_{PRS,i}$ is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer *i*,

$PPWRP_i$ is the PRS processing window repetition period in positioning frequency layer i.

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among the DL PRS resource sets is used to derive $T_{PRS,i}$, where:

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. If bitmap $\{b^1\}$ for higher-layer parameter *DL-*
N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

Note: For the purpose of calculating $T_{PRS,i}$, only the PRS resources that meet the applicability conditions and fully or partially covered by the PRS processing window are considered.

When PRS-RSRP measurements are configured for DL-AoD, the time $T_{PRS-RSRP,i}$ starts from the first PRS processing window instance aligned with DL PRS resources in the assistance data after both the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 9.9A.2.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement then the PRS-RSRP measurement shall meet the UE Rx-Tx time difference measurement requirements defined in clause 9.9A.4.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or
- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9A.3 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

If during the measurement period of one or more positioning frequency layers, the PPW is reconfigured or reactivated, the PRS-RSRP measurement period can be longer.

If any positioning frequency layer is in Case 2, the requirements in this clause apply provided that the PPWL corresponding to the positioning frequency layer is larger than (T2+X) ms.

The requirements in this clause apply provided that a single positioning frequency layer is configured for measurement in each PPW.

9.9A.3.5.3 Measurements Period Requirements without FH with both MG and PPW

If the RedCap UE is configured with both MG applicable to positioning measurement and PPW, the UE shall measure positioning frequency layer *i* within

- MG, if PRS resources on positioning frequency layer *i* are overlapped with MG, or
- PPW, if PRS resources on positioning frequency layer *i* are overlapped with PPW.

The measurement period $T_{PRS-RSRP,\ total}$ is defined as:

$$T_{PRS-RSRP,\ total} = T_{PRS-RSRP,Total,MG} + T_{PRS-RSRP,Total,PPW} + T_{guard},$$

Where

- $T_{PRS-RSRP,Total,MG}$ is defined in clause 9.9A.3.5.1 and includes all positioning frequency layers to be measured within MG,
- $T_{PRS-RSRP,Total,PPW}$ is defined in clause 9.9A.3.5.2 and includes all positioning frequency layers to be measured within PPW,
- T_{guard} is the maximum T_{effect} defined in clauses 9.9A.3.5.1 and 9.9A.3.5.2 among all PFLs.

The requirements apply provided the following conditions are satisfied:

- MGs and PPWs do not overlap in time;
- Each PFL in the assistance data can be measured completely (all PRS resources) either within MG or within activated PPW.

9.9A.3.6 Measurements Period Requirements with FH

9.9A.3.6.1 Measurements Period Requirements with FH with MG

When the UE the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], requesting RedCap UE to measure PRS-RSRP measurement with FH, the RedCap UE shall be able to measure multiple (up to the RedCapUE capability specified in clause 9.9A.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within $T_{PRS-RSRP,total}$ ms as defined clause 9.9A.3.5.1 with using the following definition for N_{sample} and $L_{available_PRS,i}$:

- N_{sample} is the number of PRS-RSRP measurement samples, where
  - N_{sample} = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.
  - N_{sample} = 4 otherwise.
- A measurement sample with FH is defined as a PRS measurement over multiple hops within a single measurement gap occasion.
- $L_{available_PRS,i}$ is the time duration of available PRS in the positioning frequency layer i to be measured during a MG, and is calculated by:

$$L_{available_PRS,i} = \sum_{j=1}^{J} N_{hop,i,j} * L_{per-hop,i,j}$$

where,

- $N_{hop,i,j}$ is the number of hops that UE can do in an MG occasion *j* as defined in the following, and
- $L_{per-hop,i,j}$ is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured in MG instance *j* during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{per-hop,i,j}$, only the PRS resources unmuted and fully or partially overlapped with the sampling duration in each hop are considered;
- *J* is the number of MG instance during $T_{available_PRS,i}$.

The sampling window per hop is the first $T_{sample,hop}$ symbols in each hop, where $T_{sample,hop} = T_{hop} - RRT_{FH}$, T_{hop} is the applicable length per hop as defined in table 9.9A.3.6.1-1, and RRT_{FH} is the retuning time between Rx hops as reported by UE in *rf-RxRetuneTimeFR1* or *rf-RxRetuneTimeFR2* via *NR-DL-PRS-ProcessingCapability* [34]. The first hop within a MG instance starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the MG instance taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table 9.9A.3.6.1-1: Applicable number of hops per slot and applicable length of each hop

RRT_{FH}	(comb size, Number of PRS symbols)	Applicable number of hops per slot (N_{hops}^{slot})	Applicable length per hop (T_{per}) in number of symbols
$RRT_{FH} \leq 2$ symbols	(2, 12) with SCS 15 kHz, 30 kHz, 60 kHz in FR2, 120 kHz	2	7
	All others	1	14
2 symbols $< RRT_{FH} \leq 6$ symbols	(≤ 6, any)	1	14
	(12, 12)	½	28
$RRT_{FH} > 6$ symbols	Any combination	½	28

The number of hops within a single MG occasion $N_{hop,i,j}$ is defined as

$$N_{hop,i,j} = min\left(N_{hops,effect,i,j}, \left\lfloor \frac{N3_i}{L_{per-hop,i,j}} \right\rfloor, N_{hop,max,i}\right)$$

where

- $N_{hop,max}$ is the maximum number of Rx hops signaled by UE in *maximumFH-Hops* via *NR-DL-PRS-ProcessingCapability* as specified in [34] for positioning frequency layer *i*
- $N3_i$ is indicated via UE capability *processingPRS-SymbolsDurationN3-r18* for positioning frequency layer *i*
- $N_{hops,effect,i,j}$ is the effective number of Rx hops within a MG instance *j*,
- $N_{hops,effect,i,j} = 2 * N_{rep}^{PRS}$, if $N_{hops}^{slot} = 2$,
- $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1$,
- $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} > 1$,
- $N_{hops,effect,i,j} = \left\lfloor \frac{(N_{rep}^{PRS}-1)}{2} \right\rfloor + 1$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} = 1$,
- where N_{rep}^{PRS} is the number of inter-slot PRS repetitions within the MG occasion, excluding the gap retuning times, which are unmuted and fully or partially overlapped with the sampling duration within each hop. M_{rep}^{PRS} is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap*, N_{hops}^{slot} is the applicable number of hops per slot as defined in table 9.9A.3.6.1-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions (N_{rep}^{PRS}) within an MG instance and the same PRS repetition interval (M_{rep}^{PRS}), otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of BW_{total} defined as

$$BW_{total} = min\left(BW_{PRS}, N_{hop} * BW_{per-hop} - \left(N_{hop} - 1\right) * BW_{overlap}\right)$$

where

- BW_{PRS} is the minimum among
- configured PRS BW, and
- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18*, and
- total BW of all hops requested by LMF via *nr-DL-PRS-RxHoppingTotalBandwidth-r18* as specified in [34],

$N_{hop,i,j}$ is number of hops within a single MG occasion as define above,

$BW_{per-hop}$ is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16* as specified in [34],

$BW_{overlap}$ is the UE capability on BW of the overlapping RB indicated via *numOfOverlappingPRB-r18* as specified in [34].

9.9A.4 UE Rx-Tx time difference measurements for RedCap

9.9A.4.1 Introduction

The requirements in this clause apply for RedCap UE, when the UE received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP specified in TS 37.355 [34] requesting the UE to measure and report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4].

If UE does not support RX FH for PRS measurement as indicated by UE capability *NR-DL-PRS-ProcessingCapability*, or if LMF does not request UE to use RX FH for PRS measurement as indicated via *NR-Multi-RTT-RequestLocationInformation* in the measurement request, the requirements in clauses 9.9A.4.5, 9.9A.4.6 and 9.9A.4.7 shall apply for applicable configurations.

If UE supports RX FH for PRS measurement as indicated by UE capability *NR-DL-PRS-ProcessingCapability*, and LMF requests UE to use RX FH for PRS measurement as indicated via *NR-Multi-RTT-RequestLocationInformation* in the measurement request, the requirements in clause 9.9A.4.8 shall apply.

9.9A.4.2 Requirements Applicability

The requirements in clause 9.9A.4 apply for periodic and triggered UE Rx-Tx time difference measurements, provided:

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1A.18.2 are met for a corresponding band.
- SRS is configured on at least one of the PCell, PSCell and SCell.
- The UE transmits SRS within the range from -160 ms to 160 ms of at least one DL PRS resource of each of the TRPs in the assistance data.

9.9A.4.3 Measurement Capability

UE Rx-Tx time difference measurement capability is as indicated by the UE in *NR-Multi-RTT-ProvideCapabilities*, according to TS 37.355 [34].

9.9A.4.4 Measurement Reporting Requirements

The requirements in clause 9.9.4.4 shall apply except that the UE Rx-Tx time difference measurement accuracy for all measured DL PRS resources shall be fulfilled according to the accuracy requirements specified in clause 10.1A.18.2.

9.9A.4.5 Measurement Period Requirements without FH with MG

The requirements in clause 9.9.4.5 shall apply.

9.9A.4.6 Measurement Period Requirements without FH without MG

The requirements in clause 9.9.4.6 shall apply.

9.9A.4.7 Measurements Period Requirements without FH with both MG and PPW

The requirements in clause 9.9.4.8 shall apply.

9.9A.4.8 Measurements Period Requirements with FH

The requirements in this clause apply when a RedCap UE is requested by the LMF to perform measurements with FH, and UE reports measurement based on multiple hops.

The requirements in clause 9.9A.4.5 shall apply with the following modifications.

- N_{sample} = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples. Otherwise, N_{sample} = 4.

- A measurement sample with FH is defined as a PRS measurement over multiple hops within a single measurement gap.

- $L_{available_PRS,i} = \sum_{j=1}^{J} N_{hop,i,j} * L_{per-hop,i,j}$, where

  - $N_{hop,i,j}$ is the number of hops that UE can do in an MG occasion *j* as defined in the following, and

  - $L_{per-hop,i,j}$ is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured in MG instance *j* during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{per-hop,i,j}$, only the PRS resources unmuted and fully or partially overlapped with the sampling duration in each hop are considered;

  - *J* is the number of MG instance during $T_{available_PRS,i}$.

The sampling window per hop is the first $T_{sample,hop}$ symbols in each hop, where $T_{sample,hop} = T_{hop} - RRT_{FH}$, T_{hop} is the applicable length per hop as defined in table 9.9A.4.8-1, and RRT_{FH} is the retuning time between Rx hops as reported by UE in *rf-RxRetuneTimeFR1* or *rf-RxRetuneTimeFR2* via *NR-DL-PRS-ProcessingCapability* specified in TS 37.355 [34]. The first hop within a MG instance starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the MG instance taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table 9.9A.4.8-1: Applicable number of hops per slot and applicable length of each hop

RRT_{FH}	(comb size, Number of PRS symbols)	Applicable number of hops per slot (N_{hops}^{slot})	Applicable length per hop (T_{hop}) in number of symbols
$RRT_{FH} \leq 2$ symbols	(2, 12) with SCS 15 kHz, 30 kHz, 60 kHz in FR2, 120 kHz	2	7
	All others	1	14
2 symbols $< RRT_{FH} \leq 6$ symbols	(≤ 6, any)	1	14
	(12, 12)	½	28
$RRT_{FH} > 6$ symbols	Any combination	½	28

The number of hops within a single MG occasion $N_{hop,i,j}$ is defined as

$$N_{hop,i,j} = min\left(N_{hops,effect,i,j}, \left\lfloor \frac{N3_i}{L_{per-hop,i,j}} \right\rfloor, N_{hop,max,i}\right)$$

where

- $N_{hop,max}$ is the maximum number of Rx hops signaled by UE in *maximumFH-Hops* via *NR-DL-PRS-ProcessingCapability* as specified in TS 37.355 [34] for positioning frequency layer *i*
- $N3_i$ is indicated via UE capability *processingPRS-SymbolsDurationN3-r18* for positioning frequency layer *i*
- $N_{hops,effect,i,j}$ is the effective number of Rx hops within a MG instance,
- $N_{hops,effect,i,j} = 2 * N_{rep}^{PRS}$, if $N_{hops}^{slot} = 2$,
- $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1$,
- $N_{hops,effect,i,j} = N_{rep}^{PRS}$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} > 1$,
- $N_{hops,effect,i,j} = \left\lfloor \frac{(N_{rep}^{PRS}-1)}{2} \right\rfloor + 1$, if $N_{hops}^{slot} = 1/2$ and $M_{rep}^{PRS} = 1$,
- where N_{rep}^{PRS} is the number of inter-slot PRS repetitions within the MG occasion excluding the gap retuning times, which are unmuted and fully or partially overlapped with the sampling duration within each hop. M_{rep}^{PRS} is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap* and N_{hops}^{slot} is the applicable number of hops per slot as defined in table 9.9A.4.8-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions $\left(N_{rep}^{PRS}\right)$ within an MG instance and the same PRS repetition interval $\left(M_{rep}^{PRS}\right)$, otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of BW_{total} defined as

$$BW_{total} = min\left(BW_{PRS}, N_{hop,i,j} * BW_{per-hop} - \left(N_{hop} - 1\right) * BW_{overlap}\right)$$

where

- BW_{PRS} is the minimum among
- configured PRS BW, and
- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18*, and
- total BW of all hops requested by LMF via *nr-DL-PRS-RxHoppingTotalBandwidth-r18* as specified in TS 37.355 [34],

  $N_{hop,i,j}$ is number of hops within a single MG occasion as define above,

  $BW_{per-hop}$ is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16* as specified in TS 37.355 [34],

  $BW_{overlap}$ is the UE capability on BW of the overlapping RB indicated via *numOfOverlappingPRB-r18* as specified in TS 37.355 [34].

9.9A.5 PRS-RSRPP measurements for RedCap

9.9A.5.1 Introduction

The requirements in this clause apply for RedCap UE, when the UE received *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report one or more PRS-RSRPP measurements defined in TS 38.215 [4].

If UE does not support FH for PRS measurement as indicated by UE capability *NR-DL-AoD-ProvideCapabilities*, or if LMF does not request UE to use FH for PRS measurement as indicated via *NR-DL-AoD-RequestLocationInformation* in the measurement request, the requirements in clauses 9.9A.5.5, 9.9A.5.6 and 9.9A.5.7 shall apply for applicable configurations.

If UE supports FH for PRS measurement as indicated by UE capability *NR-DL-AoD-ProvideCapabilities*, and LMF requests UE to use FH for PRS measurement as indicated via *NR-DL-AoD-RequestLocationInformation* in the measurement request, the requirements in clause 9.9A.5.8 shall apply.

9.9A.5.2 Requirements Applicability

The requirements in clause 9.9A.5 apply for periodic and triggered PRS-RSRPP measurements, provided:

- PRS-RSRPP related side conditions given in clause 10.1A.19.2 are met for a corresponding band.

9.9A.5.3 Measurement Capability

UE PRS-RSRPP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

9.9A.5.4 Measurement Reporting Requirements

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes the delay uncertainty caused by inserting the measurement report into the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The reported PRS-RSRPP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1A.19.3.

The PRS-RSRPP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requriements specified in the clause 10.1A.19.2.

9.9A.5.5 Measurement Period Requirements without FH with MG

For PRS measurement within MG configured to UE, measurement period requirements for PRS-RSRP defined in clause 9.9A.3.5.1 is re-used for PRS-RSRPP.

9.9A.5.6 Measurement Period Requirements without FH without MG

For PRS measurement without MG configured to UE, measurement period requirements for PRS-RSRP defined in clause 9.9A.3.5.2 is re-used for PRS-RSRPP.

The PRS-RSRPP measurement requirements in this clause apply for the first path PRS-RSRP measurement.

9.9A.5.7 Measurements Period Requirements without FH with both MG and PPW

If the UE is configured with both MG applicable to positioning measurement and PPW, the measurement period requirements for PRS-RSRP defined in clause 9.9A.3.5.3 is re-used for PRS-RSRPP.

9.9A.5.8 Measurements Period Requirements with FH

The measurement period requirements for PRS-RSRP defined in clause 9.9A.3.6 are re-used for PRS-RSRPP.

9.9C NR measurements for positioning in Satellite Access

9.9C.1 Introduction

This clause contains requirements for UE capable of performing NR positioning measurements defined in TS 38.215 [4], including UE Rx-Tx time difference , when the PCell is served by a Satellite Access Node (SAN).

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.9C.1.1 General Aspects of Gap-based Measurement

For gap-based UE Rx-Tx time difference, the requirements in clauses 9.9C.4.5 apply provided:

- the UE is configured with measurement gaps or configured with concurrent measurement gaps
  - all positioning frequency layers are measured or associated with only one measurement gap, or
- No active BWP switching occurs during the measurement gaps for PRS measurement, and

All measurement requirements specified in clause 9.9C.4.5 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

UE is only required to measure PRS resources that are fully or partially overlapped with measurement gaps, and the requirements in clause 9.9C.4.5 and are applicable to PRS resources that are fully or partially overlapped with measurement gaps.

A PRS resource is considered to be fully (partially) overlapped with measurement gaps if all (some) of its instances are overlapped with a measurement gap occasion. A PRS resource instance is considered to be overlapped with measurement gap occasion if the minimum number of unmuted repetitions of the instance taking into account *nr-DL-PRS-ExpectedRSTD-Uncertainty* and *nr-DL-PRS-ExpectedRSTD* is fully covered by the MGL excluding RF switching time, where the minimum number is given in the accuracy requirements in clause 10.1.25C, for UE Rx-Tx time difference .

When UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

If a positioning measurement gap is configured via *PosGapConfig* and activated by MAC CE, the measurement requirements in clause 9.9.4C.5 apply provided that no other MGs are configured, and only one measurement gap configured via *PosGapConfig* is activated.

9.9C.1.2 General Aspects of Gapless Measurement

The requirements for UE Rx-Tx time difference measurement without measurement gaps specified in clause 9.9C.4.6 shall apply provided that:

Positioning frequency layer to be measured is within an active BWP,

UE is configured with PPW, and the PPW for the active BWP containing the positioning frequency layer to be measured is activated,

No active BWP switching occurs during the measurement period specified in clauses 9.9.2.7, 9.9.3.6, 9.9.4.6, and 9.9.6.6,

PRS is within PPW and does not overlap with other signals/channels of higher priority,

- for PPW type 1A/1B, the PPW does not overlap with any symbol for SSB-based RLM/BFD/CBD/L1-RSRP/L1-SINR measurement on any CC or for SSB based RRM measurement on any MOs that are measured outside measurement gaps,
- for PPW type 2, PRS does not overlap with any symbol for SSB-based RLM/BFD/CBD/L1-RSRP/L1-SINR measurement on any CC or for SSB based RRM measurement on any MOs that are measured outside measurement gaps,

SCS of PRS within PPW and SCS of DL active BWP are the same.

All measurement requirements specified in clause 9.9C.4.6 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

The UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

The UE is only required to measure PRS resources that are unmuted and fully or partially overlapped with PPW, and the requirements in clause 9.9C.4.6 are applicable to PRS resources that are unmuted and fully or partially overlapped with PPW.

A PRS resource is considered to be fully (partially) overlapped with PPW if all (some) of its instances are overlapped with a PPW occasion. A PRS resource instance is considered to be overlapped with PPW occasion if the minimum number of unmuted repetitions of the instance taking into account Rx time difference between serving and non-serving cell is fully covered by the PPW, where the minimum number is given in the accuracy requirements in clause 10.1.25C for UE Rx-Tx time difference.

When UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

9.9C.1.3 Scheduling Availability of UE during PRS Measurement without Measurement Gaps

The requirements in clause 9.9.1.3 apply for UE performing UE Rx-Tx time difference measurement without measurement gaps according to clause 9.9C.4.6.

9.9C.2 Void

9.9C.3 Void

9.9C.4 UE Rx-Tx time difference measurements

9.9C.4.1 Introduction

The requirements in this clause shall apply, provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4].

9.9C.4.2 Requirements Applicability

The requirements in clause 9.9C.4 apply for periodic and triggered UE Rx-Tx time difference measurements, provided:

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25C are met for a corresponding band.
- SRS is configured on the PCell.
- The UE transmits SRS within the range from -160 ms to 160 ms of the DL PRS resource of the TRP corresponding to the PCell in the assistance data.

9.9C.4.3 Measurement Capability

UE Rx-Tx time difference measurement capability is as indicated by the UE in *NR-Multi-RTT-ProvideCapabilities*, according to TS 37.355 [34].

9.9C.4.4 Measurement Reporting Requirements

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The UE Rx-Tx time difference measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.25C.

The UE Rx-Tx time difference measurement accuracy for all measured DL PRS resources shall be fulfilled according to the accuracy requirements specified in clause 10.1.25C.

9.9C.4.5 Measurement Period Requirements

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34], UE shall be able to measure multiple (up to the UE capability specified in clause 9.9C.4.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] from its PCell in a single configured positioning frequency layer *i* within the measurement period $T_{UERxTx,i}$ ms.

Measurement period $T_{UERxTx,i}$ is defined as

$$T_{UERxTx,i} = \left(CSSF_i * \text{ceil}\left(K_{p,PRS,i}\right) * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1 \right) * T_{effect,i} + T_{last,i}$$

Where

$CSSF_i$ is the carrier-specific scaling factor for NR PRS-based measurement in the positioning frequency layer *i* as defined in clause 9.1.5.2,

$K_{p,PRS,i}$ is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as $K_{p,PRS,i} = N_{total} / N_{available}$ for UE configured with concurrent measurement gap, and $K_{p,PRS,i} = 1$ for UE not configured with concurrent measurement gap.

For a window W of duration max($T_{PRS,i}$, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:

N_{total} is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

$N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule

Requirements do not apply if $N_{available}$ =0.

$L_{available_PRS,i}$ is the time duration of available PRS resources in the positioning frequency layer *i*, to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only the PRS resources unmuted and fully or partially overlapped with MG are considered.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

{N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in clause 4.2.7.2 of TS 37.355 [34],

N' is UE capability for number of DL PRS resources that it can process in a slot corresponding to *maxNumOfDL-PRS-ResProcessedPerSlot* as specified in clause 6.4.3 of TS 37.355 [34],

N_{sample} is the number of UE Rx-Tx time difference measurement samples and $N_{sample} = 1$.

$T_{last,i}$ is the measurement duration for the last UE Rx-Tx time difference measurement sample in the positioning layer i, including the sampling time and processing time, $T_{last,i} = T_i + T_{available_PRS,i}$,

$T_{effect,i}$ is periodicity of UE Rx-Tx time difference measurement in positioning frequency layer *i*:

$$T_{\text{effect,i}} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil * T_{available_PRS,i}$$

where

T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

$T_{available_PRS,i} = LCM(T_{PRS,i}, MGRP_i)$, the least common multiple between $T_{PRS,i}$ and $MGRP_i$

$MGRP_i$ is the measurement gap repetition periodicity in positioning frequency layer *i*.

$T_{PRS,i}$ is the PRS resource periodicity in positioning frequency layer *i*. If the positioning frequency layer *i* has more than one DL PRS resource sets with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among DL PRS resource sets is used to derive $T_{PRS,i}$, where

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$

NOTE: For the purpose of calculating $T_{PRS,i}$, only the PRS resources fully or partially covered by the MG are considered.

Except for deferred MT-LR as defined in clause 4.1a.5 TS 23.273 [44], the time $T_{UERxTx,Total}$ starts from the first MG instance aligned with DL PRS resources in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{UERxTx,Total}$ starts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 TS 23.273 [44], the UE shall perform the PRS-RSRP measurement in each reporting period and activate the location report at the time when the periodic timer expires.

When HO occurs during the measurement period, UE shall stop PRS measurement for the source cell after HO occurs, and shall start PRS measurement for the target cell after SRS reconfiguration on the target cell is complete.

When satellite switch with re-sync occurs during the measurement period, UE shall stop PRS measurement at *t-Service* if hard switching is applicable, or at *t-ServiceStart* if soft switching is applicable, and shall start PRS measurement after the switch is complete.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or
- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period, the MG pattern is reconfigured either per UE request or not per UE request, the measurement period can be longer.

The requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{UERxTx,Total}$ within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

The requirements in clause 9.9C.4 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-*

Multi-RTT-ProvideCapabilities, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

When SRS is reconfigured without serving cell change during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration is complete.

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx time difference measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the N_{TA_offset} defined in table 7.1.2-2 during the UE Rx-Tx time difference measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1C.2 during the UE Rx-Tx time difference measurement period, then:

- UE Rx-Tx time difference measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in clause 7.1C.1) for SRS transmission.

9.9C.4.6 Measurement Period Requirements without Measurement Gaps

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34], UE shall be able to measure multiple (up to the UE capability specified in clause 9.9C.4.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] from its Pcell in a single configured positioning frequency layer *i* within the measurement period $T_{UERxTx_wo_gap,i}$ ms.

In the following requirements, a positioning frequency layer *i* is in Case 1 if UE reports *ppw-durationOfPRS-Processing1-r17* for the band containing the positioning frequency layer, and a positioning frequency layer is in Case 2 if UE reports *ppw-durationOfPRS-Processing2-r17* for the band containing the positioning frequency layer.

Measurement period $T_{UERxTx_wo_gap,i}$ is defined as

$$T_{UERxTx_wo_gap,i} = \left(\left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil * N_{sample} - 1 \right) * T_{effect,i} + T_{last,i}$$

Where

$T_{effect,i}$ is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer i as defined further in this clause.

$L_{available_PRS,i}$ is the time duration of available PRS resources in the positioning frequency layer *i*, to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$,

only the unmuted PRS resources that meet the applicability conditions and fully or partially overlapped with PRS processing window are considered, if positioning frequency layer i is in Case 1, or

only the PRS resources unmuted and fully or partially overlapped with the first (PPWL-T2) ms of PPW are considered, if positioning frequency layer i is in Case 2, where PPWL is the PPW length and T2 corresponds to *ppw-durationOfPRS-ProcessingSymbolsT2*.

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

{N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *ppw-durationOfPRS-ProcessingSymbolsN* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponding to *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

N′ is UE capability for number of DL PRS resources that it can process in a slot corresponding to *ppw-maxNumOfDL-PRS-ResProcessedPerSlot* as specified in clause 6.4.3 of TS 37.355 [34],

N_{sample} is the number of UE Rx-Tx time difference measurement samples, and $N_{sample} = 1$

$T_{last,i}$ is the measurement duration for the last UE Rx-Tx time difference measurement sample in the positioning layer i, including the sampling time and processing time.

If positioning frequency layer *i* is in Case 1 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i} = T_i$ +PPWL, else

if positioning frequency layer *i* is in Case 2 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i}$ = PPWL;

otherwise, $T_{last,i} = T_i + T_{available_PRS,i}$.

$T_{effect,i}$ is periodicity of UE Rx-Tx time difference measurement in positioning frequency layer *i*:

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_{PRS},i}} \right\rceil * T_{available_{PRS},i}$$

where

T_i corresponds to *ppw-durationOfPRS-ProcessingSymbolsT* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponds to the sum of *ppw-durationOfPRS-ProcessingSymbolsT2* and *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

$T_{available_PRS,i} = LCM(T_{PRS,i}, PPWRP_i)$, the least common multiple between $T_{PRS,i}$ and $PPWRP_i$

$PPWRP_i$ is the PRS processing window repetition periodicity in positioning frequency layer *i*.

$T_{PRS,i}$ is the PRS resource periodicity in positioning frequency layer *i*. If the positioning frequency layer *i* has more than one DL PRS resource sets with different PRS periodicities with muting, $T_{per}^{PRS\ with\ muting} = N_{muting} * T_{per}^{PRS}$, the least common multiple of $T_{per}^{PRS\ with\ muting}$ among DL PRS resource sets is used to derive $T_{PRS,i}$, where

T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} * L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$

NOTE: For the purpose of calculating $T_{PRS,i}$, only the PRS resources that meet the applicability conditions and fully or partially covered by the PRS processing window are considered.

The time $T_{UERxTx_wo_gap,i}$ starts from the first PRS processing window instance aligned with DL PRS resources in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

When HO occurs during the measurement period, UE shall stop PRS measurement for the source cell after HO occurs, and shall start PRS measurement for the target cell after SRS reconfiguration on the target cell is complete.

When satellite switch with re-sync occurs during the measurement period, UE shall stop PRS measurement at *t-Service* if hard switching is applicable, or at *t-ServiceStart* if soft switching is applicable, and shall start PRS measurement after the switch is complete.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$ or
- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period, the PRS processing window is reconfigured or reactivated either per UE request or not per UE request, the measurement period can be longer.

The requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{UERxTx_wo_gap,i}$ within PRS processing window due to collisions with other signals; otherwise, a longer measurement period may be used.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

The requirements in clause 9.9C.4.6 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities.

When SRS is reconfigured without cell change during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx time difference measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the N_{TA_offset} defined in table 7.1C.2-2 during the UE Rx-Tx time difference measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1C.2 during the UE Rx-Tx time difference measurement period, then:

- UE Rx-Tx time difference measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in clause 7.1C.1) for SRS transmission.

If any positioning frequency layer is in Case 2, the requirements in this clause apply provided that the PPWL corresponding to the positioning frequency layer is larger than (T2+X) ms.

The requirements in this clause apply provided that a single positioning frequency layer is configured for measurement in each PPW.

9.9D NR measurements for positioning for RedCap in Satellite Access

9.9D.1 Introduction

This clause contains requirements for RedCap UE capable of performing NR positioning measurements defined in TS 38.215 [4], including UE Rx-Tx time difference, when the PCell is served by a Satellite Access Node (SAN).

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.9D.1.1 General Aspects of Gap-based Measurement

The requirements in clause 9.9C.1.1shall apply.

9.9D.1.2 General Aspects of Gapless Measurement

The requirements in clause 9.9C.1.2 shall apply.

9.9D.1.3 Scheduling Availability of UE during PRS Measurement without Measurement Gaps

The requirements in clause 9.9C.1.3 shall apply.

9.9D.2 Void

9.9D.3 Void

9.9D.4 UE Rx-Tx time difference measurements

9.9D.4.1 Introduction

The requirements in this clause shall apply for RedCap UE, when the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4].

9.9D.4.2 Requirements Applicability

For RedCap UE not in HD-FDD mode, the requirements in clause 9.9D.4 apply for periodic and triggered RedCap UE Rx-Tx time difference measurements, provided:

- RedCap UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25D are met for a corresponding band.
- SRS is configured on the PCell.
- The RedCap UE transmits SRS within [-160, 160] msec of the DL PRS resource of the TRP corresponding to the PCell in the assistance data.

For RedCap UE in HD-FDD mode, the requirements in clause 9.9D.4 apply for periodic and triggered RedCap UE Rx-Tx time difference measurements, provided:

- RedCap UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25D are met for a corresponding band.
- SRS is configured on the PCell.
- The RedCap UE transmits SRS within [-160, 160] msec of the DL PRS resource of the TRP corresponding to the PCell in the assistance data.
- For UE supporting Handling collision Case 3 and collision Case 4 for half-duplex FDD operation for (e)RedCap UE, when *ntn-PrioritizeUl-semiStatichalfDuplexRedCapcollision* is enabled, no collision occurs between PRS and UL transmission.

9.9D.4.3 Measurement Capability

RedCap UE Rx-Tx time difference measurement capability is as indicated by the UE in *NR-Multi-RTT-ProvideCapabilities*, according to TS 37.355 [34].

9.9D.4.4 Measurement Reporting Requirements

The requirements in clause 9.9C.4.4 shall apply except that:

- the RedCap UE Rx-Tx time difference measurement accuracy for all measured DL PRS resources shall be fulfilled according to the accuracy requirements specified in clause 10.1.25D.2, and
- the RedCap UE Rx-Tx time difference measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.25D.3.

9.9D.4.5 Measurement Period Requirements

The requirements in clause 9.9C.4.5 shall apply except that:

- clause identifier 9.1.5.2 is replaced with 9.1A.5.2

- clause identifier 9.9C.4 is replaced with 9.9D.4

9.9D.4.6 Measurement Period Requirements without Measurement Gaps

The requirements in clause 9.9C.4.6 shall apply.

clause identifier 9.9C.4.6 is replaced with 9.9D.4.6.

9.9E Reporting Delay Requirements for DL AI/ML Positioning

9.9E.1 Introduction

The reporting delay requirements in Clause 9.9E shall apply provided the UE supports DL AI/ML positioning specified in TS 38.305 [22] as indicated in *NR-DL-AIML-ProvideCapabilities*, and has received *NR-DL-AIML-RequestLocationInformation* message from LMF via LPP requesting UE to report its location based on DL AI/ML positioning [34].

The position reporting delay is the sum of measurement delay, inference delay, and the time needed until the UE is ready to send the position report to LMF and is defined as the time between the moment when the position report is triggered and the moment when the UE is ready to start to transmit the position report over the air interface. This requirement assumes that the position report is not delayed by other LPP signalling on the DCCH. This position reporting delay excludes a delay uncertainty resulted when inserting the position report to the TTI of the uplink DCCH. The delay uncertainty is $2\times TTI_{DCCH}$ where TTI_{DCCH} is the duration of subframe or slot or subslot when the position report is transmitted on the PUSCH with subframe or slot or subslot duration. This position reporting delay excludes any delay caused by no UL resources for UE to send the report and is specified as:

$$T_{position_reporting_delay} = T_{measurement_delay} + T_{inference_delay}$$

Measurement delay, $T_{measurement_delay}$, for PRS measurement within measurement gap is defined in Clause 9.9E.5. Measurement delay, $T_{measurement_delay}$, for PRS measurement outside of measurement gap and within PPW is defined in Clause 9.9E.6. Measurement delay, $T_{measurement_delay}$, for PRS measurement by aggregating resources from multiple PFLs within measurement gap is defined in Clause 9.9E.7. Inference delay, $T_{inference_delay}$, is the sum of inference delays across the number of configured PFLs where inference delay per PFL is reported by UE for FG 59-3 and indicated to LMF. For bandwidth aggregation, the inference delay $T_{inference_delay}$ is the sum of inference delays across all effective PFLs where the UE performs aggregated measurements, with inference delay per effective PFL is equal to each per-PFL inference delay reported by the UE for FG 59-3 and indicated to the LMF.

The measurement delay requirements in Clauses 9.9E.5, 9.9E.6, and 9.9E.7 apply for periodic and triggered UE location reporting.

9.9E.2 General Aspects Relating to Gap-based Measurement

The requirements for gap-based measurement specified in Clauses 9.9E.5, and 9.9E.7 apply provided:

- the UE is configured or pre-configured with measurement gaps or configured with concurrent measurement gaps
    - all PFLs are measured or associated with only one per-UE measurement gap, or
    - for the UE supporting *independentGapConfigPRS-r17*, all PFLs in the same FR are measured or associated with only one per-FR measurement gap in the corresponding FR.
- if the measurement gap is pre-configured, the gap must be activated throughout the measurement period, and
- if concurrent measurement gaps are configured, one of the gap combinations specified in clause 9.1.8.2 is configured, and
- if the UE does not support *independentGapConfigPRS-r17*, the configured or pre-configured gap used to perform the PRS measurements must be of per-UE type, and

- No active BWP switching occurs during the measurement gaps for PRS measurement.

The requirements specified in Clauses 9.9E.5, and 9.9E.7 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

UE is only required to measure PRS resources that are fully or particaly overlapped with measurement gaps. A PRS resources is considered to be fully (partially) overlapped with measurement gap if all (some) of its instances are overlapped with a measurement gap occasion.

If a positioning measurement gap is configured via *PosGapConfig* and activated by MAC CE, the requirements in Clauses 9.9E.5, and 9.9E.7 apply provided that no other measurement gaps are configured, and only one measurement gap configured via *PosGapConfig* is activated.

When UE supports *musim-GapPreference-r17* and if the configured aperiodic MUSIM gap collides with the measurement gap associated with PRS measurement, where MUSIM gap collision rule in clause 9.1.10.4 is applied, longer measurement period for the PRS measurement is expected than the requirements as defined in Clauses 9.9E.5, and 9.9E.7.

9.9E.3 General Aspects Relating to Gapless Measurement

The requirements for gapless measurement specified in Clauses 9.9E.6 apply provided:

- PFL to be measured is within an active BWP,
- UE is configured with PPW, and the PPW for the active BWP containing the PFL to be measured is activated,
- No active BWP switching occurs during the measurement period specified in Clauses 9.9E.6,
- PRS is within PPW and does not overlap with other signals/channels of higher priority,
    - for PPW type 1A/1B, the PPW does not overlap with any symbol for SSB-based RLM/BFD/CBD/L1-RSRP/L1-SINR measurement on any CC or for SSB based RRM measurement on any MOs that are measured outside measurement gaps,
    - for PPW type 2, PRS does not overlap with any symbol for SSB-based RLM/BFD/CBD/L1-RSRP/L1-SINR measurement on any CC or for SSB based RRM measurement on any MOs that are measured outside measurement gaps,
- $\max|\Delta T| \leq THR$, where
    - ΔT is the time difference between the start of a slot containing PRS from the neighbor cell/TRP and the start of the closest slot from the serving cell;
    - the range of ΔT is determined by the expected RSTD and expected RSTD uncertainty in the assistance data;
    - THR is the threshold as reported in UE capability *prs-MeasurementWithoutMG-r17*.
- SCS of PRS within PPW and SCS of DL active BWP are the same.

Measurement delay requirement specified in Clause 9.9E.6 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

The UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

The UE is only required to measure PRS resources that are unmuted and fully or partially overlap with PPW.

A PRS resource is considered to be fully (partially) overlapped with PPW if all (some) of its instances overlap with a PPW occasion.

When UE supports *MUSIM-GapConfig-17* and the PPW occasion of the target PFL is overlapping with the configured aperiodic MUSIM gap, longer period for the PRS measurement is expected than the requirements as defined in Clauses 9.9E.6.

9.9E.4 Scheduling Availability Relating to Gapless Measurement

Scheduling availability specified in Clause 9.9.1.3 for gapless NR positioning measurements apply to UE performing gapless measurement for UE based DL AI/ML positioning.

9.9E.5 Measurement Delay Requirement with Measurement Gaps

When physical layer receives last of *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure PRS resources within the measurement period $T_{measurement_delay}$ to produce inputs for its AI/ML model to infer its location for reporting. The measurement delay when UE performs PRS measurement within the measurement gap is defined as:

$$T_{measurement_delay} = \sum_{i=1}^{L} T_{measure,i} + (L-1) * \max\left(T_{effect,i}\right),$$

where

- i is the index of PFL,
- L is total number of PFLs,
- $T_{effect,i}$ is the periodicity of the PRS measurement in PFL i
- $T_{measure,i}$ is the PRS measurement period for PFL i as specified below:

$$T_{measure,i} = \left(k_{multiTEG,i} \times CSSF_{PRS,i} \times \text{ceil}(K_{p,PRS,i}) \times N_{RxBeam,i} * \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil \times N_{sample} - 1 \right) \times T_{effect,i} + T_{last,i},$$

where

- $k_{multiTEG,i}$ is the scaling factor for PRS measurement with multiple Rx TEGs.
    - $k_{multiTEG,i} = N_{TEG,i}$, where $N_{TEG,i}$ is the number of Rx TEGs configured by LMF for PRS measurement depending on the UE capability regarding the number of UE-RxTEG(s) that is supported by UE reported for FG 59-6.
- $CSSF_{PRS,i}$ is the carrier-specific scaling factor for PRS measurements in PFL i as defined in clause 9.1.5.2.
- $K_{p,PRS,i}$ is a scaling factor for a PFL to be measured within the associated measurement gap pattern, which is defined as $K_{p,PRS,i} = N_{total}/N_{available}$ for UE configured with concurrent measurement gap or MUSIM gap or both concurrent measurement gap and MUSIM gap. $K_{p,PRS,i} = 1$ for UE not configured with concurrent measurement gap and not configured with MUSIM gaps.
    - For a window W of duration max($T_{PRS,i}$, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gap and per-FR measurement gap within the same FR as the PFL and periodic MUSIM gaps, and starting at the beginning of any associated gap occasions covering the PRS occasion:
        - N_{total} is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

- $N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for measurement gap and MUSIM gaps collisions by applying the selected gap collision rule

- Requirements do not apply if $N_{available} = 0$.

- $N_{RxBeam,i} = 1$ in FR1. $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-AIML-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.

- $N_{sample} = 1$ if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.

- $N_{sample} = 2$ if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.

- $N_{sample} = 4$ otherwise.

- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in PFL i configured in a slot.

- $L_{available_PRS,i}$ is the time duration of available PRS in the PFL i to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$, only the PRS resources unmuted and fully or partially overlapped with measurement gap are considered.

- $T_{last,i}$ is the measurement duration for the last PRS measurement sample in PFL i, including the sampling time and processing time. If all of the PRS resources to be measured are available in the same measurement gap occasion during $T_{availabe}$, $T_{last,i} = T_i$ +MGL. Otherwise, $T_{last,i} = T_i + T_{available_PRS,i}$,

- $T_{effect,i}$ is the periodicity of the PRS measurement in PFL i defined as:

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil \times T_{available_PRS,i},$$

where

- T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

- $T_{available_PRS,i} = LCM(T_{PRS,i}, MGRP_i)$, the least common multiple between $T_{PRS,i}$ and $MGRP_i$.

- $MGRP_i$ is the repetition periodicity of the measurement gap applicable for measurement in the PRS frequency layer i.

- $T_{PRS,i}$ is the periodicity of DL PRS resource with muting on PFL i.

- If more than one PRS periodicities are configured in PFL i, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the PFL is used to derive $T_{PRS,i}$, where

  - $T_{per}^{PRS\ with\ muting} = N_{muting} \times T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource.

- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} \times L_{muting}$.

  - T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$ which is given by the higher-layer parameter *NR-MutingPattern-r16* included in *DL-PRS-MutingOption1-r16*.

- For the purpose of calculating $T_{PRS,i}$, only the PRS resources fully or partially covered by the measurement gap are considered.

- $\{N, T\}$ is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34].

- N' is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

Except for deferred MT-LR as defined in clause 4.1a.5 TS 23.273 [44], the time $T_{meaurement_delay}$ starts from the first measurement gap instance aligned with a DL PRS resource(s) in the assistance data after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34].

For deferred MT-LR with other event than "*Periodic Location*" as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{measurement_delay}$ starts from the first measurement gap instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event "*Periodic Location*" as defined in clause 4.1a.5.1 TS 23.273 [44], the UE shall perform the PRS measurement in each reporting period and activate the position report at the time when the periodic timer expires.

9.9E.6 Measurement Delay Requirement without Measurement Gaps

When physical layer receives last of *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure PRS resources within the measurement period $T_{measurement_delay}$ to produce inputs for its AI/ML model to infer its location for reporting. The measurement delay when UE performs PRS measurement outside of the measurement gap and within PPW is defined as:

$T_{measurement_delay} = \sum_{i=1}^{L} T_{measurement_delay_wo_gap,i} + (L-1) * \max(T_{effect,i})$, if any of the PFLs are in Case 1, or

$T_{measurement_delay} = \max(T_{measurement_delay_wo_gap,i} + T_{uncertainty,i})$, if all the PFLs are in Case 2,

where,

- i is the index of PFL,

- L is total number of PFLs,

- $T_{effect,i}$ is the periodicity of the PRS measurement in PFL i, and

- $T_{uncertainty,i}$ is the time from the start of the first PPW occasion for PFL i to the start of measurement period $T_{measurement_delay}$.

A PFL is in Case 1 if UE reports *ppw-durationOfPRS-Processing1-r17* for the band containing the PFL, and a PFL is in Case 2 if UE reports *ppw-durationOfPRS-Processing2-r17* for the band containing the PFL.

$T_{measurement_delay_wo_gap,i}$ is the measurement period for PRS measurement in PFL *i* as specified below.

$$T_{measurement_delay_wo_gap,i} = \left(k_{multiTEG,i} \times N_{RxBeam,i} \times \left\lceil \frac{N_{PRS,i}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{available_PRS,i}}{N} \right\rceil \times N_{sample} - 1\right) \times T_{effect,i} + T_{last,i},$$

where:

- $k_{multiTEG,i}$ is the scaling factor for PRS measurement with multiple Rx TEGs.
  - $k_{multiTEG,i} = N_{TEG,i}$, where $N_{TEG,i}$ is the number of Rx TEGs configured by LMF for PRS measurement depending on the UE capability regarding the number of UE-RxTEG(s) that is supported by UE reported for FG 59-6.
- $N_{RxBeam,i}$ = 1 in FR1. $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-AIML-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.
- $N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in PFL i configured in a slot.
- $L_{available_PRS,i}$ is the time duration of available PRS in the PFL i to be measured during $T_{available_PRS,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS,i}$,
  - only the PRS resources unmuted and fully or partially overlapped with PPW are considered, if PFL i is in Case 1, or
  - only the PRS resources unmuted and fully or partially overlapped with the first (PPWL-T2) ms of PPW are considered, if PFL i is in Case 2, where PPWL is the PPW length and T2 corresponds to *ppw-durationOfPRS-ProcessingSymbolsT2*.
- N_{sample}= 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample}= 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample}= 4 otherwise.
- $T_{last,i}$ is the measurement duration for the last PRS measurement sample in PFL i, including the sampling time and processing time.
  - If PFL *i* is in Case 1 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i} = T_i$ +PPWL, else
  - if PFL *i* is in Case 2 and all of the PRS resources to be measured are available in the same PPW occasion during $T_{available}$, then $T_{last,i}$ = PPWL;
  - otherwise, $T_{last,i} = T_i + T_{available_PRS,i}$.
- $T_{effect,i}$ is the periodicity of the PRS measurement in PFL i defined as:

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available_PRS,i}} \right\rceil \times T_{available_PRS,i}$$

Where,

- T_i corresponds to *ppw-durationOfPRS-ProcessingSymbolsT* in TS 37.355 [34] if PFL *i* is in Case 1 or corresponds to the sum of *ppw-durationOfPRS-ProcessingSymbolsT2* and *ppw*-durationOfPRS-*ProcessingSymbolsN2* in TS 37.355 [34] if PFL *i* is in Case 2,

- $T_{available_PRS,i} = LCM(T_{PRS,i}, PPWRP_i)$, the least common multiple between $T_{PRS,i}$ and $PPWRP_i$.

- $PPWRP_i$ is the repetition periodicity of the PRS processing window applicable for measurements in the PFL *i*.

- $T_{PRS,i}$ is the periodicity of DL PRS resource with muting on PFL *i*.

If more than one PRS periodicities are configured in PFL *i*, the least common multiple of PRS periodicities $T_{per}^{PRS\ with\ muting}$ among all DL PRS resource sets in the PFL is used to derive $T_{PRS,i}$, where,

- $T_{per}^{\text{PRS with muting}} = N_{muting} \times T_{per}^{PRS}$, is the PRS periodicity with muting per PRS resource,

- T_{per}^{PRS} is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*,

- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS} \times L_{muting}$, where T_{muting}^{PRS} is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

NOTE: For the purpose of calculating $T_{PRS,i}$, only the PRS resources that meet the conditions for PRS measurement outside measurement gaps as defined in clause 9.9E.2 are considered.

N is a duration of DL PRS symbols in ms corresponding to *ppw-durationOfPRS-ProcessingSymbolsN* in TS 37.355 [34] if PFL *i* is in Case 1 or corresponding to *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if PFL *i* is in Case 2.

N' is UE capability for number of DL PRS resources that it can process in a slot as indicated by *ppw-maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

The time $T_{measurement_delay_wo_gap,i}$ starts from the first instance of the activated PPW for measurement of PFL *i* aligned with a DL PRS resource(s) in the assistance data after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation*message are delivered from LMF to the physical layer of UE via LPP [34].

If during the measurement period of one or more PFLs, the PPW is re-configured or reactivated, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{measurement_delay_wo_gap,i}$ within PPW due to collisions with other signals; otherwise, the measurement period can be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration $L_{available_PRS,i}$.

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in Clause 9.9E.6 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AIML-ProvideCapabilities.*

If any PFL is in Case 2, the requirements in this clause apply provided that the PPWL corresponding to the PFL is larger than (T2+X) ms.

9.9E.7 Measurement Delay Requirement with Bandwidth Aggregation

When UE physical layer receives last of *NR-DL-AIML-ProvideAssistanceData* message, *NR-DL-AIML-RequestLocationInformation* message from LMF via LPP [34] with an indication of PRS resources in multiple PFLs that can be aggregated in *nr-DL-PRS-AggregationInfo,* the UE shall be able to measure PRS resources within the measurement period $T_{measurement_delay}$ to produce inputs for its AI/ML model to infer its location for reporting. The measurement delay when UE performs PRS measurement by aggregating PRS resources in multiple PFLs within the measurement gap is defined as:

$$T_{measurement_delay} = T_{measurement_delay_without_aggregation} + T_{measurement_delay_with_aggregation} + T_{margin},$$

where,

- $T_{measurement_delay_without_aggregation}$ is the total measurement period for PRS resources on PFLs that do not contain PRS resources for aggregation.
    - Calculation of $T_{measurement_delay_without_aggregation}$ is based on Clause 9.9E.5 with the following exceptions,
        - only PFLs containing resource set(s) not linked to any other resource set(s) are considered in L
        - on each PFL i, only resource set(s) not linked to any other resource set(s) are considered in $T_{available_PRS,i}$, $N_{PRS,i}^{slot}$ and $L_{available_PRS,i}$
        - $(L-1) * \max(T_{effect,i})$ is replace by $(L-1) * T'_{margin}$.
- $T_{measurement_delay_without_aggregation}$ is equal to zero if UE is not provisioned with information on PRS resources that can be aggregated for measurement by the LMF.
- If UE performs measurements on PFLs that contain PRS resources for aggregation and on PFLs that do not contain PRS resources for aggregation, $T_{margin} = T'_{margin}$ is delay margin to account for delay between PRS measurement performed by UE on PFLs that contain PRS resources for aggregation and PRS measurement performed by UE on PFLs that do not contain PRS resources for aggregation.
- If UE performs measurements on PFLs that contain PRS resources for aggregation or if UE performs measurements on PFLs that do not contain PRS resources for aggregation, then $T_{margin} = 0$.
- $T'_{margin} = \max(Teffect, i)$, when both aggregated PFLs and non-aggregated PFLs are measured by UE.

$T_{measurement_delay_with_aggregation}$, is the measurement period for PRS measurements performed by UE by aggregating PRS resources from multiple PFLs and is defined as:

$$T_{measurement_delay_with_aggregation} = \sum_{i=1}^{G} T_{PRS_aggregate,i} + (G-1) * T'_{margin},$$

where

- i is the index of effective PFL, corresponding to the group of PFLs containing linked PRS resource sets that can be aggregated,
- G denotes the number of effective PFLs to perform aggregated measurements on. G is provisioned to UE by LMF in *nr-DL-PRS-AggregationInfo.*
- $T_{PRS_aggregate,i}$ is the measurement period for PRS measurement in the effective PFL *i* as specified below:

$$T_{PRS_aggregate,i} = \left(k_{multiTEG_agg,i} \times CSSF_{PRS_agg,i} \times ceil(K_{p,PRS_agg,i}) \times N_{RxBeam,i} \times \left\lceil \frac{N_{PRS_agg,i}^{slot}}{N'_{agg}} \right\rceil \left\lceil \frac{L_{available_PRS_agg,i}}{N_{agg}} \right\rceil \times N_{sample} - 1\right) \times T_{effect_agg,i} + T_{last_agg,i},$$

where

- $k_{multiTEG_agg,i}$ is the scaling factor for PRS measurement with multiple Rx TEGs.
  - $k_{multiTEG_agg,i} = N_{TEG,i}$, where $N_{TEG,i}$ is the number of Rx TEGs configured by LMF for PRS measurement depending on the UE capability regarding the number of UE-RxTEG(s) that is supported by UE reported for FG 59-6.
- $CSSF_{PRS_agg,i}$ is the carrier-specific scaling factor for NR PRS-based positioning measurements in effective PFL i as defined in clause 9.1.5.2.
- $K_{p,PRS_agg,i}$ is a scaling factor for effective PFL i to be measured within the associated measurement gap pattern, which is defined as $K_{p,PRS_agg,i} = N_{total} / N_{available}$ for UE configured with concurrent measurement gap, and $K_{p,PRS_agg,i} = 1$ for UE not configured with concurrent measurement gap.
  - For a window W of duration max($T_{PRS_agg,i}$, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE measurement gap and per-FR measurement gap within the same FR as the effective PFL, and starting at the beginning of any associated gap occasions covering the PRS occasion:
    - N_{total} is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and
    - $N_{available}$ is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for measurement gap collisions by applying the selected gap collision rule
    - Requirements do not apply if $N_{available} = 0$.
- $N_{RxBeam,i} = 1$ in FR1. $N_{RxBeam,i}$ is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-AIML-RequestLocationInformation*. $N_{RxBeam,i}$ is equal to 8, otherwise.
- $N_{PRS_agg,i}^{slot}$ is the maximum number of DL PRS resources in effective PFL i configured in a slot.
- $L_{available_PRS_agg,i}$ is the time duration of available PRS in the effective PFL i to be measured during $T_{available_PRS_agg,i}$, and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of $L_{available_PRS_agg,i}$, only the PRS resources unmuted and fully or partially overlapped with measurement gap and satisfying the conditions for PRS BW aggregation are considered.
- N_{sample}= 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:
  - PRS bandwidth is within the active BWP and
  - Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.
- N_{sample}= 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:
  - PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell's SS-RSRP and the neighbor cell's PRS-RSRP is within 6 dB.

- N_{sample} = 4 otherwise.

$T_{last_agg,i}$ is the measurement duration for the last PRS measurement sample in the effective PFL i, including the sampling time and processing time. If all of the PRS resources to be measured are available in the same measurement gap occasion during $T_{availabe_agg}$, $T_{last_agg,i} = T_{agg,i}$ + MGL. Otherwise, $T_{last_agg,i} = T_{agg,i} + T_{available_PRS_agg,i}$,

$T_{effect_agg,i}$ is the periodicity of the PRS measurement in the effective PFL i defined as:

$$T_{effect_agg,i} = \left\lceil \frac{T_{agg,i}}{T_{available_PRS_agg,i}} \right\rceil \times T_{available_PRS_agg,i}$$

where

- $T_{available_PRS_agg,i} = LCM(T_{PRS_agg,i}, MGRP_i)$, the least common multiple between $T_{PRS_agg,i}$ and $MGRP_i$. $MGRP_i$ is the repetition periodicity of the measurement gap applicable for measurement in the effective PFL i.

- $T_{PRS_agg,i}$ is the periodicity of DL PRS resources meeting the bandwidth aggregation conditions with muting on effective PFL i. If more than one PRS periodicities are configured in effective PFL i, the least common multiple of PRS periodicities $T_{per_agg}^{PRS\ with\ muting}$ among all DL PRS resource sets in the effective PFL is used to derive $T_{PRS_agg,i}$, where,

- $T_{per_agg}^{PRS\ with\ muting} = N_{muting} \times T_{per_agg}^{PRS}$, is the PRS periodicity with muting per PRS resource configured for aggregation,

- $T_{per_agg}^{PRS}$ is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- N_{muting} is the scaling factor considering PRS resource muting. $N_{muting} = T_{muting}^{PRS_agg} \times L_{muting}$, where $T_{muting}^{PRS_agg}$ is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and L_{muting} is the size of the bitmap $\{b^1\}$.

Note: For the purpose of calculating $T_{PRS_agg,i}$, only the PRS resources fully or partially covered by the measurement gap and PRS resources that satisfy the conditions for PRS BW aggregation are considered.

$\{N_{agg}, T_{agg,i}\}$ is UE capability combination per band to aggregate PRS resources from multiple PFLs within an effective PFL where N_{agg} is a duration of DL PRS symbols in ms corresponding to *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r18* in TS 37.355 [34] processed every $T_{agg,i}$ ms corresponding to *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *maximumOfTwoAggregatedDL-PRS-Bandwidth* or *maximumOfThreeAggregatedDL-PRS-Bandwidth* in TS 37.355 [34].

N'_{agg} is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18* for FR1 and *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18* for FR2 specified in TS 37.355 [34].

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements satisfy all the conditions specified in clause 5.1.6.5.3 in TS 38.214 [26].

Except for deferred MT-LR as defined in clause 4.1a.5 TS 23.273 [44], the time $T_{measurement_delay}$ starts from the first measurement gap instance aligned with DL PRS resources in the assistance data for aggregation after both the *NR-DL-AIML-ProvideAssistanceData* message and *NR-DL-AIML-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34] including a request to perform measurement by aggregating PRS resources from multiple PFLs via *nr-DL-PRS-JointMeasurementRequestedPFL-List*.

For deferred MT-LR with other event than "*Periodic Location*" as defined in clause 4.1a.5.1 TS 23.273 [44], the time $T_{measurement_delay}$ starts from the first measurement gap instance aligned with DL PRS resources in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event "*Periodic Location*" as defined in clause 4.1a.5.1 TS 23.27] [44], the UE shall perform the aggregated PRS measurement in each reporting period and activate the location report at the time when the periodic timer expires.

If during the measurement period of one or more effective PFLs, the measurement gap pattern is reconfigured, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period $T_{measurement_delay}$ within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

If CSSF changes during the measurement period, the measurement period could be longer.

The requirements in this Clause 9.9E.7 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AIML-ProvideCapabilities*.

9.10 CSI-RS based L3 measurements

9.10.1 Introduction

This clause contains general requirements on the UE regarding CSI-RS based measurement reporting in RRC_CONNECTED state. The requirements are split in intra-frequency and inter-frequency measurements requirements.

The requirements in this clause apply, provided:

- Only one MO is configured per CSI-RS frequency layer, and
- all CSI-RS resources in the same MO are configured with the same *csi-rs-MeasurementBW*, and
- *associatedSSB* is configured in *CSI-RS-Resource-Mobility* and detectable, and
- all CSI-RS resources in the same MO are configured with the same periodicity, and
- the associated SSB is QCLed with the corresponding CSI-RS resources in FR2, and
- the number of CSI-RS resources in any duration that equals to the length of a slot is no larger than UE capability *maxNumberCSI-RS-RRM-RS-SINR*.
- When there are mixed numerologies, the length of a slot is defined based on the smallest SCS
- For a UE capable of supporting *supportSBFD*,
  - Measurement requirements are applicable provided that all CSI-RS resources configured for measurement are available in one DL subband of SBFD symbols and/or on non-SBFD DL symbols of the cell transmitting the CSI-RS.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.10.2 CSI-RS based intra-frequency measurements

9.10.2.1 Introduction

A measurement is defined as a CSI-RS based intra-frequency measurement provided that:

- the SCS of the CSI-RS resource of the neighbour cell configured for measurement is the same as the SCS of the CSI-RS resource on the serving cell indicated for measurement, and
- the CP type of the CSI-RS resource of neighbour cell configured for measurement is the same as the CP type of the CSI-RS resource of the serving cell indicated for measurement, and

- It is applied for SCS = 60KHz

- the centre frequency of the CSI-RS resource of the neighbour cell configured for measurement is the same as the centre frequency of the CSI-RS resource of the serving cell indicated for measurement

The UE shall be able to identify new intra-frequency cells and perform CSI-RSRP, CSI-RSRQ and CSI-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell or the PSCell.

No measurement gap is needed for intra-frequency CSI-RS resources measurements.

For intra-frequency CSI-RS based measurements, UE may cause scheduling restriction as specified in clause 9.10.2.6.

Note: Extended CP for CSI-RS based measurement is not supported in this release.

9.10.2.2 Requirements applicability

The measurement of the associated SSB follows the same requirements as SSB based measurements defined in clause 9.2.

The requirements in clause 9.10.2 apply, provided:

- Only one intra-frequency CSI-RS layer per serving cell is configured, and

- The BW of the CSI-RS on the intra-frequency neighbor cell is within the active BWP of the UE, and

- The associated SSB of the CSI-RS resources being identified or measured are detectable, and the CSI-RS resources configured for CSI-RS based L3 measurements are measurable, and

- The bandwidth of CSI-RS resources of intra-MO is the same as that of the CSI-RS resources configured for the serving cell, and

- All CSI-RS resources on one intra-frequency layer are configured within up to two separate windows where each window is up to 5 ms, and

- for the case of single window further provided

  - The periodicity of the configured CSI-RS resources is 10 ms, 20 ms or 40 ms

- for the case of two separate windows further provided

  - The two windows are either both fully non-overlapped with MG or both partially overlapped with MG

    - The periodicity of the configured CSI-RS resources is 20 ms or 40 ms

  - The starting point of the first window is the slot boundary of the serving cell, where the corresponding slot contains the configured L3 CSI-RS resource of the serving cell in the servingCellMO with the smallest offset, and

  - The starting point of the second window if configured is determined by an offset of half of the CSI-RS periodicity in slots with regards to the starting point of the first window, and

- Numerology for intra-frequency CSI-RS and data of serving cell are the same.

An intra-frequency cell shall be considered detectable when for each relevant associated SSB:

- SS-RSRP related side conditions given in clauses 10.1.2.1 and 10.1.3.1 for FR1 and FR2, respectively, for a corresponding band,

- SS-RSRQ related side conditions given in clauses 10.1.7.1 and 10.1.8.1 for FR1 and FR2, respectively, for a corresponding band,

- SS-SINR related side conditions given in clauses 10.1.12.1 and 10.1.13.1 for FR1 and FR2, respectively, for a corresponding band,

- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding band.

A CSI-RS resource shall be considered measurable when for each relevant CSI-RS resource:

- CSI-RSRP related side conditions given in clauses 10.1.2.3 and 10.1.3.3 for FR1 and FR2, respectively, for a corresponding band,
- CSI-RSRQ related side conditions given in clauses 10.1.7.2 and 10.1.8.2 for FR1 and FR2, respectively, for a corresponding band,
- CSI-SINR related side conditions given in clauses 10.1.12.2 and 10.1.13.2 for FR1 and FR2, respectively, for a corresponding band,
- CSI_RP and CSI-RS Ês/Iot according to Annex B.2.12 for a corresponding band.

9.10.2.3 Number of cells and number of CSI-RS

9.10.2.3.1 Requirements for FR1

For each intra-frequency CSI-RS layer, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 32 CSI-RSs with different CSI-RS index and/or PCI on the intra-frequency layer, and
- the cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB

9.10.2.3.2 Requirements for FR2

For one single intra-frequency CSI-RS layer in a band, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 32 CSI-RSs with different CSI-RS index and/or PCI, and
- the cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB.

where this single intra-frequency layer shall be:

- PCC on which UE is configured to report CSI-RS measurement when UE is configured with SA NR operation mode with PCC in the band; or
- PSCC on which UE is configured to report CSI-RS measurement when UE is configured with EN-DC with PSCC in the band; or
- One of the SCCs on which UE is configured to report CSI-RS based measurements when neither PCC nor PSCC is in the same band, so that the selected SCC shall be an SCC where the UE is configured with CSI-RSRP measurement reporting if such SCC exists, otherwise the selected SCC is determined by UE implementation.

The UE shall also be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least 2 CSI-RSs on serving cell for each of the other intra-frequency layer(s) in the same band.

For each FR2 band, UE is only required to measure neighbour cell CSI-RS on the CSI-RS layer, whose associated SSB is on the same SSB layer as the one where UE is required to measure neighbour cell SSB.

9.10.2.4 Measurement Reporting Requirements

Note: The UE is not required to report CSI-RS based L3 measurements when the timing offset between the reference measurement timing and the target CSI-RS in one layer is larger than one CP. If the UE reports CSI-RS based L3 measurements when the timing offset exceeds one CP, the UE is not required to meet the CSI-RS based L3 measurement accuracy requirements for CSI-RSRP, CSI-RSRQ and CSI-SINR in TS 38.133 [2] clause 10.1, which apply only when the timing offset is no larger than one CP.

9.10.2.4.1 Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.2.3, 10.1.3.3, 10.1.7.2, 10.1.8.2, 10.1.12.2 and 10.1.13.2.

9.10.2.4.2 Event-triggered Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.1.2.3, 10.1.3.3, 10.1.7.2, 10.1.8.2, 10.1.12.2 and 10.1.13.2.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.10.2.4.3.

9.10.2.4.3 Event Triggered Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI- SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.2.3, 10.1.3.3, 10.1.7.2, 10.1.8.2, 10.1.12.2 and 10.1.13.2.

The UE shall not send any event triggered measurement reports as long as no reporting criterion is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than the CSI-RS based measurement defined in clause 9.10.2.5. When L3 filtering is used an additional delay can be expected.

9.10.2.5 Intra-frequency measurements without measurement gaps

If a UE is configured with the higher layer parameters *CSI-RS-Resource-Mobility* and *associatedSSB*, the CSI-RS based measurement shall include PSS/SSS detection time of associatedSSB, the time period used to acquire the SFN information and CSI-RS based measurement period without gap.

- PSS/SSS detection time of associatedSSB is the intra-frequency T_{PSS/SSS_sync_intra} in clause 9.2.5.1.
- The time period used to acquire the SFN information is equal to 0 if the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise, the time period used to acquire the SFN information is $T_{CSI\text{-}RS_SFN_intra}$ as shown in table 9.10.2.5-3 for FR1. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.
- If the associatedSSB, which has been detectable at least for the time period $T_{identify_intra_with_index}$ defined in clause 9.2.5.1, becomes undetectable for a period ≤ 5 seconds and then the associatedSSB becomes detectable again with the same spatial reception parameter provided the timing to that cell has not changed more than $\pm 3200/2^{\mu} T_c$, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3], PSS/SSS detection time and time period used to acquire the SFN information are equal to 0.

The measurement period for CSI- RS based intra-frequency measurements without gaps is as shown in table 9.10.2.5-1and table 9.10.2.5-2.

Additionally, for a given CSI-RS resource, if the associated SS/PBCH block is configured but not detected by the UE, or if CSI-RS is configured with associated SSB but not QCL-ed to the associated SSB, the UE is not required to monitor the corresponding CSI-RS resource.

Table 9.10.2.5-1: Measurement period for intra-frequency CSI-RS based measurements without gaps(FR1)

DRX cycle	$T_{CSI\text{-}RS_measurement_period_intra}$
No DRX	max(200 ms, ceil(5 x $K_{p_CSI\text{-}RS}$) x CSI-RS period) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x $K_{p_CSI\text{-}RS}$) x max(CSI-RS period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x $K_{p_CSI\text{-}RS}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: The requirements apply assuming CSI-RS configuration with {D=3 with PRBs ≥ 48}. D is frequency domain density for the 1-port CSI-RS for L3 mobility defined in clause 7.4.1 of TS 38.211 [6].	

Table 9.10.2.5-2: Measurement period for intra-frequency CSI-RS based measurements without gaps(FR2)

DRX cycle	$T_{CSI\text{-}RS_measurement_period_intra}$
No DRX	max(400 ms, ceil($M_{meas_period_w/o_gaps}$ x $K_{p_CSI\text{-}RS}$) x CSI-RS period) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5x $M_{meas_period_w/o_gaps}$ x $K_{p_CSI\text{-}RS}$) x max(CSI-RS period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	$M_{meas_period_w/o_gaps}$ x DRX cycle x $CSSF_{intra}$
NOTE 1: The requirements apply assuming CSI-RS configuration with {D=3 with PRBs ≥ 48}. D is frequency domain density for the 1-port CSI-RS for L3 mobility defined in clause 7.4.1 of TS 38.211 [6].	

$M_{meas_period_w/o_gaps}$: For a UE supporting power class 1, $M_{meas_period_w/o_gaps}$ =40. For a UE supporting FR2 power class 2, $M_{meas_period_w/o_gaps}$ =24. For a UE supporting power class 3, $M_{meas_period_w/o_gaps}$ =24. For a UE supporting power class 4, $M_{meas_period_w/o_gaps}$ =24.

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1.5.

For a UE not supporting *concurrentMeasGap-r17* or for a UE is supporting *concurrentMeasGap-r17* but not configured with concurrent measurement gaps, and the UE does not support [*musim-GapPreference-r17]* or is supporting [*musim-GapPreference-r17]* but not configured with periodic MUSIM gaps,

- if the intra-frequency CSI-RS resource does not overlap with any measurement gaps, $K_{p_CSI\text{-}RS}$=1;
- if some occasions of the intra-frequency CSI-RS resource is overlapped with any measurement gaps, $K_{p_CSI\text{-}RS}$ = 1/(1- (CSI-RS resource period /MGRP)) , where CSI-RS resource period < MGRP, and the MGRP is the periodicity of the measurement gap.
- Otherwise, when UE supports concurrent measurement gaps or [*musim-GapPreference-r17]* or both concurrent measurement gaps and *[musim-GapPreference-r17]*, and concurrent measurement gaps or periodic MUSIM gaps or both concurrent gaps and periodic MUSIM gaps are configured, $K_{p_CSI\text{-}RS}$ is the scaling factor for a CSI-RS frequency layer to be measured outside gap which is defined as $K_{p_CSI\text{-}RS} = N_{total} / N_{available}$

  For a window W of duration max(CSI-RS period, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE MG, periodic MUSIM gaps, and per-FR MG within the same FR as the CSI-RS frequency layer, and starting at the beginning of any gap occasions covering the CSI-RS resources:

  N_{total} is the total number of CSI-RS resource occasions within the window, including those overlapped with other MG and MUSIM gap occasions within the window, and

  $N_{available}$ is the number of CSI-RS resource occasions that are not overlapped with any other non-dropped MG or non-dropped MUSIM gap occasions within the window W, after accounting for MG and MUSIM gap collisions by applying the collision rules for the measurement gap and MUSIM gap in clauses 9.1.8.3, 9.1.10.4 and 9.1.10.5, respectively.

  $K_{p_CSI\text{-}RS}$ = 1 when $N_{available}$ = 0

  Requirements in this clause do not apply when $N_{available}$ = 0 due to fully overlapping between CSI-RS occasions and MUSIM gap occasions within the window W.

When UE supports [*MUSIM-GapConfig-17]* and the CSI-RS occasions of the target frequency layer is overlapping with the configured aperiodic MUSIM gap, longer cell identification period for the target frequency layer is expected.

Table 9.10.2.5-3: Time period for SFN acquisition for intra-frequency CSI-RS based measurements without gaps(FR1)

DRX cycle	$T_{CSI\text{-}RS_SFN_intra}$
No DRX	max(200 ms, ceil(5 x $K_{p_CSI\text{-}RS}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(2000 ms, ceil (1.5 x 5 x $K_{p_CSI\text{-}RS}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(5 x $K_{p_CSI\text{-}RS}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: $K_{p_CSI\text{-}RS}$ is applicable for a UE supporting concurrent gaps and/or MUSIM gaps.	

9.10.2.6 Scheduling availability of UE during CSI-RS based intra-frequency measurements

UE is required to be capable of measuring without measurement gaps when CSI-RS resources are completely contained in the active BWP of the UE. Note the configured CSI-RS symbol is indicated in *firstOFDMSymbolInTimeDomain* included in *CSI-RS-ResourceConfigMobility* for RRM. When UE is required to perform CSI-RS based RRM measurements, and any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note same numerology for intra-frequency CSI-RS and data of serving cell is considered in this release.

9.10.2.6.1 Scheduling availability of UE performing CSI-RS based measurements in TDD bands

When UE performs CSI-RS intra-frequency measurements in a TDD band,

- UE is not expected to transmit PUCCH/PUSCH/SRS on configured CSI-RS resource symbols, and on 1 OFDM symbol before and after each consecutively configured CSI-RS symbols.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) configured on the non-contiguous CC(s) in the same band. Ohterwise, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

For UE indicating *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 4"*

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 1"*

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2>else

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.10.2.6.2 Scheduling availability of UE performing CSI-RS based measurements in FR2

When the UE performs CSI-RS based intra-frequency measurements for L3 mobility management in FR2, the following restrictions apply.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the configured CSI-RS symbol within the configured slot as indicated in *slotConfig* of the corresponding CSI-RS resource to be measured for mobility.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to CSI-RSRP, CSI-RSRQ or CSI-SINR measurement on an FR2 intra-frequency cell in different bands, provided that UE is capable of independent beam management on this FR2 band pair.

9.10.3 CSI-RS based Inter-frequency measurements

9.10.3.1 Introduction

A measurement is defined as a CSI-RS based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.10.2.

If a UE is configured with the higher layer parameter *CSI-RS-Resource-Mobility* and the higher layer parameter *associatedSSB* is configured, the UE shall be able to identify inter-frequency cells indicated for measurement and perform CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements of identified inter-frequency cells.

When measurement gaps are needed, the UE is not expected to detect the associated SSB nor perform measurement of the CSI-RS resource configured in *CSI-RS-Resource-Mobility* on an inter-frequency measurement object which start earlier than the gap starting time + switching time, and ends later than the gap end – switching time. When the inter-frequency cells are in FR2 and the per-FR gap is configured to the UE in EN-DC, SA NR, NE-DC and NR-DC, or the serving cells are in FR2, the inter-frequency cells are in FR2 and the per-UE gap is configured to the UE in SA NR and NR-DC, the switching time is 0.25 ms. Otherwise the switching time is 0.5 ms.

If a UE is configured with multiple concurrent gaps, the requirements in this clause shall apply when the measurement gap pattern is configured to be associated to the CSI-RS resources of the inter-frequency layer.

9.10.3.2 Requirements applicability

The associated SSB layer of the CSI-RS follows the same requirements as SSB based measurements defined in clause 9.3.

The requirements in clause 9.10.3 apply, provided:

- The associated SSB of the cell being identified or measured is detectable, and
- All CSI-RS resources on one inter-frequency layer are configured within a window of up to 5 ms, and
- The periodicity of the configured CSI-RS resources is 10 ms, 20 ms or 40 ms, and
- CSI-RS resources for measurements and the associated SSB for cell identification are configured within measurement gap.

An inter-frequency cell shall be considered detectable when for each relevant associated SSB:

- SS-RSRP related side conditions given in clauses 10.1.4.1 and 10.1.5.1 for FR1 and FR2, respectively, for a corresponding band,
- SS-RSRQ related side conditions given in clauses 10.1.9.1 and 10.1.10.1 for FR1 and FR2, respectively, for a corresponding band,
- SS-SINR related side conditions given in clauses 10.1.14.1 and 10.1.15.1 for FR1 and FR2, respectively, for a corresponding band,

- SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding band.

A CSI-RS resource shall be considered measurable when for each relevant CSI-RS resource:

- CSI-RSRP related side conditions given in clauses 10.1.4.3 and 10.1.5.3 for FR1 and FR2, respectively, for a corresponding band,
- CSI-RSRQ related side conditions given in clauses 10.1.9.2 and 10.1.10.2 for FR1 and FR2, respectively, for a corresponding band,
- CSI-SINR related side conditions given in clauses 10.1.14.2 and 10.1.15.2 for FR1 and FR2, respectively, for a corresponding band,
- CSI _RP and CSI-RS Ês/Iot according to Annex B.2.13 for a corresponding band.

9.10.3.3 Number of cells and number of CSI-RS resources

9.10.3.3.1 Requirements for FR1

For each inter-frequency CSI-RS layer, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 14 CSI-RSs with different CSI-RS index and/or PCI , and
- The cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB.

9.10.3.3.2 Requirements for FR2

For each inter-frequency CSI-RS layer, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 24 CSI-RSs with different CSI-RS index and/or PCI, and
- The cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer the associated SSB.

9.10.3.4 Measurements reporting requirements

Note: The UE is not required to report CSI-RS based L3 measurements when the timing offset between the reference measurement timing and the target CSI-RS in one layer is larger than one CP. If the UE reports CSI-RS based L3 measurements when the timing offset exceeds one CP, the UE is not required to meet the CSI-RS based L3 measurement accuracy requirements for CSI-RSRP, CSI-RSRQ and CSI-SINR in TS 38.133 [2] clause 10.1, which apply only when the timing offset is no larger than one CP.

9.10.3.4.1 Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.2, 10.1.5.2, 10.1.9.2, 10.1.10.2, 10.1.14.2 and 10.1.15.2.

9.10.3.4.2 Event-triggered Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.2, 10.1.5.2, 10.1.9.2, 10.1.10.2, 10.1.14.2 and 10.1.15.2.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.10.3.4.3.

9.10.3.4.3 Event-triggered Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.2, 10.1.5.2, 10.1.9.2, 10.1.10.2, 10.1.14.2 and 10.1.15.2.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within CSI-RS based measurement defined in clause 9.10.3.5. When L3 filtering is used an additional delay can be expected.

9.10.3.5 Inter-frequency measurements with measurement gaps

When measurement gaps are provided, if configured with the higher layer parameters *CSI-RS-Resource-Mobility* and *associatedSSB*, the UE shall be able to identify a new detectable CSI-RS based inter-frequency cell within $T_{CSI-RS_identify_inter}$,

$$T_{CSI-RS_identify_inter} = (T_{PSS/SSS_sync} + T_{CSI-RS_measurement_period_inter} + T_{CSI-RS_SFN_inter})\ ms$$

Where:

T_{PSS/SSS_sync} is the time period used in PSS/SSS detection which is determined according to T_{PSS/SSS_sync_inter} in clause 9.3.4,

TCSI-RS_SFN_inter is the time period used to acquire the SFN information of the cell being measured, which is shown in table 9.10.3.5-3 for FR1 and equals inter-frequency TSSB_time_index_inter in clause 9.3.4 for FR2,

$T_{CSI-RS_measurement_period_inter}$: equal to a measurement period of CSI-RS based measurement given in table 9.10.3.5-1 and table 9.10.3.5-2.

$M_{meas_period_inter}$: For a UE supporting FR2 power class 1 or 5, $M_{meas_period_inter}$ =8×N samples. For a UE supporting FR2 power class 2, $M_{meas_period_inter}$=5×N samples. For a UE supporting FR2 power class 3, $M_{meas_period_inter}$ =5×N samples. For a UE supporting FR2 power class 4, $M_{meas_period_inter}$ = 5×N samples. Note that scaling factor N = [8].

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5 for measurement conducted within measurement gaps.

When UE supports concurrent measurement gaps or [*musim-GapPreference-r17]* or both concurrent measurement gap and [*musim-GapPreference-r17]*, and concurrent measurement gaps or periodic MUSIM gaps or both concurrent gaps and periodic MUSIM gaps are configured, K_{p_CSI-RS} is the scaling factor for a CSI-RS frequency layer to be measured within the associated measurement gap which is defined as $K_{p_CSI-RS} = N_{total} / N_{available}$. $K_{p_CSI-RS} = 1$ for UE not configured with concurrent measurement gaps and MUSIM gaps.

- For a window W of duration max(CSI-RS period, MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE MG, periodic MUSIM gaps, and per-FR MG within the same FR as the CSI-RS frequency layer, and starting at the beginning of any gap occasions covering the CSI-RS resources.
  - N_{total} is the total number of associated gap occasions covering CSI-RS resources within the window, including those overlapped with other measurement gap and MUSIM gap instances within the window, and
  - $N_{available}$ is the number of non-dropped associated gap occasions covering CSI-RS resources within the window W, after accounting for MG and MUSIM gap collisions by applying the collision rules for the measurement gap and MUSIM gap in clause 9.1.8.3 and 9.1.10.5, respectively.
  - Requirements do not apply if $N_{available} = 0$

When UE supports [*musim-GapPreference-r17*] and if the configured aperiodic MUSIM gap collides with the measurement gap associated with the target frequency layer, where MUSIM gap collision rule in clause 9.1.10.4 is applied, longer cell identification period for the target inter-frequency is expected.

Additionally, for a given CSI-RS resource, if the associated SSB is configured but not detected by the UE, or if CSI-RS configured with associated SSB but not QCL-ed to the associated SSB, the UE is not required to monitor the corresponding CSI-RS resource.

Table 9.10.3.5-1: Measurement period for CSI-RS based inter-frequency measurements with gaps (FR1)

Condition NOTE1,2	$T_{CSI\text{-}RS_measurement_period_inter}$
No DRX	$\text{Max}(200\text{ ms}, \text{ceil}(8 \times K_{p_CSI\text{-}RS}) \times \text{Max}(\text{MGRP}, \text{CSI-RS period})) \times \text{CSSF}_{inter}$
DRX cycle ≤ 320 ms	$\text{Max}(200\text{ ms}, \text{Ceil}(8 \times 1.5 \times K_{p_CSI\text{-}RS})) \times \text{Max}(\text{MGRP}, \text{CSI-RS period}, \text{DRX cycle})) \times \text{CSSF}_{inter}$
DRX cycle > 320 ms	$\text{Ceil}(8 \times K_{p_CSI\text{-}RS}) \times \text{DRX cycle} \times \text{CSSF}_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: If UE support concurrent gaps and multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the CSI-RS resources of the inter-frequency layer. NOTE 4: $K_{p_CSI\text{-}RS}$ is applicable for a UE supporting concurrent gaps and/or MUSIM gaps.	

Table 9.10.3.5-2: Measurement period for CSI-RS based inter-frequency measurements with gaps (FR2)

Condition NOTE1,2	$T_{CSI\text{-}RS_measurement_period_inter}$
No DRX	$\text{Max}(400\text{ ms}, \text{ceil}(M_{meas_period_inter} \times K_{p_CSI\text{-}RS}) \times \text{Max}(\text{MGRP}, \text{CSI-RS period})) \times \text{CSSF}_{inter}$
DRX cycle ≤ 320 ms	$\text{Max}(400\text{ ms}, \text{ceil}(1.5 \times M_{meas_period_inter} \times K_{p_CSI\text{-}RS}) \times \text{Max}(\text{MGRP}, \text{CSI-RS period}, \text{DRX cycle})) \times \text{CSSF}_{inter}$
DRX cycle > 320 ms	$\text{Ceil}(M_{meas_period_inter} \times K_{p_CSI\text{-}RS}) \times \text{DRX cycle} \times \text{CSSF}_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: If UE support concurrent gaps and multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to the CSI-RS resources of the inter-frequency layer. NOTE 4: $K_{p_CSI\text{-}RS}$ is applicable for a UE supporting concurrent gaps and/or MUSIM gaps.	

Table 9.10.3.5-3: Time period for SFN acquisition for interfrequency CSI-RS based measurements with gaps(FR1)

Condition NOTE1,2	$T_{CSI\text{-}RS_SFN_inter}$
No DRX	$\text{Max}(200\text{ ms}, \text{ceil}(5 \times K_{p_CSI\text{-}RS}) \times \text{Max}(\text{MGRP}, \text{SMTC period})) \times \text{CSSF}_{inter}$
DRX cycle ≤ 320 ms	$\text{Max}(200\text{ ms}, \text{Ceil}(5 \times 1.5 \times K_{p_CSI\text{-}RS}) \times \text{Max}(\text{MGRP}, \text{SMTC period}, \text{DRX cycle})) \times \text{CSSF}_{inter}$
DRX cycle > 320 ms	$\text{Ceil}(5 \times K_{p_CSI\text{-}RS}) \times \text{DRX cycle} \times \text{CSSF}_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: If UE support concurrent gaps and multiple concurrent gaps are configured, the MGRP is the periodicity of the MG pattern associated to *associatedSSB*. NOTE 4: $K_{p_CSI\text{-}RS}$ is applicable for a UE supporting concurrent gaps and/or MUSIM gaps.	

9.10D CSI-RS based L3 measurements for ATG

9.10D.1 Introduction

This clause contains general requirements on the ATG UE regarding CSI-RS based measurement reporting in RRC_CONNECTED state. The requirements are split in intra-frequency and inter-frequency measurements requirements.

The requirements in this clause apply, provided:

- Only one MO is configured per CSI-RS frequency layer, and
- all CSI-RS resources in the same MO are configured with the same csi-rs-MeasurementBW, and
- *associatedSSB* is configured in *CSI-RS-Resource-Mobility* and detectable, and
- all CSI-RS resources in the same MO are configured with the same periodicity, and
- the number of CSI-RS resources in any duration that equals to the length of a slot is no larger than UE capability *maxNumberCSI-RS-RRM-RS-SINR*.
- When there are mixed numerologies, the length of a slot is defined based on the smallest SCS

9.10D.2 CSI-RS based intra-frequency measurements

9.10D.2.1 Introduction

A measurement is defined as a CSI-RS based intra-frequency measurement provided that:

- the SCS of the CSI-RS resource of the neighbour cell configured for measurement is the same as the SCS of the CSI-RS resource on the serving cell indicated for measurement, and
- the CP type of the CSI-RS resource of neighbour cell configured for measurement is the same as the CP type of the CSI-RS resource of the serving cell indicated for measurement, and
  - It is applied for SCS = 60KHz
- the centre frequency of the CSI-RS resource of the neighbour cell configured for measurement is the same as the centre frequency of the CSI-RS resource of the serving cell indicated for measurement

The UE shall be able to identify new intra-frequency cells and perform CSI-RSRP, CSI-RSRQ and CSI-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell.

No measurement gap is needed for intra-frequency CSI-RS resources measurements.

For intra-frequency CSI-RS based measurements, UE may cause scheduling restriction as specified in clause 9.10D.2.6.

Note: Extended CP for CSI-RS based measurement is not supported in this release.

9.10D.2.2 Requirements applicability

The measurement of the associated SSB follows the same requirements as SSB based measurements defined in clause 9.2D.

The requirements in clause 9.10D.2 apply, provided:

- Only one intra-frequency CSI-RS layer per serving cell is configured, and
- The BW of the CSI-RS on the intra-frequency neighbor cell is within the active BWP of the UE, and
- The associated SSB of the CSI-RS resources being identified or measured are detectable, and the CSI-RS resources configured for CSI-RS based L3 measurements are measurable, and

- The bandwidth of CSI-RS resources of intra-MO is the same as that of the CSI-RS resources configured for the serving cell, and
- All CSI-RS resources on one intra-frequency layer are configured within up to two separate windows where each window is up to 5 ms, and
- for the case of single window further provided
- The periodicity of the configured CSI-RS resources is 10 ms, 20 ms or 40 ms
- for the case of two separate windows further provided
  - The two windows are either both fully non-overlapped with MG or both partially overlapped with MG
    - The periodicity of the configured CSI-RS resources is 20 ms or 40 ms
  - The starting point of the first window is the slot boundary of the serving cell, where the corresponding slot contains the configured L3 CSI-RS resource of the serving cell in the servingCellMO with the smallest offset, and
  - The starting point of the second window if configured is determined by an offset of half of the CSI-RS periodicity in slots with regards to the starting point of the first window, and
- Numerology for intra-frequency CSI-RS and data of serving cell are the same.

An intra-frequency cell shall be considered detectable when for each relevant associated SSB:

- SS-RSRP related side conditions given in clauses 10.1.2.1 for FR1, for a corresponding band,
- SS-RSRQ related side conditions given in clauses 10.1.7.1 for FR1, for a corresponding band,
- SS-SINR related side conditions given in clauses 10.1.12.1 for FR1, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding band.

A CSI-RS resource shall be considered measurable when for each relevant CSI-RS resource:

- CSI-RSRP related side conditions given in clauses 10.1.2.3 for FR1, for a corresponding band,
- CSI-RSRQ related side conditions given in clauses 10.1.7.2 for FR1, for a corresponding band,
- CSI-SINR related side conditions given in clauses 10.1.12.2 for FR1, for a corresponding band,
- CSI_RP and CSI-RS Ês/Iot according to Annex B.2.12 for a corresponding band.

9.10D.2.3 Number of cells and number of CSI-RS

9.10D.2.3.1 Requirements for FR1

For each intra-frequency CSI-RS layer, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 32 CSI-RSs with different CSI-RS index and/or PCI on the intra-frequency layer, and
- the cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB

9.10D.2.4 Measurement Reporting Requirements

Note: The UE is not required to report CSI-RS based L3 measurements when the timing offset between the reference measurement timing and the target CSI-RS in one layer is larger than one CP. If the UE reports CSI-RS based L3 measurements when the timing offset exceeds one CP, the UE may not meet the CSI-RS based L3 measurement accuracy requirements for CSI-RSRP, CSI-RSRQ and CSI-SINR in TS 38.133 [2] clause 10.1, which apply only when the timing offset is no larger than one CP.

9.10D.2.4.1 Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.2.3, 10.1.7.2, and 10.1.12.2.

9.10D.2.4.2 Event-triggered Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.1.2.3, 10.1.7.2, and 10.1.12.2.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.10D.2.4.3.

9.10D.2.4.3 Event Triggered Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI- SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.2.3, 10.1.7.2, and 10.1.12.2.

The UE shall not send any event triggered measurement reports as long as no reporting criterion is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than the CSI-RS based measurement defined in clause 9.10D.2.5. When L3 filtering is used an additional delay can be expected.

9.10D.2.5 Intra-frequency measurements without measurement gaps

If a UE is configured with the higher layer parameters *CSI-RS-Resource-Mobility* and *associatedSSB*, the CSI-RS based measurement shall include PSS/SSS detection time of associatedSSB, the time period used to acquire the SFN information and CSI-RS based measurement period without gap.

- PSS/SSS detection time of associatedSSB is the intra-frequency T_{PSS/SSS_sync_intra} in clause 9.2D.5.1.
- The time period used to acquire the SFN information is equal to 0 if the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise, the time period used to acquire the SFN information is $T_{CSI\text{-}RS_SFN_intra}$ as shown in table 9.10D.2.5-3 for FR1.
- If the associatedSSB, which has been detectable at least for the time period $T_{identify_intra_with_index}$ defined in clause 9.2D.5.1, becomes undetectable for a period ≤ 5 seconds and then the associatedSSB becomes detectable again with the same spatial reception parameter provided the timing to that cell has not changed more than $\pm 3200/2^{\mu} T_c$, where μ is the SCS configuration as defined in clause 4.2 of TS 38.211 [3], PSS/SSS detection time and time period used to acquire the SFN information are equal to 0.

The measurement period for CSI-RS based intra-frequency measurements without gaps is as shown in table 9.10D.2.5-1.

Additionally, for a given CSI-RS resource, if the associated SS/PBCH block is configured but not detected by the UE, or if CSI-RS is configured with associated SSB but not QCL-ed to the associated SSB, the UE is not required to monitor the corresponding CSI-RS resource.

Table 9.10D.2.5-1: Measurement period for intra-frequency CSI-RS based measurements without gaps(FR1)

DRX cycle	$T_{CSI\text{-}RS_measurement_period_intra}$
No DRX	max(200 ms, ceil(5 x $K_{p_CSI\text{-}RS}$ x N1[Note 3] x $K_{layer1_measurement}$) x CSI-RS period) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x $K_{p_CSI\text{-}RS}$ x N1[Note 3] x $K_{layer1_measurement}$) x max(CSI-RS period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x $K_{p_CSI\text{-}RS}$ x N1[Note 3] x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$

NOTE 1: The requirements apply assuming CSI-RS configuration with {D=3 with PRBs ≥ 48}. D is frequency domain density for the 1-port CSI-RS for L3 mobility defined in clause 7.4.1 of TS 38.211 [6].
NOTE 2: $K_{p_CSI\text{-}RS}$ is applicable for a UE supporting concurrent gaps
NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4.
Otherwise, N1 = 1.
NOTE 4: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and inter-band carrier aggregation within FR1 is configured and UE not capable of antennaArrayType-r18 on the other serving carrier or UE support two simultaneous separate Rx beams, or when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and SMTC occasion for PCC and SCC are not overlapped in the time domain and intra-band carrier aggregation within FR1 is configured or inter-band carrier aggregation within FR1 is configured and UE support one common Rx beam.
Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided.

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1D.5.

For a UE not supporting *concurrentMeasGap-r17* or for a UE is supporting *concurrentMeasGap-r17* but not configured with concurrent measurement gaps,

- if the intra-frequency CSI-RS resource does not overlap with any measurement gaps, $K_{p_CSI\text{-}RS}=1$;
- if some occasions of the intra-frequency CSI-RS resource is overlapped with measurement gaps, $K_{p_CSI\text{-}RS}$ = 1/(1-(CSI-RS resource period /MGRP)) , where CSI-RS resource period < MGRP, and the MGRP is the periodicity of the measurement gap.
- Otherwise, when UE supports concurrent measurement gaps, and concurrent measurement gaps are configured, $K_{p_CSI\text{-}RS}$ is the scaling factor for a CSI-RS frequency layer to be measured outside gap which is defined as $K_{p_CSI\text{-}RS} = N_{total} / N_{available}$

  For a window W of duration max(CSI-RS period, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE MG, and starting at the beginning of any gap occasions covering the CSI-RS resources:

  N_{total} is the total number of CSI-RS resources within the window, including those overlapped with other MG occasions within the window, and

  $N_{available}$ is the number of CSI-RS resources that are not overlapped with any other non-dropped MG occasion within the window W, after accounting for MG collisions by applying the selected gap collision rule.

  $K_{p_CSI\text{-}RS}$ = 1 when $N_{available}$ = 0

For UE supporting *antennaArrayType-r18* on the measured carrier,

$K_{layer1_measurement}=1$,

If inter-band carrier aggregation within FR1 is configured and UE not capable of *antennaArrayType-r18* on the other serving carrier, or UE support two simultaneous separate Rx beams

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on one serving cell outside measurement gap are not fully overlapped by intra-frequency SMTC occasions and CSI-RSs occasions of same serving cell, or
- if the measured carrier is the SCC with servingcellMO configured, and the network indication *neighSCellMeasSkipping* is set to 'enable' to UE

Otherwise,

If the measured carrier is the SCC with servingcellMO configured, and the network indication *neighSCellMeasSkipping* is set to 'enable' to UE

- If SMTC occasion and CSI-RSs occasions for PCC and SCC are not overlapped in the time domain, or

- If SMTC occasion and CSI-RSs occasions for PCC and SCC are overlapped in the time domain, and all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any serving frequency outside measurement gap are not fully overlapped by overlapped SMTC occasions and CSI-RSs occasions of serving cells

Otherwise

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any serving frequency outside measurement gap are not fully overlapped by intra-frequency SMTC occasions and CSI-RSs occasions

$K_{layer1_measurement}$=1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

For UE not supporting *antennaArrayType-r18* on the measured carrier, $K_{layer1_measurement}$=1.

Table 9.10D.2.5-2: Void

Table 9.10D.2.5-3: Time period for SFN acquisition for intra-frequency CSI-RS based measurements without gaps(FR1)

DRX cycle	$T_{CSI\text{-}RS_SFN_intra}$
No DRX	max(200 ms, ceil(5 x $K_{p_CSI\text{-}RS}$ x $N1^{Note\ 2}$ x $K_{layer1_measurement}$) x SMTC period)$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(2000 ms, ceil (1.5 x 5 x $K_{p_CSI\text{-}RS}$ x $N1^{Note\ 2}$ x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(5 x $K_{p_CSI\text{-}RS}$ x $N1^{Note\ 2}$ x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	
NOTE 3: For ATG UE capable of *antennaArrayType-r18*, for the SCC measurement, N1=1 when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and inter-band carrier aggregation within FR1 is configured and UE not capable of antennaArrayType-r18 on the other serving carrier or UE support two simultaneous separate Rx beams, or when the network indication *neighSCellMeasSkipping* is set to 'enable' to UE and SMTC occasion for PCC and SCC are not overlapped in the time domain and intra-band carrier aggregation within FR1 is configured or inter-band carrier aggregation within FR1 is configured and UE support one common Rx beam. Otherwise, N1 = 3 when network assistance information on ATG cells reference locations is provided, N1 = 4 when network assistance information on ATG cells reference locations is not provided.	

9.10D.2.6 Scheduling availability of UE during CSI-RS based intra-frequency measurements

UE is required to be capable of measuring without measurement gaps when CSI-RS resources are completely contained in the active BWP of the UE. Note the configured CSI-RS symbol is indicated in *firstOFDMSymbolInTimeDomain* included in *CSI-RS-ResourceConfigMobility* for RRM. When UE is required to perform CSI-RS based RRM measurements, and any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note same numerology for intra-frequency CSI-RS and data of serving cell is considered in this release.

9.10D.2.6.1 Scheduling availability of UE performing CSI-RS based measurements in TDD bands

When ATG UE performs CSI-RS intra-frequency measurements in a TDD band,

- The UE is not expected to transmit PUCCH/PUSCH/SRS on configured CSI-RS resource symbols, and on 1 OFDM symbol before and after each consecutively configured CSI-RS symbols.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When the ATG UE capable of *antennaArrayType-r18* performs intra-frequency neighbouring cell measurements in a TDD band,

- The UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on configured CSI-RS resource symbols, and on 1 OFDM symbol before and after each consecutively configured CSI-RS symbols.

When intra-band carrier aggregation is performed and the ATG UE is capable of *antennaArrayType-r18*, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation is performed and the ATG UE supporting one common Rx beam, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.10D.3 CSI-RS based Inter-frequency measurements

9.10D.3.1 Introduction

A measurement is defined as a CSI-RS based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.10D.2.

If a UE is configured with the higher layer parameter *CSI-RS-Resource-Mobility* and the higher layer parameter *associatedSSB* is configured, the UE shall be able to identify inter-frequency cells indicated for measurement and perform CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements of identified inter-frequency cells.

When measurement gaps are needed, the UE is not expected to detect the associated SSB nor perform measurement of the CSI-RS resource configured in *CSI-RS-Resource-Mobility* on an inter-frequency measurement object which start earlier than the gap starting time + switching time, and ends later than the gap end – switching time. The switching time is 0.5 ms.

9.10D.3.2 Requirements applicability

The associated SSB layer of the CSI-RS follows the same requirements as SSB based measurements defined in clause 9.3D.

The requirements in clause 9.10D.3 apply, provided:

- The associated SSB of the cell being identified or measured is detectable, and
- All CSI-RS resources on one inter-frequency layer are configured within a window of up to 5 ms, and
- The periodicity of the configured CSI-RS resources is 10 ms, 20 ms or 40 ms, and
- CSI-RS resources for measurements and the associated SSB for cell identification are configured within measurement gap.

An inter-frequency cell shall be considered detectable when for each relevant associated SSB:

- SS-RSRP related side conditions given in clauses 10.1.4.1 for FR1, for a corresponding band,
- SS-RSRQ related side conditions given in clauses 10.1.9.1 for FR1, for a corresponding band,
- SS-SINR related side conditions given in clauses 10.1.14.1 for FR1, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding band.

A CSI-RS resource shall be considered measurable when for each relevant CSI-RS resource:

- CSI-RSRP related side conditions given in clauses 10.1.4.3 for FR1, for a corresponding band,

- CSI-RSRQ related side conditions given in clauses 10.1.9.2 for FR1, for a corresponding band,
- CSI-SINR related side conditions given in clauses 10.1.14.2 for FR1, for a corresponding band,
- CSI _RP and CSI-RS Ês/Iot according to Annex B.2.13 for a corresponding band.

9.10D.3.3 Number of cells and number of CSI-RS resources

9.10D.3.3.1 Requirements for FR1

For each inter-frequency CSI-RS layer, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 14 CSI-RSs with different CSI-RS index and/or PCI , and
- The cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB.

9.10D.3.4 Measurements reporting requirements

NOTE: The UE is not required to report CSI-RS based L3 measurements when the timing offset between the reference measurement timing and the target CSI-RS in one layer is larger than one CP. If the UE reports CSI-RS based L3 measurements when the timing offset exceeds one CP, the UE may not meet the CSI-RS based L3 measurement accuracy requirements for CSI-RSRP, CSI-RSRQ and CSI-SINR in TS 38.133 [2] clause 10.1, which apply only when the timing offset is no larger than one CP.

9.10D.3.4.1 Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.3, 10.1.9.2 and 10.1.14.2.

9.10D.3.4.2 Event-triggered Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.3, 10.1.9.2, and 10.1.14.2.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.10D.3.4.3.

9.10D.3.4.3 Event-triggered Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.3, 10.1.9.2 and 10.1.14.2.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within CSI-RS based measurement defined in clause. When L3 filtering is used an additional delay can be expected.

9.10D.3.5 Inter-frequency measurements with measurement gaps

When measurement gaps are provided, if configured with the higher layer parameters *CSI-RS-Resource-Mobility* and *associatedSSB*, the UE shall be able to identify a new detectable CSI-RS based inter-frequency cell within $T_{CSI-RS_identify_inter}$,

$$T_{CSI\text{-}RS_identify_inter} = (T_{PSS/SSS_sync} + T_{CSI\text{-}RS_measurement_period_inter} + T_{CSI\text{-}RS_SFN_inter})\ ms$$

Where:

T_{PSS/SSS_sync} is the time period used in PSS/SSS detection which is determined according to T_{PSS/SSS_sync_inter} in clause 9.3D.4,

$T_{CSI\text{-}RS_SFN_inter}$ is the time period used to acquire the SFN information of the cell being measured, which is shown in table 9.10D.3.5-3 for FR1,

$T_{CSI\text{-}RS_measurement_period_inter}$: equal to a measurement period of CSI-RS based measurement given in table 9.10D.3.5-1.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1D.5 for measurement conducted within measurement gaps.

If a UE which supports concurrent measurement gaps has been configured with concurrent measurement gaps, $K_{p_CSI\text{-}RS}$ is the scaling factor for a CSI-RS frequency layer to be measured within the associated measurement gap which is defined as $K_{p_CSI\text{-}RS} = N_{total} / N_{available}$. $K_{p_CSI\text{-}RS} = 1$ for for UE not configured with concurrent measurement gaps.

- For a window W of duration max(CSI-RS period, MGRP_max), where MGRP_max is the maximum MGRP across all configured per-UE MG and per-FR1 MG within the same FR as the CSI-RS frequency layer, and starting at the beginning of any gap occasions covering the CSI-RS resources.:
  - N_{total} is the total number of associated gap occasions covering CSI-RS resources within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and
  - $N_{available}$ is the number of non-dropped associated gap occasions covering CSI-RS resources within the window W, after accounting for MG collisions by applying the selected gap collision rule.
  - Requirements do not apply if $N_{available} = 0$

Additionally, for a given CSI-RS resource, if the associated SSB is configured but not detected by the UE, or if CSI-RS configured with associated SSB but not QCL-ed to the associated SSB, the UE is not required to monitor the corresponding CSI-RS resource.

Table 9.10D.3.5-1: Measurement period for CSI-RS based inter-frequency measurements with gaps (FR1)

Condition NOTE1	$T_{CSI\text{-}RS_measurement_period_inter}$
No DRX	$Max(200\ ms, ceil(8 \times K_{p_CSI\text{-}RS} \times N1^{Note\ 3}) \times Max(MGRP, CSI\text{-}RS\ period)) \times CSSF_{inter}$
DRX cycle ≤ 320 ms	$Max(200\ ms, Ceil(8 \times 1.5 \times K_{p_CSI\text{-}RS} \times N1^{Note\ 3}) \times Max(MGRP, CSI\text{-}RS\ period, DRX\ cycle)) \times CSSF_{inter}$
DRX cycle > 320 ms	$Ceil(8 \times K_{p_CSI\text{-}RS} \times N1^{Note\ 3}) \times DRX\ cycle \times CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $K_{p_CSI\text{-}RS}$ is applicable for a UE supporting concurrent gaps NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	

Table 9.10D.3.5-2: Void

Table 9.10D.3.5-3: Time period for SFN acquisition for inter-frequency CSI-RS based measurements with gaps(FR1)

Condition NOTE1	$T_{CSI\text{-}RS_SFN_inter}$
No DRX	$Max(200\ ms, ceil(5 \times K_{p_CSI\text{-}RS} \times N1^{Note\ 3}) \times Max(MGRP, SMTC\ period)) \times CSSF_{inter}$

DRX cycle ≤ 320 ms	Max(200 ms, Ceil($5 \times 1.5 \times K_{p_CSI\text{-}RS}$ x N1[Note 3]) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320 ms	Ceil($5 \times K_{p_CSI\text{-}RS}$ x N1[Note 3])× DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $K_{p_CSI\text{-}RS}$ is applicable for a UE supporting concurrent gaps NOTE 3: For ATG UE capable of *antennaArrayType-r18*, N1 = 3 when network assistance on ATG cells reference locations is provided, otherwise N1 = 4. Otherwise, N1 = 1.	

9.11 NR measurements with autonomous gaps

9.11.1 Introduction

The requirements in this clause are applicable for CGI identification of an intra frequency and inter-frequency NR target cell.

The requirements in this clause are specified for CGI identification of an NR target cell and are applicable for a UE:

- in RRC_CONNECTED state, and
- configured with SA or NR-DC or NE-DC operation mode, or with EN-DC operation mode for CGI identification requested by NR PSCell.

The overall CGI reporting delay is defined in clause 9.11.3.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.11.2 CGI identification of an NR cell with autonomous gaps

The UE shall identify and report the CGI of a known NR target cell when requested by the network for the purpose of reportCGI. Only one cell is provided to the UE with *cellForWhichToReportCGI* for identifying the CGI.The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3 of TS 38.331 [2]. Note that a UE is not required to use autonomous gap if *useAutonomousGaps* is set to false. If autonomous gaps are used for measurement with the purpose of reportCGI, regardless of whether DRX is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of NR cell within:

$$T_{identify_CGI} = (T_{MIB} + T_{SIB1})\ ms$$

Where:

T_{MIB} is the time period used to acquire MIB message. $T_{MIB} = 6 * T_{SMTC}$ ms for target cell carrier frequency on FR1 and $T_{MIB} = 25 * T_{SMTC}$ ms for target cell carrier frequency on FR2.

T_{SIB1} is the time period used to acquire SIB1 message. $T_{SIB1} = 6 * T_{RMSI\text{-}scheduling}$ ms.

Where T_{SMTC} is the SMTC periodicity configured for the target cell measurement, and $T_{RMSI\text{-}scheduling}$ is

- the maximum between the periodicity with which the SIB1 is actually transmitted by the NR target cell and 20 ms when SSB and RMSI CORESET multiplexing pattern is 1
- the maximum between the periodicity with which the SIB1 is actually transmitted by the NR target cell and T_{SMTC} when SSB and RMSI CORESET multiplexing pattern is 2 or 3.

The requirement for identifying the CGI of an NR cell within $T_{identify_CGI}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.

Within the time $T_{identify_CGI}$, over which the UE identifies the CGI of an NR cell, the UE shall fulfil interruption requirements specified in,

- clause 8.2.1.2.16 for NR serving cells and clause 7.32.2.15 in TS 36.133 [15] for E-UTRA serving cells if the UE is configured with EN-DC operation mode,
- clause 8.2.2.2.14 if the UE is configured with SA operation mode,
- clause 8.2.3.2.14 for NR serving cells and clause 7.36.2.14 in TS 36.133 [15] for E-UTRA serving cells if the UE is configured with NE-DC operation mode,
- clause 8.2.4.2.11 if the UE is configured with NR-DC operation mode.

In the requirement a cell is known if,

- During the last 5 seconds for FR1 or 3 seconds for FR2 before the reception of the report CGI command:
  - The UE has sent a valid L3-RSRP measurement report with SSB index for the target cell and
- During MIB decoding at least reported SSBs remains detectable according to the cell identification conditions specified in clauses 9.2 or 9.3 of TS 38.133, and
- During SIB1 decoding the SSB used for MIB decoding remains detectable according to the cell identification conditions specified in clauses 9.2 or 9.3 of TS 38.133, and
- During MIB decoding, the SSB for MIB decoding remains detectable with SNR $\geqslant$-3 dB
- During SIB1 decoding, the PDSCH for SIB1 decoding remains detectable with SNR $\geqslant$-3 dB

9.11.3 CGI reporting delay

The CGI reporting delay is defined as the time between a command that will trigger a CGI report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty of 2 x TTI_{DCCH} resulting when inserting the measurement report to the TTI of the uplink DCCH. This measurement reporting delay excludes any delay caused by lack of UL resources for UE to send the measurement report.

The CGI reporting delay shall be less than $T_{identify_CGI}$ defined in clause 9.11.2 plus RRC procedure delay defined in clause 12 in TS 38.331 [2], and additional 20 ms margin if target cell is on FR2.

9.11A NR measurements with autonomous gaps for RedCap

9.11A.1 Introduction

The requirements in this clause are applicable for CGI identification of an intra frequency and inter-frequency NR target cell.

The requirements in this clause are specified for CGI identification of an NR target cell and are applicable for a UE:

- in RRC_CONNECTED state, and
- configured with SA operation mode.

The overall CGI reporting delay is defined in clause 9.11A.3.

9.11A.2 CGI identification of an NR cell with autonomous gaps

The UE shall identify and report the CGI of a known NR target cell when requested by the network for the purpose of reportCGI. Only one cell is provided to the UE with *cellForWhichToReportCGI* for identifying the CGI.The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3 of TS 38.331 [2]. Note that a UE is not required to use autonomous gap if *useAutonomousGaps* is set to false. If autonomous gaps are used for measurement with the purpose of reportCGI, regardless of whether DRX is used or not, the UE shall be able to identify a new CGI of NR cell within:

$$T_{identify_CGI_redcap} = (T_{MIB_redcap} + T_{SIB1_redcap})\ ms$$

Where:

For 2 Rx RedCap UE:

T_{MIB_redcap} is the time period used to acquire MIB message. $T_{MIB_redcap} = 6 * T_{SMTC}$ ms for target cell carrier frequency on FR1 and $T_{MIB_redcap} = 25 * T_{SMTC}$ ms for target cell carrier frequency on FR2.

T_{SIB1_redcap} is the time period used to acquire SIB1 message. $T_{SIB1_redcap} = 6 * T_{RMSI\text{-}scheduling}$ ms.

For 1 Rx RedCap UE:

T_{MIB_redcap} is the time period used to acquire MIB message. $T_{MIB_redcap} = 6 * T_{SMTC}$ ms for target cell carrier frequency on FR1.

T_{SIB1_redcap} is the time period used to acquire SIB1 message. $T_{SIB1_redcap} = 12 * T_{RMSI\text{-}scheduling}$ ms.

Where T_{SMTC} is the SMTC periodicity configured for the target cell measurement, and $T_{RMSI\text{-}scheduling}$ is

- the periodicity with which the SIB1 is actually transmitted by the NR target cell when SSB and RMSI CORESET multiplexing pattern is 1
- the maximum between the periodicity with which the SIB1 is actually transmitted by the NR target cell and T_{SMTC} when SSB and RMSI CORESET multiplexing pattern is 2 or 3.

The requirement for identifying the CGI of an NR cell within $T_{identify_CGI_redcap}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.

Within the time $T_{identify_CGI_redcap}$, over which the UE identifies the CGI of an NR cell, the UE shall fulfil interruption requirements specified in,

- clause 9.11A.4if the UE is configured with SA operation mode.

In the requirement a cell is known if,

- During the last 5 seconds for FR1 or 3 seconds for FR2 before the reception of the report CGI command:
  - The UE has sent a valid L3-RSRP measurement report with SSB index for the target cell and
- During MIB decoding at least reported SSBs remains detectable according to the cell identification conditions specified in clauses 9.2B or 9.3B of TS 38.133, and
- During SIB1 decoding the SSB used for MIB decoding remains detectable according to the cell identification conditions specified in clauses 9.2B or 9.3B of TS 38.133, and
- During MIB decoding, the SSB for MIB decoding remains detectable with SNR $\geqslant$-3 dB
- During SIB1 decoding, the PDSCH for SIB1 decoding remains detectable with SNR $\geqslant$-3 dB

9.11A.3 CGI reporting delay

The CGI reporting delay is defined as the time between a command that will trigger a CGI report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty of 2 x TTI_{DCCH} resulting when inserting the measurement report to the TTI of the uplink DCCH. This measurement reporting delay excludes any delay caused by lack of UL resources for UE to send the measurement report.

The CGI reporting delay shall be less than $T_{identify_CGI_redcap}$ defined in clause 9.11A.2 plus RRC procedure delay defined in clause 12 in TS 38.331 [2], and additional 20 ms margin if target cell is on FR2.

9.11A.4 CGI reporting scheduling restriction

When a RedCap UE is identifying CGI of an NR cell with autonomous gaps, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on PCell for the following slots:

- with up to K1 interruptions with interrupted slots up to X1 specified in table 9.11A.4-1 for each interruption during MIB decoding time period T_{MIB_redcap} (ms) specified in clause 9.11A.2.
- with up to L1 interruptions with interrupted slots up to Y1 specified in table 9.11A.4-1 during SIB1 decoding time period T_{SIB1_redcap} (ms) specified in clause 9.11A.2 for SSB and CORESET for RMSI scheduling multiplexing patterns 1.
- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in table 9.11A.4-1 during SIB1 decoding time period T_{SIB1_redcap} (ms) specified in clause 9.11A.2 for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

- K1 = 6 for the target cell carrier frequency on FR1 and K1 = 25 for the target cell carrier frequency on FR2, and
- L1 = T_{SIB1_redcap} /20 and
- L2 = T_{SIB1_redcap} /T_{SMTC}, where T_{SMTC} is the periodicity of the SMTC occasion configured for the target cell carrier.

Table 9.11A.4-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	Interruption length Y1 (slots)	Interruption length Y2 (slots)
0	1	6	7	6
1	0.5	12	13	10
2	0.25	24	25	19
3	0.125	48	49	37

9.11D NR measurements with autonomous gaps for ATG

The requirements in clause 9.11 shall apply only for FR1 without considering CA/DC and inter-RAT measurement.

9.11D.1 Introduction

The requirements in this clause are applicable for CGI identification of an intra frequency and inter-frequency NR target cell.

The requirements in this clause are specified for CGI identification of an NR target cell and are applicable for a UE:

- in RRC_CONNECTED state, and
- configured with SA for CGI identification requested by NR PSCell.

The overall CGI reporting delay is defined in clause 9.11D.3.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.11D.2 CGI identification of an NR cell with autonomous gaps

The UE shall identify and report the CGI of a known NR target cell when requested by the network for the purpose of reportCGI. Only one cell is provided to the UE with *cellForWhichToReportCGI* for identifying the CGI.The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3 of TS 38.331 [2]. Note that a UE is not required to use autonomous gap if *useAutonomousGaps* is set to false. If autonomous gaps are used for measurement with the purpose of reportCGI,

regardless of whether DRX is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of NR cell within:

$$T_{identify_CGI} = (T_{MIB} + T_{SIB1})\ ms$$

Where:

T_{MIB} is the time period used to acquire MIB message. $T_{MIB} = 6 * T_{SMTC}$ ms for target cell carrier frequency on FR1.

T_{SIB1} is the time period used to acquire SIB1 message. $T_{SIB1} = 6 * T_{RMSI\text{-}scheduling}$ ms.

Where T_{SMTC} is the SMTC periodicity configured for the target cell measurement, and $T_{RMSI\text{-}scheduling}$ is

- the maximum between the periodicity with which the SIB1 is actually transmitted by the NR target cell and 20 ms when SSB and RMSI CORESET multiplexing pattern is 1.

The requirement for identifying the CGI of an NR cell within $T_{identify_CGI}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.

Within the time $T_{identify_CGI}$, over which the UE identifies the CGI of an NR cell, the UE shall fulfil interruption requirements specified in clause 8.2.2.2.14.

In the requirement a cell is known if,

- During the last 5 seconds for FR1 before the reception of the report CGI command:
  - The UE has sent a valid L3-RSRP measurement report with SSB index for the target cell and
- During MIB decoding at least reported SSBs remains detectable according to the cell identification conditions specified in clauses 9.2D or 9.3D of TS 38.133, and
- During SIB1 decoding the SSB used for MIB decoding remains detectable according to the cell identification conditions specified in clauses 9.2D or 9.3D of TS 38.133, and
- During MIB decoding, the SSB for MIB decoding remains detectable with SNR $\geqslant$-3 dB
- During SIB1 decoding, the PDSCH for SIB1 decoding remains detectable with SNR $\geqslant$-3 dB

9.11D.3 CGI reporting delay

The CGI reporting delay is defined as the time between a command that will trigger a CGI report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty of 2 x TTI_{DCCH} resulting when inserting the measurement report to the TTI of the uplink DCCH. This measurement reporting delay excludes any delay caused by lack of UL resources for UE to send the measurement report.

The CGI reporting delay shall be less than $T_{identify_CGI}$ defined in clause 9.11.2 plus RRC procedure delay defined in clause 12 in TS 38.331 [2].

9.12 Measurement for Propagation Delay Compensation

9.12.1 Introduction

The requirements in this clause are applicable for UE capable of RTT-based propagation delay compensation based on PRS/TRS and SRS, where the UE is configured with *measObjectRxTxDiff* in *MeasObjectToAddModList* defined in TS 38.331 [2].

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.12.2 Requirements Applicability

The requirements in clause 9.12 apply for periodic triggered UE Rx-Tx time difference measurements, provided:

- If UE Rx-Tx time difference measurement is based on PRS, the related side conditions given in clause 10.1.39.2 are met for a corresponding band.
- If UE Rx-Tx time difference measurement is based on TRS, the related side conditions given in clause 10.1.39.3 are met for a corresponding band.
- SRS is configured on at least one of the PCell.

All measurement requirements specified in clause 9.12.4 shall apply when no DRX is in use as well as for when DRX is in use (clause 3.6.1) for any DRX configuration specified in TS 38.331 [2].

9.12.3 Measurement Capability

If UE Rx-Tx time difference measurement is based on PRS, the capability is as indicated by the UE in *rtt-BasedPDC-PRS-r17* in TS 38.331 [2].

If UE Rx-Tx time difference measurement is based on TRS, the capability is as indicated by the UE in *rtt-BasedPDC-CSI-RS-ForTracking-r17* in TS 38.331 [2].

9.12.4 Measurement period requirements

9.12.4.1 PRS Measurement Period

When UE is configured with *prs-Ref-r17* in *MeasObjectRxTxDiff*-r17 defined in TS 38.331 [2] and provided with PRS resource configuration, the UE shall be able to measure UE Rx-Tx time difference on PCell within the measurement period $T_{UERx-Tx_PRS}$, where:

$$T_{UERxTx,PRS} = \left\lceil \frac{N_{PRS}^{slot}}{N'} \right\rceil * N_{sample} * K_{layer3} * LCM(T_{PRS}, T_{DRX})$$

Where:

N_{PRS}^{slot} is the maximum number of DL PRS resources configured in a slot,

N′ is UE capability for number of DL PRS resources that it can process in a slot corresponding to *maxNumberPRS-ResourceProcessedPerSlot-r17* as specified in TS 38.331 [2],

N_{sample} is the number of UE Rx-Tx time difference measurement samples and N_{sample} = 4,

T_{PRS} is the PRS resource periodicity specific for RTT-based propagation delay compensation,

T_{DRX} is the DRX cycle length when DRX is in use, 1 ms otherwise.

K_{layer3} is

N_{total} / $N_{available}$, when $N_{available}$>0

Where,

- For a window W of duration LCM(T_{PRS}, MGRP_max, T_{SMTC}) and starting at the beginning of any PRS resource occasion, where T_{SMTC} is the periodicity of SMTC for intra-frequency measurement without gap and MGRP_max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as PCell for a UE that support *concurrentMeasGap-r17* and is configured with concurrent measurement gaps, otherwise MGRP_max is the MGRP of configured per-UE measurement gap or per-FR measurement gap within the same FR as PCell:
  - N_{total} is the total number of PRS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
  - $N_{available}$ is the number of PRS resource occasions that are not overlapped with:

- For FR1: any measurement gap occasions within window W. And for a UE supporting *concurrentMeasGap-r17* after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1.8.3 within the window W
- For FR2: any measurement gap occasions nor any SMTC occasions within window W. And for a UE supporting *concurrentMeasGap-r17* after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1.8.3 nor any SMTC occasions within the window W.

No requirements shall apply if $N_{available}$=0.

UE is only required to perform UE Rx-Tx time difference on PRS within the active DL BWP.

When UE is configured to perform UE Rx-Tx time difference measurement based on PRS, the requirements apply provided that the SCS of the PRS is same as that of the active BWP on PCell.

For FR2, the requirements apply if QCL information is provided for all the PRS resources in the resource set and for each resource one RS has QCL-TypeD.

If PRS resources overlap with Type 1A/1B/2 PPW, the UE is allowed longer measurement period to measure UE Rx-Tx time difference on PCell.

9.12.4.2 TRS Measurement Period

When UE is configured with *csi-RS-Ref-r17* in *MeasObjectRxTxDiff*-r17 defined in TS 38.331 [2] and provided with TRS resource configuration, the UE shall be able to measure UE Rx-Tx time difference on PCell within the measurement period $T_{UERx-Tx_TRS}$, where:

$$T_{UERxTx,TRS} = N_{sample} * K_{layer3} * LCM(T_{TRS}, T_{DRX})$$

Where

N_{sample} is the number of UE Rx-Tx time difference measurement samples and N_{sample} is [4],

T_{TRS} is the TRS resource periodicity specific for RTT-based propagation delay compensation,

T_{DRX} is the DRX cycle length when DRX is in use, 1 ms otherwise.

K_{layer3} is

N_{total} / $N_{available}$ when $N_{available}$>0

Where,

- For a window W of duration LCM(T_{TRS}, MGRP_max, T_{SMTC}) and starting at the beginning of any TRS resource occasion, where T_{SMTC} is the periodicity of SMTC for intra-frequency measurement without gap and MGRP_max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as PCell for a UE that support *concurrentMeasGap-r17* and is configured with concurrent measurement gaps, otherwise MGRP_max is the MGRP of configured per-UE measurement gap or per-FR measurement gap within the same FR as PCell:
  - N_{total} is the total number of TRS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
  - $N_{available}$ is the number of TRS resource occasions that are not overlapped with
    - For FR1: any measurement gap occasions within window W. And for a UE supporting *concurrentMeasGap-r17* after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1.8.3 within the window W
    - For FR2: any measurement gap occasions nor any SMTC occasions within window W. And for a UE supporting *concurrentMeasGap-r17* after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1.8.3 nor any SMTC occasions within the window W.

No requirements shall apply if $N_{available}$=0.

UE is only required to perform UE Rx-Tx time difference on TRS within the active DL BWP. When UE is configured to perform UE Rx-Tx time difference measurement based on TRS, the requirements apply provided that the SCS of the TRS is same as that of the active BWP on PCell.

For FR2, the requirements apply if QCL information is provided for all the TRS resources in the resource set and for each resource one RS has QCL-TypeD.

If TRS resources overlap with Type 1A/1B/2 PPW, the UE is allowed longer measurement period to measure UE Rx-Tx time difference on PCell.

9.12.5 Measurement Reporting Requirements

The UE shall report UE Rx-Tx time difference measurement results if UE supports *gNB-SideRTT-BasedPDC-r17*.

The measurement reporting delay excludes the delay uncertainty caused by inserting the measurement report into the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The UE Rx-Tx time difference measurement values contained in measurement report shall be based on the measurement report mapping requirements specified in clause 10.1.25.3, with k = 5.

The UE Rx-Tx time difference measurement accuracy shall be fulfilled according to the accuracy requirements specified in clause 10.1.39.2 and 10.1.39.3 for PRS and TRS, respectively.

9.12.6 Scheduling availability during measurement for Propagation Delay Compensation

During measurement for Propagation Delay Compensation in an FR2 cell,

- For the case where the PRS or TRS for PDC measurement is QCLed with active TCI state for PDCCH/PDSCH, there are no scheduling restrictions due to PDC measurement performed based on PRS or TRS.
- Otherwise, the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the PRS or TRS resource configured for PDC measurement.

9.12.7 Measurement restriction for measurement for Propagation Delay Compensation

During measurement for Propagation Delay Compensation in an FR2 cell, when the PRS or TRS for PDC measurement on one CC is in the same OFDM symbol as SSB or CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both PRS or TRS for PDC measurement and the other RS if they are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE. Longer measurement period for PRS or TRS for PDC measurement is expected.

9.12.8 Measurement requirement for Propagation Delay Compensation with MUSIM gaps

The measurement requirement defined for measurement for Propagation Delay Compensation in this clause 9.12 applies, if there is no overlap between MUSIM gaps and PRS or TRS for propagation delay compensation measurements.

9.13 L1-RSRP measurements for a cell with different PCI from serving cell

9.13.1 Introduction

When configured by the network, the UE shall be able to perform L1-RSRP measurements of configured measurement resources from a cell with different PCI in addition to serving cell (PCI indicated in *additionalPCI-r17*), with the measurement resources configured as SSBs of the cell with different PCI.

The UE shall be able to measure all SSB resources of the cell with different PCI in *csi-SSB-ResourceSet* within the CSI-Resource*Config* settings for the active BWP, while the *additionalPCI-r17* of the SSB resources are different from serving cell PCI. The number of resources, including the number of resources configured for serving cell L1-RSRP measurement in clause 9.5, does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the higher layer parameter *reportConfigType* of each reporting setting *CSI-ReportConfig* for the active BWP.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.13.2 Requirements Applicability

The requirements in the clause 9.13 are applicable to inter-cell beam management and inter-cell multi-TRP scenarios.

The requirements in clause 9.13 apply, provided the SSB from cell with PCI different from serving cell configured for L1-RSRP if the following conditions are met:

- the number of cells with PCI different from seving cells N_{max} = 1 for FR2 and N_{max} = maxNrofAdditionalPCI for FR1. Where, maxNrofAdditionalPCI is defined in TS 38.331 [2].
- The SSB from the cell with different PCI completely contained in the active BWP or associated with initial downlink BWP of the UE
- The SSB of the cell with different PCI from serving cell has the same SCS, SFN offset and center frequency as the SSB of the serving cell
- For a UE that supports both *multiDCI-IntraCellMultiTRP-TwoTA-r18* or *multiDCI-InterCellMultiTRP-TwoTA-r18* and *rxTimingDiff-r18*, the requirements apply when RX timing difference is up to MRTD as specified in clause 7.6.8.
- For a UE which does not support *rxTimingDiff-r18*, the requirements apply when RX timing difference is less than CP
- The cell with different PCI from serving cell is known
- The SSB resources configured for L1-RSRP measurements are measurable

An SSB resource configured for L1-RSRP for cell with different PCI from serving cell shall be considered measurable when for each relevant SSB the following conditions are met:

- L1-RSRP related side conditions given in clauses 10.1.19.1 and 10.1.20.1 for FR1 and FR2, respectively, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.4.1 for a corresponding band.

The cell with different PCI from serving cell is considered as known if the following conditions are met in this requirement:

- The UE has sent a valid L3 measurement report during the last 5 seconds, and
- The SSB from the cell with different PCI remains detectable according to the cell identification requirements specified in clause 9.2.

Otherwise, the cell is unknown.

In case the SSB resources configured for L1-RSRP measurements outside SMTCs are overlapped with PDSCH/PDCCH that is associated to serving cell, L1-RSRP measurement performance degradation is expected.

9.13.3 Measurement Reporting Requirements

The UE shall send L1-RSRP reports only for report configurations configured for the active BWP.

The UE shall report the L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1dB step size according to clauses 10.1.19 for FR1 and 10.1.20 for FR2 if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting-r17* is enabled, the UE shall use differential L1-RSRP based reporting as defined in clauses 10.1.19 for FR1 and 10.1.20 for FR2. The differential L1-RSRP is quantized to a 4-bit value with 2dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in clause 10.1.6.

In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or an additional delay can be expected in both FR1 and FR2 if the UE is not capable of per-FR gap.

9.13.3.1 Periodic Reporting

Reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively.

The UE shall only send periodic L1-RSRP measurement reports for an active BWP.

The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.13.3.2 Semi-Persistent Reporting

Reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.13.3.3 Aperiodic Reporting

Reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively.

The UE shall only send aperiodic L1-RSRP measurement report if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.13.3.4 Event triggered reporting for UE initiated beam management

For a UE configured with a *CSI-ReportConfig* with *csi-ReportUE-IBR-r19* and with *dl-OrJointTCI-StateList,* with or without *eventCountWindow-r19* configuration the reported L1-RSRP measurements contained in an event triggered L1-RSRP measurement report shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2.

The UE shall not send any event triggered measurement reports if no reporting criteria is fulfilled.

The event triggered L1-RSRP measurement reporting delay is defined as the time between an event that will trigger a measurement report after condition is met over the air and the point when the UE transmits first PUCCH over the air interface.

When *eventCountWindow-r19* is not configured,

The event triggered measurement reporting delay shall be no larger than $T_{L1\text{-}meas_basic} + T_{first_UL_channel}$.

$T_{L1\text{-}meas_basic}$ is the maximum of L1-RSRP measurement periods of the reference signals of beams corresponding to the event

For a UE configured with a *CSI-ReportConfig* with the higher layer parameter *eventTypeUE-IBR-r19* set to '*event2-r19*', UE shall perform L1-RSRP measurement based on the L1-RSRP measurement period of current beam and new beam(s) respectively.

For a UE configured with a *CSI-ReportConfig* with the higher layer parameter *eventTypeUE-IBR-r19* set to '*event1-r19*', UE shall perform L1-RSRP measurement based on the L1-RSRP measurement period of current beam.

If the SS/PBCH block is QCLed with the reference signal in the indicated TCI state, the L1-RSRP measurement period of the current beam refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB_CDP}$ in Table 9.13.4.1-1 or 9.13.4.1-2 where $T_{Report.} = 0$, and T_{SSB_CDP} is the periodicity of the SS/PBCH block which is QCLed with the reference signal in the indicated TCI state for the current beam

If the reference signals in *newBeamResourceSet-r19* are based on SSB for a cell with additional PCI, the L1-RSRP measurement period of the new beam refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB_CDP}$ in Table 9.13.4.1-1 or 9.13.4.1-2 where $T_{Report.} = 0$, and T_{SSB_CDP} is the periodicity of the *SSB-Index* of the reference signal configured by the *newBeamResourceSet-r19*.

For a UE configured with a CSI-ReportConfig with the higher layer parameter *eventTypeUE-IBR-r19* set to '*event7-r19*', UE shall perform L1-RSRP measurement based on L1-RSRP measurement period of current beam and new beam respectively.

If the SS/PBCH block is QCLed with the reference signal corresponding to the activated TCI states with the highest *valueOfQ-r19* the L1-RSRP measurement period of the beam refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB_CDP}$ as specified in table 9.13.4.1-1 or 9.13.4.1-2 where $T_{Report.} = 0$, and T_{SSB} is the periodicity of the *SSB-Index* of the reference signal corresponding to the activated TCI states with the highest *valueOfQ-r19*

If the reference signals in *newBeamResourceSet-r19* are based on SSB for a cell with additional PCI, the L1-RSRP measurement period of the new beam refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB_CDP}$ in Table 9.13.4.1-1 or 9.13.4.1-2 where $T_{Report.} = 0$, and T_{SSB_CDP} is the periodicity of the *SSB-Index* of the reference signal configured by the *newBeamResourceSet-r19*.

$T_{first\ UL\ channel}$ is the time to first PUCCH after L1 reporting condition is triggered

Otherwise, if *eventCountWindow-r19* is provided, the event triggered measurement reporting delay shall be no larger than (*eventInstanceCount-r19* + L) * $T_{L1\text{-}meas_basic} + T_{first\ UL\ channel,}$ where

- *eventInstanceCount-r19* is configured by the network

- $T_{L1\text{-}meas_basic}$ is the measurement period above based on the configuration

- L is the number of measurement instances ($T_{L1\text{-}meas_basic}$) that do not satisfy the event condition, counted after the event counter is started for the window that will trigger the measurement report and before the required number of events (eventInstanceCount-r19) are detected within the specified time window (*eventDetectionTimeWindow-r19*).

- The above requriement is applicable when *eventDetectionTimeWindow-r19* is not less than (*eventInstanceCount-r19* + L-1) * $T_{L1\text{-}meas_basic}$. The requirement does not apply when *eventDetectionTimeWindow-r19* is less than (*eventInstanceCount-r19* + L-1) * $T_{L1\text{-}meas_basic}$.

9.13.4 L1-RSRP measurement requirements

9.13.4.1 Inter-cell SSB based L1-RSRP Reporting

If a cell with PCI different from serving cell is known according to clause 9.13.2, the UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_CDP}$. The requirements specified in this clause are only applicable when

- *highSpeedMeasFlag-r16* is not configured, and
- *highSpeedMeasFlagFR2-r17* is not configured, and
- *highSpeedMeasCA-Scell-r17* is not configured, and
- SSBs of CDP outside SMTCs for L1-RSRP measurement are not overlapped with concurrent gaps.

The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_CDP}$ is defined in table 9.13.4.1-1 for FR1, The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_CDP}$ is defined in table 9.13.4.1-2 for FR2 when *highSpeedMeasFlagFR2-r17* is not configured, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise
- N= 8.

When UE supports *musim-GapPreference-r17*, and periodic MUSIM gaps are configured,

- an SSB or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to 9.1.10,
- P value for SSB resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P = P_{L1_sharing\ factor} * P_{sharing\ factor} * N_{total} / N_{outside_MG}$ in FR2, if $N_{available} = 0$
  - P is defined as below based on P_2, where $P_2 = N_{total} / N_{available}$ in FR2, if $N_{available} > 0$
- For a window W of duration max($T_{L1,}$ MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps, MUSIM gap(s) and/or per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any SSB resource occasion:
  - N_{total} is the total number of SSB resource occasions within the window, including those overlapped with measurement gap occasions, MUSIM gap occasions or SMTC occasions within the window, and
  - $N_{outside_MG}$ is the number of SSB resource occasions that are not overlapped with any non-dropped measurement gap occasion nor non-dropped MUSIM gap occasion within the window W, and
  - $N_{available}$ is the number of SSB resource occasions that are not overlapped with any non-dropped measurement gap occasion, non-dropped MUSIM gap occasion nor any SMTC occasion within the window W.
  - an SSB or an SMTC occasion is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion.
  - T_{L1} is periodicity of the target SSB.

Otherwise, when UE does not support *musim-GapPreference-r17* or when no MUSIM gaps are configured,

For FR1,

- $P=\frac{1}{1-\frac{T_{SSB_CDP}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- P is $P_{L1_sharing}$*$P_{sharing\ factor,\ CDP}$, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC period (T_{SSB_CDP} = $T_{SMTCperiod}$), and T_{SSB_SC} = $T_{SMTCperiod}$.

- P is $P_{L1_sharing} * \frac{P_{\text{sharing factor}}}{1-\frac{T_{SSB_CDP}}{MGRP}}$, when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion (T_{SSB_CDP} = $T_{SMTCperiod}$) and SMTC occasion is partially overlapped with GAP ($T_{SMTCperiod}$ < MGRP).

- $P_2=\frac{1}{1-\frac{T_{SSB_CDP}}{T_{SMTCperiod}}}$, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (T_{SSB_CDP} < $T_{SMTCperiod}$).

- $P_2= \frac{1}{1-\frac{T_{SSB_CDP}}{MGRP}-\frac{T_{SSB_CDP}}{T_{SMTCperiod}}}$, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion (T_{SSB_CDP} < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and T_{SSB_CDP} < 0.5*$T_{SMTCperiod}$

- P_2 is $\frac{P_{\text{sharing factor}}}{1-\frac{T_{SSB_CDP}}{MGRP}}$, when SSB is partially overlapped with GAP and SSB is partially overlapped with SMTC occasion (T_{SSB_CDP} < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with GAP and $T_{SMTCperiod}$ = MGRP and T_{SSB_CDP} = 0.5*$T_{SMTCperiod}$

- $P_2= \frac{1}{1-\frac{T_{SSB_CDP}}{min(T_{SMTCperiod},MGRP)}}$,when SSB is partially overlapped with measurement gap (T_{SSB_CDP} <MGRP) and SSB is partially overlapped with SMTC occasion (T_{SSB_CDP} < $T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.

- If SSB resource from serving cell is configured for L1-RSRP measurements, and P_1 is valid accoding to 9.5.4.1, and any symbol of the SSBs from serving cell and cell with different PCI are overlapping or adjacent (in time domain)

  - $P = \frac{P_2}{1-\frac{P_2*T_{SSB_CDP}}{P_1*T_{SSB_SC}}}$, if P_2*T_{SSB_CDP} < P_1*T_{SSB_SC}.

  - P = P_2, if P_2*T_{SSB_CDP}> P_1*T_{SSB_SC}.

  - P = 2*P_2, if P_1*T_{SSB_SC} = P_2*T_{SSB_CDP}.

- Otherwise, P = P_2

- T_{SSB_CDP} = SSB periodicity of the cell with PCI different from serving cell

- $T_{SMTCperiod}$ = the configured SMTC period

- T_{SSB_SC} = ssb-periodicityServingCell of the serving cell

$P_{sharing\ factor}$ = 1, if the SSB configured for L1-RSRP measurement outside measurement gap is

- not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

$P_{sharing\ factor}$ = 3, otherwise.

$P_{L1_sharing}$ = 2, if SSB resource from serving cell is configured for L1-RSRP measurements, and $P_{sharing_factor}$ is used in clause 9.5.4.1, and any symbol of the SSBs from serving cell and cell with different PCI are overlapping or adjacent (in time domain). $P_{L1_sharing}$ = 1, otherwise.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 cell with PCI different from serving cell, longer evaluation period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

When UE is configured with aperiodic MUSIM gap and the aperiodic MUSIM gap is overlapping with SSB resource occasion for inter-cell L1-RSRP, longer evaluation period would be expected.

When UE is configured with MUSIM gap(s), and SSB resource occasions for inter-cell L1-RSRP are fully overlapped with MUSIM gap(s) or fully overlapped with the union of MUSIM gap(s) and GAPs, no requirement applies for the SSB based inter-cell L1-RSRP measurement.

For either an FR1 or FR2 cell with PCI different from serving cell, longer L1 RSRP measurement period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 9.13.4.1-1: Inter-cell L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_CDP}$ for known cells with different PCIs in FR1

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_CDP}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB_CDP})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(K*M*P)*\max(T_{DRX},T_{SSB_CDP}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$
NOTE 1: T_{SSB_CDP} is the periodicity of the SSB-Index configured for inter-cell L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: K = 1.5.	

Table 9.13.4.1-2: Inter-cell L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_CDP}$ for known cells with different PCIs in FR2

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_CDP}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P*N)*T_{SSB_CDP})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P*N)*\max(T_{DRX},T_{SSB_CDP}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*M*P*N)*T_{DRX}$
NOTE: T_{SSB_CDP} is the periodicity of the SSB-Index configured for inter-cell L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

9.13.5 Measurement restriction for L1-RSRP measurement

The UE is required to be capable of measuring SSB for L1-RSRP without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following clauses.

Unless explicitly stated, the SSB to be measured for L1-RSRP measurement is transmitted from cell(s) with PCI different from serving cell(s).

9.13.5.1 Measurement restriction for SSB based L1-RSRP

For FR1,

If UE does not support [*multiDCI-InterCellMultiTRP-TwoTA-r18* or *multiDCI-IntraCellMultiTRP-TwoTA-r18* and *rxTimingDiff-r18*],

when the SSB for L1-RSRP measurement is in the same OFDM symbol as SSB transmitted from serving cell(s) for RLM, BFD, CBD or L1-RSRP measurement,

- UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;

when the SSB for L1-RSRP measurement is in the same OFDM symbol as CSI-RS transmitted from serving cell(s) for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

If UE supports [*multiDCI-InterCellMultiTRP-TwoTA-r18* or *multiDCI-IntraCellMultiTRP-TwoTA-r18* and *rxTimingDiff-r18*],

when the SSB for L1-RSRP measurement and SSB transmitted from serving cell(s) for RLM, BFD, CBD or L1-RSRP measurement are overlapping or partially overlapping in OFDM symbols,

- UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;

when the SSB for L1-RSRP measurement and CSI-RS transmitted from serving cell(s) for RLM, BFD, CBD or L1-RSRP measurement are overlapping or partially overlapping in OFDM symbols,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2,

when the SSB for L1-RSRP measurement on one CC is in the same OFDM symbol as SSB transmitted from serving cell(s) for RLM, BFD, or CBD measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both the two SSBs. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

when the SSB for L1-RSRP measurement on one CC is in the same OFDM symbol as SSB for L1-RSRP measurement on the different CCs in the same band, UE is required to measure one of but not both the two SSBs. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

when the SSB for L1-RSRP measurement on one CC is in the same OFDM symbol as CSI-RS transmitted from serving cell(s) for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, if the network configures same or mixed numerology between SSB for L1-RSRP measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, UE shall be able to perform the related SSB based measurements in one band without any measurement restrictions in the other band, provided that UE is capable of independent beam management on this FR2 band pair.

9.13.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions described in the following clauses apply when UE is performing L1-RSRP measurement on cell(s) with PCI different from serving cell, and UE is receiving PDCCH/PDSCH from serving cell and/or cell(s) with different PCI.

9.13.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

9.13.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

If UE does not support [*multiDCI-InterCellMultiTRP-TwoTA-r18* or *multiDCI-IntraCellMultiTRP-TwoTA-r18* and *rxTimingDiff-r18*],

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

If UE supports [*multiDCI-InterCellMultiTRP-TwoTA-r18* or *multiDCI-IntraCellMultiTRP-TwoTA-r18* and *rxTimingDiff-r18*],

- For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols which are overlapped or partially overlapped with SSB symbols configured for L1-RSRP measurement

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions apply to cell(s) in the same band on the symbols that fully or partially overlap with restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions apply to cell(s) in the same band on the symbols that fully or partially overlap with restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

For UE indicating *intraBandNR-CA-non-collocated-r19*,

1> when UE is configured with maxMIMO-Layers with value equal to 4 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 4"*

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2> if *nonCollocatedTypeNR-CA-v1900* is *"type 1"*

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

2> else if *nonCollocatedTypeNR-CA-v1900* is not provided

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

1> when UE is configured with maxMIMO-Layers with value equal to 2 for the configured FR1 intra-band non-contiguous CA

2> if *nonCollocatedTypeNR-CA-r18* is not provided

3> there is no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band.

2>else

3> the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 cells configured in other bands than the bands in which the cell where L1-RSRP measurement is performed is configured.

9.13.6.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions is performed apply to cell(s) in the band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 cells in the bands due to L1-RSRP measurement performed on FR2 cell(s) in different band(s), provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

If following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE’s reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for L1-RSRP measurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for L1-RSRP measurement.

9.13.6.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 cell(s) due to L1-RSRP measurement performed on FR2 cell(s).

There are no scheduling restrictions on FR2 cell(s) due to L1-RSRP measurement performed on FR1 cell(s).

9.13.6.5 Scheduling availability of UE performing L1-RSRP measurement in TDD bands on FR1

When UE performs L1-RSRP measurement on cell with different PCI from serving cell in a TDD band, the following restrictions apply due to L1-RSRP measurement

If UE does not support [*multiDCI-InterCellMultiTRP-TwoTA-r18* or *multiDCI-IntraCellMultiTRP-TwoTA-r18* and *rxTimingDiff-r18*],

- The UE is not expected to transmit PUCCH/PUSCH/SRS on symbols corresponding to the SSB indexes configured for L1-RSRP measurement, where the transmission of PUCCH/PUSCH/SRS may be on serving cell(s) and cell(s) with PCI different from serving cell(s), and restricted symbols may partially or fully overlap with UL symbols

If UE supports [*multiDCI-InterCellMultiTRP-TwoTA-r18* or *multiDCI-IntraCellMultiTRP-TwoTA-r18* and *rxTimingDiff-r18*],

- The UE is not expected to transmit PUCCH/PUSCH/SRS on the symbols configured for L1-RSRP measurement which are overlapped or partially overlapped with SSB symbols configured for L1-RSRP measurement

9.14 NR intra-frequency L1-RSRP measurements for neighbor cell

9.14.1 Introduction

A measurement is defined as an SSB based intra-frequency L1-RSRP measurement provided the centre frequency of the SSB of the serving cell and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same.

When configured with *LTM-CSI-ResourceConfig-r18* by the network, the UE shall be able to perform L1-RSRP measurements of configured measurement resources from a neighbor cell, with the measurement resources configured as SSBs of the neighbor cell.

If the number of resources/cells, including the number of resources/cells configured for L1-RSRP measurement in clause 9.14 exceeds the UE capability specified in clause 9.14.4, it is up to UE implementation on how to choose cells/SSB to measure, and the cells which have TCI state(s) in the LTM candidate cell active TCI state list shall be prioritized.

The UE shall report the measurement quantity and send periodic, semi-persistent or aperiodic reports, according to the higher layer parameter *reportConfigType-r18* of each reporting setting *LTM-CSI-ReportConfig-r18*.

9.14.2 Requirements Applicability

The requirements in the clause 9.14 are applicable to FR1 and FR2-1 for LTM.

The requirements in clause 9.14 apply, provided for the SSB from the neighbor cell configured for intra-frequency L1-RSRP measurement, the following conditions are met:

- The cell is known

- The SSB configured for intra-frequency L1-RSRP measurement is on the same carrier frequency of SSB configured for L3 intra-frequency measurement.

- The SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP for neighbor cell shall be considered measurable when for each relevant SSB the following conditions are met:

- L1-RSRP related side conditions given in clause 10.1.19D for FR1 and 10.1.20A for FR2-1, respectively, for a corresponding band,

- SSB_RP and SSB Ês/Iot according to annex B.2.4.1 for a corresponding band.

The cell is considered as known if the following conditions are met in this requirement:

- The UE has performed L3 measurement on the target cell during the last 5 seconds, and

- The SSB from the target cell configured for L1 measurement remains detectable according to the cell identification requirements specified in clause 9.2.

Otherwise, the cell is unknown.

9.14.3 Measurement Reporting Requirements

The UE shall report the L1-RSRP value as a 7-bit value in the range -140, -44 dBm with 1 dB step size according to clauses 10.1.19D for FR1 and 10.1.20A for FR2 if *noOfReportedRS-PerCell-r18* and *noOfReportedCells-r18* are both configured to one. If *noOfReportedRS-PerCell-r18* and/or *noOfReportedCells-r18* are configured to be larger than one, the UE shall use differential L1-RSRP based reporting as defined in clause 10.1.19D for FR1 and 10.1.20A for FR2. The differential L1-RSRP is quantized to a 4-bit value with 2 dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in clause 10.1.6, where the reported differential value for unmeasured LTM L1-RSRP resources is DIFFRSRP_15 in table 10.1.6.1.

9.14.3.1 Periodic Reporting

Reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clauses 10.1.19D for FR1 and 10.1.20A for FR2, respectively. The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.14.3.2 Semi-Persistent Reporting

Reported L1-RSRP measurements contained in a semi-Persistent L1-RSRP measurement report shall meet the requirements in clauses 10.1.19D for FR1 and 10.1.20A for FR2, respectively. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.14.3.3 Aperiodic Reporting

Reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clauses 10.1.19D for FR1 and 10.1.20A for FR2, respectively.

The UE shall only send aperiodic L1-RSRP measurement report if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.14.3.4 Event Triggered Reporting

Reported L1-RSRP measurements contained in an event triggered L1-RSRP measurement report shall meet the requirements in clauses 10.1.19/10.1.19D for FR1 and 10.1.20/10.1.20A for FR2, respectively. This requirement applies for event triggered L1-RSRP reports sent on PUSCH using the MAC CE specified in clause 6.1.3.84 of TS 38.321 [7].

The UE shall not send any event triggered measurement reports if no reporting criteria is fulfilled.

The event triggered measurement reporting delay is defined as the time between an event that will trigger an event triggered measurement report and the point when the UE starts to transmit the first UL transmission to report the measurement results over the air interface. This measurement reporting delay excludes a delay which is caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay shall be no larger than the maximum L1-RSRP measurement period of the cells corresponding to the event.

If serving cell is involved in event evaluation, L1-RSRP measurement period of serving cell refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ as defined in 9.5, assuming T_{Report} = 0 and T_{SSB} is the periodicity of the serving cell SSB-Index configured for event triggered L1-RSRP measurement report, which is indicated by the *ssb-periodicityServingCell*

If neighbor cell is involved in event evaluation, L1-RSRP measurement period of neighbor cell refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ for SSB based intra-frequency measurement, as defined in 9.14, assuming T_{Report} = 0 and T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for intra-frequency event-triggered L1-RSRP measurement report.

9.14.3.5 Event-triggered Periodic Reporting

Reported L1-RSRP measurements contained in an event triggered L1-RSRP measurement report shall meet the requirements in clauses 10.1.19/10.1.19D for FR1 and 10.1.20/10.1.20A for FR2, respectively. This requirement applies for event triggered L1-RSRP reports sent on PUSCH using the MAC CE specified in clause 6.1.3.84 of TS 38.321 [7].

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.14.3.4. For the subsequent reports in the event triggered periodic report, UE follows the reportInterval-r19 and reportAmount-r19 as specified in TS 38.331.

9.14.4 Number of SSB frequency layers, number of cells and number of SSBs

The number of intra-frequency layers, number of cells and number of SSBs that UE shall be capable of performing L1-RSRP measurements on are reported by the capabilities *supportedMaxIntraInterFreqLayersWithoutGaps-r18, supportedMaxNeighCellsPerFreqLayersWithoutGaps-r18, supportedMaxSSB-PerFreqLayersWithoutGaps-r18, supportedMaxCellsWithoutGapsL1-Meas-r18, supportedMaxSSB-L1-Meas-r18, and supportedMaxSSB-WithinSlotL1-Meas-r18.*

For L1-RSRP measurement on neighbour cell, UE measures only one intra-frequency layer on each FR2 band in CA scenario, where this single intra-frequency layer shall be the same frequency layer that UE performs L3 intra-frequency layer measurement in that FR2 band.

9.14.5 L1-RSRP intra-frequency measurement requirements without measurement gaps

9.14.5.1 SSB based L1-RSRP reporting

The requirements specified in this clause are only applicable when

- *highSpeedMeasFlag-r16* is not configured, and
- *highSpeedMeasFlagFR2-r17* is not configured, and
- *highSpeedMeasCA-Scell-r17* is not configured.
- The SSB from the neighbor cell is completely contained in the active BWP of the UE

If a neighbor cell is known according to clause 9.14.2, the UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ if *deriveSSB-IndexFromCell* is enabled or UE has reported SSB index in L3 measurement report of the same cell. Otherwise, UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}+T_{SSB_time_index_intra}$, where $T_{SSB_time_index_intra}$ is the time period used to acquire the index of the SSB being measured given in table 9.2.5.1-3.

The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ is defined for FR1 in table 9.14.5.1-1 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* and in table 9.14.5.1-2 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*. The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ is defined for FR2 in table 9.14.5.1-3 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* and in table 9.14.5.1-4 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*, where

- M=1.
- N= 8.
- P value for SSB resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0

  For a window W of duration max ($T_{L1,\ MGRP_max}$), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any SSB resource occasion:
  - N_{total} is the total number of SSB resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
  - $N_{outside_MG}$ is the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W
  - $N_{available}$ is the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
  - T_{L1} is periodicity of the target SSB.
- $P_{sharing\ factor}$ = 1, if the SSB configured for L1-RSRP measurement outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,
- $P_{sharing\ factor}$ = 3, otherwise.
- $P_{L1_sharing}$ is defined as
  - When number of neighboring cells configured with SSB based L1-RSRP measurement is 1
    - $P_{L1_sharing}$ = 2, if any symbol of the SSBs from serving cell and neighbor cell are overlapping or adjacent (in time domain)
    - $P_{L1_sharing}$ = 1, otherwise
  - When number of neighboring cells configured with SSB based L1-RSRP measurement is more than 1
    - When none of TCI state(s) of the intra-frequency neighbor cells or inter-frequency neighbor cells without gap are in the LTM candidate cell active TCI state list
      - $P_{L1_sharing}$ = 3*$N_{Neighbor_Cell}$, where $N_{Neighbor_Cell}$ is the number of neighbor cells to measure on intra-frequency and inter-frequency without gap
    - Otherwise
      - $P_{L1_sharing}$ = 3*$N_{Neighbor_Cell_in_list}$, where $N_{Neighbor_Cell_in_list}$ is the number of neigbour cells including intra-frequency neighbor cell(s) and inter-frequency neighbor cell(s) without gap which have TCI state(s) in the LTM candidate cell active TCI state list. No requirements are defined for the cell(s) which do not have TCI state(s) in the LTM candidate cell active TCI state list

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the

shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer measurement period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 cell, longer measurement period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 cell, longer L1 RSRP measurement period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 9.14.5.1-1: Intra-frequency L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ in FR1 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB_NBC})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(K*M*P)*\max(T_{DRX},T_{SSB_NBC}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$
NOTE 1: T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for intra-frequency L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is the configured periodicity for reporting. NOTE 2: K = 1.5. NOTE 3: The requirements apply when the max RTD between the serving cell and any candidate cell on which UE is required to perform L1-RSRP measurement on the same frequency layer is not larger than CP length of the cell on the frequency layer.	

Table 9.14.5.1-2: Intra-frequency L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ in FR1 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB_NBC}*N_{Layer})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(K*M*P)*\max(T_{DRX},T_{SSB_NBC})*N_{Layer})$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}*N_{Layer}$
NOTE 1: T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for intra-frequency L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is the configured periodicity for reporting. N_{Layer} = the number of intra-frequency layers configured for L1-RSRP measurement with *LTM-CSI-ResourceConfig-r18* + the number of inter-frequency layers without measurement gaps which are configured for L1-RSRP measurement with *LTM-CSI-ResourceConfig-r18*. NOTE 2: K = 1.5. NOTE 3: UE shall at least measure neighbour cells which have at least one TCI state on the LTM candidate cell active TCI state list within UE capability and additional cells to measure is up to UE implementation.	

Table 9.14.5.1-3: Intra-frequency L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ in FR2 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P*P_{L1_sharing}*N)*T_{SSB_NBC})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P*P_{L1_sharing}*N)*\max(T_{DRX},T_{SSB_NBC}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*M*P*P_{L1_sharing}*N)*T_{DRX}$
NOTE 1: T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for intra-frequency L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: The requirements apply when the max RTD between the serving cell and any candidate cell on which UE is required to perform L1-RSRP measurement on the same frequency layer is not larger than CP length of the cell on the frequency layer.	

NOTE:	When the number of neighbor cells to be measured on intra-frequency and inter-frequency without gap is more than 1 and TCI state(s) of at least one of these neighbor cells is in the active TCI state list, the requirements apply only to the cell(s) that have TCI state(s) is in the active TCI state list.

Table 9.14.5.1-4: Intra-frequency L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ in FR2 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_intra}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P*P_{L1_sharing}*N)*T_{SSB_NBC})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P*P_{L1_sharing}*N)*\max(T_{DRX},T_{SSB_NBC}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*M*P*P_{L1_sharing}*N)*T_{DRX}$
NOTE 1:	T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for intra-frequency L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.
NOTE 2:	When the number of neighbor cells to be measured on intra-frequency and inter-frequency without gap is more than 1 and TCI state(s) of at least one of these neighbor cells is in the active TCI state list, the requirements apply only to the cell(s) that have TCI state(s) is in the active TCI state list.

9.14.6 Measurement restriction for L1-RSRP measurement

Measurement restrictions described in the following clauses apply when UE is performing L1-RSRP measurement on neighbor cell(s) without measurement gap.

Unless explicitly stated, the SSB to be measured for L1-RSRP measurement is transmitted from neighbor cell(s).

9.14.6.1 Measurement restriction for SSB based L1-RSRP

For FR1,

when the SSB for L1-RSRP measurement fully or partially overlaps with the OFDM symbol as SSB transmitted from serving cell(s) for RLM, BFD, CBD or L1-RSRP measurement,

- UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;

when the SSB for L1-RSRP measurement is in the same OFDM symbol as CSI-RS transmitted from serving cell(s) for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* and for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*,

when the SSB for L1-RSRP measurement on one CC fully or partially overlaps with the OFDM symbol as SSB transmitted from serving cell(s) for RLM, BFD, or CBD measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSBs. Longer measurement period for SSB based L1-RSRP is expected, and no requirements are defined.

when the SSB for L1-RSRP measurement on one CC fully or partially overlaps with the OFDM symbol as CSI-RS transmitted from serving cell(s) for RLM, BFD, or CBD measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, when the SSB for L1-RSRP measurement on one CC fully or partially overlaps with the OFDM symbol as CSI-RS from candidate LTM neighbour cell for intra-frequency L1-RSRP measurement, UE is required to measure one of but not both SSB and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, if the network configures same or mixed numerology between SSB for L1-RSRP measurement on one FR2 band and CSI-RS from serving cell(s) for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, UE shall be able to perform the related SSB based measurements in one band without any measurement restrictions in the other band, provided that UE is capable of independent beam management on this FR2 band pair.

9.14.7 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions described in the following clauses apply when UE is performing L1-RSRP measurement on neighbor cell(s) without measurement gap.

Unless explicitly stated, the SSB to be measured for L1-RSRP measurement is transmitted from neigbor cell(s).

9.14.7.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

9.14.7.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on the concerned OFDM symbols, where the concerned OFDM symbols are
  - the same and 1 OFDM symbol before or after the OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement, if UE supports *multiCellL1-measRTD-greaterThan-CP-r18*,
  - the same OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement, if UE does not support *multiCellL1-measRTD-greaterThan-CP-r18*,

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions apply to cell(s) in the same band on the symbols that fully or partially overlap with restricted symbols. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 cells configured in other bands than the bands in which the cell where L1-RSRP measurement is performed.

9.14.7.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on the concerned OFDM symbols, where the concerned OFDM symbols are
  - the same and 1 OFDM symbol before or after the OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement, if UE supports *multiCellL1-measRTD-greaterThan-CP-r18*,
  - the same OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement, if UE does not support *multiCellL1-measRTD-greaterThan-CP-r18*,

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions apply to cell(s) in the band on the symbols that fully or partially overlap with restricted symbols..

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 cells in the bands due to L1-RSRP measurement performed on FR2 cell(s) in different band(s), provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

If following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for L1-RSRP measurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for L1-RSRP measurement.

9.14.7.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 cell(s) due to L1-RSRP measurement performed on FR2 cell(s).

There are no scheduling restrictions on FR2 cell(s) due to L1-RSRP measurement performed on FR1 cell(s).

9.14.7.5 Scheduling availability of UE performing L1-RSRP measurement in TDD bands on FR1

When UE performs L1-RSRP measurement on neighbor cell in a TDD band, the following restrictions apply due to L1-RSRP measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on the concerned OFDM symbols and restricted symbols may partially or fully overlap with UL symbols, where the concerned OFDM symbols are
  - the same and 1 OFDM symbol before or after the OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement, if UE supports *multiCellL1-measRTD-greaterThan-CP-r18*,
  - the same OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement, if UE does not support *multiCellL1-measRTD-greaterThan-CP-r18*.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When TDD inter-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this band pair.

When inter-band FR1+FR1 NR-DC is performed, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this band pair.

9.14a CSI-RS based Intra-frequency L1-RSRP measurements for neighbour cell

9.14a.1 Introduction

A measurement is defined as a CSI-RS based intra-frequency L1-RSRP measurement provided that:

- the SCS of the CSI-RS resource of LTM candidate cell(s) configured for L1 measurement is the same as the SCS of active DL BWP, and
- for SCS of 60KHz, the CP type of the CSI-RS resource of LTM candidate cell(s) configured for L1 measurement is the same as the CP type of active DL BWP, and
- at least 48 RBs of the CSI-RS resource of LTM candidate cell(s) configured for L1 measurement is included within the active DL BWP.

Otherwise, a measurement is defined as a CSI-RS based inter-frequency L1 measurement.

When configured by the network, the UE shall be able to perform CSI-RS based L1-RSRP measurements for neighbour cell, on the intra-frequency CSI-RS resources configured for L1-RSRP measurements.

The UE shall report the measurement quantity and send periodic, semi-persistent or aperiodic reports, according to the higher layer parameter ltm-ReportConfigType of each reporting setting LTM-CSI-ReportConfig.

9.14a.2 Requirements Applicability

The requirements in the clause 9.14a are applicable to FR1 and FR2-1 for LTM.

The requirements in clause 9.14a apply for CSI-RS L1-RSRP measurements for configured LTM candidate cell, provided the following conditions are met:

- The cell is known,
- The CSI-RS L1-RSRP measurement is configured as periodic CSI-RS or semi-persistent CSI-RS measurement, and
- at least 48 RBs of the CSI-RS configured for measurement is within the active BWP, and
- repetition is set to “OFF” or not configured.
- UE observed RTD <= CP
- All CSI-RS resources are configured within up to two separate windows where each window is up to 5 ms
- When the configured CSI-RS based L1 RSRP measurement for LTM candidate cell does not exceed UE measurement capability.
- For FR1 and FR2-1 when there are scheduling restrictions according to 9.14a.7, the requirements apply provided all CSI-RS resources within a 40 ms window on one intra-frequency layer are configured within up to two separate windows, each lasting up to 5 ms. The separation of the two 5ms windows is at least 4ms.

9.14a.3 Measurement Reporting Requirements

The UE shall report the L1-RSRP value as a 7-bit value in the range -140, -44 dBm with 1 dB step size according to clauses 10.1.19D.2 for FR1 and 10.1.20A.2 for FR2 if *noOfReportedRS-PerCell-r18* and *noOfReportedCells-r18* are both configured to one. If *noOfReportedRS-PerCell-r18* and/or *noOfReportedCells-r18* are configured to be larger than one, the UE shall use differential L1-RSRP based reporting as defined in clause 10.1.19D.2 for FR1 and 10.1.20A.2 for FR2. The differential L1-RSRP is quantized to a 4-bit value with 2 dB step size. The mapping between the reported L1-

RSRP value and the measured quantity is described in clause 10.1.6, where the reported differential value for unmeasured LTM L1-RSRP resources is DIFFRSRP_15 in table 10.1.6.1.

9.14a.3.1 Periodic Reporting

Reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clauses 10.1.19D.2 for FR1 and 10.1.20A.2 for FR2, respectively. The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.14a.3.2 Semi-Persistent Reporting

Reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clauses 10.1.19D.2 for FR1 and 10.1.20A.2 for FR2, respectively. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.14a.3.3 Aperiodic Reporting

Reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clauses 10.1.19D.2 for FR1 and 10.1.20A.2 for FR2, respectively.

The UE shall only send aperiodic L1-RSRP measurement report if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.14a.3.4 Event-triggered Periodic Reporting

Reported CSI-RS based L1-RSRP measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.x1.y1.z1 for FR1 and 10.x2.y2.z2 for FR2.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.14a.3.5.

9.14a.3.5 Event Triggered Reporting

Reported CSI-RS based L1-RSRP measurements contained in event triggered measurement reports shall meet the requirements in clauses clauses 10.x1.y1.z1 for FR1 and 10.x2.y2.z2 for FR2.

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The event triggered measurement reporting delay is defined as the time between an event that will trigger an event triggered measurement report and the point when the UE starts to transmit the first UL transmission to report the measurement results over the air interface. This measurement reporting delay excludes a delay which is caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay shall be no larger than the maximum L1-RSRP measurement period of the cells corresponding to the event.

If serving cell is involved in event evaluation, L1-RSRP measurement period of serving cell refers to $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ as defined in 9.5, assuming $T_{Report} = 0$ and $T_{CSI\text{-}RS}$ is the periodicity of the serving cell CSI-RS configured for event triggered L1-RSRP measurement report.

If neighbor cell is involved in event evaluation, L1-RSRP measurement period of neighbor cell refers to $T_{L1\text{-}RSRP_Measurement_Period_CSI_intra}$ defined in 9.14a.5, assuming $T_{Report} = 0$, and $T_{CSI\text{-}RS}$ is the periodicity of the neighbor cell CSI-RS configured for intra-frequency event-triggered L1-RSRP measurement report.

9.14a.4 Number of CSI-RS resources, number of cells

The number of cells and number of CSI-RS resources that UE shall be capable of performing L1-RSRP measurements on are reported by the capabilities.

9.14a.5 CSI-RS based L1-RSRP measurement requirements without measurement gaps

The requirements specified in this clause are only applicable when

- maximum RTD between cells are within CP.
- *highSpeedMeasFlag-r16* is not configured, and
- *highSpeedMeasFlagFR2-r17* is not configured, and
- *highSpeedMeasCA-Scell-r17* is not configured.
- At least 48 RBs of the CSI-RS configured for measurement is confined within the active BWP of the UE.

If a neighbor cell is known according to 9.14a.2, the UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_intra}$.

The value of $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_intra}$ is defined in table 9.14a.5-1 for FR1 and in table 9.14a.5-2 for FR2, where

- For periodic and semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF or repetition RRC object is not configured,
  - N=8 if UE is capable of *skippingSSBbasedL1mesurement-R19 and* the CSI-RS resources shall be Type-D QCL'ed with the associated SSB for L3 measurement and the CSI-RS resource is configured with *LTM-CSI-ResourceConfig*; Otherwise,
  - N=1 if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with SSB for L1-RSRP measurement.
- P value for CSI-RS resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0

  For a window W of duration max ($T_{L1,}$ MGRP_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any CSI-RS resource occasion:
  - N_{total} is the total number of CSI-RS resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
  - $N_{outside_MG}$ is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion within the window W
  - $N_{available}$ is the number of CSI-RS resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
  - T_{L1} is periodicity of the target CSI-RS resource.
- $P_{sharing\ factor}$ = 1, if the CSI-RS configured for L1-RSRP measurement outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure*

is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,

- not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

- $P_{sharing\ factor} = 3$, otherwise.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer measurement period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 cell, longer measurement period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 cell, longer L1 RSRP measurement period would be expected during the period $T_{identify_CGI,E\text{-}UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 9.14a.5-1: Intra-frequency L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_intra}$ in FR1

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ (ms)
non-DRX	$\max(T_{Report}, ceil(P)*T_{CSI\text{-}RS_NBC})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, ceil(K*P)*\max(T_{DRX},T_{CSI\text{-}RS_NBC}))$
DRX cycle > 320 ms	$ceil(P)*T_{DRX}$
NOTE 1: $T_{CSI\text{-}RS_NBC}$ is the periodicity of neighbor cell CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3. NOTE 3: K = 1.5.	

Table 9.14a.5-2: Intra-frequency L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS_intra}$ in FR2

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ (ms)
non-DRX	$\max(T_{Report}, ceil(P*N)*T_{CSI\text{-}RS_NBC})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, ceil(1.5*P*N)*\max(T_{DRX},T_{CSI\text{-}RS_NBC}))$
DRX cycle > 320 ms	$ceil(M*P*N)*T_{DRX}$
NOTE 1: $T_{CSI\text{-}RS_NBC}$ is the periodicity of neighbor cell CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: The requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.	

9.14a.6 Measurement restriction for CSI-RS based L1-RSRP measurement

Measurement restrictions described in the following clauses apply when UE is performing L1-RSRP measurement on neighbor cell(s) without measurement gap.

Unless explicitly stated, the CSI-RS to be measured for L1-RSRP measurement is transmitted from neighbor cell(s).

9.14a.6.1 Measurement restriction for CSI-RS based L1-RSRP measurement

The SSB mentioned in this clause can be associated with either the serving cell PCI or a PCI different from serving cell PCI or intra-frequency neighbor cell(s) configured with L1-RSRP measurement or inter-frequency neighbor cell(s) configured with L1-RSRP measurement without gap.

For both FR1 and FR2, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS as the CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

For FR2, when the CSI-RS for L1-RSRP measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD or L1-RSRP measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for L1-RSRP measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

  - The CSI-RS for L1-RSRP measurement or the other CSI-RS in a resource set configured with repetition ON, or

  - The other CSI-RS is configured in q1 and beam failure is detected, or

  - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,

- Otherwise, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

For UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18* and for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*,

- For both FR1 and FR2, when the CSI-RS for L1-RSRP measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.

- For FR1, when the CSI-RS for L1-RSRP measurement fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap, if CSI-RS and SSB have different SCS and UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP is expected, and no requirements are defined.

- For FR2, when the CSI-RS for L1-RSRP measurement on one CC fully or partially overlaps with the OFDM symbol as SSB from candidate LTM neighbor cell for intra-frequency L1-RSRP measurement or inter-frequency L1-RSRP measurement without gap in the same band, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP is expected, and no requirements are defined.

For FR2-1, when the CSI-RS for L1-RSRP measurement on the one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD or L1-RSRP measurement on the same CC, UE supporting *schedulingMeasurementRelaxation-r18* according to the conditions described in clause 3.6.19 shall be able to measure the CSI-RS for L1-RSRP measurement without restriction when the following conditions are met:

- Both CSI-RSs are not in any CSI-RS resource set with repetition ON, and
- One CSI-RS has same QCL source as either
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to TS 38.214 clause 5.1.5, and
  - the other CSI-RS has same QCL source as either
  - the active TCI state of a PDSCH scheduled in the same OFDM symbol or
  - the QCL source based on the default QCL assumption to be applied in the same OFDM symbol according to TS 38.214 clause 5.1.5, and
- Resources of the active TCI states of the two PDSCHs, or QCL sources of the default QCL assumption, or the active TCI state of PDSCH and QCL source of the default QCL assumption have been reported as a resource group in Rel-17 group-based RSRP report.

9.14a.7 Scheduling availability of UE during CSI-RS based L1-RSRP measurement

Scheduling availability restrictions described in the following clauses apply when UE is performing CSI-based L1-RSRP measurement on neighbor cell(s) without measurement gap.

Unless explicitly stated, the CSI-RS resource to be measured for L1-RSRP measurement is transmitted from neigbor cell(s).

9.14a.7.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on CSI-RS as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

9.14a.7.2 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to CSI-RS based L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on the concerned OFDM symbols, where the concern OFDM symbols are
  - the same OFDM symbols corresponding to the CSI-RS resources configured for L1-RSRP measurement.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions is performed apply to cell(s) in the band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 cells in the bands due to L1-RSRP measurement performed on FR2 cell(s) in different band(s), provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between CSI-RS resources on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

9.14a.7.3 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 cell(s) due to CSI-RS based L1-RSRP measurement performed on FR2 cell(s).

There are no scheduling restrictions on FR2 cell(s) due to CSI-RS based L1-RSRP measurement performed on FR1 cell(s).

9.14a.7.4 Scheduling availability of UE performing L1-RSRP measurement in TDD bands on FR1

When UE performs CSI-RS based L1-RSRP measurement on neighbor cell in a TDD band, the following restrictions apply due to L1-RSRP measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on the concerned OFDM symbols and restricted symbols may partially or fully overlap with UL symbols, where the concern OFDM symbols are the same OFDM symbols corresponding to the CSI-RS resources configured for L1-RSRP measurement.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.15 NR inter-frequency L1-RSRP measurements for neighbor cell

9.15.1 Introduction

A L1-RSRP measurement is defined as an inter-frequency L1-RSRP measurement provided it is not defined as an intra-frequency L1-RSRP measurement according to clause 9.14.

For UE supporting *ltm-InterFreqMeasGap-r18*, when measurement gaps are configured, the UE shall be able to perform inter-frequency L1-RSRP measurements of SSBs from inter-frequency neighbor cells. For UE supporting *interFreqSSB-L1-MeasWithoutGaps-r18*, the UE shall perform inter-frequency L1-RSRP measurements of SSBs from inter-frequency neighbor cells without gaps if SSBs are within active BWPs.

The UE shall measure SSB resources within the *LTM-CSI-ResourceConfig-r18* settings configured for L1-RSRP measurement on inter-frequency neighbor cells with measurement gaps according to UE capability specified in clause 9.15.4. If the number of resources configured exceeds the UE capability specified in clause 9.15.4, it is up to UE implementation on how to choose resources to measure, and the cell(s) which have TCI state(s) in the LTM candidate cell active TCI state list shall be prioritized.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the higher layer parameter *reportConfigType-r18*of each reporting setting *LTM-CSI-ReportConfig-r18*.

For UE supporting *interFreqL1-OnlyInBC-r18,* for each BC in which the UE indicates in *interFreqL1-MeasConfig-r18* capability, the UE is only required to measure and report L1-RSRP SSB measurements configured for the indicated BC.

9.15.2 Requirements Applicability

The requirements in clause 9.15 apply if the following conditions are met:

- The SSB configured for inter-frequency L1-RSRP measurement is on the same carrier frequency of SSB configured for RRM measurement in one of the measurement objects configured in the measObjectNR.
- The inter-frequency neighbor cell is known.
- The SSB resources configured for inter-frequency L1-RSRP measurements are measurable.

An SSB resource configured for inter-frequency L1-RSRP shall be considered measurable when for each relevant SSB the following conditions are met:

- L1-RSRP related side conditions given in clauses 10.1.19E.1 and 10.1.20B.1 for FR1 and FR2, respectively, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to annex B.2.4.1 for a corresponding band.

The inter-frequency neighbor cell is considered as known if the following conditions are met in this requirement:

- The UE has performed L3 measurement on the target cell during the last 5 seconds, and
- The SSB from the target cell configured for L1 measurement remains detectable according to the cell identification requirements specified in clause 9.3.

Otherwise, the cell is unknown.

9.15.3 Measurement Reporting Requirements

The UE shall send L1-RSRP reports for report configurations configured for the inter-frequency L1 measurement on neighbor cell.

The UE shall report the L1-RSRP value as a 7-bit value in the range -140, -44 dBm with 1dB step size according to clause 10.1.19E for FR1 and 10.1.20B for FR2 if *noOfReportedRS-PerCell-r18* and *noOfReportedCells-r18* are both configured to one. If *noOfReportedRS-PerCell-r18* and/or *noOfReportedCells-r18* is configured to be larger than one, the UE shall use differential L1-RSRP based reporting as defined in clause 10.1.19E for FR1 and 10.1.20B for FR2. The differential L1-RSRP is quantized to a 4-bit value with 2dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in clause 10.1.6, where the reported differential value for unmeasured LTM L1-RSRP resources is DIFFRSRP_15 in table 10.1.6.1.

In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or an additional delay can be expected in both FR1 and FR2 if the UE is not capable of per-FR gap.

9.15.3.1 Periodic Reporting

Reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clauses 10.1.19E for FR1 and 10.1.20B for FR2, respectively.

The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.15.3.2 Semi-Persistent Reporting

Reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clauses 10.1.19E for FR1 and 10.1.20B for FR2, respectively. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.15.3.3 Aperiodic Reporting

Reported L1-RSRP measurements contained in a semi-Persistent L1-RSRP measurement report shall meet the requirements in clauses 10.1.19E for FR1 and 10.1.20B for FR2, respectively. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send aperiodic L1-RSRP measurement report if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.15.3.4 Event Triggered Reporting

Reported L1-RSRP measurements contained in an event triggered L1-RSRP measurement report shall meet the requirements in clauses 10.1.19/10.1.19E for FR1 and 10.1.20/10.1.20B for FR2, respectively. This requirement applies for event triggered L1-RSRP reports sent on PUSCH using the MAC CE specified in clause 6.1.3.84 of TS 38.321 [7].

The UE shall not send any event triggered measurement reports if no reporting criteria is fulfilled.

The event triggered measurement reporting delay is defined as the time between an event that will trigger an event triggered measurement report and the point when the UE starts to transmit the first UL transmission to report measurement result over the air interfac. This measurement reporting delay excludes a delay which is caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay shall be no larger than the maximum L1-RSRP measurement period of the cells corresponding to the event.

If serving cell is involved in event evaluation, L1-RSRP measurement period of the serving cell refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ as defined in clause 9.5, where $T_{Report} = 0$ and T_{SSB} is the periodicity of the serving cell SSB-Index configured for event triggered L1-RSRP measurement report, which is indicated by the *ssb-periodicityServingCell*.

If an inter-frequency neighbor cell is involved in event evaluation, L1-RSRP measurement period of the neighbor cell refers to $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter}$ as defined in clause 9.15, where $T_{Report} = 0$ and T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for inter-frequency event-triggered L1-RSRP measurement report.

9.15.3.5 Event Triggered Periodic Reporting

Reported L1-RSRP measurements contained in an event triggered L1-RSRP measurement report shall meet the requirements in clauses 10.1.19/10.1.19E for FR1 and 10.1.20/10.1.20B for FR2, respectively. This requirement applies for event triggered L1-RSRP reports sent on PUSCH using the MAC CE specified in clause 6.1.3.84 of TS 38.321 [7].

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.15.3.4. For the subsequent reports in the event triggered periodic report, UE follows the *reportInterval-r19* and reportAmount-r19 as specified in TS 38.331.

9.15.4 Number of SSB frequency layers, number of cells and number of SSBs

The number of inter-frequency layers, number of cells and number of SSBs that UE shall be capable of performing L1-RSRP measurements on are reported in *maxFreqLayersL1-Meas-r18, maxNeighCellsPerFreqLayerL1-Meas-r18, maxSSB-PerFreqLayerL1-Meas-r18, supportedMaxCellsWithoutGapsL1-Meas-r18, supportedMaxSSB-L1-Meas-r18,* and *supportedMaxSSB-WithinSlotL1-Meas-r18*.

9.15.5 L1-RSRP inter-frequency measurement requirements with measurement gaps

9.15.5.1 Inter-frequency SSB based L1-RSRP reporting

The requirements specified in this clause are only applicable when

- *highSpeedMeasFlag-r16* is not configured, and
- *highSpeedMeasFlagFR2-r17* is not configured, and
- highSpeedMeasCA-Scell-r17 is not configured, and
- Concurrent gaps are not configured, and
- SSBs of the neighbor cell configured for inter-frequency L1-RSRP measurement are fully or partially overlapped with measurement gaps.

If an inter-frequency neighbor cell is known according to clause 9.15.2, the UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$ if *deriveSSB-IndexFromCellInter-r17* is enabled on target frequency layers or UE is indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured) of the same cell. Otherwise, UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter}+T_{SSB_time_index_inter}$, where $T_{SSB_time_index_inter}$ is the time period used to acquire the index of the SSB being measured given in table 9.3.4.

The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$ is defined in table 9.15.5.1-1 for FR1 and in table 9.15.5.1-3 for FR1 for the UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3. The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$ is defined in table 9.15.5.1-2 for FR2 and in table 9.15.5.1-4 for FR2 for the UE configured with measurement gap cancellation according to clause 9.1.14 and meeting all conditions in clause 9.1.14.3, where

- M= 2
- N = 8.
- $CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within_gap,i}$ in clause 9.1.5.2 for L1-RSRP measurement conducted within measurement gaps.

Table 9.15.5.1-1: Inter-frequency L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$ with measurement gapsin FR1

Condition	$T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$
No DRX	$Max(T_{report}, Ceil(M * K_{gap}) \times Max(MGRP, T_{SSB_NBC}) \times CSSF_{inter})$
DRX cycle ≤ 320 ms	$Max(T_{report}, Ceil(M \times 1.5 * K_{gap}) \times Max(MGRP, T_{SSB_NBC}, T_{DRX}) \times CSSF_{inter})$
DRX cycle > 320 ms	$Ceil(M * K_{gap}) \times T_{DRX} \times CSSF_{inter}$
NOTE 1: The definition of K_{gap} is the same as L3 measurement which is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. NOTE 2: If the UE is incapable of *multiCellL1-measRTD-greaterThan-CP-r18*, the requirements apply for the the cells configured by *LTM-CSI-ResourceConfig-r18* on which UE is required to perform L1 measurements, when the max RTD among the cells on the same inter-frequency layer is not larger than CP length. NOTE 3: T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for inter-frequency L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is the configured periodicity for reporting.	

Table 9.15.5.1-2: Inter-frequency L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$ with measurement gaps in FR2

Condition	$T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$
No DRX	$Max(T_{report}, Ceil(K_{gap} \times M*N) \times Max(MGRP, T_{SSB_NBC}) \times CSSF_{inter})$
DRX cycle ≤ 320 ms	$Max(T_{report}, Ceil(1.5 * K_{gap} \times M*N) \times Max(MGRP, T_{SSB_NBC}, T_{DRX}) CSSF_{inter})$
DRX cycle > 320 ms	$Ceil(K_{gap} \times M*N) \times T_{DRX} \times CSSF_{inter}$
NOTE 1: The definition of K_{gap} is the same as L3 measurement which is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. NOTE 2: If the UE is incapable of *multiCellL1-measRTD-greaterThan-CP-r18*, the requirements apply for the the cells configured by *LTM-CSI-ResourceConfig-r18* on which UE is required to perform L1 measurements, when the max RTD among the cells on the same inter-frequency layer is not larger than CP length. NOTE 3: T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for inter-frequency L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is the configured periodicity for reporting.	

Table 9.15.5.1-3: Inter-frequency L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$ for known cells in FR1 with measurement gap cancellation

Condition	$T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$
No DRX	$Max(T_{report}, Ceil((M+L_{cancel}) * K_{gap}) \times Max(MGRP, SSB\ period) \times CSSF_{inter})$
DRX cycle ≤ 320 ms	$Max(T_{report}, Ceil((M+L_{cancel}) \times 1.5 * K_{gap}) \times Max(MGRP, SSB\ period, DRX\ cycle) \times CSSF_{inter})$
DRX cycle > 320 ms	$Ceil((M+L_{cancel}) * K_{gap}) \times DRX\ cycle \times CSSF_{inter}$
NOTE 1: The definition of K_{gap} is the same as L3 measurement which is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. NOTE 2: If the UE is incapable of *multiCellL1-measRTD-greaterThan-CP-r18*, the requirements apply for the cells configured by *LTM-CSI-ResourceConfig-r18* on which UE is required to perform L1 measurements, when the max RTD among the cells on the same inter-frequency layer is not larger than CP length. NOTE 3: L_{cancel} is the number of gap occasions cancelled during measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$.	

Table 9.15.5.1-4: Inter-frequency L1-RSRP measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$ for known cells in FR2 with measurement gap cancellation

Condition	$T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$
No DRX	$Max(T_{report}, Ceil(K_{gap} \times (M+L_{cancel})*N) \times Max(MGRP, SSB\ period) \times CSSF_{inter})$
DRX cycle ≤ 320 ms	$Max(T_{report}, Ceil(1.5 * K_{gap} \times (M+L_{cancel})*N) \times Max(MGRP, SSB\ period, DRX\ cycle) \times CSSF_{inter})$
DRX cycle > 320 ms	$Ceil(K_{gap} \times (M+L_{cancel})*N) \times DRX\ cycle \times CSSF_{inter}$
NOTE 1: The definition of K_{gap} is the same as L3 measurement which is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. NOTE 2: If the UE is incapable of *multiCellL1-measRTD-greaterThan-CP-r18*, the requirements apply for the cells configured by *LTM-CSI-ResourceConfig-r18* on which UE is required to perform L1 measurements, when the max RTD among the cells on the same inter-frequency layer is not larger than CP length. NOTE 3: L_{cancel} is the number of gap occasions cancelled during measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_Inter}$.	

9.15.6 L1-RSRP inter-frequency L1-RSRP measurement requirements without measurement gaps

9.15.6.1 Inter-frequency L1-RSRP measurement requirements

9.15.6.1.1 Inter-frequency SSB based L1-RSRP measurement

When configured by the network and the inter-frequency cell's SSB is completely contained in the DL active BWP, the UE shall be able to perform L1-RSRP measurements without gaps and without interruptions based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$.

If a neighbor cell is known according to clause 9.15.2, the UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$ if *deriveSSB-IndexFromCellInter-r17* is enabled or UE has reported SSB index in L3 measurement report of the same cell. Otherwise, UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}+T_{SSB_time_index_inter}$, where $T_{SSB_time_index_inter}$ is the time period used to acquire the index of the SSB being measured given in table 9.3.9.1-3 for FR1 and in table 9.3.9.1-4 for FR2.

The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$ is defined for FR1 in table 9.15.6.1.1-1. The value of $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$ is defined for FR2 in table 9.15.6.1.1-2, where

- M=1
- N= 8.
- P value for SSB resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
  - $P_{sharing\ factor}$ * N_{total} / $N_{outside_MG}$ in FR2 with $N_{available}$ = 0
  - N_{total} / $N_{available}$ in FR2 with $N_{available}$ > 0

  For a window W of duration max($T_{L1,\ MGRP_max}$), where MGRP max is the maximum MGRP across all configured per-UE measurement gaps and per-FR measurement gaps within the same FR as serving cell, and starting at the beginning of any SSB resource occasion:
  - N_{total} is the total number of SSB resource occasions within the window, including those overlapped with measurement gap occasions or SMTC occasions within the window, and
  - $N_{outside_MG}$ is the number of SSB resource occasions that are not overlapped with any measurement gap occasion within the window W
  - $N_{available}$ is the number of SSB resource occasions that are not overlapped with any measurement gap occasion nor any SMTC occasion within the window W
  - T_{L1} is periodicity of the target SSB.
- $P_{sharing\ factor}$ = 1, if the SSB configured for L1-RSRP measurement outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, where the *SSB-ToMeasure* is the union set of *SSB-ToMeasure* from all the configured measurement objects merged on the same serving carrier, and,
  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,
- $P_{sharing\ factor}$ = 3, otherwise.
- $P_{L1_sharing}$ is defined as
  - When number of neighboring cells to be measured is 1
    - $P_{L1_sharing}$ = 2, if any symbol of the SSBs from serving cell and neighbor cell are overlapping or adjacent (in time domain)
    - $P_{L1_sharing}$ = 1, otherwise
  - When number of neighboring cells to be measured is more than 1
  - When none of the TCI state(s) of the intra-frequency neighbor cells or inter-frequency neighbor cells without gap are in the LTM candidate cell active TCI state list
    - $P_{L1_sharing}$ = 3*$N_{Neighbor_Cell}$, where $N_{Neighbor_Cell}$ is the number of neighbor cells to measure on intra-frequency and inter-frequency without gap
  - Otherwise
    - $P_{L1_sharing}$ = 3*$N_{Neighbor_Cell_in_list}$, where $N_{Neighbor_Cell_in_list}$ is the number of neigbour cells (including intra-frequency neighbour cell(s) and inter-frequency neighbor cell(s) without gap) which have TCI state(s) in the LTM candidate cell active TCI state list. No requirements are defined for the neighbor cell(s) which do not have TCI state(s) in the LTM candidate cell active TCI state list.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Longer measurement period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 cell, longer measurement period would be expected during the period $T_{identify_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 cell, longer L1 RSRP measurement period would be expected during the period $T_{identify_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 9.15.6.1.1-1: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$ for inter-frequency L1-RSRP measurement without measurement gaps in FR1 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB_NBC}*N_{Layer})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(K*M*P)*\max(T_{DRX},T_{SSB_NBC})*N_{Layer})$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}*N_{Layer}$
NOTE 1: T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for inter-frequency L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is the configured periodicity for reporting. N_{Layer} = the number of inter-frequency layers which are configured for L1-RSRP measurement with *LTM-CSI-ResourceConfig-r18* and measured without measurement gaps + the number of intra-frequency layers configured for L1-RSRP measurement with *LTM-CSI-ResourceConfig-r18*.	
NOTE 2: K = 1.5.	
NOTE 3: Void.	

Table 9.15.6.1.1-2: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$ for inter-frequency L1-RSRP measurement without measurement gaps in FR2 for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P*P_{L1_sharing}*N)*T_{SSB_NBC})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P*P_{L1_sharing}*N)*\max(T_{DRX},T_{SSB_NBC}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*M*P*P_{L1_sharing}*N)*T_{DRX}$
NOTE 1: T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for inter-frequency L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: void.	
NOTE 3: When the number of neighbor cells to be measured on intra-frequency and inter-frequency without gap is more than 1 and TCI state(s) of at least one of the neighbor cells is in the LTM candidate cell active TCI state list, the requirements apply only to the intra-frequency cells and inter-frequency neighbor cells without gap whose TCI state(s) are in the LTM candidate cell active TCI state list.	

Table 9.15.6.1.1-3: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$ for inter-frequency L1-RSRP measurement without measurement gaps in FR1 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P)*T_{SSB_NBC})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(K*M*P)*\max(T_{DRX},T_{SSB_NBC}))$
DRX cycle > 320 ms	$\text{ceil}(M*P)*T_{DRX}$
NOTE 1: T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for inter-frequency L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	
NOTE 2: K = 1.5	

NOTE 3: The requirements apply for the cells configured by LTM-CSI-ResourceConfig-r18 on which UE is required to perform L1 measurements, when the max RTD between the serving cell and the inter-frequency cell whose SSB are completely contained in the DL active BWP is not larger than CP length

Table 9.15.6.1.1-4: Measurement period $T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$ for inter-frequency L1-RSRP measurement without measurement gaps in FR2 for UE incapable of *multiCellL1-measRTD-greaterThan-CP-r18*

Configuration	$T_{L1\text{-}RSRP_Measurement_Period_SSB_inter_withoutGap}$ (ms)
non-DRX	$\max(T_{Report}, \text{ceil}(M*P*P_{L1_sharing}*N)*T_{SSB_NBC})$
DRX cycle ≤ 320 ms	$\max(T_{Report}, \text{ceil}(1.5*M*P*P_{L1_sharing}*N)*\max(T_{DRX},T_{SSB_NBC}))$
DRX cycle > 320 ms	$\text{ceil}(1.5*M*P*P_{L1_sharing}*N)*T_{DRX}$
NOTE 1: T_{SSB_NBC} is the periodicity of the neighbor cell SSB-Index configured for intra-frequency L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: The requirements apply for the cells configured by LTM-CSI-ResourceConfig-r18 on which UE is required to perform L1 measurements, when the max RTD between the serving cell and the inter-frequency cell whose SSB are completely contained in the DL active BWP is not larger than CP length NOTE 3: When the number of neighbor cells to be measured on intra-frequency and inter-frequency without gap is more than 1 and TCI state(s) of at least one of the neighbor cells is in the LTM candidate cell active TCI state list, the requirements only apply to intra-frequency cells and inter-frequency neighbor cells without gap whose TCI state(s) are in the LTM candidate cell active TCI state list.]	

9.15.6.2 Measurement restriction for inter-frequency L1-RSRP measurement

Measurement restrictions described in the following clauses apply when UE is performing L1-RSRP measurement on neighbor cell(s) without measurement gap.

Unless explicitly stated, the SSB to be measured for L1-RSRP measurement is transmitted from neigbor cell(s).

9.15.6.2.1 Measurement restriction for SSB based L1-RSRP

For FR1,

when the SSB for L1-RSRP measurement fully or partially overlaps with the OFDM symbol as SSB transmitted from serving cell(s) for RLM, BFD, CBD or L1-RSRP measurement,

- UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;

when the SSB for L1-RSRP measurement fully or partially overlaps with the OFDM symbol of CSI-RS transmitted from serving cell(s) for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, for UE incapable of *multiCellL1-measRTD-greaterThan-CP*-r18 and for UE capable of *multiCellL1-measRTD-greaterThan-CP-r18*,

when the SSB for L1-RSRP measurement on one CC fully or partially overlaps with the OFDM symbol as SSB transmitted from serving cell(s) for RLM, BFD, or CBD measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSBs. Longer measurement period for SSB based L1-RSRP is expected, and no requirements are defined.

when the SSB for L1-RSRP measurement on one CC fully or partially overlaps with the OFDM symbol as CSI-RS transmitted from serving cell(s) for RLM, BFD, or CBD measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, if the network configures same or mixed numerology between SSB for L1-RSRP measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, UE shall be able to perform the related SSB based measurements in one band without any measurement restrictions in the other band, provided that UE is capable of independent beam management on this FR2 band pair.

9.15.6.3 Scheduling availability of UE during inter-frequency L1-RSRP measurements

Scheduling availability restrictions described in the following clauses apply when UE is performing L1-RSRP measurement on inter-frequency cell(s), and UE is receiving PDCCH/PDSCH from serving cell.

Unless explicitly stated, the SSB to be measured for L1-RSRP measurement is transmitted from neighbor cell(s).

9.15.6.3.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

9.15.6.3.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on the concerned OFDM symbols, where the concerned OFDM symbols are
  - the same OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement, and
  - If UE supports *multiCellL1-measRTD-greaterThan-CP-r18* capability, 1 OFDM symbol before or after the OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions apply to cell(s) in the same band on the symbols that fully or partially overlap with restricted symbols. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 cells configured in other bands than the bands in which the cell where L1-RSRP measurement is performed is configured.

9.15.6.3.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on the concerned OFDM symbols, where the concerned OFDM symbols are:
  - the same OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement, and
  - if UE supports *multiCellL1-measRTD-greaterThan-CP-r18* capability, 1 OFDM symbol before or after the OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions is performed apply to cell(s) in the band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 cells in the bands due to L1-RSRP measurement performed on FR2 cell(s) in different band(s), provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

If following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE shall receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for L1-RSRP measurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE shall receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for L1-RSRP measurement.

9.15.6.3.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 cell(s) due to L1-RSRP measurement performed on FR2 cell(s).

There are no scheduling restrictions on FR2 cell(s) due to L1-RSRP measurement performed on FR1 cell(s).

9.15.6.3.5 Scheduling availability of UE performing L1-RSRP measurement in TDD bands on FR1

When UE performs L1-RSRP measurement on neighbor cell in a TDD band, the following restrictions apply due to L1-RSRP measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on the concerned OFDM symbols and restricted symbols may partially or fully overlap with UL symbols, where the concerned OFDM symbols are:
  - the same OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement, and- if UE supports *multiCellL1-measRTD-greaterThan-CP-r18* capability, 1 OFDM symbol before or after the OFDM symbols corresponding to the SSB indexes configured for L1-RSRP measurement

9.16 CJT calibration reporting for Delay offset and Frequency offset

9.16.1 Introduction

When configured with a CSI-ReportConfig where reportQuantity is set to 'CJTC-Dd', or ' CJTC -F', the UE shall perform CJT calibration measurements for delay offset, and frequency offset, respectively, on the configured CSI-RS resources. The UE shall measure all CSI-RS resources indicated by the higher layer parameter resourcesForChannelMeasurement.

For CJT reporting types (CJTC-Dd, CJTC-F), the UE shall be capable of measuring $\mathbf{N_{TRP} \in \{2, 3, 4\}}$ CSI-RS Resource Sets within a single CSI Resource Setting, all of which shall be associated with the higher layer parameter trs-Info.

The UE shall report the configured measurement quantity and transmit aperiodic CSI reports according to the CSI-ReportConfig for the active BWP.

9.16.2 Requirements applicability

The requirements in clause 9.16 apply, provided:

- The CSI-RS resources configured for CJTC measurements are measurable.

A CSI-RS resource configured for CJTC report shall be considered measurable when for each relevant CSI-RS the following conditions are met:

- CJTC reporting related side conditions given in clauses B,
- CSI-RS Ês/Iot is greater than or equal to the level described in clause B.

CJTC requirements are defined for periodic measurement resources and aperiodic reporting resources.

9.16.3 Measurement Reporting Requirements

The UE shall send CJTC reports only for report configurations configured for the active BWP.

The UE shall report the quantised CJTC value as a n-bit value ranging from 0 to $2^n - 1$ with the step size as described in clause 10; where the n is determined based on higher layer parameter.

9.16.3.1 Aperiodic Reporting

Reported CJTC measurements contained in aperiodic triggered but measured over periodic resources shall meet the accuracy requirements specified in clause 10.

The UE shall only send aperiodic CJTC measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI with (*reportQuantity* set to 'cjtc-Dd', 'cjtc-F'), the UE shall transmit the aperiodic CJTC reporting on PUSCH over the air interface at the time specified according to relevant clause in [26].9.16.4 Measurement Requirements

9.16.4.1 CSI -RS based delay and frequency offset reporting

UE shall be capable of performing CJT calibration reporting measurements based on the configured CSI-RS resource for inter-TRP delay and frequency misalignment computation, and the UE physical layer shall be capable of reporting CJT calibration measured over the measurement period of $T_{CJTC_Measurement_Period_CSI-RS}$.

The value of $T_{CJTC_Measurement_Period_CSI-RS}$ is defined in table 9.16.4.1-1 for FR1, where

- For periodic, aperiodic and semi-persistent CSI-RS resources M=1

For a UE supporting *support for Case 1 requirements* and when concurrent measurement gap(s) with Pre-MG(s) are configured, or a UE supporting *support for Case 2 requirements* and when concurrent measurement gap(s) with NCSG measurement gap(s) are configured, or a UE supporting *concurrentMeasGap-r17* or *musim-GapPreference-r17* or both concurrent measurement gap and *musim-GapPreference-r17* and when concurrent gaps or periodic MUSIM gaps or both concurrent gaps and periodic MUSIM gaps are configured,

- A CSI-RS or an SMTC occasion is not considered to be overlapped by a gap occasion if the gap occasion is dropped according to clauses 9.1.8 and 9.1.10,
- P value for a CSI-RS resource to be measured is defined as
  - N_{total} / $N_{outside_MG}$ in FR1
- For a window W of duration max($T_{L1,}$ xRP_max), where xRP_max is the maximum xRP across all configured per-UE measurement gaps or NCSGs, MUSIM gap(s)and per-FR measurement gaps or NCSGs, and, in case of Pre-MG, all activated per-UE measurement gaps and per-FR measurement gaps, within the same FR as serving cell, and starting at the beginning of any CSI-RS resource occasion:

- N_{total} is the total number of CSI-RS resource occasions within the window W, including those overlapped with measurement gap occasions, MUSIM gap occasions or SMTC occasions within the window W, and

- $N_{outside_MG}$ is the number of CSI-RS resource occasions that are not overlapped with any non-dropped GAP occasions nor non-dropped MUSIM gap occasion within the window W, and

- $N_{available}$ is the number of CSI-RS resource occasions that are not overlapped with any non-dropped GAP occasions, non-dropped MUSIM gap occasion nor any SMTC occasion within the window W.

- a CSI-RS or an SMTC occasion is considered to be overlapped with the MUSIM gap if it overlaps a MUSIM gap occasion.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG.

T_{L1} is periodicity of the target CSI-RS.

Otherwise, for a UE neither supporting *concurrentMeasGap-r17* nor *support for Case 1 requirements* nor *support for Case 2 requirements* or when neither of the above configurations applies, i.e. concurrent measurement gaps, concurrent measurement gap(s) with Pre-MG(s) and concurrent measurement gap(s) with NCSG measurement gap(s), and UE does not support *musim-GapPreference-r17* or when no MUSIM gaps are configured.

For FR1,

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{xRP}}$, when in the monitored cell there are GAPs configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no GAPs overlapping with any occasion of the CSI-RS.

Where:

T_{CSI-RS} = the periodicity of CSI-RS configured for CJTC measurement

- When a measurement gap is configured and the measurement gap is not NCSG,

  - a CSI-RS or an SMTC occasion is considered to be as overlapped with the GAP if it overlaps a measurement gap occasion, and

  - xRP = MGRP

- If the UE is configured with Pre-MG, a CSI-RS or an SMTC occasion is only considered to be overlapped by the Pre-MG if the Pre-MG is activated.

- Otherwise, when NCSG measurement gap only is configured,

  - a CSI-RS or an SMTC occasion is considered to be as overlapped with the GAP if

    - it overlaps the VIL1 or VIL2 of NCSG, or

    - it overlaps the ML of NCSG in FR2, and there exists a target carrier to be measured within NCSG that is intra-frequency carrier or inter-frequency carrier in the same band as the serving cell, or inter-frequency carrier in different band as the serving cell and UE does not support IBM between the target carrier and the serving cell,

  - and

    - xRP = VIRP

  When UE is configured with aperiodic MUSIM gap and the aperiodic MUSIM gap is overlapping with CSI-RS resource occasion for CJTC, longer evaluation period would be expected.

  When UE is configured with MUSIM gap(s), and CSI-RS resource occasions for CJTC are fully overlapped with MUSIM gap(s) or fully overlapped with the union of MUSIM gap(s) and GAPs, no requirement applies for the CSI-RS based CJTC measurement.

Table 9.16.4.1-1: Measurement period $T_{CJTC_Measurement_Period_CSI\text{-}RS}$ for FR1

Configuration	$T_{CJTC_Measurement_Period_CSI\text{-}RS}$ (ms)
non-DRX	ceil(M*P)*$T_{CSI\text{-}RS}$
DRX cycle ≤ 320 ms	ceil(M*P)*max(T_{DRX},$T_{CSI\text{-}RS}$)
DRX cycle > 320 ms	ceil(M*P)*T_{DRX}
NOTE 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for CJTC measurement. T_{DRX} is the DRX cycle length.	
NOTE 2: the requirements are applicable provided that the CSI-RS resource configured for CJTC measurement is transmitted with Density = 3.	

9.16.5 Measurement restriction for UE during CJT calibration reporting

9.16.5.1 Measurement restriction for CJT calibration reporting

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement has same SCS than CSI-RS for CJTC-Dd or CJTC-F measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement has different SCS than CSI-RS for CJTC-Dd or CJTC-F measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for CJTC-Dd or CJTC-F measurement and SSB. Longer measurement period for CSI-RS based CJTC-Dd or CJTC-F measurement is expected, and no requirements are defined.

9.16.6 Scheduling availability of UE during CJT calibration reporting

Scheduling availability restrictions described in the following clauses apply when the UE is performing CJTC calibration of delay offset, CJT calibration of frequency offset by measuring different CSI-RS Resource Sets.

9.16.6.1 Scheduling availability of UE performing measurement for CJT calibration reporting on FR1

There are no scheduling restrictions due to delay and frequency offset measurement performed on CSI-RS with the same SCS as PDSCH/PDCCH in FR1.

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to delay and frequency offset measurement based on CSI-RS.

For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to delay and frequency offset measurement based on CSI-RS.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the CSI-RS indexes configured for delay and frequency offset measurement.

9.17 OD-SSB based L3 measurement for an SCell

9.17.1 Introduction

A UE can be indicated, by *od-ssb-config* TS 38.331[2] or by a MAC CE TS 38.321[7], activation of transmission for OD-SSB in a configured DL BWP of an SCell TS 38.300[10] if UE supports *On-demand SSB operation*.

The requirements in clause 9.17 apply, provided the following conditions are met:

- an OD-SSB transmission is activated in a configured DL BWP where a first SSB transmission is not configured, or

- an OD-SSB transmission is activated in a configured DL BWP where a first SSB transmission is configured which cannot be used to obtain SIB1.

Where the first SSB transmission is specified as in TS 38.213[3] have the following relations:

- are with the same Cell ID, and
- are in the same frequency location, and
- are with same sub-carrier spacing, and
- are with the same downlink transmit power, and
- are quasi co-located with respect to Doppler shift, Doppler spread, average gain, average delay, delay spread and, when applicable, spatial RX parameters, when they have a same SSB index.

For UE supporting *On-demand SSB operation* and when OD- SSB transmission is indicated, the EMP for OD-SSB based intra-frequency measurement are

- the periodicity of OD-SSBs in the configured DL BWP if no first SSB transmission is configured or if UE supports *timec1nc2* and OD-SSB transmission is indicated with first SSB transmission and the union of the first SSB transmission and OD-SSB transmission has a non-periodic time domain pattern, or

- the periodicity of the union of OD-SSBs and first SSBs if first SSBs are transmitted and the OD-SSB activation is indicated and the union of OD-SSBs and first SSBs has a periodic time domain pattern.

For UE supports OD-SSB operation capability and when OD-SSB activation is indicated,

- the SMTC for OD-SSB based intra-frequency measurement for serving cell is OD-SMTC;
- the SMTC for OD-SSB based intra-frequency measurement for neighbor cell is the first SMTC.

Otherwise, the SMTC for OD-SSB based intra-frequency measurement is the first SMTC.

9.17.2 Requirements Applicability

The accuracy requirements in clause 9.2.2 shall be applied to OD-SSB based intra-frequency measurement.

9.17.3 Number of cells and number of SSB

The requirements of number of cells and number of SSB in clause 9.2.3 shall be applied to OD-SSB based intra-frequency measurement.

9.17.4 Measurement Reporting Requirements

The measurement reporting requirements in clause 9.2.4 shall be applied to OD-SSB based intra-frequency measurement.

9.17.5 OD-SSB based Intra-frequency measurements without measurement gaps

9.17.5.1 Intra-frequency cell identification for active SCell

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify_intra_without_index_ODSSB}$ if the UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise the UE shall be able to identify a new detectable intra frequency cell within $T_{identify_intra_with_index_ODSSB}$. The UE shall be able to identify a new detectable intra frequency SS

block of an already detected cell within $T_{identify_intra_without_index_ODSSB}$. It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2 with SCS smaller or equal to 480 kHz.

$$T_{identify_intra_without_index_ODSSB} = (T_{PSS/SSS_sync_intra_ODSSB} + T_{SSB_measurement_period_intra_ODSSB})\ ms$$

$$T_{identify_intra_with_index_ODSSB} = (T_{PSS/SSS_sync_intra_ODSSB} + T_{SSB_measurement_period_intra_ODSSB} + T_{SSB_time_index_intra_ODSSB})\ ms$$

Where:

$T_{PSS/SSS_sync_intra_ODSSB}$: it is the time period used in PSS/SSS detection

- For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC ≤ 40ms, $T_{PSS/SSS_sync_intra_ODSSB}$ is given in table 9.17.5.1-4; otherwise, $T_{PSS/SSS_sync_intra_ODSSB}$ is given in table 9.17.5.1-2.
- For UE indicating *no-gap-no-interruption* via *NeedForInterruptionInfoNR-r18*, $T_{PSS/SSS_sync_intra_ODSSB}$ is given in table 9.2.5.1-1 for FR1 and table 9.2.5.1-2 for FR2. For UE indicating *no-gap-with-interruption* via *NeedForInterruptionInfoNR-r18*, $T_{PSS/SSS_sync_intra_ODSSB}$ is given in table 9.17.5.1-5 for FR1 and table 9.17.5.1-6 for FR2.
- Otherwise, $T_{PSS/SSS_sync_intra_ODSSB}$ is given in tables 9.17.5.1-1, 9. x.5.1-2, or 9.17.5.1-3.

$T_{SSB_time_index_intra_ODSSB}$: it is the time period used to acquire the index of the SSB being measured

- For UE indicating *no-gap-no-interruption* via *NeedForInterruptionInfoNR-r18*, $T_{SSB_time_index_intra_ODSSB}$ is given in table 9.2.17.1-3 for FR1. For UE indicating *no-gap-with-interruption* via *NeedForInterruptionInfoNR-r18*, $T_{SSB_time_index_intra_ODSSB}$ is given in table 9.17.5.1-7 for FR1.
- Otherwise, $T_{SSB_time_index_intra_ODSSB}$ is given in table 9.17.5.1-3.

$T_{SSB_measurement_period_intra_ODSSB}$: equal to a measurement period of SSB based measurement

- For UE supporting power class 6 with *highSpeedMeasFlagFR2-r17* configured, if SMTC ≤ 40ms, $T_{SSB_measurement_period_intra_ODSSB}$ is given in table 9.17.5.2-4; otherwise, $T_{SSB_measurement_period_intra_ODSSB}$ is given in table 9.17.5.2-2.
- For UE indicating *no-gap-no-interruption* via *NeedForInterruptionInfoNR-r18*, $T_{SSB_measurement_period_intra_ODSSB}$ is given in table 9.17.5.2-1 for FR1 and table 9.17.5.2-2 for FR2. For UE indicating *no-gap-with-interruption* via *NeedForInterruptionInfoNR-r18*, $T_{SSB_measurement_period_intra_ODSSB}$ is given in table 9.17.5.2-5 for FR1 and table 9.17.5.2-6 for FR2.
- For power class 6 UE supporting *measEnhCAInterFreqFR2-r18* when *highSpeedMeasFlagFR2* is configured, the $T_{SSB_measurement_period_intra_ODSSB}$ given in table 9.17.5.2-4 (if SMTC ≤ 40ms) and table 9.17.5.2-2 (if SMTC > 40ms) shall apply for SCC.
- Otherwise, $T_{SSB_measurement_period_intra_ODSSB}$ is given in table 9.17.5.2-1, 9.17.5.2-2, 9.17.5.2-3 or 9.17.5.2-4.

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e.

- when intra-frequency SMTC is fully non overlapping or partially overlapping with GAP, or
- when intra-frequency SMTC is fully non overlapping with GAP for UE indicating *no-gap-with-interruption*, or
- when intra-frequency SMTC is fully non overlapping or partially overlapping with GAP for UE indicating *no-gap-no-interruption*

$M_{pss/sss_sync_w/o_gaps}$: For a UE supporting FR2-1 power class 1 or 5, $M_{pss/sss_sync_w/o_gaps}$ =40. For a UE supporting power class 2, $M_{pss/sss_sync_w/o_gaps}$ =24. For a UE supporting FR2-1 power class 3, $M_{pss/sss_sync_w/o_gaps}$ =24. For a UE supporting FR2-1 power class 4, $M_{pss/sss_sync_w/o_gaps}$ =24. For a UE supporting FR2-1 power class 6, $M_{pss/sss_sync_w/o_gaps}$ =24.

$M_{meas_period_w/o_gaps}$: For a UE supporting FR2-1 power class 1 or 5, $M_{meas_period_w/o_gaps}$ =40. For a UE supporting FR2-1 power class 2, $M_{meas_period_w/o_gaps}$ =24. For a UE supporting FR2-1 power class 3, $M_{meas_period_w/o_gaps}$ =24. For a UE supporting power class 4, $M_{meas_period_w/o_gaps}$ =24. For a UE supporting power class 6, $M_{meas_period_w/o_gaps}$ =24.

For a UE that supports Pre-MG, an SMTC occasion is only considered to be overlapped by Pre-MG if the Pre-MG is activated.

When UE supports concurrent GAPs and UE concurrent GAPs, i.e., supports the following capability or capabilities' combination:

- concurrentMeasGap-r17, or
- concurrentMeasGapsPreMG-r18, or
- concurrentMeasGapsNCSG-r18,

Or when UE supports *musim-GapPreference-r17* or both concurrent measurement GAPs and *musim-GapPreference-r17* and UE concurrent GAPs or periodic MUSIM gaps or both concurrent gaps and periodic MUSIM gaps are configured,

K_p is the scaling factor for an SSB frequency layer to be measured without GAP. $K_p = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

- For a window W of duration max(SMTC period, xRP_max), where xRP_max is the maximum xRP across all configured per-UE GAPs, periodic MUSIM gaps, and/or per-FR GAPs within the same FR as the SSB frequency layer, and starting from the beginning of any SMTC occasion:
  - N_{total} is the total number of SMTC occasions within the window, including those overlapped with GAP and MUSIM gap occasions within the window, and
  - $N_{available}$ is the number of SMTC occasions that are not overlapped with any non-dropped GAP or non-dropped MUSIM gap occasions within the window W, after accounting for measurement GAP and MUSIM gap collisions by applying the collision rules for GAP and MUSIM gap in clauses 9.1.8.3, 9.1.10.4, 9.1.10.5, 9.1.12.3, and 9.1.13.3, respectively.

    $K_p = 1$ when $N_{available} = 0$.
  - xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG, also xRP = MGRP for periodic MUSIM gap.

    Requirements in this clause do not apply when $N_{available} = 0$ due to fully overlapping between SMTC occasions and MUSIM gap occasions within the window W.

Otherwise, when the UE is not configured with or UE does not support concurrent GAPs and the UE is not configured with periodic MUSIM gaps or UE does not support MUSIM gaps:

When intra-frequency SMTC is fully non overlapping with measurement gaps or NCSG, or intra-frequency SMTC is fully overlapping with MGs or NCSG, Kp=1

When intra-frequency SMTC is partially overlapping with measurement gaps, $K_p = 1/(1- (\text{SMTC period} /\text{MGRP}))$, where SMTC period < MGRP. When intra-frequency SMTC is partially overlapping with NCSG, $K_p = 1/(1- (\text{SMTC period} /\text{VIRP}))$, where SMTC period < VIRP. For calculation of K_p, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1*.

For FR2,

$K_{layer1_measurement} = 1$,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or
- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, where SSB symbols are

indicated by the union set of SSB-ToMeasure from all the configured measurement objects on the same serving carrier which can be merged. and RSSI symbols are indicated by *SS-RSSI-Measurement*;

$K_{layer1_measurement}$ =1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

When UE supports *MUSIM-GapConfig-17* and the SMTC occasion of the target frequency layer is overlapping with the configured aperiodic MUSIM gap, longer cell identification period for the target frequency layer is expected.

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for $T_{identify_intra_without_index_ODSSB}$ or $T_{identify_intra_with_index_ODSSB}$.

If MCG DRX is in use, cell identification requirements for intra-frequency measurement in MCG specified in Table 9.17.5.1-1, Table 9.17.5.1-2, Table 9.17.5.1-3, and Table 9.17.5.1-4 shall depend on the MCG DRX cycle. If SCG DRX is in use, cell identification requirements for intra-frequency measurement in SCG specified in Table 9.17.5.1-1, Table 9.17.5.1-2, Table 9.17.5.1-3 and Table 9.17.5.1-4 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

When the target SSB is completely contained in active BWP of UE or the active downlink BWP is initial BWP, the intra-frequency measurement shall be conducted without gap and without interruption regardless of the NeedForGaps' status reporting.

Table 9.17.5.1-1: Time period for OD-SSB based PSS/SSS detection (Frequency range FR1)

DRX cycle	$T_{PSS/SSS_sync_intra_ODSSB}$
No DRX	max(600 ms, ceil(5 x K_p) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(M2 [Note 2]x 5 x K_p) x max(SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1. NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell. NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1.	

Table 9.17.5.1-2: Time period for OD-SSB based PSS/SSS detection (Frequency range FR2)

DRX cycle	$T_{PSS/SSS_sync_intra_ODSSB}$
No DRX	max(600 ms, ceil($M_{pss/sss_sync_w/o_gaps}$ x K_p x $K_{layer1_measurement}$) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x $M_{pss/sss_sync_w/o_gaps}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil($M_{pss/sss_sync_w/o_gaps}$ x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.17.5.1-3: Time period for OD-SSB based time index detection (FR1)

DRX cycle	$T_{SSB_time_index_intra_ODSSB}$
No DRX	max(120 ms, ceil(3 x K_p) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil (M2 [Note 2] x 3 x K_p) x max(SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	Ceil(3 x K_p) x DRX cycle x $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified
NOTE 2: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms,otherwise M2=1
NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.
NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1

Table 9.17.5.1-4: Time period for OD-SSB based PSS/SSS detection when *highSpeedMeasFlagFR2-r17* is configured, (FR2) when SMTC period ≤ 40ms

DRX cycle	$T_{PSS/SSS_sync_intra_ODSSB}$
No DRX	max(600 ms, ceil($M1^{Note\ 2}$ x K_p x $K_{layer1_measurement}$) x SMTC period)$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 80 ms	max(600 ms, ceil($M1^{Note\ 2}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period, DRX cycle)) x $CSSF_{intra}$
80 ms< DRX cycle≤ 320 ms	ceil(1.5 x $M_{pss/sss_sync_w/o_gaps}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period, DRX cycle) x $CSSF_{intra}$
DRX cycle>320 ms	ceil($M_{pss/sss_sync_w/o_gaps}$ x K_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified
NOTE 2: For UE supporting power class 6, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2

Table 9.17.5.1-5: Time period for PSS/SSS detection for UE indicating *no-gap-with-interruption*, (Frequency range FR1)

DRX cycle	$T_{PSS/SSS_sync_intra_ODSSB}$
No DRX	max(600 ms, 5 x max (80 ms, SMTC period))$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil($M2^{Note\ 2}$x 5) x max(80 ms, SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	5 x DRX cycle x $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified
NOTE 2: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1.
NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.
NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1.
NOTE 5: Requirements only apply when measurement gap is not configured, or measurement gap is fully non-overlapped with SMTC on any carrier on which UE indicates *no-gap-with-interruption*.

Table 9.17.5.1-6: Time period for PSS/SSS detection for UE indicating *no-gap-with-interruption*, (Frequency range FR2)

DRX cycle	$T_{PSS/SSS_sync_intra_ODSSB}$
No DRX	max(600 ms, ceil($M_{pss/sss_sync_w/o_gaps}$ x K_{FR} x $K_{layer1_measurement}$) x max (80 ms, SMTC period))$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(600 ms, ceil(1.5 x $M_{pss/sss_sync_w/o_gaps}$ x K_{FR} x $K_{layer1_measurement}$) x max(80 ms, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil($M_{pss/sss_sync_w/o_gaps}$ x K_{FR} x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified
NOTE 2: Requirements only apply when measurement gap is not configured, or measurement gap is fully non-overlapped with SMTC on any carrier on which UE indicates *no-gap-with-interruption*.

Table 9.17.5.1-7: Time period for time index detection for UE indicating *no-gap-with-interruption* (FR1)

DRX cycle	$T_{SSB_time_index_intra_ODSSB}$
No DRX	max(120 ms, 3 x max (80 ms, SMTC period))[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120 ms, ceil (M2[Note 2] x 3) x max(80 ms, SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	3 x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms;otherwise M2=1.	
NOTE 3: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16* on measurements of the primary component carrier and do not apply to measurements of a secondary component carrier with active SCell.	
NOTE 4: When *highSpeedMeasCA-Scell-r17* is configured and UE supports *measurementEnhancementCA-r17*, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1	
NOTE 5: Requirements only apply when measurement gap is not configured, or measurement gap is fully non-overlapped with SMTC on any carrier on which UE indicates *no-gap-with-interruption*.	

Table 9.17.5.1-8: Time period for time index detection for a UE operating on a target cell with 12 PRB SSB (Frequency range FR1)

DRX cycle	$T_{SSB_time_index_intra_less_than_5Mhz}$
No DRX	max(120ms, ceil(7 x Kp) x SMTC period) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(120ms, ceil(M2 x 7 x Kp) x max(SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(7 x Kp) x DRX cycle x $CSSF_{intra}$
NOTE 1: When *highSpeedMeasFlag-r16* is not configured, M2 = 1.5; When *highSpeedMeasFlag-r16* is configured, M2 = 1.5 if SMTC periodicity > 40 ms; otherwise M2=1.	
NOTE 2: When *highSpeedMeasFlag-r16* is configured, the requirements apply only to UE supporting either *measurementEnhancement-r16* or *intraNR-MeasurementEnhancement-r16*.	

9.17.5.2 Measurement period for active SCell

The measurement period for intra-frequency measurements without gaps is as shown in table 9.17.5.2-1, 9.17.5.2-2, 9.17.5.2-3, 9.17.5.2-4.

When UE *highSpeedMeasFlagFR2-r17* is configured, if SMTC $\leq$ 40ms, $T_{SSB_measurement_period_intra_ODSSB}$ is given in table 9.17.5.2-3; otherwise, $T_{SSB_measurement_period_intra_ODSSB}$ is given in table 9.17.5.2-2. For power class 6 UE supporting *measEnhCAInterFreqFR2-r18* when *highSpeedMeasFlagFR2-r17* is configured, the $T_{SSB_measurement_period_intra_ODSSB}$ is given in table 9.2.5.2-3 (if SMTC $\leq$ 40ms) and table 9.2.5.2-2 (if SMTC > 40ms) shall apply for SCC.

If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

For a UE that supports Pre-MG, an SMTC occasion is only considered to be overlapped by Pre-MG if the Pre-MG is activated.

If MCG DRX is in use, measurement period requirements for intra-frequency measurement in MCG specified in table 9.17.5.2-1, table 9.17.5.2-2, table 9.17.5.2-3 and table 9.17.5.2-4 shall depend on the MCG DRX cycle. If SCG DRX is in use, measurement period requirements for intra-frequency measurement in SCG specified in table 9.17.5.2-1, table 9.17.5.2-2, table 9.17.5.2-3 and table 9.17.5.2-4, shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

For FR2, a longer measurement period is allowed, if aperiodic CSI-RS resource is measured for L1-RSRP measurement on any FR2 serving frequency in the same band, and the CSI-RS resource is outside measurement gap and overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols. If *SSB-ToMeasure* or *SS-RSSI-Measurement* is configured, the SSB symbols are indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same band which can be merged and the RSSI symbols are indicated by *SS-RSSI-Measurement*.

Table 9.17.5.2-1: Measurement period for OD-SSB based intra-frequency measurements without gaps (FR1)

DRX cycle	$T_{SSB_measurement_period_intra_ODSSB}$
No DRX	max(200 ms, ceil(5 x K_p) x SMTC period)$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5 x K_p) x max(SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil(5 x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.17.5.2-2: Measurement period for OD-SSB based intra-frequency measurements without gaps (FR2)

DRX cycle	$T_{SSB_measurement_period_intra_ODSSB}$
No DRX	max(400 ms, ceil($M_{meas_period_w/o_gaps}$ x K_p x $K_{layer1_measurement}$) x SMTC period)$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5x $M_{meas_period_w/o_gaps}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil($M_{meas_period_w/o_gaps}$ xK_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.17.5.2-3: $T_{SSB_measurement_period_intra_ODSSB}$ when highSpeedMeasCA-Scell-r17 is configured (Frequency range FR1)

DRX cycle	$T_{SSB_measurement_period_intra_ODSSB}$
No DRX $^{Note\ 2}$	max(200 ms, ceil(5 x K_p) x SMTC period)$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 160 ms	max(200 ms, ceil(5 x M2 $^{Note\ 2}$ x K_p) x max(SMTC period, DRX cycle)) x $CSSF_{intra}$
160 ms < DRX cycle≤ 320 ms	ceil(4 x M2 $^{Note\ 2}$ x K_p) x DRX cycle x $CSSF_{intra}$
DRX cycle>320 ms	ceil(Y $^{Note\ 3}$ x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: M2 = 1.5 if SMTC period > 40 ms, otherwise M2=1	
NOTE 3: Y=3 when SMTC period ≤ 40ms, Y=5 when SMTC period > 40ms	
NOTE 4: When highSpeedMeasCA-Scell-r17 is configured, the requirements apply to measurements of secondary component carrier with active SCell.	

Table 9.17.5.2-4: Measurement period for OD-SSB based intra-frequency measurements without gaps when *highSpeedMeasFlagFR2-r17* is configured (FR2) when SMTC period <= 40 ms

DRX cycle	$T_{SSB_measurement_period_intra_ODSSB}$
No DRX	max(400 ms, ceil(M1$^{Note\ 2}$ x K_p x $K_{layer1_measurement}$) x SMTC period)$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 80 ms	max(400 ms, ceil(M1$^{Note\ 2}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
80 ms< DRX cycle≤ 320 ms	ceil(1.5 x $M_{meas_period_w/o_gaps}$ $^{Note\ 3}$ x K_p x $K_{layer1_measurement}$) x max(SMTC period,DRX cycle) x $CSSF_{intra}$
DRX cycle>320 ms	ceil($M_{meas_period_w/o_gaps}$ $^{Note\ 3}$ xK_p x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: For UE supporting power class 6, M1 = 6 if *highSpeedMeasFlagFR2-r17* = set1 or M1 = 18 if *highSpeedMeasFlagFR2-r17* = set2	

Table 9.17.5.2-5: Measurement period for intra-frequency measurements without gaps for UE indicating *no-gap-with-interruption* (FR1)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(200 ms, 5 x (80 ms, SMTC period))$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(200 ms, ceil(1.5x 5) x max(80 ms, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	5 x DRX cycle x $CSSF_{intra}$

NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified
NOTE 2: Requirements only apply when measurement gap is not configured, or measurement gap is fully non-overlapped with SMTC on any carrier on which UE indicates '*no-gap-with-interruption*' via *NeedForInterruptionInfoNR-r18*.

Table 9.17.5.2-6: Measurement period for intra-frequency measurements without gaps for UE indicating *no-gap-with-interruption* (FR2)

DRX cycle	$T_{SSB_measurement_period_intra}$
No DRX	max(400 ms, ceil($M_{meas_period_w/o_gaps}$ x $K_{layer1_measurement}$) x (80 ms, SMTC period))[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5x $M_{meas_period_w/o_gaps}$ x $K_{layer1_measurement}$) x max(80, SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	ceil($M_{meas_period_w/o_gaps}$ x $K_{layer1_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	
NOTE 2: Requirements only apply when measurement gap is not configured, or measurement gap is fully non-overlapped with SMTC on any carrier on which UE indicates *no-gap-with-interruption* via *NeedForInterruptionInfoNR-r18*.	

9.17.5.3 Intra-frequency cell identification for deactivated SCell

When UE is indicated the activation of OD-SSB transmission in slot *n* in a configured DL BWP of an SCell without a first SSB transmission before SCell activation command,

- After slot $n+\frac{T_{HARQ}+3ms+T_{processing}}{NR\ slot\ length}$, UE shall perform the deactivated SCell measurement with $T_{PSS/SSS_sync_intra_ODSSB}$, $T_{SSB_time_index_intra_ODSSB}$, $T_{SSB_measurement_period_intra_ODSSB}$ given in table 9.17.5.3-1, 9.17.5.3-2 and 9.17.5.4-1 regardless of configured DRX and *measCycleSCell* till slot $n+\frac{T_{HARQ}+3ms+T_{processing}+T_{FMW}}{NR\ slot\ length}$, where:

- T_{FMW} equals $\min(T_{report}, T_{First,OD-SSB} + T_{identify_intra})$, which is the duration of the fast measurement window(FMW).

- $T_{First,OD-SSB}$ is the time to the end of the first complete transmitted SSB burst after slot n + $\frac{T_{HARQ}+3ms+T_{processing}}{NR\ slot\ length}$.

- $T_{identify_intra}$ equals $T_{identify_intra_without_index_ODSSB}$ or $T_{identify_intra_with_index_ODSSB}$ if the cell is a newly detectable cell or $T_{SSB_measurement_period_intra_ODSSB}$ if the cell has been detected for a period less than 5 seconds.

- $T_{processing}$ is the additional processing time as 2ms or 5ms depending on *OD-SSB post processing time*.

- T_{report} is the duration after slot $n+\frac{T_{HARQ}+3ms+T_{processing}}{NR\ slot\ length}$ to the earliest OD-SSB based L3 measurement reporting.

- $CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gaps. When single OD-SSB carrier is configured with multiple SCCs without OD-SSB, $CSSF_{intra}$ equals 1 for OD-SSB carrier during the FMW.

- K_{p_OD-SSB} is the scaling factor for an OD-SSB based deactivated SCell to be measured. $K_{p_OD-SSB} = N_{total} / N_{available}$, where $N_{available}$ and N_{total} are calculated as follows:

  - For a window W of duration max(SMTC period, xRP_max), where xRP_max is the maximum xRP across all configured per-UE GAPs, periodic MUSIM gaps, and/or per-FR GAPs within the same FR as the OD-SSB frequency layer, and starting from the beginning of any OD-SSB occasion:

    - N_{total} is the total number of OD-SSB occasions within the window, including those overlapped with GAP and MUSIM gap occasions within the window, and

    - $N_{available}$ is the number of OD-SSB occasions that are not overlapped with any non-dropped GAP or non-dropped MUSIM gap occasions within the window W, after accounting for measurement GAP and

MUSIM gap collisions by applying the collision rules for GAP and MUSIM gap in clauses 9.1.8.3, 9.1.10.4, 9.1.10.5, 9.1.12.3, and 9.1.13.3, respectively.

$K_{p_OD\text{-}SSB}$ = 1 when $N_{available}$ = 0.

- xRP = MGRP when configured GAP is activated Pre-MG or MG, and xRP = VIRP when configured GAP is NCSG, also xRP = MGRP for periodic MUSIM gap.

  Requirements in this clause do not apply when $N_{available}$ = 0 due to fully overlapping between SMTC occasions and MUSIM gap occasions within the window W.

Otherwise, when the UE is not configured with or UE does not support concurrent GAPs and the UE is not configured with periodic MUSIM gaps or UE does not support MUSIM gaps:

When OD-SSB is fully non overlapping with measurement gaps or NCSG, $K_{p_OD\text{-}SSB}$ =1;

When OD-SSB is partially overlapping with measurement gaps, $K_{p_OD\text{-}SSB}$ = 1/(1- (OD-SSB period /MGRP)), where OD-SSB period < MGRP. When OD-SSB is partially overlapping with NCSG, $K_{p_OD\text{-}SSB}$ = 1/(1- (OD-SSB period /VIRP)), where OD-SSB period < VIRP.

- When UE is indicated the activation of another OD-SSB transmission in a configured DL BWP of an SCell within the T2 after the previous OD-SSB deactivation and before the SCell activation command, the UE shall perform the deactivated SCell measurement with $T_{PSS/SSS_sync_intra_ODSSB}$, $T_{SSB_time_index_intra_ODSSB}$, $T_{SSB_measurement_period_intra_ODSSB}$ given in table 9.17.5.3-3, 9.17.5.3-4, 9.17.5.3-5, 9.17.5.4-2 and 9.17.5.4-3 if OD-SSB is transmitted, where T2 is 5*max (measCycleSCell, DRX cycles) in FR1 and 4s for power class 1/5 and 3s for power class 2/3/4 in FR2.
- When UE is indicated the activation of another OD-SSB transmission in a configured DL BWP of an SCell after previous OD-SSB deactivation plus T2 and before the SCell activation command, UE shall perform the deactivated SCell measurement with $T_{PSS/SSS_sync_intra_ODSSB}$, $T_{SSB_time_index_intra_ODSSB}$, $T_{SSB_measurement_period_intra_ODSSB}$ given in table 9.17.5.3-1, 9.17.5.3-2 and 9.17.5.4-1 regardless of configured DRX and *measCycleSCell* till slot $n+\frac{T_{HARQ}+3ms+T_{processing}+T_{FMW}}{NR\ slot\ length}$.

- When UE is indicated the activation of another OD-SSB transmission with the same spatial reception parameter and same frequency as the previously deactivated OD-SSB in a configured DL BWP of an SCell, and the indication occurs within 5 seconds after the previous OD-SSB deactivation before the SCell activation command, and the SCell remains detectable during the time period $T_{identify_intra_without_index_ODSSB}$ or $T_{identify_intra_with_index_ODSSB}$ measured from previously transmitted OD-SSB, the UE shall skip the OD-SSB identification provided that the SCell is detectable and the timing that the cell has not been changed more than $\pm 3200/2^{\mu} T_c$.

- After the FMW, UE shall follow the legacy deactivated SCC measurement with $T_{PSS/SSS_sync_intra_ODSSB}$, $T_{SSB_time_index_intra_ODSSB}$, $T_{SSB_measurement_period_intra_ODSSB}$ given in table 9.17.5.3-3, 9.17.5.3-4, 9.17.5.3-5 9.17.5.4-2 and 9.17.5.4-3 if the OD-SSB transmission is not deactivated.

No OD-SSB based deactivated SCell requirement applies if NW deactivates the OD-SSB earlier than the time slot $n+\frac{T_{HARQ}+3ms+T_{processing}+\min(T_{report},T_{identify_intra})}{NR\ slot\ length}$.

When UE is indicated the activation of OD-SSB transmission in slot *n* in a configured DL BWP of an SCell with a first SSB transmission before SCell activation command, after slot $n+\frac{T_{HARQ}+3ms+T_{processing}}{NR\ slot\ length}$,

- UE shall perform the deactivated SCC measurement with $T_{PSS/SSS_sync_intra_ODSSB}$, $T_{SSB_time_index_intra_ODSSB}$, $T_{SSB_measurement_period_intra_ODSSB}$ given in table 9.17.5.3-3, 9.17.5.3-4, 9.17.5.3-5, 9.17.5.4-2 and 9.17.5.4-3 if UE has sent a valid measurement report before receiving the activation of OD-SSB transmission during the period equal to max(5*measCycleSCell, 5*DRX cycles) in FR1 or 4s for UE supporting power class1 and 3s for UE supporting power class 2/3/4 in FR2.
- Otherwise, UE shall perform the deactivated SCell measurement with $T_{PSS/SSS_sync_intra_ODSSB}$, $T_{SSB_time_index_intra_ODSSB}$, $T_{SSB_measurement_period_intra_ODSSB}$ given in table 9.17.5.3-1, 9.17.5.3-2 and 9.17.5.4-1 regardless of configured DRX and *measCycleSCell* till slot $n+\frac{T_{HARQ}+3ms+T_{processing}+T_{FMW}}{NR\ slot\ length}$..
- Before UE receiving the activation of OD-SSB transmission or after OD-SSB deactivation in a deactivated SCell, UE shall perform deactivated SCC measurement with $T_{PSS/SSS_sync_intra_ODSSB}$, $T_{SSB_time_index_intra_ODSSB}$, $T_{SSB_measurement_period_intra_ODSSB}$ given in table 9.17.5.3-3, 9.17.5.3-4, 9.17.5.3-5, 9.17.5.4-2 and 9.17.5.4-3 if OD-SSB is transmitted.

- Before UE receiving the activation of OD-SSB transmission or after OD-SSB deactivation in a deactivated SCell, for UE indicating *support3MHz-ChannelBW-Symmetric-r18* and configured to perform measurements on a deactivated SCell with 12PRB SSB in FR1, $T_{SSB_time_index_intra_less_than_5MHz_ODSSB}$ is given in table 9.17.5.3-6.

UE shall perform the deactivated SCC neighbour cell measurement with $T_{PSS/SSS_sync_intra_ODSSB}$, $T_{SSB_time_index_intra_ODSSB}$, $T_{SSB_measurement_period_intra_ODSSB}$ given in table 9.17.5.3-3, 9.17.5.3-4, 9.17.5.3-5, 9.17.5.3-6, 9.17.5.4-2 and 9.17.5.4-3 regardless of OD-SSB activation/deactivation.

If MCG DRX is in use, cell identification requirements for intra-frequency measurement in MCG specified in Table 9.17.5.3-2, Table 9.17.5.3-3, Table 9.17.5.3-4, 9.17.5.3-5 and Table 9.17.5.3-6 shall depend on the MCG DRX cycle. If SCG DRX is in use, cell identification requirements for intra-frequency measurement in SCG specified in Table 9.17.5.3-2, Table 9.17.5.3-3, Table 9.17.5.3-4, 9.17.5.3-5 and Table 9.17.5.3-6 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

When NW indicates OD-SSB transmission in one of the deactivated SCell, the longer cell identification or measurement delay for other frequency layers being measured would be expected during the T_{FMW}.

When more than one deactivated SCells are configured with OD-SSB transmission, the requirements in this clause shall be also applied provided that the time periods between OD-SSB activation and OD-SSB deactivation among multiple OD-SSBs' frequency layers are non-overlapping.

Table 9.17.5.3-1: Time period for OD-SSB based PSS/SSS detection in FMW, deactivated SCell

Frequency range	$T_{PSS/SSS_sync_intra_ODSSB}$
FR1	$ceil(M^{Note\ 2} \times K_{p_OD\text{-}SSB}) \times \max(T_{lower}^{Note\ 1}, EMP) \times CSSF_{intra}$
FR2	$ceil(M^{Note\ 2} \times K_{FR} \times K_{p_OD\text{-}SSB} \times K_{layer1_measurement}) \times \max(T_{lower}^{Note\ 1}, EMP) \times CSSF_{intra}$
NOTE 1: When UE reports not supporting *lower bound capability*, the T_{lower} equals 10ms; Otherwise, T_{lower} equals 0ms.	
NOTE 2: When multiple frequency layers are configured, M equals 6 in FR1 and $M_{pss/sss_sync_w/o_gaps}$+1 in FR2. Otherwise, M equals 5 in FR1 and $M_{pss/sss_sync_w/o_gaps}$ in FR2.	

Table 9.17.5.3-2: Time period for OD-SSB based time index detection in FMW, deactivated SCell (FR1)

FR	$T_{SSB_time_index_intra_ODSSB}$
FR1	$ceil(3 \times K_{p_OD\text{-}SSB}) \times \max(T_{lower}^{Note\ 1}, EMP) \times CSSF_{intra}$
NOTE 1: When UE reports not supporting *lower bound capability*, the T_{lower} equals 10ms; Otherwise, T_{lower} equals 0ms.	

Table 9.17.5.3-3: Time period for OD-SSB based PSS/SSS detection, deactivated SCC (FR1)

DRX cycle	$T_{PSS/SSS_sync_intra_ODSSB}$
No DRX	$Ceil(5 \times K_{p_OD\text{-}SSB}) \times measCycleSCell \times CSSF_{intra}$
DRX cycle≤ 320 ms	$Ceil(5 \times K_{p_OD\text{-}SSB}) \times \max(measCycleSCell, 1.5 \times DRX\ cycle) \times CSSF_{intra}$
DRX cycle> 320 ms	$Ceil(5 \times K_{p_OD\text{-}SSB}) \times \max(measCycleSCell, DRX\ cycle) \times CSSF_{intra}$
NOTE 1: The requirements also apply to CC with deactivated SCell in SCG.	

Table 9.17.5.3-4: Time period for OD-SSB based PSS/SSS detection, deactivated SCC (FR2)

DRX cycle	$T_{PSS/SSS_sync_intra_ODSSB}$
No DRX	$Ceil(M_{pss/sss_sync_w/o_gaps} \times K_{p_OD\text{-}SSB}) \times measCycleSCell \times CSSF_{intra}$
DRX cycle≤ 320 ms	$Ceil(M_{pss/sss_sync_w/o_gaps} \times K_{p_OD\text{-}SSB}) \times \max(measCycleSCell, 1.5 \times DRX\ cycle) \times CSSF_{intra}$
DRX cycle> 320 ms	$Ceil(M_{pss/sss_sync_w/o_gaps} \times K_{p_OD\text{-}SSB}) \times \max(measCycleSCell, DRX\ cycle) \times CSSF_{intra}$
NOTE 1: The requirements also apply to CC with deactivated SCell in SCG.	

Table 9.17.5.3-5: Time period for OD-SSB based time index detection, deactivated SCC (FR1)

DRX cycle	$T_{SSB_time_index_intra_ODSSB}$
No DRX	$Ceil(3 \times K_{p_OD\text{-}SSB}) \times measCycleSCell \times CSSF_{intra}$

DRX cycle≤ 320 ms	Ceil(3 x $K_{p_OD\text{-}SSB}$) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(3 x $K_{p_OD\text{-}SSB}$) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: The requirements also apply to CC with deactivated SCell in SCG.	

Table 9.17.5.3-6: Time period for time index detection for a UE operating on a target cell with 12PRB SSB, deactivated SCC (FR1)

DRX cycle	$T_{SSB_time_index_intra_less_than_5MHz}$
No DRX	Ceil(7 x $K_{p_OD\text{-}SSB}$) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320ms	Ceil(7 x $K_{p_OD\text{-}SSB}$) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320ms	Ceil(7 x $K_{p_OD\text{-}SSB}$) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: The requirements apply to CC with deactivated SCG SCell.	

9.17.5.4 Measurement period for deactivated SCell

The measurement period for deactivated SCell measurements is as shown in table 9.17.5.4-1, 9.17.5.4-2, 9.17.5.4-3.

If MCG DRX is in use, measurement period requirements for intra-frequency measurement in MCG specified in Table 9.17.5.4-2, and Table 9.17.5.4-3 shall depend on the MCG DRX cycle. If SCG DRX is in use, measurement period requirements for intra-frequency measurement in SCG specified in 9.17.5.4-2, and Table 9.17.5.4-3, shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

For FR2, a longer measurement period is allowed, if aperiodic CSI-RS resource is measured for L1-RSRP measurement on any FR2 serving frequency in the same band, and the CSI-RS resource is outside measurement gap and overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols. If *SSB-ToMeasure* or *SS-RSSI-Measurement* is configured, the SSB symbols are indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same band which can be merged and the RSSI symbols are indicated by *SS-RSSI-Measurement*.

When NW indicates OD-SSB transmission in one of the deactivated SCell, the longer cell identification or measurement delay for other frequency layers being measured would be expected during the T_{FMW}.

Table 9.17.5.4-1: Measurement period for OD-SSB based intra-frequency measurements without gaps (deactivated SCC)

FR	$T_{SSB_measurement_period_intra_ODSSB}$
FR1	ceil($M^{Note\ 2}$ x K_p) x max($T_{lower}^{Note\ 1}$, EMP) x $CSSF_{intra}$
FR2	ceil($M^{Note\ 2}$ x K_{FR} x K_p x $K_{layer1_measurement}$) x max($T_{lower}^{Note\ 1}$, EMP) x $CSSF_{intra}$
NOTE 1: When UE reports not supporting *lower bound capability*, the T_{lower} equals 10ms; Otherwise, T_{lower} equals 0ms.	
NOTE 2: When multiple frequency layers are configured, M equals 6 in FR1 and $M_{pss/sss_sync_w/o_gaps}$+1 in FR2 if the deactivated SCell is a detected Scell. Otherwise, M equals 5 in FR1 and $M_{pss/sss_sync_w/o_gaps}$ in FR2.	

Table 9.17.5.4-2: Measurement period for OD-SSB based intra-frequency measurements without gaps (deactivated SCC) (FR1)

DRX cycle	$T_{SSB_measurement_period_intra_ODSSB}$
No DRX	Ceil(5 x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil(5 x K_p) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil(5 x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: The requirements also apply to CC with deactivated SCell in SCG	

Table 9.17.5.4-3: Measurement period for OD-SSB based intra-frequency measurements without gaps (deactivated SCC) (FR2)

DRX cycle	$T_{SSB_measurement_period_intra_ODSSB}$

No DRX	Ceil($M_{meas_period_w/o_gaps}$ x K_p) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320 ms	Ceil($M_{meas_period_w/o_gaps}$ x K_p) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320 ms	Ceil($M_{meas_period_w/o_gaps}$ x K_p) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: The requirements also apply to CC with deactivated SCell in SCG.	

9.17.5.5 Scheduling availability of UE during intra-frequency measurements based on On-demand SSB

UE shall be capable of measuring without measurement gaps when the OD-SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that all the configured OD-SSB symbols on the target carrier are referred to in this clause.

9.17.5.5.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OD-SSB symbols to be measured, and on 1 data symbol before each consecutive OD-SSB symbols to be measured and 1 data symbol after each consecutive OD-SSB symbols to be measured within the Fast Measurement window duration.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OD-SSB symbols to be measured, and on 1 data symbol before each consecutive OD-SSB symbols to be measured and 1 data symbol after each consecutive OD-SSB symbols to be measured within SMTC window duration outside the Fast Measurement window duration. If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OD-SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive OD-SSB to be measured/RSSI symbols and 1 data symbol after each consecutive OD-SSB to be measured/RSSI symbols within the Fast Measurement window duration.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OD-SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive OD-SSB to be measured/RSSI symbols and 1 data symbol after each consecutive OD-SSB to be measured/RSSI symbols within SMTC window duration outside Fast measurement window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

When TDD inter-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this band pair.

When inter-band FR1+FR1 NR-DC is performed, the scheduling restrictions due to a given serving cell also apply to another serving cell in a different band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this band pair.

9.17.5.5.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which does not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If *deriveSSB_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on OD-SSB symbols to be measured, and on 1 data symbol before each consecutive OD-SSB symbols to be measured and 1 data symbol after each consecutive OD-SSB symbols to be measured within the Fast Measurement window duration.

- If *deriveSSB_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on OD-SSB symbols to be measured, and on 1 data symbol before each consecutive OD-SSB symbols to be measured and 1 data symbol after each consecutive OD-SSB symbols to be measured within SMTC window duration outside the Fast Measurement window duration. If the high layer signalling of *smtc2* is configured (in TS 38.331 [2]), the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If *deriveSSB_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within Fast Measurement window duration.

- If *deriveSSB_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration outside Fast Measurement window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

If the following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots

The UE shall receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and/or the corresponding PDSCH, on SSB symbols to be measured.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

9.17.5.5.3 Scheduling availability of UE performing measurements on FR2-1

The following scheduling restriction applies due to SS-RSRP or SS-SINR measurement on an FR2 intra-frequency cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on OD-SSB symbols to be measured, and on 1 data symbol(s) before each consecutive OD-SSB symbols to be measured and 1 data symbol(s) after each consecutive OD-SSB symbols to be measured within Fast Measurement window duration.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on OD-SSB symbols to be measured, and on 1 data symbol(s) before each consecutive OD-SSB symbols to be measured and 1 data symbol(s) after each consecutive OD-SSB symbols to be measured within SMTC window duration outside Fast Measurement window duration.

The following scheduling restriction applies to SS-RSRQ measurement on an FR2 intra-frequency cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on OD-SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol(s) before each consecutive OD-SSB to be measured/RSSI symbols and 1 data symbol(s) after each consecutive OD-SSB to be measured/RSSI symbols within Fast Measurement window duration.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on OD-SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol(s) before each consecutive OD-SSB to be measured/RSSI symbols and 1 data symbol(s) after each consecutive OD-SSB to be measured/RSSI symbols within SMTC window duration outside Fast Measurement window duration.

where

- If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- The signaling *deriveSSB-IndexFromCell* is always enabled.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to SS-RSRP, SS-RSRQ or SS-SINR measurement on an FR2 intra-frequency cell in different bands, provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

NOTE: When inter-band carrier aggregation in FR2 is performed, the scheduling restrictions as defined in clause 9.2.5.17.1 due to a given serving cell also apply to another serving cell in a different FR2 band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this FR2 band pair.

If following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE’s reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots

9.17.5.5.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 serving cell frequency layer. However, the scheduling restrictions as defined in clause 9.2.5.17.1 due to a given serving cell in FR2 also apply to another serving cell in an FR1 band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this FR1-FR2 band pair.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 serving cell frequency layer. However, the scheduling restrictions as defined in clause 9.2.5.17.1 due to a given serving cell in FR1 also apply to another serving cell in an FR2 band on the symbols that fully or partially overlap with the aforementioned restricted symbols, if UE does not have the capability of supporting *simultaneousRxTxInterBandCA* for this FR1-FR2 band pair.

9.18 L1 Cross Link Interference measurements

9.18.1 Introduction

The UE capable of performing L1 CLI measurements shall be able to measure L1-SRS-RSRP and L1-CLI-RSSI which are defined in TS 38.215 [4] within the active DL BWP. The measurements requirements in this clause apply for TDD mode only.

The L1 CLI measurement requirements specified in this clause are applicable only for RRC_CONNECTED intra-frequency:

- when L1-SRS-RSRP measurement resource is configured within active DL BWP
- when L1-CLI-RSSI measurement resource is configured within active DL BWP

The measurements shall be performed for a serving cell, including PCell, PSCell, or SCell, on the resources configured for L1-SRS-RSRP and L1-CLI-RSSI measurements within the active BWP.

For performing CLI measurements in FR2, UE can optionally be configured with CLI measurement resources containing an explicit indication of a TCI state providing a TypeD QCL source [26, TS 38.214]. If the TCI state is not configured, UE can assume the configured CLI measurement resources are QCL-ed with TypeD to one of the latest received PDSCH and the latest monitored CORESET.

The UE does not expect to be configured with L1-CLI-RSSI measurement resources and L1-SRS-RSRP measurement resources on the same symbol.

The measurement reporting delay can be longer for the measurement reporting requirements in this clause when IDC autonomous denial is configured.

9.18.2 L1-SRS-RSRP measurements

9.18.2.1 Introduction

When configured by the network, the UE shall be able to perform L1-SRS-RSRP measurements on the *SRS-RSRP-MeasurementResourceSet* configured in a *CSI-ResourceConfig*.

The requirements apply when the subcarrier spacing for SRS-RSRP measurement resource configuration is the same as the subcarrier spacing of the active DL BWP of serving cell. The UE is not required to measure SRS using different SCS compared to the downlink active BWP SCS of the same carrier.

When the UE measures L1-SRS-RSRP, a constant offset relative to the downlink reference timing in the serving cell shall be applied. The constant offset value is derived by UE implementation and shall be at least $Tc*N_{TA_offset}$.

9.18.2.2 Requirements applicability

The requirements in clause 9.18.2 apply, provided:

- SRS resources configured for L1-SRS-RSRP measurements are measurable.

An SRS resource configured for L1-SRS-RSRP shall be considered measurable when for each relevant SRS the following conditions are met:

- L1-SRS-RSRP related side conditions given in clauses 10.1.22.1 for FR1 and FR2 for a corresponding band,
- SRS_RP and SRS Ês/Iot according to Annex B.2.7 for a corresponding band.

9.18.2.3 Measurement Reporting Requirements

The UE shall send L1-SRS-RSRP reports only for report configurations configured for aperiodic report when *cli-SRS-RSRP* is configured.

The UE shall report the L1-SRS-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1 dB step size according to clause 10, if *nrofReportedCLImeasureResource* is configured to one. If *nrofReportedCLImeasureResource* is configured to be larger than one, the UE shall use differential L1-SRS-RSRP based reporting as defined in clause 10. The differential L1-SRS-RSRP is quantized to a 4-bit value with 2 dB step size. The mapping between the reported L1-SRS-RSRP value and the measured quantity is described in clause 10.

9.18.2.3.1 Aperiodic Reporting

Reported L1-SRS-RSRP measurements contained in aperiodic triggered L1-SRS-RSRP reports shall meet the requirements in clauses 10 for FR1 and 10 for FR2, respectively.

The UE shall only send aperiodic L1-SRS-RSRP measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-SRS-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.18.2.4 Measurement capability

The UE shall be capable of performing L1-SRS-RSRP measurements on the SRS resources configured for measurement, provided that the total number of L1-SRS-RSRP measurement resources for the UE does not exceed *maxNrofSRS-RSRP-MeasurementResources*.

9.18.2.5 L1-SRS-RSRP measurement period

The UE shall be capable of performing L1-SRS-RSRP measurement based on the configured SRS resource. For periodic and semi-persistent SRS resource, the UE shall be capable of reporting L1-SRS-RSRP measured over measurement period of $T_{L1_SRS_RSRP_measurement_period}$ for FR1 and FR2.

For the value of L1,

1> If UE does not support *supportSBFD* or SBFD is not configured by the network

2> L1 is not applicable

1> else if UE supports *supportSBFD* and SBFD is configured by the network

2> if UE is configured to report L1-SRS-RSRP for SBFD symbols

3> When DRX is not configured, L1 is the number of occasions of the L1-SRS-RSRP resource that are overlapping with non-SBFD symbols during $T_{L1\text{-}SRS\text{-}RSRP_measurement_period}$

3> When DRX is configured, L1 is the number of DRX cycles in which all occasions of the L1-SRS-RSRP resource are overlapping with non-SBFD symbols during $T_{L1\text{-}SRS\text{-}RSRP_measurement_period}$

2> if UE is configured to report L1-SRS-RSRP for non-SBFD symbols

3> When DRX is not configured, L1 is the number of occasions of the L1-SRS-RSRP resource that are overlapping with SBFD symbols, during $T_{L1\text{-}SRS\text{-}RSRP_measurement_period}$

3> When DRX is configured, L1 is the number of DRX cycles in which all occasions of the L1-SRS-RSRP resource are overlapping with SBFD symbols, during $T_{L1\text{-}SRS\text{-}RSRP_measurement_period}$

Table 9.18.2.5-1 Measurement period $T_{L1_SRS_RSRP_measurement_period}$

Configuration	$T_{L1_SRS_measurement_period}$ (ms)
No DRX	$Max(T_{Report}, (M+L1) \times T_{SRS})$
DRX cycle ≤ 320 ms	$Max(T_{Report}, Ceil(1.5 \times (M+L1)) \times max(T_{SRS}, T_{DRX}))$
DRX cycle > 320 ms	$(M+L1) \times T_{DRX}$
NOTE 1: T_{SRS} is SRS measurement periodicity configured *SRS-PeriodicityAndOffset*, and T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise.	

If the SRS resources configured for measurement are partially or fully overlapping with SMTC window, SSB or CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement or measurement gaps, requirements are not specified for $T_{L1_SRS_RSRP_measurement_period}$.

9.18.2.6 Scheduling availability of UE during L1-CLI measurements

Scheduling availability when the UE is performing L1-CLI measurements which are L1-SRS-RSRP and L1-CLI-RSSI are described in the following clause.

9.18.2.6.1 Scheduling availability of UE performing L1-SRS-RSRP measurement on FR1

The following scheduling restriction applies due to L1-SRS-RSRP measurements.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs L1-SRS-RSRP measurements, and on 1 data symbol before the OFDM symbol(s) used for L1-SRS-RSRP measurements for 15 kHz and 30 kHz subcarrier spacing.

- For the UE which does not support *L1-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbol(s) on which the UE performs L1-SRS-RSRP measurements, and on 1 data symbol before the OFDM symbol(s) used for L1-SRS-RSRP measurements for 15 kHz and 30 kHz subcarrier spacing.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs L1-SRS-RSRP measurement, and on 2 data symbols before the OFDM symbol(s) used for L1-SRS-RSRP measurements for 60 kHz subcarrier spacing.

- For the UE which does not support *L1-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs L1-SRS-RSRP measurement, and on 2 data symbols before the OFDM symbol(s) used for L1-SRS-RSRP measurements for 60 kHz subcarrier spacing.

When TDD intra-band carrier aggregation is configured, the scheduling restrictions on serving cell where CLI measurements are performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions on serving cell where CLI measurements are performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-SRS-RSRP measurement is performed is configured.

9.18.2.6.2 Scheduling availability of UE performing L1-SRS-RSRP measurement on FR2

The following scheduling restriction applies due to L1-SRS-RSRP measurements.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs L1-SRS-RSRP measurements, and on 1 data symbol before the OFDM symbol(s) used for L1-SRS-RSRP measurements for 60 kHz subcarrier spacing.

- For the UE which does not support *L1-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on the OFDM symbols on which the UE performs L1-SRS-RSRP measurements, and on 1 data symbol before the OFDM symbol(s) used for L1-SRS-RSRP measurements for 60 kHz subcarrier spacing.

- For the UE which supports *L1-SRS-RSRP-FDM_DL* but the SRS resources are not TypeD QCL-ed with PDCCH/PDSCH, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs L1-SRS-RSRP measurements, and on 1 data symbol before the OFDM symbol(s) used for L1-SRS-RSRP measurements for 60 kHz subcarrier spacing.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs L1-SRS-RSRP measurements, and on 2 data symbols before the OFDM symbol(s) used for L1-SRS-RSRP measurements for 120 kHz subcarrier spacing.

- For the UE which does not support *L1-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on the OFDM symbol(s) on which the UE performs L1-SRS-RSRP measurements, and on 2 data symbols before the OFDM symbol(s) used for L1-SRS-RSRP measurements for 120 kHz subcarrier spacing.

- For the UE which supports *L1-SRS-RSRP-FDM_DL* but the SRS resources are not TypeD QCL-ed with PDCCH/PDSCH, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on the OFDM symbols on which the UE performs L1-SRS-RSRP measurements, and on 2 data symbols before the OFDM symbol(s) used for SRS-RSRP measurements for 120 kHz subcarrier spacing.

When TDD intra-band carrier aggregation is configured, the scheduling restrictions on serving cell where L1-SRS-RSRP measurements are performed apply on all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to L1-SRS-RSRP measurement performed on FR2 serving cell(s) in different band(s), provided that UE is capable of independent beam management on this FR2 band pair.

9.18.3 L1-CLI-RSSI measurements

9.18.3.1 Introduction

When configured by the network, the UE shall be able to perform L1-CLI-RSSI measurement of configured *CLI-RSSI-MeasurementResourceSet*, and:

- UE measures L1-CLI-RSSI within one DL subband if one L1-CLI-RSSI measurement resource is configured within a DL subband or UE measures L1-CLI-RSSI within two DL subbands if one L1-CLI-RSSI measurement resource is configured across two DL subbands,

- UE measures L1-CLI-RSSI within UL subband if one L1-CLI-RSSI measurement resource is configured within a UL subband.

When the UE measures L1-CLI-RSSI, the downlink reference timing in the serving cell shall be applied.

9.18.3.2 Requirements applicability

The requirements in clause 9.18.3 apply, provided:

- The measurement resources configured for L1-CLI-RSSI measurements are measurable.

A measurement resource configured for L1-CLI-RSSI shall be considered measurable when for each relevant L1-CLI-RSSI resource the following conditions are met:

- L1-CLI-RSSI related side conditions given in clauses 10 for FR1 and FR2 for a corresponding band.

9.18.3.3 Measurement Reporting Requirements

The UE shall send L1-CLI-RSSI reports only for report configurations for periodical and aperiodic report when *cli-RSSI* is configured.

The UE shall report the L1-CLI-RSSI value as a 7-bit value in the range [-100, -25] dBm with 1 dB step size according to clause 10 if *nrofReportedCLIMeasureResources* is configured to one. If *nrofReportedCLIMeasureResources* is configured to be larger than one, the UE shall use differential L1-CLI-RSSI based reporting as defined in clause 10. The differential L1-CLI-RSSI is quantized to a 4-bit value with 2 dB step size. The mapping between the reported L1-CLI-RSSI value and the measured quantity is described in clause 10.

9.18.3.3.1 Periodic Reporting

Reported L1-CLI-RSSI measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.

The UE shall transmit the periodic L1-CLI-RSSI reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.18.3.3.2 Aperiodic Reporting

Reported L1-CLI-RSSI measurements contained in aperiodically triggered L1-CLI-RSSI measurement reports shall meet the requirements in clauses 10.

The UE shall only send aperiodic L1-CLI-RSSI measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-CLI-RSSI reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.18.3.4 Measurement capability

The UE shall be capable of performing L1-CLI-RSSI measurement based on the configured resource, provided that the maximum number of L1-CLI-RSSI measurement resources for the UE does not exceed *maxNrofCLI-RSSI-MeasurementResources*.

9.18.3.5 L1-CLI-RSSI measurement period

The UE capable of *supportL1-CLI-RSSI-Measurement* shall perform L1-CLI-RSSI measurement based on the configured L1-CLI-RSSI measurement resource. For periodic and semi-persistent L1-CLI-RSSI resource, the UE shall be capable of reporting L1-CLI-RSSI measured over measurement period of $T_{L1\text{-}CLI_RSSI_measurement_period}$ for FR1 and FR2.

For the value of L1,

1> If UE does not support *supportSBFD* or SBFD is not configured by the network

2> L1 is not applicable

1> else if UE supports *supportSBFD* and SBFD is configured by the network

2> if UE is configured to report L1- CLI-RSSI for SBFD symbols

3> When DRX is not configured, L1 is the number of occasions of the L1- CLI-RSSI resource that are overlapping with non-SBFD symbols during $T_{L1\text{-}CLI_RSSI_measurement_period}$

3> When DRX is configured, L1 is the number of DRX cycles in which all occasions of the L1- CLI-RSSI resource are overlapping with non-SBFD symbols during $T_{L1\text{-}CLI_RSSI_measurement_period}$

2> if UE is configured to report L1- CLI-RSSI for non-SBFD symbols

3> When DRX is not configured, L1 is the number of occasions of the L1- CLI-RSSI resource that are overlapping with SBFD symbols, during $T_{L1\text{-}CLI_RSSI_measurement_period}$

3> When DRX is configured, L1 is the number of DRX cycles in which all occasions of the L1- CLI-RSSI resource are overlapping with SBFD symbols, during $T_{L1\text{-}CLI_RSSI_measurement_period}$

Table 9.18.3.5-1 Measurement period $T_{L1\text{-}CLI_RSSI_measurement_period}$

Configuration	$T_{L1\text{-}CLI_RSSI\ measurement_period}$ (ms)
No DRX	$Max(T_{Report}, (M+L1)\ X\ T_{CLI\text{-}RSSI})$
DRX cycle ≤ 320ms	$Max(T_{Report}, Ceil(1.5\ X\ (M+L1))\ X\ max(T_{CLI\text{-}RSSI}, T_{DRX}))$
DRX cycle > 320ms	$(M+L1)\ X\ T_{DRX}$
NOTE 1: $T_{CLI\text{-}RSSI}$ is L1-CLI-RSSI measurement periodicity configured *RSSI-PeriodicityAndOffset*, and T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. NOTE 2: M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise.	

If the configured L1-CLI-RSSI measurement resources are partially or fully overlapping with SMTC window, SSB or CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement or measurement gaps, requirements are not specified for $T_{L1\text{-}CLI_RSSI_measurement_period}$.

9.18.3.6 Scheduling availability of UE during L1-CLI-RSSI measurements

Scheduling availability restrictions when the UE is performing L1-CLI-RSSI are described in the following clause.

9.18.3.6.1 Scheduling availability of UE performing L1-CLI-RSSI measurement on FR1

The following scheduling restriction applies due to the L1-CLI-RSSI measurement:

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs L1-CLI-RSSI measurements.

When TDD intra-band carrier aggregation is configured, the scheduling restrictions on serving cell where CLI measurements are performed apply on all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When intra-band non-contiguous carrier aggregation is configured for a UE indicating *intraBandNR-CA-non-collocated-r18* and if *nonCollocatedTypeNR-CA-r18* is not provided, there are no scheduling restrictions on FR1 serving cell(s) to be measured and configured on the non-contiguous CC(s) in the same band. Otherwise, the scheduling restrictions on serving cell where CLI measurements are performed apply on all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols if *nonCollocatedTypeNR-CA-r18* is provided.

When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-CLI-RSSI measurement is performed is configured.

9.18.3.6.2 Scheduling availability of UE performing L1-CLI-RSSI measurement on FR2

The following scheduling restriction applies due to the L1-CLI-RSSI measurement:

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs L1-CLI-RSSI measurements.

- The UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs L1-CLI-RSSI measurements when RSSI resources are not TypeD QCL-ed with PDCCH/PDSCH/CSI-RS.

When TDD intra-band carrier aggregation is configured, the scheduling restrictions on serving cell where CLI measurements are performed apply on all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to L1-CLI-RSSI measurement performed on FR2 serving cell(s) in different band(s).

10 Measurement Performance requirements

10.1 NR measurements

10.1.1 Introduction

The requirements in clause 10.1 apply as follows:

- intra-frequency requirements apply for PCell measurements in SA, NR-DC, or NE-DC operation mode,
- intra-frequency requirements apply for PSCell measurements in NR-DC or EN-DC operation mode,
- intra-frequency requirements apply for SCell measurements in SA operation mode with NR CA or any MR-DC operation mode with NR CA,
- inter-frequency requirements apply for non-serving cell measurements on NR carrier frequencies.
- inter-frequency requirements apply for measurements from one cell on a frequency compared to the measurement from another cell on a different frequency.

In the requirements of clause 10.1, the exceptions for side conditions apply as follows:

- for the UE capable of CA but not configured with any SCell, the applicable exceptions for side conditions are specified in annex B, clause B.3.2.1 for UE supporting CA in FR1, and clause B.3.2.3 for UE supporting CA in FR2, respectively;
- for the UE capable of CA and configured with at least one SCell, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.2 for UE configured with CA in FR1, and clause B.3.2.4 for UE supporting CA in FR2, respectively;
- for the UE capable of SUL but not configured with SUL, the applicable exceptions for side conditions are specified in annex B, clause B.3.4.1 for UE supporting SUL in FR1;
- for the UE capable of SUL and configured with at least one SUL, the applicable exceptions for side conditions are specified in annex B, clause B.3.4.2 for UE configured with SUL in FR1.

10.1.2 Intra-frequency RSRP accuracy requirements for FR1

10.1.2.1 Intra-frequency SS-RSRP accuracy requirements

10.1.2.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the accuracy requirements for absolute SS-RSRP in this clause apply to a cell on the same frequency as that of the serving cell in FR1. The accuracy requirements in this clause are also applicable when *highSpeedMeasFlag-r16* or *highSpeedMeasCA-Scell-r17* is configured.

The accuracy requirements in table 10.1.2.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for each relevant SSB.

Table 10.1.2.1.1-1: SS-RSRP Intra-frequency absolute accuracy in FR1

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range		
			NR operating band groups [Note 2]	Minimum Io	Maximum Io

dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.5	±9	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-70
±8	±11	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.2.1.2 Relative SS-RSRP Accuracy

The relative SS-RSRP accuracy is defined as the SS-RSRP measured from one cell compared to the SS-RSRP measured from another cell on the same frequency, or between any two SS-RSRP levels measured on the same cell in FR1. The accuracy requirements in this clause are also applicable when *highSpeedMeasFlag-r16* or *highSpeedMeasCA-Scell-r17* is configured.

The accuracy requirements in table 10.1.2.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for each relevant SSB.

Table 10.1.2.1.2-1: SS-RSRP Intra-frequency relative accuracy in FR1

Accuracy		Conditions			
Normal condition	Extreme condition	SSB $\hat{E}s/Iot$ Note 2	Io Note 1 range		
			NR operating band groups Note 4	Minimum Io	Maximum Io
dB	dB	dB		dBm / SCS_{SSB} dBm/$BW_{Channel}$	dBm/$BW_{Channel}$

				SCS_{SSB} = 15 kHz	**SCS_{SSB} = 30 kHz**		
±2	±3	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±3	±3	≥-6	Note 3	Note 3	Note 3	N/A	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.2.2 Void

10.1.2.3 Intra-frequency CSI-RSRP accuracy requirements

10.1.2.3.1 Absolute CSI-RSRP Accuracy

Unless otherwise specified, the requirements for absolute CSI-RSRP accuracy in this clause apply to a cell where the CSI-RS resources to be measured have the same center frequency as the CSI-RS resources indicated for measurement in the serving cell in FR1.

The accuracy requirements in table 10.1.2.3.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for each associated SSB.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.12 for a corresponding Band for each relevant CSI-RS to be measured.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3. The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.2.3.1-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for intra-frequency measurement is serving cell timing.

Table 10.1.2.3.1-1: CSI-RSRP Intra-frequency absolute accuracy in FR1

Accuracy		**Conditions**			
			Io [Note 1] range		
Normal condition	**Extreme condition**	**CSI-RS Ês/Iot**	**NR operating band groups [Note 2]**	**Minimum Io**	**Maximum Io**

dB	dB	dB		dBm / SCS_{CSI-RS}			dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±4.5	±9	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-70
±8	±11	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N	N/A	N/A	N/A	-70	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.2.3.2 Relative CSI-RSRP Accuracy

The relative CSI-RSRP accuracy is defined as the CSI-RSRP measured from one cell compared to the CSI-RSRP measured from another cell on the same center frequency, or between any two CSI-RSRP levels measured on the same cell in FR1.

The accuracy requirements in table 10.1.2.3.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for each associated SSB.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.12 for a corresponding Band for each relevant CSI-RS to be measured.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3. The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.2.3.2-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for intra-frequency measurement is serving cell timing.

Table 10.1.2.3.2-1: CSI-RSRP Intra-frequency relative accuracy in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS Ês/Iot Note 2	Io Note 1 range					
			NR operating band groups Note 4	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±2	±3	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50
±3	±3	≥-6	Note 3	Note 3	Note 3	Note 3	N/A	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.2B Intra-frequency RSRP accuracy requirements for FR1 for CA/DC Idle Mode Measurements

10.1.2B.1 Intra-frequency SS-RSRP accuracy requirements

The requirements in this clause are applicable for a UE:

- in state RRC_IDLE or RRC_INACTIVE
- that is synchronised to the cell that is measured.

The requirements are for absolute SS-RSRP accuracy.

10.1.2B.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute SS-RSRP accuracy in this clause apply to the serving cell in FR1.

The accuracy requirements in table 10.1.2B.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.1.2 for a corresponding Band for each relevant SSB.

Table 10.1.2B.1.1-1: SS-RSRP Intra-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±6	±10.5	≥-4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-70
±9.5	±12.5	≥-4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N	N/A	N/A	-70	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.2C Intra-frequency RSRP accuracy requirements for FR1 SAN

10.1.2C.1 Intra-frequency SS-RSRP accuracy requirements

10.1.2C.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute SS-RSRP accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR1.

The accuracy requirements in table 10.1.2C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.17 for a corresponding Band for each relevant SSB.

- Valid information for the SAN serving the target cell has been provided.

Table 10.1.2C.1.1-1: SS-RSRP Intra-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}_s/I_{ot}$	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.5	±9	≥-6	NR_FDD_SAB_FR1_A	-121	-118	N/A	-70
±8	±11	≥-6	NR_FDD_SAB_FR1_A	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2A.							

10.1.2C.1.2 Relative SS-RSRP Accuracy

The relative SS-RSRP accuracy is defined as the SS-RSRP measured from one cell compared to the SS-RSRP measured from another cell on the same frequency, or between any two SS-RSRP levels measured on the same cell in FR1.

The accuracy requirements in table 10.1.2C.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.17 for a corresponding Band for each relevant SSB.
- Valid information for the SAN serving the target cell has been provided.

Table 10.1.2C.1.2-1: SS-RSRP Intra-frequency relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}_s/I_{ot}$ [Note 2]	Io [Note 1] range				
			NR operating band groups [Note 4]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±2	±3	≥-3	NR_FDD_SAB_FR1_A	-121	-118	N/A	-50
±3	±3	≥-6	Note 3	Note 3	Note 3	N/A	Note 3
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB $\hat{E}_s/I_{ot}$ is the minimum SSB $\hat{E}_s/I_{ot}$ of the pair of cells to which the requirement applies. NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2A.							

10.1.3 Intra-frequency RSRP accuracy requirements for FR2

10.1.3.1 Intra-frequency SS-RSRP accuracy requirements

10.1.3.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute SS-RSRP accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in table 10.1.3.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.3.1.1-1: SS-RSRP Intra-frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 2] range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} [Note 1]		$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz	
±6	±9	≥-6	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival		N/A	-70
±8	±11		N/A		-70	-50

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.3.1.2 Relative SS-RSRP Accuracy

The relative SS-RSRP accuracy is defined as the SS-RSRP measured from one cell compared to the SS-RSRP measured from another cell on the same frequency, or between any two SS-RSRP levels measured on the same cell in FR2.

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.3.1.2-1: SS-RSRP Intra-frequency relative accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 2] range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} [Note 1]		$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz	
±6	±9	≥-6	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival		-50

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.

10.1.3.2 Void

10.1.3.3 Intra-frequency CSI-RSRP accuracy requirements

10.1.3.3.1 Absolute CSI-RSRP Accuracy

Unless otherwise specified, the requirements for absolute CSI-RSRP accuracy in this clause apply to a cell where the CSI-RS resources to be measured have the same center frequency as the CSI-RS resources indicated for measurement in the serving cell in FR2.

The accuracy requirements in table 10.1.3.3.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for each associated SSB(s).
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.12 for a corresponding Band for each relevant CSI-RS to be measured.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3. The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.3.3.1-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for intra-frequency measurement is serving cell timing.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.3.3.1-1: CSI-RSRP Intra-frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 1		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz	SCS_{CSI-RS} = 120 kHz		
±6	±9	≥-6	Same value as CSI-RS_RP in Table B.2.8-2, according to UE Power class, operating band and angle of arrival		N/A	-70
±8	±11		N/A		-70	-50
NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth. NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.						

10.1.3.3.2 Relative CSI-RSRP Accuracy

The relative CSI-RSRP accuracy is defined as the CSI-RSRP measured from one cell compared to the CSI-RSRP measured from another cell on the same center frequency, or between any two CSI-RSRP levels measured on the same cell in FR2.

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for each associated SSB(s).

- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.12 for a corresponding Band for each CSI-RS to be measured.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3. The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.3.3.2-1.

- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for intra-frequency measurement is serving cell timing.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.3.3.2-1: CSI-RSRP Intra-frequency relative accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS CSI-RS Note 1		dBm/BW Channel
			SCS CSI-RS = 60 kHz	SCS CSI-RS = 120 kHz	
±6	±9	≥-6	Same value as CSI-RS_RP in Table B.2.8-2, according to UE Power class, operating band and angle of arrival		-50

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of cells to which the requirement applies.

10.1.3B Intra-frequency RSRP accuracy requirements for FR2 for CA/DC Idle Mode Measurements

10.1.3B.1 Intra-frequency SS-RSRP accuracy requirements

The requirements in this clause are applicable for a UE:

- in state RRC_IDLE or RRC_INACTIVE

- that is synchronised to the cell that is measured.

The requirements are for absolute SS-RSRP accuracy.

10.1.3B.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute SS-RSRP accuracy in this clause apply to the serving cell in FR2.

The accuracy requirements in table 10.1.3B.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

- Conditions for intra-frequency measurements are fulfilled according to annex B.1.2 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.3B.1.1-1: SS-RSRP Intra-frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz		
±7.5	±10.5	≥-4	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	N/A	-70
±9.5	±12.5		N/A	-70	-50

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.3C Intra-frequency RSRP accuracy requirements for FR2-NTN

10.1.3C.1 Intra-frequency SS-RSRP accuracy requirements

10.1.3C.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute SS-RSRP accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR2-NTN.

The accuracy requirements in table 10.1.3C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.17 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.3C.1.1-1: SS-RSRP Intra-frequency absolute accuracy in FR2-NTN

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz		
±7	±10	≥-6	Same value as SSB_RP derived from annex B.2.17, according to UE VSAT type	N/A	-70
±9	±12		N/A	-70	-50

NOTE 1: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.3C.1.2 Relative SS-RSRP Accuracy

The relative SS-RSRP accuracy is defined as the SS-RSRP measured from one cell compared to the SS-RSRP measured from another cell on the same frequency, or between any two SS-RSRP levels measured on the same cell in FR2-NTN.

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.17 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.3C.1.2-1: SS-RSRP Intra-frequency relative accuracy in FR2-NTN

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±3	±6	≥-6	Same value as SSB_RP derived from annex B.2.17, according to UE VSAT type	-50

NOTE 1: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.

10.1.4 Inter-frequency RSRP accuracy requirements for FR1

10.1.4.1 Inter-frequency SS-RSRP accuracy requirements

10.1.4.1.1 Absolute SS-RSRP Accuracy in FR1

The requirements for absolute SS-RSRP accuracy in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell. The accuracy requirements in this clause are also applicable when *highSpeedMeasInterFreq-r17* is configured.

The accuracy requirements in table 10.1.4.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for each relevant SSB.

Table 10.1.4.1.1-1: SS-RSRP Inter-frequency Absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
			NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B,	-120.5	-117.5	N/A	-70

±4.5	±9	≥-6	NR_TDD_FR1_B				
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-70
±8	±11	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N	N/A	N/A	-70	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: Void
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.4.1.2 Relative SS-RSRP Accuracy in FR1

The relative SS-RSRP accuracy in inter-frequency case is defined as the RSRP measured from one cell on a frequency in FR1compared to the RSRP measured from another cell on a different frequency in FR1. The accuracy requirements in this clause are also applicable when *highSpeedMeasInterFreq-r17* is configured.

The accuracy requirements in Table 10.1.4.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27$ dB
- |Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1.4.1.2-1: SS-RSRP Inter-frequency relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
			NR_FDD_FR1_A, NR_TDD_FR1_A,	-121	-118	N/A	-50

±4.5	±6	≥-6	NR_SDL_FR1_A				
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies. NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.4.2 Void

10.1.4.3 Inter-frequency CSI-RSRP accuracy requirements

10.1.4.3.1 Absolute CSI-RSRP Accuracy in FR1

The requirements for absolute CSI-RSRP accuracy in this clause apply to a cell where the CSI-RS resources to be measured have the different center frequency as the CSI-RS resources indicated for measurement in the serving cell in FR1.

The accuracy requirements in table 10.1.4.3.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for each relevant SSB.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band for each relevant CSI-RS to be measured.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3. The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.4.3.1-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

Table 10.1.4.3.1-1: CSI-RSRP Inter-frequency Absolute accuracy in FR1

Accuracy		**Conditions**					
Normal condition	**Extreme condition**	**CSI-RS Ês/Iot**	**Io [Note 1] range**				
			NR operating band groups [Note 2]	**Minimum Io**			**Maximum Io**
dB	**dB**	**dB**		**dBm / SCS_{CSI-RS}**			**dBm/$BW_{Channel}$**	**dBm/$BW_{Channel}$**
				SCS_{CSI-RS} = 15 kHz	**SCS_{CSI-RS} = 30 kHz**	**SCS_{CSI-RS} = 60 kHz**		
			NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-70

±4.5	±9	≥-6	NR_FDD_FR1_B, NR_TDD_FR1_B,	-120.5	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-70
±8	±11	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N	N/A	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.								

10.1.4.3.2 Relative CSI-RSRP Accuracy in FR1

The relative CSI-RSRP accuracy in inter-frequency case is defined as the CSI-RSRP measured from one cell on a frequency in FR1compared to the CSI-RSRP measured from another cell on a different frequency in FR1.

The accuracy requirements in table 10.1.4.3.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for each relevant SSB.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band for each relevant CSI-RS to be measured.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3. The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.4.3.2-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.
  - NOTE: The reference measurement timing for one layer for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.
- $|CSI_RP1_{dBm} - CSI_RP2_{dBm}| \leq 27$ dB
- |Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1.4.3.2-1: CSI-RSRP Inter-frequency relative accuracy in FR1

Accuracy	Conditions

Normal condition	Extreme condition	CSI-RS Ês/Iot Note 2	Io Note 1 range					
			NR operating band groups Note 4	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±4.5	±6	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50
			NR_FDD_FR1_N	-113.5	-111.5	-108.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Void
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.4B Inter-frequency RSRP accuracy requirements for FR1 for CA/DC Idle Mode Measurements

10.1.4B.1 Inter-frequency SS-RSRP accuracy requirements

The requirements in this clause are applicable for a UE:

- in state RRC_IDLE or RRC_INACTIVE
- that is synchronised to the cell that is measured.

The requirements are for absolute SS-RSRP accuracy.

10.1.4B.1.1 Absolute SS-RSRP Accuracy in FR1

The requirements for absolute SS-RSRP accuracy in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.4B.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.1.3 for a corresponding Band for each relevant SSB.

Table 10.1.4B.1.1-1: SS-RSRP Inter-frequency Absolute accuracy in FR1

Accuracy		Conditions	
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range

			NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±6	±10.5	≥-4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-70
±9.5	±12.5	≥-4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N	N/A	N/A	-70	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: Void
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.4C Inter-frequency RSRP accuracy requirements for FR1 SAN

10.1.4C.1 Inter-frequency SS-RSRP accuracy requirements

10.1.4C.1.1 Absolute SS-RSRP Accuracy in FR1

The requirements for absolute SS-RSRP accuracy in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.4C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.18 for a corresponding Band for each relevant SSB.
- Valid information for the SAN serving the target cell has been provided.

Table 10.1.4C.1.1-1: SS-RSRP Inter-frequency Absolute accuracy in FR1

Accuracy	Conditions

Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.5	±9	≥-6	NR_FDD_SAB_FR1_A	-121	-118	N/A	-70
±8	±11	≥-6	NR_FDD_SAB_FR1_A	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: Void NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2A.							

10.1.4C.1.2 Relative SS-RSRP Accuracy in FR1

The relative SS-RSRP accuracy in inter-frequency case is defined as the RSRP measured from one cell on a frequency in FR1compared to the RSRP measured from another cell on a different frequency in FR1.

The accuracy requirements in Table 10.1.4C.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.18 for a corresponding Band for each relevant SSB.
- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27$ dB
- |Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1.4C.1.2-1: SS-RSRP Inter-frequency relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.5	±6	≥-6	NR_FDD_SAB_FR1_A	-121	-118	N/A	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies. NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2A							

10.1.5 Inter-frequency RSRP accuracy requirements for FR2

10.1.5.1 Inter-frequency SS-RSRP accuracy requirements

10.1.5.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute SS-RSRP accuracy in this clause apply to a cell on a frequency in FR2 that is on a different frequency than the serving cell.

The accuracy requirements in table 10.1.5.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.5.1.1-1: SS-RSRP Inter-frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1		$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz	
±6	±9	≥-4	Same value as SSB_RP in Table B.2.3-2, according to UE Power class, operating band and angle of arrival		N/A	-70
±8	±11		N/A		-70	-50

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.5.1.2 Relative SS-RSRP Accuracy

The relative SS-RSRP accuracy is defined as the SS-RSRP measured from one cell on a frequency in FR2 compared to the SS-RSRP measured from another cell on another frequency in FR2.

The accuracy requirements in table 10.1.5.1.2-1 are valid under the following conditions:

- Conditions defined in TS 38.101-2 [19] clause 7.3 for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for each relevant SSB.

-- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27dB$

- |Channel 1_Io -Channel 2_Io | ≤ 20 dB

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.5.1.2-1: SS-RSRP Inter-frequency relative accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz	
±6	±9	≥-4	Same value as SSB_RP in Table B.2.3-2, according to UE Power class, operating band and angle of arrival	-50

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.

10.1.5.2 Void

10.1.5.3 Inter-frequency CSI-RSRP accuracy requirements

10.1.5.3.1 Absolute CSI-RSRP Accuracy

Unless otherwise specified, the requirements for absolute CSI-RSRP accuracy in this clause apply to a cell on a frequency in FR2 where the CSI-RS resources to be measured have the different center frequency as the CSI-RS resources indicated for measurement in the serving cell.

The accuracy requirements in table 10.1.5.3.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for each relevant associated SSB.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band for each relevant CSI-RS to be measured.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3. The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.5.3.1-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.5.3.1-1: CSI-RSRP Inter-frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io [Note 2] range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} [Note 1]	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz / SCS_{CSI-RS} = 120 kHz		
±6	±9	≥-4	Same value as CSI_RP in Table B.2.9-2, according to UE Power class, operating band and angle of arrival	N/A	-70
±8	±11		N/A	-70	-50

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.5.3.2 Relative CSI-RSRP Accuracy

The relative CSI-RSRP accuracy in inter-frequency case is defined as the CSI-RSRP measured from one cell on a frequency in FR2 compared to the CSI-RSRP measured from another cell on another frequency in FR2.

The accuracy requirements in table 10.1.5.3.2-1 are valid under the following conditions:

- Conditions defined in TS 38.101-2 [19] clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for each relevant associated SSB.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band for each relevant CSI-RS to be measured.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3. The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.5.3.2-1.

- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

- $|CSI_RP1_{dBm} - CSI_RP2_{dBm}| \leq 27dB$

- |Channel 1_Io -Channel 2_Io | ≤ 20 dB

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.5.3.2-1: CSI-RSRP Inter-frequency relative accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 1		$dBm/BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz	SCS_{CSI-RS} = 120 kHz	
±6	±9	≥-4	Same value as CSI_RP in Table B.2.9-2, according to UE Power class, operating band and angle of arrival		-50

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of cells to which the requirement applies.

10.1.5B Inter-frequency RSRP accuracy requirements for FR2 for CA/DC Idle Mode Measurements

10.1.5B.1 Inter-frequency SS-RSRP accuracy requirements

The requirements in this clause are applicable for a UE:

- in state RRC_IDLE or RRC_INACTIVE

- that is synchronised to the cell that is measured.

The requirements are for absolute SS-RSRP accuracy.

10.1.5B.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute SS-RSRP accuracy in this clause apply to a cell on a frequency in FR2 that is on a different frequency than the serving cell.

The accuracy requirements in table 10.1.5B.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to annex B.1.3 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.5B.1.1-1: SS-RSRP Inter-frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz		
±7.5	±10.5	≥-4	Same value as SSB_RP in Table B.2.3-2, according to UE Power class, operating band and angle of arrival	N/A	-70
±9.5	±12.5		N/A	-70	-50

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.5C Inter-frequency RSRP accuracy requirements for FR2-NTN

10.1.5C.1 Inter-frequency SS-RSRP accuracy requirements

10.1.5C.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute SS-RSRP accuracy in this clause apply to a cell on a frequency in FR2-NTN that is on a different frequency than the serving cell.

The accuracy requirements in table 10.1.5C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.18 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.5C.1.1-1: SS-RSRP Inter-frequency absolute accuracy in FR2-NTN

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz		
±7	±10	≥-4	Same value as SSB_RP derived from annex B.2.18, according to UE VSAT type	N/A	-70
±9	±12		N/A	-70	-50

NOTE 1: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.5C.1.2 Relative SS-RSRP Accuracy

The relative SS-RSRP accuracy is defined as the SS-RSRP measured from one cell on a frequency in FR2-NTN compared to the SS-RSRP measured from another cell on another frequency in FR2-NTN.

The accuracy requirements in table 10.1.5C.1.2-1 are valid under the following conditions:

- Conditions defined in 38.101-5 [19] clause 10.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.18 for a corresponding Band for each relevant SSB.
- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27dB$
- |Channel 1_Io -Channel 2_Io | ≤ 20 dB
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.5C.1.2-1: SS-RSRP Inter-frequency relative accuracy in FR2-NTN

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz | SCS_{SSB} = 240 kHz	
±7	±10	≥-4	Same value as SSB_RP derived from annex B.2.18, according to UE VSAT type	-50

NOTE 1: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.

10.1.6 RSRP Measurement Report Mapping

The reporting range of SS-RSRP and CSI-RSRP for L3 reporting is defined from -156 dBm to -31 dBm with 1 dB resolution. The reporting range of SS-RSRP and CSI-RSRP for L1 reporting is defined from -140 to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in table 10.1.6.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

The reporting range of differential SS-RSRP and CSI-RSRP for L1 reporting is defined from 0 dB to -30 dB with 2 dB resolution.

The mapping of measured quantity is defined in table 10.1.6.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.6.1-1: SS-RSRP and CSI-RSRP measurement report mapping

Reported value	Measured quantity value (L3 SS-RSRP) and CSI-RSRP	Measured quantity value (L1 SS-RSRP and CSI-RSRP)	Unit
RSRP_0	SS-RSRP<-156	Not valid	dBm
RSRP_1	-156≤ SS-RSRP<-155	Not valid	dBm
RSRP_2	-155≤ SS-RSRP<-154	Not valid	dBm
RSRP_3	-154≤ SS-RSRP<-153	Not valid	dBm
RSRP_4	-153≤ SS-RSRP<-152	Not valid	dBm
RSRP_5	-152≤ SS-RSRP<-151	Not valid	dBm
RSRP_6	-151≤ SS-RSRP<-150	Not valid	dBm
RSRP_7	-150≤ SS-RSRP<-149	Not valid	dBm
RSRP_8	-149≤ SS-RSRP<-148	Not valid	dBm

RSRP_9	-148≤ SS-RSRP<-147	Not valid	dBm
RSRP_10	-147≤ SS-RSRP<-146	Not valid	dBm
RSRP_11	-146≤ SS-RSRP<-145	Not valid	dBm
RSRP_12	-145≤ SS-RSRP<-144	Not valid	dBm
RSRP_13	-144≤ SS-RSRP<-143	Not valid	dBm
RSRP_14	-143≤ SS-RSRP<-142	Not valid	dBm
RSRP_15	-142≤ SS-RSRP<-141	Not valid	dBm
RSRP_16	-141≤ SS-RSRP<-140	RSRP<-140	dBm
RSRP_17	-140≤ SS-RSRP<-139	-140≤RSRP<-139	dBm
RSRP_18	-139≤ SS-RSRP<-138	-139≤ RSRP<-138	dBm
…	…		…
RSRP_111	-46≤≤ SS-RSRP<-45	-46≤ RSRP<-45	dBm
RSRP_112	-45≤ SS-RSRP<-44	-45≤ RSRP<-44	dBm
RSRP_113	-44≤ SS-RSRP<-43	-44≤ RSRP	dBm
RSRP_114	-43≤ SS-RSRP<-42	Not valid	dBm
RSRP_115	-42≤ SS-RSRP<-41	Not valid	dBm
RSRP_116	-41≤ SS-RSRP<-40	Not valid	dBm
RSRP_117	-40≤ SS-RSRP<-39	Not valid	dBm
RSRP_118	-39≤ SS-RSRP<-38	Not valid	dBm
RSRP_119	-38≤ SS-RSRP<-37	Not valid	dBm
RSRP_120	-37≤ SS-RSRP<-36	Not valid	dBm
RSRP_121	-36≤ SS-RSRP<-35	Not valid	dBm
RSRP_122	-35≤ SS-RSRP<-34	Not valid	dBm
RSRP_123	-34≤ SS-RSRP<-33	Not valid	dBm
RSRP_124	-33≤ SS-RSRP<-32	Not valid	dBm
RSRP_125	-32≤ SS-RSRP<-31	Not valid	dBm
RSRP_126	-31≤ SS-RSRP	Not valid	dBm
RSRP_127 (Note)	Infinity	Infinity	dBm
NOTE: The value of RSRP_127 is applicable for RSRP threshold configured by the network as defined in TS 38.331 [2], but not for the purpose of measurement reporting.			

Table 10.1.6.1-2: Differential SS-RSRP and CSI-RSRP measurement (for L1 reporting) report mapping

Reported value	Measured quantity value (difference in measured RSRP from strongest RSRP)	Unit
DIFFRSRP_0	0≥ΔRSRP>-2	dB
DIFFRSRP_1	-2≥ΔRSRP>-4	dB
DIFFRSRP_2	-4≥ΔRSRP>-6	dB
DIFFRSRP_3	-6≥ΔRSRP>-8	dB
DIFFRSRP_4	-8≥ΔRSRP>-10	dB
DIFFRSRP_5	-10≥ΔRSRP>-12	dB
DIFFRSRP_6	-12≥ΔRSRP>-14	dB
DIFFRSRP_7	-14≥ΔRSRP>-16	dB
DIFFRSRP_8	-16≥ΔRSRP>-18	dB
DIFFRSRP_9	-18≥ΔRSRP>-20	dB
DIFFRSRP_10	-20≥ΔRSRP>-22	dB
DIFFRSRP_11	-22≥ΔRSRP>-24	dB
DIFFRSRP_12	-24≥ΔRSRP>-26	dB
DIFFRSRP_13	-26≥ΔRSRP>-28	dB
DIFFRSRP_14	-28≥ΔRSRP>-30	dB
DIFFRSRP_15	-30≥ΔRSRP	dB

10.1.7 Intra-frequency RSRQ accuracy requirements for FR1

10.1.7.1 Intra-frequency SS-RSRQ accuracy requirements in FR1

10.1.7.1.1 Absolute SS-RSRQ Accuracy in FR1

Unless otherwise specified, the requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR1. The accuracy requirements in this clause are also applicable when *highSpeedMeasFlag-r16* or *highSpeedMeasCA-Scell-r17* is configured.

The accuracy requirements in table 10.1.7.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for each relevant SSB.

Table 10.1.7.1.1-1: SS-RSRQ Intra-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}_s/I_{ot}$	Io [Note 1] range				
			NR operating band groups [Note 3]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±2.5	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.7.2 Intra-frequency CSI-RSRQ accuracy requirements

10.1.7.2.1 Absolute CSI-RSRQ Accuracy

Unless otherwise specified, the requirements for absolute CSI-RSRQ accuracy in this clause apply to the intra-frequency measurement defined in clause 9.10.2.1 in FR1.

The accuracy requirements in table 10.1.7.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for associated SSB.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.12 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
  - The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.7.2.1-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for intra-frequency measurement is serving cell timing.

Table 10.1.7.2.1-1: CSI-RSRQ Intra-frequency absolute accuracy in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 1 range					
			NR operating band groups Note 3	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±2.5	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.7B Intra-frequency RSRQ accuracy requirements for FR1 for CA/DC Idle Mode Measurements

10.1.7B.1 Intra-frequency SS-RSRQ accuracy requirements in FR1

The requirements in this clause are applicable for a UE:

- in state RRC_IDLE or RRC_INACTIVE
- that is synchronised to the cell that is measured.

The requirements are for absolute SS-RSRQ accuracy.

10.1.7B.1.1 Absolute SS-RSRQ Accuracy in FR1

Unless otherwise specified, the requirements for absolute SS-RSRQ accuracy in this clause apply to the serving cell in FR1.

The accuracy requirements in table 10.1.7B.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.1.2 for a corresponding Band for each relevant SSB.

Table 10.1.7B.1.1-1: SS-RSRQ Intra-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 3]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4	±5.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±5	±5.5	≥-4	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.7C Intra-frequency RSRQ accuracy requirements for FR1 SAN

10.1.7C.1 Intra-frequency SS-RSRQ accuracy requirements in FR1

10.1.7C.1.1 Absolute SS-RSRQ Accuracy in FR1

Unless otherwise specified, the requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR1.

The accuracy requirements in table 10.1.7C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.17 for a corresponding Band for each relevant SSB.
- Valid information for the SAN serving the target cell has been provided.

Table 10.1.7C.1.1-1: SS-RSRQ Intra-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 3]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±2.5	±4	≥-3	NR_FDD_SAB_FR1_A	-121	-118	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2A

10.1.8 Intra-frequency RSRQ accuracy requirements for FR2

10.1.8.1 Intra-frequency SS-RSRQ accuracy requirements in FR2

10.1.8.1.1 Absolute SS-RSRQ Accuracy in FR2

Unless otherwise specified, the requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in table 10.1.8.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.8.1.1-1: SS-RSRQ Intra-frequency absolute accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 2] range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} [Note 1]	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz | SCS_{SSB} = 240 kHz	
±2.5	±4	≥-3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	-50
±3.5	±4	≥-6		

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.8.2 Intra-frequency CSI-RSRQ accuracy requirements

10.1.8.2.1 Absolute CSI-RSRQ Accuracy

Unless otherwise specified, the requirements for absolute CSI-RSRQ accuracy in this clause apply to the intra-frequency measurement defined in clause 9.10.2.1 in FR2.

The accuracy requirements in table 10.1.8.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band for each relevant SSB.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.12 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
  - The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.8.2.1-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for intra-frequency measurement is serving cell timing.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.8.2.1-1: CSI-RSRQ Intra-frequency absolute accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 2 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 1	dBm/$BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz / SCS_{CSI-RS} = 120 kHz	
±2.5	±4	≥-3	Same value as CSI_RP in Table B.2.8-2, according to UE Power class, operating band and angle of arrival	-50
±3.5	±4	≥-6		

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.8B Intra-frequency RSRQ accuracy requirements for FR2 for CA/DC Idle Mode Measurements

10.1.8B.1 Intra-frequency SS-RSRQ accuracy requirements in FR2

The requirements in this clause are applicable for a UE:

- in state RRC_IDLE or RRC_INACTIVE
- that is synchronised to the cell that is measured.

The requirements are for absolute SS-RSRQ accuracy.

10.1.8B.1.1 Absolute SS-RSRQ Accuracy in FR2

Unless otherwise specified, the requirements for absolute SS-RSRQ accuracy in this clause apply to the serving cell in FR2.

The accuracy requirements in table 10.1.8B.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

- Conditions for intra-frequency measurements are fulfilled according to annex B.1.2 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.8B.1.1-1: SS-RSRQ Intra-frequency absolute accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±4	±5.5	≥-3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	-50
±5	±5.5	≥-4		

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.8C Intra-frequency RSRQ accuracy requirements for FR2-NTN

10.1.8C.1 Intra-frequency SS-RSRQ accuracy requirements in FR2-NTN

10.1.8C.1.1 Absolute SS-RSRQ Accuracy in FR2-NTN

Unless otherwise specified, the requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR2-NTN.

The accuracy requirements in table 10.1.8C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.

- Conditions for intra-frequency measurements are fulfilled according to annex B.2.17 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.8C.1.1-1: SS-RSRQ Intra-frequency absolute accuracy in FR2-NTN

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±3.5	±5	≥-3	Same value as SSB_RP derived from annex B.2.17, according to UE VSAT type	-50
±4.5	±5	≥-6		

NOTE 1: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.9 Inter-frequency RSRQ accuracy requirements for FR1

10.1.9.1 Inter-frequency SS-RSRQ accuracy requirements in FR1

10.1.9.1.1 Absolute SS-RSRQ Accuracy in FR1

The requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell. The accuracy requirements in this clause are also applicable when *highSpeedMeasInterFreq-r17* is configured.

The accuracy requirements in table 10.1.9.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for each relevant SSB.

Table 10.1.9.1.1-1: SS-RSRQ Inter-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}_s/I_{ot}$	Io [Note 1] range				
			NR operating band groups [Note 3]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±2.5	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.9.1.2 Relative SS-RSRQ Accuracy in FR1

The relative SS-RSRQ accuracy in inter-frequency case is defined as the RSRQ measured from one cell on a frequency in FR1 compared to the RSRP measured from another cell on a different frequency in FR1. The accuracy requirements in this clause are also applicable when *highSpeedMeasInterFreq-r17* is configured.

The accuracy requirements in table 10.1.9.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for each relevant SSB.

- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27$ dB
- |Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1.9.1.2-1: SS-RSRQ Inter-frequency relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±4	±4	≥-6	Note 3	Note 3	Note 3	Note 3	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.9.2 Inter-frequency CSI-RSRQ accuracy requirements

10.1.9.2.1 Absolute CSI-RSRQ Accuracy

Unless otherwise specified, the requirements for absolute CSI-RSRQ accuracy in this clause apply to the inter-frequency measurement defined in clause 9.10.3.1 in FR1.

The accuracy requirements in table 10.1.9.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for associated SSB.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
    - The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.9.2.1-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

Table 10.1.9.2.1-1: CSI-RSRQ Inter-frequency absolute accuracy in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io [Note 1] range					
			NR operating band groups [Note 3]	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±2.5	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.9.2.2 Relative CSI-RSRQ Accuracy

The relative CSI-RSRQ accuracy is defined as the CSI-RSRQ measured from one cell compared to the CSI-RSRQ measured from another cell with the same center frequency, or between any two CSI-RSRQ levels measured on the same cell in FR1.

The accuracy requirements in table 10.1.9.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for the associated SSB.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
  - The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.9.2.2-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

Table 10.1.9.2.2-1: CSI-RSRQ Inter-frequency relative accuracy in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS Ês/Iot Note 2	Io Note 1 range					
			NR operating band groups Note 4	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±3	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50
±4	±4	≥-6	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.9B Inter-frequency RSRQ accuracy requirements for FR1 for CA/DC Idle Mode Measurements

10.1.9B.1 Inter-frequency SS-RSRQ accuracy requirements in FR1

The requirements in this clause are applicable for a UE:

- in state RRC_IDLE or RRC_INACTIVE
- that is synchronised to the cell that is measured.

The requirements are for absolute SS-RSRQ accuracy.

10.1.9B.1.1 Absolute SS-RSRQ Accuracy in FR1

The requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.9B.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.1.3 for a corresponding Band for each relevant SSB.

Table 10.1.9B.1.1-1: SS-RSRQ Inter-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 3]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4	±5.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±5	±5.5	≥-4	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2A.

10.1.9C Inter-frequency RSRQ accuracy requirements for FR1 SAN

10.1.9C.1 Inter-frequency SS-RSRQ accuracy requirements in FR1

10.1.9C.1.1 Absolute SS-RSRQ Accuracy in FR1

The requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.9C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.18 for a corresponding Band for each relevant SSB.
- Valid information for the SAN serving the target cell has been provided.

Table 10.1.9C.1.1-1: SS-RSRQ Inter-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 3]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±2.5	±4	≥-3	NR_FDD_SAB_FR1_A	-121	-118	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.9C.1.2 Relative SS-RSRQ Accuracy in FR1

The relative SS-RSRQ accuracy in inter-frequency case is defined as the RSRQ measured from one cell on a frequency in FR1 compared to the RSRP measured from another cell on a different frequency in FR1.

The accuracy requirements in table 10.1.9C.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.18 for a corresponding Band for each relevant SSB.
- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27$ dB
- $|Channel\ 1_Io - Channel\ 2_Io| \leq 20$ dB
- Valid information for the SAN serving the target cell has been provided.

Table 10.1.9C.1.2-1: SS-RSRQ Inter-frequency relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3	±4	≥-3	NR_FDD_SAB_FR1_A	-121	-118	N/A	-50
±4	±4	≥-6	Note 3	Note 3	Note 3	Note 3	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2A.

10.1.10 Inter-frequency RSRQ accuracy requirements for FR2

10.1.10.1 Inter-frequency SS-RSRQ accuracy requirements in FR2

10.1.10.1.1 Absolute SS-RSRQ Accuracy in FR2

The requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.10.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.10.1.1-1: SS-RSRQ Inter-frequency absolute accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 2] range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} [Note 1]	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±2.5	±4	≥-3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	-50
±3.5	±4	≥-4		

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.10.1.2 Relative SS-RSRQ Accuracy in FR2

The relative SS-RSRQ accuracy in inter-frequency case is defined as the RSRQ measured from one cell on a frequency in FR2 compared to the RSRP measured from another cell on a different frequency in FR2.

The accuracy requirements in table 10.1.10.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for each relevant SSB.
- $|SSB_RP1\ dB_m - SSB_RP2\ dB_m| \leq 27$ dB
- $|$ Channel 1_Io -Channel 2_Io $| \leq 20$ dB
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.10.1.2-1: SS-RSRQ Inter-frequency relative accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 2] range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} [Note 1]	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±3	±4	≥-3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	-50
±4	±4	≥-4		

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.10.2 Inter-frequency CSI-RSRQ accuracy requirements

10.1.10.2.1 Absolute CSI-RSRQ Accuracy

Unless otherwise specified, the requirements for absolute CSI-RSRQ accuracy in this clause apply the inter-frequency measurement defined in clause 9.10.3.1 in FR2.

The accuracy requirements in table 10.1.10.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for associated SSB.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
  - The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.10.2.1-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

Table 10.1.10.2.1-1: CSI-RSRQ Inter-frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 1		$dBm/BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz	SCS_{CSI-RS} = 120 kHz	
±2.5	±4	≥-3	Same value as CSI_RP in Table B.2.9-2, according to UE Power class, operating band and angle of arrival		-50
±3.5	±4	≥-4			

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.10.2.2 Relative CSI-RSRQ Accuracy

The relative CSI-RSRQ accuracy is defined as the CSI-RSRQ measured from one cell compared to the CSI-RSRQ measured from another cell with the same center frequency, or between any two CSI-RSRQ levels measured on the same cell in FR2.

The accuracy requirements in table 10.1.10.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band for the associated SSB.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
  - The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.10.2.2-1.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for one layer for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

Table 10.1.10.2.2-1: CSI-RSRQ Inter-frequency relative accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io [Note 2] range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} [Note 1]	dBm/$BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz / SCS_{CSI-RS} = 120 kHz	
±3	±4	≥-3	Same value as CSI_RP in Table B.2.9-2, according to UE Power class, operating band and angle of arrival	-50
±4	±4	≥-4		

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of cells to which the requirement applies.
NOTE 4: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.10B Inter-frequency RSRQ accuracy requirements for FR2 for CA/DC Idle Mode Measurements

10.1.10B.1 Inter-frequency SS-RSRQ accuracy requirements in FR2

The requirements in this clause are applicable for a UE:

- in state RRC_IDLE or RRC_INACTIVE
- that is synchronised to the cell that is measured.

The requirements are for absolute SS-RSRQ accuracy.

10.1.10B.1.1 Absolute SS-RSRQ Accuracy in FR2

The requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.10B.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.1.3 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.10B.1.1-1: SS-RSRQ Inter-frequency absolute accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 2] range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} [Note 1]	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±4	±5.5	≥-3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	-50

±5	±5.5	≥-4		

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.10C Inter-frequency RSRQ accuracy requirements for FR2-NTN

10.1.10C.1 Inter-frequency SS-RSRQ accuracy requirements in FR2-NTN

10.1.10C.1.1 Absolute SS-RSRQ Accuracy in FR2-NTN

The requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on a frequency in FR2-NTN that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.10C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.18 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.10C.1.1-1: SS-RSRQ Inter-frequency absolute accuracy in FR2-NTN

Accuracy		**Conditions**		
Normal condition	**Extreme condition**	**SSB Ês/Iot**	**Io [Note 2] range**	
			Minimum Io	**Maximum Io**
dB	**dB**	**dB**	**dBm / SCS_{SSB} [Note 1]**	**dBm/$BW_{Channel}$**
			SCS_{SSB} = 120 kHz / **SCS_{SSB} = 240 kHz**	
±3.5	±5	≥-3	Same value as SSB_RP derived from annex B.2.18, according to UE VSAT type	-50
±4.5	±5	≥-4		

NOTE 1: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.10C.1.2 Relative SS-RSRQ Accuracy in FR2-NTN

The relative SS-RSRQ accuracy in inter-frequency case is defined as the RSRQ measured from one cell on a frequency in FR2-NTN compared to the RSRP measured from another cell on a different frequency in FR2-NTN.

The accuracy requirements in table 10.1.10C.1.2-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.18 for a corresponding Band for each relevant SSB.
- $|SSB_RP1\ dB_m - SSB_RP2\ dB_m| \leq 27$ dB
- $|$ Channel 1_Io -Channel 2_Io $| \leq 20$ dB
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.10C.1.2-1: SS-RSRQ Inter-frequency relative accuracy in FR2-NTN

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±4	±5	≥-3	Same value as SSB_RP derived from annex B.2.18, according to UE VSAT type	-50
±5	±5	≥-4		

NOTE 1: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.11 RSRQ report mapping

10.1.11.1 SS-RSRQ and CSI-RSRQ measurement report mapping

The reporting range of SS-RSRQ and CSI-RSRQ measurement is defined from -43 dB to 20 dB with 0.5 dB resolution. The mapping of measured quantity is defined in table 10.1.11.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.11.1-1: SS-RSRQ and CSI-RSRQ measurement report mapping

Reported value	Measured quantity value	Unit
SS-RSRQ_0	SS-RSRQ<-43	dB
SS-RSRQ_1	-43≤ SS-RSRQ<-42.5	dB
SS-RSRQ_2	-42.5≤ SS-RSRQ<-42	dB
SS-RSRQ_3	-42≤ SS-RSRQ<-41.5	dB
SS-RSRQ_4	-41.5≤ SS-RSRQ<-41	dB
..	..	…
SS-RSRQ_122	17.5≤ SS-RSRQ<18	dB
SS-RSRQ_123	18≤ SS-RSRQ<18.5	dB
SS-RSRQ_124	18.5≤ SS-RSRQ<19	dB
SS-RSRQ_125	19≤ SS-RSRQ<19.5	dB
SS-RSRQ_126	19.5≤ SS-RSRQ<20	dB
SS-RSRQ_127	20 ≤ SS-RSRQ	dB

10.1.12 Intra-frequency SINR accuracy requirements for FR1

10.1.12.1 Intra-frequency SS-SINR accuracy requirements in FR1

10.1.12.1.1 Absolute SS-SINR Accuracy in FR1

Unless otherwise specified, the requirements for absolute SS-SINR accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR1.

The accuracy requirements in table 10.1.12.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band.

Table 10.1.12.1.1-1: SS-SINR Intra-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 3	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3.0	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ 25 dB under non-HST scenarios.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: The requirements apply for SSB Ês/Iot ≤5 dB with SCS 15kHz or 30kHz under NR high speed scenarios.

10.1.12.2 Intra-frequency CSI-SINR accuracy requirements in FR1

10.1.12.2.1 Absolute CSI-SINR Accuracy in FR1

Unless otherwise specified, the requirements for absolute CSI-SINR accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR1.

The accuracy requirements in table 10.1.12.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.12 for a corresponding Band.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.
  - NOTE: The reference measurement timing for intra-frequency measurement is serving cell timing.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
  - The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.12.2.1-1.

Table 10.1.12.2.1-1: CSI-SINR Intra-frequency absolute accuracy in FR1

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 1 range		
			NR operating band groups	Minimum Io	Maximum Io

dB	dB	dB		dBm / SCS SCS (kHz)			dBm/BW Channel	dBm/BW Channel
				15	30	60		
±3	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-70
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	N/A	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 4: The requirements apply for CSI-RS Ês/Iot ≤XdB. X=15 if timing offset between the reference measurement timing and the target CSI-RS is no larger than 0.5*CP, and X=4 if timing offset between the reference measurement timing and the target CSI-RS is larger than 0.5*CP but no larger than CP.

10.1.12C Intra-frequency SINR accuracy requirements for FR1 SAN

10.1.12C.1 Intra-frequency SS-SINR accuracy requirements in FR1

10.1.12C.1.1 Absolute SS-SINR Accuracy in FR1

Unless otherwise specified, the requirements for absolute SS-SINR accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR1.

The accuracy requirements in table 10.1.12C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.17 for a corresponding Band.
- Valid information for the SAN serving the target cell has been provided.

Table 10.1.12C.1.1-1: SS-SINR Intra-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 3	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3	±4	≥-3	NR_FDD_SAB_FR1_A	-121	-118	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ 25 dB under non-HST scenarios.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2A.

NOTE 5: The requirements apply for SSB Ês/Iot ≤5 dB with SCS 15kHz or 30kHz under NR high speed scenarios.

10.1.13 Intra-frequency SINR accuracy requirements for FR2

10.1.13.1 Intra-frequency SS-SINR accuracy requirements in FR2

10.1.13.1.1 Absolute SS-SINR Accuracy in FR2

Unless otherwise specified, the requirements for absolute SS-SINR accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in table 10.1.13.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.2 for a corresponding Band.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.13.1.1-1: SS-SINR Intra-frequency absolute accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 2] range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} [Note 1]	$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±3	±4	≥-3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	-50
±3.5	±4	≥-6		

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The requirements apply for SSB Ês/Iot ≤ 25 dB.

10.1.13.2 Intra-frequency CSI-SINR accuracy requirements in FR2

10.1.13.2.1 Absolute CSI-SINR Accuracy in FR2

Unless otherwise specified, the requirements for absolute CSI-SINR accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in table 10.1.13.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.12 for a corresponding Band.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.
  - NOTE: The reference measurement timing for intra-frequency measurement is serving cell timing.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

- The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.13.2.1-1.

Table 10.1.13.2.1-1: CSI-SINR Intra-frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io [Note 2] range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} [Note 1]		$dBm/BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz	SCS_{CSI-RS} = 120 kHz	
±3	±4	≥-3	Same value as CSI_RP in Table B.2.8-2, according to UE Power class, operating band and angle of arrival		-50
±3.5	±4	≥-6			

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The requirements apply for CSI-RS Ês/Iot ≤XdB. X=15 if timing offset between the reference measurement timing and the target CSI-RS is no larger than 0.5*CP, and X=4 if timing offset between the reference measurement timing and the target CSI-RS is larger than 0.5*CP but no larger than CP.

10.1.13C Intra-frequency SINR accuracy requirements for FR2-NTN

10.1.13C.1 Intra-frequency SS-SINR accuracy requirements in FR2-NTN

10.1.13C.1.1 Absolute SS-SINR Accuracy in FR2-NTN

Unless otherwise specified, the requirements for absolute SS-SINR accuracy in this clause apply to a cell on the same frequency as that of the serving cell in FR2-NTN.

The accuracy requirements in table 10.1.13C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.17 for a corresponding Band.
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.13C.1.1-1: SS-SINR Intra-frequency absolute accuracy in FR2-NTN

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 2] range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} [Note 1]		$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz	
±4	±5	≥-3	Same value as SSB_RP derived from annex B.2.17, according to UE VSAT type		-50
±4.5	±5	≥-6			

NOTE 1: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The requirements apply for SSB Ês/Iot ≤ 25 dB

10.1.14 Inter-frequency SINR accuracy requirements for FR1

10.1.14.1 Inter-frequency SS-SINR accuracy requirements in FR1

10.1.14.1.1 Absolute SS-SINR Accuracy in FR1

The requirements for absolute SS-SINR accuracy in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.14.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band.

Table 10.1.14.1.1-1: SS-SINR Inter-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 3	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3.0	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ 25 dB.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: The requirements apply for SSB Ês/Iot ≤ 5 dB with SCS 15kHz or 30kHz under NR high speed scenarios.

10.1.14.1.2 Relative SS-SINR Accuracy in FR1

The relative SS-SINR accuracy in inter-frequency case is defined as the SS-SINR measured from one cell on a frequency in FR1 compared to the SS-SINR measured from another cell on a different frequency in FR1.

The accuracy requirements in table 10.1.14.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band.
- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27$ dB

- | Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1.14.1.2-1: SS-SINR Inter-frequency relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2,4	Io Note 1 range				
			NR operating band groups Note 5	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz		
±3.5	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±4	±4	≥-6	Note 3	Note 3	Note 3	Note 3	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: The requirements apply for SSB Ês/Iot ≤ 25 dB.
NOTE 5: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 6: The requirements apply for SSB Ês/Iot ≤ 5 dB with SCS 15kHz or 30kHz under NR high speed scenarios.

10.1.14.2 Inter-frequency CSI-SINR accuracy requirements in FR1

10.1.14.2.1 Absolute CSI-SINR Accuracy in FR1

The requirements for absolute CSI-SINR accuracy in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.14.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band.
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

  Note: The reference measurement timing for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
  - The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.14.2.1-1.

Table 10.1.14.2.1-1: CSI-SINR Inter-frequency absolute accuracy in FR1

Accuracy		Conditions						
			Io [Note 1] range					
Normal condition	Extreme condition	CSI-RS Ês/Iot	NR operating band groups	Minimum Io				Maximum Io
				dBm / SCS			dBm/BW Channel	dBm/BW Channel
				SCS (kHz)				
dB	dB	dB		15	30	60		
±3	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-70
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	N/A	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 4: The requirements apply for CSI-RS Ês/Iot ≤XdB. X=15 if timing offset between the reference measurement timing and the target CSI-RS is no larger than 0.5*CP, and X=4 if timing offset between the reference measurement timing and the target CSI-RS is larger than 0.5*CP but no larger than CP.

10.1.14.2.2 Relative CSI-SINR Accuracy in FR1

The relative CSI-SINR accuracy in inter-frequency case is defined as the CSI-SINR measured from one cell on a frequency in FR1 compared to the CSI-SINR measured from another cell on a different frequency in FR1.

The accuracy requirements in table 10.1.14.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band.
- $|CSI_RP1_{dBm} - CSI_RP2_{dBm}| \leq 27$ dB
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

NOTE: The reference measurement timing for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
  - The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.14.2.2-1.

Table 10.1.14.2.2-1: CSI-SINR Inter-frequency relative accuracy in FR1

Accuracy	Conditions

Normal condition	Extreme condition	CSI-RS Ês/Iot Note 3	Io Note 1 range					
			NR operating band groups	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS SCS (kHz)			dBm/BW Channel	dBm/BW Channel
				15	30	60		
±3.5	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-70
±4	±4	≥-6	Note 2	Note 2	Note 2	Note 2	N/A	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of cells to which the requirement applies.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: The requirements apply for CSI-RS Ês/Iot ≤ XdB. X=15 if timing offset between the reference measurement timing and the target CSI-RS is no larger than 0.5*CP, and X=4 if timing offset between the reference measurement timing and the target CSI-RS is larger than 0.5*CP but no larger than CP.

10.1.14C Inter-frequency SINR accuracy requirements for FR1 SAN

10.1.14C.1 Inter-frequency SS-SINR accuracy requirements in FR1

10.1.14C.1.1 Absolute SS-SINR Accuracy in FR1

The requirements for absolute SS-SINR accuracy in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.14C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.18 for a corresponding Band.
- Valid information for the SAN serving the target cell has been provided.

Table 10.1.14C.1.1-1: SS-SINR Inter-frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 3	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3	±4	≥-3	NR_FDD_SAB_FR1_A	-121	-118	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.

NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ 25 dB.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2A.

10.1.14C.1.2 Relative SS-SINR Accuracy in FR1

The relative SS-SINR accuracy in inter-frequency case is defined as the SS-SINR measured from one cell on a frequency in FR1 compared to the SS-SINR measured from another cell on a different frequency in FR1.

The accuracy requirements in table 10.1.14C.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.18 for a corresponding Band.
- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27$ dB
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB
- Valid information for the SAN serving the target cell has been provided.

Table 10.1.14C.1.2-1: SS-SINR Inter-frequency relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2,4	Io Note 1 range				
			NR operating band groups Note 5	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz		
±3.5	±4	≥-3	NR_FDD_SAB_FR1_A	-121	-118	N/A	-50
±4	±4	≥-6	Note 3	Note 3	Note 3	Note 3	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: The requirements apply for SSB Ês/Iot ≤ [25] dB.
NOTE 5: NR operating band groups in FR1 are as defined in clause 3.5.2A.

10.1.15 Inter-frequency SINR accuracy requirements for FR2

10.1.15.1 Inter-frequency SS-SINR accuracy requirements in FR2

10.1.15.1.1 Absolute SS-SINR Accuracy in FR2

The requirements for absolute SS-SINR accuracy in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.15.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.15.1.1-1: SS-SINR Inter-frequency absolute accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±3	±4	≥-3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	-50
±3.5	±4	≥-4		

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The requirements apply for SSB Ês/Iot ≤ 25 dB.

10.1.15.1.2 Relative SS-SINR Accuracy in FR2

The relative SS-SINR accuracy in inter-frequency case is defined as the SS-SINR measured from one cell on a frequency in FR2 compared to the SS-SINR measured from another cell on a different frequency in FR2.

The accuracy requirements in table 10.1.15.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.3 for a corresponding Band.
- $|SSB_RP1\ dB_m - SSB_RP2\ dB_m| \leq 27$ dB
- $|$ Channel 1_Io -Channel 2_Io $| \leq 20$ dB
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.15.1.2-1: SS-SINR Inter-frequency relative accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±3.5	±4	≥-3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival	-50
±4	±4	≥-6		

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 5: The requirements apply for SSB Ês/Iot ≤ 25 dB.

10.1.15.2 Inter-frequency CSI-SINR accuracy requirements in FR2

10.1.15.2.1 Absolute CSI-SINR Accuracy in FR2

The requirements for absolute CSI-SINR accuracy in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.15.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].
- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.
  - NOTE: The reference measurement timing for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
  - The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.15.2.1-1.

Table 10.1.15.2.1-1: CSI-SINR Inter-frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 1		$dBm/BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz	SCS_{CSI-RS} = 120 kHz	
±3	±4	≥-3	Same value as CSI_RP in Table B.2.9-2, according to UE Power class, operating band and angle of arrival		-50
3.5	±4	≥-4			

NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The requirements apply for CSI-RS Ês/Iot ≤XdB. X=15 if timing offset between the reference measurement timing and the target CSI-RS is no larger than 0.5*CP, and X=4 if timing offset between the reference measurement timing and the target CSI-RS is larger than 0.5*CP but no larger than CP.

10.1.15.2.2 Relative CSI-SINR Accuracy in FR2

The relative CSI-SINR accuracy in inter-frequency case is defined as the CSI-SINR measured from one cell on a frequency in FR2 compared to the CSI-SINR measured from another cell on a different frequency in FR2.

The accuracy requirements in table 10.1.15.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.13 for a corresponding Band.
- $|CSI_RP1\ dB_m - CSI_RP2\ dB_m| \leq 27$ dB
- $|$ Channel 1_Io -Channel 2_Io $| \leq 20$ dB
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

- The timing offset between the reference measurement timing and the target CSI-RS in one layer is no larger than CP.

  Note: The reference measurement timing for inter-frequency measurement is up to UE implementation and shall be based on the timing of one of the target cells.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

  - The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.15.2.2-1.

Table 10.1.15.2.2-1: CSI-SINR Inter-frequency relative accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 1		$dBm/BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz	SCS_{CSI-RS} = 120 kHz	
±3.5	±4	≥-3	Same value as CSI_RP in Table B.2.9-2, according to UE Power class, operating band and angle of arrival		-50
±4	±4	≥-6			
NOTE 1: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.					
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.					
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.					
NOTE 4: The requirements apply for CSI-RS Ês/Iot ≤XdB. X=15 if timing offset between the reference measurement timing and the target CSI-RS is no larger than 0.5*CP, and X=4 if timing offset between the reference measurement timing and the target CSI-RS is larger than 0.5*CP but no larger than CP.					

10.1.15C Inter-frequency SINR accuracy requirements for FR2-NTN

10.1.15C.1 Inter-frequency SS-SINR accuracy requirements in FR2-NTN

10.1.15C.1.1 Absolute SS-SINR Accuracy in FR2-NTN

The requirements for absolute SS-SINR accuracy in this clause apply to a cell on a frequency in FR2-NTN that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.15C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.18 for a corresponding Band.
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.15C.1.1-1: SS-SINR Inter-frequency absolute accuracy in FR2-NTN

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1		$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz	
±4	±5	≥-3	Same value as SSB_RP derived from annex B.2.18, according to UE VSAT type		-50
±4.5	±5	≥-4			
NOTE 1: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.					

NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The requirements apply for SSB Ês/Iot ≤ 25 dB.

10.1.15C.1.2 Relative SS-SINR Accuracy in FR2-NTN

The relative SS-SINR accuracy in inter-frequency case is defined as the SS-SINR measured from one cell on a frequency in FR2-NTN compared to the SS-SINR measured from another cell on a different frequency in FR2-NTN.

The accuracy requirements in table 10.1.15C.1.2-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.18 for a corresponding Band.
- $|SSB_RP1\ dB_m - SSB_RP2\ dB_m| \leq 27$ dB
- $|$ Channel 1_Io -Channel 2_Io $| \leq 20$ dB
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.15C.1.2-1: SS-SINR Inter-frequency relative accuracy in FR2-NTN

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1	$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±4.5	±5	≥-3	Same value as SSB_RP derived from annex B.2.18, according to UE VSAT type	-50
±5	±5	≥-6		

NOTE 1: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 3: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE ba The requirements apply for SSB Ês/Iot ≤ 25 dB.seband is above the value defined in this table.
NOTE 5: The requirements apply for SSB Ês/Iot ≤ 25 dB.

10.1.16 SINR report mapping

10.1.16.1 SS-SINR and CSI-SINR measurement report mapping

The reporting range of SS-SINR and CSI-SINR for L3 reporting and L1 reporing is defined from -23 dB to 40 dB with 0.5 dB resolution. The mapping of measured quantity is defined in table 10.1.16.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

The reporting range of differential SS-SINR and CSI-SINR for L1 reporting is defined from -15 dB to 0 dB with 1 dB resolution.

The mapping of measured quantity is defined in table 10.1.16.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.16.1-1: SS-SINR and CSI-SINR measurement report mapping

Reported value	Measured quantity value (L3 SS-SINR and L3 CSI-SINR)	Measured quantity value (L1 SS-SINR and L1 CSI-SINR)	Unit
SINR_0	SINR<-23	SINR<-23	dB
SINR_1	-23≤ SINR<-22.5	-23≤SINR<-22.5	dB

SINR_2	-22.5≤ SINR<-22	-22.5≤SINR<-22	dB
SINR_3	-22≤ SINR<-21.5	-22≤SINR<-21.5	dB
SINR_4	-21.5≤ SINR<-21	-21.5≤SINR<-21	dB
..	..	..	…
SINR_123	38≤ SINR<38.5	38≤SINR<38.5	dB
SINR_124	38.5≤ SINR<39	38.5≤SINR<39	dB
SINR_125	39≤ SINR<39.5	39≤SINR<39.5	dB
SINR_126	39.5≤ SINR<40	39.5≤SINR<40	dB
SINR_127	40≤ SINR	40≤SINR	dB

Table 10.1.16.1-2: Differential SS-SINR and CSI-SINR measurement (for L1 reporting) report mapping

Reported value	Measured quantity value (difference in measured SINR from largest SINR)	Unit
DIFFSINR_0	0≥ΔSINR>-1	dB
DIFFSINR_1	-1≥ΔSINR>-2	dB
DIFFSINR_2	-2≥ΔSINR>-3	dB
DIFFSINR_3	-3≥ΔSINR>-4	dB
DIFFSINR_4	-4≥ΔSINR>-5	dB
DIFFSINR_5	-5≥ΔSINR>-6	dB
DIFFSINR_6	-6≥ΔSINR>-7	dB
DIFFSINR_7	-7≥ΔSINR>-8	dB
DIFFSINR_8	-8≥ΔSINR>-9	dB
DIFFSINR_9	-9≥ΔSINR>-10	dB
DIFFSINR_10	-10≥ΔSINR>-11	dB
DIFFSINR_11	-11≥ΔSINR>-12	dB
DIFFSINR_12	-12≥ΔSINR>-13	dB
DIFFSINR_13	-13≥ΔSINR>-14	dB
DIFFSINR_14	-14≥ΔSINR>-15	dB
DIFFSINR_15	-15≥ΔSINR	dB

10.1.17 Power Headroom

10.1.17.1 Power Headroom Report

10.1.17.1.1 Power Headroom Report Mapping

The power headroom reporting range is from -32 ...+38 dB. table 10.1.17.1-1 defines the report mapping.

Table 10.1.17.1-1: Power headroom report mapping

Reported value	Measured quantity value (dB)
POWER_HEADROOM_0	PH < -32
POWER_HEADROOM_1	-32 ≤ PH < -31
POWER_HEADROOM_2	-31 ≤ PH < -30
POWER_HEADROOM_3	-30 ≤ PH < -29
…	…
POWER_HEADROOM_53	20 ≤ PH < 21
POWER_HEADROOM_54	21 ≤ PH < 22
POWER_HEADROOM_55	22 ≤ PH < 24
POWER_HEADROOM_56	24 ≤ PH < 26
POWER_HEADROOM_57	26 ≤ PH < 28
POWER_HEADROOM_58	28 ≤ PH < 30
POWER_HEADROOM_59	30 ≤ PH < 32
POWER_HEADROOM_60	32 ≤ PH < 34
POWER_HEADROOM_61	34 ≤ PH < 36
POWER_HEADROOM_62	36 ≤ PH < 38
POWER_HEADROOM_63	PH ≥ 38

10.1.18 $P_{CMAX,c,f}$

The UE is required to report the UE configured maximum output power ($P_{CMAX,c,f}$) together with the power headroom. This clause defines the requirements for the $P_{CMAX,c,f}$ reporting.

10.1.18.1 Report Mapping

The $P_{CMAX,c,f}$ reporting range is defined from -29 dBm to 33 dBm with 1 dB resolution. table 10.1.18.1-1 defines the reporting mapping.

Table 10.1.18.1-1 Mapping of $P_{CMAX,c,f}$

Reported value	Measured quantity value	Unit
PCMAX_C_00	$P_{CMAX,c,f} < -29$	dBm
PCMAX_C_01	$-29 \le P_{CMAX,c,f} < -28$	dBm
PCMAX_C_02	$-28 \le P_{CMAX,c,f} < -27$	dBm
…	…	…
PCMAX_C_61	$31 \le P_{CMAX,c,f} < 32$	dBm
PCMAX_C_62	$32 \le P_{CMAX,c,f} < 33$	dBm
PCMAX_C_63	$33 \le P_{CMAX,c,f}$	dBm

10.1.19 L1-RSRP accuracy requirements for FR1

10.1.19.1 SSB based L1-RSRP accuracy requirements

Unless otherwise specified, the requirements for absolute and relative SSB based L1-RSRP accuracy in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement and all SSBs of cell(s) with different PCI from serving cell configured for L1-RSRP measurement in FR1.

10.1.19.1.1 Absolute Accuracy

The accuracy requirements in table 10.1.19.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.

Table 10.1.19.1.1-1: SSB based L1-RSRP absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}_s/I_{ot}$	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±5.0	±9.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70

			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-70
±8.5	±11.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.19.1.2 Relative Accuracy

The relative SSB based L1-RSRP accuracy is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the cell (serving cell or cell with different PCI from serving cell) on which UE performs L1-RSRP measurements.

The accuracy requirements in table 10.1.19.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.

Table 10.1.19.1.2-1: SSB based L1-RSRP relative accuracy in FR1

Accuracy		**Conditions**					
Normal condition	**Extreme condition**	**SSB Ês/Iot Note 2**	**Io Note 1 range**				
			NR operating band groups Note 4	**Minimum Io**			**Maximum Io**
dB	**dB**	**dB**		**dBm / SCS_{SSB}**		**dBm/$BW_{Channel}$**	**dBm/$BW_{Channel}$**
				SCS_{SSB} = 15 kHz	**SCS_{SSB} = 30 kHz**		
±3	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50

			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies.
NOTE 3: Void
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.19.2 CSI-RS based L1-RSRP accuracy requirements

10.1.19.2.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute CSI-RS based L1-RSRP accuracy in this clause apply to all CSI-RS resources of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in table 10.1.19.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.2 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.19.2.1-1.

Table 10.1.19.2.1-1: CSI-RS based L1-RSRP absolute accuracy in FR1

Accuracy		**Conditions**						
Normal condition	**Extreme condition**	**CSI-RS Ês/Iot**	**Io [Note 1] range**					
			NR operating band groups [Note 2]	**Minimum Io**				**Maximum Io**
dB	**dB**	**dB**		**dBm / SCS_{CSI-RS}**			**$dBm/BW_{Channel}$**	**$dBm/BW_{Channel}$**
				SCS_{CSI-RS} = 15 kHz	**SCS_{CSI-RS} = 30 kHz**	**SCS_{CSI-RS} = 60 kHz**		
±5.0	±9.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-70
±8.5	±11.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E,	N/A	N/A	N/A	-70	-50

			NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N					
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.								

10.1.19.2.2 Relative Accuracy

The relative CSI-RS based L1-RSRP accuracy is defined as the L1-RSRP measured from one CSI-RS compared to the largest measured value of L1-RSRP among all CSI-RS resources of the serving cell.

The accuracy requirements in table 10.1.19.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.2 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.19.2.2-1.

Table 10.1.19.2.2-1: CSI-RS based L1-RSRP relative accuracy in FR1

Accuracy		**Conditions**						
Normal condition	**Extreme condition**	**CSI-RS Ês/Iot** Note 2	**Io** Note 1 **range**					
			NR operating band groups Note 4	**Minimum Io**				**Maximum Io**
dB	**dB**	**dB**		**dBm / SCS_{CSI-RS}**			**dBm/$BW_{Channel}$**	**dBm/$BW_{Channel}$**
				SCS_{CSI-RS} = 15 kHz	**SCS_{CSI-RS} = 30 kHz**	**SCS_{CSI-RS} = 60 kHz**		
±3	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of CSI-RS resources to which the requirement applies. NOTE 3: Void NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.								

10.1.19C L1-RSRP accuracy requirements for FR1 SAN

10.1.19C.1 SSB based L1-RSRP accuracy requirements

10.1.19C.1.1 Absolute Accuracy

Unless otherwise specified, the accuracy requirements for absolute SSB based L1-RSRP in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in table 10.1.19C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.19.1 for a corresponding Band for each relevant SSB.
- Valid information for the SAN serving the target cell has been provided.

Table 10.1.19C.1.1-1: SSB based L1-RSRP absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}s/Iot$	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±5	±9.5	≥-3	NR_FDD_SAB_FR1_A	-121	-118	N/A	-70
±8.5	±11.5	≥-3	NR_FDD_SAB_FR1_A	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2A.							

10.1.19C.1.2 Relative Accuracy

The relative SSB based L1-RSRP accuracy is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the serving cell.

The accuracy requirements in table 10.1.19C.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [43] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.19.1 for a corresponding Band for each relevant SSB.
- Valid information for the SAN serving the target cell has been provided.

Table 10.1.19C.1.2-1: SSB based L1-RSRP relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}s/Iot$ [Note 2]	Io [Note 1] range				
			NR operating band groups [Note 4]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3	±4	≥-3	NR_FDD_SAB_FR1_A	-121	-118	N/A	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB $\hat{E}s/Iot$ is the minimum SSB $\hat{E}s/Iot$ of the pair of SSBs to which the requirement applies. NOTE 3: Void NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2A.							

10.1.19C.2 CSI-RS based L1-RSRP accuracy requirements

10.1.19C.2.1 Absolute Accuracy

Unless otherwise specified, the accuracy requirements for absolute CSI-RS based L1-RSRP in this clause apply to all CSI-RS resources of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in table 10.1.19C.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.19.2 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
- Valid information for the SAN serving the target cell has been provided.

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.19C.2.1-1.

Table 10.1.19C.2.1-1: CSI-RS based L1-RSRP absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	CSI-RS $\hat{E}_s/I_{ot}$	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz		
±5	±9.5	≥-3	NR_FDD_SAB_FR1_A	-121	-118	N/A	-70
±8.5	±11.5	≥-3	NR_FDD_SAB_FR1_A	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2A.							

10.1.19C.2.2 Relative Accuracy

The relative CSI-RS based L1-RSRP accuracy is defined as the L1-RSRP measured from one CSI-RS compared to the largest measured value of L1-RSRP among all CSI-RS resources of the serving cell.

The accuracy requirements in table 10.1.19C.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.19.2 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
- Valid information for the SAN serving the target cell has been provided.

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.19C.2.2-1.

Table 10.1.19C.2.2-1: CSI-RS based L1-RSRP relative accuracy in FR1

Accuracy		Conditions	
Normal condition	Extreme condition	CSI-RS $\hat{E}_s/I_{ot}$ [Note 2]	Io [Note 1] range

			NR operating band groups [Note 4]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz		
±3	±4	≥-3	NR_FDD_SAB_FR1_A	-121	-118	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Void
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2A.

10.1.19D LTM Intra-frequency L1-RSRP accuracy requirements for FR1

10.1.19D.1 SSB based intra-frequency L1-RSRP accuracy requirements

10.1.19D.1.1 Absolute Accuracy

Unless otherwise specified, the accuracy requirements for SSB based intra-frequency L1-RSRP in this clause apply to all SSBs of candidate neighbour cell(s) on the same frequency as that of the serving cell in FR1.

The accuracy requirements in table 10.1.19D.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.

Table 10.1.19D.1.1-1: SSB based L1-RSRP absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±5.0	±9.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-70
±8.5	±11.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D,	N/A	N/A	-70	-50

			NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N				
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.19D.1.2 Relative Accuracy

The relative SSB based L1-RSRP accuracy is defined as the L1-RSRP measured on one SSB configured in *LTM-CSI-ResourceConfig* compared to the L1-RSRP measured on another SSB configured in *LTM-CSI-ResourceConfig* for the cell(s) on the same frequency in FR1.The accuracy requirements in Table 10.1.19D.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.

Table 10.1.19D.1.2-1: SSB based L1-RSRP relative accuracy in FR1

Accuracy		**Conditions**					
Normal condition	**Extreme condition**	**SSB Ês/Iot** Note 2	**Io** Note 1 **range**				
			NR operating band groups Note 4	**Minimum Io**			**Maximum Io**
dB	**dB**	**dB**		**dBm / SCS_{SSB}**		**dBm/$BW_{Channel}$**	**dBm/$BW_{Channel}$**
				SCS_{SSB} = 15 kHz	**SCS_{SSB} = 30 kHz**		
±3	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies. NOTE 3: Void NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.19E LTM Inter-frequency L1-RSRP accuracy requirements for FR1

10.1.19E.1 SSB based Inter-frequency L1-RSRP accuracy requirements

10.1.19E.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute SSB based L1-RSRP accuracy in this clause apply to all SSBs of candidate neighbour cell(s) on a frequency in FR1 that is on a different frequency than the serving cell.

The accuracy requirements in table 10.1.19E.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.

Table 10.1.19E.1.1-1: Inter-frequency L1-RSRP absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±5.0	±9.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-70
±8.5	±11.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N	N/A	N/A	-70	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.19E.1.2 Relative Accuracy

The relative SSB based L1-RSRP accuracy is defined as the L1-RSRP measured on one SSB configured in *LTM-CSI-ResourceConfig* from one cell on a frequency in FR1 compared to another SSB configured in *LTM-CSI-ResourceConfig* from any other cell on another frequency in FR1.

The accuracy requirements in table 10.1.19E.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.
- $|SSB_RP1\ dB_m - SSB_RP2\ dB_m| \leq 27$ dB
- $|Channel\ 1_Io - Channel\ 2_Io| \leq 20$ dB

Table 10.1.19E.1.2-1: Inter-frequency L1-RSRP relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±5.0	±9.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.20 L1-RSRP accuracy requirements for FR2

10.1.20.1 SSB based L1-RSRP accuracy requirements

Unless otherwise specified, the accuracy requirements for absolute and relative SSB based L1-RSRP in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement, all the SSBs of the serving cell configured for L1-RSRP measurement when the UE is configured with *groupBasedBeamReporting-r17* set to 'enabled' and all SSBs of cell(s) with different PCI from serving cell configured for L1-RSRP measurement in FR2.

10.1.20.1.1 Absolute Accuracy

The accuracy requirements in table 10.1.20.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.20.1.1-1: SSB based L1-RSRP absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 2	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz		
±6.5	±9.5	≥-3	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	N/A	-70
±8.5	±11.5	≥-3	N/A	-70	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20.1.2 Relative Accuracy

The relative SSB based L1-RSRP accuracy is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the cell (serving cell or cell with different PCI from serving cell) on which UE performs L1-RSRP measurements.

When the UE is configured with *groupBasedBeamReporting-r17* set to 'enabled', the relative SSB based L1-RSRP accuracy is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the serving cell on which UE performs L1-RSRP measurements with different Rx beams, the all SSBs are in the same or different resource set (s) in one CSI resource setting.

The accuracy requirements in table 10.1.20.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.20.1.2-1: SSB based L1-RSRP relative accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 3	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±6.5	±9.5	≥-3	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies.
NOTE 3: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20.2 CSI-RS based L1-RSRP accuracy requirements

10.1.20.2.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute CSI-RS based L1-RSRP accuracy in this clause apply to all CSI-RS resources of the serving cell configured for L1-RSRP measurement, and all the CSI-RSs of the serving cell configured for L1-RSRP measurement when the UE is configured with *groupBasedBeamReporting-r17* set to 'enabled'.

The accuracy requirements in table 10.1.20.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.2 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.20.2.1-1.

Table 10.1.20.2.1-1: CSI-RS based L1-RSRP absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io [Note 1] range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} [Note 2]	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz / SCS_{CSI-RS} = 120 kHz		
±6.5	±9.5	≥-3	Same value as CSI-RS_RP in Table B.2.4.2-2, according to UE Power class, operating band and angle of arrival	N/A	-70
±8.5	±11.5	≥-3	N/A	-70	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20.2.2 Relative Accuracy

The relative CSI-RS based L1-RSRP accuracy is defined as the L1-RSRP measured from one CSI-RS compared to the largest measured value of L1-RSRP among all CSI-RSs of the cell (serving cell or cell with different PCI from serving cell) on which UE performs L1-RSRP measurements.

For simultaneous reception from multiple directions, when the UE is configured with *groupBasedBeamReporting-r17* set to 'enabled', the relative CSI-RS based L1-RSRP accuracy is defined as the L1-RSRP measured from one CSI-RS compared to the largest measured value of L1-RSRP among all CSI-RSs of the serving cell on which UE performs L1-RSRP measurements with different Rx beams, the all CSI-RSs are in the same or different resource set (s) in one CSI resource setting. RSRP among all CSI-RS resources of the serving cell.

The accuracy requirements in table 10.1.20.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.2 for a corresponding Band for each relevant CSI-RS.

- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1.20.2.2-1.

Table 10.1.20.2.2-1: CSI-RS based L1-RSRP relative accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io [Note 1] range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS}		$dBm/BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz	SCS_{CSI-RS} = 120 kHz	
±6.5	±9.5	≥-3	Same value as CSI-RS RP in Table B.2.4.2-2, according to UE Power class, operating band and angle of arrival		-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20A LTM Intra-frequency L1-RSRP accuracy requirements for FR2

10.1.20A.1 SSB based intra-frequency L1-RSRP accuracy requirements

10.1.20A.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SSB based intra-frequency L1-RSRP in this clause apply to all SSBs of candidate neighbour cell(s) on the same frequency as that of the serving cell in FR2.

The accuracy requirements in table 10.1.20A.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.20A.1.1-1: SSB based L1-RSRP absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} [Note 2]	$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz		
±6.5	±9.5	≥-3	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	N/A	-70
±8.5	±11.5	≥-3	N/A	-70	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.

NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20A.1.2 Relative Accuracy

The relative SSB based L1-RSRP accuracy is defined as the L1-RSRP measured on one SSB configured in *LTM-CSI-ResourceConfig* compared to the L1-RSRP measured from another SSB configured in *LTM-CSI-ResourceConfig* from the cell(s) on the same frequency in FR2.

The accuracy requirements in table 10.1.20A.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.20A.1.2-1: SSB based L1-RSRP relative accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} [Note 3]	$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±6.5	±9.5	≥-3	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies.
NOTE 3: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20B LTM Inter-frequency L1-RSRP accuracy requirements for FR2

10.1.20B.1 SSB based inter-frequency L1-RSRP accuracy requirements

10.1.20B.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute SSB based L1-RSRP accuracy in this clause apply to all SSBs of candidate neighbour cell(s) on a frequency in FR2 that is on a different frequency than the serving cell.

The accuracy requirements in table 10.1.20B.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.20B.1.1-1: SSB based L1-RSRP absolute accuracy in FR2

Accuracy	Conditions

Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range			
			Minimum Io			Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 2		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz		
±6.5	±9.5	≥-3	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival		N/A	-70
±8.5	±11.5	≥-3	N/A		-70	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20B.1.2 Relative Accuracy

The relative SSB based L1-RSRP accuracy is defined as the L1-RSRP measured on one SSB configured in *LTM-CSI-ResourceConfig* on one cell on a frequency in FR2 compared to the value of L1-RSRP measured from another SSB configured in *LTM-CSI-ResourceConfig* from any other cell on another frequency in FR2.

The accuracy requirements in table 10.1.20B.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.
- $|SSB_RP1\ dB_m - SSB_RP2\ dB_m| \leq 27$ dB
- $|Channel\ 1_Io - Channel\ 2_Io| \leq 20$ dB
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.20B.1.2-1: SSB based L1-RSRP relative accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range	
			Minimum Io	Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 3	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz	
±6.5	±9.5	≥-3	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies.
NOTE 3: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20C L1-RSRP accuracy requirements for FR2-NTN

10.1.20C.1 SSB based L1-RSRP accuracy requirements

Unless otherwise specified, the requirements for absolute accuracy and relative accuracy of SSB based L1-RSRP in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement in FR2-NTN.

10.1.20C.1.1 Absolute Accuracy

The accuracy requirements in Table 10.1.20C.1.1-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.19 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.20C.1.1-1: SSB based L1-RSRP absolute accuracy in FR2-NTN

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 2		$dBm/BW_{Channel}$
			SCS_{SSB} = 120kHz	SCS_{SSB} = 240kHz	
±7.5	±10.5	≥-3	Same value as SSB_RP derived from annex B.2.17, according to UE VSAT type		N/A	-70
±9.5	±12.5	≥-3	N/A		-70	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20C.1.2 Relative Accuracy

The relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the serving cell on which UE performs L1-RSRP measurements.

The accuracy requirements in Table 10.1.20C.1.2-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.19 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.

Table 10.1.20C.1.2-1: SSB based L1-RSRP relative accuracy in FR2-NTN

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 3		$dBm/BW_{Channel}$
			SCS_{SSB} = 120kHz	SCS_{SSB} = 240kHz	
±3.5	±6.5	≥-3	Same value as SSB_RP derived from annex B.2.17, according to UE VSAT type		-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies.
NOTE 3: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.

NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20C.2 CSI-RS based L1-RSRP accuracy requirements

10.1.20C.2.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-RS based L1-RSRP in this clause apply to all CSI-RS resources of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 10.1.20C.2.1-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.19 for a corresponding Band for each relevant CSI-RS.
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.20C.2.1-1.

Table 10.1.20C.2.1-1: CSI-RS based L1-RSRP absolute accuracy in FR2-NTN

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 2	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{CSI-RS} = 60kHz / SCS_{CSI-RS} = 120kHz		
±7.5	±10.5	≥-3	Same value as SSB_RP derived from annex B.2.17, according to UE VSAT type	N/A	-70
±9.5	±12.5	≥-3	N/A	-70	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20C.2.2 Relative Accuracy

The relative accuracy of CSI-RS based L1-RSRP is defined as the L1-RSRP measured from one CSI-RS compared to the largest measured value of L1-RSRP among all CSI-RS resources of the serving cell.

The accuracy requirements in Table 10.1.20C.2.2-1 are valid under the following conditions:

- Conditions defined in clause 10.3 of TS 38.101-5 [42] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.19 for a corresponding Band for each relevant CSI-RS.
- The measured signals are in the directions within the declared minimum elevation angle supported for receiving.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.20C.2.2-1.

Table 10.1.20C.2.2-1: CSI-RS based L1-RSRP relative accuracy in FR2-NTN

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io [Note 1] range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS}		$dBm/BW_{Channel}$
			SCS_{CSI-RS} = 60kHz	SCS_{CSI-RS} = 120kHz	
±3.5	±6.5	≥-3	Same value as SSB_RP derived from annex B.2.17, according to UE VSAT type		-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Values based on EIS as defined in clause 10.3 of TS 38.101-5 [42]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.21 SFTD accuracy requirements

10.1.21.1 SFTD acuracy requirements for NE-DC

The SFN and frame timing difference (SFTD) is measured between PCell and E-UTRAN PSCell under NE-DC.

The accuracy requirements in table 10.1.21.1-4 are appilicable under the following conditions:

For FR1 PCell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Io range defined in Table 10.1.21.1-1.

Table 10.1.21.1-1: PCell Io range conditions in FR1

Parameter	Io [Note 1] range			
	NR operating band groups [Note 4, 5]	Minimum Io [Note 2, 3]		Maximum Io
		dBm/ SCS_{SSB}		$dBm/BW_{Channel}$
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A	-121	-118	-50
	NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-50
	NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-50
	NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-50
	NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-50
	NR_FDD_FR1_F	-118.5	-115.5	-50
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-50
	NR_FDD_FR1_H	-117.5	-114.5	-50
	NR_FDD_FR1_N	-114.5	-111.5	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The condition level is increased by $\Delta R_{IB,c}$ as defined in clause 7.3B in TS 38.101-3 [20], depending on E-UTRA – NR band combination.
NOTE 3: The condition level is increased by MSD as defined in clause 7.3B in TS 38.101-3 [20], if applicable depending on E-UTRA – NR band combination.
NOTE 4: NR operating band groups are as defined in clause 3.5.
NOTE 5: Only NR bands within EN-DC band combinations as specified in clause 5.5B in TS 38.101-3 [20] are applicable.

For FR2 PCell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Io range defined in Table 10.1.21.1-2.

Table 10.1.21.1-2: PCell Io range conditions in FR2

Parameter	Io Note 1 range		
	Minimum Io Note 2, 3		Maximum Io
	dBm/ SCS_{SSB}		dBm/$BW_{Channel}$
	SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth and specified at the Reference point. NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.			

For E-UTRA PSCell SFN and frame timing measurement:

- Cell specific reference signals are transmitted either from one, two or four antenna ports.
- Conditions defined in TS 36.101 [25] clause 7.3 for reference sensitivity are fulfilled.
- No changes to the uplink transmission timing are applied during the measurement period.
- $RSRP|_{dBm}$ according to annex B.3.5 in TS 36.101 [25] for a corresponding Band.
- Io range defined in Table 10.1.21.1-3.

Table 10.1.21.1-3: E-UTRA PSCell Io range conditions

Parameter	Io Note 1 range		
	E-UTRA operating band groups Note 3	Minimum Io	Maximum Io
Conditions		dBm/15 kHz Note 2	dBm/$BW_{Channel}$
	FDD_A, TDD_A	-121	-50
	FDD_C, TDD_C	-120	-50
	FDD_D	-119.5	-50
	FDD_E, TDD_E	-119	-50
	FDD_F	-118.5	-50
	FDD_G	-118	-50
	FDD_H	-117.5	-50
	FDD_N	-114.5	-50
NOTE 1: When in dBm/15 kHz, the minimum Io condition is expressed as the average Io per RE over all REs in that symbol. Io may be different in different symbols within a subframe. NOTE 2: The condition level is increased by $\Delta>0$, when applicable, as described in clauses B.4.2 and B.4.3 in TS 36.133 [15]. NOTE 3: E-UTRA operating band groups are as defined in clause 3.5 in TS 36.133 [15].			

Table 10.1.21.1-4: SFTD measurement accuracy

Accuracy	Conditions	
	Ês/Iot Note 2	Frequency range
Ts Note 1	dB	
40*64*Tc	≥-3	FR1
40*64*Tc		FR2
NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]. NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.		

10.1.21.2 SFTD acuracy requirements for NR-DC

The SFN and frame timing difference (SFTD) is measured between PCell in FR1 and PSCell in FR2 under NR dual connectivity.

The accuracy requirements in table 10.1.21.2-3 are appilicable under the following conditions:

For FR1 PCell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Io range defined in Table 10.1.21.2-1.

Table 10.1.21.2-1: PCell Io range conditions in FR1

Parameter	Io [Note 1] range			
	NR operating band groups [Note 2]	Minimum Io		Maximum Io
		dBm/ SCS_{SSB}		$dBm/BW_{Channel}$
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A	-121	-118	-50
	NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-50
	NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-50
	NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-50
	NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-50
	NR_FDD_FR1_F	-118.5	-115.5	-50
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-50
	NR_FDD_FR1_H	-117.5	-114.5	-50
	NR_FDD_FR1_N	-114.5	-111.5	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups are as defined in clause 3.5.2.				

For FR2 PSCell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Io range defined in Table 10.1.21.2-2.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.21.2-2: PSCell Io range conditions in FR2

Parameter	Io [Note 1] range		
	Minimum Io [Note 2, 3]		Maximum Io
	dBm/ SCS_{SSB}		$dBm/BW_{Channel}$
	SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth and specified at the Reference point. NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.			

Table 10.1.21.2-3: SFTD measurement accuracy

Accuracy	Conditions	
	Ês/Iot [Note 2]	Frequency range
Ts [Note 1]	dB	
40*64*Tc	≥ -3	Between FR1 and FR2

NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.

10.1.21.3 Inter-frequency SFTD acuracy requirements

The SFN and frame timing difference (SFTD) is measured between PCell and inter-frequency neighbour cell.

The accuracy requirements in table 10.1.21.3-3 are appilicable under the following conditions:

For FR1 PCell, inter-frequency neighbour cell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Io range defined in Table 10.1.21.3-1.

Table 10.1.21.3-1: PCell, inter-frequency neighbour cell Io range conditions in FR1

Parameter	Io Note 1 range			
	NR operating band groups Note 2	Minimum Io		Maximum Io
		dBm/ SCS_{SSB}		dBm/$BW_{Channel}$
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A	-121	-118	-50
	NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-50
	NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-50
	NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-50
	NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-50
	NR_FDD_FR1_F	-118.5	-115.5	-50
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-50
	NR_FDD_FR1_H	-117.5	-114.5	-50
	NR_FDD_FR1_N	-114.5	-111.5	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups are as defined in clause 3.5.2.				

For FR2 PCell, inter-frequency neighbour cell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Io range defined in Table 10.1.21.3-2.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.21.3-2: PCell, inter-frequency neighbour cell Io range conditions in FR2

Parameter	Io Note 1 range		
	Minimum Io Note 2, 3		Maximum Io
	dBm/ SCS_{SSB}		dBm/$BW_{Channel}$
	SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth and specified at the Reference point. NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.			

Table 10.1.21.3-3: Inter-frequency SFTD measurement accuracy

Accuracy	Conditions	
	Ês/Iot Note 2	Frequency range
Ts Note 1	dB	
40*64*Tc	≥ -3	FR1, FR2
NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]. NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.		

10.1.22 CLI measurement accuracy requirements

10.1.22.1 SRS-RSRP

10.1.22.1.1 SRS-RSRP Accuracy

The SRS-RSRP measurement reported by the UE shall fulfil the accuracy requirements defined in table 10.1.22.1.1-1 for FR1 and table 10.1.22.1.1-2 for FR2, provided that the following conditions are met. The accuracy requirements in this clause are derived based on AWGN radio propagation conditions.

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for SRS-RSRP measurements are fulfilled according to annex B.2.7 for a corresponding Band for each relevant SRS resource configured for measurement.
- The time difference between UE's DL reference timing in the serving cell and SRS arrival time is no larger than $T_{error_SRS_RSRP}$, where
  - $T_{error_SRS_RSRP} = T_C \times N_{TA_offset} + 4.67\mu s$ for FR1
  - $T_{error_SRS_RSRP} = T_C \times N_{TA_offset} + 3.67\mu s$ for FR2
  - N_{TA_offset} is defined in table 7.1.2-2
  - T_C is 0.509 ns
- The number of SRS ports in the SRS resource configured for measurement is 1,
- The number of symbols in the SRS resource configured for measurement is 1,
- The number of repetitions in the SRS resource configured for measurement is 1,
- Frequency hopping, sequence group hopping or sequence hopping is disabled in the SRS resource configured for measurement,
- The bandwidth of the SRS resource is 48 PRBs.
- One of the following conditions is met
  - There is no other SRS resource with the same root sequence and on the same symbol and with same comb as the relevant SRS resource.
  - If multiple SRS resources are on the same symbol and with same comb, the distance between cyclic shifts of any two resources is no less than 6 if transmissionComb = n4, and no less than 4 if transmissionComb = n2.

Table 10.1.22.1.1-1: SRS-RSRP absolute accuracy in FR1

Accuracy		Conditions			
Normal condition	Extreme condition	SRS Ês/Iot	Io Note 1 range		
			NR operating band groups Note 2	Minimum Io	Maximum Io

dB						dB		dBm / SCS_{SRS}			dBm/BW Channel	dBm/BW Channel
SCS_{SRS} (kHz)			SCS_{SRS} (kHz)									
15	30	60	15	30	60			SCS_{SRS} = 15 kHz	SCS_{SRS} = 30 kHz	SCS_{SRS} = 60 kHz		
±3	±3.5	±5	±7.5	±8	±9.5	≥1	NR_TDD_FR1_A,	-120	-117	-114	N/A	-70
							NR_TDD_FR1_C	-119	-116	-113	N/A	-70
							NR_TDD_FR1_D	-118.5	-115.5	-112.5	N/A	-70
							NR_TDD_FR1_E	-118	-115	-112	N/A	-70
±6.5	±7	±8.5	±9.5	±10	±11.5	≥1	NR_TDD_FR1_A, NR_TDD_FR1_C, NR_TDD_FR1_D, NR_TDD_FR1_E	N/A	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.												

Table 10.1.22.1.1-2: SRS-RSRP absolute accuracy in FR2

Accuracy				Conditions				
Normal condition		Extreme condition		SRS Ês/Iot	Io [Note 1] range			
					Minimum Io			Maximum Io
dB				dB	dBm / SCS_{SRS} [Note 2]		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
SCS_{SRS} (kHz)		SCS_{SRS} (kHz)			SCS_{SRS} = 60 kHz	SCS_{SRS} = 120 kHz		
60	120	60	120					
±6	±8.5	±9	±11.5	≥1	Same value as SRS_RP in Table B.2.7-2, according to UE Power class, operating band and angle of arrival		N/A	-70
±9	±11.5	±11	±13.5	≥1	N/A		-70	-50
NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth. NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.								

10.1.22.1.2 SRS-RSRP report mapping

The reporting range of SRS-RSRP is defined from -140 dBm to -44 dBm with 1 dB resolution. The mapping of measured quantity is defined in table 10.1.22.1.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.22.1.2-1: SRS-RSRP measurement report mapping

Reported value	Measured quantity value	Unit
SRS-RSRP_0	SRS-RSRP<-140	dBm
SRS-RSRP_1	-140≤ SRS-RSRP<-139	dBm
SRS-RSRP_2	-139≤ SRS-RSRP<-138	dBm
SRS-RSRP_3	-138≤ SRS-RSRP<-137	dBm
SRS-RSRP_4	-137≤ SRS-RSRP<-136	dBm
..	..	…
SRS-RSRP_95	-46≤ SRS-RSRP<-45	dBm
SRS-RSRP_96	-45≤ SRS-RSRP<-44	dBm
SRS-RSRP_97	-44≤ SRS-RSRP	dBm
SRS-RSRP_98	Infinity	
NOTE: 'Infinity' means that UE cannot detect SRS due to too strong signal to measure.		

10.1.22.2 CLI-RSSI

10.1.22.2.1 CLI-RSSI Accuracy

The CLI-RSSI measurement reported by the UE shall fulfil the accuracy requirements defined in table 10.1.22.2.1-1 for FR1 and table 10.1.22.2.1-2 for FR2, provided that the following conditions are met.

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

Table 10.1.22.2.1-1: CLI-RSSI absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	Io [Note 1] range					
		NR operating band groups [Note 2]	Minimum Io				Maximum Io
dB	dB		dBm / SCS_{SRS}			$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
			SCS_{SRS} = 15 kHz	SCS_{SRS} = 30 kHz	SCS_{SRS} = 60 kHz		
±3.5	±6.5	NR_TDD_FR1_A,	-120	-117	-114	N/A	-70
		NR_TDD_FR1_C	-119	-116	-113	N/A	-70
		NR_TDD_FR1_D	-118.5	-115.5	-112.5	N/A	-70
		NR_TDD_FR1_E	-118	-115	-112	N/A	-70
±5.5	±8.5	Note 3	Note 3	Note 3	Note 3	-70	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.

Table 10.1.22.2.1-2: CLI-RSSI absolute accuracy in FR2

Accuracy		Conditions		
Normal condition	Extreme condition	Io [Note 1] range		
		Minimum Io		Maximum Io
dB	dB	dBm / SCS_{SRS} [Note 2]	$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
		SCS_{SRS} = 60 kHz / SCS_{SRS} = 120 kHz		
±5	±8	Same value as SRS_RP in Table B.2.7-2, according to UE Power class, operating band and angle of arrival	N/A	-70
±7	±10	Note 4	-70	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.

10.1.22.2.2 CLI-RSSI report mapping

The reporting range of CLI-RSSI is defined from -100 dBm to -25 dBm with 1 dB resolution. The mapping of measured quantity is defined in table 10.1.22.2.2-1. The range in the signalling may be larger than the guaranteed accuracy range. UE shall scale the measured CLI-RSSI to report a nominal RSSI equivalent to 6RB measurement with 15 kHz SCS.

Table 10.1.22.2.2-1: CLI-RSSI measurement report mapping

Reported value	Measured quantity value	Unit
CLI-RSSI_00	CLI-RSSI < -100	dBm
CLI-RSSI_01	-100 ≤ CLI-RSSI < -99	dBm

CLI-RSSI_02	-99 ≤ CLI-RSSI < -98	dBm
…	…	…
CLI-RSSI_74	-27 ≤ CLI-RSSI < -26	dBm
CLI-RSSI_75	-26 ≤ CLI-RSSI < -25	dBm
CLI-RSSI_76	-25 ≤ CLI-RSSI	dBm

10.1.23 RSTD Measurements

10.1.23.1 Introduction

The requirements in clause 10.1.23 shall apply, provided the UE has received *nr-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to report one or more DL RSTD measurements defined in TS 38.215 [4]. The requirements in clause 10.1.23 shall apply:

- when UE is in RRC_CONNECTED state and the measurement is performed with MG or without MG,
- when UE is in RRC_INACTIVE state.
- when UE is in RRC_IDLE state.

10.1.23.2 Measurement Accuracy Requirements

The accuracy requirements for RSTD measurement shall be within $\pm(X+Y+Z+\Delta)\ T_c$.

X is defined in table 10.1.23.2-1 for AWGN channel and table 10.1.23.2-3 for fading channel for FR1, provided that the following conditions are met.

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for RSTD measurements are fulfilled according to annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.
- UE does not perform positioning measurement with reduced number of samples.

X is defined in table 10.1.23.2-2 for AWGN channel and table 10.1.23.2-4 for fading channel for FR2, provided that the following conditions are met.

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for RSTD measurements are fulfilled according to annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.
- UE does not perform positioning measurement with reduced number of samples.

X is defined in table 10.1.23.2-7 for AWGN channel in FR1 provided that the following conditions are met.

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for RSTD measurements are fulfilled according to annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.
- UE supports positioning measurement with reduced number of sample and is indicated by LMF to perform positioning measurement with reduced number of samples.

X is defined in table 10.1.23.2-8 for AWGN channel in FR2 provided that the following conditions are met.

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for RSTD measurements are fulfilled according to annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.
- UE supports positioning measurement with reduced number of sample and is indicated by LMF to perform positioning measurement with reduced number of samples.

NOTE: The requirements for fading channel in this clause are derived based on TDL-A (30 ns delay spread, 5 Hz) and TDL-C (60 ns delay spread, 300 Hz) channel models for FR1 and FR2 respectively.

When UE measures RSTD on PRS resources belonging to different PFLs, then the RSTD accuracy is defined as the accuracy corresponding to the largest accuracy value among different PFLs.

If the UE doesn't support Rx TEG reporting for RSTD measurement or when the measurements of reference cell and neighbour cell belong to different Rx TEGs, Y, Z and Δ are defined as follows:

- When UE measures RSTD on PRS resources belonging to same PFL, Y=32 Tc, provided that the time offset between the two PRS resource instances from the reference cell and the neighbor cell, which are used for a single RSTD estimate, is no greater than 160 ms.
- When UE measures RSTD on PRS resources belonging different PFLs, Y=256 Tc, provided that the time offset between the two PRS resource instances from the reference cell and the neighbor cell, which are used for a single RSTD estimate, is no greater than 1280 ms.
- Z is defined in table 10.1.23.2-5 for FR1 and table 10.1.23.2-6 for FR2, respectively.
- Δ is zero for single PFL, and is defined in table 10.1.23.2-5a for FR1 and table 10.1.23.2-6a for FR2, respectively, for dual PFL.

If the measurements of reference cell and neighbour cell belong to the same Rx TEG, i.e. associated and reported with a common Rx TEG ID, then the sum of Y+Z+Δ is equal to the timing error margin of the Rx TEG reported in *nr-UE-RxTEG-TimingErrorMargin*. The timing error margin reported via *nr-UE-RxTEG-TimingErrorMargin* cannot be larger than the value of (Y+Z+Δ) defined when the UE does not associate the measurements with the same Rx TEG.

Table 10.1.23.2-1: RSTD absolute accuracy in FR1 for AWGN channel

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB			dBm/SCS	dBm/$BW_{Channel}$
132	(PRS Ês/Iot)$_{ref}$ ≥ -6 dB (PRS Ês/Iot)$_i$ ≥ -13 dB	15	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
98			≥ 52	≥ 1	Note 6	Note 6	Note 6
42			≥ 104	≥ 1	Note 6	Note 6	Note 6
75		30	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50

					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
48			≥ 48	≥ 1	Note 6	Note 6	Note 6
24			≥ 132	≥ 1	Note 6	Note 6	Note 6
50		60	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50
24			≥ 64	≥ 1	Note 6	Note 6	Note 6
10			≥ 132	≥ 1	Note 6	Note 6	Note 6

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: Void

Table 10.1.23.2-2: RSTD absolute accuracy in FR2 for AWGN channel

Accuracy	Conditions					
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{\text{rep}}^{\text{PRS}} * L_{\text{PRS}} / K_{\text{comb}}^{\text{PRS}}$) Note 2	Io Note 3 range	
					Minimum Io	Maximum Io
Tc Note 4	dB	kHz	PRB		dBm/SCS	$\text{dBm/BW}_{\text{Channel}}$
35	(PRS Ês/Iot)$_{\text{ref}}$ ≥-6 dB	60	≥ 24	≥ 4	Same value as PRS_RP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
24			≥ 64	≥ 1	Note 5	Note 5
11			≥ 132	≥ 1	Note 5	Note 5
24	(PRS Ês/Iot)$_i$ ≥-13 dB	120	≥ 32	≥ 4	Same value as PRS_RP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
13			≥ 64	≥ 1	Note 5	Note 5
6			≥ 128	≥ 1	Note 5	Note 5

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.

NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 6: Void

Table 10.1.23.2-3: RSTD absolute accuracy in FR1 for fading channel

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB			dBm/SCS	$dBm/BW_{Channel}$
247	(PRS Ês/Iot)$_{ref}$ ≥ -6 dB (PRS Ês/Iot)$_i$ ≥ -13 dB	15	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
140			≥ 52	≥ 1	Note 6	Note 6	Note 6
86			≥ 104	≥ 1	Note 6	Note 6	Note 6
118		30	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
109			≥ 48	≥ 1	Note 6	Note 6	Note 6
28			≥ 132	≥ 1	Note 6	Note 6	Note 6
147		60	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB			dBm/SCS	dBm/BW$_{Channel}$
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50
27			≥ 64	≥ 1	Note 6	Note 6	Note 6
21			≥ 132	≥ 1	Note 6	Note 6	Note 6

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: Void

Table 10.1.23.2-4: RSTD absolute accuracy in FR2 for fading channel

Accuracy	Conditions					
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range	
					Minimum Io	Maximum Io
Tc Note 4	dB	kHz	PRB		dBm/SCS	dBm/BW$_{Channel}$
83	(PRS Ês/Iot)$_{ref}$ ≥-6 dB	60	≥ 24	≥ 4	Same value as PRS_RP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
64			≥ 64	≥ 1	Note 5	Note 5
46			≥ 132	≥ 1	Note 5	Note 5
48	(PRS Ês/Iot)$_i$ ≥-13 dB	120	≥ 32	≥ 4	Same value as PRS_RP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
54			≥ 64	≥ 1	Note 5	Note 5
36			≥ 128	≥ 1	Note 5	Note 5

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 6: Void

Table 10.1.23.2-5: Margin for RSTD measurement accuracy in FR1

PRS BW (PRB number)	Margin (Tc)

SCS=15 kHz	SCS=30 kHz	SCS=60 kHz	
≥ 24	N/A	N/A	120
≥ 52	≥ 24	N/A	72
≥ 104	≥ 48	≥ 24	36
N/A	≥ 132	≥ 64	16
N/A	N/A	≥ 132	12

Table 10.1.23.2-5a: Margin Δ for RSTD measurement accuracy in FR1

PRS BW (PRB number)			Margin (Tc)
SCS=15 kHz	SCS=30 kHz	SCS=60 kHz	
≥ 24	N/A	N/A	128
≥ 52	≥ 24	N/A	64
≥ 104	≥ 48	≥ 24	32
N/A	≥ 132	≥ 64	16
N/A	N/A	≥ 132	8

Table 10.1.23.2-6: Margin for RSTD measurement accuracy in FR2

PRS BW (PRB number)		Margin (Tc)
SCS=60 kHz	SCS=120 kHz	
≥ 24	N/A	72
≥ 64	≥ 32	32
≥ 132	≥ 64	16
N/A	≥ 128	12

Table 10.1.23.2-6a: Margin Δ for RSTD measurement accuracy in FR2

PRS BW (PRB number)		Margin (Tc)
SCS=60 kHz	SCS=120 kHz	
≥ 24	N/A	32
≥ 64	≥ 32	16
≥ 132	≥ 64	8
N/A	≥ 128	4

Table 10.1.23.2-7: RSTD absolute accuracy in FR1 for AWGN channel with reduced number of samples

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB			dBm/SCS	$dBm/BW_{Channel}$
98	(PRS Ês/Iot)$_{ref}$ ≥-3 dB (PRS Ês/Iot)$_i$ ≥-6 dB	15	≥ 52	≥ 1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB			dBm/SCS	dBm/BW$_{Channel}$
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
42			≥ 104	≥ 1	Note 6	Note 6	Note 6
48		30	≥ 48	≥ 1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
24			≥ 132	≥ 1	Note 6	Note 6	Note 6
24		60	≥ 64	≥ 1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50
10			≥ 132	≥ 1	Note 6	Note 6	Note 6

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: Void

Table 10.1.23.2-8: RSTD absolute accuracy in FR2 for AWGN channel with reduced number of samples

Accuracy	Conditions					
	PRS Ês/Iot	PRS SCS	PRS bandwidth	PRS resource repetition	Io Note 3 range	
					Minimum Io	Maximum Io

			Note 1	$(T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS})$ Note 2		
Tc Note 4	**dB**	**kHz**	**PRB**		**dBm/SCS**	**dBm/BW$_{Channel}$**
24	(PRS $\hat{E}s/Iot)_{ref}$ ≥-3 dB	60	≥ 64	≥ 1	Same value as PRS_RP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	Note 5
11			≥ 132	≥ 1	Note 5	Note 5
13	(PRS $\hat{E}s/Iot)_i$ ≥-6 dB	120	≥ 64	≥ 1	Same value as PRS_RP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	Note 5
6			≥ 128	≥ 1	Note 5	Note 5

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 6: Void

10.1.23.3 Report mapping

10.1.23.3.1 Absolute DL RSTD Measurement Reporting

The reporting range for the DL RSTD measurement is defined from -985024×T_c to 985024×T_c with the resolution step of 2^k×T_c, where

T_c is defined in TS 38.211 [6],

$k_{min} \leq k \leq k_{max}$,

k_{min} = -6 and k_{max} = 5,

$k \geq$ *timingReportingGranularityFactor* [34] configured by LMF via LPP for the RSTD measurement.

The measurement report mapping for different *k* values are specified in tables 10.1.23.3.1-1 – 10.1.23.3.1-12.

Table 10.1.23.3.1-1: Report mapping for *k*=0

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_0000000	RSTD < -985024	T_c
RSTD_0000001	-985024 ≤ RSTD < -985023	T_c
RSTD_0000002	-985023 ≤ RSTD < -985022	T_c
…	…	…
RSTD_0985024	-1 ≤ RSTD < 0	T_c
RSTD_0985025	0 ≤ RSTD < 1	T_c
…	…	…
RSTD_1970047	985022 ≤ RSTD < 985023	T_c
RSTD_1970048	985023 ≤ RSTD < 985024	T_c
RSTD_1970049	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-2: Report mapping for *k*=1

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_000000	RSTD < -985024	T_c

RSTD_000001	-985024 ≤ RSTD < -985022	T_c
RSTD_000002	-985022 ≤ RSTD < -985020	T_c
…	…	…
RSTD_492512	-2 ≤ RSTD < 0	T_c
RSTD_492513	0 ≤ RSTD < 2	T_c
…	…	…
RSTD_985023	985020 ≤ RSTD < 985022	T_c
RSTD_985024	985022 ≤ RSTD < 985024	T_c
RSTD_985025	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-3: Report mapping for *k*=2

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_000000	RSTD < -985024	T_c
RSTD_000001	-985024 ≤ RSTD < -985020	T_c
RSTD_000002	-985020 ≤ RSTD < -985016	T_c
…	…	…
RSTD_246256	-4 ≤ RSTD < 0	T_c
RSTD_246257	0 ≤ RSTD < 4	T_c
…	…	…
RSTD_492511	985016 ≤ RSTD < 985020	T_c
RSTD_492512	985020 ≤ RSTD < 985024	T_c
RSTD_492513	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-4: Report mapping for *k*=3

Reported Quantity Value RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_000000	RSTD < -985024	T_c
RSTD_000001	-985024 ≤ RSTD < -985016	T_c
RSTD_000002	-985016 ≤ RSTD < -985008	T_c
…	…	…
RSTD_123128	-8 ≤ RSTD < 0	T_c
RSTD_123129	0 ≤ RSTD < 8	T_c
…	…	…
RSTD_246255	985008 ≤ RSTD < 985016	T_c
RSTD_246256	985016 ≤ RSTD < 985024	T_c
RSTD_246257	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-5: Report mapping for *k*=4

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_000000	RSTD < -985024	T_c
RSTD_000001	-985024 ≤ RSTD < -985008	T_c
RSTD_000002	-985008 ≤ RSTD < -984992	T_c
…	…	…
RSTD_061564	-16 ≤ RSTD < 0	T_c
RSTD_061565	0 ≤ RSTD < 16	T_c
…	…	…
RSTD_123127	984992 ≤ RSTD < 985008	T_c
RSTD_123128	985008 ≤ RSTD < 985024	T_c
RSTD_123129	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-6: Report mapping for *k*=5

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit

RSTD_00000	RSTD < -985024	T_c
RSTD_00001	-985024 ≤ RSTD < -984992	T_c
RSTD_00002	-984992 ≤ RSTD < -984960	T_c
…	…	…
RSTD_30782	-32 ≤ RSTD < 0	T_c
RSTD_30783	0 ≤ RSTD < 32	T_c
…	…	…
RSTD_61563	984960 ≤ RSTD < 984992	T_c
RSTD_61564	984992 ≤ RSTD < 985024	T_c
RSTD_61565	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-7: Report mapping for *k*=-1

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_0000000	RSTD < -985024	T_c
RSTD_0000001	-985024 ≤ RSTD < -985023.5	T_c
RSTD_0000002	-985023.5 ≤ RSTD < -985023	T_c
…	…	…
RSTD_1970048	-0.5 ≤ RSTD < 0	T_c
RSTD_1970049	0 ≤ RSTD < 0.5	T_c
…	…	…
RSTD_3940095	985023 ≤ RSTD < 985023.5	T_c
RSTD_3940096	985023.5 ≤ RSTD < 985024	T_c
RSTD_3940097	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-8: Report mapping for *k*=-2

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_0000000	RSTD < -985024	T_c
RSTD_0000001	-985024 ≤ RSTD < -985023.75	T_c
RSTD_0000002	-985023.75 ≤ RSTD < -985023.5	T_c
…	…	…
RSTD_3940096	-0.25 ≤ RSTD < 0	T_c
RSTD_3940097	0 ≤ RSTD < 0.25	T_c
…	…	…
RSTD_7880191	985023.5 ≤ RSTD < 985023.75	T_c
RSTD_7880192	985023.75 ≤ RSTD < 985024	T_c
RSTD_7880193	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-9: Report mapping for *k*=-3

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_00000000	RSTD < -985024	T_c
RSTD_00000001	-985024 ≤ RSTD < -985023.875	T_c
RSTD_00000002	-985023.875 ≤ RSTD < -985023.75	T_c
…	…	…
RSTD_07880192	-0.125 ≤ RSTD < 0	T_c
RSTD_07880193	0 ≤ RSTD < 0.125	T_c
…	…	…
RSTD_15760383	985023.75 ≤ RSTD < 985023.875	T_c
RSTD_15760384	985023.875 ≤ RSTD < 985024	T_c
RSTD_15760385	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-10: Report mapping for *k*=-4

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_00000000	RSTD < -985024	T_c
RSTD_00000001	-985024 ≤ RSTD < -985023.9375	T_c
RSTD_00000002	-985023.9375 ≤ RSTD < -985023.875	T_c
…	…	…
RSTD_15760384	-0. 0625 ≤ RSTD < 0	T_c
RSTD_15760385	0 ≤ RSTD < 0.0625	T_c
…	…	…
RSTD_31520767	985023.875 ≤ RSTD < 985023.9375	T_c
RSTD_31520768	985023.9375 ≤ RSTD < 985024	T_c
RSTD_31520769	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-11: Report mapping for *k*=-5

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_00000000	RSTD < -985024	T_c
RSTD_00000001	-985024 ≤ RSTD < -985023.9688	T_c
RSTD_00000002	-985023.9688 ≤ RSTD < -985023.9375	T_c
…	…	…
RSTD_31520768	-0.0312 ≤ RSTD < 0	T_c
RSTD_31520769	0 ≤ RSTD < 0.0312	T_c
…	…	…
RSTD_63041535	985023.9375 ≤ RSTD < 985023.9688	T_c
RSTD_63041536	985023.9688 ≤ RSTD < 985024	T_c
RSTD_63041537	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-12: Report mapping for *k*=-6

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_000000000	RSTD < -985024	T_c
RSTD_000000001	-985024 ≤ RSTD < -985023.9844	T_c
RSTD_000000002	-985023.9844 ≤ RSTD < -985023.9688	T_c
…	…	…
RSTD_063041536	-0.0156 ≤ RSTD < 0	T_c
RSTD_063041537	0 ≤ RSTD < 0.0156	T_c
…	…	…
RSTD_126083071	985023.9688 ≤ RSTD < 985023.9844	T_c
RSTD_126083072	985023.9844 ≤ RSTD < 985024	T_c
RSTD_126083073	985024 ≤ RSTD	T_c

10.1.23.3.2 Differential Reporting for DL RSTD Measurement

A first DL RSTD measurement is reported by means of differential reporting, i.e. as ΔRSTD, relative to a second DL RSTD measurement (RSTD2), provided that:

- the absolute measured quantity value of the second DL RSTD measurement (RSTD2) is not larger than the absolute measured quantity value of the first DL RSTD measurement (RSTD1), i.e., ΔRSTD=RSTD1-RSTD2≥0, and

- the absolute value of the second DL RSTD measurement (RSTD2) is reported together with ΔRSTD for the first DL RSTD measurement.

The reporting range for differential reporting ΔRSTD of the first DL RSTD measurement is defined from 0 up to $8191 \times T_c$ with the resolution step of $2^k \times T_c$, where

T_c is defined in TS 38.211 [6],

$k_{min} \leq k \leq k_{max}$,

k_{min} = -6 and k_{max} = 5,

$k \geq$ *timingReportingGranularityFactor* [34] configured by LMF via LPP for the RSTD measurement.

The measurement report mapping for different *k* values are specified in tables 10.1.23.3.2-1 – 10.1.23.3.2-12.

Table 10.1.23.3.2-1: Report mapping for *k*=0

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_0000	0 ≤ ΔRSTD < 1	T_c
DIFFRSTD_0001	1 ≤ ΔRSTD < 2	T_c
DIFFRSTD_0002	2 ≤ ΔRSTD < 3	T_c
…	…	…
DIFFRSTD_8189	8189 ≤ ΔRSTD < 8190	T_c
DIFFRSTD_8190	8190 ≤ ΔRSTD < 8191	T_c
DIFFRSTD_8191	8191 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-2: Report mapping for *k*=1

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_0000	0 ≤ ΔRSTD < 2	T_c
DIFFRSTD_0001	2 ≤ ΔRSTD < 4	T_c
DIFFRSTD_0002	4 ≤ ΔRSTD < 6	T_c
…	…	…
DIFFRSTD_4093	8186 ≤ ΔRSTD < 8188	T_c
DIFFRSTD_4094	8188 ≤ ΔRSTD < 8190	T_c
DIFFRSTD_4095	8190 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-3: Report mapping for *k*=2

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_0000	0 ≤ ΔRSTD < 4	T_c
DIFFRSTD_0001	4 ≤ ΔRSTD < 8	T_c
DIFFRSTD_0002	8 ≤ ΔRSTD < 12	T_c
…	…	…
DIFFRSTD_2045	8180 ≤ ΔRSTD < 8184	T_c
DIFFRSTD_2046	8184 ≤ ΔRSTD < 8188	T_c
DIFFRSTD_2047	8188 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-4: Report mapping for *k*=3

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_0000	0 ≤ ΔRSTD < 8	T_c
DIFFRSTD_0001	8 ≤ ΔRSTD < 16	T_c
DIFFRSTD_0002	16 ≤ ΔRSTD < 24	T_c
…	…	…
DIFFRSTD_1021	8168 ≤ ΔRSTD < 8176	T_c
DIFFRSTD_1022	8176 ≤ ΔRSTD < 8184	T_c
DIFFRSTD_1023	8184 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-5: Report mapping for *k*=4

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_000	0 ≤ ΔRSTD < 16	T_c
DIFFRSTD_001	16 ≤ ΔRSTD < 32	T_c
DIFFRSTD_002	32 ≤ ΔRSTD < 48	T_c
…	…	…
DIFFRSTD_509	8144 ≤ ΔRSTD < 8160	T_c
DIFFRSTD_510	8160 ≤ ΔRSTD < 8176	T_c
DIFFRSTD_511	8176 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-6: Report mapping for *k*=5

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_000	0 ≤ ΔRSTD < 32	T_c
DIFFRSTD_001	32 ≤ ΔRSTD < 64	T_c
DIFFRSTD_002	64 ≤ ΔRSTD < 96	T_c
…	…	…
DIFFRSTD_253	8096 ≤ ΔRSTD < 8128	T_c
DIFFRSTD_254	8128 ≤ ΔRSTD < 8160	T_c
DIFFRSTD_255	8160 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-7: Report mapping for *k*=-1

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_00000	0 ≤ ΔRSTD < 0.5	T_c
DIFFRSTD_00001	0.5 ≤ ΔRSTD < 1	T_c
DIFFRSTD_00002	1 ≤ ΔRSTD < 1.5	T_c
…	…	…
DIFFRSTD_16380	8190 ≤ ΔRSTD < 8190.5	T_c
DIFFRSTD_16381	8190.5 ≤ ΔRSTD < 8191	T_c
DIFFRSTD_16382	8191 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-8: Report mapping for *k*=-2

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_00000	0 ≤ ΔRSTD < 0.25	T_c
DIFFRSTD_00001	0.25 ≤ ΔRSTD < 0.5	T_c
DIFFRSTD_00002	0.5 ≤ ΔRSTD < 0. 75	T_c
…	…	…
DIFFRSTD_32762	8190.5 ≤ ΔRSTD < 8190.75	T_c
DIFFRSTD_32763	8190.75 ≤ ΔRSTD < 8191	T_c
DIFFRSTD_32764	8191 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-9: Report mapping for *k*=-3

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_00000	0 ≤ ΔRSTD < 0.125	T_c
DIFFRSTD_00001	0.125 ≤ ΔRSTD < 0.25	T_c
DIFFRSTD_00002	0.25 ≤ ΔRSTD < 0. 375	T_c
…	…	…
DIFFRSTD_65526	8190.75 ≤ ΔRSTD < 8190.875	T_c
DIFFRSTD_65527	8190.875 ≤ ΔRSTD < 8191	T_c
DIFFRSTD_65528	8191 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-10: Report mapping for *k*=-4

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_000000	0 ≤ ΔRSTD < 0.0625	T_c
DIFFRSTD_000001	0.0625 ≤ ΔRSTD < 0.125	T_c
DIFFRSTD_000002	0.125 ≤ ΔRSTD < 0.1875	T_c
…	…	…
DIFFRSTD_131054	8190.875 ≤ ΔRSTD < 8190.9375	T_c
DIFFRSTD_131055	8190.9375 ≤ ΔRSTD < 8191	T_c
DIFFRSTD_131056	8191 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-11: Report mapping for *k*=-5

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_000000	0 ≤ ΔRSTD < 0.0312	T_c
DIFFRSTD_000001	0.0312 ≤ ΔRSTD < 0.0625	T_c
DIFFRSTD_000002	0.0625 ≤ ΔRSTD < 0.0938	T_c
…	…	…
DIFFRSTD_262110	8190.9375 ≤ ΔRSTD < 8190.9688	T_c
DIFFRSTD_262111	8190.9688 ≤ ΔRSTD < 8191	T_c
DIFFRSTD_262112	8191 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-12: Report mapping for *k*=-6

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_000000	0 ≤ ΔRSTD < 0. 0156	T_c
DIFFRSTD_000001	0. 0156≤ ΔRSTD < 0. 0312	T_c
DIFFRSTD_000002	0. 0312 ≤ ΔRSTD < 0.0469	T_c
…	…	…
DIFFRSTD_524222	8190.9688≤ ΔRSTD < 8190. 9844	T_c
DIFFRSTD_524223	8190. 9844≤ ΔRSTD < 8191	T_c
DIFFRSTD_524224	8191 ≤ ΔRSTD	T_c

10.1.23.3.3 Additional Path Report Mapping for DL RSTD

The reporting range for the additional path reporting for an RSTD measurement is defined up to the range from $-8175\times T_c$ to $8175\times T_c$ with the resolution step of $2^k\times T_c$, where

T_c is defined in TS 38.211 [6],

$k_{min}\leq k\leq k_{max}$,

k_{min} = -6 and k_{max} = 5,

$k\geq$ *timingReportingGranularityFactor* [34] configured by LMF via LPP for the RSTD measurement.

The UE can report the timing of up to two additional paths with respect to the path timing determining the RSTD measurement.

A UE capable of *additionalPathsExtSupport-r17* can report the timing for a number additional paths, up to its capability, with respect to the path timing determining the RSTD measurement.

The report mappings for different *k* values are specified in tables 10.1.23.3.3-1 – 10.1.23.3.3-12.

Table 10.1.23.3.3-1: Report mapping for *k*=0

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174	T_c
path_00002	-8174 ≤ Δpath < -8173	T_c
…	…	…
path_08175	-1 ≤ Δpath < 0	T_c
path_08176	0 ≤ Δpath < 1	T_c
…	…	…
path_16349	8173 ≤ Δpath < 8174	T_c
path_16350	8174 ≤ Δpath < 8175	T_c
path_16351	8175 ≤ Δpath	T_c

Table 10.1.23.3.3-2: Report mapping for *k*=1

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8175	T_c
path_0001	-8175 ≤ Δpath < -8173	T_c
path_0002	-8173 ≤ Δpath < -8171	T_c
…	…	…
path_4088	-1 ≤ Δpath < 1	T_c
…	…	…
path_8174	8171 ≤ Δpath < 8173	T_c
path_8175	8173 ≤ Δpath < 8175	T_c
path_8176	8175 ≤ Δpath	T_c

Table 10.1.23.3.3-3: Report mapping for *k*=2

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8174	T_c
path_0001	-8174 ≤ Δpath < -8170	T_c
path_0002	-8170 ≤ Δpath < -8166	T_c
…	…	…
path_2044	-2 ≤ Δpath < 2	T_c
…	…	…
path_4086	8166 ≤ Δpath < 8170	T_c
path_4087	8170 ≤ Δpath < 8174	T_c
path_4088	8174 ≤ Δpath	T_c

Table 10.1.23.3.3-4: Report mapping for *k*=3

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8172	T_c
path_0001	-8172 ≤ Δpath < -8164	T_c
path_0002	-8164 ≤ Δpath < -8156	T_c
…	…	…
path_1022	-4 ≤ Δpath < 4	T_c
…	…	…
path_2042	8156 ≤ Δpath < 8164	T_c
path_2043	8164 ≤ Δpath < 8172	T_c
path_2044	8172 ≤ Δpath	T_c

Table 10.1.23.3.3-5: Report mapping for *k*=4

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8168	T_c
path_0001	-8168 ≤ Δpath < -8152	T_c
path_0002	-8152 ≤ Δpath < -8136	T_c
…	…	…
path_511	-8 ≤ Δpath < 8	T_c
…	…	…
path_1020	8136 ≤ Δpath < 8152	T_c
path_1021	8152 ≤ Δpath < 8168	T_c
path_1022	8168 ≤ Δpath	T_c

Table 10.1.23.3.3-6: Report mapping for *k*=5

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000	Δpath < -8160	T_c
path_001	-8160 ≤ Δpath < -8128	T_c
path_002	-8128 ≤ Δpath < -8096	T_c
…	…	…
path_256	0 ≤ Δpath < 32	T_c
…	…	…
path_509	8096 ≤ Δpath < 8128	T_c
path_510	8128 ≤ Δpath < 8160	T_c
path_511	8160 ≤ Δpath	T_c

Table 10.1.23.3.3-7: Report mapping for *k*=-1

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174.5	T_c
path_00002	-8174.5 ≤ Δpath < -8174	T_c
…	…	…
path_16350	-0.5 ≤ Δpath < 0	T_c
path_16351	0 ≤ Δpath < 0.5	T_c
…	…	…
path_32699	8174 ≤ Δpath < 8174.5	T_c
path_32700	8174.5 ≤ Δpath < 8175	T_c
path_32701	8175 ≤ Δpath	T_c

Table 10.1.23.3.3-8: Report mapping for *k*=-2

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174.75	T_c
path_00002	-8174.75 ≤ Δpath < -8174.5	T_c
…	…	…
path_32700	-0.25 ≤ Δpath < 0	T_c
path_32701	0 ≤ Δpath < 0.25	T_c
…	…	…
path_65399	8174.5 ≤ Δpath < 8174.75	T_c
path_65400	8174.75 ≤ Δpath < 8175	T_c
path_65401	8175 ≤ Δpath	T_c

Table 10.1.23.3.3-9: Report mapping for *k*=-3

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174.8750	T_c
path_00002	-8174.8750≤ Δpath < -8174.7500	T_c
…	…	…
path_065400	-0.25 ≤ Δpath < 0	T_c
path_065401	0 ≤ Δpath < 0.25	T_c
…	…	…
path_130799	8174.7500 ≤ Δpath < 8174.8750	T_c
path_130800	8174.8750 ≤ Δpath < 8175	T_c
path_130801	8175 ≤ Δpath	T_c

Table 10.1.23.3.3-10: Report mapping for *k*=-4

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000000	Δpath < -8175	T_c
path_000001	-8175 ≤ Δpath < -8174.9375	T_c
path_000002	-8174.9375≤ Δpath < -8174.8750	T_c
…	…	…
path_130800	-0.25 ≤ Δpath < 0	T_c
path_130801	0 ≤ Δpath < 0.25	T_c
…	…	…
path_261599	8174.8750 ≤ Δpath < 8174.9375	T_c
path_261600	8174.9375 ≤ Δpath < 8175	T_c
path_261601	8175 ≤ Δpath	T_c

Table 10.1.23.3.3-11: Report mapping for *k*=-5

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000000	Δpath < -8175	T_c
path_0000001	-8175 ≤ Δpath < -8174.9688	T_c
path_0000002	-8174.9688 ≤ Δpath < -8174.9375	T_c
…	…	…
path_0261600	-0.0312 ≤ Δpath < 0	T_c
path_0261601	0 ≤ Δpath < 0.0312	T_c
…	…	…
path_523199	8174.9375 ≤ Δpath < 8174.9688	T_c
path_523200	8174.9688 ≤ Δpath < 8175	T_c
path_523201	8175 ≤ Δpath	T_c

Table 10.1.23.3.3-12: Report mapping for *k*=-6

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000000	Δpath < -8175	T_c
path_0000001	-8175 ≤ Δpath < -8174.9844	T_c
path_0000002	-8174.9844 ≤ Δpath < -8174.9688	T_c
…	…	…
path_0523200	-0.0156 ≤ Δpath < 0	T_c
path_0523201	0 ≤ Δpath < 0.0156	T_c
…	…	…
path_1046399	8174.9688 ≤ Δpath < 8174.9844	T_c
path_1046400	8174.9844 ≤ Δpath < 8175	T_c
path_1046401	8175 ≤ Δpath	T_c

10.1.23ARSTD Measurements Based on PRS Aggregation

10.1.23A.1 Introduction

The requirements in clause 10.1.23A shall apply, provided the UE has received *nr-DL-TDOA-RequestLocationInformation* message with *nr-DL-PRS-JointMeasurementRequestedPFL-List* from LMF via LPP TS 37.355 [34] requesting the UE to report one or more DL RSTD measurements defined in TS 38.215 [4] with aggregated measurement. The requirements in clause 10.1.23A shall apply:

- when UE is in RRC_CONNECTED state and the measurement is performed with MG or without MG,
- when UE is in RRC_INACTIVE state,
- when UE is in RRC_IDLE state.

10.1.23A.2 Measurement Accuracy Requirements

When UE measures RSTD on PRS resources belonging to different PFLs or different PFL combinations, then the RSTD accuracy is defined as the accuracy corresponding to the largest accuracy value among different PFLs or different PFL combinations.

The requirements in this clause for 3-PFL and 2-PFL apply provided that:

- PRS resources linked for aggregation saftisfy all the conditions specified in TS 38.214 [26] clause 5.1.6.5.3.
- The spacing between the center frequencies of adjacent PFLs containing PRS resources linked for aggregation does not exceed the nominal channel spacing for intra-band contiguous CA defined in TS 38.101-1 [18], clause 5.4A.1 for FR1, and in TS 38.101-2, [19] clause 5.4A.1 for FR2-1.

The accuracy requirements for RSTD measurement based on PRS Aggregation shall be within $\pm(X+Y+Z+\Delta)\ T_c$.

X is defined in table 10.1.23A.2-1 for AWGN channel and table 10.1.23A.2-3 for fading channel for FR1, provided that the following conditions are met:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for RSTD measurements are fulfilled according to annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.
- UE does not perform positioning measurement with reduced number of samples.

X is defined in table 10.1.23A.2-2 for AWGN channel and table 10.1.23A.2-4 for fading channel for FR2, provided that the following conditions are met:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for RSTD measurements are fulfilled according to annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.
- UE does not perform positioning measurement with reduced number of samples.

X is defined in table 10.1.23A.2-5 for AWGN channel in FR1, provided that the following conditions are met:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for RSTD measurements are fulfilled according to annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.
- UE supports positioning measurement with reduced number of sample and is indicated by LMF to perform positioning measurement with reduced number of samples.

X is defined in table 10.1.23A.2-6 for AWGN channel in FR2, provided that the following conditions are met:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for RSTD measurements are fulfilled according to annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.
- UE supports positioning measurement with reduced number of sample and is indicated by LMF to perform positioning measurement with reduced number of samples.

NOTE: The requriements for fading channel in this clause are derived based on TDL-A (30 ns delay spread, 5Hz) and TDL-C (60 ns delay spread, 300 Hz) channel models for FR1 and FR2 respectively.

If the UE doesn't support Rx TEG reporting for RSTD measurement or when the measurements of reference cell and neighbour cell belong to different Rx TEGs, Y, Z and Δ are defined as follows:

- When UE measures RSTD on PRS resources belonging to same PFL or same PFL combination, Y=32 Tc, provided that the time offset between the two PRS resource instances from the reference cell and the neighbor cell, which are used for a single RSTD estimate, is no greater than 160 ms.
- When UE measures RSTD on PRS resources belonging different PFLs or different PFL combinations, Y=256 Tc, provided that the time offset between the two PRS resource instances from the reference cell and the neighbor cell, which are used for a single RSTD estimate, is no greater than 1280 ms.
- Z is defined in table 10.1.23A.2-7 for FR1 and table 10.1.23A.2-9 for FR2, respectively, where the PRS BW refers to the sum of the PRS PRB numbers across the aggregated PFLs.
- Δ is zero when UE measures RSTD on PRS resources belonging to same PFL or same PFL combination and is defined in table 10.1.23A.2-8 for FR1 and table 10.1.23A.2-10 for FR2, respectively, when UE measures RSTD on PRS resources belonging different PFLs or different PFL combinations, where the PRS BW refers to the sum of the PRS PRB numbers across the aggregated PFLs.

If the measurements of reference cell and neighbour cell belong to the same Rx TEG, i.e. associated and reported with a common Rx TEG ID, then the sum of Y+Z+Δ is equal to the timing error margin of the Rx TEG reported in *nr-UE-RxTEG-TimingErrorMargin*. The timing error margin reported via *nr-UE-RxTEG-TimingErrorMargin* cannot be larger than the value of (Y+Z+Δ) defined when the UE does not associate the measurements with the same Rx TEG.

Table 10.1.23A.2-1: RSTD absolute accuracy in FR1 for AWGN channel

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions						
		PRS $\hat{E}s/Iot$	PRS SCS	PRS bandwidth per PFL Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range		
						NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5		dB	kHz	PRB			dBm/SCS	dBm/$BW_{Channel}$
20	16	(PRS $\hat{E}s/Iot)_{ref}$ ≥-6dB (PRS $\hat{E}s/Iot)_i$ ≥-13dB	15	≥ 104	≥ 1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
						NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
						NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
						NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
						NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
						NR_FDD_FR1_F	-124.5	-50
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
						NR_FDD_FR1_H	-123.5	-50
						NR_FDD_FR1_N	-120.5	-50
11	6		30	≥ 132	≥ 1	NR_FDD_FR1_A, NR_TDD_FR1_A,	-124	-50

						NR_SDL_FR1_A		
						NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
						NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
						NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
						NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
						NR_FDD_FR1_F	-121.5	-50
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
						NR_FDD_FR1_H	-120.5	-50
						NR_FDD_FR1_N	-117.5	-50
6	4			272	≥ 1	Note 6	Note 6	Note 6
						NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
						NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
						NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
11	6		60	≥ 64	≥ 1	NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
						NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
						NR_FDD_FR1_F	-118.5	-50
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
						NR_FDD_FR1_H	-117.5	-50
						NR_FDD_FR1_N	-114.5	-50
5	4			132	≥ 1	Note 6	Note 6	Note 6

NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.

Table 10.1.23A.2-2: RSTD absolute accuracy in FR2 for AWGN channel

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions					
		PRS Ês/Iot	PRS SCS	PRS bandwidth per PFL Note 1	PRS resource repetition ($T_{\text{rep}}^{\text{PRS}} * L_{\text{PRS}} / K_{\text{comb}}^{\text{PRS}}$) Note 2	Io Note 3 range	
						Minimum Io	Maximum Io
Tc Note 4		dB	kHz	PRB		dBm/SCS	$\text{dBm/BW}_{\text{Channel}}$
11	6	(PRS Ês/Iot)$_{\text{ref}}$ ≥-6dB (PRS Ês/Iot)$_i$ ≥-13dB	60	≥ 64	≥ 1	Same value as PRS_RP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
5	4			≥ 132	≥ 1	Note 5	Note 5

6	4		120	≥ 64	≥ 1	Same value as PRS_RP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
3	2			≥ 128	≥ 1	Note 5	Note 5

NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.

Table 10.1.23A.2-3: RSTD absolute accuracy in FR1 for fading channel

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions						
		PRS Ês/Iot	PRS SCS	PRS bandwidth per PFL Note 1	PRS resource repetition ($T_{\text{rep}}^{\text{PRS}} * L_{\text{PRS}} / K_{\text{comb}}^{\text{PRS}}$) Note 2	Io Note 3 range		
						NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5		dB	kHz	PRB			dBm/SCS	$dBm/BW_{Channel}$
38	30	(PRS Ês/Iot)$_{ref}$ ≥-6dB	15	≥ 104	≥ 1	Note 6	Note 6	Note 6
29	29		30	≥ 132	≥ 1	Note 6	Note 6	Note 6
27	26			272	≥ 1	Note 6	Note 6	Note 6
29	35		60	≥ 64	≥ 1	Note 6	Note 6	Note 6
27	31	(PRS Ês/Iot)$_i$ ≥-13dB		132	≥ 1	Note 6	Note 6	Note 6

NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1.23A.2-1.

Table 10.1.23A.2-4: RSTD absolute accuracy in FR2 for fading channel

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions					
		PRS Ês/Iot	PRS SCS	PRS bandwidth per PFL Note 1	PRS resource repetition ($T_{\text{rep}}^{\text{PRS}} * L_{\text{PRS}} / K_{\text{comb}}^{\text{PRS}}$) Note 2	Io Note 3 range	
						Minimum Io	Maximum Io
Tc Note 4		dB	kHz	PRB		dBm/SCS	$dBm/BW_{Channel}$
71	51	(PRS Ês/Iot)$_{ref}$ ≥-6dB	60	≥ 64	≥ 1	Note 5	Note 5
55	38			≥ 132	≥ 1	Note 5	Note 5
72	49		120	≥ 64	≥ 1	Note 5	Note 5
56	53			≥ 128	≥ 1	Note 5	Note 5

		(PRS Ês/Iot)$_i$ ≥-13dB					

NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1.23A.2-2.

Table 10.1.23A.2-5: RSTD absolute accuracy in FR1 for AWGN channel with reduced number of samples

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions						
		PRS Ês/Iot	PRS SCS	PRS bandwidth per PFL Note 1	PRS resource repetition ($T_{\text{rep}}^{\text{PRS}} * L_{\text{PRS}} / K_{\text{comb}}^{\text{PRS}}$) Note 2	Io Note 3 range		
						NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5		dB	kHz	PRB			dBm/SCS	dBm/BW$_{\text{Channel}}$
24	20	(PRS Ês/Iot)$_{\text{ref}}$ ≥-3dB	15	≥ 104	≥ 1	Note 6	Note 6	Note 6
13	7		30	≥ 132	≥ 1	Note 6	Note 6	Note 6
6	5			272	≥ 1	Note 6	Note 6	Note 6
13	7	(PRS Ês/Iot)$_i$ ≥-6dB	60	≥ 64	≥ 1	Note 6	Note 6	Note 6
6	5			132	≥ 1	Note 6	Note 6	Note 6

NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1.23A.2-1.

Table 10.1.23A.2-6: RSTD absolute accuracy in FR2 for AWGN channel with reduced number of samples

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions					
		PRS Ês/Iot	PRS SCS	PRS bandwidth per PFL Note 1	PRS resource repetition ($T_{\text{rep}}^{\text{PRS}} * L_{\text{PRS}} / K_{\text{comb}}^{\text{PRS}}$) Note 2	Io Note 3 range	
						Minimum Io	Maximum Io
Tc Note 4		dB	kHz	PRB		dBm/SCS	dBm/BW$_{\text{Channel}}$
13	7	(PRS Ês/Iot)$_{\text{ref}}$ ≥-3dB	60	≥ 64	≥ 1	Note 5	Note 5
6	5			≥ 132	≥ 1	Note 5	Note 5
6	4		120	≥ 64	≥ 1	Note 5	Note 5
3	2	(PRS Ês/Iot)$_i$ ≥-6dB		≥ 128	≥ 1	Note 5	Note 5

NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i among all the aggregated PFLs.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1.23A.2-2.

Table 10.1.23A.2-7: Margin for RSTD measurement accuracy in FR1

PRS BW (PRB number)			Margin (Tc)
SCS=15kHz	SCS=30kHz	SCS=60kHz	
≥ 104	N/A	N/A	36
N/A	≥ 132	≥ 64	16
N/A	N/A	≥ 132	12

Table 10.1.23A.2-8: Margin Δ for RSTD measurement accuracy in FR1

PRS BW (PRB number)			Margin (Tc)
SCS=15kHz	SCS=30kHz	SCS=60kHz	
≥ 104	N/A	N/A	32
N/A	≥ 132	≥ 64	16
N/A	N/A	≥ 132	8

Table 10.1.23A.2-9: Margin for RSTD measurement accuracy in FR2

PRS BW (PRB number)		Margin (Tc)
SCS=60kHz	SCS=120kHz	
≥ 64	N/A	32
≥ 132	≥ 64	16
N/A	≥ 128	12

Table 10.1.23A.2-10: Margin Δ for RSTD measurement accuracy in FR2

PRS BW (PRB number)		Margin (Tc)
SCS=60kHz	SCS=120kHz	
≥ 64	N/A	16
≥ 132	≥ 64	8
N/A	≥ 128	4

10.1.23A.3 Report Mapping

10.1.23A.3.1 Absolute DL RSTD Measurement Reporting

The report mapping as defined in clause 10.1.23.3.1 shall apply.

10.1.23A.3.2 Differential Reporting for DL RSTD Measurement

The report mapping as defined in clause 10.1.23.3.2 shall apply.

10.1.23A.3.3 Additional Path Report Mapping for DL RSTD

The report mapping as defined in clause 10.1.23.3.3 shall apply.

10.1.24 PRS-RSRP Measurements

10.1.24.1 Introduction

The requirements in clause 10.1.24 shall apply, provided the UE has received *nr-DL-TDOA-RequestLocationInformation* or *nr-Multi-RTT-RequestLocationInformation* or *nr-DL-AoD-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to report one or more DL PRS-RSRP measurements defined in TS 38.215 [4].

The requirements in clause 10.1.24 apply for UE in RRC_CONNECTED, including PRS-RSRP measurement with MG and outside MG, as well as for UE in RRC_INACTIVE and RRC_IDLE state. For PRS-RSRP measurement in FR2, the requirements apply with and without reduced Rx beam sweeping factor.

10.1.24.2 Measurement Accuracy Requirements

10.1.24.2.1 Absolute PRS-RSRP accuracy

The absolute accuracy requirements for PRS-RSRP measurement for FR1 defined in table 10.1.24.2.1-1 are valid under the following conditions:

- Conditions defined in 38.101-1 clause 7.3 for reference sensitivity are fulfilled.
- PRP $1,2|_{dBm}$ according to annex B.2.14 for a corresponding Band
- UE does not support positioning measurements with reduced number of samples, or LMF does not indicate UE to perform positioning measurements with reduced number of samples

The absolute accuracy requirements for PRS-RSRP measurement for FR2 defined in table 10.1.24.2.1-2 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] clause 7.3 for reference sensitivity are fulfilled.
- PRP $1,2|_{dBm}$ according to annex B.2.14 for a corresponding Band
- UE does not support positioning measurements with reduced number of samples, or LMF does not indicate UE to perform positioning measurements with reduced number of samples

Table 10.1.24.2.1-1: PRS-RSRP absolute accuracy for FR1

Accuracy		Conditions						
					Io Note 7 range			
Normal condition	Extreme condition	PRS Ês/Iot	PRS BW	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	NR operating band groups Note 8	Minimum Io Note 1 dBm / SCS_{PRS}		Maximum Io
						dBm / SCS_{PRS}		
dB	dB	dB	PRB	-		dBm/15 kHz Note 6	dBm/30 kHz Note 6	dBm/60 kHz Note 6	$dBm/BW_{Channel}$
±3.5	±8	≥-3 dB	≥24	All	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-123.5	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-123	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119	-50
					NR_FDD_FR1_F	-124.5	-121.5	-118.5	-50

					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	-118	-50
					NR_FDD_FR1_H	-123.5	-120.5	-117.5	-50
					NR_FDD_FR1_N	-120.5	-117.5	-114.5	-50
					Note 4				
					Note 4				
±8.5	±13	≥-13 dB	24 ≤ BW ≤ 52	All	Note 4				
±6	±10.5		52< BW≤ 104	All	Note 4				
±4.5	±9		BW >104	All	Note 4				

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: Void.
NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].
NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 PRB.
NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 6: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.
NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 8: NR operating band groups are as defined in clause 3.5.2.

Table 10.1.24.2.1-2: PRS-RSRP absolute accuracy for FR2

Accuracy		**Conditions**					
					Io Note 7 range		
Normal condition	**Extreme condition**	**PRS Ês/Iot**	**PRS BW**	**Repetition factor** ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	**Minimum Io Note 1 dBm / SCS_{PRS}**		**Maximum Io**
					dBm / SCS_{PRS}		
dB	**dB**	**dB**	**PRB**	**-**	**dBm/120 kHz Note 6**	**dBm/60 kHz Note 6**	**dBm/$BW_{Channel}$**
±5	±8	≥-3 dB	≥24	All	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival		-50
					Note 4		
					Note 4		
±8.5	±11.5	≥-13 dB	24 ≤ BW ≤ 64	All	Note 4		
±6	±9		BW >64	All	Note 4		

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: Void.
NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].
NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 PRB.
NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 6: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.
NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 8: NR operating band groups are as defined in clause 3.5.2.

The absolute accuracy requirements for PRS-RSRP measurement for FR1 defined in table 10.1.24.2.1-3 are valid under the following conditions:

- Conditions defined in 38.101-1 clause 7.3 for reference sensitivity are fulfilled.
- PRP $1,2|_{dBm}$ according to annex B.2.14 for a corresponding Band

- UE supports positioning measurements with reduced number of samples, and LMF indicates UE to perform positioning measurements with reduced number of samples
- AWGN channel

The absolute accuracy requirements for PRS-RSRP measurement for FR2 defined in table 10.1.24.2.1-4 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] clause 7.3 for reference sensitivity are fulfilled.
- PRP $1,2|_{dBm}$ according to annex B.2.14 for a corresponding Band
- UE supports positioning measurements with reduced number of samples, and LMF indicates UE to perform positioning measurements with reduced number of samples
- AWGN channel

Table 10.1.24.2.1-3: PRS-RSRP absolute accuracy for FR1 with reduced sample number

Accuracy		Conditions							
					Io Note 6 range				
Normal condition	Extreme condition	PRS $\hat{E}_s/I_{ot}$	PRS BW	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	NR operating band groups Note 7	Minimum Io Note 1 dBm / SCS_{PRS}			Maximum Io
						dBm / SCS_{PRS}			
dB	dB	dB	PRB	-		dBm/15 kHz Note 5	dBm/30 kHz Note 5	dBm/60 kHz Note 5	$dBm/BW_{Channel}$
±3.5	±8	≥0	≥48	All	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-123.5	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-123	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119	-50
					NR_FDD_FR1_F	-124.5	-121.5	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	-118	-50
					NR_FDD_FR1_H	-123.5	-120.5	-117.5	-50
					NR_FDD_FR1_N	-120.5	-117.5	-114.5	-50
±8.5	±13	≥-6	48 ≤ BW ≤ 52	All	Note 3				
±6	±10.5		52< BW≤ 104	All	Note 3				
±4.5	±9		BW >104	All	Note 3				

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 48 PRB.
NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 5: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.
NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 7: NR operating band groups are as defined in clause 3.5.2.

Table 10.1.24.2.1-4: PRS-RSRP absolute accuracy for FR2 with reduced sample number

Accuracy		Conditions				
Normal condition	Extreme condition	PRS Ês/Iot	PRS BW	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	Io Note 6 range	
					Minimum Io Note 1 dBm / SCS_{PRS}	Maximum Io
dB	dB	dB	PRB	-	dBm / SCS_{PRS}	dBm/$BW_{Channel}$
					dBm/120 kHz Note 5 / dBm/60 kHz Note 5	
±5	±8	≥0	≥48	All	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
±8.5	±11.5	≥-6	48 ≤ BW ≤ 64	All	Note 3	
±6	±9		BW >64	All	Note 3	

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 48 PRB.
NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 5: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.
NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 7: NR operating band groups are as defined in clause 3.5.2.

10.1.24.2.2 Relative PRS RSRP accuracy

The relative PRS-RSRP accuracy is defined as accuracy of the difference between two PRS-RSRP measurements.

The relative PRS-RSRP accuracy requirements apply for the cases when PRS-RSRP is measured from PRS resources in the same PRS resource set in FR1 or FR2, and measured with same Rx beam in case of FR2.

The accuracy requirements for PRS-RSRP measurement for FR1 defined in table 10.1.24.2.2-1 are valid under the following conditions:

- Conditions defined in 38.101-1 clause 7.3 for reference sensitivity are fulfilled.
- PRP $1,2|_{dBm}$ according to annex B.2.14 for a corresponding Band
- UE does not support positioning measurements with reduced number of samples, or LMF does not indicate UE to perform positioning measurements with reduced number of samples

The accuracy requirements for PRS-RSRP measurement for FR2 defined in table 10.1.24.2.2-2 are valid under the following conditions:

- Conditions defined in 38.101-2 clause 7.3 for reference sensitivity are fulfilled.
- PRP $1,2|_{dBm}$ according to annex B.2.14 for a corresponding Band
- UE does not support positioning measurements with reduced number of samples, or LMF does not indicate UE to perform positioning measurements with reduced number of samples

Table 10.1.24.2.2-1: PRS-RSRP relative accuracy for FR1

Accuracy		Conditions							
Normal condition	Extreme condition	PRS Ês/Iot	PRS BW	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	Io Note 7 range				
					NR operating band groups Note 8	Minimum Io Note 1 dBm / SCS_{PRS}			Maximum Io
dB	dB	dB	PRB	-		dBm / SCS_{PRS}			dBm/$BW_{Channel}$
						dBm/15 kHz Note 6	dBm/30 kHz Note 6	dBm/60 kHz Note 6	

±3.5	±5.0	≥-3 dB	≥24	All	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-123.5	-120.5	-50
					NR_FDD_FR1_C , NR_TDD_FR1_C	-126	-123	-120	-50
					NR_FDD_FR1_D , NR_TDD_FR1_D	-125.5	-122.5	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119	-50
					NR_FDD_FR1_F	-124.5	-121.5	-118.5	-50
					NR_FDD_FR1_G , NR_TDD_FR1_G , NR_SDL_FR1_G	-124	-121	-118	-50
					NR_FDD_FR1_H	-123.5	-120.5	-117.5	-50
					NR_FDD_FR1_N	-120.5	-117.5	-114.5	-50
					Note 4				
					Note 4				
±9.5	±11.0	≥-13 dB	24 ≤ BW ≤ 52	All	Note 4				
±6.5	±8.0		52< BW≤ 104	All	Note 4				
±5.0	±6.5		BW >104	All	Note 4				

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: Void.
NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].
NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 PRB.
NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 6: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.
NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 8: NR operating band groups are as defined in clause 3.5.2.

Table 10.1.24.2.2-2: PRS-RSRP relative accuracy for FR2

Accuracy		**Conditions**					
					Io [Note 7] range		
Normal condition	**Extreme condition**	**PRS Ês/Iot**	**PRS BW**	**Repetition factor** ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	**Minimum Io [Note 1] dBm / SCS_{PRS}**		**Maximum Io**
dB	**dB**	**dB**	**PRB**	**-**	**dBm / SCS_{PRS}**		**$dBm/BW_{Channel}$**
					dBm/120 kHz [Note 6]	**dBm/60 kHz [Note 6]**	
±5.0	±8.0	≥-3 dB	≥24	All	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival		-50
					Note 4		
					Note 4		
±10	±13	≥-13 dB	24 ≤ BW ≤ 64	All	Note 4		
±7.5	±10.5		BW >64	All	Note 4		

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: Void.
NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].
NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 PRB.
NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.

NOTE 6: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.
NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 8: NR operating band groups are as defined in clause 3.5.2.

The absolute accuracy requirements for PRS-RSRP measurement for FR1 defined in table 10.1.24.2.2-3 are valid under the following conditions:

- Conditions defined in 38.101-1 clause 7.3 for reference sensitivity are fulfilled.
- PRP $1,2|_{dBm}$ according to annex B.2.14 for a corresponding Band
- UE supports positioning measurements with reduced number of samples, and LMF indicates UE to perform positioning measurements with reduced number of samples
- AWGN channel

The absolute accuracy requirements for PRS-RSRP measurement for FR2 defined in table 10.1.24.2.2-4 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] clause 7.3 for reference sensitivity are fulfilled.
- PRP $1,2|_{dBm}$ according to annex B.2.14 for a corresponding Band
- UE supports positioning measurements with reduced number of samples, and LMF indicates UE to perform positioning measurements with reduced number of samples
- AWGN channel

Table 10.1.24.2.2-3: PRS-RSRP relative accuracy for FR1 with reduced sample number

Accuracy		Conditions							
					Io Note 6 range				
Normal condition	Extreme condition	PRS $\hat{E}s/Iot$	PRS BW	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	NR operating band groups Note 7	Minimum Io Note 1 dBm / SCS_{PRS}			Maximum Io
						dBm / SCS_{PRS}			
dB	dB	dB	PRB	-		dBm/15 kHz Note 5	dBm/30 kHz Note 5	dBm/60 kHz Note 5	$dBm/BW_{Channel}$
±3.5	±5.0	≥0	≥48	All	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-123.5	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-123	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119	-50
					NR_FDD_FR1_F	-124.5	-121.5	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	-118	-50
					NR_FDD_FR1_H	-123.5	-120.5	-117.5	-50
					NR_FDD_FR1_N	-120.5	-117.5	-114.5	-50
±9.5	±11.0	≥-6	48 ≤ BW ≤ 52	All	Note 3				
±6.5	±8.0		52< BW≤ 104	All	Note 3				
±5.0	±6.5		BW >104	All	Note 3				

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 48 PRB.

NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 5: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.
NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 7: NR operating band groups are as defined in clause 3.5.2.

Table 10.1.24.2.2-4: PRS-RSRP relative accuracy for FR2 with reduced sample number

Accuracy		Conditions				
Normal condition	Extreme condition	PRS Ês/Iot	PRS BW	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	Io Note 6 range	
					Minimum Io Note 1 dBm / SCS_{PRS}	Maximum Io
dB	dB	dB	PRB	-	dBm / SCS_{PRS}	dBm/$BW_{Channel}$
					dBm/120 kHz Note 5 / dBm/60 kHz Note 5	
±5.0	±8.0	≥0	≥48	All	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
±10	±13	≥-6	48 ≤ BW ≤ 64	All	Note 3	
±7.5	±10.5		BW >64	All	Note 3	

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: PRS bandwidth is as indicated in *prs-Bandwidth* in the OTDOA or DL-AoD assistance data defined in [34].
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 PRB.
NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 5: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.
NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 8: NR operating band groups are as defined in clause 3.5.2.

10.1.24.3 Report mapping

10.1.24.3.1 Absolute PRS-RSRP Measurement Report Mapping

The reporting range of absolute PRS-RSRP measurement is defined from -156 dBm to -31 dBm with 1 dB resolution.

The mapping of measured quantity is defined in table 10.1.24.3.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.24.3.1-1: Measurement report mapping for PRS-RSRP

Reported value	Measured quantity value	Unit
PRS_RSRP_0	PRS-RSRP<-156	dBm
PRS_RSRP_1	-156≤PRS-RSRP<-155	dBm
PRS_RSRP_2	-155≤PRS-RSRP<-154	dBm
PRS_RSRP_3	-154≤PRS-RSRP<-153	dBm
PRS_RSRP_4	-153≤PRS-RSRP<-152	dBm
PRS_RSRP_5	-152≤PRS-RSRP<-151	dBm
PRS_RSRP_6	-151≤PRS-RSRP<-150	dBm
PRS_RSRP_7	-150≤PRS-RSRP<-149	dBm
PRS_RSRP_8	-149≤PRS-RSRP<-148	dBm
PRS_RSRP_9	-148≤PRS-RSRP<-147	dBm
PRS_RSRP_10	-147≤PRS-RSRP<-146	dBm
PRS_RSRP_11	-146≤PRS-RSRP<-145	dBm
PRS_RSRP_12	-145≤PRS-RSRP<-144	dBm
PRS_RSRP_13	-144≤PRS-RSRP<-143	dBm
PRS_RSRP_14	-143≤PRS-RSRP<-142	dBm
PRS_RSRP_15	-142≤PRS-RSRP<-141	dBm

PRS_RSRP_16	-141≤PRS-RSRP<-140	dBm
PRS_RSRP_17	-140≤PRS-RSRP<-139	dBm
PRS_RSRP_18	-139≤PRS-RSRP<-138	dBm
…	…	…
PRS_RSRP_111	-46≤PRS-RSRP<-45	dBm
PRS_RSRP_112	-45≤PRS-RSRP<-44	dBm
PRS_RSRP_113	-44≤PRS-RSRP<-43	dBm
PRS_RSRP_114	-43≤PRS-RSRP<-42	dBm
PRS_RSRP_115	-42≤PRS-RSRP<-41	dBm
PRS_RSRP_116	-41≤PRS-RSRP<-40	dBm
PRS_RSRP_117	-40≤PRS-RSRP<-39	dBm
PRS_RSRP_118	-39≤PRS-RSRP<-38	dBm
PRS_RSRP_119	-38≤PRS-RSRP<-37	dBm
PRS_RSRP_120	-37≤PRS-RSRP<-36	dBm
PRS_RSRP_121	-36≤PRS-RSRP<-35	dBm
PRS_RSRP_122	-35≤PRS-RSRP<-34	dBm
PRS_RSRP_123	-34≤PRS-RSRP<-33	dBm
PRS_RSRP_124	-33≤PRS-RSRP<-32	dBm
PRS_RSRP_125	-32≤PRS-RSRP<-31	dBm
PRS_RSRP_126	-31≤PRS-RSRP	dBm

10.1.24.3.2 Differential Report Mapping for PRS-RSRP Measurement

The reporting range of differential PRS-RSRP is defined from -30 dB to 0 dB with 1 dB resolution when *nr-DL-AoD-RequestLocationInformation* message is received.

The mapping of measured quantity is defined in table 10.1.24.3.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

The reporting range of differential PRS-RSRP is defined from -30 dB to 30 dB with 1 dB resolution when *nr-DL-TDOA-RequestLocationInformation* or *nr-Multi-RTT-RequestLocationInformation* is received.

The mapping of measured quantity is defined in Table 10.1.24.3.2-2. The range in the signalling may be larger than the guaranteed accuracy range or the range supported by the UE receiver for differential RSRP measured on different PRS resources in frequency domain at the same time.

Table 10.1.24.3.2-1: Measurement report mapping for differential PRS-RSRP

Reported value	Measured quantity value	Unit
DIFFRSRP_0	-30≥ΔRSRP	dB
DIFFRSRP_1	-29≥ΔRSRP>-30	dB
DIFFRSRP_2	-28≥ΔRSRP>-29	dB
DIFFRSRP_3	-27≥ΔRSRP>-28	dB
DIFFRSRP_4	-26≥ΔRSRP>-27	dB
DIFFRSRP_5	-25≥ΔRSRP>-26	dB
DIFFRSRP_6	-24≥ΔRSRP>-25	dB
DIFFRSRP_7	-23≥ΔRSRP>-24	dB
DIFFRSRP_8	-22≥ΔRSRP>-23	dB
DIFFRSRP_9	-21≥ΔRSRP>-22	dB
DIFFRSRP_10	-20≥ΔRSRP>-21	dB
DIFFRSRP_11	-19≥ΔRSRP>-20	dB
DIFFRSRP_12	-18≥ΔRSRP>-19	dB
DIFFRSRP_13	-17≥ΔRSRP>-18	dB
DIFFRSRP_14	-16≥ΔRSRP>-17	dB
DIFFRSRP_15	-15≥ΔRSRP>-16	dB
DIFFRSRP_16	-14≥ΔRSRP>-15	dB
DIFFRSRP_17	-13≥ΔRSRP>-14	dB
DIFFRSRP_18	-12≥ΔRSRP>-13	dB
DIFFRSRP_19	-11≥ΔRSRP>-12	dB
DIFFRSRP_20	-10≥ΔRSRP>-11	dB

DIFFRSRP_21	-9≥ΔRSRP>-10	dB
DIFFRSRP_22	-8≥ΔRSRP>-9	dB
DIFFRSRP_23	-7≥ΔRSRP>-8	dB
DIFFRSRP_24	-6≥ΔRSRP>-7	dB
DIFFRSRP_25	-5≥ΔRSRP>-6	dB
DIFFRSRP_26	-4≥ΔRSRP>-5	dB
DIFFRSRP_27	-3≥ΔRSRP>-4	dB
DIFFRSRP_28	-2≥ΔRSRP>-3	dB
DIFFRSRP_29	-1≥ΔRSRP>-2	dB
DIFFRSRP_30	0≥ΔRSRP>-1	dB

Table 10.1.24.3.2-2: Measurement report mapping for differential PRS-RSRP

Reported value	Measured quantity value	Unit
DIFFRSRP_0	-30≥ΔRSRP	dB
DIFFRSRP_1	-29≥ΔRSRP>-30	dB
DIFFRSRP_2	-28≥ΔRSRP>-29	dB
DIFFRSRP_3	-27≥ΔRSRP>-28	dB
DIFFRSRP_4	-26≥ΔRSRP>-27	dB
DIFFRSRP_5	-25≥ΔRSRP>-26	dB
DIFFRSRP_6	-24≥ΔRSRP>-25	dB
DIFFRSRP_7	-23≥ΔRSRP>-24	dB
DIFFRSRP_8	-22≥ΔRSRP>-23	dB
DIFFRSRP_9	-21≥ΔRSRP>-22	dB
DIFFRSRP_10	-20≥ΔRSRP>-21	dB
DIFFRSRP_11	-19≥ΔRSRP>-20	dB
DIFFRSRP_12	-18≥ΔRSRP>-19	dB
DIFFRSRP_13	-17≥ΔRSRP>-18	dB
DIFFRSRP_14	-16≥ΔRSRP>-17	dB
…	…	…
DIFFRSRP_25	-5≥ΔRSRP>-6	dB
DIFFRSRP_26	-4≥ΔRSRP>-5	dB
DIFFRSRP_27	-3≥ΔRSRP>-4	dB
DIFFRSRP_28	-2≥ΔRSRP>-3	dB
DIFFRSRP_29	-1≥ΔRSRP>-2	dB
DIFFRSRP_30	0≥ΔRSRP>-1	dB
DIFFRSRP_31	1≥ΔRSRP>0	dB
DIFFRSRP_32	2≥ΔRSRP>1	dB
DIFFRSRP_33	3≥ΔRSRP>2	dB
DIFFRSRP_34	4≥ΔRSRP>3	dB
DIFFRSRP_35	5≥ΔRSRP>4	dB
DIFFRSRP_36	6≥ΔRSRP>5	dB
…	…	…
DIFFRSRP_47	17≥ΔRSRP>16	dB
DIFFRSRP_48	18≥ΔRSRP>17	dB
DIFFRSRP_49	19≥ΔRSRP>18	dB
DIFFRSRP_50	20≥ΔRSRP>19	dB
DIFFRSRP_51	21≥ΔRSRP>20	dB
DIFFRSRP_52	22≥ΔRSRP>21	dB
DIFFRSRP_53	23≥ΔRSRP>-22	dB
DIFFRSRP_54	24≥ΔRSRP>23	dB
DIFFRSRP_55	25≥ΔRSRP>24	dB
DIFFRSRP_56	26≥ΔRSRP>25	dB
DIFFRSRP_57	27≥ΔRSRP>26	dB
DIFFRSRP_58	28≥ΔRSRP>27	dB
DIFFRSRP_59	29≥ΔRSRP>28	dB
DIFFRSRP_60	30≥≥ΔRSRP>29	dB
DIFFRSRP_61	ΔRSRP>30	dB

10.1.24APRS-RSRP Measurements Based on PRS Aggregation

10.1.24A.1 Introduction

The requirements in clause 10.1.24A shall apply, provided that the UE has received *nr-DL-TDOA-RequestLocationInformation* or *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP TS 37.355 [34] requesting the UE to report one or more DL PRS-RSRP measurements defined in TS 38.215 [4] performed by aggregating PRS resources from multiple PFLs via *nr-DL-PRS-JointMeasurementRequested* TS 37.355 [34].

The requirements in clause 10.1.24A shall apply:

- when UE is in RRC_CONNECTED state and the measurement is performed with MG,
- when UE is in RRC_INACTIVE state,
- when UE is in RRC_IDLE state.

10.1.24A.2 Measurement Accuracy Requirements

10.1.24A.2.1 Absolute PRS RSRP Accuracy Requirement

The accuracy requirements in clause 10.1.24.2.1 corresponding to the total aggregated PRS bandwidth shall apply.

10.1.24A.2.2 Relative PRS RSRP Accuracy Requirement

The accuracy requirements in clause 10.1.24.2.2 corresponding to the total aggregated PRS bandwidth shall apply.

10.1.24A.3 Report Mapping

10.1.24A.3.1 Absolute PRS-RSRP Measurement Report Mapping

The absolute report mapping for PRS-RSRP measurement in clause 10.1.24.3.1 shall apply.

10.1.24A.3.2 Differential Report Mapping for PRS-RSRP Measurement

The differential report mapping for PRS-RSRP measurement in clause 10.1.24.3.2 shall apply.

10.1.25 UE Rx-Tx Time Difference Measurements

10.1.25.1 Introduction

The requirements in clause 10.1.25 shall apply, provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP [31] requesting the UE to report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4]. The requirements in clause 10.1.25 shall apply:

- when UE is in RRC_CONNECTED state and the measurement is performed with MG or without MG,
- when UE is in RRC_INACTIVE state.

10.1.25.2 Measurement Accuracy Requirements

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall not apply, if:

N_{TA_offset} defined in table 7.1.2-2 changes during the UE Rx-Tx measurement period or

if the uplink transmission timing changes during the UE Rx-Tx measurement period due to the network-configured Timing Advance.

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall apply provided that:

- The UE transmits SRS within the range from -160 ms to 160 ms of at least one DL PRS resource of each of the TRPs in the assistance data.

If the uplink transmission timing changes during the UE Rx-Tx measurement period due to the autonomous timing adjustment defined in clause 7.1.2 then:

- UE Rx-Tx measurement accuracy requirements shall apply for a cell, which is also the downlink reference cell (defined in clause 7.1.1) for SRS transmission even if the uplink transmission timing changes during the UE Rx-Tx measurement period due to autonomous adjustment.

- UE Rx-Tx measurement accuracy requirements shall not apply for a cell, which is not the downlink reference cell (defined in clause 7.1.1) for SRS transmission, if the uplink transmission timing changes during the UE Rx-Tx measurement period due to autonomous adjustment.

When a serving cell change occurs during the UE Rx-Tx measurement period, the UE Rx-Tx time difference measurement accuracy requirements in this clause shall apply provided that the serving cell change does not impact SRS configuration for the UE Rx-Tx measurement.

The relative UE Rx-Tx measurement accuracy in this clause is defined as accuracy of the difference between two UE Rx-Tx measurements.

The accuracy requirements in table 10.1.25.2-1 for FR1 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

AWGN propagation condition.

Table 10.1.25.2-1: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	RB	kHz			dBm / SCS_{PRS}	dBm/BW
± 78+δ	-3	≥24	15	≥4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	
					NR_FDD_FR1_F	-124.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	
					NR_FDD_FR1_H	-123.5	
					NR_FDD_FR1_N	-120.5	
± 59+δ		≥52		≥1	Note 6	Note 6	Note 6
± 30+δ		>104		≥1	Note 6	Note 6	Note 6
± 57+δ		≥24	30	≥4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	RB	kHz			dBm / SCS_{PRS}	dBm/BW
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	
					NR_FDD_FR1_F	-121.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	
					NR_FDD_FR1_H	-120.5	
					NR_FDD_FR1_N	-117.5	
± 30+δ		≥48		≥1	NOTE 6	NOTE 6	NOTE 6
± 15+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6
± 29+δ		≥24	60	≥4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	
					NR_FDD_FR1_F	-118.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	
					NR_FDD_FR1_H	-117.5	
					NR_FDD_FR1_N	-114.5	
± 15+δ		≥ 64		≥1	NOTE 6	NOTE 6	NOTE 6
± 7+δ		≥ 132		≥1	NOTE 6	NOTE 6	NOTE 6
± 101+δ	-13	≥24	15	≥4	NOTE 6	NOTE 6	NOTE 6
± 75+δ		≥52		≥1	NOTE 6	NOTE 6	NOTE 6
± 37+δ		>104		≥1	NOTE 6	NOTE 6	NOTE 6
± 58+δ		≥24	30	≥4	NOTE 6	NOTE 6	NOTE 6
± 39+δ		≥48		≥1	NOTE 6	NOTE 6	NOTE 6
± 16+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6
± 36+δ		≥24	60	≥4	NOTE 6	NOTE 6	NOTE 6
± 16+δ		≥ 64		≥1	NOTE 6	NOTE 6	NOTE 6
± 8+δ		≥ 132		≥1	NOTE 6	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in clause 3.5.
NOTE 3: T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from Table 10.1.25.2-5.

The accuracy requirements in table 10.1.25.2-1a for FR1 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

Number of measurement samples is less than 4

AWGN propagation condition.

Table 10.1.25.2-1a: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN with reduced measurement samples

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
± 59+δ	0	≥52	15	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
± 30+δ		>104		≥1	NOTE 6	NOTE 6	NOTE 6
± 30+δ		≥48	30	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
± 15+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6
± 15+δ		≥64	60	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50
± 7+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6
± 75+δ	-6	≥52	15	≥1	NOTE 6	NOTE 6	NOTE 6

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
± 37+δ		>104		≥1	NOTE 6	NOTE 6	NOTE 6
± 39+δ		≥48	30	≥1	NOTE 6	NOTE 6	NOTE 6
± 16+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6
± 16+δ		≥64	60	≥1	NOTE 6	NOTE 6	NOTE 6
± 8+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in clause 3.5.
NOTE 3: T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from Table 10.1.25.2-5.

The relative accuracy requirements in table 10.1.25.2-1b for FR1 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

AWGN propagation condition.

the two UE Rx-Tx time difference measurements are associated with the same RxTx TEG

Table 10.1.25.2-1b: UE Rx-Tx time difference relative measurement accuracy in FR1 in AWGN with TEG reporting

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$) Note 2	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB			dBm/SCS	dBm/$BW_{Channel}$
132 + Δ Note 7	(PRS Ês/Iot)$_j$ ≥-6 dB (PRS Ês/Iot)$_i$ ≥-13 dB	15	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
98 + Δ			≥ 52	≥ 1	Note 6	Note 6	Note 6
42 + Δ			≥ 104	≥ 1	Note 6	Note 6	Note 6
75 + Δ		30	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A,	-124	-50

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB			dBm/SCS	dBm/BW$_{Channel}$
					NR_SDL_FR1_A		
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
48 + Δ			≥ 48	≥ 1	Note 6	Note 6	Note 6
24 + Δ			≥ 132	≥ 1	Note 6	Note 6	Note 6
50 + Δ		60	≥24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50
24 + Δ			≥ 64	≥ 1	Note 6	Note 6	Note 6
10 + Δ			≥ 132	≥ 1	Note 6	Note 6	Note 6

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of resource j and resource i.
NOTE 2: Minimum number of PRS resource repetitions among resource j and resource i. T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: Δis the value of the timing error margin for the RxTx TEG, reported via *nr-UE-RxTxTEG-TimingErrorMargin*. Δ cannot be larger than the sum of the margins in table 10.1.25.2-5 (dependent on PRS/SRS BW) for any pair of individual UE Rx-Tx time difference measurements associated with the RxTx TEG. .

The accuracy requirements in table 10.1.25.2-2 for FR1 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

Fading propagation condition.

Table 10.1.25.2-2: UE Rx-Tx time difference measurement accuracy in FR1 in fading

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
± 137+δ	-3	≥24	15	≥4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	
					NR_FDD_FR1_F	-124.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	
					NR_FDD_FR1_H	-123.5	
					NR_FDD_FR1_N	-120.5	
± 96+δ		≥52		≥1	NOTE 6	NOTE 6	NOTE 6
± 62+δ		>104		≥1	NOTE 6	NOTE 6	NOTE 6
± 87+δ		≥24	30	≥4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	
					NR_FDD_FR1_F	-121.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	
					NR_FDD_FR1_H	-120.5	
					NR_FDD_FR1_N	-117.5	
± 68+δ		≥48		≥1	NOTE 6	NOTE 6	NOTE 6
± 44+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6
± 59+δ		≥24	60	≥4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	
					NR_FDD_FR1_F	-118.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	
					NR_FDD_FR1_H	-117.5	
					NR_FDD_FR1_N	-114.5	
± 42+δ		≥ 64		≥1	NOTE 6	NOTE 6	NOTE 6
± 36+δ		≥ 132		≥1	NOTE 6	NOTE 6	NOTE 6

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
± 180+δ	-13	≥24	15	≥4	NOTE 6	NOTE 6	NOTE 6
± 98+δ		≥52		≥1	NOTE 6	NOTE 6	NOTE 6
± 68+δ		>104		≥1	NOTE 6	NOTE 6	NOTE 6
± 87+δ		≥24	30	≥4	NOTE 6	NOTE 6	NOTE 6
± 85+δ		≥48		≥1	NOTE 6	NOTE 6	NOTE 6
± 44+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6
± 139+δ		≥24	60	≥4	NOTE 6	NOTE 6	NOTE 6
± 46+δ		≥ 64		≥1	NOTE 6	NOTE 6	NOTE 6
± 30+δ		≥ 132		≥1	NOTE 6	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in clause 3.5.
NOTE 3: T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from Table 10.1.25.2-5.

The accuracy requirements in table 10.1.25.2-3 for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

AWGN propagation condition.

Table 10.1.25.2-3: UE Rx-Tx time difference measurement accuracy in FR2 in AWGN

Accuracy	Conditions					
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	Io Note 4 range	
					Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz		dBm / SCS_{PRS}	$dBm/BW_{Channel}$
± 22+δ	-3	≥24	60	≥4	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
± 15+δ		≥64		≥1	NOTE 6	NOTE 6
± 7+δ		≥132		≥1	NOTE 6	NOTE 6
± 12+δ		≥32	120	≥4	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
± 7+δ		≥64		≥1	NOTE 6	NOTE 6
± 4+δ		≥128		≥1	NOTE 6	NOTE 6
± 35+δ	-13	≥24	60	≥4	NOTE 6	NOTE 6
± 15+δ		≥64		≥1	NOTE 6	NOTE 6
± 7+δ		≥132		≥1	NOTE 6	NOTE 6
± 14+δ		≥32	120	≥4	NOTE 6	NOTE 6
± 9+δ		≥64		≥1	NOTE 6	NOTE 6
± 4+δ		≥128		≥1	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in clause 3.5.

NOTE 3: $T_{\mathrm{rep}}^{\mathrm{PRS}}$, L_{PRS}, $K_{\mathrm{comb}}^{\mathrm{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from Table 10.1.25.2-6.

The accuracy requirements in table 10.1.25.2-3a for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

PRP|$_{\mathrm{dBm}}$ according to annex B.2.14 for a corresponding Band

Number of measurement samples is less than 4

AWGN propagation condition.

Table 10.1.25.2-3a: UE Rx-Tx time difference measurement accuracy in FR2 in AWGN with reduced measurement samples

Accuracy	Conditions					
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition($T_{\mathrm{rep}}^{\mathrm{PRS}} * L_{\mathrm{PRS}}/K_{\mathrm{comb}}^{\mathrm{PRS}}$ Note 3	Io Note 4 range	
					Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz		dBm / SCS_{PRS}	dBm/$BW_{Channel}$
± 15+δ	0	≥64	60	≥1	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	NOTE 6
± 7+δ		≥132		≥1	NOTE 6	NOTE 6
± 7+δ		≥64	120	≥1	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	NOTE 6
± 4+δ		≥128		≥1	NOTE 6	NOTE 6
± 15+δ	-6	≥64	60	≥1	NOTE 6	NOTE 6
± 7+δ		≥132		≥1	NOTE 6	NOTE 6
± 9+δ		≥64	120	≥1	NOTE 6	NOTE 6
± 4+δ		≥128		≥1	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in clause 3.5.
NOTE 3: $T_{\mathrm{rep}}^{\mathrm{PRS}}$, L_{PRS}, $K_{\mathrm{comb}}^{\mathrm{PRS}}$ are configured by higher layer parameter dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from Table 10.1.25.2-6.

The relative accuracy requirements in table 10.1.25.2-3b for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

PRP|$_{\mathrm{dBm}}$ according to annex B.2.14 for a corresponding Band

AWGN propagation condition.

the two UE Rx-Tx time difference measurements are associated with the same RxTx TEG

Table 10.1.25.2-3b: UE Rx-Tx time difference relative measurement accuracy in FR2 in AWGN with TEG reporting

Accuracy	Conditions					
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range	
					Minimum Io	Maximum Io
Tc Note 4	dB	kHz	PRB		dBm/SCS	$dBm/BW_{Channel}$
35 + Δ Note 6	(PRS Ês/Iot)$_i$ ≥-6 dB	60	≥ 24	≥ 4	Same value as PRS_RP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
24 + Δ			≥ 64	≥ 1	Note 5	Note 5
11 + Δ			≥ 132	≥ 1	Note 5	Note 5
24+ Δ	(PRS Ês/Iot)$_i$ ≥-13 dB	120	≥ 32	≥ 4	Same value as PRS_RP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
13 + Δ			≥ 64	≥ 1	Note 5	Note 5
6 + Δ			≥ 128	≥ 1	Note 5	Note 5

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of resource j and resource i.
NOTE 2: Minimum number of PRS resource repetitions among resource j and resource i. T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 6: Δis the value of the timing error margin for the RxTx TEG, reported via *nr-UE-RxTxTEG-TimingErrorMargin*. Δ cannot be larger than the sum of the margins in table 10.1.25.2-6 (dependent on PRS/SRS BW) for any pair of individual UE Rx-Tx time difference measurements associated with the RxTx TEG.

The accuracy requirements in table 10.1.25.2-4 for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

Fading propagation condition.

Table 10.1.25.2-4: UE Rx-Tx time difference measurement accuracy in FR2 in fading

Accuracy	Conditions					
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	Io Note 4 range	
					Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz		dBm / SCS_{PRS}	$dBm/BW_{Channel}$
± 75+δ	-3	≥24	60	≥4	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
± 72+δ		≥64		≥1	NOTE 6	NOTE 6
± 57+δ		≥132		≥1	NOTE 6	NOTE 6
± 61+δ		≥32	120	≥4	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
± 64+δ		≥64		≥1	NOTE 6	NOTE 6
± 55+δ		≥128		≥1	NOTE 6	NOTE 6
± 92+δ	-13	≥24	60	≥4	NOTE 6	NOTE 6
± 70+δ		≥64		≥1	NOTE 6	NOTE 6
± 57+δ		≥132		≥1	NOTE 6	NOTE 6

± 60+δ		≥32	120	≥4	NOTE 6	NOTE 6
± 66+δ		≥64		≥1	NOTE 6	NOTE 6
± 62+δ		≥128		≥1	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in clause 3.5.
NOTE 3: $T_{\mathrm{rep}}^{\mathrm{PRS}}$, L_{PRS}, $K_{\mathrm{comb}}^{\mathrm{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from Table 10.1.25.2-6.

Table 10.1.25.2-5: Margin for UE Rx-Tx time difference measurement accuracy in FR1

Min(PRS BW, SRS BW) (PRB)			Margin (Tc [Note 1])
SCS = 15 kHz	SCS = 30 kHz	SCS = 60 kHz	
≥ 24	N/A	N/A	160
≥ 52	≥ 24	N/A	80
≥ 104	≥ 48	≥ 24	56
N/A	≥ 132	≥ 64	24
N/A	N/A	≥ 132	24

NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 2: If SRS and PRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies.

Table 10.1.25.2-6: Margin for UE Rx-Tx time difference measurement accuracy in FR2

Min(PRS BW, SRS BW) (PRB)		Margin (Tc [Note 1])
SCS = 60 kHz	SCS = 120 kHz	
≥ 24	N/A	76
≥ 64	≥ 32	32
≥ 132	≥ 64	24
N/A	≥ 128	20

NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 2: If SRS and PRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies.

10.1.25.3 Report mapping

Absolute UE Rx-Tx measurement reporting in clause 10.1.25.3.1, differential reporting for UE Rx-Tx measurement in clause 10.1.25.3.2, and additional path report mapping for UE Rx-Tx measurement in clause 10.1.25.3.3 applies, regardless of number of samples used to measure PRS, to report:

- TEG based measurement corresponding to UE reported Rx TEG in *nr-UE-Rx-TEG-ID-r17* [34],
- gap-based UE Rx-Tx measurement,
- gapless UE Rx-Tx measurement,
- UE Rx-Tx in RRC_INACTIVE state.

10.1.25.3.1 Absolute UE Rx-Tx Measurement Report Mapping

The reporting range for the absolute UE Rx-Tx time difference measurement ($T_{\text{UE Rx-Tx}}$) is defined from $-985024 \times T_c$ to $985024 \times T_c$ with the resolution step of $2^k \times T_c$, where:

T_c is defined in TS 38.211 [6],

$k_{min} \leq k \leq k_{max}$,

k_{min} = -6 and k_{max} = 5,

$k \geq$ *timingReportingGranularityFactor* TS 34.355 [34] configured by LMF via LPP for the UE Rx-Tx time difference measurement.

The $T_{UE\ Rx\text{-}Tx}$ report mapping for k = {0, 1, 2, 3, 4, 5, -1, -2, -3, -4, -5, -6} are specified in tables 10.1.25.3.1-1, 10.1.25.3.1-2, 10.1.25.3.1-3, 10.1.25.3.1-4, 10.1.25.3.1-5, 10.1.25.3.1-6, 10.1.25.3.1-7, 10.1.25.3.1-8, 10.1.25.3.1-9, 10.1.25.3.1-10, 10.1.25.3.1-11, and 10.1.25.3.1-12, respectively.

Table 10.1.25.3.1-1: Absolute UE Rx-Tx time difference measurement report mapping for *k*=0

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_0000000	$T_{UE\ Rx\text{-}Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_0000001	$-985024 \leq T_{UE\ Rx\text{-}Tx} < -985023$	T_c
RX-TX_TIME_DIFFERENCE_0000002	$-985023 \leq T_{UE\ Rx\text{-}Tx} < -985022$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_0985024	$-1 \leq T_{UE\ Rx\text{-}Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_0985025	$0 \leq T_{UE\ Rx\text{-}Tx} < 1$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_1970047	$985022 \leq T_{UE\ Rx\text{-}Tx} < 985023$	T_c
RX-TX_TIME_DIFFERENCE_1970048	$985023 \leq T_{UE\ Rx\text{-}Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_1970049	$985024 \leq T_{UE\ Rx\text{-}Tx}$	T_c

Table 10.1.25.3.1-2: Absolute UE Rx-Tx time difference measurement report mapping for *k*=1

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_000000	$T_{UE\ Rx\text{-}Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_000001	$-985024 \leq T_{UE\ Rx\text{-}Tx} < -985022$	T_c
RX-TX_TIME_DIFFERENCE_000002	$-985022 \leq T_{UE\ Rx\text{-}Tx} < -985020$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_492512	$-2 \leq T_{UE\ Rx\text{-}Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_492513	$0 \leq T_{UE\ Rx\text{-}Tx} < 2$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_985023	$985020 \leq T_{UE\ Rx\text{-}Tx} < 985022$	T_c
RX-TX_TIME_DIFFERENCE_985024	$985022 \leq T_{UE\ Rx\text{-}Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_985025	$985024 \leq T_{UE\ Rx\text{-}Tx}$	T_c

Table 10.1.25.3.1-3: Absolute UE Rx-Tx time difference measurement report mapping for *k*=2

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_000000	$T_{UE\ Rx\text{-}Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_000001	$-985024 \leq T_{UE\ Rx\text{-}Tx} < -985020$	T_c
RX-TX_TIME_DIFFERENCE_000002	$-985020 \leq T_{UE\ Rx\text{-}Tx} < -985016$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_246256	$-4 \leq T_{UE\ Rx\text{-}Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_246257	$0 \leq T_{UE\ Rx\text{-}Tx} < 4$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_492511	$985016 \leq T_{UE\ Rx\text{-}Tx} < 985020$	T_c
RX-TX_TIME_DIFFERENCE_492512	$985020 \leq T_{UE\ Rx\text{-}Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_492513	$985024 \leq T_{UE\ Rx\text{-}Tx}$	T_c

Table 10.1.25.3.1-4: Absolute UE Rx-Tx time difference measurement report mapping for *k*=3

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_000000	$T_{UE\ Rx\text{-}Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_000001	$-985024 \leq T_{UE\ Rx\text{-}Tx} < -985016$	T_c
RX-TX_TIME_DIFFERENCE_000002	$-985016 \leq T_{UE\ Rx\text{-}Tx} < -985008$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_123128	$-8 \leq T_{UE\ Rx\text{-}Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_123129	$0 \leq T_{UE\ Rx\text{-}Tx} < 8$	T_c

…	…	…
RX-TX_TIME_DIFFERENCE_246255	$985008 \le T_{UE\ Rx-Tx} < 985016$	T_c
RX-TX_TIME_DIFFERENCE_246256	$985016 \le T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_246257	$985024 \le T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.1-5: Absolute UE Rx-Tx time difference measurement report mapping for *k*=4

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_000000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_000001	$-985024 \le T_{UE\ Rx-Tx} < -985008$	T_c
RX-TX_TIME_DIFFERENCE_000002	$-985008 \le T_{UE\ Rx-Tx} < -984992$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_061564	$-16 \le T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_061565	$0 \le T_{UE\ Rx-Tx} < 16$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_123127	$984992 \le T_{UE\ Rx-Tx} < 985008$	T_c
RX-TX_TIME_DIFFERENCE_123128	$985008 \le T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_123129	$985024 \le T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.1-6: Absolute UE Rx-Tx time difference measurement report mapping for *k*=5

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_00000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_00001	$-985024 \le T_{UE\ Rx-Tx} < -984992$	T_c
RX-TX_TIME_DIFFERENCE_00002	$-984992 \le T_{UE\ Rx-Tx} < -984960$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_30782	$-32 \le T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_30783	$0 \le T_{UE\ Rx-Tx} < 32$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_61563	$984960 \le T_{UE\ Rx-Tx} < 984992$	T_c
RX-TX_TIME_DIFFERENCE_61564	$984992 \le T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_61565	$985024 \le T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.1-7: Absolute UE Rx-Tx time difference measurement report mapping for *k*=-1

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_0000000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_0000001	$-985024 \le T_{UE\ Rx-Tx} < -985023.5$	T_c
RX-TX_TIME_DIFFERENCE_0000002	$-985023.5 \le T_{UE\ Rx-Tx} < -985023$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_1970048	$-0.5 \le T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_1970049	$0 \le T_{UE\ Rx-Tx} < 0.5$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_3940095	$985023 \le T_{UE\ Rx-Tx} < 985023.5$	T_c
RX-TX_TIME_DIFFERENCE_3940096	$985023.5 \le T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_3940097	$985024 \le T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.1-8: Absolute UE Rx-Tx time difference measurement report mapping for *k*=-2

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_0000000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_0000001	$-985024 \le T_{UE\ Rx-Tx} < -985023.75$	T_c
RX-TX_TIME_DIFFERENCE_0000002	$-985023.75 \le T_{UE\ Rx-Tx} < -985023.5$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_3940096	$-0.25 \le T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_3940097	$0 \le T_{UE\ Rx-Tx} < 0.25$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_7880191	$985023.5 \le T_{UE\ Rx-Tx} < 985023.75$	T_c

RX-TX_TIME_DIFFERENCE_7880192	$985023.75 \leq T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_7880193	$985024 \leq T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.1-9: Absolute UE Rx-Tx time difference measurement report mapping for *k*=-3

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_00000000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_00000001	$-985024 \leq T_{UE\ Rx-Tx} < -985023.875$	T_c
RX-TX_TIME_DIFFERENCE_00000002	$-985023.875 \leq T_{UE\ Rx-Tx} < -985023.75$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_07880192	$-0.125 \leq T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_07880193	$0 \leq T_{UE\ Rx-Tx} < 0.125$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_15760383	$985023.75 \leq T_{UE\ Rx-Tx} < 985023.875$	T_c
RX-TX_TIME_DIFFERENCE_15760384	$985023.875 \leq T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_15760385	$985024 \leq T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.1-10: Absolute UE Rx-Tx time difference measurement report mapping for *k*=-4

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_00000000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_00000001	$-985024 \leq T_{UE\ Rx-Tx} < -985023.9375$	T_c
RX-TX_TIME_DIFFERENCE_00000002	$-985023.9375 \leq T_{UE\ Rx-Tx} < -985023.875$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_15760384	$-0.0625 \leq T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_15760385	$0 \leq T_{UE\ Rx-Tx} < 0.0625$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_31520767	$985023.875 \leq T_{UE\ Rx-Tx} < 985023.9375$	T_c
RX-TX_TIME_DIFFERENCE_31520768	$985023.9375 \leq T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_31520769	$985024 \leq T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.1-11: Absolute UE Rx-Tx time difference measurement report mapping for *k*=-5

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_00000000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_00000001	$-985024 \leq T_{UE\ Rx-Tx} < -985023.9688$	T_c
RX-TX_TIME_DIFFERENCE_00000002	$-985023.9688 \leq T_{UE\ Rx-Tx} < -985023.9375$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_31520768	$-0.0312 \leq T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_31520769	$0 \leq T_{UE\ Rx-Tx} < 0.0312$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_63041535	$985023.9375 \leq T_{UE\ Rx-Tx} < 985023.9688$	T_c
RX-TX_TIME_DIFFERENCE_63041536	$985023.9688 \leq T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_63041537	$985024 \leq T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.1-12: Absolute UE Rx-Tx time difference measurement report mapping for *k*=-6

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_00000000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_00000001	$-985024 \leq T_{UE\ Rx-Tx} < -985023.9844$	T_c
RX-TX_TIME_DIFFERENCE_00000002	$-985023.9844 \leq T_{UE\ Rx-Tx} < -985023.9688$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_63041536	$-0.0156 \leq T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_63041537	$0 \leq T_{UE\ Rx-Tx} < 0.0156$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_126083071	$985023.9688 \leq T_{UE\ Rx-Tx} < 985023.9844$	T_c
RX-TX_TIME_DIFFERENCE_126083072	$985023.9844 \leq T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_126083073	$985024 \leq T_{UE\ Rx-Tx}$	T_c

10.1.25.3.2 Differential UE Rx-Tx Measurement Report Mapping

The reporting range for differential UE Rx-Tx time difference measurement ($\Delta T_{UE\ Rx\text{-}Tx}$) is defined from 0 up to $8191 \times T_c$ where:

$\Delta T_{UE\ Rx\text{-}Tx} = T_{UE\ Rx\text{-}Tx1} - T_{UE\ Rx\text{-}Tx2;}$ where:

$T_{UE\ Rx\text{-}Tx1} > T_{UE\ Rx\text{-}Tx2}$,

$T_{UE\ Rx\text{-}Tx1}$ is the first absolute UE Rx-Tx time difference measurement,

$T_{UE\ Rx\text{-}Tx1}$ is the second absolute UE Rx-Tx time difference measurement,

T_c is defined in TS 38.211 [6],

$k_{min} \leq k \leq k_{max}$,

$k_{min} = -6$ and $k_{max} = 5$,

$k \geq$ *timingReportingGranularityFactor* [34] configured by LMF via LPP for the UE Rx-Tx time difference measurement.

The $\Delta T_{UE\ Rx\text{-}Tx}$ report mapping for $k = \{0, 1, 2, 3, 4, 5, -1, -2, -3, -4, -5, -6\}$ are specified in tables 10.1.25.3.2-1, 10.1.25.3.2-2, 10.1.25.3.2-3, 10.1.25.3.2-4, 10.1.25.3.2-5, 10.1.25.3.2-6, 10.1.25.3.2-7, 10.1.25.3.2-8, 10.1.25.3.2-9, 10.1.25.3.2-10, 10.1.25.3.2-11, and 10.1.25.3.2-12, respectively.

Table 10.1.25.3.2-1: Differential UE Rx-Tx time difference measurement report mapping for *k*=0

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_0000	$0 \leq \Delta T_{UE\ Rx\text{-}Tx} < 1$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0001	$1 \leq \Delta T_{UE\ Rx\text{-}Tx} < 2$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0002	$2 \leq \Delta T_{UE\ Rx\text{-}Tx} < 3$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_8189	$8189 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8190$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_8190	$8190 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8191$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_8191	$8191 \leq \Delta T_{UE\ Rx\text{-}Tx}$	T_c

Table 10.1.25.3.2-2: Differential UE Rx-Tx time difference measurement report mapping for *k*=1

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_0000	$0 \leq \Delta T_{UE\ Rx\text{-}Tx} < 2$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0001	$2 \leq \Delta T_{UE\ Rx\text{-}Tx} < 4$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0002	$4 \leq \Delta T_{UE\ Rx\text{-}Tx} < 6$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_4093	$8186 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8188$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_4094	$8188 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8190$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_4095	$8190 \leq \Delta T_{UE\ Rx\text{-}Tx}$	T_c

Table 10.1.25.3.2-3: Differential UE Rx-Tx time difference measurement report mapping for *k*=2

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_0000	$0 \leq \Delta T_{UE\ Rx\text{-}Tx} < 4$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0001	$4 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0002	$8 \leq \Delta T_{UE\ Rx\text{-}Tx} < 12$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_2045	$8180 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8184$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_2046	$8184 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8188$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_2047	$8188 \leq \Delta T_{UE\ Rx\text{-}Tx}$	T_c

Table 10.1.25.3.2-4: Differential UE Rx-Tx time difference measurement report mapping for *k*=3

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_0000	$0 \le \Delta T_{UE\ Rx-Tx} < 8$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0001	$8 \le \Delta T_{UE\ Rx-Tx} < 16$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0002	$16 \le \Delta T_{UE\ Rx-Tx} < 24$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_1021	$8168 \le \Delta T_{UE\ Rx-Tx} < 8176$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_1022	$8176 \le \Delta T_{UE\ Rx-Tx} < 8184$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_1023	$8184 \le \Delta T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.2-5: Differential UE Rx-Tx time difference measurement report mapping for *k*=4

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_000	$0 \le \Delta T_{UE\ Rx-Tx} < 16$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_001	$16 \le \Delta T_{UE\ Rx-Tx} < 32$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_002	$32 \le \Delta T_{UE\ Rx-Tx} < 48$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_509	$8144 \le \Delta T_{UE\ Rx-Tx} < 8160$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_510	$8160 \le \Delta T_{UE\ Rx-Tx} < 8176$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_511	$8176 \le \Delta T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.2-6: Differential UE Rx-Tx time difference measurement report mapping for *k*=5

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_000	$0 \le \Delta T_{UE\ Rx-Tx} < 32$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_001	$32 \le \Delta T_{UE\ Rx-Tx} < 64$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_002	$64 \le \Delta T_{UE\ Rx-Tx} < 96$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_253	$8096 \le \Delta T_{UE\ Rx-Tx} < 8128$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_254	$8128 \le \Delta T_{UE\ Rx-Tx} < 8160$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_255	$8160 \le \Delta T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.2-7: Differential UE Rx-Tx time difference measurement report mapping for *k*=-1

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_00000	$0 \le \Delta T_{UE\ Rx-Tx} < 0.5$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_00001	$0.5 \le \Delta T_{UE\ Rx-Tx} < 1$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_00002	$1 \le \Delta T_{UE\ Rx-Tx} < 1.5$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_16380	$8190 \le \Delta T_{UE\ Rx-Tx} < 8190.5$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_16381	$8190.5 \le \Delta T_{UE\ Rx-Tx} < 8191$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_16382	$8191 \le \Delta T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.2-8: Differential UE Rx-Tx time difference measurement report mapping for *k*=-2

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_00000	$0 \le \Delta T_{UE\ Rx-Tx} < 0.25$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_00001	$0.25 \le \Delta T_{UE\ Rx-Tx} < 0.5$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_00002	$0.5 \le \Delta T_{UE\ Rx-Tx} < 0.75$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_32762	$8190.5 \le \Delta T_{UE\ Rx-Tx} < 8190.75$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_32763	$8190.75 \le \Delta T_{UE\ Rx-Tx} < 8191$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_32764	$8191 \le \Delta T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.2-9: Differential UE Rx-Tx time difference measurement report mapping for *k*=-3

Reported Quantity Value	Measured Quantity Value	Unit

DIFF_RX-TX_TIME_DIFFERENCE_00000	$0 \le \Delta T_{UE\ Rx-Tx} < 0.125$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_00001	$0.125 \le \Delta T_{UE\ Rx-Tx} < 0.25$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_00002	$0.25 \le \Delta T_{UE\ Rx-Tx} < 0.375$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_65526	$8190.75 \le \Delta T_{UE\ Rx-Tx} < 8190.875$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_65527	$8190.875 \le \Delta T_{UE\ Rx-Tx} < 8191$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_65528	$8191 \le \Delta T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.2-10: Differential UE Rx-Tx time difference measurement report mapping for *k*=-4

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_000000	$0 \le \Delta T_{UE\ Rx-Tx} < 0.0625$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_000001	$0.0625 \le \Delta T_{UE\ Rx-Tx} < 0.125$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_000002	$0.125 \le \Delta T_{UE\ Rx-Tx} < 0.1875$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_131054	$8190.875 \le \Delta T_{UE\ Rx-Tx} < 8190.9375$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_131055	$8190.9375 \le \Delta T_{UE\ Rx-Tx} < 8191$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_131056	$8191 \le \Delta T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.2-11: Differential UE Rx-Tx time difference measurement report mapping for *k*=-5

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_000000	$0 \le \Delta T_{UE\ Rx-Tx} < 0.0312$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_000001	$0.0312 \le \Delta T_{UE\ Rx-Tx} < 0.0625$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_000002	$0.0625 \le \Delta T_{UE\ Rx-Tx} < 0.0938$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_262110	$8190.9375 \le \Delta T_{UE\ Rx-Tx} < 8190.9688$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_262111	$8190.9688 \le \Delta T_{UE\ Rx-Tx} < 8191$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_262112	$8191 \le \Delta T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.2-12: Differential UE Rx-Tx time difference measurement report mapping for *k*=-6

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_000000	$0 \le \Delta T_{UE\ Rx-Tx} < 0.0156$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_000001	$0.0156 \le \Delta T_{UE\ Rx-Tx} < 0.0312$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_000002	$0.0312 \le \Delta T_{UE\ Rx-Tx} < 0.0469$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_524222	$8190.9688 \le \Delta T_{UE\ Rx-Tx} < 8190.9844$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_524223	$8190.9844 \le \Delta T_{UE\ Rx-Tx} < 8191$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_524224	$8191 \le \Delta T_{UE\ Rx-Tx}$	T_c

10.1.25.3.3 Additional Path Report Mapping for UE Rx-Tx Time Difference

The reporting range for the additional path reporting for an UE Rx-Tx time difference measurement is defined up to the range from $-8175 \times T_c$ to $8175 \times T_c$ with the resolution step of $2^k \times T_c$, where

T_c is defined in TS 38.211 [6],

$k_{min} \le k \le k_{max}$,

$k_{min} = -6$ and $k_{max} = 5$,

$k \ge$ *timingReportingGranularityFactor* [34] configured by LMF via LPP for the UE Rx-Tx time difference measurement.

The UE can report the timing of up to two additional paths with respect to the path timing determining the UE Rx-Tx time difference measurement.

The UE capable of *additionalPathsExtSupport-r17* can report the timing of up to its supported number of additional paths with respect to the path timing determining the UE Rx-Tx measurement.

The report mappings for different *k* values are specified in tables 10.1.25.3.3-1 – 10.1.25.3.3-12.

Table 10.1.25.3.3-1: Report mapping for *k*=0

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174	T_c
path_00002	-8174 ≤ Δpath < -8173	T_c
…	…	…
path_08175	-1 ≤ Δpath < 0	T_c
path_08176	0 ≤ Δpath < 1	T_c
…	…	…
path_16349	8173 ≤ Δpath < 8174	T_c
path_16350	8174 ≤ Δpath < 8175	T_c
path_16351	8175 ≤ Δpath	T_c

Table 10.1.25.3.3-2: Report mapping for *k*=1

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8175	T_c
path_0001	-8175 ≤ Δpath < -8173	T_c
path_0002	-8173 ≤ Δpath < -8171	T_c
…	…	…
path_4088	-1 ≤ Δpath < 1	T_c
…	…	…
path_8174	8171 ≤ Δpath < 8173	T_c
path_8175	8173 ≤ Δpath < 8175	T_c
path_8176	8175 ≤ Δpath	T_c

Table 10.1.25.3.3-3: Report mapping for *k*=2

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8174	T_c
path_0001	-8174 ≤ Δpath < -8170	T_c
path_0002	-8170 ≤ Δpath < -8166	T_c
…	…	…
path_2044	-2 ≤ Δpath < 2	T_c
…	…	…
path_4086	8166 ≤ Δpath < 8170	T_c
path_4087	8170 ≤ Δpath < 8174	T_c
path_4088	8174 ≤ Δpath	T_c

Table 10.1.25.3.3-4: Report mapping for *k*=3

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8172	T_c
path_0001	-8172 ≤ Δpath < -8164	T_c
path_0002	-8164 ≤ Δpath < -8156	T_c
…	…	…
path_1022	-4 ≤ Δpath < 4	T_c
…	…	…
path_2042	8156 ≤ Δpath < 8164	T_c
path_2043	8164 ≤ Δpath < 8172	T_c

path_2044	8172 ≤ Δpath	T_c

Table 10.1.25.3.3-5: Report mapping for *k*=4

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8168	T_c
path_0001	-8168 ≤ Δpath < -8152	T_c
path_0002	-8152 ≤ Δpath < -8136	T_c
…	…	…
path_511	-8 ≤ Δpath < 8	T_c
…	…	…
path_1020	8136 ≤ Δpath < 8152	T_c
path_1021	8152 ≤ Δpath < 8168	T_c
path_1022	8168 ≤ Δpath	T_c

Table 10.1.25.3.3-6: Report mapping for *k*=5

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000	Δpath < -8160	T_c
path_001	-8160 ≤ Δpath < -8128	T_c
path_002	-8128 ≤ Δpath < -8096	T_c
…	…	…
path_256	0 ≤ Δpath < 32	T_c
…	…	…
path_509	8096 ≤ Δpath < 8128	T_c
path_510	8128 ≤ Δpath < 8160	T_c
path_511	8160 ≤ Δpath	T_c

Table 10.1.25.3.3-7: Report mapping for *k*=-1

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174.5	T_c
path_00002	-8174.5 ≤ Δpath < -8174	T_c
…	…	…
path_16350	-0.5 ≤ Δpath < 0	T_c
path_16351	0 ≤ Δpath < 0.5	T_c
…	…	…
path_32699	8174 ≤ Δpath < 8174.5	T_c
path_32700	8174.5 ≤ Δpath < 8175	T_c
path_32701	8175 ≤ Δpath	T_c

Table 10.1.25.3.3-8: Report mapping for *k*=-2

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174.75	T_c
path_00002	-8174.75 ≤ Δpath < -8174.5	T_c
…	…	…
path_32700	-0.25 ≤ Δpath < 0	T_c
path_32701	0 ≤ Δpath < 0.25	T_c
…	…	…
path_65399	8174.5 ≤ Δpath < 8174.75	T_c
path_65400	8174.75 ≤ Δpath < 8175	T_c

path_65401	8175 ≤ Δpath	T_c

Table 10.1.25.3.3-9: Report mapping for *k*=-3

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174.875	T_c
path_00002	-8174.875 ≤ Δpath < -8174.75	T_c
…	…	…
path_65400	-0.125 ≤ Δpath < 0	T_c
path_65401	0 ≤ Δpath < 0.125	T_c
…	…	…
path_130799	8174.75 ≤ Δpath < 8174.875	T_c
path_130800	8174.875 ≤ Δpath < 8175	T_c
path_130801	8175 ≤ Δpath	T_c

Table 10.1.25.3.3-10: Report mapping for *k*=-4

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174.9375	T_c
path_00002	-8174.9375 ≤ Δpath < -8174.875	T_c
…	…	…
path_130800	-0.0625 ≤ Δpath < 0	T_c
path_130801	0 ≤ Δpath < 0.0625	T_c
…	…	…
path_261599	8174.875 ≤ Δpath < 8174.9375	T_c
path_261600	8174.9375 ≤ Δpath < 8175	T_c
path_261601	8175 ≤ Δpath	T_c

Table 10.1.25.3.3-11: Report mapping for *k*=-5

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000000	Δpath < -8175	T_c
path_000001	-8175 ≤ Δpath < -8174.9688	T_c
path_000002	-8174.9688 ≤ Δpath < -8174.9375	T_c
…	…	…
path_261600	-0.0312 ≤ Δpath < 0	T_c
path_261601	0 ≤ Δpath < 0.0312	T_c
…	…	…
path_523199	8174.9375 ≤ Δpath < 8174.9688	T_c
path_523200	8174.9688 ≤ Δpath < 8175	T_c
path_ 523201	8175 ≤ Δpath	T_c

Table 10.1.25.3.3-12: Report mapping for *k*=-6

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000000	Δpath < -8175	T_c
path_0000001	-8175 ≤ Δpath < -8174.9844	T_c
path_0000002	-8174.9844 ≤ Δpath < -8174.9688	T_c
…	…	…
path_0523200	-0.0156 ≤ Δpath < 0	T_c
path_0523201	0 ≤ Δpath < 0.0156	T_c
…	…	…

path_1046399	8174.9688≤ Δpath < 8174.9844	T_c
path_1046400	8174.9844 ≤ Δpath < 8175	T_c
path_1046401	8175 ≤ Δpath	T_c

10.1.25AUE Rx-Tx Time Difference Measurement Based on PRS Aggregation

10.1.25A.1 Introduction

The requirements in clause 10.1.25A apply provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP TS 37.355 [34] requesting the UE to report one or more UE Rx-Tx time difference measurements, defined in TS 38.215 [4], performed by aggregating PRS resources on multiple PFLs. The requirements in clause 10.1.25A apply:

- when UE is in RRC_CONNECTED state and the measurement is performed with MG,
- when UE is in RRC_INACTIVE state.

10.1.25A.2 Measurement Accuracy Requirements

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall not apply, if:

N_{TA_offset} defined in table 7.1.2-2 changes during the UE Rx-Tx measurement period or

if the uplink transmission timing changes during the UE Rx-Tx measurement period due to the network-configured Timing Advance.

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall apply provided that:

- The UE transmits SRS within the range from -160 ms to 160 ms of at least one DL PRS resource of each of the TRPs in the assistance data.
- PRS resources linked for aggregation saftisfy all the conditions specified in TS 38.214 [26] clause 5.1.6.5.3.
- the spacing between the center frequencies of adjacent PFLs containing PRS resources linked for aggregation does not exceed the nominal channel spacing for intra-band contiguous CA defined in TS 38.101-1 [18], clause 5.4A.1 for FR1 and in TS 38.101-2 [19], clause 5.4A.1 for FR2-1.

If the uplink transmission timing changes during the UE Rx-Tx measurement period due to the autonomous timing adjustment defined in clause 7.1.2 then:

- UE Rx-Tx measurement accuracy requirements shall apply for a cell, which is also the downlink reference cell (defined in clause 7.1.1) for SRS transmission even if the uplink transmission timing changes during the UE Rx-Tx measurement period due to autonomous adjustment.
- UE Rx-Tx measurement accuracy requirements shall not apply for a cell, which is not the downlink reference cell (defined in clause 7.1.1) for SRS transmission, if the uplink transmission timing changes during the UE Rx-Tx measurement period due to autonomous adjustment.

When a serving cell change occurs during the UE Rx-Tx measurement period, the UE Rx-Tx time difference measurement accuracy requirements in this clause shall apply provided that the serving cell change does not impact SRS configuration for the UE Rx-Tx measurement.

The accuracy requirements in table 10.1.25A.2-1 for FR1 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

AWGN propagation condition.

Table 10.1.25A.2-1: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions						
		PRS Ês/Iot	PRS bandwidth per PFL	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$ Note 3)	NR operating band groups Note 2	Io Note 4 range	
							Minimum Io Note 1	Maximum Io
Tc Note 5	Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
±12 + δ	±10 + δ	-3	≥104	15	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
						NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	
						NR_FDD_FR1_C, NR_TDD_FR1_C	-126	
						NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-125	
						NR_FDD_FR1_F	-124.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	
						NR_FDD_FR1_H	-123.5	
						NR_FDD_FR1_N	-120.5	
±6 + δ	±3 + δ		≥132	30	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
						NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	
						NR_FDD_FR1_C, NR_TDD_FR1_C	-123	
						NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-122	
						NR_FDD_FR1_F	-121.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	
						NR_FDD_FR1_H	-120.5	
						NR_FDD_FR1_N	-117.5	
±3 + δ	±2 + δ		≥272		≥1	NOTE 6	NOTE 6	NOTE 6
±6 + δ	±3 + δ		≥64	60	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
						NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	
						NR_FDD_FR1_C, NR_TDD_FR1_C	-120	
						NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-119	
						NR_FDD_FR1_F	-118.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	
						NR_FDD_FR1_H	-117.5	
						NR_FDD_FR1_N	-114.5	
±3 + δ	±2 + δ		≥ 132		≥1	NOTE 6	NOTE 6	NOTE 6

±14+δ	±13+δ	-13	≥104	15	≥1	NOTE 6	NOTE 6	NOTE 6
±8+δ	±4+δ		≥132	30	≥1	NOTE 6	NOTE 6	NOTE 6
±4+δ	±3+δ		≥272		≥1	NOTE 6	NOTE 6	NOTE 6
±9+δ	±4+δ		≥ 64	60	≥1	NOTE 6	NOTE 6	NOTE 6
±4+δ	±3+δ		≥ 132		≥1	NOTE 6	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from table 10.1.25A.2-5, where the PRS BW refers to the sum of the PRS PRB numbers across the aggregated PFLs.

The accuracy requirements in table 10.1.25A.2-1a for FR1 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

$\text{PRP}|_{\text{dBm}}$ according to annex B.2.14 for a corresponding Band.

Number of measurement samples is less than 4.

AWGN propagation condition.

Table 10.1.25A.2-1a: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN with reduced measurement samples

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions						
							Io[Note 4] range	
		PRS Ês/Iot	PRS bandwidth per PFL	PRS SCS	PRS resource repetition ($T_{\text{rep}}^{\text{PRS}} * L_{\text{PRS}} / K_{\text{comb}}^{\text{PRS}}$ [Note 3])	NR operating band groups[Note 2]	Minimum Io[Note 1]	Maximum Io
Tc[Note 5]	Tc[Note 5]	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
±11+δ	±9+δ	0	≥104	15	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
						NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	
						NR_FDD_FR1_C, NR_TDD_FR1_C	-126	
						NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-125	
						NR_FDD_FR1_F	-124.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	
						NR_FDD_FR1_H	-123.5	
						NR_FDD_FR1_N	-120.5	
±5+δ	±3+δ		≥132	30	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
						NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	
						NR_FDD_FR1_C, NR_TDD_FR1_C	-123	

						NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-122	
						NR_FDD_FR1_F	-121.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	
						NR_FDD_FR1_H	-120.5	
						NR_FDD_FR1_N	-117.5	
±3+δ	±2+δ		≥272		≥1	NOTE 6	NOTE 6	NOTE 6
±5+δ	±3+δ		≥64	60	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
						NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	
						NR_FDD_FR1_C, NR_TDD_FR1_C	-120	
						NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-119	
						NR_FDD_FR1_F	-118.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	
						NR_FDD_FR1_H	-117.5	
						NR_FDD_FR1_N	-114.5	
±3+δ	±2+δ		≥ 132		≥1	NOTE 6	NOTE 6	NOTE 6
±14+δ	±13+δ		≥104	15	≥1	NOTE 6	NOTE 6	NOTE 6
±9+δ	±4+δ		≥132	30	≥1	NOTE 6	NOTE 6	NOTE 6
±4+δ	±3+δ	-6	≥272		≥1	NOTE 6	NOTE 6	NOTE 6
±9+δ	±4+δ		≥ 64	60	≥1	NOTE 6	NOTE 6	NOTE 6
±4+δ	±3+δ		≥ 132		≥1	NOTE 6	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from table 10.1.25A.2-5, where the PRS BW refers to the sum of the PRS PRB numbers across the aggregated PFLs.

The accuracy requirements in table 10.1.25A.2-2 for FR1 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

Fading propagation condition.

Table 10.1.25A.2-2: UE Rx-Tx time difference measurement accuracy in FR1 for fading channel

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions						
		PRS Ês/Iot	PRS bandwidth per PFL	PRS SCS	PRS resource repetition ($T_{\text{rep}}^{\text{PRS}} * L_{\text{PRS}}$/	NR operating band groups[Note 2]	Io[Note 4] range	
							Minimum Io[Note 1]	Maximum Io

					K_{comb}^{PRS} Note 3			
Tc Note 5	**Tc Note 5**	**dB**	**PRB**	**kHz**			**dBm / SCS_{PRS}**	**dBm/BW**
±40+δ	±38+δ	-3	≥104	15	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
						NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	
						NR_FDD_FR1_C, NR_TDD_FR1_C	-126	
						NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-125	
						NR_FDD_FR1_F	-124.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	
						NR_FDD_FR1_H	-123.5	
						NR_FDD_FR1_N	-120.5	
±33+δ	±32+δ		≥132	30	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
						NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	
						NR_FDD_FR1_C, NR_TDD_FR1_C	-123	
						NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-122	
						NR_FDD_FR1_F	-121.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	
						NR_FDD_FR1_H	-120.5	
						NR_FDD_FR1_N	-117.5	
±33+δ	±30+δ		≥272		≥1	NOTE 6	NOTE 6	NOTE 6
±35+δ	±34+δ		≥64	60	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
						NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	
						NR_FDD_FR1_C, NR_TDD_FR1_C	-120	
						NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-119	
						NR_FDD_FR1_F	-118.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	
						NR_FDD_FR1_H	-117.5	
						NR_FDD_FR1_N	-114.5	
±32+δ	±31+δ		≥ 132		≥1	NOTE 6	NOTE 6	NOTE 6
±44+δ	±39+δ	--13	≥104	15	≥1	NOTE 6	NOTE 6	NOTE 6
±34+δ	±34+δ		≥132	30	≥1	NOTE 6	NOTE 6	NOTE 6
±33+δ	±30+δ		≥272		≥1	NOTE 6	NOTE 6	NOTE 6
±35+δ	±37+δ		≥ 64	60	≥1	NOTE 6	NOTE 6	NOTE 6
±33+δ	±34+δ		≥ 132		≥1	NOTE 6	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.

NOTE 3: $T_{\mathrm{rep}}^{\mathrm{PRS}}$, L_{PRS} , $K_{\mathrm{comb}}^{\mathrm{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from table 10.1.25A.2-5, where the PRS BW refers to the sum of the PRS PRB numbers across the aggregated PFLs.

The accuracy requirements in table 10.1.25A.2-3 for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

AWGN propagation condition.

Table 10.1.25A.2-3: UE Rx-Tx time difference measurement accuracy in FR2 in AWGN

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions					
		PRS Ês/Iot	PRS bandwidth per PFL	PRS SCS	PRS resource repetition ($T_{\mathrm{rep}}^{\mathrm{PRS}} * L_{\mathrm{PRS}} / K_{\mathrm{comb}}^{\mathrm{PRS}}$ Note 3	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	Tc Note 5	dB	PRB	kHz		dBm / SCS_{PRS}	dBm/$BW_{Channel}$
±6+δ	±3+δ	-3	≥64	60	≥1	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
±3+δ	±2+δ		≥132		≥1	NOTE 6	NOTE 6
±3+δ	±2+δ		≥64	120	≥1	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
±2+δ	±1+δ		≥128		≥1	NOTE 6	NOTE 6
±9+δ	±4+δ	-13	≥64	60	≥1	NOTE 6	NOTE 6
±4+δ	±3+δ		≥132		≥1	NOTE 6	NOTE 6
±4+δ	±3+δ		≥64	120	≥1	NOTE 6	NOTE 6
±2+δ	±1+δ		≥128		≥1	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: $T_{\mathrm{rep}}^{\mathrm{PRS}}$, L_{PRS} , $K_{\mathrm{comb}}^{\mathrm{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from table 10.1.25A.2-6, where the PRS BW refers to the sum of the PRS PRB numbers across the aggregated PFLs.

The accuracy requirements in table 10.1.25A.2-3a for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

Number of measurement samples is less than 4.

AWGN propagation condition.

Table 10.1.25A.2-3a: UE Rx-Tx time difference measurement accuracy in FR2 in AWGN with reduced measurement samples

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions					
		PRS Ês/Iot	PRS bandwidth per PFL	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$ Note 3	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	Tc Note 5	dB	PRB	kHz		dBm / SCS_{PRS}	dBm/$BW_{Channel}$
±5+δ	±3+δ	0	≥64	60	≥1	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
±3+δ	±2+δ		≥132		≥1	NOTE 6	NOTE 6
±3+δ	±2+δ		≥64	120	≥1	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
±2+δ	±1+δ		≥128		≥1	NOTE 6	NOTE 6
±9+δ	±4+δ	-6	≥64	60	≥1	NOTE 6	NOTE 6
±4+δ	±3+δ		≥132		≥1	NOTE 6	NOTE 6
±4+δ	±3+δ		≥64	120	≥1	NOTE 6	NOTE 6
±2+δ	±1+δ		≥128		≥1	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from table 10.1.25A.2-6, where the PRS BW refers to the sum of the PRS PRB numbers across the aggregated PFLs.

The accuracy requirements in table 10.1.25A.2-4 for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

Fading propagation condition.

Table 10.1.25A.2-4: UE Rx-Tx time difference measurement accuracy in FR2 for fading channel

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions					
		PRS Ês/Iot	PRS bandwidth per PFL	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$ Note 3	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	Tc Note 5	dB	PRB	kHz		dBm / SCS_{PRS}	dBm/$BW_{Channel}$
±57+δ	±38+δ	-3	≥64	60	≥1	Same value as PRP in table B.2.14-2, according to UE Power	-50

						class, operating band and angle of arrival	
±37+δ	±32+δ		≥132		≥1	NOTE 6	NOTE 6
±44+δ	±37+δ		≥64	120	≥1	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
±38+δ	±38+δ		≥128		≥1	NOTE 6	NOTE 6
±73+δ	±43+δ	-13	≥64	60	≥1	NOTE 6	NOTE 6
±46+δ	±35+δ		≥132		≥1	NOTE 6	NOTE 6
±56+δ	±42+δ		≥64	120	≥1	NOTE 6	NOTE 6
±43+δ	±47+δ		≥128		≥1	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: $T_{\text{rep}}^{\text{PRS}}$, L_{PRS} , $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from table 10.1.25A.2-6, where the PRS BW refers to the sum of the PRS PRB numbers across the aggregated PFLs.

Table 10.1.25A.2-5: Margin for UE Rx-Tx time difference measurement accuracy in FR1

Min(PRS BW, SRS BW) (PRB)			Margin (Tc [Note 1])
SCS = 15 kHz	SCS = 30 kHz	SCS = 60 kHz	
≥ 104	N/A	N/A	56
N/A	≥ 132	≥ 64	24
N/A	N/A	≥ 132	24

NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 2: If SRS and PRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies.

Table 10.1.25A.2-6: Margin for UE Rx-Tx time difference measurement accuracy in FR2

Min(PRS BW, SRS BW) (PRB)		Margin (Tc [Note 1])
SCS = 60 kHz	SCS = 120 kHz	
≥ 64	N/A	32
≥ 132	≥ 64	24
N/A	≥ 128	20

NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 2: If SRS and PRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies.

The relative accuracy of UE Rx-Tx measurement in this clause is defined as accuracy of the difference between two UE Rx-Tx measurements.

The relative accuracy requirements in table 10.1.25A.2-7 for FR1 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

$\text{PRP}|_{\text{dBm}}$ according to annex B.2.14 for a corresponding Band.

AWGN propagation condition.

The two UE Rx-Tx time difference measurements are associated with the same RxTx TEG.

Table 10.1.25A.2-7: UE Rx-Tx time difference relative measurement accuracy in FR1 in AWGN with TEG reporting

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions						
		PRS $\hat{E}_s/I_{ot}$	PRS bandwidth per PFL Note 1	PRS SCS	PRS resource repetition $(T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$ Note 2	NR operating band groups Note 4	Io Note 3 range	
							Minimum Io Note 1	Maximum Io
Tc Note 5	Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
±20+ Δ	±16+ Δ	(PRS $\hat{E}_s/I_{ot})_j$ ≥-6 (PRS $\hat{E}_s/I_{ot})_i$ ≥-13	≥104	15	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
						NR_FDD_FR1_B	-126.5	
						NR_TDD_FR1_C	-126	
						NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-125	
						NR_FDD_FR1_F	-124.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G	-124	
						NR_FDD_FR1_H	-123.5	
						NR_FDD_FR1_N	-120.5	
±11+ Δ	±6+ Δ		≥132	30	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
						NR_FDD_FR1_B	-123.5	
						NR_TDD_FR1_C	-123	
						NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-122	
						NR_FDD_FR1_F	-121.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G	-121	
						NR_FDD_FR1_H	-120.5	
						NR_FDD_FR1_N	-117.5	
±6+ Δ	±4+ Δ		≥272		≥1	NOTE 6	NOTE 6	NOTE 6
±11+ Δ	±6+ Δ		≥64	60	≥1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
						NR_FDD_FR1_B	-120.5	
						NR_TDD_FR1_C	-120	
						NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	
						NR_FDD_FR1_E, NR_TDD_FR1_E	-119	
						NR_FDD_FR1_F	-118.5	
						NR_FDD_FR1_G, NR_TDD_FR1_G	-118	
						NR_FDD_FR1_H	-117.5	
						NR_FDD_FR1_N	-114.5	
±5+ Δ	±4+ Δ		≥ 132		≥1	NOTE 6	NOTE 6	NOTE 6

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of resource j and resource i.
NOTE 2: Minimum number of PRS resource repetitions among resource j and resource i. T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: Δ is the value of the timing error margin for the RxTx TEG, reported via *nr-UE-RxTxTEG-TimingErrorMargin*. Δ cannot be larger than the sum of the margins in table 10.1.25A.2-5 (dependent on PRS/SRS BW) for any pair of individual UE Rx-Tx time difference measurements associated with the RxTx TEG.

The relative accuracy requirements in table 10.1.25A.2-8 for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

AWGN propagation condition.

the two UE Rx-Tx time difference measurements are associated with the same RxTx TEG.

Table 10.1.25A.2-8: UE Rx-Tx time difference relative measurement accuracy in FR2 in AWGN with TEG reporting

Accuracy for 2 PFLs	Accuracy for 3 PFLs	Conditions					
		PRS Ês/Iot	PRS bandwidth per PFL Note 1	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$ Note 2	Io Note 3 range	
						Minimum Io	Maximum Io
Tc Note 5	Tc Note 5	dB	PRB	kHz		dBm / SCS_{PRS}	dBm/$BW_{Channel}$
11+ Δ	6+ Δ	(PRS Ês/Iot)$_j$ ≥-6	≥64	60	≥1	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
5+ Δ	4+ Δ		≥132		≥1	NOTE 6	NOTE 6
6+ Δ	4+ Δ	(PRS Ês/Iot)$_i$ ≥-13	≥64	120	≥1	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
3+ Δ	2+ Δ		≥128		≥1	NOTE 6	NOTE 6

NOTE 1: Minimum PRS bandwidth per PFL, which is minimum of the PRS bandwidths of resource j and resource i.
NOTE 2: Minimum number of PRS resource repetitions among resource j and resource i. T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 6: Δ is the value of the timing error margin for the RxTx TEG, reported via *nr-UE-RxTxTEG-TimingErrorMargin*. Δ cannot be larger than the sum of the margins in table 10.1.25A.2-6 (dependent on PRS/SRS BW) for any pair of individual UE Rx-Tx time difference measurements associated with the RxTx TEG.

10.1.25A.3 Report mapping

Applicable measurement report mappings are defined in clause 10.1.25.3.

10.1.25C UE Rx-Tx Time Difference Measurements in Satellite Accesss

10.1.25C.1 Introduction

The requirements in clause 10.1.25C shall apply, provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP [31] requesting the UE to report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4]. The requirements in clause 10.1.25C shall apply:

- when UE is in RRC_CONNECTED state and the measurement is performed with MG or without MG.

10.1.25C.2 Measurement Accuracy Requirements

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall not apply, if:

- N_{TA_offset} defined in table 7.1.2-2 changes during the UE Rx-Tx measurement period or
- if the uplink transmission timing changes during the UE Rx-Tx measurement period due to the network-configured Timing Advance.

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall apply provided that:

- The UE transmits SRS within -160, 160 msec of at least one DL PRS resource of each of the TRPs corresponding to the serving cell in the assistance data.

If the uplink transmission timing changes during the UE Rx-Tx measurement period due to the autonomous timing adjustment defined in clause 7.1C.2 then:

- UE Rx-Tx measurement accuracy requirements shall apply for a cell, which is also the downlink reference cell (defined in clause 7.1C.1) for SRS transmission even if the uplink transmission timing changes during the UE Rx-Tx measurement period due to autonomous adjustment.

The accuracy requirements in table 10.1.25C.2-1 for FR1-NTN are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-5 [18] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- AWGN propagation condition.

Table 10.1.25C.2-1: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN with reduced measurement samples

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
± 59+δ	0	≥52	15	≥1	NR_FDD_SAB_FR1_A	-121	-50
± 30+δ		>104		≥1	NOTE 6	NOTE 6	NOTE 6
± 30+δ		≥48	30	≥1	NR_FDD_SAB_FR1_A	-118	-50
± 15+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6
± 15+δ		≥64	60	≥1	NR_FDD_SAB_FR1_A	-115	-50
± 7+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6
± 75+δ	-6	≥52	15	≥1	NOTE 6	NOTE 6	NOTE 6
± 37+δ		>104		≥1	NOTE 6	NOTE 6	NOTE 6
± 39+δ		≥48	30	≥1	NOTE 6	NOTE 6	NOTE 6
± 16+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6
± 16+δ		≥64	60	≥1	NOTE 6	NOTE 6	NOTE 6
± 8+δ		≥132		≥1	NOTE 6	NOTE 6	NOTE 6
NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol. NOTE 2: NR operating band groups are as defined in clause 3.5.							

NOTE 3: $T_{\mathrm{rep}}^{\mathrm{PRS}}$, L_{PRS}, $K_{\mathrm{comb}}^{\mathrm{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from Table 10.1.25C.2-2.

Table 10.1.25C.2-2: Margin for UE Rx-Tx time difference measurement accuracy in FR1-NTN

Min(PRS BW, SRS BW) (PRB)			Margin (Tc [Note 1])
SCS = 15 kHz	SCS = 30 kHz	SCS = 60 kHz	
≥ 24	N/A	N/A	160
≥ 52	≥ 24	N/A	80
≥ 104	≥ 48	≥ 24	56
N/A	≥ 132	≥ 64	24
N/A	N/A	≥ 132	24
NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]. NOTE 2: If SRS and PRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies.			

10.1.25C.3 Report mapping

The report mapping provided in clause 10.1.25.3 is applicable for NTN.

10.1.26 FR2 P-MPR report

The FR2 P-MPR report mapping is defined by this clause.

10.1.26.1 Report mapping

table 10.1.26.1-1 defines the FR2 P-MPR report mapping.

Table 10.1.26.1-1 Mapping of FR2 P-MPR

Reported value	Measured quantity value	Unit
P-MPR_00	3 ≤ P-MP < 6	dB
P-MPR_01	6 ≤ P-MP < 9	dB
P-MPR_02	9 ≤ P-MP < 12	dB
P-MPR_03	P-MP ≥ 12	dB

10.1.27 L1-SINR accuracy requirements for FR1

10.1.27.1 L1-SINR accuracy requirements with CSI-RS based CMR and no dedicated IMR configured

10.1.27.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute CSI-RS based L1-SINR accuracy in this clause apply to all CSI-RS resources configured as CMR and no dedicated resource configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements in table 10.1.27.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.1 for a corresponding Band for each relevant CSI-RS based CMR.
- The bandwidth of CSI-RS as CMR is 48 PRBs and the density is 3.
- AWGN radio propagation conditions.

The performance with larger bandwidth of CSI-RS as CMR is equal to or better than the accuracy requirements in table 10.1.27.1.1-1.

Table 10.1.27.1.1-1: L1-SINR absolute accuracy for CSI-RS based CMR only in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS CMR Ês/Iot	Io [Note 1] range					
			NR operating band groups [Note 2]	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±5.5	±6.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 3: The requirements apply for CSI-RS CMR Ês/Iot ≤ 6 dB with SCS 15kHz or 30kHz under NR high speed scenarios.

10.1.27.1.2 Relative Accuracy

The relative CSI-RS based L1-SINR accuracy is defined as the L1-SINR measured from one CSI-RS compared to the largest measured value of L1-SINR among all CSI-RS resources of the serving cell.

The accuracy requirements in table 10.1.27.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.1 for a corresponding Band for each relevant CSI-RS based CMR.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
- AWGN radio propagation conditions.

The performance with larger bandwidth of CSI-RS as CMR is equal to or better than the accuracy requirements in table 10.1.27.1.2-1.

Table 10.1.27.1.2-1: L1-SINR relative accuracy for CSI-RS based CMR only in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS CMR Ês/Iot Note 2	Io Note 1 range					
			NR operating band groups Note 3	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±[4.5]	±[5.5]	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS CMR Ês/Iot is the minimum CMR Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 4: The requirements apply for CSI-RS CMR Ês/Iot ≤ 6 dB with SCS 15kHz or 30kHz under NR high speed scenarios.

10.1.27.2 L1-SINR accuracy requirements with SSB based CMR and dedicated IMR configured

10.1.27.2.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute SSB based L1-SINR accuracy in this clause apply to all SSBs configured as CMR and dedicated resources configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements are defined in table 10.1.27.2.1-1 for SSB based CMR and NZP-IMR and in table 10.1.27.2.1-2 for SSB based CMR and ZP-IMR.

The accuracy requirements in tables 10.1.27.2.1-1 and 10.1.27.2.1-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.2 for a corresponding Band for each relevant SSB based CMR and IMR.
- The bandwidth of NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- AWGN radio propagation conditions.

The performance with larger bandwidth of NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in tables 10.1.27.2.1-1 and 10.1.27.2.1-2.

Table 10.1.27.2.1-1: L1-SINR absolute accuracy for SSB based CMR and NZP-IMR in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	SSB-CMR Ês/Iot	NZP-IMR Ês/Iot	Io [Note 1] range				
				NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
					SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.0	±5.0	≥0	≥0	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
				NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
				NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
				NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
				NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
				NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
				NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
				NR_FDD_FR1_N	-114.5	-111.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 3: The requirements apply for SSB-CMR Ês/Iot ≤ [6] dB with SCS 15 kHz or 30 kHz under NR high speed scenarios.

Table 10.1.27.2.1-2: L1-SINR absolute accuracy for SSB based CMR and ZP-IMR in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB-CMR Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.5	±5.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ [6] dB with SCS 15 kHz or 30 kHz under NR high speed scenarios.

10.1.27.2.2 Relative Accuracy

The relative SSB based L1-SINR accuracy is defined as the L1-SINR measured from one SSB configured as CMR and one IMR configured as IMR compared to the largest measured value of L1-SINR among all SSBs and IMRs of the serving cell.

The accuracy requirements are defined in table 10.1.27.2.2-1 for SSB based CMR and NZP-IMR and in table 10.1.27.2.2-2 for SSB based CMR and ZP-IMR.

The accuracy requirements in tables 10.1.27.2.2-1 and 10.1.27.2.2-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.2 for a corresponding Band for each relevant SSB based CMR and IMR.
- The bandwidth of NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- AWGN radio propagation conditions.

The performance with larger bandwidth of NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in tables 10.1.27.2.2-1 and 10.1.27.2.2-2.

Table 10.1.27.2.2-1: L1-SINR relative accuracy for SSB based CMR and NZP-IMR in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	SSB-CMR Ês/Iot Note 2	NZP-IMR Ês/Iot	Io Note 1 range				
				NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
					SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3.0	±4.0	≥0	≥0	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
				NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
				NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
				NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
				NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
				NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
				NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
				NR_FDD_FR1_N	-114.5	-111.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB CMR Ês/Iot is the minimum SSB CMR Ês/Iot of the pair of SSBs to which the requirement applies.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 4: The requirements apply for SSB-CMR Ês/Iot ≤ 6 dB with SCS 15kHz or 30kHz under NR high speed scenarios.

Table 10.1.27.2.2-2: L1-SINR relative accuracy for SSB based CMR and ZP-IMR in FR1

Accuracy	Conditions

Normal condition	Extreme condition	SSB-CMR Ês/Iot Note 2	Io Note 1 range			
			NR operating band groups Note 3	Minimum Io		Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3.5	±4.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB CMR Ês/Iot is the minimum SSB CMR Ês/Iot of the pair of SSBs to which the requirement applies. NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2. NOTE 4: he requirements apply for SSB Ês/Iot ≤ 6 dB with SCS 15kHz or 30kHz under NR high speed scenarios.							

10.1.27.3 L1-SINR accuracy requirements with CSI-RS based CMR and dedicated IMR configured

10.1.27.3.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute CSI-RS based L1-SINR accuracy in this clause apply to all CSI-RS resources configured as CMR and dedicated resources configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements are defined in table 10.1.27.3.1-1 for CSI-RS based CMR and NZP-IMR and in table 10.1.27.3.1-2 for CSI-RS based CMR and ZP-IMR.

The accuracy requirements in tables 10.1.27.3.1-1 and 10.1.27.3.1-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.3 for a corresponding Band for each relevant CSI-RS based CMR and IMR.
- The bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- AWGN radio propagation conditions.

The performance with larger bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in tables 10.1.27.3.1-1 and 10.1.27.3.1-2.

Table 10.1.27.3.1-1: L1-SINR absolute accuracy for CSI-RS based CMR and NZP-IMR in FR1

Accuracy		Conditions		
Normal condition	Extreme condition	CSI-RS	NZP-IMR	Io Note 1 range

		CMR Ês/Iot	Ês/Iot						
				NR operating band groups [Note 2]	Minimum Io				Maximum Io
dB	dB	dB	dB		dBm / SCS_{CSI-RS}			$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
					SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±4.0	±5.0	≥0	≥0	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
				NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
				NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
				NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
				NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
				NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
				NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50
				NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 3: The requirements apply for CSI-RS CMR Ês/Iot ≤ 6 dB with SCS 15kHz or 30kHz under NR high speed scenarios.

Table 10.1.27.3.1-2: L1-SINR absolute accuracy for CSI-RS based CMR and ZP-IMR in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS CMR Ês/Iot	Io [Note 1] range					
			NR operating band groups [Note 2]	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±4.5	±5.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50

			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2. NOTE 3: The requirements apply for CSI-RS CMR Ês/Iot ≤ 6 dB with SCS 15kHz or 30kHz under NR high speed scenarios.								

10.1.27.3.2 Relative Accuracy

The relative CSI-RS based L1-SINR accuracy is defined as the L1-SINR measured from one CSI-RS configured as CMR and one IMR configured as IMR compared to the largest measured value of L1-SINR among all CSI-RS and IMR resources of the serving cell.

The accuracy requirements are defined in table 10.1.27.3.2-1 for CSI-RS based CMR and NZP-IMR and in table 10.1.27.3.2-2 for CSI-RS based CMR and ZP-IMR.

The accuracy requirements in tables 10.1.27.3.2-1 and 10.1.27.3.2-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.3 for a corresponding Band for each relevant CSI-RS based CMR and IMR.
- The bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- AWGN radio propagation conditions.

The performance with larger bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in tables 10.1.27.3.2-1 and 10.1.27.3.2-2.

Table 10.1.27.3.2-1: L1-SINR relative accuracy for CSI-RS based CMR and NZP-IMR in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS CMR Ês/Iot Note 2	NZP-IMR Ês/Iot	Io Note 1 range				
				NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB	dB		dBm / SCS_{CSI-RS}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
					SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz	
±3.0	±4.0	≥0	≥0	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
				NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
				NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
				NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
				NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
				NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
				NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50

				NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS CMR Ês/Iot is the minimum CMR Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 4: The requirements apply for CSI-RS CMR Ês/Iot ≤ 6 dB with SCS 15kHz or 30kHz under NR high speed scenarios.

Table 10.1.27.3.2-2: L1-SINR relative accuracy for CSI-RS based CMR and ZP-IMR in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS CMR Ês/Iot Note 2	Io Note 1 range					
			NR operating band groups Note 3	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±[3.5]	±[4.5]	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS CMR Ês/Iot is the minimum CMR Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 4: The requirements apply for CSI-RS CMR Ês/Iot ≤ 6 dB with SCS 15kHz or 30kHz under NR high speed scenarios.

10.1.28 L1-SINR accuracy requirements for FR2

10.1.28.1 L1-SINR accuracy requirements with CSI-RS based CMR and no dedicated IMR configured

10.1.28.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute CSI-RS based L1-SINR accuracy in this clause apply to all CSI-RS resources configured as CMR and no dedicated resource configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements in table 10.1.28.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.1 for a corresponding Band for each relevant CSI-RS based CMR.
- The bandwidth of CSI-RS as CMR is 48 PRBs and the density is 3.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].
- AWGN radio propagation conditions.

The performance with larger bandwidth of CSI-RS as CMR is equal to or better than the accuracy requirements in table 10.1.28.1.1-1.

Table 10.1.28.1.1-1: L1-SINR absolute accuracy for CSI-RS based CMR only in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS CMR $\hat{E}s/Iot$ Note 3	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 2	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz / SCS_{CSI-RS} = 120 kHz		
±5.5	±6.5	≥-3	Same value as CSI-RS_RP in clause B.2.8.1, according to UE Power class, operating band and angle of arrival	N/A	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the CSI-RS CMR $\hat{E}s/Iot$ and related parameters may need to be adjusted to ensure $\hat{E}s/Iot$ at UE baseband is above the value defined in this table.

10.1.28.1.2 Relative Accuracy

The relative CSI-RS based L1-SINR accuracy is defined as the L1-SINR measured from one CSI-RS compared to the largest measured value of L1-SINR among all CSI-RS resources of the serving cell.

The accuracy requirements in table 10.1.28.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.1 for a corresponding Band for each relevant CSI-RS based CMR.
- The bandwidth of CSI-RS as CMR is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].
- AWGN radio propagation conditions.

The performance with larger bandwidth of CSI-RS as CMR is equal to or better than the accuracy requirements in table 10.1.28.1.2-1.

Table 10.1.28.1.2-1: L1-SINR relative accuracy for CSI-RS based CMR only in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS CMR $\hat{E}s/Iot$ Note 2, Note 4	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 3	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz / SCS_{CSI-RS} = 120 kHz		
±4.5	±5.5	≥-3	Same value as CSI-RS_RP in clause B.2.8.1, according to UE Power class, operating band and angle of arrival	N/A	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.

NOTE 2: The parameter CSI-RS CMR Ês/Iot is the minimum CSI-RS CMR Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the te Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.st cases, the CSI-RS CMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.28.2 L1-SINR accuracy requirements with SSB based CMR and dedicated IMR configured

10.1.28.2.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute SSB based L1-SINR accuracy in this clause apply to all SSBs configured as CMR and dedicated resources configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements are defined in table 10.1.28.2.1-1 for SSB based CMR and NZP-IMR and in table 10.1.28.2.1-2 for SSB based CMR and ZP-IMR.

The accuracy requirements in tables 10.1.28.2.1-1 and 10.1.28.2.1-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.2 for a corresponding Band for each relevant SSB based CMR and IMR.
- The bandwidth of NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].
- AWGN radio propagation conditions.
- SSB based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in tables 10.1.28.2.1-1 and 10.1.28.2.1-2.

Table 10.1.28.2.1-1: L1-SINR absolute accuracy for SSB based CMR and NZP-IMR in FR2

Accuracy		Conditions				
Normal condition	Extreme condition	SSB CMR Ês/Iot Note 3	NZP-IMR Ês/Iot Note 3	Io Note 1 range		
				Minimum Io		Maximum Io
dB	dB	dB	dB	dBm / SCS_{SSB} Note 2	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz	
±4.0	±5.0	≥0	≥0	Same value as SSB_RP in clause B.2.8.2, according to UE Power class, operating band and angle of arrival	N/A	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the SSB Ês/Iot, NZP-IMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

Table 10.1.28.2.1-2: L1-SINR absolute accuracy for SSB based CMR and ZP-IMR in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB CMR Ês/Iot Note 3	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 2	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz		
±4.5	±5.5	≥-3	Same value as SSB_RP in clause B.2.8.2, according to UE Power class, operating band and angle of arrival	N/A	-50
NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth. NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the SSB CMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.					

10.1.28.2.2 Relative Accuracy

The relative SSB based L1-SINR accuracy is defined as the L1-SINR measured from one SSB configured as CMR and one IMR configured as IMR compared to the largest measured value of L1-SINR among all SSB based CMRs and IMRs of the serving cell.

The accuracy requirements are defined in table 10.1.28.2.2-1 for SSB based CMR and NZP-IMR and in table 10.1.28.2.2-2 for SSB based CMR and ZP-IMR.

The accuracy requirements in tables 10.1.28.2.2-1 and 10.1.28.2.2-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.2 for a corresponding Band for each relevant SSB based CMR and IMR.
- The bandwidth of NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].
- AWGN radio propagation conditions.
- SSB based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in tables 10.1.28.2.2-1 and 10.1.28.2.2-2.

Table 10.1.28.2.2-1: L1-SINR relative accuracy for SSB based CMR and NZP-IMR in FR2

Accuracy		Conditions				
Normal condition	Extreme condition	SSB CMR Ês/Iot Note 2, Note 4	NZP-IMR Ês/Iot Note 4	Io Note 1 range		
				Minimum Io		Maximum Io
dB	dB	dB	dB	dBm / SCS_{SSB} Note 3	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 120 kHz / SCS_{SSB} = 240 kHz		
±3.0	±4.0	≥0	≥0	Same value as SSB_RP in clause B.2.8.2, according to UE Power class, operating band and angle of arrival	N/A	-50
NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.						

NOTE 2: The parameter SSB CMR Ês/Iot is the minimum SSB CMR Ês/Iot of the pair of SSBs to which the requirement applies.
NOTE 3: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the SSB CMR Ês/Iot, NZP-IMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

Table 10.1.28.2.2-2: L1-SINR relative accuracy for SSB based CMR and ZP-IMR in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB CMR Ês/Iot Note 2, Note 4	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 3		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
			SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz		
±3.5	±4.5	≥-3	Same value as SSB_RP in clause B.2.8.2, according to UE Power class, operating band and angle of arrival		N/A	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB CMR Ês/Iot is the minimum SSB CMR Ês/Iot of the pair of SSBs to which the requirement applies.
NOTE 3: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the SSB CMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.28.3 L1-SINR accuracy requirements with CSI-RS based CMR and dedicated IMR configured

10.1.28.3.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute CSI-RS based L1-SINR accuracy in this clause apply to all CSI-RS resources as CMR and dedicated resources configured as IMR of the serving cell configured for L1-SINR measurement.

The accuracy requirements are defined in table 10.1.28.3.1-1 for CSI-RS based CMR and NZP-IMR and in table 10.1.28.3.1-2 for CSI-RS based CMR and ZP-IMR.

The accuracy requirements in tables 10.1.28.3.1-1 and 10.1.28.3.1-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.3 for a corresponding Band for each relevant CSI-RS based CMR and IMR.
- The bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].
- AWGN radio propagation conditions.
- CSI-RS based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in tables 10.1.28.3.1-1 and 10.1.28.3.1-2.

Table 10.1.28.3.1-1: L1-SINR absolute accuracy for CSI-RS based CMR and NZP-IMR in FR2

Accuracy	Conditions

Normal condition	Extreme condition	CSI-RS CMR Ês/Iot Note 3	NZP-IMR Ês/Iot Note 3	Io Note 1 range		
				Minimum Io		Maximum Io
dB	dB	dB	dB	dBm / SCS_{CSI-RS} Note 2	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{CSI-RS} = 60 kHz / SCS_{CSI-RS} = 120 kHz		
±4.0	±5.0	≥0	≥0	Same value as CSI-RS_RP in clause B.2.8.3, according to UE Power class, operating band and angle of arrival	N/A	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the CSI-RS Ês/Iot, NZP-IMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

Table 10.1.28.3.1-2: L1-SINR absolute accuracy for CSI-RS based CMR and ZP-IMR in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS CMR Ês/Iot Note 3	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 2	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz / SCS_{CSI-RS} = 120 kHz		
±4.5	±5.5	≥-3	Same value as CSI-RS_RP in clause B.2.8.3, according to UE Power class, operating band and angle of arrival	N/A	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.28.3.2 Relative Accuracy

The relative CSI-RS based L1-SINR accuracy is defined as the L1-SINR measured from one CSI-RS configured as CMR and one IMR configured as IMR compared to the largest measured value of L1-SINR among all CSI-RS based CMRs and IMRs of the serving cell.

The accuracy requirements are defined in table 10.1.28.3.2-1 for CSI-RS based CMR and NZP-IMR and in table 10.1.28.3.2-2 for CSI-RS based CMR and ZP-IMR.

The accuracy requirements in tables 10.1.28.3.2-1 and 10.1.28.3.2-2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-SINR measurements are fulfilled according to annex B.2.8.3 for a corresponding Band for each relevant CSI-RS based CMR and IMR.
- The bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].
- AWGN radio propagation conditions.
- CSI-RS based CMR and IMR in the test come from the same direction.

The performance with larger bandwidth of CSI-RS as CMR, NZP-IMR and ZP-IMR is equal to or better than the accuracy requirements in tables 10.1.28.3.2-1 and 10.1.28.3.2-2.

Table 10.1.28.3.2-1: L1-SINR relative accuracy for CSI-RS based CMR and NZP-IMR in FR2

Accuracy		Conditions				
Normal condition	Extreme condition	CSI-RS CMR Ês/Iot Note 2, Note 4	NZP-IMR Ês/Iot Note 4	Io Note 1 range		
				Minimum Io		Maximum Io
dB	dB	dB	dB	dBm / SCS_{CSI-RS} Note 3	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{CSI-RS} = 60 kHz / SCS_{CSI-RS} = 120 kHz		
±3.0	±4.0	≥0	≥0	Same value as CSI-RS_RP in clause B.2.8.3, according to UE Power class, operating band and angle of arrival	N/A	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS CMR Ês/Iot is the minimum CSI-RS CMR Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the CSI-RS CMR Ês/Iot, NZP-IMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

Table 10.1.28.3.2-2: L1-SINR relative accuracy for CSI-RS based CMR and ZP-IMR in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS CMR Ês/Iot Note 2, Note 4	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 3	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{CSI-RS} = 60 kHz / SCS_{CSI-RS} = 120 kHz		
±3.5	±4.5	≥-3	Same value as CSI-RS_RP in clause B.2.8.3, according to UE Power class, operating band and angle of arrival	N/A	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS CMR Ês/Iot is the minimum CSI-RS CMR Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Values based on REFSENS and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the CSI-RS CMR Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.29 Intra-frequency RSRQ accuracy requirements under CCA

10.1.29.1 Intra-frequency SS-RSRQ accuracy requirements in FR1

10.1.29.1.1 Absolute SS-RSRQ Accuracy

Unless otherwise specified, the requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on the same frequency as that of the serving cell under CCA.

The accuracy requirements in table 10.1.29.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for intra-frequency measurements are fulfilled according to annex B.2.9 for a corresponding Band for each relevant SSB.

Table 10.1.29.1.1-1: SS-RSRQ intra-frequency absolute accuracy under CCA

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 3]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±2.5	±4	≥-3	NR_CCA_FR1_I	-117	-114	N/A	-50
			NR_CCA_FR1_J	-116.5	-113.5		
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. NOTE 3: NR operating band groups are as defined in clause 3.5.2.							

10.1.30 Inter-frequency RSRQ accuracy requirements under CCA

10.1.30.1 Inter-frequency SS-RSRQ accuracy requirements in FR1

10.1.30.1.1 Absolute SS-RSRQ Accuracy

The requirements for absolute SS-RSRQ accuracy in this clause apply to a cell on a frequency under CCA that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.30.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to annex B.2.10 for a corresponding Band for each relevant SSB.

Table 10.1.30.1.1-1: SS-RSRQ inter-frequency absolute accuracy under CCA

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 3]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±2.5	±4	≥-3	NR_CCA_FR1_I	-117	-114	N/A	-50
			NR_CCA_FR1_J	-116.5	-113.5		
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. NOTE 3: NR operating band groups are as defined in clause 3.5.2.							

10.1.30.1.2 Relative SS-RSRQ Accuracy

The relative SS-RSRQ accuracy in inter-frequency case is defined as the RSRQ measured from one cell on a frequency compared to the RSRP measured from another cell on a different frequency, with at least one of the two frequencies being under CCA.

The accuracy requirements in table 10.1.30.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.10 for a corresponding Band for each relevant SSB.
- |SSB_RP1 dB_m - SSB_RP2 dB_m| ≤ 27 dB
- |Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1.30.1.2-1: SS-RSRQ inter-frequency relative accuracy under CCA

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3	±4	≥-3	NR_CCA_FR1_I	-117	-114	N/A	-50
			NR_CCA_FR1_J	-116.5	-113.5		
±4	±4	≥-6	Note 3	Note 3	Note 3	Note 3	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups are as defined in clause 3.5.2.

10.1.31 Intra-frequency SINR accuracy requirements under CCA

10.1.31.1 Intra-frequency SS-SINR accuracy requirements in FR1

10.1.31.1.1 Absolute SS-SINR Accuracy

Unless otherwise specified, the requirements for absolute SS-SINR accuracy in this clause apply to a cell on the same frequency as that of the serving cell under CCA.

The accuracy requirements in table 10.1.31.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.9 for a corresponding Band.

Table 10.1.31.1.1-1: SS-SINR intra-frequency absolute accuracy under CCA

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 3	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3.0	±4	≥-3	NR_CCA_FR1_I	-117	-114	N/A	-50
			NR_CCA_FR1_J	-116.5	-113.5		
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ 25 dB.
NOTE 4: NR operating band groups are as defined in clause 3.5.2.

10.1.32 Inter-frequency SINR accuracy requirements under CCA

10.1.32.1 Inter-frequency SS-SINR accuracy requirements in FR1

10.1.32.1.1 Absolute SS-SINR Accuracy

The requirements for absolute SS-SINR accuracy in this clause apply to a cell on a frequency under CCA that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.32.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.10 for a corresponding Band.

Table 10.1.32.1.1-1: SS-SINR inter-frequency absolute accuracy under CCA

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}s/Iot$ Note 3	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3.0	±4	≥-3	NR_CCA_FR1_I	-117	-114	N/A	-50
			NR_CCA_FR1_J	116.5	-113.5		
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. NOTE 3: The requirements apply for SSB $\hat{E}s/Iot \leq 25$ dB. NOTE 4: NR operating band groups are as defined in clause 3.5.2.							

10.1.32.1.2 Relative SS-SINR Accuracy

The relative SS-SINR accuracy in inter-frequency case is defined as the SS-SINR measured from one cell on a frequency compared to the SS-SINR measured from another cell on a different frequency, with at least one of the two frequencies being under CCA.

The accuracy requirements in table 10.1.32.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.10 for a corresponding Band.
- $|SSB_RP1\ dB_m - SSB_RP2\ dB_m| \leq 27$ dB
- $|Channel\ 1_Io - Channel\ 2_Io| \leq 20$ dB

Table 10.1.32.1.2-1: SS-SINR inter-frequency relative accuracy under CCA

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}s/Iot$ Note 2,4	Io Note 1 range				
			NR operating band groups Note 5	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz		

±3.5	±4	≥-3	NR_CCA_FR1_I	-117	-114	N/A	-50
			NR_CCA_FR1_J	-116.5	-113.5		
±4	±4	≥-6	Note 3	Note 3	Note 3	Note 3	Note 3
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies. NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. NOTE 4: The requirements apply for SSB Ês/Iot ≤ 25 dB. NOTE 5: NR operating band groups are as defined in clause 3.5.2.							

10.1.33 L1-RSRP accuracy requirements under CCA

10.1.33.1 SSB based L1-RSRP accuracy requirements in FR1

10.1.33.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute SSB based L1-RSRP accuracy in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement under CCA.

The accuracy requirements in table 10.1.33.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.10.1 for a corresponding Band for each relevant SSB.

Table 10.1.33.1.1-1: SSB based L1-RSRP absolute accuracy under CCA

Accuracy		**Conditions**					
Normal condition	**Extreme condition**	**SSB Ês/Iot**	**Io [Note 1] range**				
			NR operating band groups [Note 2]	**Minimum Io**			**Maximum Io**
dB	**dB**	**dB**		**dBm / SCS_{SSB}**		**dBm/$BW_{Channel}$**	**dBm/$BW_{Channel}$**
				SCS_{SSB} = 15 kHz	**SCS_{SSB} = 30 kHz**		
±5.0	±9.5	≥-3	NR_CCA_FR1_I	-117	-114	N/A	-70
			NR_CCA_FR1_J	-116.5	-113.5		
±8.5	±11.5	≥-3	NR_CCA_FR1_I	N/A	N/A	-70	-50
			NR_CCA_FR1_J				
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups are as defined in clause 3.5.2.							

10.1.33.1.2 Relative Accuracy

The relative SSB based L1-RSRP accuracy is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the serving cell under CCA.

The accuracy requirements in table 10.1.33.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.10.1 for a corresponding Band for each relevant SSB.

Table 10.1.33.1.2-1: SSB based L1-RSRP relative accuracy under CCA

Accuracy		**Conditions**	
Normal condition	**Extreme condition**	**SSB Ês/Iot [Note 2]**	**Io [Note 1] range**

			NR operating band groups [Note 3]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3	±4	≥-3	NR_CCA_FR1_I	-117	-114	N/A	-50
			NR_CCA_FR1_J	-116.5	-113.5		
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies. NOTE 3: NR operating band groups are as defined in clause 3.5.2.							

10.1.34 RSSI measurements under CCA

10.1.34.1 Intra-frequency absolute RSSI measurement accuracy requirements in FR1

The accuracy requirements for intra-frequency RSSI measurements on a carrier frequency under CCA are specified in table 10.1.34.1-1. The requirements apply for any configured RSSI *measDuration* [2], provided that:

- All symbols during each RSSI measurement duration are available for RSSI sampling within the same reporting interval.

The intra-frequency RSSI measurement bandwidth is the channel bandwidth defined in clause 4 of TS 37.213 [33], where the channel has the center frequency configured by *ARFCN-valueNR*.

Table 10.1.34.1-1: Intra-frequency RSSI accuracy under CCA

Accuracy		Conditions				
Normal condition	Extreme condition	Io [Note 1] range				
		NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
			SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
[±3.5]	[±6.5]	NR_CCA_FR1_I	-117	-114	N/A	-70
		NR_CCA_FR1_J	-116.5	-113.5		
[±5.5]	[±8.5]	NR_CCA_FR1_I	N/A	N/A	-70	-50
		NR_CCA_FR1_J				
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups are as defined in clause 3.5.2.						

10.1.34.2 Inter-frequency absolute RSSI measurement accuracy requirements in FR1

The accuracy requirements for inter-frequency RSSI measurements on a carrier frequency under CCA are the same as specified in clause 10.1.34.1.

The inter-frequency RSSI measurement bandwidth is the channel bandwidth defined in clause 4 of TS 37.213 [33], where the channel has the center frequency configured by *ARFCN-valueNR*.

10.1.34.3 RSSI measurement report mapping

The reporting range of RSSI measurement is defined from -100 dBm to -25 dBm with 1 dBm resolution.

The mapping of the measured quantity is defined in table 10.1.34.3-1. The range in the signalling may be larger than the guaranteed accuracy range, provided that the following condition is met:

the RSSI measurement bandwidth is the channel bandwidth defined in clause 4 of TS 37.213 [33], where the channel has the center frequency configured by *ARFCN-valueNR*.

Table 10.1.34.3-1: RSSI measurement report mapping

Reported value	Measured quantity value	Unit

RSSI_00	RSSI < -100	dBm
RSSI_01	-100 ≤ RSSI < -99	dBm
RSSI_02	-99 ≤ RSSI < -98	dBm
…	…	…
RSSI_74	-27 ≤ RSSI < -26	dBm
RSSI_75	-26 ≤ RSSI < -25	dBm
RSSI_76	-25 ≤ RSSI	dBm

10.1.35 Channel occupancy measurements under CCA

10.1.35.1 Intra-frequency channel occupancy measurement accuracy requirements in FR1

The UE shall be able to correctly evaluate the intra-frequency channel occupancy configured according to TS 38.331 [2], provided that the following conditions are met:

- All symbols during each RSSI measurement duration are available for RSSI sampling within the same reporting interval,
- RSSI at the UE receiver meets the following condition with respect to the configured *channelOccupancyThreshold* [2]:
  - RSSI at the UE receiver is below *channelOccupancyThreshold*- Δ_{RSSI}, or
  - RSSI at the UE receiver is above *channelOccupancyThreshold*+ Δ_{RSSI},
- where Δ_{RSSI} is the applicable RSSI measurement accuracy value from the RSSI measurement accuracy requirements specified in clause 10.1.34.1.

The channel occupancy measurement bandwidth is the same as the RSSI measurement bandwidth in clause 10.1.34.1.

10.1.35.2 Inter-frequency channel occupancy measurement accuracy requirements in FR1

The UE shall be able to correctly evaluate the inter-frequency channel occupancy configured according to TS 38.331 [2], provided that the following conditions are met:

- All symbols during each RSSI measurement duration are available for RSSI sampling within the same reporting interval,
- RSSI at the UE receiver meets the following condition with respect to the configured *channelOccupancyThreshold* [2]:
  - RSSI at the UE receiver is below *channelOccupancyThreshold*- Δ_{RSSI}, or
  - RSSI at the UE receiver is above *channelOccupancyThreshold*+ Δ_{RSSI},
- where Δ_{RSSI} is the applicable RSSI measurement accuracy value from the RSSI measurement accuracy requirements specified in clause 10.1.34.2.

The channel occupancy measurement bandwidth is the same as the RSSI measurement bandwidth in clause 10.1.34.2.

10.1.36 Intra-frequency RSRP accuracy requirements under CCA

10.1.36.1 Intra-frequency SS-RSRP accuracy requirements in FR1

10.1.36.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute SS-RSRP accuracy in this clause apply to a cell on the same frequency as that of the serving cell under CCA.

The accuracy requirements in table 10.1.36.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.8 for a corresponding Band for each relevant SSB.

Table 10.1.36.1.1-1: SS-RSRP intra-frequency absolute accuracy

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.5	±9	≥-6	NR_CCA_FR1_I	-117	-114	N/A	-70
			NR_CCA_FR1_J	-116.5	-113.5		
±8	±11	≥-6	NR_CCA_FR1_I	N/A	N/A	-70	-50
			NR_CCA_FR1_J				
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups are as defined in clause 3.5.2.							

10.1.36.1.2 Relative SS-RSRP Accuracy

The relative SS-RSRP accuracy is defined as the SS-RSRP measured from one cell compared to the SS-RSRP measured from another cell on the same frequency, or between any two SS-RSRP levels measured on the same cell under CCA.

The accuracy requirements in table 10.1.36.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.8 for a corresponding Band for each relevant SSB.

Table 10.1.36.1.2-1: SS-RSRP intra-frequency relative accuracy under CCA

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot [Note 2]	Io [Note 1] range				
			NR operating band groups [Note 4]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±2	±3	≥-3	NR_CCA_FR1_I	-117	-114	N/A	-50
			NR_CCA_FR1_J	-116.5	-113.5		
±3	±3	≥-6	Note 3	Note 3	Note 3	N/A	Note 3
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.							

NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups are as defined in clause 3.5.2.

10.1.37 Inter-frequency RSRP accuracy requirements under CCA

10.1.37.1 Inter-frequency SS-RSRP accuracy requirements in FR1

10.1.37.1.1 Absolute SS-RSRP

The requirements for absolute SS-RSRP in this clause apply to a cell on a frequency under CCA that has different carrier frequency from the serving cell.

The accuracy requirements in table 10.1.37.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.9 for a corresponding Band for each relevant SSB.

Table 10.1.37.1.1-1: SS-RSRP inter-frequency absolute accuracy under CCA

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}_s/I_{ot}$	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.5	±9	≥-6	NR_CCA_FR1_I	-117	-114	N/A	-70
			NR_CCA_FR1_J	-116.5	-113.5		
±8	±11	≥-6	NR_CCA_FR1_I	N/A	N/A	-70	-50
			NR_CCA_FR1_J				

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups are as defined in clause 3.5.2.

10.1.37.1.2 Relative SS-RSRP Accuracy

The relative SS-RSRP accuracy in inter-frequency case is defined as the RSRP measured from one cell on a frequency compared to the RSRP measured from another cell on a different frequency, with at least one of the two frequencies being under CCA.

The accuracy requirements in table 10.1.37.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.9 for a corresponding Band for each relevant SSB.
- $|SSB_RP1\ dB_m - SSB_RP2\ dB_m| \leq 27$ dB
- $|Channel\ 1_Io - Channel\ 2_Io| \leq 20$ dB

Table 10.1.37.1.2-1: SS-RSRP inter-frequency relative accuracy under CCA

Accuracy		Conditions	
Normal condition	Extreme condition	SSB $\hat{E}_s/I_{ot}$ Note 2	Io [Note 1] range

			NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.5	±6	≥-6	NR_CCA_FR1_I	-117	-114	N/A	-50
			NR_CCA_FR1_J	-116.5	-113.5		
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies. NOTE 3: NR operating band groups are as defined in clause 3.5.2.							

10.1.38 PRS-RSRPP Measurements

10.1.38.1 Introduction

The requirements in clause 10.1.38.2 shall apply, provided the UE has received *nr-DL-AoD-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to report one or more DL PRS-RSRPP measurements defined in TS 38.215 [4]. The requirements in clause 10.1.38 shall apply:

- when UE is in RRC_CONNECTED state,
- when UE is in RRC_INACTIVE state,
- when UE is in RRC_IDLE state.

The requirements in clause 10.1.38.2 apply for the first path PRS-RSRP measurement.

10.1.38.2 Measurement Accuracy Requirements

10.1.38.2.1 Absolute PRS RSRPP accuracy

The absolute accuracy requirements for PRS-RSRPP measurement for FR1 defined in table 10.1.38.2.1-1 and table 10.1.38.2.1-3 are valid under the following conditions:

- Conditions defined in 38.101-1 clause 7.3 for reference sensitivity are fulfilled.
- PRP $1,2|_{dBm}$ according to annex B.2.14 for a corresponding Band

The absolute accuracy requirements for PRS-RSRPP measurement for FR2 defined in table 10.1.38.2.1-2 and table 10.1.38.2.1-4 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] clause 7.3 for reference sensitivity are fulfilled.
- PRP $1,2|_{dBm}$ according to annex B.2.14 for a corresponding Band

The absolute accuracy requirements for PRS-RSRPP measurement defined in table 10.1.38.2.1-1 and table 10.1.38.2.1-2 apply for the UE not supporting *supportedDL-PRS-ProcessingSamples* [34] or LMF does not indicate UE to perform positioning measurements with reduced number of samples.

The absolute accuracy requirements for PRS-RSRPP measurement defined in table 10.1.38.2.1-3 and table 10.1.38.2.1-4 apply for the UE supporting *supportedDL-PRS-ProcessingSamples* [34].

NOTE: The requirements in this clause are derived based on two-tap channel defined in TS 38.101-4 [21] annex B.2.4 ($a = 1$, τ_d=0.45 μs and f_D=5 Hz).

NOTE: The requirements in this clause are derived based on the difference between the estimated PRS-RSRPP compared to the ideal PRS-RSRPP defined as

$$\mathrm{RSRPP}_p \propto \left| \sum_k H_k \exp\left(j 2\pi D_p \frac{k}{N_{\mathrm{IFFT}}} \right) \right|^2$$

Where:

H_k is the effective channel frequency response (over REs occupied by PRS) measured without receiver noise.

D_p is the exact delay of the p-th path in the channel model.

Table 10.1.38.2.1-1: PRS-RSRPP absolute accuracy for FR1

Accuracy		Conditions						
					Io [Note 7] range			
Normal condition	Extreme condition	PRS Ês/Iot	PRS BW	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	NR operating band groups [Note 8]	Minimum Io [Note 1] dBm / SCS_{PRS}		Maximum Io
						dBm / SCS_{PRS}		
dB	dB	dB	PRB	-		dBm/15 kHz [Note 6]	dBm/30 kHz [Note 6]	dBm/60 kHz [Note 6]	$dBm/BW_{Channel}$
±4.1	±8.6	≥-3	≥24	All	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-123.5	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-123	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119	-50
					NR_FDD_FR1_F	-124.5	-121.5	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	-118	-50
					NR_FDD_FR1_H	-123.5	-120.5	-117.5	-50
					NR_FDD_FR1_N	-120.5	-117.5	-114.5	-50
					Note 4				
					Note 4				
±5.8	±10.3	≥-13	24 ≤ BW ≤ 52	All	Note 4				
±4.9	±9.4		BW > 52	All	Note 4				

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: Void.
NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the DL-TDOA or DL-AoD assistance data defined in [34].
NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 PRB.
NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 6: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.
NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 8: NR operating band groups are as defined in clause 3.5.2.

Table 10.1.38.2.1-2: PRS-RSRPP absolute accuracy for FR2

Accuracy		Conditions					
					Io [Note 7] range		
Normal condition	Extreme condition	PRS Ês/Iot	PRS BW	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	Minimum Io [Note 1] dBm / SCS_{PRS}		Maximum Io
					dBm / SCS_{PRS}		
dB	dB	dB	PRB	-	dBm/120 kHz [Note 6]	dBm/60 kHz [Note 6]	$dBm/BW_{Channel}$

±6.0	±9.0	≥-3	≥24	All	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
					Note 4	
					Note 4	
±7.3	±10.3	≥-13	24 ≤ BW ≤ 64	All	Note 4	
±6.2	±9.2		BW >64	All	Note 4	

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: Void.
NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the DL-TDOA or DL-AoD assistance data defined in [34].
NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 PRB.
NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 6: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.
NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 8: NR operating band groups are as defined in clause 3.5.2.

Table 10.1.38.2.1-3: PRS-RSRPP absolute accuracy for FR1 for reduced number of samples

Accuracy		**Conditions**						
					Io Note 7 range			
Normal condition	**Extreme condition**	**PRS $\hat{E}_s/I_{ot}$**	**PRS BW**	**Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)**	**NR operating band groups Note 8**	**Minimum Io Note 1 dBm / SCS_{PRS}**		**Maximum Io**
						dBm / SCS_{PRS}		
dB	**dB**	**dB**	**PRB**	**-**		**dBm/15 kHz Note 6**	**dBm/30 kHz Note 6**	**dBm/60 kHz Note 6**	**dBm/$BW_{Channel}$**
±3.9	±8.4	≥0	≥48	All	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-123.5	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-123	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119	-50
					NR_FDD_FR1_F	-124.5	-121.5	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	-118	-50
					NR_FDD_FR1_H	-123.5	-120.5	-117.5	-50
					NR_FDD_FR1_N	-120.5	-117.5	-114.5	-50
					Note 4				
					Note 4				
±4.2	±8.7	≥-6	48 ≤ BW ≤ 52	All	Note 4				
±4.1	±8.6		BW >52	All	Note 4				

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: Void.
NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the DL-TDOA or DL-AoD assistance data defined in [34].
NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 48 PRB.
NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 6: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.

NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 8: NR operating band groups are as defined in clause 3.5.2.

Table 10.1.38.2.1-4: PRS-RSRPP absolute accuracy for FR2 for reduced number of samples

Accuracy		Conditions					
					Io Note 7 range		
Normal condition	Extreme condition	PRS $\hat{E}s/Iot$	PRS BW	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	Minimum Io Note 1 dBm / SCS_{PRS}		Maximum Io
					dBm / SCS_{PRS}		
dB	dB	dB	PRB	-	dBm/120 kHz Note 6	dBm/60 kHz Note 6	$dBm/BW_{Channel}$
± 5.9	± 8.9	≥0	≥48	All	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival		-50
					Note 4		
					Note 4		
±5.6	±8.6	≥-6	48 ≤ BW ≤ 64	All	Note 4		
±5.4	±8.4		BW >64	All	Note 4		

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: Void.
NOTE 3: PRS bandwidth is as indicated in *prs-Bandwidth* in the DL-TDOA or DL-AoD assistance data defined in [34].
NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 48 PRB.
NOTE 5: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 6: The condition level is increased by Δ>0, when applicable, as described in clauses B.3.2 and B.3.3.
NOTE 7: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 8: NR operating band groups are as defined in clause 3.5.2.

10.1.38.3 Report mapping

10.1.38.3.1 Absolute PRS-RSRPP Measurement Report Mapping

The reporting range of absolute PRS-RSRPP measurement is defined from -156 dBm to -31 dBm with 1 dB resolution.

The mapping of measured quantity is defined in table 10.1.38.3.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

The UE capable of *additionalPathsExtSupport-r17* can report the PRS-RSRPP measurement of up to its supported number of additional paths.

Table 10.1.38.3.1-1: Measurement report mapping for PRS-RSRPP

Reported value	Measured quantity value	Unit
PRS_RSRPP_0	PRS-RSRPP<-156	dBm
PRS_RSRPP_1	-156≤PRS-RSRPP<-155	dBm
PRS_RSRPP_2	-155≤PRS-RSRPP<-154	dBm
PRS_RSRPP_3	-154≤PRS-RSRPP<-153	dBm
PRS_RSRPP_4	-153≤PRS-RSRPP<-152	dBm
PRS_RSRPP_5	-152≤PRS-RSRPP<-151	dBm
PRS_RSRPP_6	-151≤PRS-RSRPP<-150	dBm
PRS_RSRPP_7	-150≤PRS-RSRPP<-149	dBm
PRS_RSRPP_8	-149≤PRS-RSRPP<-148	dBm
PRS_RSRPP_9	-148≤PRS-RSRPP<-147	dBm
PRS_RSRPP_10	-147≤PRS-RSRPP<-146	dBm
PRS_RSRPP_11	-146≤PRS-RSRPP<-145	dBm
PRS_RSRPP_12	-145≤PRS-RSRPP<-144	dBm

PRS_RSRPP_13	-144≤PRS-RSRPP<-143	dBm
PRS_RSRPP_14	-143≤PRS-RSRPP<-142	dBm
PRS_RSRPP_15	-142≤PRS-RSRPP<-141	dBm
PRS_RSRPP_16	-141≤PRS-RSRPP<-140	dBm
PRS_RSRPP_17	-140≤PRS-RSRPP<-139	dBm
PRS_RSRPP_18	-139≤PRS-RSRPP<-138	dBm
…	…	…
PRS_RSRPP_111	-46≤PRS-RSRPP<-45	dBm
PRS_RSRPP_112	-45≤PRS-RSRPP<-44	dBm
PRS_RSRPP_113	-44≤PRS-RSRPP<-43	dBm
PRS_RSRPP_114	-43≤PRS-RSRPP<-42	dBm
PRS_RSRPP_115	-42≤PRS-RSRPP<-41	dBm
PRS_RSRPP_116	-41≤PRS-RSRPP<-40	dBm
PRS_RSRPP_117	-40≤PRS-RSRPP<-39	dBm
PRS_RSRPP_118	-39≤PRS-RSRPP<-38	dBm
PRS_RSRPP_119	-38≤PRS-RSRPP<-37	dBm
PRS_RSRPP_120	-37≤PRS-RSRPP<-36	dBm
PRS_RSRPP_121	-36≤PRS-RSRPP<-35	dBm
PRS_RSRPP_122	-35≤PRS-RSRPP<-34	dBm
PRS_RSRPP_123	-34≤PRS-RSRPP<-33	dBm
PRS_RSRPP_124	-33≤PRS-RSRPP<-32	dBm
PRS_RSRPP_125	-32≤PRS-RSRPP<-31	dBm
PRS_RSRPP_126	-31≤PRS-RSRPP	dBm

10.1.38.3.2 Differential Report Mapping for PRS-RSRPP Measurement

The reporting range of differential PRS-RSRPP is defined from -30 dB to 30 dB with 1 dB resolution.

The mapping of measured quantity is defined in table 10.1.38.3.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

For differential reporting, PRS-RSRPP is reported as the difference in dB with respect to the first reported PRS-RSRPP.

Table 10.1.38.3.2-1: Measurement report mapping for differential PRS-RSRPP

Reported value	Measured quantity value	Unit
DIFFRSRPP_0	-30≥ΔRSRPP	dB
DIFFRSRPP_1	-29≥ΔRSRPP>-30	dB
DIFFRSRPP_2	-28≥ΔRSRPP>-29	dB
DIFFRSRPP_3	-27≥ΔRSRPP>-28	dB
DIFFRSRPP_4	-26≥ΔRSRPP>-27	dB
DIFFRSRPP_5	-25≥ΔRSRPP>-26	dB
DIFFRSRPP_6	-24≥ΔRSRPP>-25	dB
DIFFRSRPP_7	-23≥ΔRSRPP>-24	dB
DIFFRSRPP_8	-22≥ΔRSRPP>-23	dB
DIFFRSRPP_9	-21≥ΔRSRPP>-22	dB
DIFFRSRPP_10	-20≥ΔRSRPP>-21	dB
DIFFRSRPP_11	-19≥ΔRSRPP>-20	dB
DIFFRSRPP_12	-18≥ΔRSRPP>-19	dB
DIFFRSRPP_13	-17≥ΔRSRPP>-18	dB
DIFFRSRPP_14	-16≥ΔRSRPP>-17	dB
…	…	…
DIFFRSRPP_25	-5≥ΔRSRPP>-6	dB
DIFFRSRPP_26	-4≥ΔRSRPP>-5	dB
DIFFRSRPP_27	-3≥ΔRSRPP>-4	dB
DIFFRSRPP_28	-2≥ΔRSRPP>-3	dB
DIFFRSRPP_29	-1≥ΔRSRPP>-2	dB
DIFFRSRPP_30	0≥ΔRSRPP>-1	dB
DIFFRSRPP_31	1≥ΔRSRPP>0	dB
DIFFRSRPP_32	2≥ΔRSRPP>1	dB
DIFFRSRPP_33	3≥ΔRSRPP>2	dB
DIFFRSRPP_34	4≥ΔRSRPP>3	dB
DIFFRSRPP_35	5≥ΔRSRPP>4	dB

DIFFRSRPP_36	6≥ΔRSRPP>5	dB
…	…	…
DIFFRSRPP_47	17≥ΔRSRPP>16	dB
DIFFRSRPP_48	18≥ΔRSRPP>17	dB
DIFFRSRPP_49	19≥ΔRSRPP>18	dB
DIFFRSRPP_50	20≥ΔRSRPP>19	dB
DIFFRSRPP_51	21≥ΔRSRPP>20	dB
DIFFRSRPP_52	22≥ΔRSRPP>21	dB
DIFFRSRPP_53	23≥ΔRSRPP>-22	dB
DIFFRSRPP_54	24≥ΔRSRPP>23	dB
DIFFRSRPP_55	25≥ΔRSRPP>24	dB
DIFFRSRPP_56	26≥ΔRSRPP>25	dB
DIFFRSRPP_57	27≥ΔRSRPP>26	dB
DIFFRSRPP_58	28≥ΔRSRPP>27	dB
DIFFRSRPP_59	29≥ΔRSRPP>28	dB
DIFFRSRPP_60	30≥ΔRSRPP>29	dB
DIFFRSRPP_61	ΔRSRPP>30	dB

10.1.38APRS-RSRPP Measurements Based on PRS Aggregation

10.1. 38A.1 Introduction

The requirements in clause 10.1.38A.2 shall apply, provided the UE has received *nr-DL-TDOA-RequestLocationInformation* or *nr-Multi-RTT-RequestLocationInformation* or *nr-DL-AoD-RequestLocationInformation* message from LMF via LPP TS 37.355 [34] with a request to perform measurement by aggregating PRS resources from multiple PFLs via *nr-DL-PRS-JointMeasurementRequested* for UE to report one or more DL PRS-RSRPP measurements defined in TS 38.215 [4]. The requirements in clause 10.1.38A.2 shall apply:

- when UE is in RRC_CONNECTED state, and the measurement is performed with MG,
- when UE is in RRC_INACTIVE state.
- when UE is in RRC_IDLE state.

The requirements in clause 10.1.38A.2 apply for the first path PRS-RSRP measurement.

10.1.38A.2 Measurement Accuracy Requirements

10.1.38A.2.1 Absolute PRS RSRPP accuracy

The accuracy requirements in clause 10.1.38.2.1 corresponding to the total aggregated PRS bandwidth shall apply.

10.1.38A.3 Report mapping

10.1.38A.3.1 Absolute PRS-RSRPP Measurement Report Mapping

The absolute report mapping for PRS-RSRPP measurement in clause 10.1.38.3.1 shall apply.

10.1.38A.3.2 Differential Report Mapping for PRS-RSRPP Measurement

The differential report mapping for PRS-RSRPP measurement in clause 10.1.38.3.2 shall apply.

10.1.39 UE Rx-Tx time difference measurements for RTT-based PDC

10.1.39.1 *Void*

10.1.39.2 Measurement Accuracy Requirements for PRS

The error in the reported value of UE Rx-Tx time difference measurement, including both the measurement error and the reporting quantization error, shall be within the accuracy requirements specified in this clause.

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall not apply, if:

- N_{TA_offset} defined in table 7.1.2-2 changes during the UE Rx-Tx measurement period or
- if the uplink transmission timing changes during the UE Rx-Tx measurement period due to the network-configured Timing Advance.

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall apply provided that:

- The UE transmits SRS within -160, 160 msec of at least one PDC DL PRS resource from the serving cell (PCell).

When a serving cell change occurs during the UE Rx-Tx measurement period, the UE Rx-Tx time difference measurement accuracy requirements in this clause shall apply provided that the serving cell change does not impact SRS configuration for the UE Rx-Tx measurement.

The accuracy requirements in table 10.1.39.2-1 for FR1 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to Annex B.2.14 for a corresponding Band.

AWGN propagation condition.

Table 10.1.39.2-1: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
± [78+δ+ε]	-3	≥[24]	15	≥[4]	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	
					NR_FDD_FR1_F	-118.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	
					NR_FDD_FR1_H	-117.5	
					NR_FDD_FR1_N	-114.5	
± [59+δ+ε]		≥[52]		≥[1]	Note 6	NOTE 6	NOTE 6
± [30+δ+ε]		>[104]		≥[1]	Note 6	NOTE 6	NOTE 6
± [57+δ+ε]		≥[24]	30	≥[4]	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-118	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-117.5	

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
					NR_FDD_FR1_C, NR_TDD_FR1_C	-117	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-116.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-116	
					NR_FDD_FR1_F	-115.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-115	
					NR_FDD_FR1_H	-114.5	
					NR_FDD_FR1_N	-111.5	
± [30+δ+ε]		≥[48]		≥[1]	NOTE 6	NOTE 6	NOTE 6
± [15+δ+ε]		≥[132]		≥[1]	NOTE 6	NOTE 6	NOTE 6
± [29+δ+ε]		≥[24]	60	≥[4]	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-115	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-114.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-114	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-113.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-113	
					NR_FDD_FR1_F	-113.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-113	
					NR_FDD_FR1_H	-111.5	
					NR_FDD_FR1_N	-108.5	
± [15+δ+ε]		≥[64]		≥[1]	NOTE 6	NOTE 6	NOTE 6
± [7+δ+ε]		≥[132]		≥[1]	NOTE 6	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in clause 3.5.
NOTE 3: T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from Table 10.1.39.2-3.
NOTE 8: ε is the margin for reporting quantitization error and $\varepsilon = 16\ Tc$.

The accuracy requirements in table 10.1.39.2-2 for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.

AWGN propagation condition.

Table 10.1.39.2-2: UE Rx-Tx time difference measurement accuracy in FR2 in AWGN

Accuracy	Conditions					
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$ Note 3	Io Note 4 range	
					Minimum Io Note 1	Maximum Io

Tc[Note 5]	dB	PRB	kHz		dBm / SCS$_{PRS}$	dBm/BW$_{Channel}$
± [22+δ+ε]	-3	≥[24]	60	≥[1]	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
± [15+δ+ε]		≥[64]		≥[1]	NOTE 6	NOTE 6
± [7+δ+ε]		≥[132]		≥[1]	NOTE 6	NOTE 6
± [12+δ+ε]		≥[32]	120	≥[1]	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
± [7+δ+ε]		≥[64]		≥[1]	NOTE 6	NOTE 6
± [4+δ+ε]		≥[128]		≥[1]	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in clause 3.5.
NOTE 3: $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols and dl-PRS-CombSizeN defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from Table 10.1.39.2-4.
NOTE 8: ε is the margin for reporting quantitization error and ε=16 Tc.

Table 10.1.39.2-3: Margin for UE Rx-Tx time difference measurement accuracy in FR1

Min(PRS BW, SRS BW) (PRB)			Margin (Tc [Note 1])
SCS = 15 kHz	SCS = 30 kHz	SCS = 60 kHz	
≥ 24	N/A	N/A	160
≥ 52	≥ 24	N/A	80
≥ 104	≥ 48	≥ 24	56
N/A	≥ 132	≥ 64	24
N/A	N/A	≥ 132	24

NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 2: If SRS and PRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies.

Table 10.1.39.2-4: Margin for UE Rx-Tx time difference measurement accuracy in FR2

Min(PRS BW, SRS BW) (MHz)		Margin (Tc [Note 1])
SCS = 60 kHz	SCS = 120 kHz	
≥ 24	N/A	76
≥ 64	≥ 32	32
≥ 132	≥ 64	24
N/A	≥ 128	20

NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 2: If SRS and PRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies.

10.1.39.3 Measurement Accuracy Requirements for TRS

The error in the reported value of UE Rx-Tx time difference measurement, including both the measurement error and the reporting quantization error, shall be within the accuracy requirements specified in this clause.

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall not apply, if:

- N_{TA_offset} defined in table 7.1.2-2 changes during the UE Rx-Tx measurement period or
- if the uplink transmission timing changes during the UE Rx-Tx measurement period due to the network-configured Timing Advance.

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall apply provided that:

- The UE transmits SRS within -160, 160 msec of at least one PDC TRS resource from the serving cell (PCell).

When a serving cell change occurs during the UE Rx-Tx measurement period, the UE Rx-Tx time difference measurement accuracy requirements in this clause shall apply provided that the serving cell change does not impact SRS configuration for the UE Rx-Tx measurement.

The accuracy requirements in table 10.1.39.3-1 for FR1 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.13 for a corresponding Band.

AWGN propagation condition.

Table 10.1.39.3-1: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN

Accuracy	Conditions					
	TRS Ês/Iot	Minimum TRS bandwidth	TRS SCS	NR operating band groups[Note 2]	Io[Note 3] range	
					Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB	kHz		dBm / SCS_{TRS}	dBm/BW
[116+δ+ε]	-3	≥[24]	15	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
				NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	
				NR_FDD_FR1_C, NR_TDD_FR1_C	-120	
				NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	
				NR_FDD_FR1_E, NR_TDD_FR1_E	-119	
				NR_FDD_FR1_F	-118.5	
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	
				NR_FDD_FR1_H	-117.5	
				NR_FDD_FR1_N	-114.5	
[60+δ+ε]		≥[52]		Note 5	NOTE 5	NOTE 5
[29+δ+ε]		>[104]		Note 5	NOTE 5	NOTE 5
[56+δ+ε]		≥[24]	30	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-118	-50
				NR_FDD_FR1_B, NR_TDD_FR1_B	-117.5	
				NR_FDD_FR1_C, NR_TDD_FR1_C	-117	
				NR_FDD_FR1_D, NR_TDD_FR1_D	-116.5	
				NR_FDD_FR1_E, NR_TDD_FR1_E	-116	
				NR_FDD_FR1_F	-115.5	
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-115	
				NR_FDD_FR1_H	-114.5	
				NR_FDD_FR1_N	-111.5	
[29+δ+ε]		≥[48]		NOTE 5	NOTE 5	NOTE 5
[15+δ+ε]		≥[132]		NOTE 5	NOTE 5	NOTE 5
[29+δ+ε]		≥[24]	60	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-115	-50

				NR_FDD_FR1_B, NR_TDD_FR1_B	-114.5	
				NR_FDD_FR1_C, NR_TDD_FR1_C	-114	
				NR_FDD_FR1_D, NR_TDD_FR1_D	-113.5	
				NR_FDD_FR1_E, NR_TDD_FR1_E	-113	
				NR_FDD_FR1_F	-113.5	
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-113	
				NR_FDD_FR1_H	-111.5	
				NR_FDD_FR1_N	-108.5	
[14+δ+ε]		≥[64]		NOTE 5	NOTE 5	NOTE 5
[7+δ+ε]		≥[132]		NOTE 5	NOTE 5	NOTE 5

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in clause 3.5.
NOTE 3: The Io is defined in TRS slots. The same Io range applies to TRS and non-TRS symbols. Io levels are different in TRS and non-TRS symbols within the same slot.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the TRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 6: δ is the margin determined from Table 10.1.39.3-3.
NOTE 7: ε is the margin for reporting quantization error and $\varepsilon = 16\,Tc$.

The accuracy requirements in table 10.1.39.3-2 for FR2 are valid under the following conditions:

Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

$PRP|_{dBm}$ according to annex B.2.13 for a corresponding Band.

AWGN propagation condition.

Table 10.1.39.3-2: UE Rx-Tx time difference measurement accuracy in FR2 in AWGN

Accuracy	Conditions				
	TRS Ês/Iot	Minimum TRS bandwidth	TRS SCS	Io[Note 3] range	
				Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB	kHz	dBm / SCS_{TRS}	dBm/$BW_{Channel}$
[29+δ+ε]	-3	≥[24]	60	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
[14+δ+ε]		≥[64]		NOTE 5	NOTE 5
[7+δ+ε]		≥[132]		NOTE 5	NOTE 5
[15+δ+ε]		≥[32]	120	Same value as PRP in Table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
[7+δ+ε]		≥[64]		NOTE 5	NOTE 5
[4+δ+ε]		≥[128]		NOTE 5	NOTE 5

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in clause 3.5.
NOTE 3: The Io is defined in TRS slots. The same Io range applies to TRS and non-TRS symbols. Io levels are different in TRS and non-TRS symbols within the same slot.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the TRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 6: δ is the margin determined from Table 10.1.39.3-4.
NOTE 7: ε is the margin for reporting quantization error and ε=16 Tc.

Table 10.1.39.3-3: Margin for UE Rx-Tx time difference measurement accuracy in FR1

Min(TRS BW, SRS BW) (RB)	Margin (Tc [Note 1])

SCS = 15 kHz	SCS = 30 kHz	SCS = 60 kHz	
≥ 24	N/A	N/A	160
≥ 52	≥ 24	N/A	80
≥ 104	≥ 48	≥ 24	56
N/A	≥ 132	≥ 64	24
N/A	N/A	≥ 132	24
NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]. NOTE 2: If SRS and TRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies.			

Table 10.1.39.3-4: Margin for UE Rx-Tx time difference measurement accuracy in FR2

Min(TRS BW, SRS BW) (MHz)		Margin (Tc Note 1)
SCS = 60 kHz	SCS = 120 kHz	
≥ 24	N/A	76
≥ 64	≥ 32	32
≥ 132	≥ 64	24
N/A	≥ 128	20
NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]. NOTE 2: If SRS and TRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies.		

10.1.40 Void

10.1.41 FR1 DPC report

The FR1 DPC report mapping is defined in this clause.

10.1.41.1 Report mapping

table 10.1.41.1-1 defines the FR1 DPC report mapping.

Table 10.1.41.1-1 Mapping of FR1 DPC

Reported value	Reported quantity value	Unit
DPC_00	0	dB
DPC_03	3	dB
DPC_06	6	dB

10.1.42 TDCP Measurement Report Mapping

The reporting range of TDCP amplitude is defined from 0 to 1. The reporting range of TDCP phase is 0 to 2π. The mapping of measured quantity is defined in tables 10.1.42-1, 10.1.42-2. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.42-1: TDCP amplitude measurement report mapping

Reported value	Measured quantity value
TDCP_0	$1 - \frac{1}{128\sqrt{2}} < \text{TDCP} \leq 1$
TDCP_1	$1 - \frac{1}{128} < \text{TDCP} \leq 1 - \frac{1}{128\sqrt{2}}$
TDCP_2	$1 - \frac{1}{64\sqrt{2}} < \text{TDCP} \leq 1 - \frac{1}{128}$
TDCP_3	$1 - \frac{1}{64} < \text{TDCP} \leq 1 - \frac{1}{64\sqrt{2}}$
TDCP_4	$1 - \frac{1}{32\sqrt{2}} < \text{TDCP} \leq 1 - \frac{1}{64}$
TDCP_5	$1 - \frac{1}{32} < \text{TDCP} \leq 1 - \frac{1}{32\sqrt{2}}$

TDCP_6	$1-\frac{1}{16\sqrt{2}} < \text{TDCP} \le 1-\frac{1}{32}$
TDCP_7	$1-\frac{1}{16} < \text{TDCP} \le 1-\frac{1}{16\sqrt{2}}$
TDCP_8	$1-\frac{1}{8\sqrt{2}} < \text{TDCP} \le 1-\frac{1}{16}$
TDCP_9	$1-\frac{1}{8} < \text{TDCP} \le 1-\frac{1}{8\sqrt{2}}$
TDCP_10	$1-\frac{1}{4\sqrt{2}} < \text{TDCP} \le 1-\frac{1}{8}$
TDCP_11	$1-\frac{1}{4} < \text{TDCP} \le 1-\frac{1}{4\sqrt{2}}$
TDCP_12	$1-\frac{1}{2\sqrt{2}} < \text{TDCP} \le 1-\frac{1}{4}$
TDCP_13	$1-\frac{1}{2} < \text{TDCP} \le 1-\frac{1}{2\sqrt{2}}$
TDCP_14	$1-\frac{1}{\sqrt{2}} < \text{TDCP} \le 1-\frac{1}{2}$
TDCP_15	$0 \le \text{TDCP} \le 1-\frac{1}{\sqrt{2}}$

Table 10.1.42-2: TDCP phase measurement report mapping

Reported value	Measured quantity value
TDCP_PH_0	$0 \le \text{TDCP_PH} < \frac{2\pi}{16}$
TDCP_PH_1	$\frac{2\pi}{16} \le \text{TDCP_PH} < \frac{2\pi*2}{16}$
TDCP_PH_2	$\frac{2\pi*2}{16} \le \text{TDCP_PH} < \frac{2\pi*3}{16}$
TDCP_PH_3	$\frac{2\pi*3}{16} \le \text{TDCP_PH} < \frac{2\pi*4}{16}$
TDCP_PH_4	$\frac{2\pi*4}{16} \le \text{TDCP_PH} < \frac{2\pi*5}{16}$
TDCP_PH_5	$\frac{2\pi*5}{16} \le \text{TDCP_PH} < \frac{2\pi*6}{16}$
TDCP_PH_6	$\frac{2\pi*6}{16} \le \text{TDCP_PH} < \frac{2\pi*7}{16}$
TDCP_PH_7	$\frac{2\pi*7}{16} \le \text{TDCP_PH} < \frac{2\pi*8}{16}$
TDCP_PH_8	$\frac{2\pi*8}{16} \le \text{TDCP_PH} < \frac{2\pi*9}{16}$
TDCP_PH_9	$\frac{2\pi*9}{16} \le \text{TDCP_PH} < \frac{2\pi*10}{16}$
TDCP_PH_10	$\frac{2\pi*10}{16} \le \text{TDCP_PH} < \frac{2\pi*11}{16}$
TDCP_PH_11	$\frac{2\pi*11}{16} \le \text{TDCP_PH} < \frac{2\pi*12}{16}$
TDCP_PH_12	$\frac{2\pi*12}{16} \le \text{TDCP_PH} < \frac{2\pi*13}{16}$
TDCP_PH_13	$\frac{2\pi*13}{16} \le \text{TDCP_PH} < \frac{2\pi*14}{16}$
TDCP_PH_14	$\frac{2\pi*14}{16} \le \text{TDCP_PH} < \frac{2\pi*15}{16}$
TDCP_PH_15	$\frac{2\pi*15}{16} \le \text{TDCP_PH} \le 2\pi$

10.1.43 DL-RSCPD Measurements

10.1.43.1 Introduction

The requirements in clause 10.1.43 shall apply, provided the UE has received *NR-DL-TDOA-RequestLocationInformation* message with *dl-PRS-RSCPD-Request-r18* from LMF via LPP TS 37.355 [34] requesting the UE to measure and report DL RSCPD measurement together with DL RSTD measurements defined in TS 38.215 [4]. The requirements in clause 10.1.43 shall apply:

- when UE is in RRC_CONNECTED state and the measurement is performed with MG,
- when UE is in RRC_IDLE or RRC_INACTIVE state.

10.1.43.2.1 Measurement Accuracy Requirements

The accuracy requirements for DL RSCPD measurement are based on single measurement sample in single PFL and shall be within ±(X+Y) degree, provided that the following conditions are met:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled for FR1.
- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled for FR2.
- Conditions for DL RSCPD measurements are fulfilled according to annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.
- The measurements to derive DL RSCPD are performed on PRS resources within same set of symbols.
- DL RSCPD measurements are based on PRS resources with comb size other than 12.

The requirements in this clause are derived based on AWGN channel and on two-tap channel defined in 38.101-4 [21] annex B.2.4 (a = 1, τ_d=0.45 μs and f_D=5 Hz).

X is defined in table 10.1.43.2-1 for AWGN channel and table 10.1.43.2-2 for two-tap channel for FR1 and is derived assuming no carrier frequency offset at TRP.

X is defined in table 10.1.43.2-3 for AWGN channel and table 10.1.43.2-4 for two-tap channel for FR2 and is derived assuming no carrier frequency offset at TRP.

Y is 14 degrees for FR1 and 28 degrees for FR2.

Table 10.1.43.2-1: DL RSCPD absolute accuracy in FR1 for AWGN channel

Accuracy ($\hat{E}s/Iot)_{ref}$ ≥ -6dB, ($\hat{E}s/Iot)_i$ ≥ -13dB	Accuracy ($\hat{E}s/Iot)_{ref}$ ≥ -3dB, ($\hat{E}s/Iot)_i$ ≥ -6dB	Conditions					
		PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
degree	degree	kHz	PRB			dBm/SCS	dBm/$BW_{Channel}$
16	3	15	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
11	5		≥ 52	≥ 1	Note 5	Note 5	Note 5
8	4		≥ 104	≥ 1	Note 5	Note 5	Note 5
16	3	30	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50

					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
11	4		≥ 48	≥ 1	Note 5	Note 5	Note 5
6	3		≥ 132	≥ 1	Note 5	Note 5	Note 5
17	3	60	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50
8	4		≥ 64	≥ 1	Note 5	Note 5	Note 5
6	3		≥ 132	≥ 1	Note 5	Note 5	Note 5

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS.

Table 10.1.43.2-2: DL RSCPD absolute accuracy in FR1 for two-tap channel

Accuracy $(\text{PRS Ês/Iot})_{ref}$ ≥ -3dB $(\text{PRS Ês/Iot})_i$ ≥ -6dB	**Conditions**					
				Io Note 3 **range**		
	PRS SCS	**PRS bandwidth** Note 1	**PRS resource repetition** $(T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS})$ Note 2	**NR operating band groups** Note 4	**Minimum Io**	**Maximum Io**
degree	**kHz**	**PRB**			**dBm/SCS**	**dBm/BW$_{Channel}$**
7	15	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
				NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
				NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
				NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
				NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
				NR_FDD_FR1_F	-124.5	-50
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
				NR_FDD_FR1_H	-123.5	-50
				NR_FDD_FR1_N	-120.5	-50
7		≥ 52	≥ 1	Note 5	Note 5	Note 5
5		≥ 104	≥ 1	Note 5	Note 5	Note 5
5	30	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A,	-124	-50

				NR_SDL_FR1_A		
				NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
				NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
				NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
				NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
				NR_FDD_FR1_F	-121.5	-50
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
				NR_FDD_FR1_H	-120.5	-50
				NR_FDD_FR1_N	-117.5	-50
6		≥ 48	≥ 1	Note 5	Note 5	Note 5
5		≥ 132	≥ 1	Note 5	Note 5	Note 5
5	60	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
				NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
				NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
				NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
				NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
				NR_FDD_FR1_F	-118.5	-50
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
				NR_FDD_FR1_H	-117.5	-50
				NR_FDD_FR1_N	-114.5	-50
7		≥ 64	≥ 1	Note 5	Note 5	Note 5
4		≥ 132	≥ 1	Note 5	Note 5	Note 5

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS.

Table 10.1.43.2-3: DL RSCPD absolute accuracy in FR2 for AWGN channel

Accuracy $(\hat{E}s/Iot)_{ref} \geq -6dB$ $(\hat{E}s/Iot)_i \geq -13dB$	**Accuracy** $(\hat{E}s/Iot)_{ref} \geq -3dB$ $(\hat{E}s/Iot)_i \geq -6dB$	**Conditions**				
		PRS SCS	**PRS bandwidth** Note 1	**PRS resource repetition** $(T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS})$ Note 2	**Io** Note 3 **range**	
					Minimum Io	**Maximum Io**
degree	**degree**	**kHz**	**PRB**		**dBm/SCS**	**dBm/BW$_{Channel}$**
17	3	60	≥ 24	≥ 4	Same value as PRS_RP in table B.2.14-2,	-50

					according to UE Power class, operating band and angle of arrival	
9	5		≥ 64	≥ 1	Note 4	Note 4
7	3		≥ 132	≥ 1	Note 4	Note 4
17	3	120	≥ 32	≥ 4	Same value as PRS_RP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
10	6		≥ 64	≥ 1	Note 4	Note 4
6	3		≥ 128	≥ 1	Note 4	Note 4
NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i. NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively. NOTE 3: Io is assumed to have constant EPRE across the bandwidth. NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS.						

Table 10.1.43.2-4: DL RSCPD absolute accuracy in FR2 for two-tap channel

Accuracy $(\text{PRS } \hat{E}s/Iot)_{ref} \geq$ -3dB $(\text{PRS } \hat{E}s/Iot)_i \geq$ -6dB	**Conditions**				
	PRS SCS	**PRS bandwidth** Note 1	**PRS resource repetition** ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	**Io** Note 3 **range**	
				Minimum Io	**Maximum Io**
degree	**kHz**	**PRB**		**dBm/SCS**	**dBm/BW$_{Channel}$**
5	60	≥ 24	≥ 4	Same value as PRS_RP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
5		≥ 64	≥ 1	Note 4	Note 4
4		≥ 132	≥ 1	Note 4	Note 4
5	120	≥ 32	≥ 4	Same value as PRS_RP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
7		≥ 64	≥ 1	Note 4	Note 4

5		≥ 128	≥ 1	Note 4	Note 4

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.

10.1.43.3 Report Mapping

10.1.43.3.1 Absolute DL RSCPD Measurement Reporting

The reporting range of DL RSCPD, as defined in clause 5.1.43 of TS 38.215 [4], is defined from -180 degree to +180 degree. The reporting resolution is 0.1 degree.

The mapping of DL RSCPD measured quantity is defined in table 10.1.43.3.1-1.

Table 10.1.43.3.1-1: DL RSCPD measurement report mapping

Reported value	Measured quantity value (DL RSCPD)	Unit
DL_RSCPD_0000	-180 ≤ DL RSCPD < -179.9	degree
DL_RSCPD_0001	-179.9 ≤ DL RSCPD < -179.8	degree
DL_RSCPD_0002	-179.8 ≤ DL RSCPD < -179.7	degree
…	…	…
DL_RSCPD_1798	-0.2 ≤ DL RSCPD < -0.1	degree
DL_RSCPD_1799	-0.1 ≤ DL RSCPD < 0	degree
DL_RSCPD_1800	0 ≤ DL RSCPD < 0.1	degree
DL_RSCPD_1801	0.1 ≤ DL RSCPD < 0.2	degree
DL_RSCPD_1802	0.2 ≤ DL RSCPD < 0.3	degree
…	…	…
DL_RSCPD_3598	179.8 ≤ DL RSCPD < 179.9	degree
DL_RSCPD_3599	179.9 ≤ DL RSCPD < 180	degree

10.1.44 DL-RSCP Measurements

10.1.44.1 Introduction

The requirements in clause 10.1.44 shall apply, provided the UE has received *NR-Multi-RTT-RequestLocationInformation* message with *dl-PRS-RSCP-Request-r18* from LMF via LPP TS 37.355 [34] requesting the UE to measure and report DL RSCP measurement together with UE Rx-Tx time difference measurements defined in TS 38.215 [4].

The requirements in clause 10.1.44 shall apply:

- when UE is in RRC_CONNECTED state and the measurement is performed with MG,
- when UE is in RRC_INACTIVE state.

10.1.44.2 Measurement Accuracy Requirements

The relative accuracy of DL RSCP measurement in this clause is defined as accuracy of the difference between two DL RSCP measurements, each based on single measurement sample in single PFL.

The requirements in this clause are derived based on AWGN channel and based on two-tap channel defined in 38.101-4 [21] annex B.2.4 (a = 1, τ_d=0.45 μs and f_D=5 Hz).

The DL RSCP relative measurement accuracy requirements in this clause shall not apply, if:

- N_{TA_offset} defined in table 7.1.2-2 changes during the DL RSCP with UE Rx-Tx measurement period, or
- if the uplink transmission timing changes during the DL RSCP with UE Rx-Tx measurement period due to the network-configured Timing Advance.

The DL RSCP relative measurement accuracy requirements in this clause shall apply provided that:

- The UE transmits SRS within the range from -160 ms to 160 ms of at least one DL PRS resource of each of the TRPs in the assistance data.

If the uplink transmission timing changes during the DL RSCP with UE Rx-Tx measurement period due to the autonomous timing adjustment defined in clause 7.1.2 then:

- DL RSCP and UE Rx-Tx measurement accuracy requirements shall apply for a cell, which is also the downlink reference cell (defined in section 7.1.1) for SRS transmission.
- UE Rx-Tx measurement accuracy requirements shall not apply for a cell, which is not the downlink reference cell (defined in section 7.1.1) for SRS transmission.

When a serving cell change occurs during the DL RSCP with UE Rx-Tx measurement period, UE Rx-Tx measurement accuracy requirements and DL RSCP measurement requirements do not apply.

The relative DL RSCP accuracy requirements defined in clause 10.1.44 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled for FR1.
- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled for FR2.
- Conditions for DL RSCP measurements are fulfilled according to annex B.2.14 for a corresponding Band for each relevant PRS resource configured for measurement.
- DL RSCP measurements to derive the relative accuracy are performed on PRS resources within the same set of symbols.
- DL RSCPD measurements are based on PRS resources with comb size other than 12.

The accuracy requirement for relative DL-RSCP shall be within ±(X+Y) degree.

The values of X for accuracy requirements for relative DL-RSCP measurement in FR1 are defined in table 10.1.44.2-1 for AWGN channel and in table 10.1.44.2-2 for two-tap channel and is derived assuming no carrier frequency offset at TRP.

The values of X for accuracy requirements for relative DL-RSCP measurement in FR2 are defined in table 10.1.44.2-3 for AWGN channel and in table 10.1.44.2-4 for two-tap channel and is derived assuming no carrier frequency offset at TRP.

Y is 14 degrees for FR1 and 28 degrees for FR2.

Table 10.1.44.2-1: DL RSCP relative accuracy in FR1 for AWGN channel

Accuracy ($\hat{E}s/Iot)_{ref}$ ≥ -3dB ($\hat{E}s/Iot)_i$ ≥ -13dB	Accuracy ($\hat{E}s/Iot)_{ref}$ ≥ 0dB ($\hat{E}s/Iot)_i$ ≥ -6dB	Conditions					
		PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io

				Note 2			
degree	**degree**	**kHz**	**PRB**			**dBm/SCS**	**dBm/BW$_{Channel}$**
14	4	15	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
9	4		≥ 52	≥ 1	Note 5	Note 5	Note 5
6	3		≥ 104	≥ 1	Note 5	Note 5	Note 5
14	5	30	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
9	3		≥ 48	≥ 1	Note 5	Note 5	Note 5
7	3		≥ 132	≥ 1	Note 5	Note 5	Note 5
14	4	60	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50
10	4		≥ 64	≥ 1	Note 5	Note 5	Note 5
7	3		≥ 132	≥ 1	Note 5	Note 5	Note 5

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.

NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.

NOTE 3: Io is assumed to have constant EPRE across the bandwidth.

NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS.

Table 10.1.44.2-2: DL RSCP relative accuracy in FR1 for two-tap channel

Accuracy $(\hat{E}s/Iot)_{ref} \geq 0dB$ $(\hat{E}s/Iot)_i \geq -6dB$	Conditions					
	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range		
				NR operating band groups Note 4	Minimum Io	Maximum Io
degree	kHz	PRB			dBm/SCS	$dBm/BW_{Channel}$
9	15	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
				NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
				NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
				NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
				NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
				NR_FDD_FR1_F	-124.5	-50
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
				NR_FDD_FR1_H	-123.5	-50
				NR_FDD_FR1_N	-120.5	-50
7		≥ 52	≥ 1	Note 5	Note 5	Note 5
5		≥ 104	≥ 1	Note 5	Note 5	Note 5
7	30	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
				NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
				NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
				NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
				NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
				NR_FDD_FR1_F	-121.5	-50
				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
				NR_FDD_FR1_H	-120.5	-50
				NR_FDD_FR1_N	-117.5	-50
5		≥ 48	≥ 1	Note 5	Note 5	Note 5
7		≥ 132	≥ 1	Note 5	Note 5	Note 5
7	60	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
				NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
				NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
				NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
				NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
				NR_FDD_FR1_F	-118.5	-50

				NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
				NR_FDD_FR1_H	-117.5	-50
				NR_FDD_FR1_N	-114.5	-50
9		≥ 64	≥ 1	Note 5	Note 5	Note 5
6		≥ 132	≥ 1	Note 5	Note 5	Note 5
NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.						
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.						
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.						
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.						
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.						

Table 10.1.44.2-3: DL RSCP relative accuracy in FR2 for AWGN channel

Accuracy **$(\hat{E}s/Iot)_{ref} \geq -3dB$** **$(\hat{E}s/Iot)_i \geq -13dB$**	**Accuracy** **$(\hat{E}s/Iot)_{ref} \geq 0dB$** **$(\hat{E}s/Iot)_i \geq -6dB$**	**Conditions**				
		PRS SCS	**PRS bandwidth** Note 1	**PRS resource repetition** **($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$)** Note 2	**Io** Note 3 **range**	
					Minimum Io	**Maximum Io**
degree	**degree**	**kHz**	**PRB**		**dBm/SCS**	**dBm/BW$_{Channel}$**
14	4	60	≥ 24	≥ 4	Same value as PRS_RP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
8	4		≥ 64	≥ 1	Note 4	Note 4
6	3		≥ 132	≥ 1	Note 4	Note 4
16	5	120	≥ 32	≥ 4	Same value as PRS_RP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
9	4		≥ 64	≥ 1	Note 4	Note 4
7	3		≥ 128	≥ 1	Note 4	Note 4
NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.						
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by						

	higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3:	Io is assumed to have constant EPRE across the bandwidth.
NOTE 4:	The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest RB number for the corresponding SCS.

Table 10.1.44.2-4: DL RSCP relative accuracy in FR2 for two-tap channel.

Accuracy $(PRS Ês/Iot)_{ref}$ ≥ 0dB $(PRS Ês/Iot)_i$ ≥ -6dB	Conditions				
	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range	
				Minimum Io	Maximum Io
degree	kHz	PRB		dBm/SCS	$dBm/BW_{Channel}$
8	60	≥ 24	≥ 4	Same value as PRS_RP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
5		≥ 64	≥ 1	Note 4	Note 4
3		≥ 132	≥ 1	Note 4	Note 4
9	120	≥ 32	≥ 4	Same value as PRS_RP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
6		≥ 64	≥ 1	Note 4	Note 4
5		≥ 132	≥ 1	Note 4	Note 4

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.

10.1.44.3 Report Mapping

Relative DL RSCP measurement reporting in clause 10.1.44.3.1 applies to report:

- gap-based DL RSCP measurement, and
- DL RSCP in RRC_INACTIVE state.

10.1.44.3.1 Relative DL RSCP Measurement Reporting

The reporting range of relative DL RSCP, as defined in clause 5.1.42 of TS 38.215 [4], is defined from 0 degree to 360 degree. The reporting resolution is 0.1 degree.

The mapping of DL RSCP measured quantity is defined in table 10.1.44.3.1-1.

Table 10.1.44.3.1-1: DL RSCP measurement report mapping

Reported value	Measured quantity value (DL RSCP)	Unit
DL_RSCP_0000	0 ≤ DL RSCP < 0.1	degree
DL_RSCP_0001	0.1 ≤ DL RSCP < 0.2	degree
DL_RSCP_0002	0.2 ≤ DL RSCP < 0.3	degree
…	…	…
DL_RSCP_1798	179.8 ≤ DL RSCP < 179.9	degree
DL_RSCP_1799	179.9 ≤ DL RSCP < 180	degree
DL_RSCP_1800	180 ≤ DL RSCP < 180.1	degree
DL_RSCP_1801	180.1 ≤ DL RSCP < 180.2	degree
DL_RSCP_1802	180.2 ≤ DL RSCP < 180.3	degree
…	…	…
DL_RSCP_3598	359.8 ≤ DL RSCP < 359.9	degree
DL_RSCP_3599	359.9 ≤ DL RSCP < 360	degree

10.1A NR measurements for RedCap

10.1A.1 Introduction

The requirements in this clause are applicable for RedCap UE as follows:

- intra-frequency requirements apply for PCell measurements in SA,
- inter-frequency requirements apply for non-serving cell measurements on NR carrier frequencies.
- inter-frequency requirements apply for measurements from one cell on a frequency compared to the measurement from another cell on a different frequency.

The accuracy requirements in this clause are applicable for AWGN radio propagation conditions. The accuracy requirements of RSRP, RSRQ and SINR are applicable provided that reference SSB is not changed during measurement period.

10.1A.2 Intra-frequency RSRP accuracy requirements for FR1

10.1A.2.1 Intra-frequency SS-RSRP accuracy requirements

10.1A.2.1.1 Absolute SS-RSRP Accuracy

The accuracy requirements in clause 10.1.2.1.1 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.2.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.15 for a corresponding Band for each relevant SSB.

Table 10.1A.2.1.1-1: SS-RSRP Intra-frequency absolute accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range		
			NR operating band groups [Note 2]	Minimum Io	Maximum Io

dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±5.5	±10	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-70
±9	±12	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N	N/A	N/A	-70	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1A.2.1.2 Relative SS-RSRP Accuracy

The accuracy requirements in clause 10.1.2.1.2 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.2.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.15 for a corresponding Band for each relevant SSB.

Table 10.1A.2.1.2-1: SS-RSRP Intra-frequency relative accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}s/Iot$ Note 2	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
			NR_FDD_FR1_A, NR_TDD_FR1_A,	-121	-118	N/A	-50

±3	±4	≥-3	NR_SDL_FR1_A				
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±4	±4	≥-6	Note 3	Note 3	Note 3	N/A	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1A.3 Intra-frequency RSRP accuracy requirements for FR2

10.1A.3.1 Intra-frequency SS-RSRP accuracy requirements

10.1A.3.1.1 Absolute SS-RSRP Accuracy

The accuracy requirements in clause 10.1.3.1.1 shall apply.

10.1A.3.1.2 Relative SS-RSRP Accuracy

The accuracy requirements in clause 10.1.3.1.2 shall apply.

10.1A.4 Inter-frequency RSRP accuracy requirements for FR1

10.1A.4.1 Inter-frequency SS-RSRP accuracy requirements

10.1A.4.1.1 Absolute SS-RSRP Accuracy in FR1

The accuracy requirements in clause 10.1.4.1.1 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.4.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.16 for a corresponding Band for each relevant SSB.

Table 10.1A.4.1.1-1: SS-RSRP Inter-frequency Absolute accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		

±5.5	±10	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-70
±9	±12	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: Void NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1A.4.1.2 Relative SS-RSRP Accuracy in FR1

The accuracy requirements in clause 10.1.4.1.2 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.4.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.16 for a corresponding Band for each relevant SSB.
- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27$ dB
- |Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1A.4.1.2-1: SS-RSRP Inter-frequency relative accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		

±5.5	±7	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies. NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1A.5 Inter-frequency RSRP accuracy requirements for FR2

10.1A.5.1 Inter-frequency SS-RSRP accuracy requirements

10.1A.5.1.1 Absolute SS-RSRP Accuracy

The accuracy requirements in clause 10.1.5.1.1 shall apply.

10.1A.5.1.2 Relative SS-RSRP Accuracy

The accuracy requirements in clause 10.1.5.1.2 shall apply.

10.1A.6 Intra-frequency RSRQ accuracy requirements for FR1

10.1A.6.1 Intra-frequency SS-RSRQ accuracy requirements in FR1

10.1A.6.1.1 Absolute SS-RSRQ Accuracy in FR1

The accuracy requirements in clause 10.1.7.1.1 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.6.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.15 for a corresponding Band for each relevant SSB.

Table 10.1A.6.1.1-1: SS-RSRQ Intra-frequency absolute accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions				
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range			
			NR operating band groups [Note 3]	Minimum Io		Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		

±3.5	±5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±4.5	±5	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1A.7 Intra-frequency RSRQ accuracy requirements for FR2

10.1A.7.1 Intra-frequency SS-RSRQ accuracy requirements in FR2

10.1A.7.1.1 Absolute SS-RSRQ Accuracy in FR2

The accuracy requirements in clause 10.1.8.1.1 shall apply.

10.1A.8 Inter-frequency RSRQ accuracy requirements for FR1

10.1A.8.1 Inter-frequency SS-RSRQ accuracy requirements in FR1

10.1A.8.1.1 Absolute SS-RSRQ in FR1

The accuracy requirements in clause 10.1.9.1.1 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.8.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.16 for a corresponding Band for each relevant SSB.

Table 10.1A.8.1.1-1: SS-RSRQ Inter-frequency absolute accuracy for 1Rx RedCap UE in FR1

Accuracy		**Conditions**					
Normal condition	**Extreme condition**	**SSB $\hat{E}_s/I_{ot}$**	**Io [Note 1] range**				
			NR operating band groups [Note 3]	**Minimum Io**			**Maximum Io**
dB	**dB**	**dB**		**dBm / SCS_{SSB}**		**$dBm/BW_{Channel}$**	**$dBm/BW_{Channel}$**
				SCS_{SSB} = 15 kHz	**SCS_{SSB} = 30 kHz**		
			NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50

±3.5	±5	≥-3	NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±4.5	±5	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1A.8.1.2 Relative SS-RSRQ Accuracy in FR1

The accuracy requirements in clause 10.1.9.1.2 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.8.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.16 for a corresponding Band for each relevant SSB.
- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27$ dB
- |Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1A.8.1.2-1: SS-RSRQ Inter-frequency relative accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4	±5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±5	±5	≥-6	Note 3	Note 3	Note 3	Note 3	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.

NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1A.9 Inter-frequency RSRQ accuracy requirements for FR2

10.1A.9.1 Inter-frequency SS-RSRQ accuracy requirements in FR2

10.1A.9.1.1 Absolute SS-RSRQ Accuracy in FR2

The accuracy requirements in clause 10.1.10.1.1 shall apply.

10.1A.9.1.2 Relative SS-RSRQ Accuracy in FR2

The accuracy requirements in clause 10.1.10.1.2 shall apply.

10.1A.10 Intra-frequency SINR accuracy requirements for FR1

10.1A.10.1 Intra-frequency SS-SINR accuracy requirements in FR1

10.1A.10.1.1 Absolute SS-SINR Accuracy in FR1

The accuracy requirements in clause 10.1.12.1.1 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.10.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to annex B.2.15 for a corresponding Band.

Table 10.1A.10.1.1-1: SS-SINR Intra-frequency absolute accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB $\hat{E}_s/I_{ot}$ Note 3	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.0	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±4.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.

NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ 25 dB under non-HST scenarios.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: The requirements apply for SSB Ês/Iot ≤5 dB with SCS 15 kHz or 30 kHz under NR high speed scenarios.

10.1A.11 Intra-frequency SINR accuracy requirements for FR2

10.1A.11.1 Intra-frequency SS-SINR accuracy requirements in FR2

10.1A.11.1.1 Absolute SS-SINR Accuracy in FR2

The accuracy requirements in clause 10.1.13.1.1 shall apply.

10.1A.12 Inter-frequency SINR accuracy requirements for FR1

10.1A.12.1 Inter-frequency SS-SINR accuracy requirements in FR1

10.1A.12.1.1 Absolute SS-SINR Accuracy in FR1

The accuracy requirements in clause 10.1.14.1.1 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.12.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.16 for a corresponding Band.

Table 10.1A.12.1.1-1: SS-SINR Inter-frequency absolute accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 3	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.0	±5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±4.5	±5	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ 25 dB.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1A.12.1.2 Relative SS-SINR Accuracy in FR1

The accuracy requirements in clause 10.1.14.1.2 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.12.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to annex B.2.16 for a corresponding Band.
- $|SSB_RP1_{dBm} - SSB_RP2_{dBm}| \leq 27$ dB
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1A.12.1.2-1: SS-SINR Inter-frequency relative accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2,4	Io Note 1 range				
			NR operating band groups Note 5	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz		
±4.5	±5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50
±5	±5	≥-6	Note 3	Note 3	Note 3	Note 3	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: The requirements apply for SSB Ês/Iot ≤ [25] dB.
NOTE 5: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1A.13 Inter-frequency SINR accuracy requirements for FR2

10.1A.13.1 Inter-frequency SS-SINR accuracy requirements in FR2

10.1A.13.1.1 Absolute SS-SINR Accuracy in FR2

The accuracy requirements in clause 10.1.15.1.1 shall apply.

10.1A.13.1.2 Relative SS-SINR Accuracy in FR2

The accuracy requirements in clause 10.1.15.1.1 shall apply.

10.1A.14L1-RSRP accuracy requirements for FR1

10.1A.14.1 SSB based L1-RSRP accuracy requirements

10.1A.14.1.1 Absolute Accuracy

The accuracy requirements in clause 10.1.19.1.1 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.14.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.

Table 10.1A.14.1.1-1: SSB based L1-RSRP absolute accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io [Note 1] range				
			NR operating band groups [Note 2]	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±8.0	±12.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-70
±11.5	±14.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N	N/A	N/A	-70	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1A.14.1.2 Relative Accuracy

The accuracy requirements in clause 10.1.19.1.2 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.14.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.1 for a corresponding Band for each relevant SSB.

Table 10.1A.14.1.2-1: SSB based L1-RSRP relative accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±6	±7	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies.
NOTE 3: Void
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1A.14.2 CSI-RS based L1-RSRP accuracy requirements

10.1A.14.2.1 Absolute Accuracy

The accuracy requirements in clause 10.1.19.2.2 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.14.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.2 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1A.19.2.1-1.

Table 10.1A.14.2.1-1: CSI-RS based L1-RSRP absolute accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io [Note 1] range					
			NR operating band groups [Note 2]	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±8.0	±12.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-70
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-70
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-70
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-70
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-70
±11.5	±14.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_B, NR_FDD_FR1_C, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G, NR_FDD_FR1_H, NR_FDD_FR1_N	N/A	N/A	N/A	-70	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1A.14.2.2 Relative Accuracy

The accuracy requirements in clause 10.1.19.2.2 shall apply when RedCap UE is capable of 2Rx. When UE is only required to support 1RX, the absolute accuracy requirements in table 10.1A.14.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3I of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to annex B.2.4.2 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in table 10.1A.14.2.2-1.

Table 10.1A.14.2.2-1: CSI-RS based L1-RSRP relative accuracy for 1Rx RedCap UE in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS Ês/Iot Note 2	Io Note 1 range					
			NR operating band groups Note 4	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±6	±7	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-50
			NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-50
			NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-50
			NR_FDD_FR1_N	-114.5	-111.5	-108.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Void
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1A.15 L1-RSRP accuracy requirements for FR2

10.1A.15.1 SSB based L1-RSRP accuracy requirements

10.1A.15.1.1 Absolute Accuracy

The accuracy requirements in clause 10.1.20.1.1 shall apply.

10.1A.15.1.2 Relative Accuracy

The accuracy requirements in clause 10.1.20.1.1 shall apply.

10.1A.15.2 CSI-RS based L1-RSRP accuracy requirements

10.1A.15.2.1 Absolute Accuracy

The accuracy requirements in clause 10.1.20.1.1 shall apply.

10.1A.15.2.2 Relative Accuracy

The accuracy requirements in clause 10.1.20.1.1 shall apply.

10.1A.16RSTD Measurements for RedCap Positioning

10.1A.16.1 Introduction

The requirements in clause 10.1A.16 shall apply, provided the UE has received *nr-DL-TDOA-RequestLocationInformation* message from LMF via LPP TS 37.355 [34] requesting the UE to report one or more DL RSTD measurements defined in TS 38.215 [4].

The requirements in clause 10.1A.16 shall apply,

- When the RedCap UE is in RRC_CONNECTED state and the RSTD measurement is performed with and without RX FH within measurement gap.
- When RedCap UE is in RRC_CONNECTED state and the RSTD measurement is performed without RX FH outside of the measurement gap.
- When RedCap UE is in RRC_CONNECTED state and the RSTD measurement is performed without RX FH when both PPW and measurement gap is configured.
- When RedCap UE is in RRC_INACTIVE state and the RSTD measurement is performed with and without RX FH.
- When RedCap UE is in RRC_IDLE state and the RSTD measurement is performed with and without RX FH.

The requirements defined in clause 10.1A.16 are valid under the conditions defined in clause 10.1.23.

10.1A.16.2 Measurement Accuracy Requirements

The accuracy requirements for RSTD measurement shall be within $\pm(X+Y+Z+\Delta)$ T_c. The values of Y, Z and Δ and Rx TEG based requirement are as defined in clause 10.1.23.2. For Rx FH, PRS BW in tables 10.1.23.2-5, 10.1.23.2-5a, 10.1.23.2-6, and 10.1.23.2-6a refer to per hop BW. The requirements for fading channel in this clause are derived based on TDL-A (30 ns delay spread, 5Hz) and TDL-C (60 ns delay spread, 300 Hz) channel models for FR1 and FR2, respectively.

10.1A.16.2.1 Accuracy requirement for RSTD measurement without RX FH

For 4 sample RSTD measurement performed by 2Rx RedCap UE without RX FH, the values of X, corresponding to the PRS bandwidth supported by the RedCap UE for PRS measurement without RX FH, in tables 10.1.23.2-1 in FR1 for AWGN, 10.1.23.2-2 in FR2 for AWGN, 10.1.23.2-3 in FR1 for fading channel, and 10.1.23.2-4 in FR2 for fading channel apply.

For reduced sample RSTD measurement performed by 2Rx RedCap UE without RX FH, the values of X, corresponding to the PRS bandwidth supported by the RedCap UE for PRS measurement without RX FH, in tables 10.1.23.2-7 in FR1 for AWGN, and 10.1.23.2-8 in FR2 for AWGN apply.

The value of X for 4 sample RSTD measurement performed by 1Rx RedCap UE without RX FH is defined in table 10.1A.16.2.1-1 in FR1 for AWGN, and in table 10.1A.16.2.1-2 in FR1 for fading channel.

The value of X for reduced sample RSTD measurement performed by 1Rx RedCap UE without RX FH is defined in table 10.1A.16.2.1-3 in FR1 for AWGN.

Table 10.1A.16.2.1-1: RSTD absolute accuracy for 1Rx RedCap UE in FR1 for AWGN channel (without RX FH)

Accuracy	Conditions						
					Io Note 3 range		
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB			dBm/SCS	dBm/BW$_{Channel}$

137	(PRS Ês/Iot)$_{ref}$ ≥ -6dB (PRS Ês/Iot)$_i$ ≥ -13dB	15	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
79			≥ 52	≥ 1	Note 6	Note 6	Note 6
45			≥ 104	≥ 1	Note 6	Note 6	Note 6
81		30	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
46		30	≥ 48	≥ 1	Note 6	Note 6	Note 6
52		60	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.

NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\text{rep}}^{\text{PRS}}$, L_{PRS}, $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.

NOTE 3: Io is assumed to have constant EPRE across the bandwidth.

NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].

NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.

Table 10.1A.16.2.1-2: RSTD absolute accuracy for 1Rx RedCap UE in FR1 for fading channel (without RX FH)

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$) Note 2	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB			dBm/SCS	dBm/BW$_{Channel}$
191	(PRS Ês/Iot)$_{ref}$ ≥ -6dB (PRS Ês/Iot)$_{i}$ ≥ -10dB	15	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
146			≥ 52	≥ 1	Note 6	Note 6	Note 6
100			≥ 104	≥ 1	Note 6	Note 6	Note 6
129		30	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
110			≥ 48	≥ 1	Note 6	Note 6	Note 6
96		60	≥ 24	≥ 4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\mathrm{rep}}^{\mathrm{PRS}}$, L_{PRS}, $K_{\mathrm{comb}}^{\mathrm{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.

Table 10.1A.16.2.1-3: RSTD absolute accuracy for 1Rx RedCap UE in FR1 for AWGN channel with reduced number of samples (without RX FH)

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{\mathrm{rep}}^{\mathrm{PRS}} * L_{\mathrm{PRS}} / K_{\mathrm{comb}}^{\mathrm{PRS}}$) Note 2	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB			dBm/SCS	dBm/BW$_{\text{Channel}}$
109	(PRS Ês/Iot)$_{ref}$ ≥ -3dB	15	≥ 52	≥ 1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
60			≥ 104	≥ 1	Note 6	Note 6	Note 6
62	(PRS Ês/Iot)$_{i}$ ≥ -6dB	30	≥ 48	≥ 1	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Minimum number of PRS resource repetitions among the reference resource and the measured neighbour resource i. $T_{\mathrm{rep}}^{\mathrm{PRS}}$, L_{PRS}, $K_{\mathrm{comb}}^{\mathrm{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.

10.1A.16.2.2 Accuracy requirement for RSTD measurement with RX FH

The value of X for 4 sample RSTD measurement performed by 2Rx RedCap UE with RX FH is defined in tables 10.1A.16.2.2-1 in FR1 for AWGN, 10.1A.16.2.2-2 in FR2 for AWGN, 10.1A.16.2.2-3 in FR1 for fading channel, and 10.1.23.2-4 in FR2 for fading channel, respectively.

The value of X for reduced sample RSTD measurement performed by 2Rx RedCap UE with RX FH is defined in tables 10.1A.16.2.2-5 in FR1 for AWGN, and 10.1A.16.2.2-6 in FR2 for AWGN, respectively.

The value of for 4 sample RSTD measurement performed by 1Rx RedCap UE with RX FH is defined in tables 10.1A.16.2.2-7 in FR1 for AWGN, and 10.1A.16.2.2-8 in FR1 for fading channel, respectively.

The value of for reduced sample RSTD measurement performed by 1Rx RedCap UE with RX FH is defined in table 10.1A.16.2.2-9 in FR1 for AWGN.

Table 10.1A.16.2.2-1: RSTD absolute accuracy for 2Rx RedCap UE in FR1 for AWGN channel (with RX FH)

Accuracy	Conditions						
	PRS $\hat{E}s/Iot$	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	$dBm/BW_{Channel}$
50	(PRS $\hat{E}s/Iot)_{ref} \geq$ -6dB (PRS $\hat{E}s/Iot)_i \geq$ -13dB	15	≥ 52	268	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B	-126.5	-50
					NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
26		30	48	272	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B	-123.5	-50
					NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
27		60	24	132	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G,	-118	-50

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	dBm/$BW_{Channel}$
					NR_SDL_FR1_G		
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Void
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: Void
NOTE 7: Total PRS bandwidth after all hops regardless of the size of the overlapping bandwidth between hops.

Table 10.1A.16.2.2-2: RSTD absolute accuracy for 2Rx RedCap UE in FR2 for AWGN channel (with RX FH)

Accuracy	Conditions					
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 6	Io Note 3 range	
					Minimum Io	Maximum Io
Tc Note 4	dB	kHz	PRB	PRB	dBm/SCS	dBm/$BW_{Channel}$
15	(PRS Ês/Iot)$_{ref}$ ≥ -6dB	60	≥ 64	264	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
8	(PRS Ês/Iot)$_i$ ≥ -13dB	120	64	264	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Void
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: Void
NOTE 6: Total PRS bandwidth after all hops regardless of the size of the overlapping bandwidth between hops.

Table 10.1A.16.2.2-3: RSTD absolute accuracy for 2Rx RedCap UE in FR1 for fading channel (with RX FH)

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	dBm/$BW_{Channel}$
36	(PRS Ês/Iot)$_{ref}$ ≥ -6dB (PRS Ês/Iot)$_i$ ≥ -13dB	15	≥ 52	268	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B	-126.5	-50
					NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
22		30	48	272	NR_FDD_FR1_A, NR_TDD_FR1_A,	-124	-50

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	dBm/$BW_{Channel}$
					NR_SDL_FR1_A		
					NR_FDD_FR1_B	-123.5	-50
					NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
29		60	24	132	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Void
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: Void
NOTE 7: Total PRS bandwidth after all hops regardless of the size of the overlapping bandwidth between hops.

Table 10.1A.16.2.2-4: RSTD absolute accuracy for 2Rx RedCap UE in FR2 for fading channel (with RX FH)

Accuracy	Conditions					
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 6	Io Note 3 range	
					Minimum Io	Maximum Io
Tc Note 4	dB	kHz	PRB	PRB	dBm/SCS	dBm/$BW_{Channel}$
37	(PRS Ês/Iot)$_{ref}$ ≥ -6dB	60	≥ 64	264	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
37	(PRS Ês/Iot)$_{i}$ ≥ -13dB	120	64	264	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Void
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: Void
NOTE 6: Total PRS bandwidth after all hops regardless of the size of the overlapping bandwidth between hops.

Table 10.1A.16.2.2-5: RSTD absolute accuracy for 2Rx RedCap UE in FR1 for AWGN channel with reduced number of samples (with RX FH)

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	dBm/BW$_{Channel}$
33	(PRS Ês/Iot)$_{ref}$ ≥ -3dB (PRS Ês/Iot)$_i$ ≥ -6dB	15	≥ 52	268	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
18		30	48	272	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
21		60	24	132	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Void
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: Void
NOTE 7: Total PRS bandwidth after all hops regardless of the size of the overlapping bandwidth between hops.

Table 10.1A.16.2.2-6: RSTD absolute accuracy for 2Rx RedCap UE in FR2 for AWGN channel with reduced number of samples (with RX FH)

Accuracy	Conditions					
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	Total PRS bandwidth after all hops Note 6	Io Note 3 range	
					Minimum Io	Maximum Io
Tc Note 4	dB	kHz	PRB	PRB	dBm/SCS	$dBm/BW_{Channel}$
12	(PRS Ês/Iot)$_{ref}$ ≥ -3dB	60	≥ 64	264	Same value as PRS_RP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
6	(PRS Ês/Iot)$_i$ ≥ -6dB	120	64	264	Same value as PRS_RP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Void
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: Void
NOTE 6: Total PRS bandwidth after all hops regardless of the size of the overlapping bandwidth between hops.

Table 10.1A.16.2.2-7: RSTD absolute accuracy for 1Rx RedCap UE in FR1 for AWGN channel (with RX FH)

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	$dBm/BW_{Channel}$
58	(PRS	15	≥ 52	268	NR_FDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B	-126.5	-50
					NR_TDD_FR1_C	-126	-50
	(PRS				NR_FDD_FR1_D,	-125.5	-50

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	dBm/BW$_{Channel}$
					NR_FDD_FR1_E,	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G,	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
30		30	48	272	NR_FDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C,	-123	-50

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	dBm/BW$_{Channel}$
					NR_FDD_FR1_D,	-122.5	-50
					NR_FDD_FR1_E,	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
27		60	≥24	132	NR_FDD_FR1_A,	-121	-50

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	$dBm/BW_{Channel}$
					NR_SDL_FR1_A		
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C,	-120	-50
					NR_FDD_FR1_D,	-119.5	-50
					NR_FDD_FR1_E,	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G,	-118	-50

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	dBm/BW$_{Channel}$
					NR_SDL_FR1_G		
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Void
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: Void
NOTE 7: Total PRS bandwidth after all hops regardless of the size of the overlapping bandwidth between hops.

Table 10.1A.16.2.2-8: RSTD absolute accuracy for 1Rx RedCap UE in FR1 for fading channel (with RX FH)

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	dBm/BW$_{Channel}$
72		15	≥ 52	268	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B	-126.5	-50
					NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
59		30	48	272	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B	-123.5	-50
					NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	dBm/BW$_{Channel}$
					NR_FDD_FR1_G, NR_TDD_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
31		60	24	132	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Void
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: Void
NOTE 7: Total PRS bandwidth after all hops regardless of the size of the overlapping bandwidth between hops.

Table 10.1A.16.2.2-9: RSTD absolute accuracy for 1Rx RedCap UE in FR1 for AWGN channel with reduced number of samples (with RX FH)

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	dBm/BW Channel
42	(PRS Ês/Iot)$_{ref}$ ≥-3dB (PRS Ês/Iot)$_{i}$ ≥-6dB	15	≥ 52	268	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-50
					NR_FDD_FR1_F	-124.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-50
					NR_FDD_FR1_H	-123.5	-50
					NR_FDD_FR1_N	-120.5	-50
21		30	48	272	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth per hop Note 1	Total PRS bandwidth after all hops Note 7	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB	PRB		dBm/SCS	dBm/BW Channel
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-50
					NR_FDD_FR1_F	-121.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-50
					NR_FDD_FR1_H	-120.5	-50
					NR_FDD_FR1_N	-117.5	-50
24		60	24	132	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-50
					NR_FDD_FR1_F	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-50
					NR_FDD_FR1_H	-117.5	-50
					NR_FDD_FR1_N	-114.5	-50

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Void
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: Void
NOTE 7: Total PRS bandwidth after all hops regardless of the size of the overlapping bandwidth between hops.

10.1A.16.3 Report Mapping

10.1A.16.3.1 Absolute DL RSTD Measurement Reporting

Measurement reporting range and report mapping tables defined in clause 10.1.23.3.1 apply to DL RSTD measurement reporting for both 1Rx and 2Rx RedCap UEs and DL RSTD measurement performed with and without RX FH.

10.1A.16.3.2 Differential Reporting for DL RSTD Measurement

Measurement reporting range and report mapping tables defined in clause 10.1.23.3.2 apply to DL RSTD measurement reporting for both 1Rx and 2Rx RedCap UEs and DL RSTD measurement performed with and without RX FH.

10.1A.16.3.3 Additional Path Report Mapping for DL RSTD

Measurement reporting range and report mapping tables defined in clause 10.1.23.3.3 apply to DL RSTD measurement reporting for both 1Rx and 2Rx RedCap UEs and DL RSTD measurement performed with and without RX FH.

10.1A.17PRS-RSRP Measurements for RedCap positioning

10.1A.17.1 Introduction

The requirements in clause 10.1A.17 shall apply, provided the UE has received *nr-DL-TDOA-RequestLocationInformation* or *nr-Multi-RTT-RequestLocationInformation* or *nr-DL-AoD-RequestLocationInformation* message from LMF via LPP TS 37.355 [34] requesting the UE to report one or more DL PRS-RSRP measurements defined in TS 38.215 [4].

The requirements in clause 10.1A.17 shall apply,

- When the RedCap UE is in RRC_CONNECTED state and the PRS-RSRP measurement is performed with and without RX FH within measurement gap.
- When RedCap UE is in RRC_CONNECTED state and the PRS-RSRP measurement is performed without RX FH outside of the measurement gap.
- When RedCap UE is in RRC_CONNECTED state and the PRS-RSRP measurement is performed without RX FH when both PPW and measurement gap is configured.
- When RedCap UE is in RRC_INACTIVE state and the PRS-RSRP measurement is performed with and without RX FH.
- When RedCap UE is in RRC_IDLE state and the PRS-RSRP measurement is performed with and without RX FH.

The requirements defined in clause 10.1A.17 are valid under the conditions defined in clause 10.1.24.1.

10.1A.17.2 Measurement Accuracy Requirements

10.1A.17.2.1 Absolute PRS RSRP Accuracy Requirement

Accuracy requirement, corresponding to the PRS bandwidth supported by the RedCap UE for measurement without RX FH, defined in clause 10.1.24.2.1 apply to the PRS-RSRP measurement performed by 2Rx RedCap UE without RX FH.

Accuracy requirement in clause 10.1.24.2.1 apply to the PRS-RSRP measurement performed by 2Rx RedCap UE with RX FH, where the PRS bandwidth in clause 10.1.24.2.1 correspond to the PRS bandwidth measured by the RedCap UE per hop.

Accuracy requirement in table 10.1A.17.2.1-1 applies to the 4-sample PRS-RSRP measurement performed by 1Rx RedCap UE without RX FH.

Accuracy requirement in table 10.1A.17.2.1-2 applies to reduced sample PRS-RSRP measurement performed by 1Rx RedCap UE without RX FH

Accuracy requirement in table 10.1A.17.2.1-1 and table 10.1A.17.2.1-2 apply to the PRS-RSRP measurement performed by 1Rx RedCap UE with RX FH, where the PRS bandwidth in table 10.1A.17.2.1-1 and table 10.1A.17.2.1-2 correspond to the PRS bandwidth measured by the RedCap UE per hop.

Table 10.1A.17.2.1-1: PRS-RSRP absolute accuracy for 1Rx RedCap UE in FR1 (without RX FH)

Accuracy		Conditions							
					Io Note 5 range				
Normal condition	Extreme condition	PRS $\hat{E}s/Iot$	PRS BW Note 2	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	NR operating band groups Note 6	Minimum Io Note 1 dBm / SCS_{PRS}			Maximum Io
						dBm / SCS_{PRS}			$dBm/BW_{Channel}$
dB	dB	dB	PRB			dBm/15kHz Note 4	dBm/30kHz Note 4	dBm/60kHz Note 4	
±7	±11.5	≥-3dB	≥24	All	NR_FDD_FR1_A,	-127	-124	-121	-50

Accuracy		Conditions							
					Io Note 5 range				
Normal condition	Extreme condition	PRS Ês/Iot	PRS BW Note 2	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	NR operating band groups Note 6	Minimum Io Note 1 dBm / SCS_{PRS}			Maximum Io
						dBm / SCS_{PRS}			
dB	dB	dB	PRB			dBm/15kHz Note 4	dBm/30kHz Note 4	dBm/60kHz Note 4	dBm/$BW_{Channel}$
					NR_TDD_FR1_A, NR_SDL_FR1_A				
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-123.5	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-123	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119	-50
					NR_FDD_FR1_F	-124.5	-121.5	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	-118	-50
					NR_FDD_FR1_H	-123.5	-120.5	-117.5	-50
					NR_FDD_FR1_N	-120.5	-117.5	-114.5	-50
±7.5	±12	≥-10dB	24 ≤ BW ≤ 52	All	Note 3				
±6	±10.5		52< BW≤ 104	All	Note 3				
±5.5	±9.5		BW >104	All	Note 3				

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: PRS bandwidth is as indicated in *dl-PRS-ResourceBandwidth* in the DL-TDOA or DL-AoD or multi-RTT assistance data defined in TS 37.355 34].
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 PRB.
NOTE 4: The condition level is increased by Δ>0, when applicable, as described in Sections B.3.2 and B.3.3.
NOTE 5: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 6: NR operating band groups are as defined in Section 3.5.2.

Table 10.1A.17.2.1-2: PRS-RSRP absolute accuracy for 1Rx RedCap UE in FR1 with reduced sample number (without RX FH)

Accuracy		Conditions			
					Io Note 6 range

Normal condition	Extreme condition	PRS Ês/Iot	PRS BW Note 2	Repetition factor ($T_{rep}^{PRS} * L_{PRS}/K_{comb}^{PRS}$)	NR operating band groups Note 5	Minimum Io Note 1 dBm / SCS_{PRS}			Maximum Io
						dBm / SCS_{PRS}			
dB	dB	dB	PRB			dBm/15kHz Note 4	dBm/30kHz Note 4	dBm/60kHz Note 4	dBm/$BW_{Channel}$
±3.5	±8	≥0	≥48	All	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-123.5	-120.5	-50
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-123	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119	-50
					NR_FDD_FR1_F	-124.5	-121.5	-118.5	-50
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	-118	-50
					NR_FDD_FR1_H	-123.5	-120.5	-117.5	-50
					NR_FDD_FR1_N	-120.5	-117.5	-114.5	-50
±4	±8.5	≥-6	48 ≤ BW ≤ 52	All	Note 3				
±4	±8.5		52< BW≤ 104	All	Note 3				
±3.5	±8		BW >104	All	Note 3				

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: PRS bandwidth is as indicated in *dl-PRS-ResourceBandwidth* in the DL-TDOA or DL-AoD or multi-RTT assistance data defined in TS 37.355 [34].
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 48 PRB.
NOTE 4: The condition level is increased by Δ>0, when applicable, as described in Sections B.3.2 and B.3.3.
NOTE 5: NR operating band groups are as defined in Section 3.5.2.

10.1A.17.2.2 Relative PRS RSRP Accuracy Requirement

Relative accuracy requirement, corresponding to the PRS bandwidth supported by the RedCap UE for measurement without RX FH, defined in clause 10.1.24.2.2 apply to the PRS-RSRP measurement performed by 2Rx RedCap UE without RX FH.

Relative accuracy requirement in clause 10.1.24.2.2 apply to the PRS-RSRP measurement performed by 2Rx RedCap UE with RX FH, where the PRS bandwidth in clause 10.1.24.2.2 correspond to the PRS bandwidth measured by the RedCap UE per hop.

10.1A.17.3 Report Mapping

10.1A.17.3.1 Absolute PRS-RSRP Measurement Report Mapping

Measurement reporting range and report mapping tables defined in clause 10.1.24.3.1 apply to PRS-RSRP measurement reporting for both 1Rx and 2Rx RedCap UEs and PRS-RSRP measurement performed with and without RX FH.

10.1A.17.3.2 Differential Report Mapping for PRS-RSRP Measurement

Measurement reporting range and report mapping tables defined in clause 10.1.24.3.2 apply to PRS-RSRP measurement reporting for both 1Rx and 2Rx RedCap UEs and PRS-RSRP measurement performed with and without RX FH.

10.1A.18 UE Rx-Tx Time Difference Measurements for RedCap Positioning

10.1A.18.1 Introduction

The requirements in clause 10.1A.18 shall apply, provided the RedCap UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP TS 37.355 [34] requesting the UE to report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4]. The requirements in clause 10.1A.18 shall apply:

- When the RedCap UE is in RRC_CONNECTED state and the UE Rx-Tx time difference measurement is performed with and without RX FH within measurement gap.
- When RedCap UE is in RRC_CONNECTED state and the UE Rx-Tx time difference measurement is performed without RX FH outside of the measurement gap.
- When RedCap UE is in RRC_CONNECTED state and the UE Rx-Tx time difference measurement is performed without RX FH when both PPW and measurement gap is configured.
- When RedCap UE is in RRC_INACTIVE state and the UE Rx-Tx time difference measurement is performed with and without RX FH.

10.1A.18.2 Measurement Accuracy Requirements

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall not apply, if:

- N_{TA_offset} defined in table 7.1A.2-2 changes during the UE Rx-Tx measurement period or
- if the uplink transmission timing changes during the UE Rx-Tx measurement period due to the network-configured Timing Advance.

The UE Rx-Tx time difference measurement accuracy requirements in this clause shall apply provided that:

- The UE transmits SRS within the range from -160 ms to 160 ms of at least one DL PRS resource of each of the TRPs in the assistance data.

If the uplink transmission timing changes during the UE Rx-Tx measurement period due to the autonomous timing adjustment defined in clause 7.1A.2 then:

- UE Rx-Tx measurement accuracy requirements shall apply for a cell, which is also the downlink reference cell (defined in clause 7.1A.1) for SRS transmission even if the uplink transmission timing changes during the UE Rx-Tx measurement period due to autonomous adjustment.
- UE Rx-Tx measurement accuracy requirements shall not apply for a cell, which is not the downlink reference cell (defined in clause 7.1A.1) for SRS transmission, if the uplink transmission timing changes during the UE Rx-Tx measurement period due to autonomous adjustment.

When a serving cell change occurs during the UE Rx-Tx measurement period, the UE Rx-Tx time difference measurement accuracy requirements in this clause shall apply provided that the serving cell change does not impact SRS configuration for the UE Rx-Tx measurement.

The relative accuracy of UE Rx-Tx measurement in this clause is defined as accuracy of the difference between two UE Rx-Tx measurements.

10.1A.18.2.1 UE Rx-Tx Accuracy Requirement for 2RX RedCap UE without FH

For UE Rx-Tx time difference measurement performed by 2RX RedCap UE without RX FH, the accuracy requirements corresponding to the PRS bandwidth supported by the RedCap UE for PRS measurement without RX FH in clause 10.1.25.2 shall apply.

10.1A.18.2.2 UE Rx-Tx Accuracy Requirement for 1RX RedCap UE without FH

The accuracy requirements in table 10.1A.18.2.2-1 for FR1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- AWGN propagation condition.

Table 10.1A.18.2.2-1: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition $(T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
±89+δ	-3	≥24	15	≥4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	
					NR_FDD_FR1_F	-124.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	
					NR_FDD_FR1_H	-123.5	
					NR_FDD_FR1_N	-120.5	
±51+δ		≥52		≥1	NOTE 6	NOTE 6	NOTE 6
±25+δ		104		≥1	NOTE 6	NOTE 6	NOTE 6
±49+δ		≥24	30	≥4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	
					NR_FDD_FR1_F	-121.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	
					NR_FDD_FR1_H	-120.5	
					NR_FDD_FR1_N	-117.5	
±27+δ		48		≥1	NOTE 6	NOTE 6	NOTE 6
±27+δ		24	60	≥4	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	
					NR_FDD_FR1_F	-118.5	

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	
					NR_FDD_FR1_H	-117.5	
					NR_FDD_FR1_N	-114.5	
±98+δ	-13	≥24	15	≥4	NOTE 6	NOTE 6	NOTE 6
±61+δ		≥52		≥1	NOTE 6	NOTE 6	NOTE 6
±32+δ		104		≥1	NOTE 6	NOTE 6	NOTE 6
±55+δ		≥24	30	≥4	NOTE 6	NOTE 6	NOTE 6
±34+δ		48		≥1	NOTE 6	NOTE 6	NOTE 6
±31+δ		24	60	≥4	NOTE 6	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: T_{rep}^{PRS}, L_{PRS}, K_{comb}^{PRS} are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols* and *dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 7: δ is the margin determined from table 10.1A.18.2.2-3.

The accuracy requirements in table 10.1A.18.2.2-1a for FR1 for are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- Number of measurement samples is less than 4.
- AWGN propagation condition.

Table 10.1A.18.2.2-1a: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN with reduced measurement samplesAccuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
±65+δ	0	≥52	15	≥1	NOTE 6	NOTE 6	NOTE 6
±36+δ		104		≥1	NOTE 6	NOTE 6	NOTE 6
±35+δ		48	30	≥1	NOTE 6	NOTE 6	NOTE 6
±73+δ	-6	≥52	15	≥1	NOTE 6	NOTE 6	NOTE 6
±40+δ		104		≥1	NOTE 6	NOTE 6	NOTE 6
±39+δ		48	30	≥1	NOTE 6	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: $T_{\mathrm{rep}}^{\mathrm{PRS}}$, L_{PRS}, $K_{\mathrm{comb}}^{\mathrm{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols,* and *dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1A.18.2.2-1.
NOTE 7: δ is the margin determined from table 10.1A.18.2.2-3.

The relative accuracy requirements in table 10.1A.18.2.2-1b for FR1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- AWGN propagation condition.
- the two UE Rx-Tx time difference measurements are associated with the same RxTx TEG.

Table 10.1A.18.2.2-1b: UE Rx-Tx time difference relative measurement accuracy in FR1 in AWGN with TEG reporting

Accuracy	Conditions						
	PRS Ês/Iot	PRS SCS	PRS bandwidth Note 1	PRS resource repetition ($T_{\mathrm{rep}}^{\mathrm{PRS}} * L_{\mathrm{PRS}} / K_{\mathrm{comb}}^{\mathrm{PRS}}$) Note 2	Io Note 3 range		
					NR operating band groups Note 4	Minimum Io	Maximum Io
Tc Note 5	dB	kHz	PRB			dBm/SCS	dBm/$BW_{Channel}$
137 + Δ	(PRS Ês/Iot)$_j$ ≥ -6dB	15	≥ 24	≥ 4	Note 6	Note 6	Note 6
79 + Δ			≥ 52	≥ 1	Note 6	Note 6	Note 6
45 + Δ			104	≥ 1	Note 6	Note 6	Note 6
81 + Δ	(PRS Ês/Iot)$_i$ ≥ -13dB	30	≥ 24	≥ 4	Note 6	Note 6	Note 6
46 + Δ			48	≥ 1	Note 6	Note 6	Note 6
52 + Δ		60	24	≥ 4	Note 6	Note 6	Note 6

NOTE 1: Minimum PRS bandwidth, which is minimum of the PRS bandwidths of resource j and resource i.
NOTE 2: Minimum number of PRS resource repetitions among resource j and resource i. $T_{\mathrm{rep}}^{\mathrm{PRS}}$, L_{PRS}, $K_{\mathrm{comb}}^{\mathrm{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols,* and *dl-PRS-CombSizeN* defined in TS 37.355 [34], respectively.
NOTE 3: Io is assumed to have constant EPRE across the bandwidth.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1A.18.2.2-1.
NOTE 7: Δ is the value of the timing error margin for the RxTx TEG, reported via *nr-UE-RxTxTEG-TimingErrorMargin*. Δ cannot be larger than the sum of the margins in table 10.1A.18.2.2-3 (dependent on PRS/SRS BW) for any pair of individual UE Rx-Tx time difference measurements associated with the RxTx TEG.

The accuracy requirements in table 10.1A.18.2.2-2 for FR1 for are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- Fading propagation condition.

Table 10.1A.18.2.2-2: UE Rx-Tx time difference measurement accuracy in FR1 in fading

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	PRS SCS	PRS resource repetition ($T_{\text{rep}}^{\text{PRS}} * L_{\text{PRS}}/K_{\text{comb}}^{\text{PRS}}$ Note 3	NR operating band groups Note 2	Io Note 4 range	
						Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz			dBm / SCS_{PRS}	dBm/BW
±202+δ	-3	≥24	15	≥4	NOTE 6	NOTE 6	NOTE 6
±158+δ		≥52		≥1	NOTE 6	NOTE 6	NOTE 6
±114+δ		104		≥1	NOTE 6	NOTE 6	NOTE 6
±153+δ		≥24	30	≥4	NOTE 6	NOTE 6	NOTE 6
±120+δ		48		≥1	NOTE 6	NOTE 6	NOTE 6
±72+δ		24	60	≥4	NOTE 6	NOTE 6	NOTE 6
±179+δ	-10	≥24	15	≥4	NOTE 6	NOTE 6	NOTE 6
±169+δ		≥52		≥1	NOTE 6	NOTE 6	NOTE 6
±126+δ		104		≥1	NOTE 6	NOTE 6	NOTE 6
±152+δ		≥24	30	≥4	NOTE 6	NOTE 6	NOTE 6
±133+δ		48		≥1	NOTE 6	NOTE 6	NOTE 6
±72+δ		24	60	≥4	NOTE 6	NOTE 6	NOTE 6

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: $T_{\text{rep}}^{\text{PRS}}$, L_{PRS} , $K_{\text{comb}}^{\text{PRS}}$ are configured by higher layer parameter *dl-PRS-ResourceRepetitionFactor, dl-PRS-NumSymbols*, and *dl-PRS-CombSizeN* defined in TS 37.355 [34].
NOTE 4: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 5: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 6: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1A.18.2.2-1.
NOTE 7: δ is the margin determined from table 10.1A.18.2.2-3.

Table 10.1A.18.2.2-3: Margin for UE Rx-Tx time difference measurement accuracy in FR1

Min(PRS BW, SRS BW) (PRB)			Margin (Tc Note 1)
SCS = 15 kHz	SCS = 30 kHz	SCS = 60 kHz	
≥ 24	N/A	N/A	160
≥ 52	≥ 24	N/A	80
104	48	24	56

NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 2: If SRS and PRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies.

10.1A.18.2.3 UE Rx-Tx Accuracy Requirement for 2RX RedCap UE with FH

The accuracy requirements in table 10.1A.18.2.3-1 for FR1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- AWGN propagation condition.
- The BW_{total} as defined in clause 9.9A.4.8 for RRC_CONNECTED and in clause 5.6A.6.6 for RRC_INACTIVE is no less than the “Total PRS bandwidth after FH”.

Table 10.1A.18.2.3-1: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN

Accuracy	Conditions						
	PRS Ês/Iot	PRS bandwidth per hop	PRS SCS	Total PRS bandwidth after FH	NR operating band groups[Note 2]	Io[Note 3] range	
						Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB	kHz	PRB		dBm / SCS_{PRS}	dBm/BW
±23+δ	-3	≥52	15	268	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	
					NR_FDD_FR1_F	-124.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	
					NR_FDD_FR1_H	-123.5	
					NR_FDD_FR1_N	-120.5	
±17+δ		48	30	272	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	
					NR_FDD_FR1_F	-121.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	
					NR_FDD_FR1_H	-120.5	
					NR_FDD_FR1_N	-117.5	
±21+δ		24	60	132	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	
					NR_FDD_FR1_F	-118.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	
					NR_FDD_FR1_H	-117.5	
					NR_FDD_FR1_N	-114.5	
±54+δ	-13	≥52	15	268	NOTE 5	NOTE 5	NOTE 5
±38+δ		48	30	272	NOTE 5	NOTE 5	NOTE 5
±40+δ		24	60	132	NOTE 5	NOTE 5	NOTE 5

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.

Accuracy	Conditions						
	PRS Ês/Iot	PRS bandwidth per hop	PRS SCS	Total PRS bandwidth after FH	NR operating band groups[Note 2]	Io[Note 3] range	
						Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB	kHz	PRB		dBm / SCS_{PRS}	dBm/BW
NOTE 3: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.							
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].							
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.							
NOTE 6: δ is the margin determined from table 10.1A.18.2.3-5.							

The accuracy requirements in table 10.1A.18.2.3-1a for FR1 for are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- Number of measurement samples is less than 4.
- AWGN propagation condition.
- The BW_{total} as defined in clause 9.9A.4.8 for RRC_CONNECTED and in clause 5.6A.6.6 for RRC_INACTIVE is no less than the "Total PRS bandwidth after FH".

Table 10.1A.18.2.3-1a: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN with reduced measurement samples

Accuracy	Conditions						
	PRS Ês/Iot	PRS bandwidth per hop	PRS SCS	Total PRS bandwidth after FH	NR operating band groups[Note 2]	Io[Note 3] range	
						Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB	kHz	PRB		dBm / SCS_{PRS}	dBm/BW
±17+δ	0	≥52	15	268	NOTE 5	NOTE 5	NOTE 5
±11+δ		48	30	272	NOTE 5	NOTE 5	NOTE 5
±18+δ		24	60	132	NOTE 5	NOTE 5	NOTE 5
±32+δ	-6	≥52	15	268	NOTE 5	NOTE 5	NOTE 5
±20+δ		48	30	272	NOTE 5	NOTE 5	NOTE 5
±31+δ		24	60	132	NOTE 5	NOTE 5	NOTE 5
NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.							
NOTE 2: NR operating band groups are as defined in Section 3.5.							
NOTE 3: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.							
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].							
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1A.18.2.3-1.							
NOTE 6: δ is the margin determined from table 10.1A.18.2.3-5.							

The accuracy requirements in table 10.1A.18.2.3-2 for FR1 for are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- Fading propagation condition.
- The BW_{total} as defined in clause 9.9A.4.8 for RRC_CONNECTED and in clause 5.6A.6.6 for RRC_INACTIVE is no less than the "Total PRS bandwidth after FH".

Table 10.1A.18.2.3-2: UE Rx-Tx time difference measurement accuracy in FR1 in fading

Accuracy	Conditions						
	PRS Ês/Iot	PRS bandwidth per hop	PRS SCS	Total PRS bandwidth after FH	NR operating band groups[Note 2]	Io[Note 3] range	
						Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB	kHz	PRB		dBm / SCS_{PRS}	dBm/BW
±94+δ	-3	≥52	15	268	NOTE 5	NOTE 5	NOTE 5
±52+δ		48	30	272	NOTE 5	NOTE 5	NOTE 5
±52+δ		24	60	132	NOTE 5	NOTE 5	NOTE 5
±99+δ	-13	≥52	15	268	NOTE 5	NOTE 5	NOTE 5
±53+δ		48	30	272	NOTE 5	NOTE 5	NOTE 5
±63+δ		24	60	132	NOTE 5	NOTE 5	NOTE 5

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1A.18.2.3-1.
NOTE 6: δ is the margin determined from table 10.1A.18.2.3-5.

The accuracy requirements in table 10.1A.18.2.3-3 for FR2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- AWGN propagation condition.
- The BW_{total} as defined in clause 9.9A.4.8 for RRC_CONNECTED and in clause 5.6A.6.6 for RRC_INACTIVE is no less than the "Total PRS bandwidth after FH".

Table 10.1A.18.2.3-3: UE Rx-Tx time difference measurement accuracy in FR2 in AWGN

Accuracy	Conditions					
	PRS Ês/Iot	Minimum PRS bandwidth per hop	PRS SCS	Total PRS bandwidth after FH	Io[Note 4] range	
					Minimum Io[Note 1]	Maximum Io
Tc[Note 5]	dB	PRB	kHz	PRB	dBm / SCS_{PRS}	$dBm/BW_{Channel}$
±11+δ	-3	≥64	60	264	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
±7+δ		64	120	264	Same value as PRP in table B.2.14-2, according to UE Power class, operating band and angle of arrival	-50
±33+δ	-13	≥64	60	264	NOTE 5	NOTE 5
±27+δ		64	120	264	NOTE 5	NOTE 5

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 6: δ is the margin determined from table 10.1A.18.2.3-6.

The accuracy requirements in table 10.1A.18.2.3.3-3a for FR2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.

- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- Number of measurement samples is less than 4.
- AWGN propagation condition.
- The BW_{total} as defined in clause 9.9A.4.8 for RRC_CONNECTED and in clause 5.6A.6.6 for RRC_INACTIVE is no less than the "Total PRS bandwidth after FH".

Table 10.1A.18.2.3-3a: UE Rx-Tx time difference measurement accuracy in FR2 in AWGN with reduced measurement samples

Accuracy	Conditions					
	PRS Ês/Iot	Minimum PRS bandwidth per hop	PRS SCS	Total PRS bandwidth after FH	Io Note 4 range	
					Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz	PRB	dBm / SCS_{PRS}	dBm/$BW_{Channel}$
±11+δ	0	≥64	60	264	NOTE 5	NOTE 5
±5+δ		64	120	264	NOTE 5	NOTE 5
±17+δ	-6	≥64	60	264	NOTE 5	NOTE 5
±14+δ		64	120	264	NOTE 5	NOTE 5

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1A.18.2.3-3.
NOTE 6: δ is the margin determined from table 10.1A.18.2.3-6.

The accuracy requirements in table 10.1A.18.2.3-4 for FR2 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- Fading propagation condition.
- The BW_{total} as defined in clause 9.9A.4.8 for RRC_CONNECTED and in clause 5.6A.6.6 for RRC_INACTIVE is no less than the "Total PRS bandwidth after FH".

Table 10.1A.18.2.3-4: UE Rx-Tx time difference measurement accuracy in FR2 in fading

Accuracy	Conditions					
	PRS Ês/Iot	Minimum PRS bandwidth per hop	PRS SCS	Total PRS bandwidth after FH	Io Note 4 range	
					Minimum Io Note 1	Maximum Io
Tc Note 5	dB	PRB	kHz		dBm / SCS_{PRS}	dBm/$BW_{Channel}$
±27+δ	-3	≥64	60	264	NOTE 5	NOTE 5
±17+δ		64	120	264	NOTE 5	NOTE 5
±41+δ	-13	≥64	60	264	NOTE 5	NOTE 5
±38+δ		64	120	264	NOTE 5	NOTE 5

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].

NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1A.18.2.3-3.
NOTE 6: δ is the margin determined from table 10.1A.18.2.3-6.

Table 10.1A.18.2.3-5: Margin for UE Rx-Tx time difference measurement accuracy in FR1 with FH

Min(PRS BW, SRS BW) (PRB)			Margin (Tc [Note 1])
SCS = 15 kHz	SCS = 30 kHz	SCS = 60 kHz	
≥ 52	N/A	N/A	80
N/A	48	24	56
NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]. NOTE 2: If SRS and PRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies. NOTE 3: PRS BW and SRS BW refer to BW per hop.			

Table 10.1A.18.2.3-6: Margin for UE Rx-Tx time difference measurement accuracy in FR2 with FH

Min(PRS BW, SRS BW) (PRB)		Margin (Tc [Note 1])
SCS = 60 kHz	SCS = 120 kHz	
≥ 64	N/A	32
N/A	64	24
NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]. NOTE 2: If SRS and PRS have different SCS, the margin corresponding to the smallest RS BW in MHz applies. NOTE 3: PRS BW and SRS BW refer to BW per hop.		

10.1A.18.2.4 UE Rx-Tx Accuracy Requirement for 1RX RedCap UE with FH

The accuracy requirements in table 10.1A.18.2.4-1 for FR1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- AWGN propagation condition.

Table 10.1A.18.2.4-1: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN

Accuracy	Conditions						
	PRS Ês/Iot	PRS bandwidth per hop	PRS SCS	Total PRS bandwidth after FH	NR operating band groups[Note 2]	Io[Note 3] range	
						Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB	kHz	PRB		dBm / SCS_{PRS}	dBm/BW
±23+δ	-3	≥52	15	268	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-126	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	
					NR_FDD_FR1_F	-124.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	
					NR_FDD_FR1_H	-123.5	

Accuracy	Conditions						
	PRS Ês/Iot	PRS bandwidth per hop	PRS SCS	Total PRS bandwidth after FH	NR operating band groups[Note 2]	Io[Note 3] range	
						Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB	kHz	PRB		dBm / SCS_{PRS}	dBm/BW
					NR_FDD_FR1_N	-120.5	
±14+δ		48	30	272	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-123	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-122	
					NR_FDD_FR1_F	-121.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	
					NR_FDD_FR1_H	-120.5	
					NR_FDD_FR1_N	-117.5	
±22+δ		24	60	132	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-50
					NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	
					NR_FDD_FR1_C, NR_TDD_FR1_C	-120	
					NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	
					NR_FDD_FR1_E, NR_TDD_FR1_E	-119	
					NR_FDD_FR1_F	-118.5	
					NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	
					NR_FDD_FR1_H	-117.5	
					NR_FDD_FR1_N	-114.5	
±60+δ	-13	≥52	15	268	NOTE 5	NOTE 5	NOTE 5
±42+δ		48	30	272	NOTE 5	NOTE 5	NOTE 5
±45+δ		24	60	132	NOTE 5	NOTE 5	NOTE 5

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 6: δ is the margin determined from table 10.1A.18.2.3-5.

The accuracy requirements in table 10.1A.18.2.4-1a for FR1 for are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- Number of measurement samples is less than 4.
- AWGN propagation condition.

Table 10.1A.18.2.4-1a: UE Rx-Tx time difference measurement accuracy in FR1 in AWGN with reduced measurement samples

Accuracy	Conditions						
	PRS Ês/Iot	PRS bandwidth per hop	PRS SCS	Total PRS bandwidth after FH	NR operating band groups[Note 2]	Io[Note 3] range	
						Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB	kHz	PRB		dBm / SCS_{PRS}	dBm/BW
±16+δ	0	≥52	15	268	NOTE 5	NOTE 5	NOTE 5
±9+δ		48	30	272	NOTE 5	NOTE 5	NOTE 5
±10+δ		24	60	132	NOTE 5	NOTE 5	NOTE 5
±33+δ	-6	≥52	15	268	NOTE 5	NOTE 5	NOTE 5
±16+δ		48	30	272	NOTE 5	NOTE 5	NOTE 5
±21+δ		24	60	132	NOTE 5	NOTE 5	NOTE 5

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1A.18.2.4-1.
NOTE 6: δ is the margin determined from table 10.1A.18.2.3-5.

The accuracy requirements in table 10.1A.18.2.4-2 for FR1 for are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- $PRP|_{dBm}$ according to annex B.2.14 for a corresponding Band.
- Fading propagation condition.

Table 10.1A.18.2.4-2: UE Rx-Tx time difference measurement accuracy in FR1 in fading

Accuracy	Conditions						
	PRS Ês/Iot	PRS bandwidth per hop	PRS SCS	Total PRS bandwidth after FH	NR operating band groups[Note 2]	Io[Note 3] range	
						Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB	kHz	PRB		dBm / SCS_{PRS}	dBm/BW
±63+δ	-3	≥52	15	268	NOTE 5	NOTE 5	NOTE 5
±43+δ		48	30	272	NOTE 5	NOTE 5	NOTE 5
±40+δ		24	60	132	NOTE 5	NOTE 5	NOTE 5
±85+δ	-10	≥52	15	268	NOTE 5	NOTE 5	NOTE 5
±61+δ		48	30	272	NOTE 5	NOTE 5	NOTE 5
±55+δ		24	60	132	NOTE 5	NOTE 5	NOTE 5

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS as defined in table 10.1A.18.2.4-1.
NOTE 6: δ is the margin determined from table 10.1A.18.2.3-5.

10.1A.18.3 Report mapping

10.1A.18.3.1 Absolute UE Rx-Tx Measurement Report Mapping

The report mapping as defined in clause 10.1.25.3.1 shall apply.

10.1A.18.3.2 Differential UE Rx-Tx Measurement Report Mapping

The report mapping as defined in clause 10.1.25.3.2 shall apply.

10.1A.18.3.3 Additional Path Report Mapping for UE Rx-Tx Time Difference

The report mapping as defined in clause 10.1.25.3.3 shall apply.

10.1A.19PRS-RSRPP Measurements for RedCap Positioning

10.1A.19.1 Introduction

The requirements in clause 10.1A.19.2 shall apply, provided the RedCap UE has received *nr-DL-AoD-RequestLocationInformation* message from LMF via LPP 37.355 [34] requesting the RedCap UE to report one or more DL PRS-RSRPP measurements defined in TS 38.215 [4]. The requirements in clause 10.1A.19 shall apply:

- when RedCap UE is in RRC_CONNECTED state,
- when RedCap UE is in RRC_INACTIVE state,
- when RedCap UE is in RRC_IDLE state.

The requirements in clause 10.1A.19.2 apply for the first path PRS-RSRP measurement.

10.1A.19.2 Measurement Accuracy Requirements

10.1A.19.2.1 Absolute PRS RSRPP accuracy

The absolute accuracy requirements for PRS-RSRPP measurements for 1Rx RedCap UE for FR1 defined in table 10.1A.19.2.1-1 and table 10.1A.19.2.1-2 are valid under the following conditions:

- Conditions defined in TS 38.101-1 [18] clause 7.3 for reference sensitivity are fulfilled.
- PRP $1,2|_{\text{dBm}}$ according to annex B.2.14 for a corresponding Band.

The absolute accuracy requirements for PRS-RSRPP measurements defined in clause 10.1.38.2.1 are reused for 2Rx RedCap UE.

The absolute accuracy requirements for PRS-RSRPP measurement defined in table 10.1A.19.2.1-1 apply for the RedCap UE not supporting *supportedDL-PRS-ProcessingSamples* TS 37.355 [34] or LMF does not indicate RedCap UE to perform positioning measurements with reduced number of samples.

The absolute accuracy requirements for PRS-RSRPP measurement defined in table 10.1A.19.2.1-2 apply for the RedCap UE supporting *supportedDL-PRS-ProcessingSamples* TS 37.355 [34].

The absolute accuracy requirements for PRS-RSRPP measurement defined in this clause apply to the measurements with and without frequency hopping. For the measurements with frequency hopping, the accuracy requirements apply for the corresponding PRS bandwidth per hop.

NOTE 1: The requriements in this clause are derived based on two-tap channel defined in TS 38.101-4 [21] annex B.2.4 (a = 1, τ_d=0.45 μs and f_D=5 Hz).

NOTE 2: The requirements in this clause are derived based on the difference between the estimated PRS-RSRPP compared to the ideal PRS-RSRPP defined as

$$\text{RSRPP}_p \propto \left| \sum_k H_k \exp\left(j 2\pi D_p \frac{k}{N_{\text{IFFT}}} \right) \right|^2$$

Where:

H_k is the effective channel frequency response (over REs occupied by PRS) measured without receiver noise.

D_p is the exact delay of the p-th path in the channel model.

Table 10.1A.19.2.1-1: PRS-RSRPP absolute accuracy for 1Rx RedCap UE for FR1

Accuracy		Conditions							
					Io Note 6 range				
Normal condition	Extreme condition	PRS Ês/Iot	PRS BW	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	NR operating band groups Note 7	Minimum Io Note 1 dBm / SCS_{PRS}			Maximum Io
						dBm / SCS_{PRS}			dBm/$BW_{Channel}$
dB	dB	dB	PRB	-		dBm/15kHz Note 5	dBm/30kHz Note 5	dBm/60kHz Note 5	
±3.5	±8	≥-3	≥24	All	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	-121	-50
					NR_FDD_FR1_B	-126.5	-123.5	-120.5	-50
					NR_TDD_FR1_C	-126	-123	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119	-50
					NR_FDD_FR1_F	-124.5	-121.5	-118.5	-50
					NR_FDD_FR1_G	-124	-121	-118	-50
					NR_FDD_FR1_H	-123.5	-120.5	-117.5	-50
					NR_FDD_FR1_N	-120.5	-117.5	-114.5	-50
					Note 3				
					Note 3				
±4.5	±9	≥-10	24 ≤ BW ≤ 52	All	Note 3				
±4	±8.5		BW > 52	All	Note 3				

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: PRS bandwidth is as indicated in *prs-Bandwidth* in the DL-TDOA or DL-AoD assistance data defined in TS 37.355 [34].
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 PRB.
NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 5: The condition level is increased by Δ>0, when applicable, as described in Sections B.3.2 and B.3.3.
NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 7: NR operating band groups are as defined in Section 3.5.2.

Table 10.1A.19.2.1-2: PRS-RSRPP absolute accuracy for 1Rx RedCap UE for FR1 for reduced number of samples

Accuracy		Conditions							
					Io Note 6 range				
Normal condition	Extreme condition	PRS $\hat{E}s/Iot$	PRS BW	Repetition factor ($T_{rep}^{PRS} * L_{PRS} / K_{comb}^{PRS}$)	NR operating band groups Note 7	Minimum Io Note 1 dBm / SCS_{PRS}			Maximum Io
						dBm / SCS_{PRS}			dBm/$BW_{Channel}$
dB	dB	dB	PRB	-		dBm/15kHz Note 5	dBm/30kHz Note 5	dBm/60kHz Note 5	
±3.5	±8	≥0	≥48	All	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	-121	-50
					NR_FDD_FR1_B	-126.5	-123.5	-120.5	-50
					NR_TDD_FR1_C	-126	-123	-120	-50
					NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	-119.5	-50
					NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119	-50
					NR_FDD_FR1_F	-124.5	-121.5	-118.5	-50
					NR_FDD_FR1_G	-124	-121	-118	-50
					NR_FDD_FR1_H	-123.5	-120.5	-117.5	-50
					NR_FDD_FR1_N	-120.5	-117.5	-114.5	-50
					Note 3				
					Note 3				
±4	±8.5	≥-6	48 ≤ BW ≤ 52	All	Note 3				
±3.5	±7.5		BW >52	All	Note 3				

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: PRS bandwidth is as indicated in *prs-Bandwidth* in the DL-TDOA or DL-AoD assistance data defined in TS 37.355 [34].
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 48 PRB.
NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.
NOTE 5: The condition level is increased by Δ>0, when applicable, as described in Sections B.3.2 and B.3.3.
NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 7: NR operating band groups are as defined in Section 3.5.2.

10.1A.19.3 Report mapping

10.1A.19.3.1 Absolute PRS-RSRPP Measurement Report Mapping

The absolute PRS-RSRPP measurement report mapping defined in clause 10.1.38.3.1 applies.

10.1A.19.3.2 Differential Report Mapping for PRS-RSRPP Measurement

The differential report mapping for PRS-RSRPP measurement defined in clause 10.1.38.3.2 applies.

10.2 E-UTRAN measurements

10.2.1 Introduction

Accuracy requirements for measurements on E-UTRAN carrier frequencies are specified in clause 10.2 and apply for UE in SA or NR-DC or NE-DC operation mode, unless otherwise specified.

Unless otherwise specified, the requirements in clause 10.2 are applicable for a UE:

- in RRC_CONNECTED state
- performing measurements with appropriate measurement gaps according to clause 9.1.2.
- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 36.300 [24].

The accuracy requirements of E-UTRA measurements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

If the UE needs measurement gaps to perform the inter-RAT NR ─ E-UTRAN FDD and NR ─ E-UTRAN TDD measurements, the relevant measurement procedure and measurement gap patterns stated in clause 9.1.2 shall apply.

10.2.2 E-UTRAN RSRP measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RSRP in RRC_CONNECTED state is specified in clauses 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RSRP measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRP Accuracy Requirements in clause 9.1.3 of TS 36.133 [15].

The reporting range and mapping specified for RSRP measurements in clause 9.1.4 of TS 36.133 [15] shall apply.

10.2.3 E-UTRAN RSRQ measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RSRQ in RRC_CONNECTED state is specified in clauses 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RSRQ measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRQ Accuracy Requirements in clause 9.1.6 of TS 36.133 [15].

The requirements for E-UTRA RSRQ measurements accuracy in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRQ Accuracy Requirements in clause 9.1.6 of TS 36.133 [15].

The reporting range and mapping specified for RSRQ measurements in clause 9.1.7 of TS 36.133 [15] shall apply.

10.2.4 E-UTRAN RSTD measurements

The requirements in this clause are valid for UE supporting this capability.

The measurement period is specified in clauses 9.4.4.1 and 9.4.4.2 for inter-RAT NR ─ E-UTRAN FDD and inter-RAT NR ─ E-UTRAN TDD RSTD measurements, respectively.

The accuracy requirements and the corresponding side conditions shall be the same as the inter-frequency measurement accuracy requirements for RSTD measurements in RRC_CONNECTED in clauses 9.1.10.2 of TS 36.133 [15].

If the UE needs measurement gaps to perform the inter-RAT NR ─ E-UTRAN FDD and NR ─ E-UTRAN TDD RSTD measurements, the relevant measurement procedure and measurement gap patterns stated in clause 9.1.2 shall apply.

The reporting range and mapping for the inter-RAT NR ─ E-UTRAN FDD and NR ─ E-UTRAN TDD RSTD measurements is the same as specified for RSTD measurements in TS 36.133 [15, clauses 9.1.10.3 and 9.1.10.4].

10.2.5 E-UTRAN RS-SINR measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RS-SINR in RRC_CONNECTED state is specified in clauses 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RS-SINR measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RS-SINR Accuracy Requirements in clause 9.1.17.3 of TS 36.133 [15].

The reporting range and mapping for E-UTRA RS-SINR measurements shall be the same as specified for RS-SINR measurements in clause 9.1.17.1 of TS 36.133 [15].

10.2.6 E-UTRAN RSRP measurements for CA/DC Idle Mode Measurements

NOTE: This measurement is for CA/DC Idle Mode measurements between NR and E-UTRAN.

The requirements in this clause are applicable for a UE:

- in state RRC_IDLE or RRC_INACTIVE
- that is synchronised to the cell that is measured.

The requirements are for absolute E-UTRA RSRP accuracy.

The measurement period of E-UTRA RSRP in RRC_IDLE and RRC_INACTIVE states are specified in clause 4.4.2.

The accuracy requirements of E-UTRA RSRP measurements in RRC_IDLE and RRC_INACTIVE states and the corresponding side conditions shall be as the inter-frequency RSRP Accuracy Requirements in clause 9.1.3B.2 of TS 36.133 [15].

The reporting range and mapping specified for RSRP measurements in clause 9.1.4 of TS 36.133 [15] shall apply.

10.2.7 E-UTRAN RSRQ measurements for CA/DC Idle Mode Measurements

NOTE: This measurement is for CA/DC Idle Mode measurements between NR and E-UTRAN.

The requirements in this clause are applicable for a UE:

- in state RRC_IDLE or RRC_INACTIVE
- that is synchronised to the cell that is measured.

The requirements are for absolute E-UTRA RSRQ accuracy.

The measurement period of E-UTRA RSRQ in RRC_IDLE and RRC_INACTIVE states are specified in clause 4.4.2.

The accuracy requirements of E-UTRA RSRQ measurements in RRC_IDLE and RRC_INACTIVE states and the corresponding side conditions shall be as the inter-frequency RSRQ Accuracy Requirements in clause 9.1.6B.2 of TS 36.133 [15].

The reporting range and mapping specified for RSRQ measurements in clause 9.1.7 of TS 36.133 [15] shall apply.

10.2A E-UTRAN measurements for RedCap

10.2A.1 Introduction

Accuracy requirements for measurements on E-UTRAN carrier frequencies are specified in clause 10.2A and apply for RedCap UE in SA operation mode, unless otherwise specified.

Unless otherwise specified, the requirements in clause 10.2A are applicable for a UE:

- in RRC_CONNECTED state
- performing measurements with appropriate measurement gaps according to clause 9.1A.2.
- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 36.300 [24].

The accuracy requirements of E-UTRA measurements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

If the UE needs measurement gaps to perform the inter-RAT NR ─ E-UTRAN FDD and NR ─ E-UTRAN TDD measurements, the relevant measurement procedure and measurement gap patterns stated in clause 9.1A.2 shall apply.

10.2A.2 E-UTRAN RSRP measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RSRP in RRC_CONNECTED state is specified in clauses 9.4A.2 and 9.4A.3.

For 2Rx RedCap,

- The accuracy requirements of E-UTRA RSRP measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRP accuracy requirements for UE other than Cat.1bis in clause 9.1.3 of TS 36.133 [15].

For 1Rx RedCap,

- The accuracy requirements of E-UTRA RSRP measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRP accuracy requirements for UE Cat.1bis in clause 9.1.3 of TS 36.133 [15].

The reporting range and mapping specified for RSRP measurements in clause 9.1.4 of TS 36.133 [15] shall apply.

10.2A.3 E-UTRAN RSRQ measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RSRQ in RRC_CONNECTED state is specified in clauses 9.4A.2 and 9.4A.3.

For 2Rx RedCap,

- The accuracy requirements of E-UTRA RSRQ measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRQ accuracy requirements for UE other than Cat.1bis in clause 9.1.6 of TS 36.133 [15].

For 1Rx RedCap,

- The accuracy requirements of E-UTRA RSRQ measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRQ accuracy requirements for UE Cat.1bis in clause 9.1.6 of TS 36.133 [15].

The requirements for accuracy of E-UTRA RSRQ measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRQ Accuracy Requirements in clause 9.1.6 of TS 36.133 [15].

The reporting range and mapping specified for RSRQ measurements in clause 9.1.7 of TS 36.133 [15] shall apply.

10.2A.4 E-UTRAN RS-SINR measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RS-SINR in RRC_CONNECTED state is specified in clauses 9.4A.2 and 9.4A.3.

For 2Rx RedCap,

- The accuracy requirements of E-UTRA RS-SINR measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RS-SINR accuracy requirements in clause 9.1.17.3 of TS 36.133 [15].

The reporting range and mapping for E-UTRA RS-SINR measurements shall be the same as specified for RS-SINR measurements in clause 9.1.17.1 of TS 36.133 [15].

10.3 UTRAN FDD Measurements

The requirements in this clause are applicable for a UE:

- in state RRC_CONNECTED
- performing measurements according to clause 9.4.6 with appropriate measurement gaps
- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 25.302 [30].

The accuracy requirements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

10.3.1 UTRAN FDD CPICH RSCP

NOTE: This measurement is for handover between E-UTRAN and UTRAN FDD.

The requirements in this clause are valid for terminals supporting this capability.

The measurement period for RRC_CONNECTED state is specified in clause 9.4.6.

In RRC_CONNECTED state the accuracy requirements shall meet the absolute accuracy requirements in table 10.3.1-1, under the following conditions:

- CPICH Ec/Io condition for a detectable cell is as specified in clause 9.4.6;
- SCH_Ec/Io condition for a detectable cell is as specified in clause 9.4.6.

Table 10.3.1-1: UTRAN FDD CPICH_RSCP absolute accuracy

Accuracy		Conditions
Normal condition	Extreme condition	Io range

		UTRA operating bands	Minimum Io	Maximum Io
dB	**dB**		**dBm/3.84 MHz**	**dBm/3.84 MHz**
±6	±9	Band I, IV, VI, X XI, XIX and XXI	-94	-70
		Band IX	-93	-70
		Band II, V and VII	-92	-70
		Band III, VIII, XII, XIII, XIV , XX and XXII	-91	-70
		Band XXV, XXVI Note 1	-90.5	-70
±8	±11	Note 2	-70	-50
NOTE 1: For Band XXVI, the condition has the minimum Io of -92 dBm/3.84 MHz when the carrier frequency of the assigned UTRA channel is within 869-894 MHz for the UE which supports both Band V and Band XXVI operating frequencies.				
NOTE 2: The same bands apply for this requirement as for the corresponding highest accuracy requirement.				

If the UE, in RRC_CONNECTED state, needs measurement gaps to perform UTRAN FDD measurements, the relevant UTRAN FDD measurement procedure and measurement gap pattern stated in clause 9.4.6 shall apply.

The reporting range and mapping specified for FDD CPICH RSCP in TS 25.133 [29] shall apply.

10.3.2 UTRAN FDD CPICH Ec/No

NOTE: This measurement is for handover between E-UTRAN and UTRAN FDD.

The requirements in this clause are valid for terminals supporting this capability.

The measurement period for RRC_CONNECTED state is specified in clause 9.4.6.

In RRC_CONNECTED state the accuracy requirements shall be the same as the inter-frequency measurement accuracy requirements for FDD CPICH Ec/No in TS 25.133 [29].

If the UE, in RRC_CONNECTED state, needs measurement gaps to perform UTRAN FDD measurements, the UTRAN FDD measurement procedure and measurement gap pattern stated in clause 9.4.6 shall apply.

The reporting range and mapping specified for FDD CPICH Ec/No in TS 25.133 [29] shall apply.

10.4 V2X measurements

10.4.1 Introduction

The requirements in this clause are applicable for a UE capable of V2X sidelink communication.

The accuracy requirements in this clause are:

- applicable for AWGN radio propagation conditions,
- assume independent interference (noise) at each receiver antenna port.

10.4.2 Intra-frequency PSBCH-RSRP accuracy requirements for FR1

10.4.2.1 PSBCH-RSRP Absolute Accuracy

The requirements for absolute PSBCH-RSRP accuracy in this clause apply to a V2X synchronization source on the same frequency as that of the own V2X UE performing the measurement in FR1.

The accuracy requirements in table 10.4.2.1-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.
- Conditions defined in clause 7.3E of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for PSBCH-RSRP measurements are fulfilled according to annex B.4.2 for a corresponding Band for each relevant PSBCH-DMRS.

Table 10.4.2.1-1: Intra-frequency PSBCH-RSRP absolute accuracy in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	Ês/Iot Note 3	Io Note 1 range					
			NR V2X operating band groups Note 2	Minimum Io				Maximum Io
				dBm / SCS_{SL}				
dB	dB	dB		SCS_{SL} = 15 kHz	SCS_{SL} = 30 kHz	SCS_{SL} = 60 kHz	$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
±4.5	±9	≥-6	NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-70
			NR_TDD_FR1_J	-116.5	-113.5	-110.5	N/A	-70
±8	±11	≥-6	NR_TDD_FR1_B, NR_TDD_FR1_J	N/A	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR V2X operating band groups in FR1 are as defined in clause 3.5.2. NOTE 3: Ês/Iot for a SyncRef UE is the Ês/Iot of PSBCH-DMRS.								

10.4.2.2 PSBCH-RSRP Relative Accuracy

The relative PSBCH-RSRP accuracy is defined as the PSBCH-RSRP measured from one V2X synchronization source compared to the PSBCH-RSRP measured from another V2X synchronization source on the same frequency in FR1.

The accuracy requirements in table 10.4.2.2-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.
- Conditions defined in clause 7.3E of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for PSBCH-RSRP accuracy measurements are fulfilled according to annex B.4.2 for a corresponding Band for each relevant PSBCH-DMRS.

Table 10.4.2.2-1: Intra-frequency PSBCH-RSRP relative accuracy in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	Ês/Iot Note 3	Io Note 1 range					
			NR V2X operating band groups Note 2	Minimum Io				Maximum Io
				dBm / SCS_{SL}				
dB	dB	dB		SCS_{SL} = 15 kHz	SCS_{SL} = 30 kHz	SCS_{SL} = 60 kHz	$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
±2	±3	≥-3	NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-50
			NR_TDD_FR1_J	-116.5	-113.5	-110.5	N/A	-50
±3	±3	≥-6	Note 4	Note 4	Note 4	Note 4	N/A	Note 4
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR V2X operating band groups in FR1 are as defined in clause 3.5.2. NOTE 3: Ês/Iot for a SyncRef UE is the Ês/Iot of PSBCH-DMRS. NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.								

10.4.2A Intra-frequency PSBCH-RSRP accuracy requirements for FR1 under CCA

10.4.2A.1 PSBCH-RSRP Absolute Accuracy

The requirements for absolute PSBCH-RSRP accuracy in this clause apply to a sidelink synchronization source on the same frequency as that of the own sidelink UE performing the measurement in FR1 under CCA.

The accuracy requirements in table 10.4.2A.1-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.
- Conditions defined in clause 7.3E of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for PSBCH-RSRP measurements are fulfilled according to annex B.4.2 for a corresponding Band for each relevant PSBCH-DMRS.

Table 10.4.2A.1-1: Intra-frequency PSBCH-RSRP absolute accuracy in FR1

Accuracy		Conditions					
			Io Note 1 range				
Normal condition	Extreme condition	Ês/Iot Note 3	NR sidelink operating band groups Note 2	Minimum Io			Maximum Io
				dBm / SCS_{SL}			
dB	dB	dB		SCS_{SL} = 15 kHz	SCS_{SL} = 30 kHz	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
±4.5	±9	≥-6	NR_CCA_FR1_I	-117	-114	N/A	-70
			NR_CCA_FR1_J	-116.5	-113.5	N/A	-70
±8	±11	≥-6	NR_CCA_FR1_I, NR_CCA_FR1_J	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR sidelink operating band groups in FR1 are as defined in clause 3.5.2. NOTE 3: Ês/Iot for a SyncRef UE is the Ês/Iot of PSBCH-DMRS.							

10.4.2A.2 PSBCH-RSRP Relative Accuracy

The relative PSBCH-RSRP accuracy is defined as the PSBCH-RSRP measured from one sidelink synchronization source compared to the PSBCH-RSRP measured from another sidelink synchronization source on the same frequency in FR1 under CCA.

The accuracy requirements in table 10.4.2A.2-1 are valid under the following conditions:

- Demodulation reference signals are transmitted from one port.
- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for PSBCH-RSRP accuracy measurements are fulfilled according to annex B.4.2 for a corresponding Band for each relevant PSBCH-DMRS.
- The same number of S-SSB repetitions on frequency domain is configured between two sidelink synchronization sources.

Table 10.4.2A.2-1: Intra-frequency PSBCH-RSRP relative accuracy in FR1

Accuracy		Conditions					
			Io Note 1 range				
Normal condition	Extreme condition	Ês/Iot Note 3	NR sidelink operating band groups Note 2	Minimum Io			Maximum Io
				dBm / SCS_{SL}			
dB	dB	dB		SCS_{SL} = 15 kHz	SCS_{SL} = 30 kHz	dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
±2	±3	≥-3	NR_CCA_FR1_I	-117	-114	N/A	-50
			NR_CCA_FR1_J	-116.5	-113.5	N/A	-50
±3	±3	≥-6	Note 4	Note 4	Note 4	N/A	Note 4
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR sidelink operating band groups in FR1 are as defined in clause 3.5.2. NOTE 3: Ês/Iot for a SyncRef UE is the Ês/Iot of PSBCH-DMRS. NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.							

10.4.3 Intra-Frequency SL-RSSI Measurement Accuracy Requirements for FR1

10.4.3.1 Absolute SL-RSSI Accuracy

The intra-frequency SL-RSSI requirements are specified in table 10.4.3.1-1. The requirements apply for measurement period of 1 slot and for any configured measurement bandwidth larger than 10 PRBs, provided that:

- All symbols duing each RSSI measurement duration are available for RSSI sampling within the same measurement interval.

Table 10.4.3.1-1: Intra-frequency SL-RSSI absolute accuracy

Accuracy		Conditions				
		Io [Note 1] range				
Normal condition	Extreme condition	NR V2X operating band groups [Note 2]	Minimum Io			Maximum Io
			dBm/SCS_{SL}			
dB	dB		SCS_{SL} = 15 kHz	SCS_{SL} = 30 kHz	SCS_{SL} = 60 kHz	$dBm/BW_{Channel}$
±2.5	±5.5	NR_TDD_FR1_B	-120.5	-117.5	-114.5	-50
		NR_TDD_FR1_J	-116.5	-113.5	-110.5	-50
±4.5	±7.5	Note 3	Note 3	Note 3	Note 3	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR V2X operating band groups are as defined in clause 3.5 for the corresponding NR operating bands.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.

10.4.3A Intra-Frequency SL-RSSI Measurement Accuracy Requirements for FR1 under CCA

10.4.3A.1 Absolute SL-RSSI Accuracy

The intra-frequency SL-RSSI requirements are specified in table 10.4.3A.1-1 under CCA. The requirements apply for measurement period of 1 slot and for any configured measurement bandwidth larger than 10 PRBs, provided that:

- All symbols during each RSSI measurement duration according to indication of first or second starting symbol within a slot are available for RSSI sampling within the same measurement interval.

Table 10.4.3A.1-1: Intra-frequency SL-RSSI absolute accuracy

Accuracy		Conditions			
		Io [Note 1] range			
Normal condition	Extreme condition	NR sidelink operating band groups [Note 2]	Minimum Io		Maximum Io
			dBm/SCS_{SL}		
dB	dB		SCS_{SL} = 15 kHz	SCS_{SL} = 30 kHz	$dBm/BW_{Channel}$
±2.5	±5.5	NR_CCA_FR1_I	-117	-114	-50
		NR_CCA_FR1_J	-116.5	-113.5	-50
±4.5	±7.5	Note 3	Note 3	Note 3	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: NR sidelink operating band groups are as defined in clause 3.5 for the corresponding NR operating bands.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.

10.4.4 Intra-Frequency L1 SL-RSRP Measurement Accuracy Requirements for FR1

10.4.4.1 Absolute L1 SL-RSRP Accuracy

The requirements for absolute L1 SL-RSRP accuracy in this clause apply to a UE performing PSCCH-RSRP and/or PSSCH-RSRP measurements on the same frequency as used by operating V2X sidelink communication.

The accuracy requirements in table 10.4.4.1-1 are valid under the following conditions:

- Demodulation reference signals for PSCCH and/or PSSCH are transmitted from one port.
- Conditions defined in clause 7.3E of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- PSCCH-RSRP|dBm and/or PSSCH-RSRP|dBm according to annex B.4.4 for a corresponding Band are fulfilled.

Table 10.4.4.1-1: Intra-frequency L1 SL-RSRP absolute accuracy for UE capable of V2X sidelink communication

Accuracy		Conditions						
			Io Note 1 range					
Normal condition	Extreme condition	Ês/Iot Note 3	NR V2X operating band groups Note 2	Minimum Io				Maximum Io
				dBm/SCS			dBm/BW$_{Channel}$	dBm/BW$_{Channel}$
dB	dB	dB		SCS = 15 kHz	SCS = 30 kHz	SCS = 60 kHz		
± 4.5	± 9	≥0 dB	NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-70
			NR_TDD_FR1_J	-116.5	-113.5	-110.5	N/A	-70
± 8	± 11	≥0 dB	NR_TDD_FR1_B NR_TDD_FR1_J	N/A	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR V2X operating band groups are as defined in clause 3.5 for the corresponding NR operating bands. NOTE 3: The parameter Ês/Iot is the Ês/Iot of PSCCH-DMRS and/or PSSCH-DMRS.								

10.4.4A Intra-Frequency L1 SL-RSRP Measurement Accuracy Requirements for FR1 under CCA

10.4.4A.1 Absolute L1 SL-RSRP Accuracy

The requirements for absolute L1 SL-RSRP accuracy in this clause apply to a UE performing PSCCH-RSRP and/or PSSCH-RSRP measurements on the same frequency as used by operating sidelink communication under CCA.

The accuracy requirements in table 10.4.4A.1-1 are valid under the following conditions:

- Demodulation reference signals for PSCCH and/or PSSCH are transmitted from one port.
- Conditions defined in clause 7.3F of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- PSCCH-RSRP|dBm and/or PSSCH-RSRP|dBm according to annex B.4.4 for a corresponding Band are fulfilled.

Table 10.4.4A.1-1: Intra-frequency L1 SL-RSRP absolute accuracy for UE capable of sidelink communication

Accuracy		Conditions					
			Io Note 1 range				
Normal condition	Extreme condition	Ês/Iot Note 3	NR sidelink operating band groups Note 2	Minimum Io			Maximum Io
				dBm/SCS		dBm/BW$_{Channel}$	dBm/BW$_{Channel}$
dB	dB	dB		SCS = 15 kHz	SCS = 30 kHz		

± 4.5	± 9	≥0 dB	NR_CCA_FR1_I	-117	-114	N/A	-70
			NR_CCA_FR1_J	-116.5	-113.5	N/A	-70
± 8	± 11	≥0 dB	NR_CCA_FR1_I NR_CCA_FR1_J	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR sidelink operating band groups are as defined in clause 3.5 for the corresponding NR operating bands. NOTE 3: The parameter Ês/Iot is the Ês/Iot of PSCCH-DMRS and/or PSSCH-DMRS.							

10.4.5 Intra-Frequency Discovery Signal Measurement Accuracy Requirements

The requirements in this clause are applicable for a remote sidelink UE in U2N relay scenario provided that the remote UE:

- is out of coverage on the frequency used for sidelink, and
- that is synchronised to the sidelink relay UE that is measured.

The requirements in this clause are applicable for a remote sidelink UE in multipath relay scenario provided that the remote UE:

- is synchronised to the sidelink relay UE that is measured and
- is in coverage on the frequency used for sidelink if both the direct path and the sidelink on the indirect path are on the same frequency
- is out of coverage on the frequency used for sidelink if the direct path and the sidelink on the indirect path are on different frequencies.

10.4.5.1 Absolute Discovery Signal Measurement Accuracy

The accuracy requirements for absolute discovery signal measurement in this clause apply to a sidelink UE performing SL-RSRP measurements for direct to indirect path switch or SL-RSRP measurements for indirect to direct path switch on the same frequency as used by the sidelink relay UE transmitting the relay Discovery message.

The accuracy requirements in table 10.4.5.1-1 are valid under the following conditions:

- Demodulation reference signals for PSCCH and/or PSSCH are transmitted from one port.
- Conditions defined in clause 7.3E of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- PSCCH-RSRP|dBm and/or PSSCH-RSRP|dBm according to annex B.4.4 for a corresponding Band are fulfilled.

Table 10.4.5.1-1: Intra-frequency discovery signal measurement absolute accuracy for a remote sidelink UE [2] capable of sidelink Communication and sidelink Discovery and configured by upper layers for relay operation.

Accuracy		**Conditions**						
Normal condition	**Extreme condition**	**Ês/Iot** Note 3	**Io** Note 1 **range**					
			NR V2X operating band groups Note 2	**Minimum Io**				**Maximum Io**
				dBm/SCS				
dB	**dB**	**dB**		**SCS = 15 kHz**	**SCS = 30 kHz**	**SCS = 60 kHz**	**dBm/BW$_{Channel}$**	**dBm/BW$_{Channel}$**
± 4.5	± 9	≥0 dB	NR_TDD_FR1_B	-120.5	-117.5	-114.5	N/A	-70
			NR_TDD_FR1_J	-116.5	-113.5	-110.5	N/A	-70
± 8	± 11	≥0 dB	NR_TDD_FR1_B NR_TDD_FR1_J	N/A	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR sidelink operating band groups are as defined in clause 3.5 for the corresponding NR operating bands. NOTE 3: The parameter Ês/Iot is the Ês/Iot of PSCCH-DMRS and/or PSSCH-DMRS.								

10.4A NR Sidelink Measurements for Positioning

10.4A.1 Introduction

The SL measurements for positioning are performed based on SL-PRS. The SL-PRS reception procedure is as described in TS 38.321 [7]. The UE shall monitor PSCCH to receive the associated SL-PRS in the same slot TS 38.214 [26].

10.4A.2 SL RSTD measurements

10.4A.2.1 Measurement Report Mapping

10.4A.2.1.1 Absolute SL RSTD Measurement Reporting

The reporting range for the SL RSTD measurement is defined from $-985024 \times T_c$ to $985024 \times T_c$ with the resolution step of $2^k \times T_c$, where

T_c is defined in TS 38.211 [6],

$k_{min} \leq k \leq k_{max}$,

k_{min}=2 and k_{max}=5, when configured SL-PRS resources of both of the reference UE and the second anchor UE measured for the SL RSTD measurement are in FR1.

The measurement report mapping for different k values are specified in tables 10.4A.2.1.1-1 – 10.4A.2.1.1-4.

Table 10.4A.2.1.1-1: Report mapping for *k*=2

Reported Quantity Value, SL_RSTD_i	Measured Quantity Value, SL_RSTD	Unit
SL_RSTD_000000	SL_RSTD < -985024	T_c
SL_RSTD_000001	-985024 ≤ SL_RSTD < -985020	T_c
SL_RSTD_000002	-985020 ≤ SL_RSTD < -985016	T_c
…	…	…
SL_RSTD_246256	-4 ≤ SL_RSTD < 0	T_c
SL_RSTD_246257	0 ≤ SL_RSTD < 4	T_c
…	…	…
SL_RSTD_492511	985016 ≤ SL_RSTD < 985020	T_c
SL_RSTD_492512	985020 ≤ SL_RSTD < 985024	T_c
SL_RSTD_492513	985024 ≤ SL_RSTD	T_c

Table 10.4A.2.1.1-2: Report mapping for *k*=3

Reported Quantity Value SL_RSTD_i	Measured Quantity Value, SL_RSTD	Unit
SL_RSTD_000000	SL_RSTD < -985024	T_c
SL_RSTD_000001	-985024 ≤ SL_RSTD < -985016	T_c
SL_RSTD_000002	-985016 ≤ SL_RSTD < -985008	T_c
…	…	…
SL_RSTD_123128	-8 ≤ SL_RSTD < 0	T_c
SL_RSTD_123129	0 ≤ SL_RSTD < 8	T_c
…	…	…
SL_RSTD_246255	985008 ≤ SL_RSTD < 985016	T_c
SL_RSTD_246256	985016 ≤ SL_RSTD < 985024	T_c
SL_RSTD_246257	985024 ≤ SL_RSTD	T_c

Table 10.4A.2.1.1-3: Report mapping for *k*=4

Reported Quantity Value,	Measured Quantity Value,	Unit

SL_RSTD_i	SL_RSTD	
SL_RSTD_000000	SL_RSTD < -985024	T_c
SL_RSTD_000001	-985024 ≤ SL_RSTD < -985008	T_c
SL_RSTD_000002	-985008 ≤ SL_RSTD < -984992	T_c
…	…	…
SL_RSTD_061564	-16 ≤ SL_RSTD < 0	T_c
SL_RSTD_061565	0 ≤ SL_RSTD < 16	T_c
…	…	…
SL_RSTD_123127	984992 ≤ SL_RSTD < 985008	T_c
SL_RSTD_123128	985008 ≤ SL_RSTD < 985024	T_c
SL_RSTD_123129	985024 ≤ SL_RSTD	T_c

Table 10.4A.2.1.1-4: Report mapping for *k*=5

Reported Quantity Value, SL_RSTD_i	Measured Quantity Value, SL_RSTD	Unit
SL_RSTD_00000	SL_RSTD < -985024	T_c
SL_RSTD_00001	-985024 ≤ SL_RSTD < -984992	T_c
SL_RSTD_00002	-984992 ≤ SL_RSTD < -984960	T_c
…	…	…
SL_RSTD_30782	-32 ≤ SL_RSTD < 0	T_c
SL_RSTD_30783	0 ≤ SL_RSTD < 32	T_c
…	…	…
SL_RSTD_61563	984960 ≤ SL_RSTD < 984992	T_c
SL_RSTD_61564	984992 ≤ SL_RSTD < 985024	T_c
SL_RSTD_61565	985024 ≤ SL_RSTD	T_c

10.4A.2.2 Measurement Accuracy Requirements

The accuracy requirements for SL RSTD measurement shall be within ±(X+Y+Z) T_c, where X, Y, and Z are defined as follows.

X is defined in table 10.4A.2.2-1 for AWGN propagation condition and table 10.4A.2.2-2 for fading propagation condition in FR1, provided that the following conditions are met:

- Conditions defined in clause 7.3E of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for SL RSTD measurements are fulfilled according to annex B.4A.1 for a corresponding Band for each relevant SL-PRS resource configured for measurement.
- Y=32 Tc, provided that the time offset between the two SL-PRS resource instances from the reference UE and the second anchor UE, which are used for a single SL RSTD estimate, is no greater than 160 ms.
- Z is defined in table 10.4A.2.2-3 for FR1.

NOTE: The requriements for fading channel in this clause are derived based on TDL-A (30 ns delay spread, 5Hz) channel models for FR1.

Table 10.4A.2.2-1: SL RSTD absolute accuracy in FR1 for AWGN channel

Accuracy	Conditions						
	SL-PRS $\hat{E}_s/I_{ot}$	SL-PRS SCS	SL-PRS bandwidth Note 1	Number of samples, S	Io Note 2 range		
					NR operating band groups Note 3	Minimum Io	Maximum Io
Tc Note 4	dB	kHz	PRB			dBm/SCS	$dBm/BW_{Channel}$
±66	$(\hat{E}_s/I_{ot})_{ref}$ ≥ 0 dB	15	48	≥ 4	NR_TDD_FR1_B	-123.5	-50
					NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_G	-121	-50
					NR_TDD_FR1_J	-119.5	-50
±69			>48	≥ 1	Note 5	Note 5	Note 5

Accuracy	Conditions						
	SL-PRS Ês/Iot	SL-PRS SCS	SL-PRS bandwidth Note 1	Number of samples, S	Io Note 2 range		
					NR operating band groups Note 3	Minimum Io	Maximum Io
Tc Note 4	dB	kHz	PRB			dBm/SCS	dBm/BW$_{Channel}$
±40	(SL-PRS Ês/Iot)$_i$ ≥ -3 dB		≥ 96	≥ 1	Note 5	Note 5	Note 5
±73		30	≥ 24	≥ 4	NR_TDD_FR1_B	-120.5	-50
					NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_G	-118	-50
					NR_TDD_FR1_J	-116.5	-50
±39		>48	≥ 1	Note 5	Note 5	Note 5	
±40		60	≥ 24	≥ 4	NR_TDD_FR1_B	-117.5	-50
					NR_TDD_FR1_C	-117	-50
					NR_FDD_FR1_G	-115	-50
					NR_TDD_FR1_J	-113.5	-50

NOTE 1: Minimum SL-PRS bandwidth, which is the minimum of the SL-PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Io is assumed to have constant EPRE across the bandwidth.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the SL-PRS bandwidth of the smallest PRB number for the corresponding SCS.

Table 10.4A.2.2-2: SL RSTD absolute accuracy in FR1 for fading channel

Accuracy	Conditions						
	SL-PRS Ês/Iot	SL-PRS SCS	SL-PRS bandwidth Note 1	Number of samples, S	Io Note 2 range		
					NR operating band groups Note 3	Minimum Io	Maximum Io
Tc Note 4	dB	kHz	PRB			dBm/SCS	dBm/BW$_{Channel}$
±97	(SL-PRS Ês/Iot)$_{ref}$ ≥ 0 dB (SL-PRS Ês/Iot)$_i$ ≥ -3 dB	15	48	≥ 4	NR_TDD_FR1_B	-123.5	-50
					NR_TDD_FR1_C	-123	-50
					NR_FDD_FR1_G	-121	-50
					NR_TDD_FR1_J	-119.5	-50
±133			>48	≥ 1	Note 5	Note 5	Note 5
±91			≥ 96	≥ 1	Note 5	Note 5	Note 5
±138		30	≥ 24	≥ 4	NR_TDD_FR1_B	-120.5	-50
					NR_TDD_FR1_C	-120	-50
					NR_FDD_FR1_G	-118	-50
					NR_TDD_FR1_J	-116.5	-50
±99			>48	≥ 1	Note 5	Note 5	Note 5
±83		60	≥ 24	≥ 4	NR_TDD_FR1_B	-117.5	-50
					NR_TDD_FR1_C	-117	-50
					NR_FDD_FR1_G	-115	-50
					NR_TDD_FR1_J	-113.5	-50

NOTE 1: Minimum SL-PRS bandwidth, which is the minimum of the SL-PRS bandwidths of the reference resource and the measured neighbour resource i.
NOTE 2: Io is assumed to have constant EPRE across the bandwidth.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the SL-PRS bandwidth of the smallest PRB number for the corresponding SCS.

Table 10.4A.2.2-3: Margin for SL RSTD measurement accuracy in FR1

PRS BW (PRB number)			Margin Z (Tc)
SCS=15kHz	SCS=30kHz	SCS=60kHz	
≥ 48	≥ 24	N/A	72
≥ 96	≥ 48	≥ 24	36

10.4A.3 SL PRS-RSRP measurements

10.4A.3.1 Measurement Report Mapping

10.4A.3.1.1 Absolute SL PRS-RSRP Measurement Report Mapping

The reporting range of absolute SL PRS-RSRP measurement is defined from -156 dBm to -31 dBm with 1 dB resolution.

The mapping of measured quantity is defined in table 10.4A.3.1.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.4A.3.1.1-1: Measurement report mapping for SL PRS-RSRP

Reported value	Measured quantity value	Unit
SL_PRS-RSRP_0	SL_PRS-RSRP<-156	dBm
SL_PRS-RSRP_1	-156≤SL_PRS-RSRP<-155	dBm
SL_PRS-RSRP_2	-155≤SL_PRS-RSRP<-154	dBm
SL_PRS-RSRP_3	-154≤SL_PRS-RSRP<-153	dBm
SL_PRS-RSRP_4	-153≤SL_PRS-RSRP<-152	dBm
SL_PRS-RSRP_5	-152≤SL_PRS-RSRP<-151	dBm
SL_PRS-RSRP_6	-151≤SL_PRS-RSRP<-150	dBm
SL_PRS-RSRP_7	-150≤SL_PRS-RSRP<-149	dBm
SL_PRS-RSRP_8	-149≤SL_PRS-RSRP<-148	dBm
SL_PRS-RSRP_9	-148≤SL_PRS-RSRP<-147	dBm
SL_PRS-RSRP_10	-147≤SL_PRS-RSRP<-146	dBm
SL_PRS-RSRP_11	-146≤SL_PRS-RSRP<-145	dBm
SL_PRS-RSRP_12	-145≤SL_PRS-RSRP<-144	dBm
SL_PRS-RSRP_13	-144≤SL_PRS-RSRP<-143	dBm
SL_PRS-RSRP_14	-143≤SL_PRS-RSRP<-142	dBm
SL_PRS-RSRP_15	-142≤SL_PRS-RSRP<-141	dBm
SL_PRS-RSRP_16	-141≤SL_PRS-RSRP<-140	dBm
SL_PRS-RSRP_17	-140≤SL_PRS-RSRP<-139	dBm
SL_PRS-RSRP_18	-139≤SL_PRS-RSRP<-138	dBm
…	…	…
SL_PRS-RSRP_111	-46≤SL_PRS-RSRP<-45	dBm
SL_PRS-RSRP_112	-45≤SL_PRS-RSRP<-44	dBm
SL_PRS-RSRP_113	-44≤SL_PRS-RSRP<-43	dBm
SL_PRS-RSRP_114	-43≤SL_PRS-RSRP<-42	dBm
SL_PRS-RSRP_115	-42≤SL_PRS-RSRP<-41	dBm
SL_PRS-RSRP_116	-41≤SL_PRS-RSRP<-40	dBm
SL_PRS-RSRP_117	-40≤SL_PRS-RSRP<-39	dBm
SL_PRS-RSRP_118	-39≤SL_PRS-RSRP<-38	dBm
SL_PRS-RSRP_119	-38≤SL_PRS-RSRP<-37	dBm
SL_PRS-RSRP_120	-37≤SL_PRS-RSRP<-36	dBm
SL_PRS-RSRP_121	-36≤SL_PRS-RSRP<-35	dBm
SL_PRS-RSRP_122	-35≤SL_PRS-RSRP<-34	dBm
SL_PRS-RSRP_123	-34≤SL_PRS-RSRP<-33	dBm

Reported value	Measured quantity value	Unit
SL_PRS-RSRP_124	-33≤SL_PRS-RSRP<-32	dBm
SL_PRS-RSRP_125	-32≤SL_PRS-RSRP<-31	dBm
SL_PRS-RSRP_126	-31≤SL_PRS-RSRP	dBm

10.4A.3.2 Measurement Accuracy Requirements

10.4A.3.2.1 Absolute SL PRS-RSRP accuracy

The absolute accuracy requirements for SL PRS-RSRP measurement for FR1 defined in table 10.4A.3.2.1-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] clause 7.3E for reference sensitivity are fulfilled.
- PRP $1,2|_{dBm}$ according to annex B.4A.1 for a corresponding Band.

Table 10.4A.3.2.1-1: SL PRS-RSRP absolute accuracy for FR1

Accuracy		Conditions						
							Io Note 4 range	
Normal condition	Extreme condition	SL- PRS Ês/Iot	SL-PRS SCS	SL-PRS BW Note 2	Number of SL-PRS samples, S	NR operating band group Note 5	Minimum Io Note 1	Maximum Io
dB	dB	dB	kHz	PRB	-		dBm / SCS_{PRS}	dBm/ $BW_{Channel}$
±3.3	±7.9	≥-3 dB	15	48	≥4	NR_TDD_FR1_B	-123.5	-50
						NR_TDD_FR1_C	-123	-50
						NR_FDD_FR1_G	-121	-50
						NR_TDD_FR1_J	-119.5	-50
±5.3	±9.8			> 48	≥1	Note 3		
±4.7	±9.2			≥ 96	≥1	Note 3		
±4.5	±9.0		30	≥ 24	≥4	NR_TDD_FR1_B	-120.5	-50
						NR_TDD_FR1_C	-120	-50
						NR_FDD_FR1_G	-118	-50
						NR_TDD_FR1_J	-116.5	-50
±5.0	±9.5			> 48	≥1	Note 3		
±4.6	±9.1		60	≥ 24	≥4	NR_TDD_FR1_B	-117.5	-50
						NR_TDD_FR1_C	-117	-50
						NR_FDD_FR1_G	-115	-50
						NR_TDD_FR1_J	-113.5	-50

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: SL-PRS bandwidth is as indicated in *sl-PRS-BW* in the *SL-PRS-AssistanceData* defined in TS 38.355 [37].
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the SL-PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 4: The Io is defined in PRS positioning slots. The same Io range applies to SL-PRS and non-SL-PRS symbols. Io levels are different in SL-PRS and non-SL-PRS symbols within the same slot.
NOTE 5: NR operating band groups are as defined in Section 3.5.2.

10.4A.4 SL Rx-Tx measurements

10.4A.4.1 Measurement Report Mapping

10.4A.4.1.1 Absolute SL Rx-Tx Measurement Report Mapping

The reporting range for the absolute SL Rx-Tx time difference measurement ($T_{SL\ Rx\text{-}Tx}$) is defined from -985024´T_c to 985024´T_c with the resolution step of 2^{k}´T_c, where:

T_c is defined in TS 38.211 [6],

$k_{min} \leq k \leq k_{max}$,

k_{min}=2 and k_{max}=5, when both of the transmitted SL-PRS and the received SL-PRS resources configured for $T_{SL\ Rx\text{-}Tx}$ are in FR1.

The $T_{SL\ Rx\text{-}Tx}$ report mapping for k = 2, 3, 4, and 5 are specified in tables 10.4A.4.1.1-1, 10.4A.4.1.1-2, 10.4A.4.1.1-3, and 10.4A.4.1.1-4, respectively.

Table 10.4A.4.1.1-1: Absolute SL Rx-Tx time difference measurement report mapping for *k*=2

Reported Quantity Value	Measured Quantity Value	Unit
SL_RX-TX_TIME_DIFFERENCE_0000	$T_{SL\ Rx\text{-}Tx} < -985024$	T_c
SL_RX-TX_TIME_DIFFERENCE_0001	$-985024 \leq T_{SL\ Rx\text{-}Tx} < -985020$	T_c
SL_RX-TX_TIME_DIFFERENCE_0002	$-985020 \leq T_{SL\ Rx\text{-}Tx} < -985016$	T_c
…	…	…
SL_RX-TX_TIME_DIFFERENCE_246256	$-4 \leq T_{SL\ Rx\text{-}Tx} < 0$	T_c
SL_RX-TX_TIME_DIFFERENCE_246257	$0 \leq T_{SL\ Rx\text{-}Tx} < 4$	T_c
…	…	…
SL_RX-TX_TIME_DIFFERENCE_492511	$985016 \leq T_{SL\ Rx\text{-}Tx} < 985020$	T_c
SL_RX-TX_TIME_DIFFERENCE_492512	$985020 \leq T_{SL\ Rx\text{-}Tx} < 985024$	T_c
SL_RX-TX_TIME_DIFFERENCE_492513	$985024 \leq T_{SL\ Rx\text{-}Tx}$	T_c

Table 10.4A.4.1.1-2: Absolute SL Rx-Tx time difference measurement report mapping for *k*=3

Reported Quantity Value	Measured Quantity Value	Unit
SL_RX-TX_TIME_DIFFERENCE_0000	$T_{SL\ Rx\text{-}Tx} < -985024$	T_c
SL_RX-TX_TIME_DIFFERENCE_0001	$-985024 \leq T_{SL\ Rx\text{-}Tx} < -985016$	T_c
SL_RX-TX_TIME_DIFFERENCE_0002	$-985016 \leq T_{SL\ Rx\text{-}Tx} < -985008$	T_c
…	…	…
SL_RX-TX_TIME_DIFFERENCE_123128	$-8 \leq T_{SL\ Rx\text{-}Tx} < 0$	T_c
SL_RX-TX_TIME_DIFFERENCE_123129	$0 \leq T_{SL\ Rx\text{-}Tx} < 8$	T_c
…	…	…
SL_RX-TX_TIME_DIFFERENCE_246255	$985008 \leq T_{SL\ Rx\text{-}Tx} < 985016$	T_c
SL_RX-TX_TIME_DIFFERENCE_246256	$985016 \leq T_{SL\ Rx\text{-}Tx} < 985024$	T_c
SL_RX-TX_TIME_DIFFERENCE_246257	$985024 \leq T_{SL\ Rx\text{-}Tx}$	T_c

Table 10.4A.4.1.1-3: Absolute SL Rx-Tx time difference measurement report mapping for *k*=4

Reported Quantity Value	Measured Quantity Value	Unit
SL_RX-TX_TIME_DIFFERENCE_0000	$T_{SL\ Rx\text{-}Tx} < -985024$	T_c
SL_RX-TX_TIME_DIFFERENCE_0001	$-985024 \leq T_{SL\ Rx\text{-}Tx} < -985008$	T_c
SL_RX-TX_TIME_DIFFERENCE_0002	$-985008 \leq T_{SL\ Rx\text{-}Tx} < -984992$	T_c
…	…	…
SL_RX-TX_TIME_DIFFERENCE_61564	$-16 \leq T_{SL\ Rx\text{-}Tx} < 0$	T_c
SL_RX-TX_TIME_DIFFERENCE_61565	$0 \leq T_{SL\ Rx\text{-}Tx} < 16$	T_c
…	…	…
SL_RX-TX_TIME_DIFFERENCE_123127	$984992 \leq T_{SL\ Rx\text{-}Tx} < 985008$	T_c
SL_RX-TX_TIME_DIFFERENCE_123128	$985008 \leq T_{SL\ Rx\text{-}Tx} < 985024$	T_c
SL_RX-TX_TIME_DIFFERENCE_123129	$985024 \leq T_{SL\ Rx\text{-}Tx}$	T_c

Table 10.4A.4.1.1-4: Absolute SL Rx-Tx time difference measurement report mapping for *k*=5

Reported Quantity Value	Measured Quantity Value	Unit
SL_RX-TX_TIME_DIFFERENCE_0000	$T_{SL\ Rx\text{-}Tx} < -985024$	T_c
SL_RX-TX_TIME_DIFFERENCE_0001	$-985024 \leq T_{SL\ Rx\text{-}Tx} < -984992$	T_c
SL_RX-TX_TIME_DIFFERENCE_0002	$-984992 \leq T_{SL\ Rx\text{-}Tx} < -984960$	T_c
…	…	…
SL_RX-TX_TIME_DIFFERENCE_30782	$-32 \leq T_{SL\ Rx\text{-}Tx} < 0$	T_c
SL_RX-TX_TIME_DIFFERENCE_30783	$0 \leq T_{SL\ Rx\text{-}Tx} < 32$	T_c
…	…	…

SL_RX-TX_TIME_DIFFERENCE_61563	$984960 \leq T_{SL\ Rx\text{-}Tx} < 984992$	T_c
SL_RX-TX_TIME_DIFFERENCE_61564	$984992 \leq T_{SL\ Rx\text{-}Tx} < 985024$	T_c
SL_RX-TX_TIME_DIFFERENCE_61565	$985024 \leq T_{SL\ Rx\text{-}Tx}$	T_c

10.4A.4.2 Measurement Accuracy

The accuracy requirements for SL Rx-Tx time difference measurement shall be within $\pm(X+Y+\delta)\ T_c$, where X, Y, and δ are defined as follows.

X is defined in table 10.4A.4.2-1 for AWGN propagation condition and table 10.4A.4.2-2 for fading propagation condition in FR1, provided that the following conditions are met:

- Conditions defined in clause 7.3E of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- SL $PRP|_{dBm}$ according to annex B.4A.1 for a corresponding Band.
- The UE transmits SL PRS within -160, 160 msec of at least one SL PRS resource of each of the anchor UEs in the assistance data.
- N_{TA_offset} defined in table 7.1.2-2 does not change during the UE Rx-Tx measurement period when the reference timing used for SL PRS transmissions is a NR serving cell.

If UE indicates *tx-TimeInfo* when reporting SL Rx-Tx time difference results, the frequency drift margin Y=32 Tc, provided that the time offset between the SL PRS transmission and reception, which are used for a single SL Rx-Tx estimate, is no greater than 160 ms. Otherwise, Y=0.

Margin δ are defined in table 10.4A.4.2-3.

Table 10.4A.4.2-1: SL Rx-Tx time difference measurement accuracy in FR1 for AWGN channel

Accuracy	Conditions						
	PRS $\hat{E}s/Iot$	Minimum PRS bandwidth	Number of samples, S	PRS SCS	NR operating band groups[Note 2]	Io[Note 3] range	
						Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB		kHz		dBm / SCS_{PRS}	dBm/BW
±49	-3	48	≥ 4	15	NR_TDD_FR1_B	-123.5	-50
					NR_TDD_FR1_C	-123	
					NR_FDD_FR1_G	-121	
					NR_TDD_FR1_J	-119.5	
±59		>48	≥ 1		NOTE 5	NOTE 5	NOTE 5
±31		≥ 96	≥ 1		NOTE 5	NOTE 5	NOTE 5
±52		≥ 24	≥ 4	30	NR_TDD_FR1_B	-120.5	-50
					NR_TDD_FR1_C	-120	
					NR_FDD_FR1_G	-118	
					NR_TDD_FR1_J	-116.5	
±31		>48	≥ 1		NOTE 5	NOTE 5	NOTE 5
±29		≥ 24	≥ 4	60	NR_TDD_FR1_B	-117.5	-50
					NR_TDD_FR1_C	-117	
					NR_FDD_FR1_G	-115	
					NR_TDD_FR1_J	-113.5	

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.

Table 10.4A.4.2-2: SL Rx-Tx time difference measurement accuracy in FR1 for fading channel

Accuracy	Conditions						
	PRS Ês/Iot	Minimum PRS bandwidth	Number of samples, S	PRS SCS	NR operating band groups[Note 2]	Io[Note 3] range	
						Minimum Io[Note 1]	Maximum Io
Tc[Note 4]	dB	PRB		kHz		dBm / SCS_{PRS}	dBm/BW
±86	-3	48	≥ 4	15	NR_TDD_FR1_B	-123.5	-50
					NR_TDD_FR1_C	-123	
					NR_FDD_FR1_G	-121	
					NR_TDD_FR1_J	-119.5	
±104		>48	≥ 1		NOTE 5	NOTE 5	NOTE 5
±72		≥ 96	≥ 1		NOTE 5	NOTE 5	NOTE 5
±84		≥ 24	≥ 4	30	NR_TDD_FR1_B	-120.5	-50
					NR_TDD_FR1_C	-120	
					NR_FDD_FR1_G	-118	
					NR_TDD_FR1_J	-116.5	
±86		>48	≥ 1		NOTE 5	NOTE 5	NOTE 5
±65		≥ 24	≥ 4	60	NR_TDD_FR1_B	-117.5	-50
					NR_TDD_FR1_C	-117	
					NR_FDD_FR1_G	-115	
					NR_TDD_FR1_J	-113.5	

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: NR operating band groups are as defined in Section 3.5.
NOTE 3: The Io is defined in PRS slots. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same slot.
NOTE 4: Tc is the basic timing unit defined in TS 38.211 [6].
NOTE 5: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth of the smallest PRB number for the corresponding SCS.

Table 10.4A.4.2-3: Margin for UE Rx-Tx time difference measurement accuracy in FR1

Min(receive SL-PRS BW, transmit SL-PRS BW) (PRB)			Margin δ (Tc)
SCS = 15 kHz	SCS = 30 kHz	SCS = 60 kHz	
≥ 48	≥ 24	N/A	80
≥ 96	≥ 48	≥ 24	56

10.4A.5 SL PRS-RSRPP measurements

10.4A.5.1 Measurement Report Mapping

10.4A.5.1.1 Absolute SL PRS-RSRPP Measurement Report Mapping

The reporting range of absolute SL PRS-RSRPP measurement is defined from -156 dBm to -31 dBm with 1 dB resolution.

The mapping of measured quantity is defined in table 10.4A.5.1.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.4A.5.1.1-1: Measurement report mapping for SL PRS-RSRPP

Reported value	Measured quantity value	Unit
SL_PRS-RSRPP_0	SL_PRS-RSRPP<-156	dBm
SL_PRS-RSRPP_1	-156≤SL_PRS-RSRPP<-155	dBm
SL_PRS-RSRPP_2	-155≤SL_PRS-RSRPP<-154	dBm
SL_PRS-RSRPP_3	-154≤SL_PRS-RSRPP<-153	dBm

Reported value	Measured quantity value	Unit
SL_PRS-RSRPP_4	-153≤SL_PRS-RSRPP<-152	dBm
SL_PRS-RSRPP_5	-152≤SL_PRS-RSRPP<-151	dBm
SL_PRS-RSRPP_6	-151≤SL_PRS-RSRPP<-150	dBm
SL_PRS-RSRPP_7	-150≤SL_PRS-RSRPP<-149	dBm
SL_PRS-RSRPP_8	-149≤SL_PRS-RSRPP<-148	dBm
SL_PRS-RSRPP_9	-148≤SL_PRS-RSRPP<-147	dBm
SL_PRS-RSRPP_10	-147≤SL_PRS-RSRPP<-146	dBm
SL_PRS-RSRPP_11	-146≤SL_PRS-RSRPP<-145	dBm
SL_PRS-RSRPP_12	-145≤SL_PRS-RSRPP<-144	dBm
SL_PRS-RSRPP_13	-144≤SL_PRS-RSRPP<-143	dBm
SL_PRS-RSRPP_14	-143≤SL_PRS-RSRPP<-142	dBm
SL_PRS-RSRPP_15	-142≤SL_PRS-RSRPP<-141	dBm
SL_PRS-RSRPP_16	-141≤SL_PRS-RSRPP<-140	dBm
SL_PRS-RSRPP_17	-140≤SL_PRS-RSRPP<-139	dBm
SL_PRS-RSRPP_18	-139≤SL_PRS-RSRPP<-138	dBm
…	…	…
SL_PRS-RSRPP_111	-46≤SL_PRS-RSRPP<-45	dBm
SL_PRS-RSRPP_112	-45≤SL_PRS-RSRPP<-44	dBm
SL_PRS-RSRPP_113	-44≤SL_PRS-RSRPP<-43	dBm
SL_PRS-RSRPP_114	-43≤SL_PRS-RSRPP<-42	dBm
SL_PRS-RSRPP_115	-42≤SL_PRS-RSRPP<-41	dBm
SL_PRS-RSRPP_116	-41≤SL_PRS-RSRPP<-40	dBm
SL_PRS-RSRPP_117	-40≤SL_PRS-RSRPP<-39	dBm
SL_PRS-RSRPP_118	-39≤SL_PRS-RSRPP<-38	dBm
SL_PRS-RSRPP_119	-38≤SL_PRS-RSRPP<-37	dBm
SL_PRS-RSRPP_120	-37≤SL_PRS-RSRPP<-36	dBm
SL_PRS-RSRPP_121	-36≤SL_PRS-RSRPP<-35	dBm
SL_PRS-RSRPP_122	-35≤SL_PRS-RSRPP<-34	dBm
SL_PRS-RSRPP_123	-34≤SL_PRS-RSRPP<-33	dBm
SL_PRS-RSRPP_124	-33≤SL_PRS-RSRPP<-32	dBm
SL_PRS-RSRPP_125	-32≤SL_PRS-RSRPP<-31	dBm
SL_PRS-RSRPP_126	-31≤SL_PRS-RSRPP	dBm

10.4A.5.2 Measurement Accuracy

10.4A.5.2.1 Introduction

The requirements in clause 10.4A.5.2 shall apply provided the UE has received *SL-TDOA-RequestLocationInformation* or *SL-AOA-RequestLocationInformation* or *SL-TOA-RequestLocationInformation* or *SL-RTT-RequestLocationInformation* from LMF or another UE via SLPP requesting the UE to measure and report SL PRS-RSRPP measurements defined in TS 38.215 [4].

The requirements in clause 10.4A.5.2 apply for the first path SL PRSRSRPP measurement.

10.4A.5.2.2 Measurement Accuracy Requirements

10.4A.5.2.2.2 Absolute SL PRS-RSRPP accuracy

The absolute accuracy requirements for SL PRS-RSRPP measurement for FR1 defined in table 10.4A.5.2.2.2-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] clause 7.3E for reference sensitivity are fulfilled.
- PRP $1,2|_{\mathrm{dBm}}$ according to annex B.4A.1 for a corresponding Band.

NOTE 1: The requriements in this clause are derived based on two-tap channel defined in TS 38.101-4 [21] annex B.2.4 (a = 1, τ_d=0.45 μs and f_D=5 Hz).

NOTE 2: The requirements in this clause are derived based on the difference between the estimated SL PRSRSRPP compared to the ideal SL PRSRSRPP defined as

$$\mathrm{RSRPP}_p \propto \left| \sum_k H_k \exp\left(j 2\pi D_p \frac{k}{N_{\mathrm{IFFT}}} \right) \right|^2$$

where:

H_k is the effective channel frequency response (over REs occupied by SL-PRS) measured without receiver noise.

D_p is the exact delay of the p-th path in the channel model.

Table 10.4A.5.2.2.2-1: SL PRS-RSRPP absolute accuracy for FR1

Accuracy		Conditions						
							Io Note 4 range	
Normal condition	Extreme condition	PRS Ês/Iot	PRS SCS	PRS BW Note 2	PRS sample	operating band group Note 5	Minimum Io Note 1	Maximum Io
dB	dB	dB	kHz	PRB	-		dBm / SCS_{PRS}	dBm/$BW_{Channel}$
±4.8	±9.3	≥-3	15	48	≥4	NR_TDD_FR1_B	-123.5	-50
						NR_TDD_FR1_C	-123	-50
						NR_FDD_FR1_G	-121	-50
						NR_TDD_FR1_J	-119.5	-50
±4.7	±9.2			> 48	≥1	Note 3		
±4.5	±9.0			≥ 96	≥1	Note 3		
±4.7	±9.2		30	≥ 24	≥4	NR_TDD_FR1_B	-120.5	-50
						NR_TDD_FR1_C	-120	-50
						NR_FDD_FR1_G	-118	-50
						NR_TDD_FR1_J	-116.5	-50
±4.8	±9.3			> 48	≥1	Note 3		
±4.8	±9.3		60	≥ 24	≥4	NR_TDD_FR1_B	-117.5	-50
						NR_TDD_FR1_C	-117	-50
						NR_FDD_FR1_G	-115	-50
						NR_TDD_FR1_J	-113.5	-50

NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.
NOTE 2: SL PRS bandwidth is as indicated in *sl-PRS-BW* in the SL-PRS-AssistanceData defined in TS 38.355 [37].
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the SL PRS bandwidth of the smallest PRB number for the corresponding SCS.
NOTE 4: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.
NOTE 5: NR V2X operating band groups are as defined in Section 3.5.2.

10.4A.6 SL AoA measurements

10.4A.6.1 Measurement Report Mapping

10.4A.6.1.1 Absolute SL AoA Measurement Report Mapping

The UE shall report A-AoA measurement results based on measurement report mapping in this clause. The UE shall report Z-AoA measurement results based on measurement report mapping in this clause.

The reporting range of SL AoA, as defined in TS 38.215 [4], is defined from -180 degree to +180 degree for A-AoA. The reporting resolution is 0.1 degree. The mapping of A-AoA measured quantity is defined in table 10.4A.6.1.1-1.

Table 10.4A.6.1.1-1: A-AoA measurement report mapping

Reported value	Measured quantity value (A-AoA)	Unit
A-AoA_0	-180 ≤ A-AoA < -179.9	Degree
A-AoA_1	-179.9 ≤ A-AoA < -179.8	Degree
A-AoA_2	-179.8 ≤ A-AoA < -179.7	Degree
…	…	…
A-AoA_1798	-0.2 ≤ A-AoA < -0.1	Degree
A-AoA_1799	-0.1 ≤ A-AoA < 0	Degree
A-AoA_1800	0 ≤ A-AoA < 0.1	Degree
A-AoA_1801	0.1 ≤ A-AoA < 0.2	Degree
A-AoA_1802	0.2 ≤ A-AoA < 0.3	Degree
…	…	…
A-AoA_3598	179.8 ≤ A-AoA < 179.9	Degree
A-AoA_3599	179.9 ≤ A-AoA < 180	Degree

The reporting range of SL AoA, as defined in TS 38.215 [4], is defined from 0 degree to +180 degree for Z-AoA. The reporting resolution is 0.1 degree. The reporting resolution is 0.1 degree. The mapping of Z-AoA measured quantity is defined in table 10.4A.6.1.1-2.

Table 10.4A.6.1.1-2: Z-AoA measurement report mapping

Reported value	Measured quantity value (Z-AoA)	Unit
Z-AoA_0	0 ≤ Z-AoA < 0.1	degree
Z-AoA _1	0.1 ≤ Z-AoA < 0.2	degree
Z-AoA _2	0.2 ≤ Z-AoA < 0.3	degree
…	…	…
Z-AoA _1798	179.8 ≤ Z-AoA < 179.9	degree
Z-AoA _1799	179.9 ≤ Z-AoA ≤ 180	degree

10.4A.7 SL RTOA measurements

10.4A.7.1 Measurement Report Mapping

10.4A.7.1.1 Absolute SL RTOA Measurement Report Mapping

The reporting range of SL RTOA measurement, as defined in clause 5.2.2 of TS 38.215 [4], is defined from $-985024T_c$ to $+985024 \times T_c$. The reporting resolution is uniform across the reporting range and is defined as $T = T_c * 2^k$ where

k is selected from the set {02, 3, 4, 5},

T_c is defined in TS 38.211 [6].

The mapping of measured quantity for each reporting resolution (k) is defined in table 10.4A.7.1.1-1 to table 10.4A.7.1.1-4.

Table 10.4A.7.1.1-1: Absolute SL RTOA measurement report mapping for *k*=2

Reported Value	Measured Quantity Value	Unit
SL_RTOA_000000	-985024 > SL_RTOA	T_c
SL_RTOA_000001	-985024 ≤ SL_RTOA < -985020	T_c
SL_RTOA_000002	-985020 ≤ SL_RTOA < -985018	T_c
…	…	…
SL_RTOA_246255	-8 ≤ SL_RTOA < -4	T_c
SL_RTOA_246256	-4 ≤ SL_RTOA ≤ 0	T_c
SL_RTOA_246257	0 < SL_RTOA ≤ 4	T_c
SL_RTOA_246258	4 < SL_RTOA ≤ 8	T_c
SL_RTOA_246259	8 < SL_RTOA ≤ 12	T_c
…	…	…
SL_RTOA_492512	985020 < SL_RTOA ≤ 985024	T_c
SL_RTOA_492513	985024 < SL_RTOA	T_c

Table 10.4A.7.1.1-2: Absolute SL RTOA measurement report mapping for *k*=3

Reported Value	Measured Quantity Value	Unit
SL_RTOA_000000	-985024 > SL_RTOA	T_c
SL_RTOA_000001	-985024 ≤ SL_RTOA < -985016	T_c
SL_RTOA_000002	-985016 ≤ SL_RTOA < -985008	T_c
…	…	…
SL_RTOA_123127	-16 ≤ SL_RTOA < -8	T_c
SL_RTOA_123128	-8 ≤ SL_RTOA ≤ 0	T_c
SL_RTOA_123129	0 < SL_RTOA ≤ 8	T_c
SL_RTOA_123130	8 < SL_RTOA ≤ 16	T_c
SL_RTOA_123131	16 < SL_RTOA ≤ 24	T_c
…	…	…
SL_RTOA_246256	985016 < SL_RTOA ≤ 985024	T_c
SL_RTOA_246257	985024 < SL_RTOA	T_c

Table 10.4A.7.1.1-3: Absolute SL RTOA measurement report mapping for *k*=4

Reported Value	Measured Quantity Value	Unit
SL_RTOA_000000	-985024 > SL_RTOA	T_c
SL_RTOA_000001	-985024 ≤ SL_RTOA < -985008	T_c
SL_RTOA_000002	-985008 ≤ SL_RTOA < -984992	T_c
…	…	…
SL_RTOA_61563	-32 ≤ SL_RTOA < -16	T_c
SL_RTOA_61564	-16 ≤ SL_RTOA ≤ 0	T_c
SL_RTOA_61565	0 < SL_RTOA ≤ 16	T_c
SL_RTOA_61566	16 < SL_RTOA ≤ 32	T_c
SL_RTOA_61567	32 < SL_RTOA ≤ 48	T_c
…	…	…
SL_RTOA_123128	985008 < SL_RTOA ≤ 985024	T_c
SL_RTOA_123129	985024 < SL_RTOA	T_c

Table 10.4A.7.1.1-4: Absolute SL RTOA measurement report mapping for *k*=5

Reported Value	Measured Quantity Value	Unit
SL_RTOA_00000	-985024 > SL_RTOA	T_c
SL_RTOA_00001	-985024 ≤ SL_RTOA < -984992	T_c

SL_RTOA_00002	-984992 ≤ SL_RTOA < -984960	T_c
…	…	…
SL_RTOA_30781	-64 ≤ SL_RTOA < -32	T_c
SL_RTOA_30782	-32 ≤ SL_RTOA ≤ 0	T_c
SL_RTOA_30783	0 < SL_RTOA ≤ 32	T_c
SL_RTOA_30784	32 < SL_RTOA ≤ 64	T_c
SL_RTOA_30785	64 < SL_RTOA ≤ 96	T_c
…	…	…
SL_RTOA_61564	984992 < SL_RTOA ≤ 985024	T_c
SL_RTOA_61565	985024 < SL_RTOA	T_c

11 Void

12 V2X Requirements

12.1 Introduction

This clause contains the requirements for the UE capable of V2X sidelink communication when the UE is out of coverage on the carrier used for V2X sidelink operation, as defined in TS 38.304 [1]. The requirements apply when the UE is:

- in any cell selection state, or any of the below applies:
- configured for V2X SL operation on a V2X carrier which is dedicated to only V2X SL operation and configured with only a PCell on WAN carrier,
- configured for SL operation on a sidelink carrier with CCA and configured with only a PCell on WAN carrier,
- configured for inter-band con-current V2X operation,
- configured for intra-band con-current V2X operation with different carriers,
- configured in co-channel coexistence for LTE SL and NR SL operation with same carrier.

NOTE: Any cell selection state refers to a UE that is out of network coverage and is not associated with a serving cell on any carrier as defined in TS 38.304 [1].

NOTE: When a UE in RRC_CONNECTED state is performing transmissions and/or reception for V2X sidelink communication, the UE shall meet all the requirements specified in Clause 9 assuming that UE has a dedicated RX/TX chain for V2X sidelink communication. Otherwise, the UE may interrupt the V2X sidelink communication in order to meet the measurement requirements specified in Clause 9.

This clause also contains the requirements for the UE capable of V2X sidelink communication when the UE is in coverage on the carrier used for V2X sidelink operation, as defined in TS 38.304 [1]. The requirements apply when the UE is:

- configured for intra-band con-current NR V2X cooperation with same carrier.
- configured in co-channel coexistence for LTE SL and NR SL operation with same carrier，

For UE capable of Public Safety sidelink communication and/or other commercial sidelink communication, unless explicitly stated, V2X requirements apply.

For sidelink communication in unlicensed spectrum,

- the term SyncRef UE subject to CCA is not available at the UE refers to when all the candidate S-SSB positions monitored in every S-SSB period are not available during the last 1280 ms. Otherwise, the SyncRef UE subject to CCA is considered as available at the UE.
- the term S-SSB period subject to CCA is not available at the UE refers to the S-SSB period in which all the candidate S-SSB positions are not available. Otherwise, the S-SSB period subject to CCA is considered as available at the UE.

12.2 UE Transmit Timing

12.2.1 Introduction

This clause contains requirements of transmission timing for V2X sidelink communication when:

- GNSS is used as the synchronization reference source;
- NR Cell is used as the synchronization reference source;
- E-UTRAN Cell is used as the synchronization reference source;

- SyncRef UE is used as the synchronization reference source.

The requirements for 60 kHz SCS of sidelink signal defined in this clause do not apply to the sidelink communication in unlicensed spectrum.

12.2.2 GNSS as synchronization reference source

The requirements in this subclause are applicable when the reference timing used by the UE for V2X sidelink communication is derived from GNSS.

The sidelink transmissions takes place $(N_{TA,SL} + N_{TA\ offset}) \times T_c$ before the subframe starting boundary as defined in TS 38.331 [2], where $N_{TA\ offset}$ = 0 and $N_{TA,SL}$=0.

The transmission timing error for sidelink transmissions shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is defined in table 12.2.2-1.

Table 12.2.2-1: T_e Timing Error Limit

Frequency Range of sidelink	T_e
FR1	$12*64*T_c$
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6].	

12.2.3 NR Cell as synchronization reference source

The requirements in this subclause are applicable when the reference timing used for sidelink transmissions is a NR serving cell on a non-V2X sidelink carrier or a V2X sidelink carrier.

The sidelink transmissions takes place $(N_{TA,SL} + N_{TA\ offset}) \times T_c$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell, where $N_{TA,SL}$ = 0. If uplink transmission and sidelink transmission are in the same band, $N_{TA\ offset}$ is defined in table 7.1.2-2, otherwise $N_{TA\ offset}$ is 0.

The transmission timing error for sidelink transmissions shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is defined in table 12.2.3-1.

Table 12.2.3-1: T_e Timing Error Limit

Frequency Range of sidelink	SCS of SSB signals (kHz)	SCS of sidelink signals (kHz)	T_e
FR1	15	15	$14*64*T_c$
		30	$12*64*T_c$
		60	$12*64*T_c$
	30	15	$10*64*T_c$
		30	$10*64*T_c$
		60	$9*64*T_c$
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6].			

12.2.4 E-URTAN Cell as synchronization reference source

The requirements in this subclause are applicable when the reference timing used for sidelink transmissions is an E-UTRAN serving cell on a non-V2X sidelink carrier.

The sidelink transmissions takes place $(N_{TA,SL} + N_{TA\ offset}) \times T_c$ before the reception of the first detected path (in time) of the corresponding E-UTRAN downlink frame from the reference cell, where $N_{TA\ offset}$ = 0 and $N_{TA,SL}$=0.

The transmission timing error for sidelink transmissions shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is defined in table 12.2.4-1.

Table 12.2.4-1: T_e Timing Error Limit

Frequency Range of sidelink	E-UTRAN downlink bandwidth (MHz)	$T_{e_}$
FR1	≥3	$14*64*T_c$
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6].		

12.2.5 SyncRef UE as synchronization reference source

The requirements in this subclause are applicable when the reference timing used for deriving sidelink transmission is from SyncRef UE transmitting sidelink synchronization signals.

The sidelink transmissions takes place $(N_{TA,SL} + N_{TA\ offset}) \times T_c$ before the reception of the first detected path (in time) of the corresponding timing reference frame from the SyncRef UE, where $N_{TA\ offset}$ = 0 and $N_{TA,SL}$=0.

The transmission timing error for sidelink transmissions shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is defined in table 12.2.5-1.

Table 12.2.5-1: T_e Timing Error Limit

Frequency Range of sidelink	SCS of sidelink signals (kHz)	T_e
FR1	15	$12*64*T_c$
	30	$8*64*T_c$
	60	$5*64*T_c$
NOTE 1: T_c is the basic timing unit defined in TS 38.211 [6].		

If the UE uses SyncRefUE on a carrier frequency subject to CCA for deriving the UE transmit timing, then the UE shall meet all the transmit timing requirements defined in clause 12.2.5: The transmission timing error for sidelink transmissions shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is defined in table 12.2.5-1 provided that at least one S-SSB is available at the UE during the last 160 ms.

12.3 Initiation/Cease of SLSS Transmissions

12.3.1 Introduction

The requirements in this subclause are applicable to the UE capable of V2X sidelink communication when:

- GNSS is used as the synchronization reference source;
- NR Cell is used as the synchronization reference source;
- EUTRAN Cell is used as the synchronization reference source;
- SyncRef UE is used as the synchronization reference source.

12.3.1.1 Initiation/Cease of SLSS transmissions with NR cell as synchronization reference source

The requirements apply when the NR Cell is used as synchronization reference source and when the UE is

- out of coverage on the V2X NR sidelink carrier and in coverage with a serving cell on a NR non-V2X sidelink carrier, or
- in coverage with a serving cell on a NR V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in TS 38.331 [2] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType12*. The UE shall be capable of measuring the RSRP of the cell used as synchronization reference source to evaluate to initiate/cease SLSS transmissions within $T_{evaluate,SLSS}$

where,

- $T_{evaluate,SLSS}$ is as specified in table 12.3.1.1-1 when UE performs SSB based measurements without measurement gaps.
- $T_{evaluate,SLSS}$ is as specified in table 12.3.1.1-2 when UE performs SSB based measurements with measurement gaps.

Table 12.3.1.1-1: $T_{evaluate,SLSS}$ for measurements without measurement gaps when NR cell is used as synchronization reference source (FR1)

DRX cycle in NR cell	$T_{evaluate,SLSS}$
No DRX	max(400 ms, ceil(2 x 5 x K_p) x SMTC period)[Note 1]
DRX cycle≤ 320 ms	max(400 ms, ceil(1.5 x 2 x 5 x K_p) x max(SMTC period, DRX cycle))
DRX cycle>320 ms	ceil(7 x K_p) x DRX cycle
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 12.3.1.1-2: $T_{evaluate,SLSS}$ for measurements with measurement gaps when NR cell is used as synchronization reference source (FR1)

DRX cycle in NR cell	$T_{evaluate,SLSS}$
No DRX	max(400 ms, 2 x 5 x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320 ms	max(400 ms, ceil(2 x 1.5x 5) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320 ms	7 x max(MGRP, DRX cycle) x $CSSF_{intra}$

If higher layer filtering is configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the NR cell as synchronization reference source:

- SS-RSRP related side conditions given in clauses 10.1.2 for FR1, respectively, for a corresponding Band,
- SS-RSRQ related side conditions given in clauses 10.1.7 for FR1, respectively, for a corresponding Band,
- SS-SINR related side conditions given in clauses 10.1.12 for FR1, respectively, for a corresponding Band,
- SSB_RP and SSB Ês/Iot according to annex B.2.2 for a corresponding Band.

12.3.1.2 Initiation/Cease of SLSS transmissions with EUTRAN cell as synchronization reference source

The requirements apply when the EUTRAN Cell is used as synchronization reference source and when the UE is

- out of coverage on the V2X NR sidelink carrier and in coverage with a serving cell on a LTE non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in TS 36.331 [16] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType28*. The UE shall be capable of measuring the RSRP of the cell used as synchronization reference source to evaluate to initiate/cease SLSS transmissions within $T_{evaluate,SLSS}$

where,

- $T_{evaluate,SLSS}$ = 0.4 seconds when UE is not configured with DRX.
- $T_{evaluate,SLSS}$ = as specified in table 12.3.1.2-1 when UE is configured with DRX.

Table 12.3.1.2-1: $T_{evaluate,SLSS}$ when EUTRAN cell is used as synchronization reference source

DRX cycle length in EUTRAN cell[s]	$T_{evaluate,SLSS}$ [s] (number of DRX cycles)
≤0.04	0.4 (Note 1)
0.04<DRX-cycle≤2.56	Note 2 (6)
NOTE 1: Number of DRX cycles depends upon the DRX cycle in use NOTE 2: Time depends upon the DRX cycles in use	

If higher layer filtering is configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the cell as synchronization reference source:

- RSRP related side conditions given in TS 36.133[15] clauses 9.1.2.1 and 9.1.2.2 and RSRQ related side conditions given in TS 36.133[15] clause 9.1.5.1 for a corresponding Band are fulfilled,
- SCH_RP and SCH Ês/Iot according to TS 36.133[15] annex B.2.1 for a corresponding Band are fulfilled.

12.3.1.3 Initiation/Cease of SLSS transmissions with GNSS as synchronization reference source

The requirements apply when GNSS is used as synchronization reference source and when the UE is

- out of coverage on the V2X sidelink carrier and in coverage with a serving cell on a non-V2X sidelink carrier, or
- in coverage with a serving cell on a NR V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in TS 38.331 [2] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType12* in a NR cell.

When the conditions for SLSS transmissions specified in TS 36.331 [16] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType28* in a EUTRAN cell.

The requirements in clause 12.3.1.1 shall apply if the serving cell is a NR cell.

The requirements in clause 12.3.1.2 shall apply if the serving cell is a EUTRAN cell.

12.3.1.4 Initiation/Cease of SLSS transmissions with SyncRef UE as synchronization reference source

The requirements apply when SyncRef UE is used as synchronization reference source and when the UE is

- in any cell selection state, or
- out of coverage on the V2X sidelink carrier and is associated with a serving cell on a non-V2X sidelink carrier, or
- in coverage with a serving cell on a NR V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in TS 38.331 [2] are met and when SyncRef UE is used as synchronization reference source and if *syncTxThreshOoC* is included in the preconfigured V2X parameters.

The UE shall be capable of measuring the PSBCH-RSRP of the selected SyncRef UE used as synchronization reference source and evaluate it to initiate/cease SLSS transmissions within $T_{evaluate,SLSS}$, as shown in table 12.3.1.4-1.

Table 12.3.1.4-1: $T_{evaluate,SLSS}$ when SyncRef UE is used as synchronization reference source

SL-DRX cycle[Note 1] [ms]	$T_{evaluate,SLSS}$ [ms]
No SL-DRX	4 x S-SSB periods
SL-DRX cycle ≤ 160	4 x S-SSB periods
SL-DRX cycle > 160	4 x SL-DRX cycle

NOTE 1:	If multiple SL-DRX cycles are configured for SL UE, the SL-DRX cycle in the requirement is the shortest one. When the shortest SL-DRX cycle UE used changes, the requirements do not apply to the time of transition.

If higher layer filtering for PSBCH-RSRP measurements is pre-configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the selected SyncRef UE as defined in TS 38.331 [2] used to derive transmission timing for V2X sidelink communication:

- PSBCH-RSRP related side conditions given in clause 12.4 for a corresponding Band are fulfilled,
- V2X S-SSB_RP and S-SSB Ês/Iot according to annex B. 4 for a corresponding Band are fulfilled.

12.3A Initiation/Cease of SLSS Transmissions with CCA

12.3A.1 Introduction

The requirements in this subclause are applicable to the UE capable of sidelink communication in unlicensed spectrum when:

- GNSS is used as the synchronization reference source;
- NR Cell is used as the synchronization reference source;
- EUTRAN Cell is used as the synchronization reference source;
- SyncRef UE is used as the synchronization reference source on a carrier frequency subject to CCA.

12.3A.1.1 Initiation/Cease of SLSS transmissions with NR cell as synchronization reference source

The requirements defined in subclause 12.3.1.1 apply when the NR Cell is used as synchronization reference source and when the UE is

- out of coverage on the NR sidelink carrier and in coverage with a serving cell on a NR non- sidelink carrier.

12.3A.1.2 Initiation/Cease of SLSS transmissions with EUTRAN cell as synchronization reference source

The requirements defined in subclause 12.3.1.2 apply when the EUTRAN Cell is used as synchronization reference source and when the UE is

- out of coverage on the NR sidelink carrier and in coverage with a serving cell on a LTE non-sidelink carrier.

12.3A.1.3 Initiation/Cease of SLSS transmissions with GNSS as synchronization reference source

The requirements defined in subclause 12.3.1.3 apply when GNSS is used as synchronization reference source and when the UE is

- out of coverage on the sidelink carrier and in coverage with a serving cell on a non-sidelink carrier.

12.3A.1.4 Initiation/Cease of SLSS transmissions with SyncRef UE as synchronization reference source

The requirements apply when SyncRef UE is used as synchronization reference source and when the UE is

- in any cell selection state, or

- out of coverage on the sidelink carrier and is associated with a serving cell on a non-sidelink carrier.

and when the conditions for SLSS transmissions specified in TS 38.331[2] are met and when SyncRef UE is used as synchronization reference source and if *syncTxThreshOoC* is included in the preconfigured sidelink parameters.

The UE shall be capable of measuring the PSBCH-RSRP of the selected SyncRef UE used as synchronization reference source and evaluate it to initiate/cease SLSS transmissions within $T_{evaluate,SLSS_CCA}$, as shown in table 12.3A.1.4-1 when the SyncRef UE is transmitting S-SSB on a carrier frequency subject to CCA.

Table 12.3A.1.4-1: $T_{evaluate,SLSS_CCA}$ when SyncRef UE is transmitting S-SSB on a carrier subject to CCA and is used as synchronization reference source

SL-DRX cycle[Note 1] [ms]	$T_{evaluate,SLSS_CCA}$ [ms]
No SL-DRX	(4 + L_{SLSS}) x S-SSB periods
SL-DRX cycle ≤ 160	(4 + L_{SLSS}) x S-SSB periods
SL-DRX cycle > 160	(4 + L_{SLSS}) x SL-DRX cycle
NOTE 1: If multiple SL-DRX cycles are configured for SL UE, the SL-DRX cycle in the requirement is the shortest of all the configured SL-DRX cycles. When the shortest SL-DRX cycle UE used changes, the requirements do not apply to the time of transition.	
NOTE 2: L_{SLSS} is the number of unavailable S-SSB period during $T_{evaluate,SLSS_CCA}$ due to the CCA failures; where $L_{SLSS} \leq L_{SLSS,\ max}$ and $L_{SLSS,\ max} = 4$.	

The UE shall initiate the procedure for selection/reselection of different synchronization reference source as defined in TS 38.331 [2] when the requirements cannot be met due to that L_{SLSS} exceeding $L_{SLSS,\ max}$ during $T_{evaluate,SLSS_CCA}$.

If higher layer filtering for PSBCH-RSRP measurements is pre-configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the selected SyncRef UE as defined in TS 38.331 [2] used to derive transmission timing for sidelink communication:

- PSBCH-RSRP related side conditions given in clause 12.4 for a corresponding Band are fulfilled,
  - sidelink S-SSB_RP and S-SSB Ês/Iot according to annex B. 4 for a corresponding Band are fulfilled.

12.4 Selection / Reselection of V2X Synchronization Reference Source

The requirements defined in this clause do not apply to the UEs that do not support transmission and reception of SLSS.

A SyncRef UE is considered to be detectable when

- PSBCH-RSRP related side conditions given in clause 10 are fulfilled for a corresponding Band,
- S-SSB_RP and S-SSB Ês/Iot according to annex B.4.3 for a corresponding Band are fulfilled.

When GNSS synchronization reference source is configured as the highest priority and

- UE is synchronized to GNSS directly,
  - UE shall not drop any V2X SLSS and data transmission for the purpose of selection/reselection to the SyncRef UE.
- UE is synchronized to a SyncRef UE that is synchronized to GNSS directly or in-directly,
  - UE shall not drop any V2X data transmission for the purpose of selection/reselection to the SyncRef UE. The UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE_V2X}$ seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 38.331 [2]. $T_{detect,SyncRef\ UE_V2X}$ is defined as 1.6 seconds at S-SSB Ês/Iot ≥ 0 dB, provided that the UE is allowed to drop a maximum of 30% of its SLSS transmissions during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection / reselection to the SyncRef UE.

- in other case
  - When UE is in non-SL-DRX
    - The UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE_V2X}$ seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 38.331 [2]. $T_{detect,SyncRef\ UE_V2X}$ is defined as 8 seconds at S-SSB $\hat{E}s/Iot \geq 0$ dB, provided that the UE is allowed to drop a maximum of 6 % of its V2X data and SLSS transmissions during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection / reselection to the SyncRef UE.
    - UE is allowed to drop up to 2 slots of its V2X data reception per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its V2X data reception during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection / reselection to the SyncRef UE.
  - When UE is in SL-DRX
    - UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE_V2X}$ seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 38.331 [2]. $T_{detect,SyncRef\ UE_V2X}$ is defined as 8 seconds at S-SSB $\hat{E}s/Iot \geq 0$ dB, provided that the V2X UE is allowed to drop a maximum of 6 % of its V2X data and SLSS transmissions for the purpose of selection / reselection to the SyncRef UE.
    - UE is allowed to drop up to 2 slots of its V2X data reception per PSBCH monitoring occasion and UE is allowed to drop at most an aggregated window of 24 ms of its V2X data reception during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection / reselection to the SyncRef UE.
    - The UE is allowed to extend $T_{detect,SyncRef\ UE_V2X}$ to max(4 x 50 SL-DRX cycle length, 8 s) when the following conditions are satisfied over an evaluation period $T_{evaluate,SLSS}$ in clause 12.3.1.1 if an NR cell is used as synchronization reference source, or $T_{evaluate,SLSS}$ in clause 12.3.1.2 if an EUTRA cell is used as synchronization reference source, or $T_{evaluate,SLSS}$ in clause 12.3.1.4 if an SLSS is used as synchronization reference source. If multiple SL-DRX cycles are configured, the SL-DRX cycle length is the longest one.
    - SS-RSRP is larger than *syncTxThreshOoC*.

When serving cell/PCell synchronization reference source is configured as the highest priority,

- When UE is in non-SL-DRX
  - UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE_V2X}$ seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 38.331 [2]. $T_{detect,SyncRef\ UE_V2X}$ is defined as 8 seconds at SCH Es/Iot ≥ 0 dB, provided that the V2X UE is allowed to drop a maximum of 6 % of its V2X data and SLSS transmissions for the purpose of selection / reselection to the SyncRef UE.
  - UE is allowed to drop up to 2 slots of its V2X data reception per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its V2X data reception during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection / reselection to the SyncRef UE.
- When UE is in SL-DRX
  - The UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE_V2X}$ seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 38.331 [2]. $T_{detect,SyncRef\ UE_V2X}$ is defined as 8 seconds at SCH Es/Iot ≥ 0 dB, provided that the UE is allowed to drop its V2X data and SLSS transmissions at most in an aggregated window of 480ms during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection / reselection to the SyncRef UE.
  - UE is allowed to drop up to 2 slots of its V2X data reception per PSBCH monitoring occasion and UE is allowed to drop at most an aggregated window of 24 ms of its V2X data reception during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection / reselection to the SyncRef UE.
  - The UE is allowed to extend $T_{detect,SyncRef\ UE_V2X}$ to max(4 x 50 SL-DRX cycle length, 8 s) when the following conditions are satisfied over an evaluation period $T_{evaluate,SLSS}$ in clause 12.3.1.1 if an NR cell is used as synchronization reference source, or $T_{evaluate,SLSS}$ in clause 12.3.1.2 if an EUTRA cell is used as synchronization reference source, or $T_{evaluate,SLSS}$ in clause 12.3.1.4 if an SLSS is used as synchronization reference source. If multiple SL-DRX cycles are configured, the SL-DRX cycle length is the longest one.

- SS-RSRP is larger than *syncTxThreshOoC*.

UE shall be capable of performing PSBCH-RSRP measurements for 3 identified intra-frequency SyncRef UE with the measurement period of $T_{measure,PSBCH-RSRP}$ in table 12.4-1. It is assumed that the SyncRef UE do not drop or delay any SLSS transmission within the measurement period. Otherwise, the measurement period may be extended.

Table 12.4-1: PSBCH-RSRP measurement period for intra-frequency SyncRef UE

SL-DRX cycle[Note 1] [ms]	$T_{measure,PSBCH-RSRP}$ [ms]
No SL-DRX	320
SL-DRX cycle ≤ 160 ms	320
SL-DRX cycle > 160 ms	2 x SL-DRX cycle
NOTE 1: If multiple SL-DRX cycles are configured, the SL-DRX cycle is the shortest one.	

When UE is synchronized to GNSS directly, before selection / reselection of the new synchronization reference source UE shall evaluate the GNSS synchronization source reliability for at least 20 seconds before changing the synchronization reference from GNSS to another synchronization reference source. UE shall be always synchronized to GNSS directly during the evaluation of GNSS synchronization source reliability.

12.4A Selection / Reselection of Sidelink Synchronization Reference Source with CCA

The requirements defined in this clause do not apply to the UEs that do not support transmission and reception of SLSS.

A SyncRef UE is considered to be detectable when

- PSBCH-RSRP related side conditions given in clause 10 are fulfilled for a corresponding Band,
- S-SSB_RP and S-SSB Ês/Iot according to annex B.4.3 for a corresponding Band are fulfilled.

When GNSS synchronization reference source is configured as the highest priority and

- UE is synchronized to GNSS directly,
  - UE shall not drop any sidelink SLSS and data transmission for the purpose of selection/reselection to the SyncRef UE.
- UE is synchronized to a SyncRef UE that is synchronized to GNSS directly or in-directly,
  - UE shall not drop any sidelink data transmission for the purpose of selection/reselection to the SyncRef UE. The UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE_V2X_CCA}$ seconds if the SyncRef UE meets the selection/reselection criterion defined in TS 38.331[2] and all S-SSB periods selected for SyncRefUE identification are available during the $T_{detect,SyncRef\ UE_V2X_CCA}$ seconds. $T_{detect,SyncRef\ UE_V2X_CCA}$ is defined as 1.6 seconds at S-SSB Ês/Iot ≥ 0 dB, provided that the UE is allowed to drop a maximum of 30% of its SLSS transmissions during $T_{detect,SyncRef\ UE_V2X_CCA}$ for the purpose of selection/reselection to the SyncRef UE.
- For other cases
  - When UE is in non-SL-DRX
    - The UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE_V2X_CCA}$ seconds if the SyncRef UE meets the selection/reselection criterion defined in TS 38.331[2] and all S-SSB periods selected for SyncRefUE identification are available during the $T_{detect,SyncRef\ UE_V2X_CCA}$ seconds. $T_{detect,SyncRef\ UE_V2X_CCA}$ is defined as 8 seconds at S-SSB Ês/Iot ≥ 0 dB, provided that the UE is allowed to drop its sidelink data and SLSS transmissions at most in an aggregated window of 480 ms during $T_{detect,SyncRef\ UE_V2X_CCA}$ for the purpose of selection/reselection to the SyncRef UE. Only if UE additionally drops a maximum of 30% of its SLSS transmission, the UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T'_{detect,SyncRef\ UE_V2X_CCA}$ seconds, when all S-SSB periods selected for SyncRefUE identification are available during the $T'_{detect,SyncRef\ UE_V2X_CCA}$ seconds. $T'_{detect,SyncRef\ UE_V2X_CCA}$ is defined as 1.6 seconds at S-SSB Ês/Iot ≥ 0 dB.

- UE is allowed to drop up to 2 slots of its sidelink data reception per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its sidelink data reception during $T_{detect,SyncRef\ UE_V2X_CCA}$ for the purpose of selection/reselection to the SyncRef UE.

- When UE is in SL-DRX

  - UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE_V2X_CCA}$ seconds if the SyncRef UE meets the selection/reselection criterion defined in TS 38.331[2] and all S-SSB periods selected for SyncRefUE identification are available during the $T_{detect,SyncRef\ UE_V2X_CCA}$ seconds. $T_{detect,SyncRef\ UE_V2X_CCA}$ is defined as 8 seconds at S-SSB $\hat{E}s/Iot \geq 0$ dB, provided that the sidelink UE is allowed to drop a maximum of 6 % of its sidelink data and SLSS transmissions for the purpose of selection/reselection to the SyncRef UE. Only if UE additionally drops a maximum of 30% of its SLSS transmission, the UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T'_{detect,SyncRef\ UE_V2X_CCA}$ seconds, when all S-SSB periods selected for SyncRefUE identification are available during the $T'_{detect,SyncRef\ UE_V2X_CCA}$ seconds. $T'_{detect,SyncRef\ UE_V2X_CCA}$ is defined as 1.6 seconds at S-SSB $\hat{E}s/Iot \geq 0$ dB.

  - UE is allowed to drop up to 2 slots of its sidelink data reception per PSBCH monitoring occasion and UE is allowed to drop at most an aggregated window of 24 ms of its sidelink data reception during $T_{detect,SyncRef\ UE_V2X_CCA}$ for the purpose of selection/reselection to the SyncRef UE.

  - The UE is allowed to extend $T_{detect,SyncRef\ UE_V2X_CCA}$ to max(4 x 50 SL-DRX cycle length, 8 s) when the following conditions are satisfied over an evaluation period $T_{evaluate,SLSS}$ in clause 12.3.1.1 if an NR cell is used as synchronization reference source, or $T_{evaluate,SLSS}$ in clause 12.3.1.2 if an EUTRA cell is used as synchronization reference source, or $T_{evaluate,SLSS_CCA}$ in clause 12.3A.1.4 if an SLSS is used as synchronization reference source. If multiple SL-DRX cycles are configured, the SL-DRX cycle length is the longest one.

  - SS-RSRP is larger than *syncTxThreshOoC*.

When serving cell/PCell synchronization reference source is configured as the highest priority,

- When UE is in non-SL-DRX

  - UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE_V2X_CCA}$ seconds if the SyncRef UE meets the selection/reselection criterion defined in TS 38.331[2] and all S-SSB periods selected for SyncRefUE identification are available during the $T_{detect,SyncRef\ UE_V2X_CCA}$ seconds. $T_{detect,SyncRef\ UE_V2X_CCA}$ is defined as 8 seconds at SCH Es/Iot ≥ 0 dB, provided that the sidelink UE is allowed to drop a maximum of 6 % of its sidelink data and SLSS transmissions for the purpose of selection/reselection to the SyncRef UE. When GNSS is not available and only if UE additionally drops a maximum of 30% of its SLSS transmission, the UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T'_{detect,SyncRef\ UE_V2X_CCA}$ seconds, when all S-SSB periods selected for SyncRefUE identification are available during the $T'_{detect,SyncRef\ UE_V2X_CCA}$ seconds. $T'_{detect,SyncRef\ UE_V2X_CCA}$ is defined as 1.6 seconds at S-SSB $\hat{E}s/Iot \geq 0$ dB.

  - UE is allowed to drop up to 2 slots of its sidelink data reception per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its sidelink data reception during $T_{detect,SyncRef\ UE_V2X_CCA}$ for the purpose of selection/reselection to the SyncRef UE.

- When UE is in SL-DRX

  - The UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE_V2X_CCA}$ seconds if the SyncRef UE meets the selection/reselection criterion defined in TS 38.331[2] and all S-SSB periods selected for SyncRefUE identification are available during the $T_{detect,SyncRef\ UE_V2X_CCA}$ seconds. $T_{detect,SyncRef\ UE_V2X_CCA}$ is defined as 8 seconds at SCH Es/Iot ≥ 0 dB, provided that the UE is allowed to drop its sidelink data and SLSS transmissions at most in an aggregated window of 480 ms during $T_{detect,SyncRef\ UE_V2X_CCA}$ for the purpose of selection/reselection to the SyncRef UE. When GNSS is not available and only if UE additionally drops a maximum of 30% of its SLSS transmission, the UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T'_{detect,SyncRef\ UE_V2X_CCA}$ seconds, when all S-SSB periods selected for SyncRefUE identification are available during the $T'_{detect,SyncRef\ UE_V2X_CCA}$ seconds. $T'_{detect,SyncRef\ UE_V2X_CCA}$ is defined as 1.6 seconds at S-SSB $\hat{E}s/Iot \geq 0$ dB.

UE is allowed to drop up to 2 slots of its sidelink data reception per PSBCH monitoring occasion and UE is allowed to drop at most an aggregated window of 24 ms of its sidelink data reception during $T_{detect,SyncRef\ UE_V2X_CCA}$ for the purpose of selection/reselection to the SyncRef UE.

- The UE is allowed to extend $T_{detect,SyncRef\ UE_V2X_CCA}$ to max(4 x 50 SL-DRX cycle length, 8 s) when the following conditions are satisfied over an evaluation period $T_{evaluate,SLSS}$ in clause 12.3.1.1 if an NR cell is used as synchronization reference source, or $T_{evaluate,SLSS}$ in clause 12.3.1.2 if an EUTRA cell is used as synchronization reference source, or $T_{evaluate,SLSS_CCA}$ in clause 12.3A.1.4 if an SLSS is used as synchronization reference source. If multiple SL-DRX cycles are configured, the SL-DRX cycle length is the longest one.

- SS-RSRP is larger than *syncTxThreshOoC*.

The UE shall be capable of performing PSBCH-RSRP measurements for 3 identified intra-frequency SyncRef UE with the measurement period of $T_{measure,PSBCH\text{-}RSRP_CCA}$ in table 12.4A-1. It is assumed that the SyncRef UE do not drop or delay any SLSS transmission within the measurement period. Otherwise, the measurement period may be extended.

Table 12.4A-1: PSBCH-RSRP measurement period for intra-frequency SyncRef UE

SL-DRX cycle[Note 1] [ms]	$T_{measure,PSBCH\text{-}RSRP_CCA}$[Note 3] [ms]
No SL-DRX	$(2 + L_{PSBCH})$*160
SL-DRX cycle ≤ 160	$(2 + L_{PSBCH})$*160
SL-DRX cycle > 160	$(2 + L_{PSBCH})$*SL-DRX cycle
NOTE 1: If multiple SL-DRX cycles are configured, the SL-DRX cycle is the shortest one.	
NOTE 2: L_{PSBCH} is the number of S-SSB periods in which the SLSS is not available due to CCA failures during $T_{measure,PSBCH\text{-}RSRP_CCA}$, where $L_{PSBCH} \leq L_{PSBCH,max}$ and $L_{PSBCH,max} = 2$.	
NOTE 3: Upon L_{PSBCH} exceeding $L_{PSBCH,max}$, the UE shall not reselect to the measured candidate SyncRef UE based on the measurement result.	

When UE is synchronized to GNSS directly, before selection/reselection of the new synchronization reference source UE shall evaluate the GNSS synchronization source reliability for at least 20 seconds before changing the synchronization reference from GNSS to another synchronization reference source. UE shall be always synchronized to GNSS directly during the evaluation of GNSS synchronization source reliability.

12.5 L1 SL-RSRP measurements

12.5.1 Introduction

This clause contains the measurement requirements related to resource reselection and resource pre-emption of the UE capable of V2X sidelink communication.

12.5.2 SL-RSRP measurements

The UE physical layer shall be capable of performing the L1 SL-RSRP measurements on the carrier operating V2X sidelink communication for determining the subset of resources to be excluded in PSSCH resource selection in sidelink transmission mode 2 based on network configuration or pre-configuration. The L1 SL-RSRP measurement period corresponds to one slot and the measurement shall meet the L1 SL-RSRP measurement accuracy requirement in Clause 10. After resource (re-)selection procedure, re-evaluation is performed on the reserved resources by L1 SL-RSRP measurements before transmission of SCI with reservation when the conditions specified in TS 38.214 [26] are satisfied.

When the pre-emption mechanism is enabled for the resource pool that UE is monitoring and selecting resource from, after UE selects from the resource not excluded based on L1 SL-RSRP measurement procedure, the UE shall be capable of triggering reselection of already signalled resource(s) as a resource reservation when the conditions specified in TS 38.214 [26] are satisfied.

When partial sensing mechanism is enabled for the resource pool that UE is monitoring and selecting resource from, the UE shall be capable of performing the L1 SL-RSRP measurements on the sensing periods specified in TS 38.214 [26].

When SL-DRX is enabled, the UE shall be capable of performing the L1 SL-RSRP measurements and select resource during SL-DRX active time as specified in TS 38.214 [26].

12.6 Congestion Control measurements

The UE shall be capable of estimating the channel busy ratio for one or more transmission pools indicated by higher layers in TS 38.331 [2], based on SL-RSSI measurements provided by the physical layer.

When no sidelink transmissions occur, the UE physical layer shall perform a single-shot SL-RSSI measurement for each sub-channel included in all the slots configured as transmission pools.

The SL-RSSI measurement performed according to this clause shall meet the SL-RSSI measurement accuracy requirements defined in clause 10.

The UE shall perform channel busy ratio (CBR) measurement based on SL-RSSI measurements as described in TS 38.215 [4].

12.7 Interruption

12.7.1 Interruptions to WAN due to V2X Sidelink Communication

This clause contains the requirements related to the interruptions on the PCell/serving cell due to V2X sidelink communication.

A UE capable of V2X sidelink communication may indicate its interest (initiation or termination) in V2X sidelink communication to the connected gNodeB using IE *SidelinkUEInformationNR* in TS 38.331 [2].

The UE is allowed an interruption of up to the duration shown in table 12.7.1-1 on the PCell/serving cell during the RRC reconfiguration procedure that includes the V2X sidelink communication configuration message *SL-ConfigDedicatedNR* in TS 38.331 [2] (setup and release). This interruption is for both uplink and downlink of the PCell/serving cell.

Table 12.7.1-1: Interruption length at V2X RRC reconfiguration

μ	NR Slot length (ms)	Interruption length (number of slots)
0	1	2
1	0.5	3
2	0.25	5
3	0.125	9

12.7.2 V2X Sidelink Communication Dropping due to synchronization source change

This clause contains the requirements related to the interruptions on the V2X sidelink communication due to synchronization source change.

For NR V2X UE not supporting gNB/eNB as synchronization reference source, UE is allowed to drop LTE and NR V2X SL transmission or reception for up to 1ms when synchronization source is changed, where the drop of LTE V2X SL transmission or reception applies only to in-device coexistence scenario in TS 38.213 [3]:

- From GNSS
  - to syncRef UE that is synchronized to GNSS directly/in-directly
  - to syncRef UE that has the lowest priority
- From syncRef UE that is synchronized to GNSS directly/in-directly
  - to GNSS

    - to syncRef UE that has the lowest priority
- From syncRef UE that has the lowest priority
    - to GNSS
    - to syncRef UE that is synchronized to GNSS directly/in-directly
    - to syncRef UE that has the lowest priority

For NR V2X UE supporting gNB/eNB as synchronization reference source, UE is allowed to drop LTE and NR V2X SL transmission or reception for up to 1 ms when synchronization source is changed, where the drop of LTE V2X SL transmission or reception applies only to in-device coexistence scenario in TS38.213 [3]:

- From GNSS
    - to syncRef UE that is synchronized to GNSS directly/in-directly
    - to gNB/eNB
    - to syncRef UE that is synchronized to gNB/eNB directly
    - to syncRef UE that is synchronized to gNB/eNB in-directly
    - to syncRef UE that has the lowest priority
- From syncRef UE that is synchronized to GNSS directly/in-directly
    - to GNSS
    - to gNB/eNB
    - to syncRef UE that is synchronized to gNB/eNB directly
    - to syncRef UE that is synchronized to gNB/eNB in-directly
    - to syncRef UE that has the lowest priority
- From gNB or eNB
    - to GNSS
    - to syncRef UE that is synchronized to GNSS directly/in-directly
    - to eNB or gNB
    - to syncRef UE that is synchronized to gNB or eNB directly
    - to syncRef UE that is synchronized to gNB or eNB in-directly
    - to syncRef UE that has the lowest priority
- From syncRef UE that is synchronized to gNB/eNB directly
    - to GNSS
    - to syncRef UE that is synchronized to GNSS directly/in-directly
    - to gNB/eNB
    - to syncRef UE that is synchronized to gNB/eNB directly
    - to syncRef UE that is synchronized to gNB/eNB in-directly
    - to syncRef UE that has the lowest priority
- From syncRef UE that is synchronized to gNB/eNB in-directly
    - to GNSS

- to syncRef UE that is synchronized to GNSS directly/in-directly
- to gNB/eNB
- to syncRef UE that is synchronized to gNB/eNB directly
- to syncRef UE that is synchronized to gNB/eNB in-directly
- to syncRef UE that has the lowest priority

- From syncRef UE that has the lowest priority
  - to GNSS
  - to syncRef UE that is synchronized to GNSS directly
  - to syncRef UE that is synchronized to GNSS in-directly
  - to gNB/eNB
  - to syncRef UE that is synchronized to gNB/eNB directly
  - to syncRef UE that is synchronized to gNB/eNB in-directly
  - to syncRef UE that has the lowest priority

UE is allowed to interruption any V2X sidelink signals including PSSCH, PSCCH, PSBCH, PSFCH and SLSS signals.

12.7.3 Interruptions to WAN due to switching between E-UTRA V2X Sidelink and NR V2X Sidelink

This sub-clause contains the requirements related to the interruptions on the PCell/serving cell due to switching between E-UTRA V2X sidelink and NR V2X sidelink transmissions on a dedicated carrier. It is applicable for UE capable of both NR V2X sidelink and E-UTRA V2X sidelink transmissions in TDM-ed manner.

When a UE capable of switching between E-UTRA V2X sidelink and NR V2X sidelink, the UE is allowed an interruption of up to the duration shown in table 12.7.3-1 on the PCell/serving cell during the E-UTRA V2X sidelink and NR V2X sidelink switch.

This interruption is for both uplink and downlink of the PCell/serving cell.

Table 12.7.3-1: Interruption length due to switching between E-UTRA V2X and NR V2X

μ	Slot length (ms)	Interruption length (number of slots)
0	1	2
1	0.5	2
2	0.25	2
3	0.125	3

12.7.4 Interruptions to WAN at transitions between active and non-active during SL-DRX

Interruption on PCell/serving cell if configured due to V2X transitions between active and non-active during SL-DRX are allowed with up to 1% probability of missed ACK/NACK when the configured SL-DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured SL-DRX cycle is 640 ms or longer. When multiple SL-DRX cycles are configured, the shortest SL-DRX cycle is applied. Each interruption shall not exceed X slot as defined in table 12.7.4-1.

Table 12.7.4-1: Interruption length X at transition between active and non-active during SL-DRX

μ	NR Slot length (ms)	Interruption length X (slots)	
		Sync	Async

0	1	1	2
1	0.5	1	2
2	0.25	3	

For SL-DRX active to inactive state transition, when the UE is in non-DRX or DRX on WAN and V2X is in sidelink resource allocation mode 2, the interruptions in this clause shall not apply when one of the following conditions is met:

- While receiving paging,
- While receiving system information.

In addition, for SL-DRX active to inactive state transition, when the UE is in non-DRX or DRX on WAN and V2X is in sidelink resource allocation mode 2 and SL DRX cycle is less than 320 ms, the interruptions in this clause shall not apply when one of the following conditions is met:

- T310 timer is running for RLF on PCell
- performing candidate beam detection on PCell/serving cell as specfied in section 8.5.5. and 8.5.6

During the U2N relay operation as defined in clause 5.8.14 of TS 38.331 [2], the interruption requirements defined in this clause apply only to the sidelink relay UE.

During the multipath relay operation [2], the interruption requirements defined in this clause apply to the SL remote UE or the SL relay UE.

12.7.5 Interruptions to V2X sidelink at transitions between active and non-active during DRX

Interruption on V2X sidelink if configured due to PCell transitions between active and non-active during DRX are allowed with up to 1% probability of missed ACK/NACK when the configured DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured DRX cycle is 640 ms or longer. It is only applied when HARQ process on V2X sidelink is supported. Each interruption shall not exceed X slot as defined in table 12.7.5-1.

Table 12.7.5-1: Interruption length X at transition between active and non-active during DRX

μ	NR V2X Slot length (ms)	Interruption length X (slots)	
		Sync	Async
0	1	1	2
1	0.5	1	2
2	0.25	3	

12.7.6 Interruptions to V2X sidelink due to Active BWP switching Requirement

This clause contains the requirements related to the interruptions on the V2X sidelink due to BWP switch in FDM based intra-band concurrent V2X operation.

The requirements in clause 8.2.2.2.5 shall apply. The interrupted X slot is defined in table 12.7.6-1.

Table 12.7.6-1: Interruption length X

μ	NR V2X Slot length (ms)	Interruption length X (slots)
0	1	1
1	0.5	1
2	0.25	3

NOTE: No sidelink communication happens during BWP switching delay period for TDM based intra-band concurrent operation.

12.7.7 Interruptions to WAN due to SyncRef UE detection and/or Sensing during SL DRX off duration

This sub-clause contains the requirements related to the interruptions on the PCell/serving cell due to SyncRef UE detection and/or Sensing during SL DRX off duration.

The requirements in clause 12.7.4 shall apply.

12.7.8 Interruptions at NR sidelink discovery configuration

This clause contains the requirements related to the interruptions on the PCell/serving cell due to NR sidelink discovery.

A UE capable of NR sidelink discovery may indicate its interest (initiation or termination) in NR sidelink discovery to the connected gNodeB using IE *SidelinkUEInformationNR* in TS 38.331 [2].

The UE is allowed an interruption of up to the duration shown in Table 12.7.8-1 on the PCell/serving cell during the RRC reconfiguration procedure that includes the NR sidelink discovery configuration message *sl-DiscConfig* in TS 38.331 [2] (setup and release). This interruption is for both uplink and downlink of the PCell/serving cell.

12.7.8-1: Interruption length at NR sidelink discovery configuration

μ	NR Slot length (ms)	Interruption length (number of slots)
0	1	2
1	0.5	3
2	0.25	5
3	0.125	9

12.7.9 Interruptions to WAN due to sidelink carrier addition/release

This sub-clause contains the requirements related to the interruptions on the PCell/serving cell due to sidelink component carrier addition/release. It is applicable for UE is in sidelink resource allocation mode 2.

A UE capable of V2X sidelink communication may indicate its interest (initiation or termination) in V2X sidelink communication to the connected gNodeB using IE *SidelinkUEInformationNR* in TS38.331[2].

The UE is allowed an interruption of up to the duration shown in table 12.7.9-1 on the PCell/serving cell when any number of sidelink component carriers is added or released. This interruption is for both uplink and downlink of the PCell/serving cell.

Table 12.7.9-1: Interruption length due to sidelink component carrier addition/release

μ	NR Slot length (ms)	Interruption length (number of slots)
0	1	2
1	0.5	3
2	0.25	5
3	0.125	9

For sidelink component carrier addition/release, when the UE is in RRC_IDLE/RRC_INACTIVE mode, the interruptions in this clause shall not apply when one of the following conditions is met:

- While the UE is receiving paging,
- While the UE is receiving system information.

12.8 Reliability of GNSS signal

This clause contains requirements regarding reliability of GNSS signal for the UE capable of V2X sidelink communication under the following additional condition:

- The UE is configured or pre-configured with parameters for enabling the UE to acquire the GNSS synchronization.

If UE considers GNSS is a reliable synchronization reference, the UE shall meet timing accuracy requirement as specified in clause 12.2 and frequency accuracy requirement as specified in clause 6.4E of TS 38.101-1 [18]. Otherwise, the UE shall be capable to select another synchronization reference source.

12.9 Scheduling availability

12.9.1 Scheduling availability of UE switching between E-UTRA sidelink and NR sidelink

This clause contains the restrictions on the scheduling availability for V2X sidelink due to switching between E-UTRA V2X sidelink and NR V2X sidelink transmission on a dedicated carrier. For the NR V2X sidelink, the assumed number of configured symbols in a slot is 14.

When switch from E-UTRA V2X sidelink to NR V2X sidelink occurs in NR slot ‘n’,

- UE is not expected to transmit or receive on NR V2X sidelink on the slot ‘n’.

When switch from NR V2X sidelink to E-UTRA V2X sidelink occurs in NR slot ‘n-1’,

- UE is not expected to transmit or receive on NR V2X sidelink on the slot ‘n-1’.

When switch from NR V2X sidelink to E-UTRA V2X sidelink occurs in E-UTRA subframe ‘n’,

- UE is not expected to transmit or receive on E-UTRA V2X sidelink on the subframe ‘n’.

When switch from E-UTRA V2X sidelink to NR V2X sidelink occurs in E-UTRA subframe ‘n-1’,

- UE is not expected to transmit or receive E-UTRA on V2X sidelink on the subframe ‘n-1’.

12.9.2 Scheduling availability of UE switching between Uu uplink and V2X sidelink

This clause contains the restrictions on the scheduling availability for V2X sidelink due to switching between Uu uplink and V2X sidelink. For NR V2X sidelink, the assumed number of configured symbols in a slot is 14.

When switch from Uu uplink slot to V2X sidelink slot occurs in sidelink slot ‘n’,

- UE is not expected to transmit or receive on V2X sidelink on the sidelink slot ‘n’.

When switch from V2X sidelink slot to Uu uplink slot occurs in sidelink slot ‘n-1’,

- UE is not expected to transmit or receive on V2X sidelink on the sidelink slot ‘n-1’.

When switch from V2X sidelink slot to Uu uplink slot occurs in Uu slot ‘n’,

- UE is not expected to transmit uplink or receive downlink on the Uu slot ‘n’.

When switch from Uu uplink slot to V2X sidelink slot occurs in Uu slot ‘n-1’,

- UE is not expected to transmit uplink or receive downlink on the Uu slot ‘n-1’.

- UE is not expected to transmit uplink or receive downlink on the Uu slot ‘n-1’.

12.10 Selection / Reselection of relay UE

12.10.1 Introduction

This section contains the requirements related to selection and reselection of relay UE.

The requirements apply for the selection and reselection of candidate relay UEs that are transmitting relay discovery signals within the resource pool as configured for the remote UE. The requirements are applicable to the following UE capabilities [2]:

- a remote UE that communicates with the network via a UE-to-network (U2N) relay UE or
- a remote UE that communicates with another via a UE-to-UE (U2U) relay UE.

12.10.2 Selection / Reselection of relay UE

For a remote UE configured by upper layer for relay operation, the remote UE shall search for candidate relay UEs for selection and/or reselection every discovery period which is determined by resource reservation period or SPS transmission periodicity configured by network.

If the remote UE has a selected sidelink relay UE, then the remote UE shall measure the SD-RSRP or SL-RSRP of the selected relay once in every four discovery periods and evaluate if it meets the relay selection criterion as defined in TS 38.331 [2] (clause 5.8.15.3 for U2N relay and clause 5.8.17.3 for U2U relay).

The remote UE shall measure SD-RSRP or SL-RSRP of the candidate relay UEs every $T_{measure, SL_Relay_Intra}$ for relay UEs that are detected and measured according to the measurement rules.

For intra-frequency relay UEs that are detected, but that has not been selected or reselected to, the remote UE shall be capable of evaluating that the intra-frequency relay UE has met selection or reselection criterion defined in TS 38.331 [2] (clause 5.8.15.3 for U2N relay and clause 5.8.17.3 for U2U relay) within $T_{evaluate, SL_Relay_Intra}$ as specified in table 12.10.2-1.

The minimum requirements are required to meet when the selected and candidate relay UEs are transmitting relay discovery message every discovery period.

Table 12.10.2-1: $T_{measure, SL_Relay_Intra}$ and $T_{evaluate, SL_Relay_Intra}$

Discovery Period [s]	$T_{measure,SL_Relay_Intra}$ [s] (number of discovery periods)	$T_{evaluate, SL_Relay_Intra}$ [s] (number of discovery periods)
0.04≤Discovery period≤10.24	Note 1 (4)	Note 1 (16)
NOTE 1: Time depends upon the discovery period which is resource reservation period (in mode 2) or SPS transmission periodicity (in mode 1). NOTE 2: SL-RSRP or SD-RSRP can be derived from PSCCH-DMRS and/or PSSCH-DMRS.		

12.11 Component Carrier Addition and Release Delay for Sidelink Carrier Aggregation

Requirements in this clause are applicable to UE supporting NR sidelink carrier aggregation.

For UE configured in sidelink resource allocation mode 2, the delay within which the UE shall accomplish the NR sidelink component carrier addition/release is up to UE implementation.

12.12 Selection / Reselection of Synchronization Reference Source for NR SL Carrier Aggregation

Requirements in this clause are applicable to UE supporting NR sidelink carrier aggregation.

When the UE is synchronized to a SyncRef UE in a carrier and required only to search other SyncRef UEs in the synchronized carrier, the UE shall be able to identify a newly detectable NR SL SyncRef UE within $T_{detect,SyncRef\ UE_V2X}$ if the SyncRef UE meets the selection/reselection criterion defined in TS 38.331 [2]. The UE shall be capable of performing PSBCH-RSRP measurements for 3 identified NR SL SyncRef UE with the measurement period of $T_{measure,PSBCH\text{-}RSRP}$ in table 12.4-1.

When the synchronization reference source for NR sidelink carrier aggregation is lost and UE has to search SyncRef UE on the aggregated carriers which are configured as synchronization carrier, the UE shall be able to identify a newly detectable NR SL SyncRef UE within $N \times T_{detect,SyncRef\ UE_V2X}$ if the SyncRef UE meets the selection/reselection criterion defined in TS 38.331 [2]. The UE shall be capable of performing PSBCH-RSRP measurements for 3 identified NR SL SyncRef UE per carrier with the measurement period of $N \times T_{measure,PSBCH\text{-}RSRP}$. N is the number of aggregated carriers configured as synchronization carrier.

It is assumed that the identified NR SL SyncRef UE does not drop or delay any SLSS transmission within the measurement period. Otherwise, the measurement period may be extended.

When GNSS synchronization reference source is configured as the highest priority and

- UE is synchronized to a SyncRef UE that is synchronized to GNSS directly or in-directly,
  - The value of $T_{detect,SyncRef\ UE_V2X}$ is as 1.6 seconds at S-SSB Es/Iot $\geq$0 dB, provided that the UE is allowed to drop a maximum of 30% of its SLSS transmissions on each carrier operating NR SL sidelink communication during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection / reselection to the SyncRef UE.
- in other case:
- When UE is in non-SL-DRX
  - The value of $T_{detect,SyncRef\ UE_V2X}$ is as 8 seconds at S-SSB Es/Iot $\geq$0 dB, provided that the UE is allowed to drop a maximum of 6% of its SLSS transmissions on each carrier operating SL sidelink communication during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection/reselection to the SyncRef UE.
  - UE is allowed to drop up to 2 slots of its SL data reception on each carrier operating SL sidelink communication per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its SL data reception during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection/reselection to the SyncRef UE.
- When UE is in SL-DRX
  - The value of $T_{detect,SyncRef\ UE_V2X}$ is as 8 seconds at S-SSB Es/Iot $\geq$0 dB, provided that the UE is allowed to drop a maximum of 6% of its SLSS transmissions on each carrier operating SL sidelink communication during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection/reselection to the SyncRef UE.
  - UE is allowed to drop up to 2 slots of its SL data reception on each carrier operating SL sidelink communication per PSBCH monitoring occasion and UE is allowed to drop at most an aggregated window of 24 ms of its SL data reception during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection/reselection to the SyncRef UE.
  - The UE is allowed to extend $T_{detect,SyncRef\ UE_V2X}$ to max(4×50 SL-DRX cycle length, 8 s) when the following conditions are satisfied over an evaluation period $T_{evaluate,SLSS}$ in clause 12.3.1.1 if an NR cell is used as synchronization reference source, or $T_{evaluate,SLSS}$ in clause 12.3.1.2 if an EUTRA cell is used as synchronization reference source, or $T_{evaluate,SLSS}$ in clause 12.3.1.4 if an SLSS is used as synchronization reference source. If multiple SL-DRX cycles are configured, the SL-DRX cycle length is the longest one.
  - SS-RSRP is larger than *syncTxThreshOoC*.

When serving cell/PCell synchronization reference source is configured as the highest priority,

- When UE is in non-SL-DRX
  - The value of $T_{detect,SyncRef\ UE_V2X}$ is as 8 seconds at S-SSB Es/Iot $\geq$0 dB, provided that the UE is allowed to drop a maximum of 6% of its SLSS transmissions on each carrier operating NR sidelink communication during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection/reselection to the SyncRef UE.
  - UE is allowed to drop up to 2 slots of its SL data reception on each carrier operating NR SL sidelink communication per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its SL data reception during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection/reselection to the SyncRef UE.

- When UE is in SL-DRX

  - The value of $T_{detect,SyncRef\ UE_V2X}$ is as 8 seconds at S-SSB Es/Iot ≥0 dB, provided that the UE is allowed to drop a maximum of 6% of its SLSS transmissions on each carrier operating NR SL sidelink communication during $T_{detect,SyncRef\ UE_V2X}$ at most in an aggregated window of 480 ms during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection/reselection to the SyncRef UE.

  - UE is allowed to drop up to 2 slots of its SL data reception per PSBCH monitoring occasion and UE is allowed to drop at most an aggregated window of 24 ms of its SL data reception during $T_{detect,SyncRef\ UE_V2X}$ for the purpose of selection/reselection to the SyncRef UE.

  - The UE is allowed to extend $T_{detect,SyncRef\ UE_V2X}$ to max(4×50 SL-DRX cycle length, 8 s) when the following conditions are satisfied over an evaluation period $T_{evaluate,SLSS}$ in clause 12.3.1.1 if an NR cell is used as synchronization reference source, or $T_{evaluate,SLSS}$ in clause 12.3.1.2 if an EUTRA cell is used as synchronization reference source, or $T_{evaluate,SLSS}$ in clause 12.3.1.4 if an SLSS is used as synchronization reference source. If multiple SL-DRX cycles are configured, the SL-DRX cycle length is the longest one.

  - SS-RSRP is larger than *syncTxThreshOoC*.

12A NR Sidelink Measurements for Positioning

12A.1 Introduction

Clause 12A contains requirements for UE capable of V2X sidelink or 5G ProSe operation, which is also capable of performing SL positioning measurements defined in TS 38.215 [4], including SL RSTD, SL PRS-RSRP, SL Rx-Tx time difference, SL PRS-RSRPP measurements, SL AoA, and SL RTOA, provided that:

- The SL-PRS are received on NR PC5 interface within a single sidelink BWP on a single carrier,
- The UE is in any cell selection state or the UE is inside NG-RAN coverage while configured for SL positioning operation on a sidelink carrier, which is dedicated to only sidelink operation, and configured with only a PCell on WAN carrier, and
- The measuring UE is the location target UE or an anchor UE, and
- The UE is not required to monitor PSCCH, which is associated with SL-PRS in the same slot, outside the SL-DRX active time.

NOTE 1: Any cell selection state refers to a UE that is out of network coverage and is not associated with a serving cell on any carrier as defined in TS 38.304 [1].

NOTE 2: When a UE in RRC_CONNECTED state is performing transmissions and/or reception for SL positioning operation, the UE shall meet all the requirements specified in clause 9 assuming that UE has a dedicated RX/TX chain for the sidelink operation. Otherwise, the UE may interrup the SL positioning measurements in order to meet the measurement requirements specified in clause 9.

NOTE 3: When a UE in RRC_CONNECTED state is performing transmissions and/or reception for SL positioning operation, the UE shall meet all relevant requirements related to its WAN operation, assuming that UE has a dedicated RX/TX chain for the sidelink operation. Otherwise, the UE may interrup the SL positioning measurements or SL-PRS transmissions in order to meet the measurement requirements related to its WAN operation.

Prior to performing SL-PRS based measurements, the target UE may need to perform the discovery procedure to discover anchor UEs according to TS 38.305 [22].

12A.2 SL RSTD measurements

12A.2.1 Introduction

The requirements in clause 12A.2 apply for SL RSTD measurements of the first and additional paths.

The requirements in clause 12A.2 shall apply provided the UE has received a *RequestLocationInformation* message from LMF or another UE via SLPP specified in TS 38.355 [37] requesting the UE to measure and report SL RSTD measurements defined in TS 38.215 [4] based on SL-PRS.

12A.2.2 Requirements Applicability

The requirements in clause 12A.2 apply for periodic, aperiodic, and triggered SL RSTD measurements, provided:

- SL RSTD related side conditions given in clause 10.4A.2.2 for FR1 are fulfilled, for a corresponding Band.

12A.2.3 Measurement Capability

UE SL RSTD measurement capability is as indicated by the UE in:

SL-TDOA-ProvideCapabilities, according to TS 38.355 [37].

12A.2.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE reporting to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.

For UE reporting to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the transmitted STCH. The delay uncertainty is: 2 x TTI_{STCH} where TTI_{STCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

This measurement reporting delay excludes any delay caused by no SL resources for UE to send the measurement report.

The reported SL RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.4A.2.1.

The SL RSTD measurements performed and reported according to this section shall meet the SL RSTD measurement accuracy requirements in clause 10.4A.2.2, for each measured SL-PRS resource.

12A.2.5 Measurements Period Requirements

When the UE physical layer receives the last of *SL-TDOA-ProvideAssistanceData* and *SL-TDOA-RequestLocationInformation* from LMF or another UE via SLPP specified in TS 38.355 [37], the UE shall be able to perform multiple SL RSTD measurements based on SL-PRS from one or more other SL UEs (up to the UE capability specified in clause 12A.2.3), with each SL RSTD measurement based on SL-PRS from the reference UE and SL-PRS from another anchor UE, as defined in TS 38.215 [4]. The SL RSTD measurement for each anchor UE shall be performed during the measurement period $T_{SL\,RSTD,total}$ defined as:

$$T_{\text{SL RSTD,total}} = \sum_{s=1}^{S} T_{SL\,RSTD,effect,s} \ ,$$

where

S is the number of samples for each measured anchor link, defined below:

S = 1 for SL-PRS bandwidth>48 PRBs,

S = 4 for SL-PRS bandwidth≤48 PRBs, and

for each SL-PRS sample *s* of the target measured link, which is received within a slot where the UE receives SCI and the associated SL-PRS within its capabilities reported by UE via *maxNumOfActiveSL-PRS-ResourcesInOneSlot* and *maxNumOfSlotsWIthActiveSL-PRS-Resources* specified in TS 38.355 [37], $T_{SL\ RSTD,effect,s}$ is defined as:

$T_{SL\ RSTD,effect,s} = t_{s+1} - t_s$, for *s*<*S*, where t_{s+1} and t_s are the beginning of the first slot of SL-PRS sample *s+1* and SL-PRS sample *s*, respectively,

$T_{SL\ RSTD,effect,s} = T_{dur,s} + \Delta_{SLproc}$, for *s*=*S*,

$T_{dur,s}$ is the duration of the slot carrying SL-PRS sample *s* of the SL RSTD measurement,

Δ_{SLproc} is the processing time reported by the UE via *minTimeAfterEndofSlotCarryActiveSL-PRS-Resources* specified in TS 38.355 [37].

the time $T_{SL\ RSTD,total}$ starts from the first slot where the UE receives SCI and the associated SL-PRS within its capabilities reported by UE via *maxNumOfActiveSL-PRS-ResourcesInOneSlot* and *maxNumOfSlotsWIthActiveSL-PRS-Resources* specified in TS 38.355 [37].

The SL RSTD measurement period ends after the UE has measured SL-PRS resources from multiple anchor UEs including reference UE and one or more other anchor UEs.

A UE may drop one or more SL-PRS measurement samples if the number of active slots or the number of active resources per slot for the ongoing SL-PRS measurement exceed the UE capabilities reported by UE via *sl-PRS-CommonProcCapabilityPerBand* specified in TS 38.355 [37]. For a single-sample measurement, the whole measurement may not be performed.

If the synchronization reference source changes during $T_{SL\ RSTD,total}$ at the measuring UE, while the UE is performing the SL RSTD measurement, then the UE shall restart the SL RSTD measurement after the synchronization reference source change and shall send the measurement report during a measurement period, which can be longer than $T_{SL\ RSTD,total}$.

The requirements in this clause do not apply, when the synchronization reference source changes during $T_{SL\ RSTD,total}$ at the UE transmitting SL-PRS for the SL RSTD measurement.

The requirements in this clause apply, provided that no SL-PRS symbols are dropped due to, e.g., selection or reselection of synchronization reference source according to clause 12.4 during the measurement period $T_{SL\ RSTD,total}$. Otherwise, the measurement period can be longer.

The requirements in this clause apply, provided that the reception of slots containing SL-PRS is not interrupted during the measurement period $T_{SL\ RSTD,total}$. Otherwise, if the reception of the slots containing SL-PRS is interrupted, the measurement period can be longer.

12A.3 SL PRS-RSRP measurements

12A.3.1 Introduction

The requirements in clause 12A.3 apply for SL PRS-RSRP measurements and for SL PRS-RSRP path measurements of the first and additional paths.

The requirements in clause 12A.3 shall apply provided the UE has received a *RequestLocationInformation* message from LMF or another UE via SLPP specified in TS 38.355 [37] requesting the UE to measure and report SL PRS-RSRP measurements defined in TS 38.215 [4] based on SL-PRS.

12A.3.2 Requirements Applicability

The requirements in clause 12A.3 apply for periodic, aperiodic, and triggered SL PRS-RSRP measurements, provided:

- SL PRS-RSRP related side conditions given in clause 10.4A.3.2 for FR1 are fulfilled, for a corresponding Band.

12A.3.3 Measurement Capability

UE SL PRS-RSRP measurement capability is as indicated by the UE in:

- SL-TDOA-ProvideCapabilities, SL-RTT-ProvideCapabilities, SL-AOA-ProvideCapabilities, or SL-TOA-ProvideCapabilities, according to TS 38.355 [37].

12A.3.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE reporting to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.

For UE reporting to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the transmitted STCH. The delay uncertainty is: 2 x TTI_{STCH} where TTI_{STCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

This measurement reporting delay excludes any delay caused by no SL resources for UE to send the measurement report.

The reported SL PRS-RSRP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.4A.3.1.

The SL PRS-RSRP measurements performed and reported according to this section shall meet the SL PRS-RSRP measurement accuracy requirements in clause 10.4A.3.2, for each measured SL-PRS resource.

12A.3.5 Measurements Period Requirements

When the physical layer receives the last of:

- SL-TDOA-ProvideAssistanceData and SL-TDOA-RequestLocationInformation, or
- SL-AOA-ProvideAssistanceData and SL-AOA-RequestLocationInformation, or
- SL-TOA-ProvideAssistanceData and SL-TOA-RequestLocationInformation, or
- SL-RTT-ProvideAssistanceData and SL-RTT-RequestLocationInformation,

from LMF or another UE via SLPP specified in TS 38.355 [37], and the UE is configured to perform SL PRS-RSRP measurement together with the corresponding mandatory measurement (SL RSTD, SL AoA/ZoA, SL RTOA, and SL Rx-Tx, respectively), the UE shall be able to perform multiple SL PRS-RSRP measurements based on SL-PRS from one or more other SL UEs (up to the UE capability specified in clause 12A.3.3), as defined in TS 38.215 [4].

The SL PRS-RSRP measurement for the measured anchor UE SL-PRS shall be performed during the measurement period of the corresponding mandatory measurement, with which the SL PRS-RSRP measurement is configured, i.e., during:

$T_{SL\ RSTD,total}$ defined in clause 12A.2.5, for SL PRS-RSRP configured together with SL RSTD,

$T_{SL\ Rx-Tx,total}$ defined in clause 12A.4.5, for SL PRS-RSRP configured together with SL Rx-Tx,

$T_{SL\ AoA,total}$ defined in clause 12A.6.5, for SL PRS-RSRP configured together with SL AoA/ZoA, or

$T_{SL\ RTOA,total}$ defined in clause 12A.7.5, for SL PRS-RSRP configured together with SL RTOA.

A UE may drop one or more SL-PRS measurement samples if the number of active slots or the number of active resources per slot for the ongoing SL-PRS measurement exceed the UE capabilities reported by UE via *sl-PRS-*

CommonProcCapabilityPerBand specified in TS 38.355 [37]. For a single-sample measurement, the whole measurement may not be performed.

12A.4 SL Rx-Tx measurements

12A.4.1 Introduction

The requirements in clause 12A.4 apply for SL Rx-Tx measurements of the first and additional paths.

The requirements in clause 12A.4 shall apply provided the UE has received *SL-RTT-RequestLocationInformation* from LMF or another UE via SLPP specified in TS 38.355 [37] requesting the UE to measure and report SL Rx-Tx time difference measurements defined in TS 38.215 [4] based on SL-PRS.

12A.4.2 Requirements Applicability

The requirements in clause 12A.4 apply for periodic, aperiodic, and triggered SL Rx-Tx time difference measurements, provided:

- SL Rx-Tx time difference related side conditions given in clause 10.4A.4.2 for FR1 are met for a corresponding Band.
- The actual time difference between the corresponding SL-PRS transmission and reception used to derive the measurement is no larger than 160 ms.

12A.4.3 Measurement Capability

SL Rx-Tx time difference measurement capability is as indicated by the UE in *SL-RTT-ProvideCapabilities* according to TS 38.355 [37].

12A.4.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE report to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

For UE report to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the sidelink STCH. The delay uncertainty is: 2 x TTI_{STCH} where TTI_{STCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

The measurement reporting delay excludes any delay caused by no SL resources for UE to send the measurement report.

The reported SL Rx-Tx time difference measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.4A.4.1.

The SL Rx-Tx time difference measurements performed and reported according to this section shall meet the SL Rx-Tx time difference measurement accuracy requirements in clause 10.4A.4.2, for each measured SL-PRS resource.

12A.4.5 Measurement Period Requirements

When the UE physical layer receives *SL-RTT-ProvideAssistanceData* message and *SL-RTT-RequestLocationInformation* message from LMF or another UE via SLPP specified in TS 38.355 [37], the UE shall be able to perform multiple SL Rx-Tx time difference measurements based on SL-PRS from one or more other SL UEs (up

to the UE capability specified in clause 12A.4.3), as defined in TS 38.215 [4]. For each individual SL-PRS resource measured by a UE, the SL Rx-Tx time difference measurement is performed during $T_{SL\ Rx-Tx,total}$ defined as:

$$T_{SL\ Rx-Tx,total} = \sum_{s=1}^{S} T_{SL\ Rx-Tx,effect,s} + T_{uncertain},$$

where,

S is the number of samples for a single SL Rx-Tx measurement defined below:

S = 1 for SL-PRS bandwidth > 48 PRBs,

S = 4 for SL-PRS bandwidth≤48 PRBs, and

for SL-PRS sample s, which is received within a slot where the UE receives SCI and the associated SL-PRS is within its capabilities reported by UE via *maxNumOfActiveSL-PRS-ResourcesInOneSlot* and *maxNumOfSlotsWIthActiveSL-PRS-Resources* specified in TS 38.355 [37], $T_{SL\ Rx-Tx,effect,s}$ is defined as:

$T_{SL\ Rx-Tx,effect,s} = t_{s+1} - t_s$, for s<S, where t_s and t_{s+1} are the start of the *s*-th and *(s+1)*-th slot of SL-PRS samples *s* and SL-PRS samples *s*+1, respectively,

$T_{SL\ Rx-Tx,effect,s} = T_{dur,s} + \Delta_{SLproc}$, for *s* = *S*,

$T_{dur,s}$ is the duration of the slot carrying SL-PRS sample s of SL Rx-Tx measurement,

Δ_{SLproc} is the processing time indicated by UE via *minTimeAfterEndofSlotCarryActiveSL-PRS-Resources* specified in TS 38.355 [37] of the UE performing the SL Rx-Tx time difference measurement.

$T_{uncertain}$ is defined as below:

If the UE reports the transmission timestamp of a SL-PRS as defined in TS 38.215 [4], and the SL-PRS transmission occurs after the SL-PRS reception used to derive the measurement, $T_{uncertain}$ is the additional time delay from the SL PRS reception until the actual SL PRS transmission.

Otherwise, $T_{uncertain} = 0$.

A UE may drop one or more SL-PRS measurement samples if the number of active slots or the number of active resources per slot for the ongoing SL-PRS measurement exceed the UE capabilities reported by UE via *sl-PRS-CommonProcCapabilityPerBand* specified in TS 38.355 [37]. For a single-sample measurement, the whole measurement may not be performed.

If the synchronization reference source changes during $T_{SL\ Rx-Tx,total}$ at the measuring UE, while the measuring UE is performing the SL Rx-Tx time difference measurement, then the measuring UE shall restart the SL Rx-Tx time difference measurement and shall send the measurement report during a measurement period, which can be longer than $T_{SL\ Rx-Tx,total}$.

The requirements in this clause do not apply, when the synchronization reference source changes during $T_{SL\ Rx-Tx,total}$ at the UE transmitting SL-PRS for the SL Rx-Tx measurement.

The requirements in this clause apply, provided that no SL-PRS symbols are dropped due to, e.g., selection or reselection of synchronization reference source according to clause 12.4 during the measurement period $T_{SL\ Rx-Tx,total}$. Otherwise, the measurement period can be longer.

The requirements in this clause apply, provided that the reception of slots containing SL-PRS is not interrupted during the measurement period $T_{SL\ Rx-Tx,total}$. Otherwise, if the reception of the slots containing SL-PRS is interrupted, the measurement period can be longer.

12A.5 SL PRS-RSRPP measurements

12A.5.1 Introduction

The requirements in clause 12A.5 shall apply provided the UE has received *SL-TDOA-RequestLocationInformation* or *SL-AOA-RequestLocationInformation* or *SL-TOA-RequestLocationInformation* or *SL-RTT-RequestLocationInformation* from LMF or another UE via SLPP requesting the UE to measure and report SL PRS-RSRPP measurements defined in TS 38.215 [4].

12A.5.2 Requirements Applicability

The requirements in clause 12A.5 apply for periodic and triggered SL PRS-RSRPP measurements, provided:

- SL PRS-RSRPP related side conditions given in clause 10.4A.5.2 for FR1 are met for a corresponding Band.

12A.5.3 Measurement Capability

SL PRS-RSRPP measurement capability is as indicated by the UE in *SL-TDOA-ProvideCapabilities*, *SL-RTT-ProvideCapabilities*, *SL-AOA-ProvideCapabilities*, or *SL-TOA-ProvideCapabilities* according to TS 38.355 [37].

12A.5.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE report to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

For UE report to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the sidelink STCH. The delay uncertainty is: 2 x TTI_{STCH} where TTI_{STCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

This measurement reporting delay excludes any delay caused by no SL resources-for UE to send the measurement report.

The reported SL PRS-RSRPP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.4A.5.1.

The SL PRS-RSRPP measurements performed and reported according to this section shall meet the SL PRS-RSRPP measurement accuracy requirements in clause 10.4A.5.2, for each measured SL-PRS resource.

12A.5.5 Measurement Period Requirements

When the physical layer receives

- *SL-TDOA-ProvideAssistanceData* message and *SL-TDOA-RequestLocationInformation* message, or
- *SL-AOA-ProvideAssistanceData* message and *SL-AOA-RequestLocationInformation* message, or
- *SL-TOA-ProvideAssistanceData* message and *SL-TOA-RequestLocationInformation* message, or
- *SL-RTT-ProvideAssistanceData* message and *SL-RTT-RequestLocationInformation* message,

from LMF or another UE via SLPP specified in TS 38.355 [37], and the UE is configured to perform SL PRS-RSRPP measurement together with the corresponding mandatory measurement (SL RSTD, SL AoA/ZoA, SL RTOA, and SL Rx-Tx, respectively), the UE shall be able to perform multiple SL PRS-RSRPP measurements based on SL-PRS from one or more other SL UEs (up to the UE capability specified in clause 12A.5.3), as defined in TS 38.215 [4].

The SL PRS-RSRPP measurement for the measured anchor UE SL-PRS shall be performed during the measurement period of the corresponding mandatory measurement, with which the SL PRS-RSRPP measurement is configured, i.e., during:

- $T_{SL\,RSTD,total}$ defined in clause 12A.2.5, for SL PRS-RSRPP configured together with SL RSTD,
- $T_{SL\,Rx-Tx,total}$ defined in clause 12A.4.5, for SL PRS-RSRPP configured together with SL Rx-Tx,
- $T_{SL\,AoA,total}$ defined in clause 12A.6.5, for SL PRS-RSRPP configured together with SL AoA/ZoA, or
- $T_{SL\,RTOA,total}$ defined in clause 12A.7.5, for SL PRS-RSRPP configured together with SL RTOA.

A UE may drop one or more SL-PRS measurement samples if the number of active slots or the number of active resources per slot for the ongoing SL-PRS measurement exceed the UE capabilities reported by UE via *sl-PRS-CommonProcCapabilityPerBand* specified in TS 38.355 [37]. For a single-sample measurement, the whole measurement may not be performed.

12A.6 SL AoA measurements

12A.6.1 Introduction

The requirements in clause 12A.6 apply for SL AoA measurements of the first and additional paths.

The requirements in clause 12A.6.5 shall apply for azimuth angle of arrival (A-AoA) and zenith angle of arrival (Z-AoA) first path measurement, provided the UE has received *SL-AoA-RequestLocationInformation* from LMF or another UE via SLPP specified in TS 38.355 [37] requesting the UE to measure and report SL AoA measurements defined in TS 38.215 [4] based on SL-PRS.

12A.6.2 Requirements Applicability

The requirements in clause 12A.6 apply for periodic, aperiodic, and triggered SL AoA measurements, provided:

- Conditions defined in clause 7.3E of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- SL AoA related side conditions given in clause B.4A.1 for FR1 are met for a corresponding Band.

12A.6.3 Measurement Capability

SL AoA measurement capability is as indicated by the UE in:

SL-AoA-ProvideCapabilities according to TS 38.355 [37].

12A.6.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE reporting to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.

For UE reporting to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the sidelink STCH. The delay uncertainty is: 2 x TTI_{STCH} where TTI_{STCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

The measurement reporting delay excludes any delay caused by no SL resources or no SL-PRS resources for UE to send the measurement report.

The reported SL AoA measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.4A.6.1.

12A.6.5 Measurement Period Requirements

When the UE physical layer receives the last of *SL-AoA-ProvideAssistanceData* message and *SL-AoA-RequestLocationInformation* message from LMF or another UE via SLPP specified in TS 38.355 [37], the UE shall be able to measure multiple SL AoA measurements based on SL-PRS from one or more other SL UEs (up to the UE capability specified in 12A.6.3), as defined in TS 38.215 [4]. The SL AoA measurement shall be performedduring the measurement period $T_{SL\ AoA,total}$ defined as:

$$T_{SL\ AoA,total} = \sum_{s=1}^{S} T_{SL\ AoA,effect,s}\ ,$$

where,

S is the number of samples for the SL AoA measurement, defined as below:

S = 1 for SL-PRS bandwidth > 48 PRBs,

S = 4 for SL-PRS bandwidth ≤ 48 PRBs, and

for each SL-PRS sample s, which is received within a slot where the UE receives SCI and the associated SL-PRS is within its capabilities reported by UE via *maxNumOfActiveSL-PRS-ResourcesInOneSlot* and *maxNumOfSlotsWIthActiveSL-PRS-Resources* specified in TS 38.355 [37]. $T_{SL\ AoA,effect,s}$ is defined as below,

$T_{SL\ AoA,effect,s} = t_{s+1} - t_s$ for *s* < *S*, where t_s and t_{s+1} are the beginning of the slots of SL-PRS sample s and SL-PRS sample s+1, respectively,

$T_{SL\ AoA,effect,s} = T_{dur,s} + \Delta_{SLproc}$ for *s* = *S*,

- $T_{dur,s}$ is the duration of slot carrying SL-PRS sample *s* of the SL AoA measurement,
- Δ_{SLproc} is the processing time indicated by UE *minTimeAfterEndofSlotCarryActiveSL-PRS-Resources* specified in TS 38.355 [37] of the UE performing SL AoA measurement.

A UE may drop one or more SL-PRS measurement samples if the number of active slots or the number of active resources per slot for the ongoing SL-PRS measurement exceed the UE capabilities reported by UE via *sl-PRS-CommonProcCapabilityPerBand* specified in TS 38.355 [37]. For a single-sample measurement, the whole measurement may not be performed.

If the synchronization reference source of the measuring UE changes during $T_{SL\ AoA,total}$, while the UE is performing the SL AoA measurements, then the measuring UE shall continue performing the SL AoA measurement after the synchronization reference source change, while meeting the requirements in this clause.

The requirements in this clause do not apply, when the synchronization reference source changes during $T_{SL\ AoA,total}$ at the UE transmitting SL-PRS for the SL AoA measurement.

The requirements in this clause apply provided that no SL-PRS symbols for the SL AoA measurement are dropped due to e.g., the selection or reselection of synchronization reference source according to clause 12.4 during the measurement period. Otherwise, the measurement period can be extended.

The requirements in this clause, apply provided that reception of slots containing SL-PRS for the SL AoA measurement is not interrupted e.g., due to network coverage change. Otherwise, if the reception of the slots containing SL-PRS is interrupted, the measurement period can be extended.

12A.7 SL RTOA measurements

12A.7.1 Introduction

The requirements in clause 12A.7 apply for SL RTOA measurements of the first and additional paths.

The requirements in clause 12A.7.5 shall apply provided the UE has received *SL-RTOA-RequestLocationInformation* from LMF or another UE via SLPP requesting the UE to measure and report SL RTOA measurements defined in TS 38.215 [4].

12A.7.2 Requirements Applicability

The requirements in clause 12A.7 apply for periodic, aperiodic, and triggered SL RTOA measurements, provided:

- Conditions defined in clause 7.3E of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- SL RTOA related side conditions given in clause B.4A.1 for FR1 are met for a corresponding Band.

12A.7.3 Measurement Capability

SL RTOA measurement capability is as indicated by the UE in *SL-RTOA-ProvideCapabilities* according to TS 38.355 [37].

12A.7.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE reporting to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.

For UE reporting to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the sidelink STCH. The delay uncertainty is: 2 x TTI_{STCH} where TTI_{STCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

The measurement reporting delay excludes any delay caused by no SL resources or no SL-PRS resources for UE to send the measurement report.

The reported SL RTOA measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.4A.7.1.

12A.7.5 Measurement Period Requirements

When the UE physical layer receives the last of *SL-RTOA-ProvideAssistanceData* message and *SL-RTOA-RequestLocationInformation* message from LMF or another UE via SLPP specified in TS 38.355 [37], the UE shall be able to measure multiple SL RTOA measurements based on SL-PRS from one or more other SL UEs (up to the UE capability specified in 12A.7.3), as defined in TS 38.215 [4]. The SL RTOA measurement shall be performed during $T_{SL\ RTOA,total}$ defined as:

$$T_{SL\ RTOA,total} = \sum_{s=1}^{S} T_{SL\ RTOA,effect,s} \ ,$$

where,

S is the number of samples for the SL RTOA measurement, defined as below:

S = 1 for SL-PRS bandwidth > 48 PRBs,

S = 4 for SL-PRS bandwidth ≤ 48 PRBs, and

for SL-PRS sample s, which is received within a slot where the UE receives SCI, provided that the associated SL-PRS is within its capabilities reported by UE via *maxNumOfActiveSL-PRS-ResourcesInOneSlot* and *maxNumOfSlotsWIthActiveSL-PRS-Resources* specified in TS 38.355 [37]. $T_{SL\ RTOA,effect,s}$ is defined as below,

$T_{SL\ RTOA,effect,s} = t_{s+1} - t_s$, for $s<S$, where t_s and t_{s+1} are the beginning of the slots of SL-PRS sample s and SL-PRS sample s+1, respectively,

$T_{SL\ RTOA,effect,s} = T_{dur,s} + \Delta_{SLproc}$ for $s = S$,

$T_{dur,s}$ is the duration of the slot carrying SL-PRS sample *s* of the SL RTOA measurement,

Δ_{SLproc} is the processing time indicated by UE via *minTimeAfterEndofSlotCarryActiveSL-PRS-Resources* specified in TS 38.355 [37] of the UE performing SL RTOA measurement.

A UE may drop one or more SL-PRS measurement samples if the number of active slots or the number of active resources per slot for the ongoing SL-PRS measurement exceed the UE capabilities reported by UE via *sl-PRS-CommonProcCapabilityPerBand* specified in TS 38.355 [37]. For a single-sample measurement, the whole measurement may not be performed.

If the synchronization reference source of the measuring UE changes during $T_{SL\ RTOA,total}$, while the UE is performing the SL RTOA measurements, then the measuring UE shall restart the SL RTOA measurement after the synchronization reference source change and shall send the measurement report during a measurement period, which can be longer than $T_{SL\ RTOA,total}$.

The requirements in this clause do not apply, when the synchronization reference source changes during $T_{SL\ RTOA,total}$ at the UE transmitting SL-PRS for the SL RTOA measurement.

The requirements in this clause apply provided that no SL-PRS symbols for the SL RTOA measurement that are dropped due to e.g., the selection or reselection of synchronization reference source according to clause 12.4 during the measurement period. Otherwise, the measurement period can be extended. The requirements in this clause apply, provided that reception of slots containing SL-PRS for the SL RTOA measurement is not interrupted due to network coverage change. Otherwise, if the reception of the slots containing SL-PRS is interrupted, the measurement period can be longer.

13 Measurement Performance Requirements for NR gNB

13.1 UL-RTOA

13.1.1 Report mapping

The reporting range of UL Relative Time of Arrival (UL-RTOA), as defined in Clause 5.2.2 of TS 38.215 [4], is defined from $-985024T_c$ to $+985024\times T_c$. The reporting resolution is uniform across the reporting range and is defined as $T = T_c\times 2^k$ where k is selected by gNB from the set {-6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5}.

T_c is defined in TS 38.211 [6].

LMF provides a recommended resolution parameter, *timingReportingGranularityFactor* or *timingReportingGranularityFactorExtended* [35]. gNB selects parameter k based on *timingReportingGranularityFactor* or *timingReportingGranularityFactorExtended* [35] and informs the LMF.

The mapping of measured/inferred quantity for each reporting resolution (k) is defined in table 13.1.1-1 to table 13.1.1-12.

Table 13.1.1-1: Measurement report mapping for k=0

Reported Value	Measured Quantity Value	Unit
UL_RTOA_0000000	-985024 > UL_RTOA	T_c
UL_RTOA_0000001	-985024 ≤ UL_RTOA < -985023	T_c
UL_RTOA_0000002	-985023 ≤ UL_RTOA < -985022	T_c
…	…	…
UL_RTOA_0985023	-2 ≤ UL_RTOA < -1	T_c
UL_RTOA_0985024	-1 ≤ UL_RTOA ≤ 0	T_c

UL_RTOA_0985025	0 < UL_RTOA ≤ 1	T_c
UL_RTOA_0985026	1 < UL_RTOA ≤ 2	T_c
UL_RTOA_0985027	2 < UL_RTOA ≤ 3	T_c
…	…	…
UL_RTOA_1970048	985023 < UL_RTOA ≤ 985024	T_c
UL_RTOA_1970049	985024 < UL_RTOA	T_c

Table 13.1.1-2: Measurement report mapping for k=1

Reported Value	Measured Quantity Value	Unit
UL_RTOA_000000	-985024 > UL_RTOA	T_c
UL_RTOA_000001	-985024 ≤ UL_RTOA < -985022	T_c
UL_RTOA_000002	-985022 ≤ UL_RTOA < -985020	T_c
…	…	…
UL_RTOA_492511	-4 ≤ UL_RTOA < -2	T_c
UL_RTOA_492512	-2 ≤ UL_RTOA ≤ 0	T_c
UL_RTOA_492513	0 < UL_RTOA ≤ 2	T_c
UL_RTOA_492514	2 < UL_RTOA ≤ 4	T_c
UL_RTOA_492515	4 < UL_RTOA ≤ 6	T_c
…	…	…
UL_RTOA_985024	985022 < UL_RTOA ≤ 985024	T_c
UL_RTOA_985025	985024 < UL_RTOA	T_c

Table 13.1.1-3: Measurement report mapping for k=2

Reported Value	Measured Quantity Value	Unit
UL_RTOA_000000	-985024 > UL_RTOA	T_c
UL_RTOA_000001	-985024 ≤ UL_RTOA < -985020	T_c
UL_RTOA_000002	-985020 ≤ UL_RTOA < -985018	T_c
…	…	…
UL_RTOA_246255	-8 ≤ UL_RTOA < -4	T_c
UL_RTOA_246256	-4 ≤ UL_RTOA ≤ 0	T_c
UL_RTOA_246257	0 < UL_RTOA ≤ 4	T_c
UL_RTOA_246258	4 < UL_RTOA ≤ 8	T_c
UL_RTOA_246259	8 < UL_RTOA ≤ 12	T_c
…	…	…
UL_RTOA_492512	985020 < UL_RTOA ≤ 985024	T_c
UL_RTOA_492513	985024 < UL_RTOA	T_c

Table 13.1.1-4: Measurement report mapping for k=3

Reported Value	Measured Quantity Value	Unit
UL_RTOA_000000	-985024 > UL_RTOA	T_c
UL_RTOA_000001	-985024 ≤ UL_RTOA < -985016	T_c
UL_RTOA_000002	-985016 ≤ UL_RTOA < -985008	T_c
…	…	…
UL_RTOA_123127	-16 ≤ UL_RTOA < -8	T_c
UL_RTOA_123128	-8 ≤ UL_RTOA ≤ 0	T_c
UL_RTOA_123129	0 < UL_RTOA ≤ 8	T_c
UL_RTOA_123130	8 < UL_RTOA ≤ 16	T_c
UL_RTOA_123131	16 < UL_RTOA ≤ 24	T_c
…	…	…
UL_RTOA_246256	985016 < UL_RTOA ≤ 985024	T_c
UL_RTOA_246257	985024 < UL_RTOA	T_c

Table 13.1.1-5: Measurement report mapping for k=4

Reported Value	Measured Quantity Value	Unit
UL_RTOA_000000	-985024 > UL_RTOA	T_c

UL_RTOA_000001	-985024 ≤ UL_RTOA < -985008	T_c
UL_RTOA_000002	-985008 ≤ UL_RTOA < -984992	T_c
…	…	…
UL_RTOA_061563	-32 ≤ UL_RTOA < -16	T_c
UL_RTOA_061564	-16 ≤ UL_RTOA ≤ 0	T_c
UL_RTOA_061565	0 < UL_RTOA ≤ 16	T_c
UL_RTOA_061566	16 < UL_RTOA ≤ 32	T_c
UL_RTOA_061567	32 < UL_RTOA ≤ 48	T_c
…	…	…
UL_RTOA_123128	985008 < UL_RTOA ≤ 985024	T_c
UL_RTOA_123129	985024 < UL_RTOA	T_c

Table 13.1.1-6: Measurement report mapping for k=5

Reported Value	Measured Quantity Value	Unit
UL_RTOA_00000	-985024 > UL_RTOA	T_c
UL_RTOA_00001	-985024 ≤ UL_RTOA < -984992	T_c
UL_RTOA_00002	-984992 ≤ UL_RTOA < -984960	T_c
…	…	…
UL_RTOA_30781	-64 ≤ UL_RTOA < -32	T_c
UL_RTOA_30782	-32 ≤ UL_RTOA ≤ 0	T_c
UL_RTOA_30783	0 < UL_RTOA ≤ 32	T_c
UL_RTOA_30784	32 < UL_RTOA ≤ 64	T_c
UL_RTOA_30785	64 < UL_RTOA ≤ 96	T_c
…	…	…
UL_RTOA_61564	984992 < UL_RTOA ≤ 985024	T_c
UL_RTOA_61565	985024 < UL_RTOA	T_c

Table 13.1.1-7: Measurement report mapping for k=-1

Reported Value	Measured Quantity Value	Unit
UL_RTOA_0000000	-985024 > UL_RTOA	T_c
UL_RTOA_0000001	-985024 ≤ UL_RTOA < -985023.5	T_c
UL_RTOA_0000002	-985023.5 ≤ UL_RTOA < -985023	T_c
…	…	…
UL_RTOA_1970048	-0.5 ≤ UL_RTOA < 0	T_c
UL_RTOA_1970049	0 ≤ UL_RTOA < 0.5	T_c
…	…	…
UL_RTOA_3940095	985023 ≤ UL_RTOA < 985023.5	T_c
UL_RTOA_3940096	985023.5 ≤ UL_RTOA < 985024	T_c
UL_RTOA_3940097	985024 ≤ UL_RTOA	T_c

Table 13.1.1-8: Measurement report mapping for k=-2

Reported Quantity Value	Measured Quantity Value	Unit
UL_RTOA_0000000	-985024 > UL_RTOA	T_c
UL_RTOA_0000001	-985024 ≤ UL_RTOA < -985023.75	T_c
UL_RTOA_0000002	-985023.75 ≤ UL_RTOA < -985023.5	T_c
…	…	…
UL_RTOA_3940096	-0.25 ≤ UL_RTOA < 0	T_c
UL_RTOA_3940097	0 ≤ UL_RTOA < 0.25	T_c
…	…	…
UL_RTOA_7880191	985023.5 ≤ UL_RTOA < 985023.75	T_c
UL_RTOA_7880192	985023.75 ≤ UL_RTOA < 985024	T_c
UL_RTOA_7880193	985024 ≤ UL_RTOA	T_c

Table 13.1.1-9: Measurement report mapping for k=-3

Reported Quantity Value	Measured Quantity Value	Unit
UL_RTOA_00000000	-985024 > UL_RTOA	T_c
UL_RTOA_00000001	-985024 ≤ UL_RTOA < -985023.875	T_c
UL_RTOA_00000002	-985023.875 ≤ UL_RTOA < -985023.75	T_c
…	…	…
UL_RTOA_07880192	-0.125 ≤ UL_RTOA < 0	T_c
UL_RTOA_07880193	0 ≤ UL_RTOA < 0.125	T_c
…	…	…
UL_RTOA_15760383	985023.75 ≤ UL_RTOA < 985023.875	T_c
UL_RTOA_15760384	985023.875 ≤ UL_RTOA < 985024	T_c
UL_RTOA_15760385	985024 ≤ UL_RTOA	T_c

Table 13.1.1-10: Measurement report mapping for k=-4

Reported Quantity Value	Measured Quantity Value	Unit
UL_RTOA_0000000	-985024 > UL_RTOA	T_c
UL_RTOA_0000001	-985024 ≤ UL_RTOA < -985023.9375	T_c
UL_RTOA_0000002	-985023.9375 ≤ UL_RTOA < -985023.875	T_c
…	…	…
UL_RTOA_15760384	-0.0625 ≤ UL_RTOA < 0	T_c
UL_RTOA_15760385	0 ≤ UL_RTOA < 0.0625	T_c
…	…	…
UL_RTOA_31520767	985023.875 ≤ UL_RTOA < 985023.9375	T_c
UL_RTOA_31520768	985023.9375 ≤ UL_RTOA < 985024	T_c
UL_RTOA_31520769	985024 ≤ UL_RTOA	T_c

Table 13.1.1-11: Measurement report mapping for k=-5

Reported Quantity Value	Measured Quantity Value	Unit
UL_RTOA_00000000	-985024 > UL_RTOA	T_c
UL_RTOA_00000001	-985024 ≤ UL_RTOA < -985023.9688	T_c
UL_RTOA_00000002	-985023.9688 ≤ UL_RTOA < -985023.9375	T_c
…	…	…
UL_RTOA_31520768	-0.0312 ≤ UL_RTOA < 0	T_c
UL_RTOA_31520769	0 ≤ UL_RTOA < 0.0312	T_c
…	…	…
UL_RTOA_63041535	985023.9375 ≤ UL_RTOA < 985023.9688	T_c
UL_RTOA_63041536	985023.9688 ≤ UL_RTOA < 985024	T_c
UL_RTOA_63041537	985024 ≤ UL_RTOA	T_c

Table 13.1.1-12: Measurement report mapping for k=-6

Reported Quantity Value	Measured Quantity Value	Unit
UL_RTOA_000000000	-985024 > UL_RTOA	T_c
UL_RTOA_000000001	-985024 ≤ UL_RTOA < -985023.9844	T_c
UL_RTOA_000000002	-985023.9844 ≤ UL_RTOA < -985023.9688	T_c
…	…	…
UL_RTOA_063041536	-0.0156 ≤ UL_RTOA < 0	T_c
UL_RTOA_063041537	0 ≤ UL_RTOA < 0.0156	T_c
…	…	…
UL_RTOA_126083071	985023.9688 ≤ UL_RTOA < 985023.9844	T_c
UL_RTOA_126083072	985023.9844 ≤ UL_RTOA < 985024	T_c
UL_RTOA_126083073	985024 ≤ UL_RTOA	T_c

13.1.1A Additional Path Report Mapping for UL-RTOA

The reporting range of additional path reporting for UL Relative Time of Arrival (UL-RTOA), as defined in Clause 5.2.2 of TS 38.215 [4], is defined from $-8175 \times T_c$ to $+8175 \times T_c$. The reporting resolution is uniform across the reporting range and is defined as $T = T_c \times 2^k$ where k is selected by gNB from the set {-6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5}.

T_c is defined in TS 38.211 [6].

LMF provides a recommended resolution parameter, *timingReportingGranularityFactor* or *timingReportingGranularityFactorExtended* [35]. gNB selects parameter k based on *timingReportingGranularityFactor* or *timingReportingGranularityFactorExtended* [35] and informs the LMF.

The mapping of measured/inferred quantity for each reporting resolution (k) is defined in Table 13.1.1A-1 to Table 13.1.1A-12.

Table 13.1.1A-1: Measurement report mapping for k=0

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174	T_c
path_00002	-8174 ≤ Δpath < -8173	T_c
…	…	…
path_08175	-1 ≤ Δpath < 0	T_c
path_08176	0 ≤ Δpath < 1	T_c
…	…	…
path_ 16349	8173 ≤ Δpath < 8174	T_c
path_ 16350	8174 ≤ Δpath < 8175	T_c
path_ 16351	8175 ≤ Δpath	T_c

Table 13.1.1A-2: Measurement report mapping for k=1

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8175	T_c
path_0001	-8175 ≤ Δpath < -8173	T_c
path_0002	-8173 ≤ Δpath < -8171	T_c
…	…	…
path_4088	-1 ≤ Δpath < 1	T_c
…	…	…
path_8174	8171 ≤ Δpath < 8173	T_c
path_8175	8173 ≤ Δpath < 8175	T_c
path_8176	8175 ≤ Δpath	T_c

Table 13.1.1A-3: Measurement report mapping for k=2

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8174	T_c
path_0001	-8174 ≤ Δpath < -8170	T_c
path_0002	-8170 ≤ Δpath < -8166	T_c
…	…	…
path_2044	-2 ≤ Δpath < 2	T_c
…	…	…
path_4086	8166 ≤ Δpath < 8170	T_c
path_4087	8170 ≤ Δpath < 8174	T_c
path_4088	8174 ≤ Δpath	T_c

Table 13.1.1A-4: Measurement report mapping for k=3

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8172	T_c
path_0001	-8172 ≤ Δpath < -8164	T_c
path_0002	-8164 ≤ Δpath < -8156	T_c
…	…	…
path_1022	-4 ≤ Δpath < 4	T_c
…	…	…
path_2042	8156 ≤ Δpath < 8164	T_c
path_2043	8164 ≤ Δpath < 8172	T_c
path_2044	8172 ≤ Δpath	T_c

Table 13.1.1A-5: Measurement report mapping for k=4

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8168	T_c
path_0001	-8168 ≤ Δpath < -8152	T_c
path_0002	-8152 ≤ Δpath < -8136	T_c
…	…	…
path_511	-8 ≤ Δpath < 8	T_c
…	…	…
path_1020	8136 ≤ Δpath < 8152	T_c
path_1021	8152 ≤ Δpath < 8168	T_c
path_1022	8168 ≤ Δpath	T_c

Table 13.1.1A-6: Measurement report mapping for k=5

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000	Δpath < -8160	T_c
path_001	-8160 ≤ Δpath < -8128	T_c
path_002	-8128 ≤ Δpath < -8096	T_c
…	…	…
path_256	0 ≤ Δpath < 32	T_c
…	…	…
path_509	8096 ≤ Δpath < 8128	T_c
path_510	8128 ≤ Δpath < 8160	T_c
path_511	8160 ≤ Δpath	T_c

Table 13.1.1A-7: Measurement report mapping for k=-1

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174.5	T_c
path_00002	-8174.5 ≤ Δpath < -8174	T_c
…	…	…
path_16350	-0.5 ≤ Δpath < 0	T_c
path_16351	0 ≤ Δpath < 0.5	T_c
…	…	…
path_32699	8174 ≤ Δpath < 8174.5	T_c
path_32700	8174.5 ≤ Δpath < 8175	T_c
path_32701	8175 ≤ Δpath	T_c

Table 13.1.1A-8: Measurement report mapping for k=-2

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174.75	T_c
path_00002	-8174.75 ≤ Δpath < -8174.5	T_c
…	…	…
path_32700	-0.25 ≤ Δpath < 0	T_c
path_32701	0 ≤ Δpath < 0.25	T_c
…	…	…
path_65399	8174.5 ≤ Δpath < 8174.75	T_c
path_65400	8174.75 ≤ Δpath < 8175	T_c
path_65401	8175 ≤ Δpath	T_c

Table 13.1.1A-9: Measurement report mapping for k=-3

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000000	Δpath < -8175	T_c
path_000001	-8175 ≤ Δpath < -8174.875	T_c
path_000002	-8174.875 ≤ Δpath < -8174.75	T_c
…	…	…
path_065400	-0.125 ≤ Δpath < 0	T_c
path_065401	0 ≤ Δpath < 0.125	T_c
…	…	…
path_130799	8174.75 ≤ Δpath < 8174.875	T_c
path_130800	8174.875 ≤ Δpath < 8175	T_c
path_130801	8175 ≤ Δpath	T_c

Table 13.1.1A-10: Measurement report mapping for k=-4

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000000	Δpath < -8175	T_c
path_000001	-8175 ≤ Δpath < -8174.9375	T_c
path_000002	-8174.9375 ≤ Δpath < -8174.875	T_c
…	…	…
path_130800	-0.0625 ≤ Δpath < 0	T_c
path_130801	0 ≤ Δpath < 0.0625	T_c
…	…	…
path_261599	8174.875 ≤ Δpath < 8174.9375	T_c
path_261600	8174.9375 ≤ Δpath < 8175	T_c
path_261601	8175 ≤ Δpath	T_c

Table 13.1.1A-11: Measurement report mapping for k=-5

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000000	Δpath < -8175	T_c
path_000001	-8175 ≤ Δpath < -8174.9688	T_c
path_000002	-8174.9688 ≤ Δpath < -8174.9375	T_c
…	…	…
path_261600	-0.0312 ≤ Δpath < 0	T_c
path_261601	0 ≤ Δpath < 0.0312	T_c
…	…	…
path_523199	8174.9375 ≤ Δpath < 8174.9688	T_c
path_523200	8174.9688 ≤ Δpath < 8175	T_c
path_523201	8175 ≤ Δpath	T_c

Table 13.1.1A-12: Measurement report mapping for k=-6

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000000	Δpath < -8175	T_c
path_0000001	-8175 ≤ Δpath < -8174.9844	T_c
path_0000002	-8174.9844 ≤ Δpath < -8174.9688	T_c
…	…	…
path_0523200	-0.0156 ≤ Δpath < 0	T_c
path_0523201	0 ≤ Δpath < 0.0156	T_c
…	…	…
path_1046399	8174.9688 ≤ Δpath < 8174.9844	T_c
path_1046400	8174.9844 ≤ Δpath < 8175	T_c
path_1046401	8175 ≤ Δpath	T_c

13.2 gNB Rx-Tx time difference

13.2.1 Report mapping

The reporting range of gNB Rx-Tx time difference, as defined in Clause 5.2.3 of TS 38.215 [4], is defined from -985024T_c to +985024×T_c. The reporting resolution is uniform across the reporting range and is defined as $T = T_c \times 2^k$ where k is selected by gNB from the set {-6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5}.

T_c is defined in TS 38.211 [6].

LMF provides a recommended resolution parameter, *timingReportingGranularityFactor* or *timingReportingGranularityFactorExtended* [35]. gNB selects parameter k based on *timingReportingGranularityFactor* or *timingReportingGranularityFactorExtended* [35] and informs the LMF.

The mapping of measured/inferred quantity for each reporting resolution (k) is defined in table 13.2.1-1 to table 13.2.1-12.

Table 13.2.1-1: Measurement report mapping for k=0

Reported Value	Measured Quantity Value	Unit
RX-TX_0000000	-985024 > RX-TX	T_c
RX-TX_0000001	-985024 ≤ RX-TX < -985023	T_c
RX-TX_0000002	-985023 ≤ RX-TX < -985022	T_c
…	…	…
RX-TX_0985023	-2 ≤ RX-TX < -1	T_c
RX-TX_0985024	-1 ≤ RX-TX ≤ 0	T_c
RX-TX_0985025	0 < RX-TX ≤ 1	T_c
RX-TX_0985026	1 < RX-TX ≤ 2	T_c
RX-TX_0985027	2 < RX-TX ≤ 3	T_c
…	…	…
RX-TX_1970048	985023 < RX-TX ≤ 985024	T_c
RX-TX_1970049	985024 < RX-TX	T_c

Table 13.2.1-2: Measurement report mapping for k=1

Reported Value	Measured Quantity Value	Unit
RX-TX_000000	-985024 > RX-TX	T_c
RX-TX_000001	-985024 ≤ RX-TX < -985022	T_c
RX-TX_000002	-985022 ≤ RX-TX < -985020	T_c
…	…	…
RX-TX_492511	-4 ≤ RX-TX < -2	T_c
RX-TX_492512	-2 ≤ RX-TX ≤ 0	T_c

RX-TX_492513	0 < RX-TX ≤ 2	T_c
RX-TX_492514	2 < RX-TX ≤ 4	T_c
RX-TX_492515	4 < RX-TX ≤ 6	T_c
…	…	…
RX-TX_985024	985022 < RX-TX ≤ 985024	T_c
RX-TX_985025	985024 < RX-TX	T_c

Table 13.2.1-3: Measurement report mapping for k=1

Reported Value	Measured Quantity Value	Unit
RX-TX_000000	-985024 > RX-TX	T_c
RX-TX_000001	-985024 ≤ RX-TX < -985020	T_c
RX-TX_000002	-985020 ≤ RX-TX < -985018	T_c
…	…	…
RX-TX_246255	-8 ≤ RX-TX < -4	T_c
RX-TX_246256	-4 ≤ RX-TX ≤ 0	T_c
RX-TX_246257	0 < RX-TX ≤ 4	T_c
RX-TX_246258	4 < RX-TX ≤ 8	T_c
RX-TX_246259	8 < RX-TX ≤ 12	T_c
…	…	…
RX-TX_492512	985020 < RX-TX ≤ 985024	T_c
RX-TX_492513	985024 < RX-TX	T_c

Table 13.2.1-4: Measurement report mapping for k=3

Reported Value	Measured Quantity Value	Unit
RX-TX_0000	-985024 > RX-TX	T_c
RX-TX_0001	-985024 ≤ RX-TX < -985016	T_c
RX-TX_0002	-985016 ≤ RX-TX < -985008	T_c
…	…	…
RX-TX_123127	-16 ≤ RX-TX < -8	T_c
RX-TX_123128	-8 ≤ RX-TX ≤ 0	T_c
RX-TX_123129	0 < RX-TX ≤ 8	T_c
RX-TX_123130	8 < RX-TX ≤ 16	T_c
RX-TX_123131	16 < RX-TX ≤ 24	T_c
…	…	…
RX-TX_246256	985016 < RX-TX ≤ 985024	T_c
RX-TX_246257	985024 < RX-TX	T_c

Table 13.2.1-5: Measurement report mapping for k=4

Reported Value	Measured Quantity Value	Unit
RX-TX_000000	-985024 > RX-TX	T_c
RX-TX_000001	-985024 ≤ RX-TX < -985008	T_c
RX-TX_000002	-985008 ≤ RX-TX < -984992	T_c
…	…	…
RX-TX_061563	-32 ≤ RX-TX < -16	T_c
RX-TX_061564	-16 ≤ RX-TX ≤ 0	T_c
RX-TX_061565	0 < RX-TX ≤ 16	T_c
RX-TX_061566	16 < RX-TX ≤ 32	T_c
RX-TX_061567	32 < RX-TX ≤ 48	T_c
…	…	…
RX-TX_123128	985008 < RX-TX ≤ 985024	T_c
RX-TX_123129	985024 < RX-TX	T_c

Table 13.2.1-6: Measurement report mapping for k=5

Reported Value	Measured Quantity Value	Unit
RX-TX_00000	-985024 > RX-TX	T_c

RX-TX_00001	-985024 ≤ RX-TX < -984992	T_c
RX-TX_00002	-984992 ≤ RX-TX < -984960	T_c
…	…	…
RX-TX_30781	-64 ≤ RX-TX < -32	T_c
RX-TX_30782	-32 ≤ RX-TX ≤ 0	T_c
RX-TX_30783	0 < RX-TX ≤ 32	T_c
RX-TX_30784	32 < RX-TX ≤ 64	T_c
RX-TX_30785	64 < RX-TX ≤ 96	T_c
…	…	…
RX-TX_61564	984992 < RX-TX ≤ 985024	T_c
RX-TX_61565	985024 < RX-TX	T_c

Table 13.2.1-7: Measurement report mapping for k=-1

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_0000000	-985024 > RX-TX	T_c
RX-TX_0000001	-985024 ≤ RX-TX < -985023.5	T_c
RX-TX_0000002	-985023.5 ≤ RX-TX < -985023	T_c
…	…	…
RX-TX_1970048	-0.5 ≤ RX-TX < 0	T_c
RX-TX_1970049	0 ≤ RX-TX < 0.5	T_c
…	…	…
RX-TX_3940095	985023 ≤ RX-TX < 985023.5	T_c
RX-TX_3940096	985023.5 ≤ RX-TX < 985024	T_c
RX-TX_3940097	985024 ≤ RX-TX	T_c

Table 13.2.1-8: Measurement report mapping for k=-2

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_0000000	-985024 > RX-TX	T_c
RX-TX_0000001	-985024 ≤ RX-TX < -985023.75	T_c
RX-TX_0000002	-985023.75 ≤ RX-TX -985023.5	T_c
…	…	…
RX-TX_3940096	-0.25 ≤ RX-TX < 0	T_c
RX-TX_3940097	0 ≤ RX-TX < 0.25	T_c
…	…	…
RX-TX_7880191	985023.5 ≤ RX-TX < 985023.75	T_c
RX-TX_7880192	985023.75 ≤ RX-TX < 985024	T_c
RX-TX_7880193	985024 ≤ RX-TX	T_c

Table 13.2.1-9: Measurement report mapping for k=-3

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_0000000	-985024 > RX-TX	T_c
RX-TX_0000001	-985024 ≤ RX-TX < -985023.875	T_c
RX-TX_0000002	-985023.875 ≤ RX-TX -985023.75	T_c
…	…	…
RX-TX_7880192	-0.125 ≤ RX-TX < 0	T_c
RX-TX_7880193	0 ≤ RX-TX < 0.125	T_c
…	…	…
RX-TX_15760383	985023.75 ≤ RX-TX < 985023.875	T_c
RX-TX_15760384	985023.875 ≤ RX-TX < 985024	T_c
RX-TX_15760385	985024 ≤ RX-TX	T_c

Table 13.2.1-10: Measurement report mapping for k=-4

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_0000000	-985024 > RX-TX	T_c
RX-TX_0000001	-985024 ≤ RX-TX < -985023.9375	T_c

RX-TX_0000002	-985023.9375 ≤ RX-TX -985023.875	T_c
…	…	…
RX-TX_15760384	-0.0625 ≤ RX-TX < 0	T_c
RX-TX_15760385	0 ≤ RX-TX < 0.0625	T_c
…	…	…
RX-TX_31520767	985023.875 ≤ RX-TX < 985023.9375	T_c
RX-TX_31520768	985023.9375 ≤ RX-TX < 985024	T_c
RX-TX_31520769	985024 ≤ RX-TX	T_c

Table 13.2.1-11: Measurement report mapping for k=-5

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_00000000	-985024 > RX-TX	T_c
RX-TX_00000001	-985024 ≤ RX-TX < -985023.9688	T_c
RX-TX_00000002	-985023.9688 ≤ RX-TX -985023.9375	T_c
…	…	…
RX-TX_31520768	-0.0312 ≤ RX-TX < 0	T_c
RX-TX_31520769	0 ≤ RX-TX < 0.0312	T_c
…	…	…
RX-TX_63041535	985023.9375 ≤ RX-TX < 985023.9688	T_c
RX-TX_63041536	985023.9688 ≤ RX-TX < 985024	T_c
RX-TX_63041537	985024 ≤ RX-TX	T_c

Table 13.2.1-12: Measurement report mapping for k=-6

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_00000000	-985024 > RX-TX	T_c
RX-TX_00000001	-985024 ≤ RX-TX < -985023.9844	T_c
RX-TX_00000002	-985023.9844 ≤ RX-TX -985023.9688	T_c
…	…	…
RX-TX_63041536	-0.0156 ≤ RX-TX < 0	T_c
RX-TX_63041537	0 ≤ RX-TX < 0.0156	T_c
…	…	…
RX-TX_126083071	985023.9688 ≤ RX-TX < 985023.9844	T_c
RX-TX_126083072	985023.9844 ≤ RX-TX < 985024	T_c
RX-TX_126083073	985024 ≤ RX-TX	T_c

13.2.1A Additional Path Report Mapping for gNB Rx-Tx

The reporting range of additional path for gNB Rx-Tx time difference, as defined in Clause 5.2.3 of TS 38.215 [4], is defined from $-8175 \times T_c$ to $8175 \times T_c$. The reporting resolution is uniform across the reporting range and is defined as $T = T_c \times 2^k$ where k is selected by gNB from the set {-6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5}.

T_c is defined in TS 38.211 [6].

LMF provides a recommended resolution parameter, *timingReportingGranularityFactor* or *timingReportingGranularityFactorExtended* [35]. gNB selects parameter k based on *timingReportingGranularityFactor* or *timingReportingGranularityFactorExtended* [35] and informs the LMF.

The mapping of measured/inferred quantity for each reporting resolution (k) is defined in table 13.2.1A-1 to table 13.2.1A-12.

Table 13.2.1A-1: Measurement report mapping for k=0

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174	T_c
path_00002	-8174 ≤ Δpath < -8173	T_c

…	…	…
path_08175	-1 ≤ Δpath < 0	T_c
path_08176	0 ≤ Δpath < 1	T_c
…	…	…
path_ 16349	8173 ≤ Δpath < 8174	T_c
path_ 16350	8174 ≤ Δpath < 8175	T_c
path_ 16351	8175 ≤ Δpath	T_c

Table 13.2.1A-2: Measurement report mapping for k=1

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8175	T_c
path_0001	-8175 ≤ Δpath < -8173	T_c
path_0002	-8173 ≤ Δpath < -8171	T_c
…	…	…
path_4088	-1 ≤ Δpath < 1	T_c
…	…	…
path_8174	8171 ≤ Δpath < 8173	T_c
path_8175	8173 ≤ Δpath < 8175	T_c
path_8176	8175 ≤ Δpath	T_c

Table 13.2.1A-3: Measurement report mapping for k=2

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8174	T_c
path_0001	-8174 ≤ Δpath < -8170	T_c
path_0002	-8170 ≤ Δpath < -8166	T_c
…	…	…
path_2044	-2 ≤ Δpath < 2	T_c
…	…	…
path_4086	8166 ≤ Δpath < 8170	T_c
path_4087	8170 ≤ Δpath < 8174	T_c
path_4088	8174 ≤ Δpath	T_c

Table 13.2.1A-4: Measurement report mapping for k=3

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8172	T_c
path_0001	-8172 ≤ Δpath < -8164	T_c
path_0002	-8164 ≤ Δpath < -8156	T_c
…	…	…
path_1022	-4 ≤ Δpath < 4	T_c
…	…	…
path_2042	8156 ≤ Δpath < 8164	T_c
path_2043	8164 ≤ Δpath < 8172	T_c
path_2044	8172 ≤ Δpath	T_c

Table 13.2.1A-5: Measurement report mapping for k=4

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8168	T_c
path_0001	-8168 ≤ Δpath < -8152	T_c
path_0002	-8152 ≤ Δpath < -8136	T_c
…	…	…
path_511	-8 ≤ Δpath < 8	T_c

…	…	…
path_1020	8136 ≤ Δpath < 8152	T_c
path_1021	8152 ≤ Δpath < 8168	T_c
path_1022	8168 ≤ Δpath	T_c

Table 13.2.1A-6: Measurement report mapping for k=5

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000	Δpath < -8160	T_c
path_001	-8160 ≤ Δpath < -8128	T_c
path_002	-8128 ≤ Δpath < -8096	T_c
…	…	…
path_256	0 ≤ Δpath < 32	T_c
…	…	…
path_509	8096 ≤ Δpath < 8128	T_c
path_510	8128 ≤ Δpath < 8160	T_c
path_511	8160 ≤ Δpath	T_c

Table 13.2.1A-7: Measurement report mapping for k=-1

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174.5	T_c
path_00002	-8174.5 ≤ Δpath < -8174	T_c
…	…	…
path_16350	-0.5 ≤ Δpath < 0	T_c
path_16351	0 ≤ Δpath < 0.5	T_c
…	…	…
path_32699	8174 ≤ Δpath < 8174.5	T_c
path_32700	8174.5 ≤ Δpath < 8175	T_c
path_32701	8175 ≤ Δpath	T_c

Table 13.2.1A-8: Measurement report mapping for k=-2

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174.75	T_c
path_00002	-8174.75 ≤ Δpath < -8174.5	T_c
…	…	…
path_32700	-0.25 ≤ Δpath < 0	T_c
path_32701	0 ≤ Δpath < 0.25	T_c
…	…	…
path_65399	8174.5 ≤ Δpath < 8174.75	T_c
path_65400	8174.75 ≤ Δpath < 8175	T_c
path_65401	8175 ≤ Δpath	T_c

Table 13.2.1A-9: Measurement report mapping for k=-3

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000000	Δpath < -8175	T_c
path_000001	-8175 ≤ Δpath < -8174.875	T_c
path_000002	-8174.875 ≤ Δpath < -8174.75	T_c
…	…	…
path_065400	-0.125 ≤ Δpath < 0	T_c

path_065401	0 ≤ Δpath < 0.125	T_c
…	…	…
path_130799	8174.75 ≤ Δpath < 8174.875	T_c
path_130800	8174.875 ≤ Δpath < 8175	T_c
path_130801	8175 ≤ Δpath	T_c

Table 13.2.1A-10: Measurement report mapping for k=-4

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000000	Δpath < -8175	T_c
path_000001	-8175 ≤ Δpath < -8174.9375	T_c
path_000002	-8174.9375 ≤ Δpath < -8174.875	T_c
…	…	…
path_130800	-0.0625 ≤ Δpath < 0	T_c
path_130801	0 ≤ Δpath < 0.0625	T_c
…	…	…
path_261599	8174.875 ≤ Δpath < 8174.9375	T_c
path_261600	8174.9375 ≤ Δpath < 8175	T_c
path_261601	8175 ≤ Δpath	T_c

Table 13.2.1A-11: Measurement report mapping for k=-5

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000000	Δpath < -8175	T_c
path_000001	-8175 ≤ Δpath < -8174.9688	T_c
path_000002	-8174.9688 ≤ Δpath < -8174.9375	T_c
…	…	…
path_261600	-0.0312 ≤ Δpath < 0	T_c
path_261601	0 ≤ Δpath < 0.0312	T_c
…	…	…
path_523199	8174.9375 ≤ Δpath < 8174.9688	T_c
path_523200	8174.9688 ≤ Δpath < 8175	T_c
path_523201	8175 ≤ Δpath	T_c

Table 13.2.1A-12: Measurement report mapping for k=-6

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000000	Δpath < -8175	T_c
path_000001	-8175 ≤ Δpath < -8174.9844	T_c
path_000002	-8174.9844 ≤ Δpath < -8174.9688	T_c
…	…	…
path_523200	-0.0156 ≤ Δpath < 0	T_c
path_523201	0 ≤ Δpath < 0.0156	T_c
…	…	…
path_1046399	8174.9688≤ Δpath < 8174.9844	T_c
path_1046400	8174.9844 ≤ Δpath < 8175	T_c
path_1046401	8175 ≤ Δpath	T_c

13.2.2 Measurement Accuracy Requirements

13.2.2.1 Introduction

This clause defines accuracy requirements for measured/inferred gNB Rx-Tx time difference measurement in FR1 and FR2. The requirements are applicable for gNB supporting gNB Rx-Tx time difference measurement. The gNB, which

declares the support for gNB Rx-Tx time difference measurement also declares that it meets gNB Rx-Tx time difference accuracy requirements at least for one side condition $\hat{E}s/Iot \geq +3$ dB or $\hat{E}s/Iot \geq -13$ dB.

13.2.2.2 Requirements

The accuracy requirements for measured/inferred gNB Rx-Tx time difference measurement shall be within $\pm(X+Y)\ T_c$ under the following conditions:

- AWGN propagation conditions.
- The measured signals are in the directions covered by RoAoA of OTA reference sensitivity requirements for gNB type 1-O and 2-O BS

where

- X is defined in table 13.2.2.2-1 for gNB types 1-C, 1-H and 1-O and in table 13.2.2.2-2 for gNB type 2-O.
- Y is declared by manufacturer and can be different for different gNB types 1-C, 1-H, 1-O and 2-O.

NOTE: The measurement accuracy requirements in table 13.2.2.2-1 and table 13.2.2.2-2 are defined under an assumption that gNB is not mandated to perform receive beam sweeping.

Table 13.2.2.2-1: gNB Rx-Tx time difference absolute accuracy in FR1 for gNB type 1-C, 1-H and 1-O

Accuracy	SRS $\hat{E}s/Iot$	SCS	SRS bandwidth range
Unit: Tc	Unit: dB	Unit: kHz	Unit: PRB
123	≥ -13	15	44 ≤ BW ≤ 84
48			88 ≤ BW ≤ 168
17			176 ≤ BW
122	≥ +3		24 ≤ BW ≤ 40
62			44 ≤ BW ≤ 84
32			88 ≤ BW ≤ 168
16			176 ≤ BW
42	≥ -13	30	48 ≤ BW ≤ 84
24			88 ≤ BW ≤ 168
8			176 ≤ BW
32	≥ +3		48 ≤ BW ≤ 84
17			88 ≤ BW ≤ 168
9			176 ≤ BW
21	≥ -13	60	48 ≤ BW ≤ 84
12			88 ≤ BW
16	≥ +3		48 ≤ BW ≤ 84
9			88 ≤ BW

Table 13.2.2.2-2: gNB Rx-Tx time difference absolute accuracy in FR2 for gNB type 2-O

Accuracy	SRS $\hat{E}s/Iot$	SCS	SRS bandwidth range
Unit: Tc	Unit: dB	Unit: kHz	Unit: PRB
9	≥ -13	60	132 ≤ BW ≤ 168
8			176 ≤ BW
9	≥ +3		132 ≤ BW ≤ 168
8			176 ≤ BW
22	≥ -13	120	32 ≤ BW ≤ 40
15			44 ≤ BW ≤ 84
8			88 ≤ BW
16	≥ +3		32 ≤ BW ≤ 40
9			44 ≤ BW ≤ 84
8			88 ≤ BW

13.3 UL SRS RSRP measurement

13.3.1 Report mapping

The reporting range of UL SRS RSRP, as defined in clause 5.2.5 of 38.215 [4], is defined from -156 dBm to -31 dBm with resolution 1 dB.

The mapping of measured quantity is defined in table 13.3.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 13.3.1-1: UL SRS RSRP report mapping

Reported value	Measured quantity value	Unit
SRS_RSRP_0	SRS-RSRP<-156	dBm
SRS_RSRP_1	-156≤SRS-RSRP<-155	dBm
SRS_RSRP_2	-155≤SRS-RSRP<-154	dBm
SRS_RSRP_3	-154≤SRS-RSRP<-153	dBm
SRS_RSRP_4	-153≤SRS-RSRP<-152	dBm
SRS_RSRP_5	-152≤SRS-RSRP<-151	dBm
SRS_RSRP_6	-151≤SRS-RSRP<-150	dBm
SRS_RSRP_7	-150≤SRS-RSRP<-149	dBm
SRS_RSRP_8	-149≤SRS-RSRP<-148	dBm
SRS_RSRP_9	-148≤SRS-RSRP<-147	dBm
SRS_RSRP_10	-147≤SRS-RSRP<-146	dBm
SRS_RSRP_11	-146≤SRS-RSRP<-145	dBm
SRS_RSRP_12	-145≤SRS-RSRP<-144	dBm
SRS_RSRP_13	-144≤SRS-RSRP<-143	dBm
SRS_RSRP_14	-143≤SRS-RSRP<-142	dBm
SRS_RSRP_15	-142≤SRS-RSRP<-141	dBm
SRS_RSRP_16	-141≤SRS-RSRP<-140	dBm
SRS_RSRP_17	-140≤SRS-RSRP<-139	dBm
SRS_RSRP_18	-139≤SRS-RSRP<-138	dBm
…	…	…
SRS_RSRP_111	-46≤SRS-RSRP<-45	dBm
SRS_RSRP_112	-45≤SRS-RSRP<-44	dBm
SRS_RSRP_113	-44≤SRS-RSRP<-43	dBm
SRS_RSRP_114	-43≤SRS-RSRP<-42	dBm
SRS_RSRP_115	-42≤SRS-RSRP<-41	dBm
SRS_RSRP_116	-41≤SRS-RSRP<-40	dBm
SRS_RSRP_117	-40≤SRS-RSRP<-39	dBm
SRS_RSRP_118	-39≤SRS-RSRP<-38	dBm
SRS_RSRP_119	-38≤SRS-RSRP<-37	dBm
SRS_RSRP_120	-37≤SRS-RSRP<-36	dBm
SRS_RSRP_121	-36≤SRS-RSRP<-35	dBm
SRS_RSRP_122	-35≤SRS-RSRP<-34	dBm
SRS_RSRP_123	-34≤SRS-RSRP<-33	dBm
SRS_RSRP_124	-33≤SRS-RSRP<-32	dBm
SRS_RSRP_125	-32≤SRS-RSRP<-31	dBm
SRS_RSRP_126	-31≤SRS-RSRP	dBm

13.3.2 Measurement accuracy requirements

13.3.2.1 Introduction

This clause defines accuracy requirements for SRS-RSRP measurement in FR1 and FR2. The requirements are applicable for gNB supporting SRS-RSRP measurement. The gNB, which declares the support for SRS-RSRP measurement also declares that it meets SRS-RSRP accuracy requirements at least for one side condition $\hat{E}s/Iot \geq +3$ dB or $\hat{E}s/Iot \geq -13$ dB.

13.3.2.2 Requirements

The accuracy requirements in table 13.3.2.2-1, table 13.3.2.2-2 and table 13.3.2.2-3 are valid under the following conditions:

- AWGN propagation conditions.
- The measured signals are in the directions covered by RoAoA of OTA reference sensitivity requirements for gNB type 1-O and 2-O BS

NOTE: The measurement accuracy requirements in table 13.3.2.2-1, table 13.3.2.2-2 and table 13.3.2.2-3 are defined under an assumption that gNB is not mandated to perform receive beam sweeping.

Table 13.3.2.2-1 gNB SRS-RSRP absolute accuracy requirements in FR1 for gNB type 1-C

Accuracy	Conditions	
	SRS Ês/Iot	SRS bandwidth range
dB	dB	PRB
±4	Ês/Iot ≥ +3	24 ≤ BW < 48
±4		48 ≤ BW < 132
±4		132 ≤ BW
±6.5	Ês/Iot ≥ -13	48 ≤ BW < 132
±5.5		132 ≤ BW

Table 13.3.2.2-2 gNB SRS-RSRP absolute accuracy requirements in FR1 for gNB type 1-H and 1-O

Accuracy	Conditions	
	SRS Ês/Iot	SRS bandwidth range
dB	dB	PRB
±5.5	Ês/Iot ≥ +3	24 ≤ BW < 48
±5.5		48 ≤ BW < 132
±5.5		132 ≤ BW
±8	Ês/Iot ≥ -13	48 ≤ BW < 132
±7		132 ≤ BW

Table 13.3.2.2-3 gNB SRS-RSRP absolute accuracy requirements in FR2 for gNB type 2-O

Accuracy	Conditions	
	SRS Ês/Iot	SRS bandwidth range
dB	dB	PRB
±5.5	Ês/Iot ≥ +3	32 ≤ BW < 64
±5.5		64 ≤ BW < 132
±5.5		132 ≤ BW
±8	Ês/Iot ≥ -13	64 ≤ BW < 132
±7		132 ≤ BW

13.4 AoA/ZoA

13.4.1 Report mapping

The reporting range of UL Angle of Arrival (UL-AoA), as defined in clause 5.2.4 of TS 38.215 [4], is defined from -180 degree to +180 degree for azimuth angle of arrival (A-AoA). The reporting resolution is 0.1 degree.

The reporting range of UL Angle of Arrival, as defined in clause 5.2.4 of TS 38.215 [4], is defined from 0 degree to +180 degree for zenith angle of arrival (Z-AoA). The reporting resolution is 0.1 degree.

The mapping of A-AoA measured quantity is defined in table 13.4.1-1. The mapping of Z-AoA measured quantity is defined in table 13.4.1-2.

Table 13.4.1-1: Azimuth Angle of Arrival (A-AoA) measurement report mapping

Reported value	Measured quantity value (A-AoA)	Unit
A-AoA_0	-180 ≤ A-AoA < -179.9	degree
A-AoA_1	-179.9 ≤ A-AoA < -179.8	degree
A-AoA_2	-179.8 ≤ A-AoA < -179.7	degree
…	…	…
A-AoA_1798	-0.2 ≤ A-AoA < -0.1	degree
A-AoA_1799	-0.1 ≤ A-AoA < 0	degree
A-AoA_1800	0 ≤ A-AoA < 0.1	degree
A-AoA_1801	0.1 ≤ A-AoA < 0.2	degree
A-AoA_1802	0.2 ≤ A-AoA < 0.3	degree
…	…	…
A-AoA_3598	179.8 ≤ A-AoA < 179.9	degree
A-AoA_3599	179.9 ≤ A-AoA < 180	degree

Table 13.4.1-2: Zenith Angle of Arrival (Z-AoA) measurement report mapping

Reported value	Measured quantity value (Z-AoA)	Unit
Z-AoA_0	0 ≤ Z-AoA < 0.1	degree
Z-AoA _1	0.1 ≤ Z-AoA < 0.2	degree
Z-AoA _2	0.2 ≤ Z-AoA < 0.3	degree
…	…	…
Z-AoA _1798	179.8 ≤ Z-AoA < 179.9	degree
Z-AoA _1799	179.9 ≤ Z-AoA ≤ 180	degree

13.5 Timing advance (T_{ADV})

13.5.1 Report mapping

The reporting range of T_{ADV}, as defined in clause 5.2.7 of TS 38.215 [4], is defined from 0 to 3150848 T_c with 128 T_c resolution for timing advance less than 262144 T_c, and 512 T_c for timing advance greater than or equal to 262144 T_c.

T_c is defined in TS 38.211 [6].

The mapping of measured quantity is defined in table 13.5.1-1.

Table 13.5.1-1: T_{ADV} measurement report mapping

Reported value	Measured quantity value	Unit
TIME_ADVANCE_00	$T_{ADV} < 128$	T_c
TIME_ADVANCE_01	$128 \le T_{ADV} < 256$	T_c
TIME_ADVANCE_02	$256 \le T_{ADV} < 384$	T_c
…	…	…
TIME_ADVANCE_2046	$261888 \le T_{ADV} < 262016$	T_c
TIME_ADVANCE_2047	$262016 \le T_{ADV} < 262144$	T_c
TIME_ADVANCE_2048	$262144 \le T_{ADV} < 262656$	T_c
TIME_ADVANCE_2049	$262656 \le T_{ADV} < 263168$	T_c
…	…	…
TIME_ADVANCE_7688	$3149824 \le T_{ADV} < 3150336$	T_c
TIME_ADVANCE_7689	$3150336 \le T_{ADV} < 3150848$	T_c
TIME_ADVANCE_7690	$3150848 \le T_{ADV}$	T_c

NOTE: For report mapping, T_{ADV} is equal to (gNB Rx – Tx time difference) + N_{TA_offset}, where N_{TA_offset} is based on the information *n-TimingAdvanceOffset* as specified in TS 38.331 [2].

13.6 UL SRS RSRPP measurement

13.6.1 Report mapping

The reporting range of UL SRS RSRPP, as defined in clause 5.2.5 of 38.215 [4], is defined from -156 dBm to -31 dBm with resolution 1 dB.

The mapping of measured quantity is defined in table 13.6.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 13.6.1-1: UL SRS RSRPP report mapping

Reported value	Measured quantity value	Unit
SRS_RSRPP_0	SRS-RSRPP<-156	dBm
SRS_RSRPP_1	-156≤SRS-RSRPP<-155	dBm
SRS_RSRPP_2	-155≤SRS-RSRPP<-154	dBm
SRS_RSRPP_3	-154≤SRS-RSRPP<-153	dBm
SRS_RSRPP_4	-153≤SRS-RSRPP<-152	dBm
SRS_RSRPP_5	-152≤SRS-RSRPP<-151	dBm
SRS_RSRPP_6	-151≤SRS-RSRPP<-150	dBm
SRS_RSRPP_7	-150≤SRS-RSRPP<-149	dBm
SRS_RSRPP_8	-149≤SRS-RSRPP<-148	dBm
SRS_RSRPP_9	-148≤SRS-RSRPP<-147	dBm
SRS_RSRPP_10	-147≤SRS-RSRPP<-146	dBm
SRS_RSRPP_11	-146≤SRS-RSRPP<-145	dBm
SRS_RSRPP_12	-145≤SRS-RSRPP<-144	dBm
SRS_RSRPP_13	-144≤SRS-RSRPP<-143	dBm
SRS_RSRPP_14	-143≤SRS-RSRPP<-142	dBm
SRS_RSRPP_15	-142≤SRS-RSRPP<-141	dBm
SRS_RSRPP_16	-141≤SRS-RSRPP<-140	dBm
SRS_RSRPP_17	-140≤SRS-RSRPP<-139	dBm
SRS_RSRPP_18	-139≤SRS-RSRPP<-138	dBm
…	…	…
SRS_RSRPP_111	-46≤SRS-RSRPP<-45	dBm
SRS_RSRPP_112	-45≤SRS-RSRPP<-44	dBm
SRS_RSRPP_113	-44≤SRS-RSRPP<-43	dBm
SRS_RSRPP_114	-43≤SRS-RSRPP<-42	dBm
SRS_RSRPP_115	-42≤SRS-RSRPP<-41	dBm
SRS_RSRPP_116	-41≤SRS-RSRPP<-40	dBm
SRS_RSRPP_117	-40≤SRS-RSRPP<-39	dBm
SRS_RSRPP_118	-39≤SRS-RSRPP<-38	dBm
SRS_RSRPP_119	-38≤SRS-RSRPP<-37	dBm
SRS_RSRPP_120	-37≤SRS-RSRPP<-36	dBm
SRS_RSRPP_121	-36≤SRS-RSRPP<-35	dBm
SRS_RSRPP_122	-35≤SRS-RSRPP<-34	dBm
SRS_RSRPP_123	-34≤SRS-RSRPP<-33	dBm
SRS_RSRPP_124	-33≤SRS-RSRPP<-32	dBm
SRS_RSRPP_125	-32≤SRS-RSRPP<-31	dBm
SRS_RSRPP_126	-31≤SRS-RSRPP	dBm

13.7 gNB Rx-Tx time difference measurements for RTT-based PDC

13.7.1 Report mapping

The reporting range of gNB Rx-Tx time difference, as defined in clause 5.2.3 of TS 38.215 [4], is defined from -985024T_c to +985024×T_c. The reporting resolution is uniform across the reporting range and is defined as T_c*32.

T_c is defined in TS 38.211 [6].

The mapping of measured quantity is defined in table 13.7.1-1.

Table 13.7.1-1: gNB Rx-Tx time difference measurement report mapping

Reported Value	Measured Quantity Value	Unit
RX-TX_0000	-985024 > RX-TX	T_c
RX-TX_0001	-985024 ≤ RX-TX < -984992	T_c
RX-TX_0002	-984992 ≤ RX-TX < -984960	T_c
…	…	…
RX-TX_30781	-64 ≤ RX-TX < -32	T_c
RX-TX_30782	-32 ≤ RX-TX ≤ 0	T_c
RX-TX_30783	0 < RX-TX ≤ 32	T_c
RX-TX_30784	32 < RX-TX ≤ 64	T_c
RX-TX_30785	64 < RX-TX ≤ 96	T_c
…	…	…
RX-TX_61564	984992 < RX-TX ≤ 985024	T_c
RX-TX_61565	985024 < RX-TX	T_c

13.7.2 Measurement Accuracy Requirements

13.7.2.1 Introduction

This clause defines accuracy requirements for gNB Rx-Tx time difference measurement in FR1 and FR2. The requirements are applicable for gNB supporting gNB Rx-Tx time difference measurement for RTT-based PDC.

13.7.2.2 Requirements

The accuracy requirements for gNB Rx-Tx time difference measurement for RTT-based PDC shall be within ±(X+Y) T_c under the following conditions:

- AWGN propagation conditions.
- The measured signals are in the directions covered by RoAoA of OTA reference sensitivity requirements for gNB type 1-O and 2-O BS

where

- X is defined in table 13.7.2.2-1 for gNB types 1-C, 1-H and 1-O and in table 13.7.2.2-2 for gNB type 2-O.
- Y is declared by manufacturer and can be different for different gNB types 1-C, 1-H, 1-O and 2-O.

NOTE: The measurement accuracy requirements in table 13.7.2.2-1 and table 13.7.2.2-2 are defined under an assumption that gNB is not mandated to perform receive beam sweeping.

Table 13.7.2.2-1: gNB Rx-Tx time difference absolute accuracy in FR1 for gNB type 1-C, 1-H and 1-O

Accuracy	SRS Ês/Iot	SCS	SRS bandwidth range
Unit: Tc	Unit: dB	Unit: kHz	Unit: PRB
122	≥ +3	15	24 ≤ BW ≤ 40
62			44 ≤ BW ≤ 84
32			88 ≤ BW ≤ 168
16			176 ≤ BW
32		30	48 ≤ BW ≤ 84
17			88 ≤ BW ≤ 168
9			176 ≤ BW
16		60	48 ≤ BW ≤ 84
9			88 ≤ BW

Table 13.7.2.2-2: gNB Rx-Tx time difference absolute accuracy in FR2 for gNB type 2-O

Accuracy	SRS Ês/Iot	SCS	SRS bandwidth range
Unit: Tc	Unit: dB	Unit: kHz	Unit: PRB
9	≥ +3	60	132 ≤ BW ≤ 168
8			176 ≤ BW
16		120	32 ≤ BW ≤ 40
9			44 ≤ BW ≤ 84
8			88 ≤ BW

13.8 UL-RSCP measurement

13.8.1 Report mapping

The reporting range of UL-RSCP, as defined in clause 5.2.8 of 38.215 [4], is defined from 0 degree to 360 degree. The reporting resolution is 0.1 degree.

The mapping of UL-RSCP measured quantity is defined in table 13.8.1-1.

Table 13.8.1-1: UL-RSCP report mapping

Reported value	Measured quantity value (UL-RSCP)	Unit
UL_RSCP_0000	0 ≤ UL-RSCP < 0.1	degree
UL_RSCP_0001	0.1 ≤ UL-RSCP < 0.2	degree
UL_RSCP_0002	0.2 ≤ UL-RSCP < 0.3	degree
…	…	…
UL_RSCP_1798	179.8 ≤ UL-RSCP < 179.9	degree
UL_RSCP_1799	179.9 ≤ UL-RSCP < 180	degree
UL_RSCP_1800	180 ≤ UL-RSCP < 180.1	degree
UL_RSCP_1801	180.1 ≤ UL-RSCP < 180.2	degree
UL_RSCP_1802	180.2 ≤ UL-RSCP < 180.3	degree
…	…	…
UL_RSCP_3598	359.8 ≤ UL-RSCP < 359.9	degree
UL_RSCP_3599	359.9 ≤ UL-RSCP < 360	degree

13.9 UL SRS-TDCT measurement

13.9.1 Report mapping

The reporting range of UL SRS-TDCT measurement, as defined in Clause 5.2.9 of TS 38.215 [4], is defined from -985024×T_c to +985024×T_c. The reporting resolution is uniform across the reporting range and is defined as $T = T_c \times 2^k$, where k is selected by gNB from the set {0, 1, 2, 3, 4, 5}.

T_c is defined in TS 38.211 [6].

LMF provides a recommended resolution parameter, *timingReportingGranularityFactor* [35]. gNB selects parameter k based on *timingReportingGranularityFactor* [35] and informs the LMF.

The mapping of measured quantity for each reporting resolution (k) is defined in table 13.9.1-1 to table 13.9.1-6.

Table 13.9.1-1: Measurement report mapping for k=0

Reported Value	Measured Quantity Value	Unit
SRS_TDCT_0000000	-985024 > SRS-TDCT	T_c
SRS_TDCT_0000001	-985024 ≤ SRS-TDCT < -985023	T_c
SRS_TDCT_0000002	-985023 ≤ SRS-TDCT < -985022	T_c
…	…	…
SRS_TDCT_0985023	-2 ≤ SRS-TDCT < -1	T_c
SRS_TDCT_0985024	-1 ≤ SRS-TDCT ≤ 0	T_c
SRS_TDCT_0985025	0 < SRS-TDCT ≤ 1	T_c
SRS_TDCT_0985026	1 < SRS-TDCT ≤ 2	T_c
SRS_TDCT_0985027	2 < SRS-TDCT ≤ 3	T_c
…	…	…
SRS_TDCT_1970048	985023 < SRS-TDCT ≤ 985024	T_c
SRS_TDCT_1970049	985024 < SRS-TDCT	T_c

Table 13.9.1-2: Measurement report mapping for k=1

Reported Value	Measured Quantity Value	Unit
SRS_TDCT_000000	-985024 > SRS-TDCT	T_c
SRS_TDCT_000001	-985024 ≤ SRS-TDCT < -985022	T_c
SRS_TDCT_000002	-985022 ≤ SRS-TDCT < -985020	T_c
…	…	…
SRS_TDCT_492511	-4 ≤ SRS-TDCT < -2	T_c
SRS_TDCT_492512	-2 ≤ SRS-TDCT ≤ 0	T_c
SRS_TDCT_492513	0 < SRS-TDCT ≤ 2	T_c
SRS_TDCT_492514	2 < SRS-TDCT ≤ 4	T_c
SRS_TDCT_492515	4 < SRS-TDCT ≤ 6	T_c
…	…	…
SRS_TDCT_985024	985022 < SRS-TDCT ≤ 985024	T_c
SRS_TDCT_985025	985024 < SRS-TDCT	T_c

Table 13.9.1-3: Measurement report mapping for k=2

Reported Value	Measured Quantity Value	Unit
SRS_TDCT_000000	-985024 > SRS-TDCT	T_c
SRS_TDCT_000001	-985024 ≤ SRS-TDCT < -985020	T_c
SRS_TDCT_000002	-985020 ≤ SRS-TDCT < -985018	T_c

…	…	…
SRS_TDCT_246255	-8 ≤ SRS-TDCT < -4	T_c
SRS_TDCT_246256	-4 ≤ SRS-TDCT ≤ 0	T_c
SRS_TDCT_246257	0 < SRS-TDCT ≤ 4	T_c
SRS_TDCT_246258	4 < SRS-TDCT ≤ 8	T_c
SRS_TDCT_246259	8 < SRS-TDCT ≤ 12	T_c
…	…	…
SRS_TDCT_492512	985020 < SRS-TDCT ≤ 985024	T_c
SRS_TDCT_492513	985024 < SRS-TDCT	T_c

Table 13.9.1-4: Measurement report mapping for k=3

Reported Value	Measured Quantity Value	Unit
SRS_TDCT_000000	-985024 > SRS-TDCT	T_c
SRS_TDCT_000001	-985024 ≤ SRS-TDCT < -985016	T_c
SRS_TDCT_000002	-985016 ≤ SRS-TDCT < -985008	T_c
…	…	…
SRS_TDCT_123127	-16 ≤ SRS-TDCT < -8	T_c
SRS_TDCT_123128	-8 ≤ SRS-TDCT ≤ 0	T_c
SRS_TDCT_123129	0 < SRS-TDCT ≤ 8	T_c
SRS_TDCT_123130	8 < SRS-TDCT ≤ 16	T_c
SRS_TDCT_123131	16 < SRS-TDCT ≤ 24	T_c
…	…	…
SRS_TDCT_246256	985016 < SRS-TDCT ≤ 985024	T_c
SRS_TDCT_246257	985024 < SRS-TDCT	T_c

Table 13.9.1-5: Measurement report mapping for k=4

Reported Value	Measured Quantity Value	Unit
SRS_TDCT_000000	-985024 > SRS-TDCT	Tc
SRS_TDCT_000001	-985024 ≤ SRS-TDCT < -985008	Tc
SRS_TDCT_000002	-985008 ≤ SRS-TDCT < -984992	Tc
…	…	…
SRS_TDCT_061563	-32 ≤ SRS-TDCT < -16	Tc
SRS_TDCT_061564	-16 ≤ SRS-TDCT ≤ 0	Tc
SRS_TDCT_061565	0 < SRS-TDCT ≤ 16	Tc
SRS_TDCT_061566	16 < SRS-TDCT ≤ 32	Tc

SRS_TDCT_061567	32 < SRS-TDCT ≤ 48	Tc
…	…	…
SRS_TDCT_123128	985008 < SRS-TDCT ≤ 985024	Tc
SRS_TDCT_123129	985024 < SRS-TDCT	Tc

Table 13.9.1-6: Measurement report mapping for k=5

Reported Value	Measured Quantity Value	Unit
SRS_TDCT_00000	-985024 > SRS-TDCT	T_c
SRS_TDCT_00001	-985024 ≤ SRS-TDCT < -984992	T_c
SRS_TDCT_00002	-984992 ≤ SRS-TDCT < -984960	T_c
…	…	…
SRS_TDCT_30781	-64 ≤ SRS-TDCT < -32	T_c
SRS_TDCT_30782	-32 ≤ SRS-TDCT ≤ 0	T_c
SRS_TDCT_30783	0 < SRS-TDCT ≤ 32	T_c
SRS_TDCT_30784	32 < SRS-TDCT ≤ 64	T_c
SRS_TDCT_30785	64 < SRS-TDCT ≤ 96	T_c
…	…	…
SRS_TDCT_61564	984992 < SRS-TDCT ≤ 985024	T_c
SRS_TDCT_61565	985024 < SRS-TDCT	T_c

13.10 UL SRS-TDCP measurement

13.10.1 Report mapping

The reporting range of UL SRS-TDCP measurement, as defined in clause 5.2.10 of 38.215 [4], is defined from -156 dBm to -31 dBm with resolution 1 dB.

The mapping of measured quantity is defined in table 13.10.1-1.

Table 13.10.1-1: UL SRS-TDCP report mapping

Reported value	Measured quantity value	Unit
SRS_TDCP_000	SRS-TDCP < -156	dBm
SRS_TDCP_001	-156 ≤ SRS-TDCP < -155	dBm
SRS_TDCP_002	-155 ≤ SRS-TDCP < -154	dBm
SRS_TDCP_003	-154 ≤ SRS-TDCP < -153	dBm
SRS_TDCP_004	-153 ≤ SRS-TDCP < -152	dBm
SRS_TDCP_005	-152 ≤ SRS-TDCP < -151	dBm
SRS_TDCP_006	-151 ≤ SRS-TDCP < -150	dBm
SRS_TDCP_007	-150 ≤ SRS-TDCP < -149	dBm
SRS_TDCP_008	-149 ≤ SRS-TDCP < -148	dBm
SRS_TDCP_009	-148 ≤ SRS-TDCP < -147	dBm

SRS_TDCP_010	-147 ≤ SRS-TDCP < -146	dBm
SRS_TDCP_011	-146 ≤ SRS-TDCP < -145	dBm
SRS_TDCP_012	-145 ≤ SRS-TDCP < -144	dBm
SRS_TDCP_013	-144 ≤ SRS-TDCP < -143	dBm
SRS_TDCP_014	-143 ≤ SRS-TDCP < -142	dBm
SRS_TDCP_015	-142 ≤ SRS-TDCP < -141	dBm
SRS_TDCP_016	-141 ≤ SRS-TDCP < -140	dBm
SRS_TDCP_017	-140 ≤ SRS-TDCP < -139	dBm
SRS_TDCP_018	-139 ≤ SRS-TDCP < -138	dBm
…	…	…
SRS_TDCP_111	-46 ≤ SRS-TDCP < -45	dBm
SRS_TDCP_112	-45 ≤ SRS-TDCP < -44	dBm
SRS_TDCP_113	-44 ≤ SRS-TDCP < -43	dBm
SRS_TDCP_114	-43 ≤ SRS-TDCP < -42	dBm
SRS_TDCP_115	-42 ≤ SRS-TDCP < -41	dBm
SRS_TDCP_116	-41 ≤ SRS-TDCP < -40	dBm
SRS_TDCP_117	-40 ≤ SRS-TDCP < -39	dBm
SRS_TDCP_118	-39 ≤ SRS-TDCP < -38	dBm
SRS_TDCP_119	-38 ≤ SRS-TDCP < -37	dBm
SRS_TDCP_120	-37 ≤ SRS-TDCP < -36	dBm
SRS_TDCP_121	-36 ≤ SRS-TDCP < -35	dBm
SRS_TDCP_122	-35 ≤ SRS-TDCP < -34	dBm
SRS_TDCP_123	-34 ≤ SRS-TDCP < -33	dBm
SRS_TDCP_124	-33 ≤ SRS-TDCP < -32	dBm
SRS_TDCP_125	-32 ≤ SRS-TDCP < -31	dBm
SRS_TDCP_126	-31 ≤ SRS-TDCP	dBm

Annex A (normative): Test Cases

A.1 Purpose of annex

The purpose of annex A is to define test cases and the relevant configurations for verifying various types of RRM requirements with NR cells, including SA NR, EN-DC, and NE-DC deployments as well as standalone E-UTRA deployments.

A.2 Requirement classification for statistical testing

Requirements in this specification are either expressed as absolute requirements with a single value stating the requirement or expressed as a success rate. There are no provisions for the statistical variations that will occur when the parameter is tested.

Annex A outlines the tests in more detail and lists the test parameters needed. The test will result in an outcome of a test variable value for the device under test (DUT) inside or outside the test limit. Overall, the probability of a "good" DUT being inside the test limit(s) and the probability of a "bad" DUT being outside the test limit(s) should be as high as possible. For this reason, when selecting the test variable and the test limit(s), the statistical nature of the test is accounted for.

The statistical nature depends on the type of requirement. Some have large statistical variations, while others are not statistical in nature at all. When testing a parameter with a statistical nature, a confidence level is set. This establishes the probability that a DUT passing the test actually meets the requirements and determines how many times a test has to be repeated and what the pass and fail criteria are. Those aspects are not covered by TS 38.133. The details of the tests on how many times to run it and how to establish confidence in the tests are described in TS 38.533 [5]. This annex establishes the variable to be used in the test and whether it can be viewed as statistical in nature or not.

A.2.1 Types of requirements in TS 38.133

A.2.1.1 Time and delay requirements on UE higher layer actions

A very large part of the RRM requirements are delay requirements:

- In RRC_IDLE state mobility (clause A.6.1 and A.7.1) there is cell re-selection delay.
- In RRC_CONNECTED state mobility (clauses A.4.3, A.4.6, A.5.3, A.5.6, A.6.3, A.6.6, A.7.3 and A.7.6) there is handover delay, cell search delay and measurement reporting delay.
- In RRC Connection Control (clauses A.4.3.2, A.5.3.2, A.6.3.2 and A.7.3.2) there is RRC re-establishment delay.

All have in common that the UE is required to perform an action observable in higher layers (e.g. camp on the correct cell) within a certain time after a specific event (e.g. when a new strong pilot or reference signal appears). The delay time is statistical in nature for several reasons, among others that several of the measurements are performed by the UE in a fading radio environment.

The variations make a strict limit unsuitable for a test. Instead there is a condition set for a correct action by the UE, e.g. that the UE shall camp on the correct cell within X seconds. Then the rate of correct events is observed during repeated tests and a limit is set on the rate of correct events, usually 90% correct events are required. How the limit is applied in the test depends on the confidence required, further detailed are in TS 38.533 [5].

A.2.1.2 Measurements of power levels, relative powers and time

A very large number of requirements are on measurements that the UE performs:

- In RRC_CONNECTED state mobility (clauses A.4.3, A.5.3, A.6.3 and A.7.3) there are measurement reports.
- In Measurement Performance Requirements (clauses A.4.7, A.5.7, A.6.7 and A.7.7) there are requirements for all type of measurements.

The accuracy requirements on measurements are expressed in this specification as a fixed limit (e.g. +/-X dB), but the measurement error will have a distribution that is not easily confined in fixed limits. Assuming a Gaussian distribution of the error, the limits will have to be set at +/-3.29σ if the probability of failing a "good DUT" in a single test is to be kept at 0.1%. It is more reasonable to set the limit tighter and test the DUT by counting the rate of measurements that are within the limits, in a way similar to the requirements on delay.

A.2.1.3 Implementation requirements

A few requirements are strict actions the UE should take or capabilities the UE should have, without any allowance for deviations. These requirements are absolute and should be tested as such. Examples are:

- "Event triggered report rate" in RRC_CONNECTED state mobility (clauses A.4.3, A.4.6, A.5.3, A.5.6, A.6.3, A.6.6, A.7.3 and A.7.6),
- "Correct behaviour at time-out" in RRC connection control (clauses A.4.3.2, A.5.3.2, A.6.3.2 and A.7.3.2).

A.2.1.4 Physical layer timing requirements

There are requirements on Timing (clauses A.4.4, A.5.4, A.6.4 and A.7.4). There are both absolute and relative limits on timing accuracy depending upon the type of requirement. Examples are:

- Initial Transmit Timing (clauses A.4.4.1, A.5.4.1, A.6.4.1 and A.7.4.1) has an absolute limit on timing accuracy.
- Timing Advance (clauses A.4.4.2, A.5.4.2, A.6.4.2 and A.7.4.2) has a relative limit on timing accuracy.

A.2.1.5 Requirements under CCA

A few requirements include CCA failures in DL and or UL. Considering that the CCA model is of statistical nature, requirements that include CCA failures are always considered of statistical nature.

A.3 RRM test configurations

A.3.1 Reference measurement channels

A.3.1.1 PDSCH

A.3.1.1.1 FDD

Table A.3.1.1.1-1: PDSCH Reference Measurement Channels for SCS=15 kHz

Parameter	Unit	Value						
Reference channel		SR.1.1 FDD	SR.1.2 FDD	SR.1.3 FDD				
Channel bandwidth	MHz	Defined in test case	Defined in test case by the parameter $N_{RB,c}$	Defined in test case by the parameter $N_{RB,c}$				

Number of transmitter antennas		1	1	1				
Allocated resource blocks for PDSCH Note 1		24	15	12				
Allocated slots per Radio Frame		10	10	10				
Radio frame containing SSB	slots	Note 5	Note 5	Note 5				
Radio frame not containing SSB	slots	10	10	10				
MCS index		4	4	4				
Modulation		QPSK	QPSK	QPSK				
Target Coding Rate		1/3	1/3	1/3				
Number of control symbols		2	2	2				
PDSCH mapping type		Type A	Type A	Type A				
Information Bit Payload								
For slots with RMSI Note 2	bits	1608	984	736				
For slots without RMSI	bits	1864	1128	888				
Number of Code Blocks per slot		1	1	1				
Binary Channel Bits Per slot								
For slots with RMSI Note 2, Note 4	bits	5184	3240	2592				
For slots without RMSI Note 6	bits	6048	3780	3024				

NOTE 1: Allocated outside the SMTC duration in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block.
NOTE 2: PDSCH is scheduled on the slots with RMSI.
NOTE 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
NOTE 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 2.
NOTE 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in clause A.3.10.
NOTE 6: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.
NOTE 7: When DRX is configured, PDCCH can be scheduled both for downlink assignment and/or UL grant only during (10ms - drx-InactivityTimer) from timing when drx-onDurationTimer starts, unless otherwise specified in the test case.

A.3.1.1.2 TDD

Table A.3.1.1.2-1: PDSCH Reference Measurement Channels for SCS=15 kHz

Parameter	Unit	Value						
Reference channel		SR.1.1 TDD	SR.1.2 TDD					
Channel bandwidth	MHz	Defined in test case	Defined in test case					
Number of transmitter antennas		1	1					
Allocated resource blocks for PDSCH Note 1		24	24					
Allocated slots per Radio Frame								
Radio frame containing SSB	slots	Note 5	Note 5					
Radio frame not containing SSB	slots	4	6					
MCS table		64QAM	64QAM					
MCS index		4	4					

Modulation		QPSK	QPSK					
Target Coding Rate		1/3	1/3					
Number of control symbols		2	2					
PDSCH mapping type		Type A	Type A					
Information Bit Payload								
For slots with RMSI Note 2	bits	1608	1608					
For slots without RMSI	bits	1864	1864					
For special slots	bits	N/A	1128					
Number of Code Blocks per slot		1	1					
Binary Channel Bits Per slot								
For slots with RMSI Note 2, Note 4	bits	5184	5184					
For slots without RMSI Note 6	bits	6048	6048					
For special slots Note 6	bits	-	3744					

NOTE 1: Allocated outside the SMTC duration in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block.
NOTE 2: PDSCH is scheduled on the slots with RMSI.
NOTE 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
NOTE 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 2.
NOTE 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in clause A.3.10.
NOTE 6: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.
NOTE 7: When DRX is configured, PDCCH can be scheduled both for downlink assignment and/or UL grant only during (10ms - drx-InactivityTimer) from timing when drx-onDurationTimer starts, unless otherwise specified in the test case.

Table A.3.1.1.2-2: PDSCH Reference Measurement Channels for SCS=30 kHz

Parameter	Unit	Value						
Reference channel		SR.2.1 TDD						
Channel bandwidth	MHz	Defined in test case						
Number of transmitter antennas		1						
Allocated resource blocks for PDSCH Note 1		24						
Allocated slots per Radio Frame								
Radio frame containing SSB	slots	Note 5						
Radio frame not containing SSB	slots	10						
MCS table		64QAM						
MCS index		4						
Modulation		QPSK						
Target Coding Rate		1/3						
Number of control symbols		2						
PDSCH mapping type		Type A						
Information Bit Payload								
For slots with RMSI Note 2	bits	1608						
For slots without RMSI	bits	1864						
Number of Code Blocks per slot		1						
Binary Channel Bits Per slot								

For slots with RMSI Note 2, Note 4	bits	6048						

NOTE 1: Allocated outside the SMTC duration in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block.
NOTE 2: PDSCH is scheduled on the slots with RMSI.
NOTE 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
NOTE 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 2.
NOTE 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in clause A.3.10.
NOTE 6: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.
NOTE 7: When DRX is configured, PDCCH can be scheduled both for downlink assignment and/or UL grant only during (10ms - drx-InactivityTimer) from timing when drx-onDurationTimer starts, unless otherwise specified in the test case.

Table A.3.1.1.2-3: PDSCH Reference Measurement Channels for SCS=120 kHz

Parameter	Unit	Value						
Reference channel		SR.3.1 TDD	SR.3.2 TDD	SR.3.3 TDD				
Channel bandwidth	MHz	100	100	100				
Number of transmitter antennas		1	1	1				
Allocated resource blocks for PDSCH		24 Note 1	24 Note 7	48 Note 7				
Allocated slots per Radio Frame								
Radio frame containing SSB	slots	Note 5	Note 5	Note 5				
Radio frame not containing SSB	slots	48	48	48				
MCS table		64QAM	64QAM	64QAM				
MCS index		4	4	4				
Modulation		QPSK	QPSK	QPSK				
Target Coding Rate		1/3	1/3	1/3				
Number of control symbols		2	2	2				
PDSCH mapping type		Type A	Type A	Type A				
Information Bit Payload								
For slots with RMSI	bits	1608	1608	3104				
For slots without RMSI	bits	1864	1864	3624				
Number of Code Blocks per slot		1	1	1				
Binary Channel Bits Per slot								
For slots with RMSI Note 4	bits	5184	5184	10368				
For slots without RMSI Note 6	bits	6048	6048	12096				

NOTE 1: Allocated in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block
NOTE 2: Void
NOTE 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
NOTE 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 2.
NOTE 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in clause A.3.10.
NOTE 6: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.
NOTE 7: Allocated in the same resource blocks as the CORESET.
NOTE 8: When DRX is configured, PDSCH is scheduled only while *drx-onDurationTimer* is running, unless otherwise specified in the test case.

A.3.1.2 CORESET for RMSI scheduling

A.3.1.2.1 FDD

Table A.3.1.2.1-1: RMSI CORESET Reference Channel for FDD with SCS=15KHz

Parameter	Unit	Value						
Reference channel		CR.1.1 FDD	CR.1.2 FDD	CR.1.3 FDD	CR.1.4 FDD			
Channel bandwidth	MHz	Defined in test case	Defined in test case	Defined in test case	Defined in test case			
Subcarrier spacing for RMSI CORESET	kHz	15	15	15	15			
Allocated resource blocks for RMSI CORESET		24 (Note 8)	12 (Note 9)	15 (Note 10)	20 (Note 11)			
Subcarrier spacing for SSB	kHz	15	15	15	15			
SSB and RMSI CORESET multiplexing configuration		Pattern 1	Pattern 1	Pattern 1	Pattern 1			
Offset between SSB and RMSI CORESET Note 3, 7	PRB	0 (Note 8)	0 (Note 9)	0 (Note 10)	0 (Note 11)			
Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4		Index 4	Index 4	Index 4	Index 4			
Number of transmitter antennas		1	1	1	1			
Duration of RMSI CORESET	symbols	2 (Note 8)	2 (Note 9)	3 (Note 10)	3 (Note 11)			
DCI Format Note 1		Note 2	Note 2	Note 2	Note 2			
Aggregation level	CCE	8	4	8	8			
DMRS precoder granularity		6	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size			
REG bundle size		6	6	6	6			
Mapping from REG to CCE		Distributed (Note 8)	Distributed (Note 9)	Non-Distributed (Note 10)	Distributed (Note 11)			
Cell ID		Note 5	Note 5	Note 5	Note 5			
Payload (without CRC)	bits	Note 6	Note 6	Note 6	Note 6			

NOTE 1: DCI formats are defined in TS 38.212 [8].
NOTE 2: DCI format shall depend upon the test configuration.
NOTE 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest PRB index of RMSI CORESET to the smallest PRB index of the common PRB overlapping with the first PRB of the SS/PBCH block.
NOTE 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in table 13-11 in TS 38.213 [3].
NOTE 5: Cell ID shall depend upon the test configuration.
NOTE 6: Payload size shall depend upon the test configuration.
NOTE 7: Other values can be used to align with GSCN [13] as long as SSB does not overlap the RMC.
NOTE 8: The configuration of set of resource blocks, slot symbols, RB offset and REG to CCE mapping of control resource set for Type0-PDCCH search space corresponds to index 0 in table 13-1 in TS 38.213 [3]
NOTE 9: The configuration of set of resource blocks, slot symbols, RB offset and REG to CCE mapping of control resource set for Type0-PDCCH search space corresponds to index 0 in table 13-0 in TS 38.213 [3]
NOTE 10: The configuration of set of resource blocks, slot symbols, RB offset and REG to CCE mapping of control resource set for Type0-PDCCH search space corresponds to index 8 in table 13-0 in TS 38.213 [3]
NOTE 11: The configuration of set of resource blocks, slot symbols, RB offset and REG to CCE mapping of control resource set for Type0-PDCCH search space corresponds to index 11 in table 13-0 in TS 38.213 [3]

A.3.1.2.2 TDD

Table A.3.1.2.2-1: RMSI CORESET Reference Channel for TDD with SCS=15kHz

Parameter	Unit	Value						
Reference channel		CR.1.1 TDD						
Channel bandwidth	MHz	Defined in test case						
Subcarrier spacing	kHz	15						
Allocated resource blocks for RMSI CORESET Note 7		24						
SSB and RMSI CORESET multiplexing configuration Note 7		Pattern 1						
Offset between SSB and RMSI CORESET Note 3, 7	PRB	0 (Note 8)						
Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4		Index 4						
Number of transmitter antennas		1						
Duration of RMSI CORESET Note 7	symbols	2						
DCI Format Note 1		Note 2						
Aggregation level	CCE	8						
DMRS precoder granularity		6						
REG bundle size		6						
Mapping from REG to CCE		Distributed						
Cell ID		Note 5						
Payload (without CRC)	bits	Note 6						

NOTE 1: DCI formats are defined in TS 38.212 [8].
NOTE 2: DCI format shall depend upon the test configuration.
NOTE 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest PRB index of RMSI CORESET to the smallest PRB index of the common PRB overlapping with the first PRB of the SS/PBCH block.
NOTE 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in table 13-11 in TS 38.213 [3].
NOTE 5: Cell ID shall depend upon the test configuration.
NOTE 6: Payload size shall depend upon the test configuration.
NOTE 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 0 in table 13-1 in TS 38.213 [3].
NOTE 8: Other values can be used to align with GSCN [13] as long as SSB does not overlap the RMC.

Table A.3.1.2.2-2: RMSI CORESET Reference Channel for TDD with SCS=30kHz

Parameter	Unit	Value						
Reference channel		CR.2.1 TDD						
Channel bandwidth	MHz	Defined in test case						
Subcarrier spacing	kHz	30						
Allocated resource blocks for RMSI CORESET Note 7		24						
SSB and RMSI CORESET multiplexing configuration Note 7		Pattern 1						
Offset between SSB and RMSI CORESET Note 3, 7	PRB	0 (Note 8)						
Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4		Index 4						

Number of transmitter antennas		1						
Duration of RMSI CORESET Note 7	symbols	2						
DCI Format Note 1		Note 2						
Aggregation level	CCE	8						
DMRS precoder granularity		6						
REG bundle size		6						
Mapping from REG to CCE		Distributed						
Cell ID		Note 5						
Payload (without CRC)	bits	Note 6						

NOTE 1: DCI formats are defined in TS 38.212 [8].
NOTE 2: DCI format shall depend upon the test configuration.
NOTE 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest PRB index of RMSI CORESET to the smallest PRB index of the common PRB overlapping with the first PRB of the SS/PBCH block.
NOTE 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in table 13-11 in TS 38.213 [3].
NOTE 5: Cell ID shall depend upon the test configuration.
NOTE 6: Payload size shall depend upon the test configuration.
NOTE 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 0 in table 13-6 in TS 38.213 [3].
NOTE 8: Other values can be used to align with GSCN [13] as long as SSB does not overlap the RMC.

Table A.3.1.2.2-3: RMSI CORESET Reference Channel for TDD with SCS=120kHz

Parameter	Unit	Value						
Reference channel		CR.3.1 TDD	CR.3.2 TDD					
Channel bandwidth	MHz	100	100					
Subcarrier spacing	kHz	120	120					
Allocated resource blocks for RMSI CORESET		24 Note 7	48 Note 9					
SSB and RMSI CORESET multiplexing configuration		Pattern 1 Note 7	Pattern 1 Note 9					
Offset between SSB and RMSI CORESET Note 3	PRB	0 (Note 8) Note 7	0 (Note 8) Note 9					
Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4		Index 4	Index 4					
Number of transmitter antennas		1	1					
Duration of RMSI CORESET	symbols	2 Note 7	2 Note 9					
DCI Format Note 1		Note 2	Note 2					
Aggregation level	CCE	8	8					
DMRS precoder granularity		6	6					
REG bundle size		6	6					
Mapping from REG to CCE		Distributed	Distributed					
Cell ID		Note 5	Note 5					
Payload (without CRC)	bits	Note 6	Note 6					

NOTE 1: DCI formats are defined in TS 38.212 [8].
NOTE 2: DCI format shall depend upon the test configuration.
NOTE 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest PRB index of RMSI CORESET to the smallest PRB index of the common PRB overlapping with the first PRB of the SS/PBCH block.
NOTE 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in table 13-12 in TS 38.213 [3].
NOTE 5: Cell ID shall depend upon the test configuration.
NOTE 6: Payload size shall depend upon the test configuration.
NOTE 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 0 in table 13-8 in TS 38.213 [3].
NOTE 8: Other values can be used to align with GSCN [13] as long as SSB does not overlap the RMC.
NOTE 9: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 2 in table 13-10 in TS 38.213 [3].

A.3.1.3 CORESET for RMC scheduling

A.3.1.3.1 FDD

Table A.3.1.3.1-1: Control Channel RMC for FDD with SCS=15kHz

Parameter	Unit	Value									
Reference channel		CCR.1.1 FDD	CCR.1.2 FDD	CCR.1.3 FDD	CCR.1.4 FDD	CCR.1.5 FDD	CCR.1.6 FDD	CCR.1.7 FDD	CCR.1.8 FDD		
Channel bandwidth	MHz	Defined in test case	Defined in test case	Defined in test case	Defined in test case	10	3 MHz	3 MHz	5 MHz		
Subcarrier spacing	kHz	15	15	15	15	15	15	15	15		
Allocated resource blocks for CORESET Note 3		24	18	24	18	24	12	12	18		
Number of transmitter antennas		1	1	1	1	1	1	1	1		
Duration of CORESET	symbols	2	2	2	2	2	2	2	3		
monitoringSymbolsWithinSlot		10000000000000	10000000000000	10000000000000	10000000000000	00100000000000	10000000000000	10000000000000	10000000000000		
REG bundle size		6	6	6	6	6	6	6	6		
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size		
CCE to REG mapping		Interleaved	Interleaved	Interleaved	Interleaved	Interleaved	Interleaved	Non-Interleaved	Interleaved		
Interleave n_shift		0	0	0	0	0	0	0	0		
Interleave size		2	2	2	2	2	2	N/A	2		
Beamforming Pre-Coder		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Aggregation level	CCE	4	2	8	4	4	4	4	8		
DCI formats		Note 1	Note 1	Note 1	Note 1	Note 1	1-0	1-0	1-0		
Payload size (without CRC)	bits	Note 2	Note 2	Note 2	Note 2	Note 2	Note 2	Note 2	Note 2		
NOTE 1: DCI format shall depend upon the test configuration. NOTE 2: Payload size shall depend upon the test configuration. NOTE 3: Allocated in the resource blocks where the associated RMC is scheduled.											

Table A.3.1.3.1-2: Control Channel RMC for FDD with SCS=120kHz

Parameter	Unit	Value						
Reference channel		CCR.2.1 FDD						
Channel bandwidth	MHz	100						
Subcarrier spacing	kHz	120						
Allocated resource blocks for CORESET Note 3		24						
Number of transmitter antennas		1						
Duration of CORESET	symbols	1						
monitoringSlotPeriodicityAndOffset Note 4		sl1600						
monitoringSymbolsWithinSlot		11000000000000						
REG bundle size		6						

DMRS precoder granularity		Same as REG bundle size						
CCE to REG mapping		Interleaved						
Interleave n_shift		0						
Interleave size		2						
Beamforming Pre-Coder		N/A						
Aggregation level	CCE	4						
DCI formats		Note 1						
Payload size (without CRC)	bits	Note 2						
NOTE 1: DCI format shall depend upon the test configuration. NOTE 2: Payload size shall depend upon the test configuration. NOTE 3: Allocated in the resource blocks where the associated RMC is scheduled. NOTE 4: *monitoringSlotPeriodicityAndOffet* is set to “sl1 0” if it is specifically stated that cell(s) configured with one of the control channel RMCs above shall transmit PDCCHs continuously.								

Table A.3.1.3.1-3: Control Channel RMC for FDD with SCS=15kHz

Parameter	Unit	Value				
Reference channel		CCR.3.1 FDD	CCR.3.2 FDD			
Channel bandwidth	MHz	Defined in test case	Defined in test case			
Subcarrier spacing	kHz	15	15			
Allocated resource blocks for CORESET Note 3		48	48			
Number of transmitter antennas		1	1			
Duration of CORESET	symbols	2	2			
monitoringSymbolsWithinSlot		10000000000000	10000000000000			
REG bundle size		6	6			
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size			
CCE to REG mapping		Interleaved	Interleaved			
Interleave n_shift		0	0			
Interleave size		2	2			
Beamforming Pre-Coder		N/A	N/A			
Aggregation level	CCE	8	16			
DCI formats		Note 1	Note 1			
Payload size (without CRC)	bits	Note 2	Note 2			
Note 1: DCI format shall depend upon the test configuration. Note 2: Payload size shall depend upon the test configuration Note 3: Allocated in the resource blocks where the associated RMC is scheduled.						

A.3.1.3.2 TDD

Table A.3.1.3.2-1: Control Channel RMC for TDD with SCS=15kHz

Parameter	Unit	Value						
Reference channel		CCR.1.1 TDD	CCR.1.2 TDD	CCR.1.3 TDD	CCR.1.4 TDD	CCR.1.5 TDD		
Channel bandwidth	MHz	Defined in test case	Defined in test case	Defined in test case	Defined in test case	10		
Subcarrier spacing	kHz	15	15	15	15	15		
Allocated resource blocks for CORESET Note 3		24	18	24	18	18		
Number of transmitter antennas		1	1	1	1	1		
Duration of CORESET	symbols	2	2	2	2	2		
monitoringSymbolsWithinSlot		1000000	1000000	1000000	1000000	0010000		

		0000000	0000000	0000000	0000000	0000000		
REG bundle size		6	6	6	6	6		
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size		
CCE to REG mapping		Interleaved	Interleaved	Interleaved	Interleaved	Interleaved		
Interleave n_shift		0	0	0	0	0		
Interleave size		2	2	2	2	2		
Beamforming Pre-Coder		N/A	N/A	N/A	N/A	N/A		
Aggregation level	CCE	4	2	8	4	4		
DCI formats		Note 1	Note 1	Note 1	Note 1	Note 1		
Payload size (without CRC)	bits	Note 2	Note 2	Note 2	Note 2	Note 2		
NOTE 1: DCI format shall depend upon the test configuration. NOTE 2: Payload size shall depend upon the test configuration. NOTE 3: Allocated in the resource blocks where the associated RMC is scheduled.								

Table A.3.1.3.2-2: Control Channel RMC for TDD with SCS=30kHz

Parameter	Unit	Value						
Reference channel		CCR.2.1 TDD	CCR.2.2 TDD	CCR.2.3 TDD	CCR.2.4 TDD			
Channel bandwidth	MHz	Defined in test case	Defined in test case	Defined in test case	Defined in test case			
Subcarrier spacing	kHz	30	30	30	30			
Allocated resource blocks for CORESET Note 3		24	24	18	18			
Number of transmitter antennas		1	1	1	1			
Duration of CORESET	symbols	2	2	2	2			
REG bundle size		6	6	6	6			
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size			
CCE to REG mapping		Interleaved	Interleaved	Interleaved	Interleaved			
Interleave n_shift		0	0	0	0			
Interleave size		2	2	2	2			
Beamforming Pre-Coder		N/A	N/A	N/A	N/A			
Aggregation level	CCE	4	8	4	2			
DCI formats		Note 1	Note 1	Note 1	Note 1			
Payload size (without CRC)	bits	Note 2	Note 2	Note 2	Note 2			
NOTE 1: DCI format shall depend upon the test configuration. NOTE 2: Payload size shall depend upon the test configuration. NOTE 3: Allocated in the same resource blocks where the associated RMC is scheduled.								

Table A.3.1.3.2-3: Control Channel RMC for TDD with SCS=120kHz

Parameter	Unit	Value						
Reference channel		CCR.3.1 TDD	CCR.3.2 TDD	CCR.3.3 TDD	CCR.3.4 TDD	CCR.3.5 TDD	CCR.3.6 TDD	CCR.3.7 TDD
Channel bandwidth	MHz	100	100	100	100	100	100	100
Subcarrier spacing	kHz	120	120	120	120	120	120	120
Allocated resource blocks for CORESET Note 3		24	24	24	24	24	24	48
Number of transmitter antennas		1	1	1	1	1	1	1

monitoringSlotPeriodicityAndOffset Note 4		sl160 0	sl160 0	sl160 80	sl160 0	sl160 0	sl160 80	sl160 0
monitoringSymbolsWithinSlot		1100000 0000000	0011000 0000000	1100000 0000000	1000000 0000000	0010000 0000000	1000000 0000000	1100000 0000000
Duration of CORESET	slot	1	1	1	2	2	2	1
REG bundle size		6	6	6	6	6	6	6
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size
CCE to REG mapping		Interleaved	Interleaved	Interleaved	Interleaved	Interleaved	Interleaved	Interleaved
Interleave n_shift		0	0	0	0	0	0	0
Interleave size		2	2	2	2	2	2	2
Beamforming Pre-Coder		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aggregation level	CCE	4	4	4	8	8	8	4
DCI formats		Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Payload size (without CRC)	bits	Note 2	Note 2	Note 2	Note 2	Note 2	Note 2	Note 2
NOTE 1: DCI format shall depend upon the test configuration. NOTE 2: Payload size shall depend upon the test configuration. NOTE 3: Allocated in the same resource blocks where the associated PDSCH RMC is scheduled. NOTE 4: *monitoringSlotPeriodicityAndOffet* is set to “sl1 0” if it is specifically stated that cell(s) configured with one of the control channel RMCs above shall transmit PDCCHs continuously.								

Table A.3.1.3.2-4: Control Channel RMC for TDD with SCS=15kHz

Parameter	Unit	Value				
Reference channel		CCR.4.1 TDD	CCR.4.2 TDD			
Channel bandwidth	MHz	Defined in test case	Defined in test case			
Subcarrier spacing	kHz	15	15			
Allocated resource blocks for CORESET Note 3		48	48			
Number of transmitter antennas		1	1			
Duration of CORESET	symbols	2	2			
monitoringSymbolsWithinSlot		1000000 0000000	1000000 0000000			
REG bundle size		6	6			
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size			
CCE to REG mapping		Interleaved	Interleaved			
Interleave n_shift		0	0			
Interleave size		2	2			
Beamforming Pre-Coder		N/A	N/A			
Aggregation level	CCE	8	16			
DCI formats		Note 1	Note 1			
Payload size (without CRC)	bits	Note 2	Note 2			
Note 1: DCI format shall depend upon the test configuration. Note 2: Payload size shall depend upon the test configuration Note 3: Allocated in the resource blocks where the associated RMC is scheduled.						

Table A.3.1.3.2-5: Control Channel RMC for TDD with SCS=30kHz

Parameter	Unit	Value				
Reference channel		CCR.5.1 TDD	CCR.5.2 TDD			

Channel bandwidth	MHz	Defined in test case	Defined in test case			
Subcarrier spacing	kHz	30	30			
Allocated resource blocks for CORESET Note 3		48	48			
Number of transmitter antennas		1	1			
Duration of CORESET	symbols	2	2			
REG bundle size		6	6			
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size			
CCE to REG mapping		Interleaved	Interleaved			
Interleave n_shift		0	0			
Interleave size		2	2			
Beamforming Pre-Coder		N/A	N/A			
Aggregation level	CCE	8	16			
DCI formats		Note 1	Note 1			
Payload size (without CRC)	bits	Note 2	Note 2			
Note 1: DCI format shall depend upon the test configuration. Note 2: Payload size shall depend upon the test configuration. Note 3: Allocated in the same resource blocks where the associated RMC is scheduled.						

A.3.1.4 TDD UL/DL configuration

Table A.3.1.4-1: TDD UL/DL configuration for SCS=15 kHz

Parameter	Unit	Value		
Reference channel		TDDConf.1.1	TDDConf.1.2	
referenceSubcarrierSpacing	kHz	15	15	
TDD UL/DL pattern 1 Note 2		'DSUU' S='10DL:2GP:2UL'	'DSUU' S=' 6DL: 2GP: 6UL'	
dl-UL-TransmissionPeriodicity	ms	4	4	
nrofDownlinkSlots		1	1	
nrofDownlinkSymbols		10	6	
nrofUplinkSlot		2	2	
nrofUplinkSymbols		2	6	
TDD UL/DL pattern 2 Note 2		'D'	'D'	
dl-UL-TransmissionPeriodicity	ms	1	1	
nrofDownlinkSlots		1	1	
nrofDownlinkSymbols		0	0	
nrofUplinkSlot		0	0	
nrofUplinkSymbols		0	0	
NOTE 1: As specified in TS 38.213 [3] and TS 38.331 [2]. NOTE 2: For information.				

Table A.3.1.4-2: TDD UL/DL configuration for SCS=30 kHz

Parameter	Unit	Value		
Reference channel		TDDConf.2.1	TDDConf.2.2	TDDConf.2.3

referenceSubcarrierSpacing	kHz	30	30	30
TDD UL/DL pattern 1 Note 2		‘3D1S4U’ S=’6DL:4GP:4UL’	‘1D1S2U’ S=’11DL: 1GP:2UL’	‘3D1S4U’ S=’4DL:4GP:6UL’
dl-UL-TransmissionPeriodicity	ms	4	2	4
nrofDownlinkSlots		3	1	3
nrofDownlinkSymbols		6	11	4
nrofUplinkSlot		4	2	4
nrofUplinkSymbols		4	2	6
TDD UL/DL pattern 2 Note 2		‘DD’	Not configured	‘DD’
dl-UL-TransmissionPeriodicity	ms	1	Not configured	1
nrofDownlinkSlots		2	Not configured	2
nrofDownlinkSymbols		0	Not configured	0
nrofUplinkSlot		0	Not configured	0
nrofUplinkSymbols		0	Not configured	0
NOTE 1: As specified in TS 38.213 [3] and TS 38.331 [2].				
NOTE 2: For information				

Table A.3.1.4-3: TDD UL/DL configuration for SCS=120 kHz

Parameter	Unit	Value		
Reference channel		TDDConf.3.1	TDDConf.3.2	
referenceSubcarrierSpacing	kHz	120	120	
TDD UL/DL pattern 1 Note 2		‘DDDSU’ S=’10DL:2GP:2UL’	‘DDDSU’ S=’ 6DL: 2GP: 6UL’	
dl-UL-TransmissionPeriodicity	ms	0.625	0.625	
nrofDownlinkSlots		3	3	
nrofDownlinkSymbols		10	6	
nrofUplinkSlot		1	1	
nrofUplinkSymbols		2	6	
TDD UL/DL pattern 2 Note 2		Not configured	Not configured	
dl-UL-TransmissionPeriodicity	ms	Not configured	Not configured	
nrofDownlinkSlots		Not configured	Not configured	
nrofDownlinkSymbols		Not configured	Not configured	
nrofUplinkSlot		Not configured	Not configured	
nrofUplinkSymbols		Not configured	Not configured	
NOTE 1: As specified in TS 38.213 [3] and TS 38.331 [2].				
NOTE 2: For information				

A.3.1A Reference measurement channels under CCA

A.3.1A.1 PDSCH

A.3.1A.1.1 TDD

Table A.3.1A.1.1-1: PDSCH Reference Measurement Channels for SCS=30 kHz

Parameter	Unit	Value						
Reference channel		SR.1.1 CCA						
Channel bandwidth	MHz	40						
Number of transmitter antennas		1						
Allocated resource blocks for PDSCH Note 1		24						

Allocated slots per Radio Frame								
Radio frame containing SSB	slots	Note 5						
Radio frame not containing SSB	slots	Note 7						
MCS table		64QAM						
MCS index		4						
Modulation		QPSK						
Target Coding Rate		1/3						
Number of control symbols		2						
PDSCH mapping type		Type A						
Information Bit Payload								
For slots with RMSI Note 2	bits	1608						
For slots without RMSI	bits	1864						
Number of Code Blocks per slot		1						
Binary Channel Bits Per slot								
For slots with RMSI Note 2, Note 4	bits	5184						
For slots without RMSI Note 6	bits	6048						

NOTE 1: Allocated outside the discovery burst transmission window in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block.
NOTE 2: PDSCH is scheduled on the slots with RMSI.
NOTE 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
NOTE 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 2.
NOTE 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in clause A.3.10A.
NOTE 6: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.
NOTE 7: PDSCH is transmitted during the RMC burst as specified in clause A.3.1A.5.

A.3.1A.2 CORESET for RMSI scheduling

A.3.1A.2.1 TDD

Table A.3.1A.2.1-1: RMSI CORESET Reference Channel for SCS=30KHz

Parameter	Unit	Value						
Reference channel		CR.1.1 CCA						
Channel bandwidth	MHz	40						
Subcarrier spacing	kHz	30						
Allocated resource blocks for RMSI CORESET Note 7		48						
SSB and RMSI CORESET multiplexing configuration Note 7		Pattern 1						
Offset between SSB and RMSI CORESET Note 3, 7	RB	0 (Note 8)						
Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4		Index 0						
Number of transmitter antennas		1						
Duration of RMSI CORESET Note 7	symbols	2						

DCI Format Note 1		Note 2						
Aggregation level	CCE	8						
DMRS precoder granularity		6						
REG bundle size		6						
Mapping from REG to CCE		Distributed						
Cell ID		Note 5						
Payload (without CRC)	bits	Note 6						

NOTE 1: DCI formats are defined in TS 38.212 [8].
NOTE 2: DCI format shall depend upon the test configuration.
NOTE 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest PRB index of RMSI CORESET to the smallest PRB index of the common PRB overlapping with the first PRB of the SS/PBCH block.
NOTE 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in table 13-11 in TS 38.213 [3].
NOTE 5: Cell ID shall depend upon the test configuration.
NOTE 6: Payload size shall depend upon the test configuration.
NOTE 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 4 in table 13-4A in TS 38.213 [3].
NOTE 8: Other values can be used to align with GSCN [13] as long as SSB does not overlap the RMC.

A.3.1A.3 CORESET for RMC scheduling

A.3.1A.3.1 TDD

Table A.3.1A.3.1-1: Control Channel RMC with SCS=30KHz

Parameter	Unit	Value						
Reference channel		CCR.1.1 CCA	CCR.1.2 CCA	CCR.1.3 CCA				
Channel bandwidth	MHz	40	40	40				
Subcarrier spacing	kHz	30	30	30				
Allocated resource blocks for CORESET Note 3		24	24	18				
Number of transmitter antennas		1	1	1				
Duration of CORESET	symbols	2	2	2				
REG bundle size		6	6	6				
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size	Same as REG bundle size				
CCE to REG mapping		Interleaved	Interleaved	Interleaved				
Interleave n_shift		0	0	0				
Interleave size		2	2	2				
Beamforming Pre-Coder		N/A	N/A	N/A				
Aggregation level	CCE	4	8	4				
DCI formats		Note 1	Note 1	Note 1				
Payload size (without CRC)	bits	Note 2	Note 2	Note 2				

NOTE 1: DCI format shall depend upon the test configuration.
NOTE 2: Payload size shall depend upon the test configuration.
NOTE 3: Allocated in the same resource blocks where the associated RMC is scheduled.

A.3.1A.4 TDD UL/DL configuration

Table A.3.1A.4-1: TDD UL/DL configuration for SCS=30 kHz

Parameter	Unit	Value

Reference channel		TDDConf.1.1 CCA		
referenceSubcarrierSpacing	kHz	N/A		
TDD UL/DL pattern 1 Note 2, Note 3		'3D1S4U' S='6DL:4GP:4UL'		
dl-UL-TransmissionPeriodicity	ms	N/A		
nrofDownlinkSlots		N/A		
nrofDownlinkSymbols		N/A		
nrofUplinkSlot		N/A		
nrofUplinkSymbols		N/A		
TDD UL/DL pattern 2 Note 2, Note 3		'DD'		
dl-UL-TransmissionPeriodicity	ms	N/A		
nrofDownlinkSlots		N/A		
nrofDownlinkSymbols		N/A		
nrofUplinkSlot		N/A		
nrofUplinkSymbols		N/A		
NOTE 1: As specified in TS 38.213 [3] and TS 38.331 [2]. NOTE 2: Do not configure *tdd-UL-DL-ConfigurationCommon* using RRC configuration NOTE 3: The UE will be scheduled via DCI according to the TDD pattern defined in the table.				

A.3.1A.5 RMC burst transmission model

RMC not conveying RMSI is scheduled during the RMC burst. The length of the transmission burst in slots is defined as N. The burst transmission format is determined according to the steps below:

1. Select N randomly from a given set of the number of slots $S_1 = \{1,3,5\}$ with equal probability as the total length of RMC burst transmission format.

2. A uniform random variable from 0 to 1 is generated. If the random variable is less than P_{CCA_DL}, a burst of N fully occupied slots is transmitted. Otherwise, the RMC burst transmission is muted and the muting duration is the same as the number N of slots for determined burst format.

RMC burst transmission is scheduled outside discovery burst transmission window. If transmission occurred in the previous slot, transmission is muted for a duration of one slot. Additionally, if the start time of the candidate RMC burst transmission is within 5 slots of the start of the discovery burst transmission window, RMC transmission is not performed.A.3.2 OFDMA channel noise generator (OCNG).

A.3.2.1 Generic OFDMA Channel Noise Generator (OCNG)

The OCNG pattern is used in a test for modelling allocations of unused resources in the channel bandwidth to virtual UEs (which are not under test). The OCNG pattern comprises PDCCH and PDSCH transmissions to the virtual UEs. For the cells operating under CCA, OCNG is transmitted only in slots with RMC burst transmission and is not transmitted during the slots for which CCA attempt is unsuccessful or during DBT windows.

A.3.2.1.1 OCNG pattern 1: Generic OCNG pattern for all unused REs

Table A.3.2.1.1-1: OP.1: Generic OCNG pattern for all unused REs

OCNG Parameters	Control Region	Data Region
Resource allocation	Unused REs (Note 1)	Unused REs (Note 2)
Channel	PDCCH	PDSCH
Contents	Virtual UE IDs	Uncorrelated pseudo random QPSK modulated data
Antenna transmission scheme	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Subcarrier spacing	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Aggregation level	Same as used in PDCCH RMC	N/A
Code rate	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Transmit Power	Same as used in PDCCH RMC	Same as used in PDSCH RMC

CP length	Same as used in PDCCH RMC	Same as used in PDSCH RMC
NOTE 1: REs not used in the active CORESETs where PDCCH is scheduled for the UE under test. NOTE 2: REs not allocated to any physical channels, CORESET, SSB or any other reference signal within the channel bandwidth of the cell, confined to $BW_{occupied}$ where specified in the test case.		

A.3.2.1.2 OCNG pattern 2: Generic OCNG pattern for all unused REs for 2AoA setup

Table A.3.2.1.2-2: OP.2: Generic OCNG pattern for all unused REs for 2AoA setup

OCNG Parameters	Control Region	Data Region
Probe	Transmitting the serving beam	
Resource allocation	Unused REs (Note 1) in the symbols where SSB/CSI-RS are not transmitted from both the serving beam probe and non-serving beam probe.	Unused REs (Note 2) in the symbols where SSB/CSI-RS are not transmitted from both the serving beam probe and non-serving beam probe.
Channel	PDCCH	PDSCH
Contents	Virtual UE IDs	Uncorrelated pseudo random QPSK modulated data
Antenna transmission scheme	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Subcarrier spacing	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Aggregation level	Same as used in PDCCH RMC	N/A
Code rate	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Transmit Power	Same as used in PDCCH RMC	Same as used in PDSCH RMC
CP length	Same as used in PDCCH RMC	Same as used in PDSCH RMC
NOTE 1: REs not used in the active CORESETs where PDCCH is scheduled for the UE under test. NOTE 2: REs not allocated to any physical channels, CORESET, SSB or any other reference signal within the channel bandwidth of the cell, confined to $BW_{occupied}$ where specified in the test case. NOTE 3: No OCNG is transmitted from the probe transmitting non-serving beam.		

A.3.2.1.3 OCNG pattern 3: Generic OCNG pattern for unused REs in the same bandwidth as CORESET

Table A.3.2.1.3-1: OP.3: Generic OCNG pattern for unused REs in the same BW as CORESET

OCNG Parameters	Control Region	Data Region
Resource allocation	Unused REs (Note 1)	Unused REs (Note 2)
Channel	PDCCH	PDSCH
Contents	Virtual UE IDs	Uncorrelated pseudo random QPSK modulated data
Antenna transmission scheme	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Subcarrier spacing	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Aggregation level	Same as used in PDCCH RMC	N/A
Code rate	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Transmit Power	Same as used in PDCCH RMC	Same as used in PDSCH RMC
CP length	Same as used in PDCCH RMC	Same as used in PDSCH RMC
NOTE 1: REs not used in the active CORESETs where PDCCH is scheduled for the UE under test. REs for OCNG shall not be allocated outside the allocated bandwidth of the CORESET of the serving cell. NOTE 2: REs not allocated to any physical channels, CORESET, SSB or any other reference signal within the allocated bandwidth of the CORESET of the serving cell. REs for OCNG shall not be allocated outside the allocated bandwidth of the CORESET of the serving cell.		

A.3.2.1.4 OCNG pattern 4: Generic OCNG pattern for all unused REs outside SSB slot(s)

Table A.3.2.1.4-1: OP.4: Generic OCNG pattern for all unused REs outside SSB slot(s)

OCNG Parameters	Control Region	Data Region

Resource allocation	Unused REs (Note 1)	Unused REs (Note 2)
Channel	PDCCH	PDSCH
Contents	Virtual UE IDs	Uncorrelated pseudo random QPSK modulated data
Antenna transmission scheme	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Subcarrier spacing	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Aggregation level	Same as used in PDCCH RMC	N/A
Code rate	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Transmit Power	Same as used in PDCCH RMC	Same as used in PDSCH RMC
CP length	Same as used in PDCCH RMC	Same as used in PDSCH RMC
NOTE 1: REs not used in the active CORESETs where PDCCH is scheduled for the UE under test. REs for OCNG shall not be allocated in the slot(s) containing SSB of the respective cell. NOTE 2: REs not allocated to any physical channels, CORESET, SSB or any other reference signal within the channel bandwidth of the cell. REs for OCNG shall not be allocated in the slot(s) containing SSB of the respective cell.		

A.3.2.1.5 OCNG pattern 5: Generic OCNG pattern for unused REs in the same bandwidth as CORESET for 2AoA setup

Table A.3.2.1.5-1: OP.5: Generic OCNG pattern for unused REs in the same BW as CORESET for 2AoA setup

OCNG Parameters	Control Region	Data Region
Probe	Transmitting the serving beam	
Resource allocation	Unused REs (Note 1) in the symbols where SSB/CSI-RS are not transmitted from both the serving beam probe and non-serving beam probe.	Unused REs (Note 2) in the symbols where SSB/CSI-RS are not transmitted from both the serving beam probe and non-serving beam probe.
Channel	PDCCH	PDSCH
Contents	Virtual UE IDs	Uncorrelated pseudo random QPSK modulated data
Antenna transmission scheme	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Subcarrier spacing	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Aggregation level	Same as used in PDCCH RMC	N/A
Code rate	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Transmit Power	Same as used in PDCCH RMC	Same as used in PDSCH RMC
CP length	Same as used in PDCCH RMC	Same as used in PDSCH RMC
NOTE 1: REs not used in the active CORESETs where PDCCH is scheduled for the UE under test. REs for OCNG shall not be allocated outside the allocated bandwidth of the CORESET of the serving cell. NOTE 2: REs not allocated to any physical channels, CORESET, SSB or any other reference signal within the allocated bandwidth of the CORESET of the serving cell. REs for OCNG shall not be allocated outside the allocated bandwidth of the CORESET of the serving cell. NOTE 3: No OCNG is transmitted from the probe transmitting non-serving beam.		

A.3.2.2 Void

A.3.3 Reference DRX configurations

A.3.3.1 DRX Configuration 1: DRX cycle = 40 ms and TAT = 500 ms

Table A.3.3.1-1: DRX.1: DRX cycle = 40 ms and time alignment timer (TAT) = 500 ms

Field	Value
drx-onDurationTimer	1 ms
drx-InactivityTimer	1 ms

drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	40 ms
shortDRX	disable
TimeAlignmentTimer	500 ms
NOTE: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.2 DRX Configuration 2: DRX cycle = 640 ms and TAT = 500 ms

Table A.3.3.2-1: DRX.2: DRX cycle = 640 ms and time alignment timer (TAT) = 500 ms

Field	Value
drx-onDurationTimer	1 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	640 ms
shortDRX	disable
TimeAlignmentTimer	500 ms
NOTE: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.3 DRX Configuration 3: DRX cycle = 40 ms and TAT = Infinity

Table A.3.3.3-1: DRX.3: DRX cycle = 40 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	6 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	40 ms
shortDRX	disable
TimeAlignmentTimer	Infinity
NOTE: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.4 DRX Configuration 4: DRX cycle = 160 ms and TAT = Infinity

Table A.3.3.4-1: DRX.4: DRX cycle = 160 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	psf2
drx-InactivityTimer	psf2
drx-RetransmissionTimer	Psf16
longDRX-CycleStartOffset	sf160, 0
shortDRX	disable
TimeAlignmentTimer	Infinity
NOTE: This DRX configuration is applicable for E-UTRA serving cell. For further information see clause 6.3.2 in TS 36.331 [16].	

A.3.3.5 DRX Configuration 5: DRX cycle = 320 ms and TAT = Infinity

Table A.3.3.5-1: DRX.5: DRX cycle = 320 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	psf6
drx-InactivityTimer	psf1920
drx-RetransmissionTimer	psf16
longDRX-CycleStartOffset	sf320, 0
shortDRX	disable
TimeAlignmentTimer	Infinity
NOTE: This DRX configuration is applicable for E-UTRA serving cell. For further information see clause 6.3.2 in TS 36.331 [16].	

A.3.3.6 DRX Configuration 6: DRX cycle = 320 ms and TAT = 500 ms

Table A.3.3.6-1: DRX.6: DRX cycle = 320 ms and time alignment timer (TAT) = 500 ms

Field	Value
drx-onDurationTimer	1 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	320 ms
shortDRX	disable
TimeAlignmentTimer	500 ms
NOTE: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.7 DRX Configuration 7: DRX cycle = 640 ms and TAT = Infinity

Table A.3.3.7-1: DRX.7: DRX cycle = 640 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	6 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	640 ms
shortDRX	disable
TimeAlignmentTimer	Infinity
NOTE: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.8 DRX Configuration 8: DRX cycle = 320 ms and TAT = Infinity

Table A.3.3.8-1: DRX.8: DRX cycle = 320 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	6 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	320 ms
shortDRX	disable
TimeAlignmentTimer	Infinity
NOTE: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.9 DRX Configuration 9: DRX cycle = 40 ms and TAT = 500 ms

Table A.3.3.9-1: DRX.9: DRX cycle = 40 ms and time alignment timer (TAT) = 500 ms

Field	Value
drx-onDurationTimer	psf2
drx-InactivityTimer	psf2
drx-RetransmissionTimer	psf16
longDRX-CycleStartOffset	sf40, 0
shortDRX	disable
TimeAlignmentTimer	500 ms
NOTE: This DRX configuration is applicable for E-UTRA serving cell. For further information see clause 6.3.2 in TS 36.331 [16].	

A.3.3.10 DRX Configuration 10: DRX cycle = 640 ms and TAT = 500 ms

Table A.3.3.10-1: DRX.10: DRX cycle = 640 ms and time alignment timer (TAT) = 500 ms

Field	Value
drx-onDurationTimer	psf6
drx-InactivityTimer	psf2
drx-RetransmissionTimer	psf16
longDRX-CycleStartOffset	sf640, 0
shortDRX	disable
TimeAlignmentTimer	500 ms
NOTE: This DRX configuration is applicable for E-UTRA serving cell. For further information see clause 6.3.2 in TS 36.331 [16].	

A.3.3.11 DRX Configuration 11: DRX cycle = 20 ms and TAT = Infinity

Table A.3.3.11-1: DRX.11: DRX cycle = 20 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	6 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	20 ms
shortDRX	disable
TimeAlignmentTimer	Infinity
NOTE: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.12 DRX Configuration 12: DRX cycle = 640 ms and TAT = Infinity

Table A.3.3.12-1: DRX.12: DRX cycle = 640 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	psf6
drx-InactivityTimer	psf2
drx-RetransmissionTimer	psf16
longDRX-CycleStartOffset	sf640, 0
shortDRX	disable
TimeAlignmentTimer	Infinity
NOTE: This DRX configuration is applicable for E-UTRA serving cell. For further information see clause 6.3.2 in TS 36.331 [16].	

A.3.3.13 DRX Configuration X1: DRX cycle = 80 ms and TAT = Infinity

Table A.3.3.13-1: DRX.X1: DRX cycle = 80 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	6 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	80 ms
shortDRX	disable
TimeAlignmentTimer	Infinity
NOTE: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.14 DRX Configuration 14: DRX cycle = 160 ms and TAT = Infinity

Table A.3.3.13-1: DRX.14: DRX cycle = 160 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	6 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	160 ms
shortDRX	disable
TimeAlignmentTimer	Infinity
NOTE: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.4 Test Cases with Different Channel Bandwidths

A.3.4.1 Test Cases with Different E-UTRA Channel Bandwidths

A.3.4.1.1 Introduction

In annex A test cases involving E-UTRA cell(s) may be defined with different E-UTRA channel bandwidths to verify the same type of RRM requirement.

A.3.4.1.2 Principle of testing

If multiple test cases involving E-UTRA cell(s) are defined with different E-UTRA channel bandwidths to verify the same type of RRM requirement that is E-UTRA channel bandwidth independent, then the UE needs to be tested with only one channel bandwidth in each E-UTRA cell and with the same bandwidth in all the E-UTRA cells used in the test case.

A.3.5 Test Cases for Synchronous and Asynchronous DC Operations

A.3.5.1 EN-DC Test Cases for Synchronous and Asynchronous EN-DC Operations

A.3.5.1.1 Introduction

This clause defines a principle which is applicable to test cases verifying RRM requirements for EN-DC operation in synchronous and asynchronous scenarios.

In annex A test cases may be defined in both synchronous EN-DC and asynchronous EN-DC scenarios to verify the same type of RRM requirement.

A.3.5.1.2 Principle of Testing

If EN-DC test cases are defined in both synchronous and asynchronous EN-DC scenarios to verify the same type of RRM requirement then the UE capable of both synchronous and asynchronous EN-DC operations needs to be tested with one of the tests in either synchronous or asynchronous EN-DC scenarios.

A.3.6 Antenna configurations

A.3.6.1 Antenna configurations for FR1

Unless otherwise specified, NR FDD or NR TDD cells in all RRM Test cases in AWGN propagation condition are configured with Antenna Configuration 1x2.

A.3.6.1.1 Antenna connection for 4 Rx capable UEs

A.3.6.1.1.1 Introduction

All tests in clause A.4 and A.6 are specified for UEs supporting 2RX. In this clause, the antenna connection method for applying 2RX tests to UEs supporting 4RX antenna ports is specified. No tests are currently specified in clause A.4 or A.6 which are applicable only to 4RX antenna ports, so 4RX capable UEs are always tested by reusing tests which were originally specified for 2RX UEs.

A.3.6.1.1.2 Principle of testing

A.3.6.1.1.2.1 Single carrier tests

For 4RX capable UEs supporting at least one band where 2RX is supported and 4RX is not supported, the, all single carrier tests specified in clause A.4 and A.6 except those in clauses A.4.7 and A.6.7 shall be tested on any band where 2RX is supported and 4RX is not supported with the antenna connection specified in clause A.3.6.1.1.2.4. For single carrier tests specified in clause A.4.7 or A.6.7, all tests shall be tested with the antenna connection specified in clause A.3.6.1.1.2.4 for bands where 2RX is supported and 4RX is not supported, and the antenna connection specified in clause A.3.6.1.1.2.5 for bands where 4RX is supported.

For 4RX capable UEs which do not support any band where 2RX is supported and 4RX is not supported, all tests specified in clauses A.4 and A.6 shall be tested using the antenna connection specified in clause A.3.6.1.1.2.5. For radio link monitoring tests, the SNR levels are modified according to table A.3.6.1.1.2.1-1 and table A.3.6.1.1.2.1-2. For beam failure detection and link recovery tests, the SNR levels are modified according to table A.3.6.1.1.2.1-3.

Table A.3.6.1.1.2.1-1: Modified parameters for RLM out of sync testing with 4 RX antenna connection

Test case	SNR during T3 (dB)			
	Test 1	Test 2	Test 3	Test 4
A.4.5.1.1	-18	N/A	N/A	N/A

A.4.5.1.3	-18	N/A	N/A	N/A
A.4.5.1.5	-18	N/A	N/A	N/A
A.4.5.1.7	-18	N/A	N/A	N/A
A.5.5.1.1	-18	N/A	N/A	N/A
A.5.5.1.3	-18	N/A	N/A	N/A
A.5.5.1.5	-18	N/A	N/A	N/A
A.5.5.1.7	-18	N/A	N/A	N/A
A.6.5.1.1	-18	N/A	N/A	N/A
A.6.5.1.3	-18	N/A	N/A	N/A
A.6.5.1.5	-18	N/A	N/A	N/A
A.6.5.1.7	-18	N/A	N/A	N/A
A.7.5.1.1	-18	N/A	N/A	N/A
A.7.5.1.3	-18	N/A	N/A	N/A
A.7.5.1.5	-18	N/A	N/A	N/A
A.7.5.1.7	-18	N/A	N/A	N/A

Table A.3.6.1.1.2.1-2: Modified parameters for RLM in sync single carrier testing with 4 RX antenna connection

Test case	SNR during T3 (dB)		SNR during T4 (dB)	
	Test 1	Test 2	Test 1	Test 2
A.4.5.1.2	-18	N/A	-8	N/A
A.4.5.1.4	-18	N/A	-8	N/A
A.4.5.1.6	-18	N/A	-8	N/A
A.4.5.1.8	-18	N/A	-8	N/A
A.5.5.1.2	-18	N/A	-8	N/A
A.5.5.1.4	-18	N/A	-8	N/A
A.5.5.1.6	-18	N/A	-8	N/A
A.5.5.1.8	-18	N/A	-8	N/A
A.6.5.1.2	-18	N/A	-8	N/A
A.6.5.1.4	-18	N/A	-8	N/A
A.6.5.1.6	-18	N/A	-8	N/A
A.6.5.1.8	-18	N/A	-8	N/A
A.7.5.1.2	-18	N/A	-8	N/A
A.7.5.1.4	-18	N/A	-8	N/A
A.7.5.1.6	-18	N/A	-8	N/A
A.7.5.1.8	-18	N/A	-8	N/A

Table A.3.6.1.1.2.1-3: Modified parameters for Beam Failure Detection and Link Recovery testing with 4 RX antenna connection

Test case	SNR for RS in set q_0 during T3, T4 and T5 (dB)
	Test 1
A.4.5.5.1	-15
A.4.5.5.2	-15
A.4.5.5.3	-15
A.4.5.5.4	-15
A.4.5.5.5	-15
A.4.5.5.6	-15
A.5.5.5.1	-15
A.5.5.5.2	-15
A.5.5.5.3	-15
A.5.5.5.4	-15
A.5.5.5.5	-15
A.5.5.5.6	-15
A.5.5.5.7	-15
A.6.5.5.1	-15
A.6.5.5.2	-15
A.6.5.5.3	-15
A.6.5.5.4	-15
A.6.5.5.5	-15
A.6.5.5.6	-15
A.7.5.5.1	-15

A.7.5.5.2	-15
A.7.5.5.3	-15
A.7.5.5.4	-15
A.7.5.5.5	-15
A.7.5.5.6	-15
A.7.5.5.7	-15

A.3.6.1.1.2.2 Carrier aggregation tests

All carrier aggregation tests are performed using the antenna connection in clause A.3.6.1.1.2.4 for the PCell antenna connection if the PCell is on a band where 2RX is supported and 4RX is not supported, or using the antenna connection in clause A.3.6.1.1.2.5 for the PCell antenna connection if the PCell is on a band where 4RX is supported.

All carrier aggregation tests are performed using the antenna connection in clause A.3.6.1.1.2.4 for the SCell antenna connection if an SCell is on band where 2RX is supported and 4RX is not supported, or using the antenna connection in clause A.3.6.1.1.2.5 for the SCell antenna connection if an SCell is on a band where 4RX is supported.

A.3.6.1.1.2.3 EN-DC tests

All EN-DC tests are performed using the antenna connection in clause A.3.6.1.1.2.6 for the PCell antenna connection if the PCell is on a band where 2RX is supported and 4RX is not supported, or using the antenna connection in clause A.3.6.1.1.2.7 for the PCell antenna connection if the PCell is on a band where 4RX is supported.

All EN-DC tests are performed using the antenna connection in clause A.3.6.1.1.2.4 for the PSCell or SCell antenna connection if an SCell is on band where 2RX is supported and 4RX is not supported, or using antenna connection in clause A.3.6.1.1.2.5 for the SCell antenna connection if an SCell or PSCell is on a band where 4RX is supported.

A.3.6.1.1.2.4 Antenna connection for bands where 2RX is supported

For bands where 2RX is supported and 4RX is not supported, it is left to the UE declaration and antenna port configuration to decide which 2 of the 4 Rx ports are connected with data source from system simulator. The remaining 2 RX ports shall be connected with zero input**.** No test parameters or requirements are modified.

A.3.6.1.1.2.5 Antenna connection for bands where 4RX is supported

For bands where 4RX is supported, all 4 RX antennas are connected with data source from system simulator**.** The system simulator shall provide independent noise and fading (low correlation) for each antenna port. Except for the modifications to radio link monitoring thresholds and beam failure detection thresholds described in clauses A.3.6.1.1.2.1, no test parameters or requirements are modified.

A.3.6.1.1.2.6 EN-DC LTE Antenna connection for bands where 2RX is supported

For E-UTRAN bands where 2RX is supported and 4RX is not supported, it is left to the UE declaration and antenna port configuration to decide which 2 of the 4 Rx ports are connected with data source from system simulator. The remaining 2 RX ports shall be connected with zero input**.** No test parameters or requirements are modified.

A.3.6.1.1.2.7 EN-DC LTE Antenna connection for bands where 4RX is supported

For bands E-UTRAN where 4RX is supported, all 4 RX antennas are connected with data source from system simulator**.** The system simulator shall provide independent noise and fading (low correlation) for each antenna port. Except for the modifications to radio link monitoring thresholds described in clauses A.3.8.1.2.1 and A.3.8.1.2.2 of TS 36.133 [15], no test parameters or requirements are modified.

A.3.6.1.2 Antenna connection for 8 Rx capable UEs

A.3.6.1.2.1 Introduction

All tests in clause A.4 and A.6 are specified for UEs supporting 2RX. In this clause, the antenna connection method for applying 2RX tests or 4RX tests to UEs supporting 8RX antenna ports is specified. No tests are currently specified in

clause A.4 or A.6 which are applicable only to 8RX antenna ports, so 8RX capable UEs are always tested by reusing tests which were originally specified for 2RX UEs or 4Rx UEs.

A.3.6.1.2.2 Principle of testing

A.3.6.1.2.2.1 Single carrier tests

For 8RX capable UEs supporting at least one band where 2RX is supported and either 4RX, 6RX or 8RX is not supported, all single carrier tests specified in clauses A.4 and A.6 except those in clauses A.4.7 and A.6.7 shall be tested on any band where 2RX is supported and 8RX is not supported with the antenna connection specified in clause A.3.6.1.2.2.4. For single carrier tests specified in clauses A.4.7 or A.6.7, all tests shall be tested with the antenna connection specified in clause A.3.6.1.2.2.4 for bands where 2RX is supported and 8RX is not supported, and the antenna connection specified in clause A.3.6.1.2.2.6 for bands where 8RX is supported.

For 8RX capable UEs supporting at least one band where 4RX is supported and either 6RX or 8RX is not supported but without supporting any band where only 2RX is supported, all single carrier tests specified in clauses A.4 and A.6 except those in clauses A.4.7 and A.6.7 shall be tested on any band where 4RX is supported and 8RX is not supported with the antenna connection specified in clause A.3.6.1.2.2.5. For single carrier tests specified in clauses A.4.7 or A.6.7, all tests shall be tested with the antenna connection specified in clause A.3.6.1.2.2.5 for bands where 4RX is supported and 8RX is not supported, and the antenna connection specified in clause A.3.6.1.2.2.6 for bands where 8RX is supported. For radio link monitoring tests, the SNR levels are modified according to table A.3.6.1.1.2.1-1 and table A.3.6.1.1.2.1-2. For beam failure detection and link recovery tests, the SNR levels are modified according to table A.3.6.1.1.2.1-3.

For 8RX capable UEs supporting at least one band where 6RX is supported and 8RX is not supported but without supporting any band where only 2RX or only 4RX is supported, all single carrier tests specified in clauses A.4 and A.6 except those in clauses A.4.7 and A.6.7 shall be tested on any band where 6RX is supported and 8RX is not supported with the antenna connection specified in clause A.3.6.1.2.2.5A. For single carrier tests specified in clauses A.4.7 or A.6.7, all tests shall be tested with the antenna connection specified in clause A.3.6.1.2.2.5A for bands where 6RX is supported and 8RX is not supported, and the antenna connection specified in clause A.3.6.1.2.2.6 for bands where 8RX is supported. For radio link monitoring tests, the SNR levels are modified according to table A.3.6.1.1.2.1-1 and table A.3.6.1.1.2.1-2. For beam failure detection and link recovery tests, the SNR levels are modified according to table A.3.6.1.1.2.1-3.

For 8RX capable UEs which do not support any band where 8RX is not supported, all tests specified in clauses A.4 and A.6 shall be tested using the antenna connection specified in clause A.3.6.1.2.2.6. For radio link monitoring tests, the SNR levels are modified according to table A.3.6.1.1.2.1-1 and table A.3.6.1.1.2.1-2. For beam failure detection and link recovery tests, the SNR levels are modified according to table A.3.6.1.1.2.1-3.

A.3.6.1.2.2.2 Carrier aggregation tests

All carrier aggregation tests are performed using the antenna connection in clause A.3.6.1.2.2.4 for the PCell antenna connection if the PCell is on a band where 2RX is supported and either 4RX or 8RX is not supported, or using the antenna connection in clause A.3.6.1.2.2.5 for the PCell antenna connection if the PCell is on a band where 4RX is supported and 8RX is not supported, or using the antenna connection in clause A.3.6.1.2.2.6 for the PCell antenna connection if the PCell is on a band where 8RX is supported.

All carrier aggregation tests are performed using the antenna connection in clause A.3.6.1.2.2.4 for the SCell antenna connection if an SCell is on band where 2RX is supported and either 4RX or 8RX is not supported, or using the antenna connection in clause A.3.6.1.2.2.5 for the SCell antenna connection if an SCell is on a band where 4RX is supported and 8RX is not supported, or using the antenna connection in clause A.3.6.1.2.2.6 for the SCell antenna connection if an SCell is on a band where 8RX is supported.

A.3.6.1.2.2.3 EN-DC tests

All EN-DC tests are performed using the antenna connection in clause A.3.6.1.2.2.7 for the PCell antenna connection if the PCell is on a band where 2RX is supported and either 4RX or 8RX is not supported, or using the antenna connection in clause A.3.6.1.2.2.8 for the PCell antenna connection if the PCell is on a band where 4RX is supported and 8RX is not supported, or using the antenna connection in clause A.3.6.1.2.2.9 for the PCell antenna connection if the PCell is on a band where 8RX is supported.

All EN-DC tests are performed using the antenna connection in clause A.3.6.1.2.2.4 for the PSCell or SCell antenna connection if an SCell or PSCell is on band where 2RX is supported and either 4RX or 8RX is not supported, or using antenna connection in clause A.3.6.1.2.2.5 for the PSCell or SCell antenna connection if an SCell or PSCell is on a band where 4RX is supported and 8RX is not supported, or using antenna connection in clause A.3.6.1.2.2.6 for the PSCell or SCell antenna connection if an SCell or PSCell is on a band where 8RX is supported.

A.3.6.1.2.2.4 Antenna connection for bands where 2RX is supported

For bands where 2RX is supported and either 4RX, 6RX or 8RX is not supported, it is left to the UE declaration and antenna port configuration to decide which 2 of the 8 Rx ports are connected with data source from system simulator. The remaining 6 RX ports shall be connected with zero input**.** No test parameters or requirements are modified.

A.3.6.1.2.2.5 Antenna connection for bands where 4RX is supported

For bands where 4RX is supported and either 6RX or 8RX is not supported, it is left to the UE declaration and antenna port configuration to decide which 4 of the 8 Rx ports are connected with data source from system simulator. The remaining 4 RX ports shall be connected with zero input. Except for the modifications to radio link monitoring thresholds and beam failure detection thresholds described in clause A.3.6.1.1.2.1, no test parameters or requirements are modified.

A.3.6.1.2.2.5A Antenna connection for bands where 6RX is supported

For bands where 6RX is supported and 8RX is not supported, it is left to the UE declaration and antenna port configuration to decide which 6 of the 8 Rx ports are connected with data source from system simulator. The remaining 2 RX ports shall be connected with zero input. Except for the modifications to radio link monitoring thresholds and beam failure detection thresholds described in clause A.3.6.1.1.2.1, no test parameters or requirements are modified.

A.3.6.1.2.2.6 Antenna connection for bands where 8RX is supported

For bands where 8RX is supported, all 8 RX antennas are connected with data source from system simulator. The system simulator shall provide independent noise and fading (low correlation) for each antenna port. Except for the modifications to radio link monitoring thresholds described in clause A.3.6.1.1.2.1, no test parameters or requirements are modified.

A.3.6.1.2.2.7 EN-DC LTE Antenna connection for bands where 2RX is supported

For E-UTRAN bands where 2RX is supported and 4RX or 8RX is not supported, it is left to the UE declaration and antenna port configuration to decide which 2 of the 8 Rx ports are connected with data source from system simulator. The remaining 6 RX ports shall be connected with zero input. No test parameters or requirements are modified.

A.3.6.1.2.2.8 EN-DC LTE Antenna connection for bands where 4RX is supported

For bands E-UTRAN where 4RX is supported and 8RX is not supported, it is left to the UE declaration and antenna port configuration to decide which 4 of the 8 Rx ports are connected with data source from system simulator. The remaining 4 RX ports shall be connected with zero input. Except for the modifications to radio link monitoring thresholds described in clauses A.3.8.1.2.1 and A.3.8.1.2.2 of TS 36.133 [15], no test parameters or requirements are modified.

A.3.6.1.2.2.9 EN-DC LTE Antenna connection for bands where 8RX is supported

For bands E-UTRAN where 8RX is supported, all 8 RX antennas are connected with data source from system simulator. The system simulator shall provide independent noise and fading (low correlation) for each antenna port. Except for the modifications to radio link monitoring thresholds described in clauses A.3.8.1.2.1 and A.3.8.1.2.2 of TS 36.133 [15], no test parameters or requirements are modified.

A.3.6.1.3 Antenna connection for 6 Rx capable UEs

A.3.6.1.3.1 Introduction

All tests in clause A.4 and A.6 are specified for UEs supporting 2RX. In this clause, the antenna connection method for applying 2RX tests or 4RX tests to UEs supporting 6Rx antenna ports is specified. No tests are currently specified in clause A.4 or A.6 which are applicable only to 6Rx antenna ports, so 6Rx capable UEs are always tested by reusing tests which were originally specified for 2RX UEs or 4Rx UEs.

A.3.6.1.3.2 Principle of testing

A.3.6.1.3.2.1 Single carrier tests

For 6Rx capable UEs supporting at least one band where 2RX is supported and either 4RX or 6Rx is not supported, all single carrier tests specified in clauses A.4 and A.6 except those in clauses A.4.7 and A.6.7 shall be tested on any band where 2RX is supported and 6Rx is not supported with the antenna connection specified in clause A.3.6.1.3.2.2. For single carrier tests specified in clauses A.4.7 or A.6.7, all tests shall be tested with the antenna connection specified in clause A.3.6.1.3.2.2 for bands where 2RX is supported and 6Rx is not supported, and the antenna connection specified in clause A.3.6.1.3.2.4 for bands where 6Rx is supported.

For 6Rx capable UEs supporting at least one band where 4RX is supported and 6Rx is not supported but without supporting any band where only 2RX is supported, all single carrier tests specified in clauses A.4 and A.6 except those in clauses A.4.7 and A.6.7 shall be tested on any band where 4RX is supported and 6Rx is not supported with the antenna connection specified in clause A.3.6.1.3.2.3. For single carrier tests specified in clauses A.4.7 or A.6.7, all tests shall be tested with the antenna connection specified in clause A.3.6.1.3.2.3 for bands where 4RX is supported and 6Rx is not supported, and the antenna connection specified in clause A.3.6.1.3.2.4 for bands where 6Rx is supported. For radio link monitoring tests, the SNR levels are modified according to table A.3.6.1.1.2.1-1 and table A.3.6.1.1.2.1-2. For beam failure detection and link recovery tests, the SNR levels are modified according to table A.3.6.1.1.2.1-3.

For 6Rx capable UEs which do not support any band where 6Rx is not supported, all tests specified in clauses A.4 and A.6 shall be tested using the antenna connection specified in clause A.3.6.1.3.2.4. For radio link monitoring tests, the SNR levels are modified according to table A.3.6.1.1.2.1-1 and table A.3.6.1.1.2.1-2. For beam failure detection and link recovery tests, the SNR levels are modified according to table A.3.6.1.1.2.1-3.

A.3.6.1.3.2.2 Antenna connection for bands where 2RX is supported

For bands where 2RX is supported and either 4RX or 6Rx is not supported, it is left to the UE declaration and antenna port configuration to decide which 2 of the 6 Rx ports are connected with data source from system simulator. The remaining 6 RX ports shall be connected with zero input**.** No test parameters or requirements are modified.

A.3.6.1.3.2.3 Antenna connection for bands where 4RX is supported

For bands where 4RX is supported and 6Rx is not supported, it is left to the UE declaration and antenna port configuration to decide which 4 of the 6 Rx ports are connected with data source from system simulator. The remaining 4 RX ports shall be connected with zero input. Except for the modifications to radio link monitoring thresholds and beam failure detection thresholds described in clause A.3.6.1.1.2.1, no test parameters or requirements are modified.

A.3.6.1.3.2.4 Antenna connection for bands where 6Rx is supported

For bands where 6Rx is supported, all 6 RX antennas are connected with data source from system simulator. The system simulator shall provide independent noise and fading (low correlation) for each antenna port. Except for the modifications to radio link monitoring thresholds described in clause A.3.6.1.1.2.1, no test parameters or requirements are modified.

A.3.6.2 Antenna configurations for FR2

Unless otherwise specified, the default Downlink Antenna Configuration for NR FR2 cells is 1x2.

In case of Downlink Antenna Configuration 2x2 for NR FR2 cells, unless otherwise specified, the downlink signal is transmitted over the two polarizations (V and H) of the dual polarized antenna of the test equipment.

In both cases, the downlink signal is received assuming 2 UE baseband receivers. As the UE is tested following the Blackbox Approach with regard to the UE Rx antennas, the exact UE Rx antenna configuration is not relevant for the test configuration and has no impact on the test implementation.

A.3.6A Antenna configurations with unlicensed bands

A.3.6A.1 Antenna configurations for FR1

Unless otherwise specified, NR unlicensed cells in all RRM Test cases in AWGN propagation condition are configured with Antenna Configuration 1x2.

A.3.6A.1.1 Antenna connection for 4 Rx capable UEs

A.3.6A.1.1.1 Introduction

All tests in clause A.13, A.10, A.11, and A.12 are specified for UEs supporting 2RX. In this clause, the antenna connection method for applying 2RX tests to UEs supporting 4RX antenna ports is specified. No tests are currently specified in clause A.13, A.10, A.11 or A.12 which are applicable only to 4RX antenna ports, so 4RX capable UEs are always tested by reusing tests which were originally specified for 2RX UEs.

A.3.6A.1.1.2 Principle of testing

A.3.6A.1.1.2.1 Single carrier tests

For 4RX capable UEs supporting at least one 2RX band, the, all single carrier tests specified in clause A.13. A.10, A.11 and A.12 except those in clauses A.13.4, A.10.5, A.11.6 and A.12.5 shall be tested on any band where 2RX is supported with the antenna connection specified in clause A.3.6A.1.1.2.4. For single carrier tests specified in clauses A.13.4, A.10.5, A.11.6 or A.12.5, all tests shall be tested with the antenna connection specified in clause A.3.6A.1.1.2.4 for bands where 2RX is supported, and the antenna connection specified in clause A.3.6A.1.1.2.5 for bands where 4RX is supported.

For 4RX capable UEs which do not support any 2RX band, all tests specified in clauses A.13, A.10, A.11 and A.12 shall be tested using the antenna connection specified in clause A.3.6A.1.1.2.5. For radio link monitoring tests, the SNR levels are modified according to table A.3.6A.1.1.2.1-1 and table A.3.6A.1.1.2.1-2.

Table A.3.6A.1.1.2.1-1: Modified parameters for RLM out of sync testing with 4 RX antenna connection

Test case	SNR during T3 (dB)			
	Test 1	Test 2	Test 3	Test 4
A.10.3.1.2	-18	N/A	N/A	N/A
A.11.4.1.2	-18	N/A	N/A	N/A

Table A.3.6A.1.1.2.1-2: Modified parameters for RLM in sync single carrier testing with 4 RX antenna connection

Test case	SNR during T3 (dB)		SNR during T4 (dB)	
	Test 1	Test 2	Test 1	Test 2
A.10.3.1.3	-18	N/A	-8	N/A
A.11.4.1.3	-18	N/A	-8	N/A

Table A.3.6A.1.1.2.1-3: Modified parameters for Beam Failure Detection and Link Recovery testing with 4 RX antenna connection

Test case	SNR for RS in set q_0 during T3, T4 and T5 (dB)

	Test 1	Test 2
A.10.3.4.1	-15	N/A
A.10.3.4.2	-15	N/A
A.11.4.4.1	-15	N/A
A.11.4.4.2	-15	N/A

A.3.6A.1.1.2.2 Carrier aggregation tests

All carrier aggregation tests are performed using the antenna connection in clause A.3.6A.1.1.2.4 for the PCell antenna connection if the PCell is on a band where 2RX is supported or the antenna connection in clause A.3.6A.1.1.2.5 for the PCell antenna connection if the PCell is on a band where 4RX is supported.

All carrier aggregation tests are performed using the antenna connection in clause A.3.6A.1.1.2.4 for the SCell antenna connection if an SCell is on band where 2RX is supported or the testing procedure in clause A.3.6A.1.1.2.5 for the SCell antenna connection if an SCell is on a band where 4RX is supported.

A.3.6A.1.1.2.3 EN-DC tests

All carrier aggregation tests are performed using the antenna connection in clause A.3.6A.1.1.2.6 for the PCell antenna connection if the PCell is on a band where 2RX is supported or the antenna connection in clause A.3.6A.1.1.2.7 for the PCell antenna connection if the PCell is on a band where 4RX is supported.

All carrier aggregation tests are performed using the antenna connection in clause A.3.6A.1.1.2.4 for the PSCell or SCell antenna connection if an SCell is on band where 2RX is supported or the testing procedure in clause A.3.6A.1.1.2.5 for the SCell antenna connection if an SCell or PSCell is on a band where 4RX is supported.

A.3.6A.1.1.2.4 Antenna connection for bands where 2RX is supported

For bands where 2RX is supported, it is left to the UE declaration and AP configuration to decide which 2 of the 4 Rx ports are connected with data source from system simulator. The remaining 2 Rx ports shall be connected with zero input**.** No test parameters or requirements are modified.

A.3.6A.1.1.2.5 Antenna connection for bands where 4RX is supported

For bands where 4RX is supported, all 4 RX antennas are connected with data source from system simulator**.** The system simulator shall provide independent noise and fading (low correlation) for each antenna port. Except for the modifications to radio link monitoring thresholds described in clauses A.3.6A.1.1.2.1 and A.3.6A.1.1.2.2, no test parameters or requirements are modified.

A.3.6A.1.1.2.6 EN-DC LTE Antenna connection for bands where 2RX is supported

For bands where LTE 2RX is supported, it is left to the UE declaration and AP configuration to decide which 2 of the 4 Rx ports are connected with data source from system simulator. The remaining 2 Rx ports shall be connected with zero input**.** No test parameters or requirements are modified.

A.3.6A.1.1.2.7 EN-DC LTE Antenna connection for bands where 4RX is supported

For bands where LTE 4RX is supported, all 4 RX antennas are connected with data source from system simulator**.** The system simulator shall provide independent noise and fading (low correlation) for each antenna port. Except for the modifications to radio link monitoring thresholds described in clauses A.3.8.1.2.1 and A.3.8.1.2.2 of TS 36.133 [15], no test parameters or requirements are modified.

A.3.7 EN-DC test setup

A.3.7.1 Introduction

A.3.7.2 E-UTRAN Serving Cell Parameters

A.3.7.2.1 E-UTRAN Serving Cell Parameters for Tests with NR Cell(s) in FR1

table A.3.7.2.1-1 defines cell specific test parameters for E-UTRAN cell which can be used in EN-DC test cases or in any test case comprising at least one E-UTRA serving cell with all NR cells in FR1. Unless otherwise stated within the test, all measurements in annex A.4 and A.5 are performed only on the NR carrier. The E-UTRA serving cell shall configured to not interfere with NR operation and the E-UTRA serving cell signal power shall not be critical to the test purpose.

Table A.3.7.2.1-1: E-UTRAN cell specific test parameters for tests with all NR cells in FR1

Parameter	Unit	E-UTRAN Cell
Duplex mode		FDD or TDD
TDD special subframe configuration[Note1]		6
TDD uplink-downlink configuration[Note1]		1
$BW_{channel}$		5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100
PDSCH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD
OCNG Patterns[Note2]		5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD
PBCH_RA	dB	0
PBCH_RB	dB	
PSS_RA	dB	
SSS_RA	dB	
PCFICH_RB	dB	
PHICH_RA	dB	
PHICH_RB	dB	
PDCCH_RA	dB	
PDCCH_RB	dB	
PDSCH_RA	dB	
PDSCH_RB	dB	
OCNG_RA[Note3]	dB	
OCNG_RB[Note3]	dB	
N_{oc}[Note4]	dBm/15 kHz	-104
$\hat{E}_s/N_{oc}$	dB	17
$\hat{E}_s/I_{ot}$	dB	17
RSRP [Note5]	dBm/15 kHz	-87
SCH_RP [Note5]	dBm/15 kHz	-87
Io [Note5]	dBm/Ch BW	$-59.13+10\log(N_{RB,c}/50)$
Propagation Condition		AWGN
Antenna Configuration		1x2

Parameter	Unit	E-UTRAN Cell
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211.		
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 respectively.		
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 5: E_s/I_{ot}, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		

A.3.7.2.2 E-UTRAN Serving Cell Parameters for Tests with NR Cell(s) in FR2

table A.3.7.2.2-1 defines cell specific test parameters for E-UTRAN cell which can be used in EN-DC test cases or in any test case comprising at least one E-UTRA serving cell with one or more NR cells in FR2.

Table A.3.7.2.2-1: E-UTRAN cell specific test parameters for tests with one or more NR cells in FR2

Parameter	Unit	E-UTRAN Cell
Duplex mode		FDD or TDD
TDD special subframe configuration[Note1]		6
TDD uplink-downlink configuration[Note1]		1
$BW_{channel}$	MHz	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100
PDSCH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD
OCNG Patterns[Note2]		5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD
PBCH_RA	dB	0
PBCH_RB	dB	
PSS_RA	dB	
SSS_RA	dB	
PCFICH_RB	dB	
PHICH_RA	dB	
PHICH_RB	dB	
PDCCH_RA	dB	
PDCCH_RB	dB	
PDSCH_RA	dB	
PDSCH_RB	dB	
OCNG_RA[Note3]	dB	
OCNG_RB[Note3]	dB	

Parameter	Unit	E-UTRAN Cell
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211. NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 respectively. NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 4: The E-UTRA signal is required only to ensure the E-UTRA link to the DUT in the EN-DC operation. The Test System shall provide a stable and noise-free E-UTRA signal without need of precise propagation modelling, path loss and polarization control. Further details of the E-UTRA signal configuration are not defined as part of the cell specific test parameters, since the E-UTRA link is not under performance verification and shall not affect the test result unless otherwise specifically stated in the test case.		

A.3.7A NR FR1-FR2 test setup

Some Test cases in clause A.7 have NR cells in both FR1 and FR2. Unless otherwise stated within the test, the NR FR1 Cell signal is required only to provide a link to the UE under test. The Test System shall provide a stable and noise-free NR FR1 signal without need of precise propagation modelling, path loss and polarization control. Further details of the NR FR1 signal configuration are not defined as part of the cell specific test parameters, since the NR FR1 link is not under performance verification and shall not affect the test result unless otherwise specifically stated in the test case.

A.3.7B EN-DC test setup with unlicensed bands

A.3.7B.1 Introduction

A.3.7B.2 E-UTRAN Serving Cell Parameters

A.3.7B.2.1 E-UTRAN Serving Cell Parameters for Tests with NR Cell(s) under CCA in FR1

table A.3.7A.2.1-1 defines cell specific test parameters for E-UTRAN cell which can be used in EN-DC test cases or in any test case comprising at least one E-UTRA serving cell with all NR cells under CCA in FR1. Unless otherwise stated within the test, all measurements in annex A.4 and A.5 are performed only on the unlicensed NR carrier. The E-UTRA serving cell shall configured to not interfere with NR operation and the E-UTRA serving cell signal power shall not be critical to the test purpose.

Table A.3.7B.2.1-1: E-UTRAN cell specific test parameters for tests with all NR cells user CCA in FR1

Parameter	Unit	E-UTRAN Cell
Duplex mode		FDD or TDD
TDD special subframe configuration[Note1]		6
TDD uplink-downlink configuration[Note1]		1
$BW_{channel}$		5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100
PDSCH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD

Parameter	Unit	E-UTRAN Cell
OCNG Patterns[Note2]		5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD
PBCH_RA	dB	0
PBCH_RB	dB	
PSS_RA	dB	
SSS_RA	dB	
PCFICH_RB	dB	
PHICH_RA	dB	
PHICH_RB	dB	
PDCCH_RA	dB	
PDCCH_RB	dB	
PDSCH_RA	dB	
PDSCH_RB	dB	
OCNG_RA[Note3]	dB	
OCNG_RB[Note3]	dB	
N_{oc}[Note4]	dBm/15 kHz	-104
$\hat{E}_s/N_{oc}$	dB	17
$\hat{E}_s/I_{ot}$	dB	17
RSRP [Note5]	dBm/15 kHz	-87
SCH_RP [Note5]	dBm/15 kHz	-87
Io [Note5]	dBm/Ch BW	$-59.13+10\log(N_{RB,c}/50)$
Propagation Condition		AWGN
Antenna Configuration		1x2

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211.
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: E_s/I_{ot}, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.3.7C LTE-FR1/FR2 test setup

Some Test cases in clause A.5 have LTE and FR2 NR cells. Unless otherwise stated within the test, the LTE Cell signal is required only to provide a link to the UE under test. The Test System shall provide a stable and noise-free LTE signal without need of precise propagation modelling, path loss and polarization control. Further details of the LTE signal configuration are not defined as part of the cell specific test parameters, since the LTE link is not under performance verification and shall not affect the test result unless otherwise specifically stated in the test case.

A.3.7D NE-DC test setup

A.3.7D.1 Introduction

A.3.7D.2 E-UTRAN Serving Cell Parameters

A.3.7D.2.1 E-UTRAN Serving Cell Parameters for Tests with NR Cell(s) in FR1

The parameters are same as specified in clause A.3.7.2.1.

A.3.7D.2.2 E-UTRAN Serving Cell Parameters for Tests with NR Cell(s) in FR2

The parameters are same as specified in clause A.3.7.2.2.

A.3.8 PRACH configurations

A.3.8.1 Introduction

This clause provides the typical PRACH configurations used for RRM test cases defined in annex A. To note that for other parameters not listed in this clause, either it can be derived from the set up of each test or it is subjected to RAN5 specifications.

A.3.8.2 PRACH configurations in FR1

A.3.8.2.1 FR1 PRACH configuration 1

FR1 PRACH configuration 1 in this clause provides the typical PRACH configuration for SSB-based contention based random access in FR1.

Table A.3.8.2.1-1: Parameters for FR1 PRACH configuration 1

Field	Value	Comment
prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n48	OneFourth: 1 SSB associated with 4 RACH occasions n48: 48 contention based preambles per SSB
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
ra-ContentionResolutionTimer	sf48	48 sub-frames
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.2.2 FR1 PRACH configuration 2

FR1 PRACH configuration 2 in this clause provides the typical PRACH configuration for SSB based non-contention based random access in FR1.

Table A.3.8.2.2-1: Parameters for FR1 PRACH configuration 2

Field	Value	Comment
prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.

ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
ssb-ResourceList	ra-PreambleIndex = 40	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE doesn't use this field if is transmitting CFRA to convey BFR.
BFR-SSB-Resource	ra-PreambleIndex = 40	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE uses this field only if is transmitting CFRA to convey BFR
ra-ssb-OccasionMaskIndex	1	PRACH occasion index 1 is allowed
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.2.3 FR1 PRACH configuration 3

FR1 PRACH configuration 3 in this clause provides the typical PRACH configuration for CSI-RS based non-contention based random access in FR1.

Table A.3.8.2.3-1: Parameters for FR1 PRACH configuration 3

Field	Value	Comment
prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
csirs-ResourceList	ra-PreambleIndex = 40	Associated with CSI-RS configured
ra-OccasionList	1	RA occasions allowed corresponding to CSI-RS
rsrp-ThresholdCSI-RS	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.2.4 FR1 PRACH configuration 4

FR1 PRACH configuration 4 in this clause provides the PRACH configuration for CSI-RS based non-contention based random access in FR1 to convey BFR.

Table A.3.8.2.4-1: Parameters for FR1 PRACH configuration 4

Field	Value	Comment
prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n200	Max number of RA preamble transmission performed before declaring a failure is 200
ra-ResponseWindow	sl1	1 slot
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 93
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
BFR-CSIRS-Resource	ra-PreambleIndex = 40	Associated with CSI-RS configured
ra-OccasionList	1	RA occasions allowed corresponding to CSI-RS
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.2.5 FR1 PRACH configuration 5

FR1 PRACH configuration 5 in this clause provides the typical PRACH configuration for LTM early UL synchronization on candidate cell in FR1.

Table A.3.8.2.5-1: Parameters for FR1 PRACH configuration 5

Field	Value	Comment
prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
msg1-FrequencyStart	0	
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	
powerRampingStep	dB2	
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ltm-prach-SubcarrierSpacing	Same as UL carrier SCS	
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.2.6 FR1 PRACH configuration 6

FR1 PRACH configuration 6 in this clause provides the typical PRACH configuration for SSB-based contention free random access in FR1.

Table A.3.8.2.6-1: Parameters for FR1 PRACH configuration 6

Field	Value	Comment
prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n16	OneFourth: 1 SSB associated with 4 RACH occasions n16: 16 contention based preambles per SSB
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
ra-ContentionResolutionTimer	sf48	48 sub-frames
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.3 PRACH configurations in FR2

A.3.8.3.1 FR2 PRACH configuration 1

FR2 PRACH configuration 1 in this clause provides the typical PRACH configuration for SSB-based contention based random access in FR2.

Table A.3.8.3.1-1: Parameters for FR2 PRACH configuration 1

Field	Value	Comment
prach-ConfigurationIndex	190	Preamble Format C2, with 10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n48	OneFourth: 1 SSB associated with 4 RACH occasions n48: 48 contention based preambles per SSB
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
ra-ContentionResolutionTimer	sf48	48 sub-frames
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	

preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.3.2 FR2 PRACH configuration 2

FR2 PRACH configuration 2 in this clause provides the typical PRACH configuration for SSB based non-contention based random access in FR2.

Table A.3.8.3.2-1: Parameters for FR2 PRACH configuration 2

Field	Value	Comment
prach-ConfigurationIndex	190	Preamble Format C2, with 10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
ssb-ResourceList	ra-PreambleIndex = 40	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE doesn't use this field if is transmitting CFRA to convey BFR.
BFR-SSB-Resource	ra-PreambleIndex = 40	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE uses this field only if is transmitting CFRA to convey BFR
ra-ssb-OccasionMaskIndex	1	PRACH occasion index 1 is allowed
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.3.3 FR2 PRACH configuration 3

FR2 PRACH configuration 3 in this clause provides the typical PRACH configuration for CSI-RS based non-contention based random access in FR2.

Table A.3.8.3.3-1: Parameters for FR2 PRACH configuration 3Field	**Value**	**Comment**
prach-ConfigurationIndex	190	Preamble Format C2, with 10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random acces
numberOfRA-PreamblesGroupA	48	No group B.

prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
csirs-ResourceList	ra-PreambleIndex = 40	Associated with CSI-RS configured
ra-OccasionList	1	RA occasions allowed corresponding to CSI-RS
rsrp-ThresholdCSI-RS	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.3.4 FR2 PRACH configuration 4

FR2 PRACH configuration 4 in this clause provides the PRACH configuration for CSI-RS based non-contention based random access in FR2 to convey BFR.

Table A.3.8.3.4-1: Parameters for FR2 PRACH configuration 4

Field	Value	Comment
prach-ConfigurationIndex	190	Preamble Format C2, with 10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n200	Max number of RA preamble transmission performed before declaring a failure is 200.
ra-ResponseWindow	sl40	40 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
BFR-CSIRS-Resource	ra-PreambleIndex = 40	Associated with CSI-RS configured
ra-OccasionList	1	RA occasions allowed corresponding to CSI-RS
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.3.5 FR2 PRACH configuration 5

FR2 PRACH configuration 5 in this clause provides the typical PRACH configuration for LTM early UL synchronization on candidate cell in FR2.

Table A.3.8.3.5-1: Parameters for FR2 PRACH configuration 5

Field	Value	Comment
prach-ConfigurationIndex	190	Preamble Format C2, with 10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6]
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
msg1-FrequencyStart	0	
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	
powerRampingStep	dB2	
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ltm-prach-SubcarrierSpacing	Same as UL carrier SCS	
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.3.6 FR2 PRACH configuration 6

FR2 PRACH configuration 6 in this clause provides the typical PRACH configuration for SSB-based contention free random access in FR2.

Table A.3.8.3.6-1: Parameters for FR2 PRACH configuration 6

Field	Value	Comment
prach-ConfigurationIndex	190	Preamble Format C2, with 10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n16	OneFourth: 1 SSB associated with 4 RACH occasions n16: 16 contention based preambles per SSB
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
ra-ContentionResolutionTimer	sf48	48 sub-frames
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8A PRACH configurations under CCA

A.3.8A.1 Introduction

This clause provides the typical PRACH configurations used for RRM test cases defined in annex A. To note that for other parameters not listed in this clause, either it can be derived from the set up of each test or it is subjected to RAN5 specifications.

A.3.8A.2 PRACH configurations in FR1

A.3.8A.2.1 FR1 PRACH configuration 1 under CCA

FR1 PRACH configuration 1 under CCA in this clause provides the typical PRACH configuration for SSB-based contention based random access in FR1.

Table A.3.8A.2.1-1: Parameters for FR1 PRACH configuration 1 under CCA

Field	Value	Comment
prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n48	OneFourth: 1 SSB associated with 4 RACH occasions n48: 48 contention based preambles per SSB
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
ra-ContentionResolutionTimer	sf48	48 sub-frames
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-114	Increased by 6 dB compared with FR1 PRACH configuration 1 for random access test with UL CCA failures.
preambleTransMax	n20	Max number of RA preamble transmission performed before declaring a failure is 20 to account for CCA failures
ra-ResponseWindow	Sl20	20 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8A.2.2 FR1 PRACH configuration 2 under CCA

FR1 PRACH configuration 2 under CCA in this clause provides the typical PRACH configuration for SSB based non-contention based random access in FR1.

Table A.3.8A.2.2-1: Parameters for FR1 PRACH configuration 2 under CCA

Field	Value	Comment
prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.

Field	Value	Comment
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-114	Increased by 6 dB compared with FR1 PRACH configuration 2 for random access test with UL CCA failures.
preambleTransMax	n20	Max number of RA preamble transmission performed before declaring a failure is 20 to account for CCA failures
ra-ResponseWindow	sl20	20 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
ssb-ResourceList	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE doesn't use this field if is transmitting CFRA to convey BFR.
BFR-SSB-Resource	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE uses this field only if is transmitting CFRA to convey BFR
ra-ssb-OccasionMaskIndex	1	PRACH occasion index 1 is allowed
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.9 BWP configurations

A.3.9.1 Introduction

This clause provides the typical BWP configurations used for RRM test cases defined in annex A. For downlink BWP, both initial BWP and dedicated BWP configurations are specified in clause A.3.9.2 and for uplink BWP, both initial BWP and dedicated BWP configurations are specified in clause A.3.9.3. To note that for other parameters not listed in this clause, either it can be derived from the set up of each test or it is subjected to RAN5 specifications.

A.3.9.2 Downlink BWP configurations

A.3.9.2.1 Initial BWP

Table A.3.9.2.1-1: Downlink BWP patterns for initial BWP configuration

BWP Parameters	Unit	Values		
Reference BWP		DLBWP.0.1	DLBWP.0.2	
Starting PRB index		0	RB_c Note 1	
Bandwidth	PRB	Same as RF channel defined in each test	same as RMSI CORESET (CORESET #0) defined in each test Note 2	
NOTE 1: RB_c is the lowest PRB index to guarantee the BWP including CORESET #0 which is defined in clause A.3.1.2. Note 2: In case CORESET#0 and SSBs defined in the test do not completely fit into the bandwidth of the reference BWP bandwidth, the latter one is extended to the next smallest size which can fully accommodate the respective CORESET#0 and SSBs..				

A.3.9.2.2 Dedicated BWP

Table A.3.9.2.2-1: Downlink BWP patterns for dedicated BWP configuration

BWP Parameters	Unit	Values						
Reference BWP		DLBWP.1.1	DLBWP.1.2	DLBWP.1.3	DLBWP.1.4	DLBWP.1.5	DLBWP.1.6	DLBWP.1.7
Starting PRB index		0	RB_b Note 1	RB_a Note 2	0	RB_b Note 1	RB_a Note 2	RB_c Note 3
Bandwidth	PRB	Same as RF channel defined in each test	25 for SSB SCS = 15kHz, 51 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 48 for SSB SCS = 240kHz	25 for SSB SCS = 15kHz, 51 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 48 for SSB SCS = 240kHz	24 for SSB SCS = 120kHz 24 for SSB SCS = 240kHz	24 for SSB SCS = 120kHz 24 for SSB SCS = 240kHz	24 for SSB SCS = 120kHz 24 for SSB SCS = 240kHz	25 for SSB SCS = 15kHz, 51 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 48 for SSB SCS = 240kHz

NOTE 1: RB_b is the lowest PRB index to guarantee the BWP not fully overlapped with SSB PRB index (RB_J, PRB_{J+1},…., PRB_{J+19}) which is defined in clause A.3.10.
NOTE 2: RB_a is the lowest PRB index to guarantee the BWP including SSB PRB index (RB_J, PRB_{J+1},…., PRB_{J+19}) which is defined in clause A.3.10.
NOTE 3: RB_c is the PRB index having an offset of 6 PRBs with respect to the start of SSB PRB index (RB_J, PRB_{J+1},…., PRB_{J+19}) which is defined in clause A.3.10.

A.3.9.3 Uplink BWP configurations

A.3.9.3.1 Initial BWP

Table A.3.9.3.1-1: Uplink BWP patterns for initial BWP configuration

BWP Parameters	Unit	Values		
Reference BWP		ULBWP.0.1	ULBWP.0.2	
Starting PRB index		0	RB_c Note 1	
Bandwidth	PRB	Same as RF channel defined in each test	same as RMSI CORESET (CORESET #0) defined in each test Note 2	

NOTE 1: RB_c is same as PRB_c for DLBWP.0.2 as defined in table A.3.9.2.1-1.
Note 2: In case CORESET#0 and SSBs defined in the test do not completely fit into the bandwidth of the reference BWP bandwidth, the latter one is extended to the next smallest size which can fully accommodate the respective CORESET#0 and SSBs.

A.3.9.3.2 Dedicated BWP

Table A.3.9.3.2-1: Uplink BWP patterns for dedicated BWP configuration

BWP Parameters	Unit	Values						
Reference BWP		ULBWP.1.1	ULBWP.1.2	ULBWP.1.3	ULBWP.1.4	ULBWP.1.5	ULBWP.1.6	ULBWP.1.7
Starting PRB index		0	RB_b Note 1	RB_a Note 2	0	RB_b Note 1	RB_a Note 2	RB_c Note 3

Bandwidth	PRB	Same as RF channel defined in each test	25 for SSB SCS = 15kHz, 51 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 48 for SSB SCS = 240kHz	25 for SSB SCS = 15kHz, 51 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 48 for SSB SCS = 240kHz	24 for SSB SCS = 120kHz 24 for SSB SCS = 240kHz	24 for SSB SCS = 120kHz 24 for SSB SCS = 240kHz	24 for SSB SCS = 120kHz 24 for SSB SCS = 240kHz	25 for SSB SCS = 15kHz, 51 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 48 for SSB SCS = 240kHz
NOTE 1: RB_b is same as PRB_b for DLBWP.1.2 as defined in table A.3.9.2.2-1.								
NOTE 2: RB_a is same as PRB_a for DLBWP.1.3 as defined in table A.3.9.2.2-1.								
NOTE 3: RB_c is same as PRB_c for DLBWP.1.7 as defined in table A.3.9.2.2-1								

A.3.9A BWP configurations for RedCap

A.3.9A.1 Introduction

This clause provides the typical BWP configurations used for RedCap RRM test cases defined in annex A. For downlink BWP, RedCap dedicated BWP configurations are specified in clause A.3.9A.2 and for uplink BWP, RedCap dedicated BWP configurations are specified in clause A.3.9A.3. To note that for other parameters not listed in this clause, either it can be derived from the set up of each test or it is subjected to RAN5 specifications.

A.3.9A.2 Downlink BWP configurations

A.3.9A.2.1 Dedicated BWP

Table A.3.9A.2.2-1: Downlink BWP patterns for RedCap dedicated BWP configuration

BWP Parameters	Unit	Values		
Reference BWP		**DLBWP.1.1 RedCap**	**DLBWP.1.2 RedCap**	**DLBWP.1.3 RedCap**
Starting PRB index		RB_a Note 1	RB_b Note 2	RB_c Note 3
Bandwidth	PRB	25 for SSB SCS = 15kHz, 25 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 16 for SSB SCS = 240kHz	25 for SSB SCS = 15kHz, 25 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 16 for SSB SCS = 240kHz	25 for SSB SCS = 15kHz, 25 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 16 for SSB SCS = 240kHz
NOTE 1: RB_a is the lowest PRB index to guarantee the BWP including SSB PRB index (RB_J, PRB_{J+1},…., PRB_{J+19}) which is defined in clause A.3.10.				
NOTE 2: RB_b is the lowest PRB index to guarantee the BWP not fully overlapped with SSB PRB index (RB_J, PRB_{J+1},…., PRB_{J+19}) which is defined in clause A.3.10.				
NOTE 3: RB_c is the lowest PRB index to guarantee the BWP including SSB PRB index (RB_J, PRB_{J+1},…., PRB_{J+19}) which is defined in clause A.3.10.				

A.3.9A.3 Uplink BWP configurations

A.3.9A.3.1 Dedicated BWP

Table A.3.9A.3.1-1: Uplink BWP patterns for RedCap dedicated BWP configuration

BWP Parameters	Unit	Values		
Reference BWP		**ULBWP.1.1 RedCap**	**ULBWP.1.2 RedCap**	**ULBWP.1.3 RedCap**

Starting PRB index		RB_a Note 1	RB_b Note 2	RB_c Note 3
Bandwidth	PRB	25 for SSB SCS = 15kHz, 25 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 16 for SSB SCS = 240kHz	25 for SSB SCS = 15kHz, 25 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 16 for SSB SCS = 240kHz	25 for SSB SCS = 15kHz, 25 for SSB SCS = 30kHz, 32 for SSB SCS = 120kHz 16 for SSB SCS = 240kHz
NOTE 1: RB_a is the same as PRB_a for DLBWP.1.1 RedCap. NOTE 2: RB_b is the same as PRB_b for DLBWP.1.2 RedCap. NOTE 3: RB_c is the same as PRB_c for DLBWP.1.3 RedCap.				

A.3.10 SSB Configurations

A.3.10.1 SSB Configurations for FR1

A.3.10.1.1 SSB pattern 1 in FR1: SSB allocation for SSB SCS=15 kHz in 10 MHz

Table A.3.10.1.1-1: SSB.1 FR1: SSB Pattern 1 for SSB SCS=15 kHz in 10 MHz channel

SSB Parameters	Values
Channel bandwidth	10 MHz
SSB SCS	15 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 2	2-5
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.1.2 SSB pattern 2 in FR1: SSB allocation for SSB SCS=30 kHz in 40 MHz

Table A.3.10.1.2-1: SSB.2 FR1: SSB Pattern 2 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values
Channel bandwidth	40 MHz
SSB SCS	30 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2
Slot numbers containing SSB Note 3	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen. NOTE 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves	

A.3.10.1.3 SSB pattern 3 in FR1: SSB allocation for SSB SCS=15 kHz in 10 MHz

Table A.3.10.1.3-1: SSB.3 FR1: SSB Pattern 3 for SSB SCS=15 kHz in 10 MHz channel

SSB Parameters	Values	
Channel bandwidth	10 MHz	
SSB SCS	15 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSB Note 2	2-5	8-11
Slot numbers containing SSB Note 2	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.1.4 SSB pattern 4 in FR1: SSB allocation for SSB SCS=30 kHz in 40 MHz

Table A.3.10.1.4-1: SSB.4 FR1: SSB Pattern 4 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values	
Channel bandwidth	40 MHz	
SSB SCS	30 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2	8-11
Slot numbers containing SSB Note 3	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen. NOTE 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.1.5 SSB pattern 5 in FR1: SSB allocation for SSB SCS=15 kHz starting from odd SFN in 10 MHz

Table A.3.10.1.5-1: SSB.5 FR1: SSB Pattern 5 for SSB SCS=15 kHz in 10 MHz channel

SSB Parameters	Values
Channel bandwidth	10 MHz
SSB SCS	15 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 2	2-5
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 1
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.1.6 SSB pattern 6 in FR1: SSB allocation for SSB SCS=30 kHz starting from odd SFN in 40 MHz

Table A.3.10.1.6-1: SSB.6 FR1: SSB Pattern 6 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values
Channel bandwidth	40 MHz
SSB SCS	30 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2
Slot numbers containing SSB Note 3	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 1
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen. NOTE 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.1.7 SSB pattern 7 in FR1: SSB allocation for SSB SCS=15 kHz in 10 MHz

Table A.3.10.1.7-1: SSB.7 FR1: SSB Pattern 7 for SSB SCS=15 kHz in 10 MHz channel

SSB Parameters	Values	
Channel bandwidth	10 MHz	
SSB SCS	15 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	2	3
Symbol numbers containing SSB Note 2	2-5	8-11
Slot numbers containing SSB Note 2	1	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.1.8 SSB pattern 8 in FR1: SSB allocation for SSB SCS=30 kHz in 40 MHz

Table A.3.10.1.8-1: SSB.8 FR1: SSB Pattern 8 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values	
Channel bandwidth	40 MHz	
SSB SCS	30 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	2	3
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2	8-11
Slot numbers containing SSB Note 3	1	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen. NOTE 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.1.9 SSB pattern 9 in FR1: SSB allocation for SSB SCS=15 kHz in 10 MHz

Table A.3.10.1.9-1: SSB.9 FR1: SSB Pattern 9 for SSB SCS=15 kHz in 10 MHz channel

SSB Parameters	Values
Channel bandwidth	10 MHz
SSB SCS	15 kHz
SSB periodicity (T_{SSB})	80 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 2	2-5
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the associated bandwidth part except the PRBs for allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.1.10 SSB pattern 10 in FR1: SSB allocation for SSB SCS=30 kHz in 40 MHz

Table A.3.10.1.10-1: SSB.10 FR1: SSB Pattern 10 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values
Channel bandwidth	40 MHz
SSB SCS	30 kHz
SSB periodicity (T_{SSB})	80 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2
Slot numbers containing SSB Note 3	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the associated bandwidth part except the PRBs for allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen. NOTE 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves	

A.3.10.1.11 SSB pattern 11 in FR1: SSB allocation for SSB SCS=15 kHz in 10 MHz

Table A.3.10.1.11-1: SSB.11 FR1: SSB Pattern 11 for SSB SCS=15 kHz in 10 MHz channel

SSB Parameters	Values	
Channel bandwidth	10 MHz	
SSB SCS	15 kHz	
SSB periodicity (T_{SSB})	80 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSB Note 2	2-5	8-11
Slot numbers containing SSB Note 2	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the associated bandwidth part except the PRBs for allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.1.12 SSB pattern 12 in FR1: SSB allocation for SSB SCS=30 kHz in 40 MHz

Table A.3.10.1.12-1: SSB.12 FR1: SSB Pattern 12 for SSB SCS=30 kHz in 20 MHz channel

SSB Parameters	Values	
Channel bandwidth	20 MHz	
SSB SCS	30 kHz	
SSB periodicity (T_{SSB})	80 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2	8-11
Slot numbers containing SSB Note 3	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the associated bandwidth part except the PRBs for allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen. NOTE 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.1.13 SSB pattern 13 in FR1: SSB allocation for SSB SCS=15 kHz in 3 MHz

Table A.3.10.1.13-1: SSB.13 FR1: SSB Pattern 1 for SSB SCS=15 kHz in 3 MHz channel

SSB Parameters	Values
Channel bandwidth	3 MHz
SSB SCS	15 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 2	2-5
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+11})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2 SSB Configurations for FR2

A.3.10.2.1 SSB pattern 1 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.1-1: SSB.1 FR2: SSB Pattern 1 for SSB SCS = 120 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	120 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSBs Note 2	4-7	8-11
Slot numbers containing SSB Note 2	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13].		

NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.

A.3.10.2.2 SSB pattern 2 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.2-1: SSB.2 FR2: SSB Pattern 2 for SSB SCS = 240 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	240 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSBs Note 2	8-11	12-13, 0-1
Slot numbers containing SSB Note 2	0	0, 1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+39})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.3 SSB pattern 3 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.3-1: SSB.3 FR2: SSB Pattern 3 for SSB SCS = 120 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	120 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	4-7
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.4 SSB pattern 4 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.4-1: SSB.4 FR2: SSB Pattern 4 for SSB SCS = 240 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	240 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	8-11
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+39})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13].	

NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.

A.3.10.2.5 SSB pattern 5 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.5-1: SSB.5 FR2: SSB Pattern 5 for SSB SCS = 120 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	120 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	2	3
Symbol numbers containing SSBs Note 2	2-5	6-9
Slot numbers containing SSB Note 2	1	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.6 SSB pattern 6 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.6-1: SSB.6 FR2: SSB Pattern 6 for SSB SCS = 240 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	240 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	2	3
Symbol numbers containing SSBs Note 2	2-5	6-9
Slot numbers containing SSB Note 2	1	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+39})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.7 SSB pattern 7 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.7-1: SSB.7 FR2: SSB Pattern 7 for SSB SCS = 120 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	120 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	1
Symbol numbers containing SSBs Note 2	8-11
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13].	

NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.

A.3.10.2.8 SSB pattern 8 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.8-1: SSB.8 FR2: SSB Pattern 8 for SSB SCS = 240 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	240 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	1	
SS/PBCH block index	1	
Symbol numbers containing SSBs Note 2	12-13	0-1
Slot numbers containing SSB Note 2	0	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+39})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.9 SSB pattern 9 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.9-1: SSB.9 FR2: SSB Pattern 9 for SSB SCS = 120 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	120 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	2	3
Symbol numbers containing SSBs Note 2	2-5	6-9
Slot numbers containing SSB Note 2	1	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.10 SSB pattern 10 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.10-1: SSB.10 FR2: SSB Pattern 10 for SSB SCS = 240 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	240 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	2	3
Symbol numbers containing SSBs Note 2	4-7	8-11
Slot numbers containing SSB Note 2	1	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+39})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13].		

NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.

A.3.10.2.11 SSB pattern 11 in FR2: SSB allocation for SSB SCS=480 kHz in 400 MHz

Table A.3.10.2.11-1: SSB.11 FR2: SSB Pattern 11 for SSB SCS = 480 kHz in 400 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	400 MHz	
SSB SCS	480 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSBs Note 2	2-5	9-12
Slot numbers containing SSB Note 2	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.12 SSB pattern 12 in FR2: SSB allocation for SSB SCS=960 kHz in 400 MHz

Table A.3.10.2.12-1: SSB.12 FR2: SSB Pattern 12 for SSB SCS = 960 kHz in 400 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	400 MHz	
SSB SCS	960 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSBs Note 2	2-5	9-12
Slot numbers containing SSB Note 2	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+39})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.13 SSB pattern 13 in FR2: SSB allocation for SSB SCS=480 kHz in 400 MHz

Table A.3.10.2.13-1: SSB.13 FR2: SSB Pattern 13 for SSB SCS = 480 kHz in 400 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	400 MHz
SSB SCS	480 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	2-5
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0

PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})[Note 1]
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.14 SSB pattern 14 in FR2: SSB allocation for SSB SCS=960 kHz in 400 MHz

Table A.3.10.2.14-1: SSB.14 FR2: SSB Pattern 14 for SSB SCS = 960 kHz in 400 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	400 MHz
SSB SCS	960 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs [Note 2]	2-5
Slot numbers containing SSB [Note 2]	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+39})[Note 1]
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.15 SSB pattern 15 in FR2: SSB allocation for SSB SCS=480 kHz in 400 MHz

Table A.3.10.2.15-1: SSB.15 FR2: SSB Pattern 15 for SSB SCS = 480 kHz in 400 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	400 MHz	
SSB SCS	480 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	2	3
Symbol numbers containing SSBs [Note 2]	2-5	9-12
Slot numbers containing SSB [Note 2]	1	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})[Note 1]	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.16 SSB pattern 16 in FR2: SSB allocation for SSB SCS=960 kHz in 400 MHz

Table A.3.10.2.16-1: SSB.16 FR2: SSB Pattern 16 for SSB SCS = 960 kHz in 400 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	400 MHz	
SSB SCS	960 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	2	3

Symbol numbers containing SSBs [Note 2]	2-5	9-12
Slot numbers containing SSB [Note 2]	1	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+39})[Note 1]	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.17 SSB pattern 17 in FR2: SSB allocation for SSB SCS=480 kHz in 400 MHz

Table A.3.10.2.17-1: SSB.17 FR2: SSB Pattern 17 for SSB SCS = 480 kHz in 400 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	400 MHz
SSB SCS	480 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	1
Symbol numbers containing SSBs [Note 2]	9-12
Slot numbers containing SSB [Note 2]	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})[Note 1]
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.18 SSB pattern 18 in FR2: SSB allocation for SSB SCS=960 kHz in 400 MHz

Table A.3.10.2.18-1: SSB.18 FR2: SSB Pattern 18 for SSB SCS = 960 kHz in 400 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	400 MHz
SSB SCS	960 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	1
Symbol numbers containing SSBs [Note 2]	9-12
Slot numbers containing SSB [Note 2]	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+39})[Note 1]
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.19 SSB pattern 19 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10B.2.2-1: SSB.19 FR2: SSB Pattern 17 for SSB SCS = 120 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	120 kHz
SSB periodicity (T_{SSB})	40 ms

Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	4-7
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the PRBs for allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.20 SSB pattern 20 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.20-1: SSB.20 FR2: SSB Pattern 18 for SSB SCS = 240 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	240 kHz
SSB periodicity (T_{SSB})	40 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	8-11
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the PRBs for allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.21 SSB pattern 21 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.21-1: SSB.21 FR2: SSB Pattern 19 for SSB SCS = 120 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	120 kHz	
SSB periodicity (T_{SSB})	80 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSBs Note 2	4-7	8-11
Slot numbers containing SSB Note 2	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the associated bandwidth part except the PRBs for allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.22 SSB pattern 22 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.22-1: SSB.22 FR2: SSB Pattern 20 for SSB SCS = 240 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values

Channel bandwidth	100 MHz	
SSB SCS	240 kHz	
SSB periodicity (T_{SSB})	80 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSBs Note 2	8-11	12-13, 0-1
Slot numbers containing SSB Note 2	0	0, 1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+39})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the associated bandwidth part except the PRBs for allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.23 SSB pattern 23 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.23-1: SSB.23 FR2: SSB Pattern 21 for SSB SCS = 120 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	120 kHz
SSB periodicity (T_{SSB})	40 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	1
Symbol numbers containing SSBs Note 2	8-11
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.24 SSB pattern 24 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.24-1: SSB.24 FR2: SSB Pattern 22 for SSB SCS = 240 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	240 kHz	
SSB periodicity (T_{SSB})	40 ms	
Number of SSBs per SS-burst	1	
SS/PBCH block index	1	
Symbol numbers containing SSBs Note 2	12-13	0-1
Slot numbers containing SSB Note 2	0	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+39})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.25 SSB pattern 25 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.25-1: SSB.25 FR2: SSB Pattern 17 for SSB SCS = 120 kHz in 100 MHz channel with 3 SSBs per SS-burst

SSB Parameters	Values			
Channel bandwidth	100 MHz			
SSB SCS	120 kHz			
SSB periodicity (T_{SSB})	20 ms			
Number of SSBs per SS-burst	3			
SS/PBCH block index	0	1	2	3
Symbol numbers containing SSBs Note 2	4-7	8-11	2-5	6-9
Slot numbers containing SSB Note 2	0	0	1	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0			
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1			
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.				

A.3.10.2.26 SSB pattern 26 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.26-1: SSB.26 FR2: SSB Pattern 26 for SSB SCS = 120 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	120 kHz
SSB periodicity (T_{SSB})	80 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	4-7
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0
RB numbers containing SSBs within channel BW	(RB_J, RB_{J+1},…., RB_{J+19})Note 1
Note 1: RBs containing SSB can be configured in any frequency location within the associated bandwidth part except the RBs for allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.27 SSB pattern 27 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.27-1: SSB. 27 FR2: SSB Pattern 27 for SSB SCS = 240 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	240 kHz
SSB periodicity (T_{SSB})	80 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	8-11
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0
RB numbers containing SSBs within channel BW	(RB_J, RB_{J+1},…., RB_{J+39})Note 1
Note 1: RBs containing SSB can be configured in any frequency location within the associated bandwidth part except the RBs for allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10A SSB Configurations under CCA

A.3.10A.1 SSB Configurations under CCA for FR1

A.3.10A.1.1 SSB pattern 1 under CCA for semi-static channel access: SSB allocation for SSB SCS=30 kHz in 40 MHz

Table A.3.10A.1.1-1: SSB.1 CCA: SSB Pattern 1 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values
Channel bandwidth	40 MHz
SSB SCS	30 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSB indexes per SS-burst (N_{SSB}^{QCL})	1
Number of SS/PBCH block candidates per SSB index	1
SS/PBCH block candidate position	0
SS/PBCH block index	0
Symbol numbers containing SSB Note 2	2-5
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves	

A.3.10A.1.2 SSB pattern 2 under CCA for dynamic channel access: SSB allocation for SSB SCS=30 kHz in 40 MHz

Table A.3.10A.1.2-1: SSB.2 CCA: SSB Pattern 2 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values	
Channel bandwidth	40 MHz	
SSB SCS	30 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSB indexes per SS-burst (N_{SSB}^{QCL})	1	
Number of SS/PBCH block candidates per SSB index	2	
SS/PBCH block candidate position	0	2
SS/PBCH block index	0	0
Symbol numbers containing SSB Note 2	2-5	2-5
Slot numbers containing SSB Note 2	0	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves		

A.3.10A.1.3 SSB pattern 3 under CCA for semi-static channel access: SSB allocation for SSB SCS=30 kHz in 40 MHz

Table A.3.10.1.3-1: SSB.3 CCA: SSB Pattern 3 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values
Channel bandwidth	40 MHz
SSB SCS	30 kHz

SSB periodicity (T_{SSB})	20 ms	
Number of SSB indexes per SS-burst (N_{SSB}^{QCL})	2	
Number of SS/PBCH block candidates per SSB index	1	
SS/PBCH block candidate position	0	1
SS/PBCH block index	0	1
Symbol numbers containing SSB Note 2	2-5	8-11
Slot numbers containing SSB Note 2	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10A.1.4 SSB pattern 4 under CCA for dynamic channel access: SSB allocation for SSB SCS=30 kHz in 40 MHz

Table A.3.10.1.4-1: SSB.4 CCA: SSB Pattern 4 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values			
Channel bandwidth	40 MHz			
SSB SCS	30 kHz			
SSB periodicity (T_{SSB})	20 ms			
Number of SSB indexes per SS-burst (N_{SSB}^{QCL})	2			
Number of SS/PBCH block candidates per SSB index	2			
SS/PBCH block candidate position	0	2	1	3
SS/PBCH block index	0	0	1	1
Symbol numbers containing SSB Note 2	2-5	2-5	8-11	8-11
Slot numbers containing SSB Note 2	0	1	0	1
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0			
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1			
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.				

A.3.10B SSB Configurations for RedCap

A.3.10B.1 SSB Configurations for FR1

A.3.10B.1.1 SSB pattern 1 for RedCap in FR1: SSB allocation for SSB SCS=30 kHz in 20 MHz

Table A.3.10B.1.1-1: SSB.1 RedCap FR1: SSB Pattern 1 for SSB SCS=30 kHz in 20 MHz channel

SSB Parameters	Values
Channel bandwidth	20 MHz
SSB SCS	30 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2
Slot numbers containing SSB Note 3	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen.	

NOTE 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves

A.3.10B.1.2 SSB pattern 2 for RedCap in FR1: SSB allocation for SSB SCS=30 kHz in 20 MHz

Table A.3.10B.1.2-1: SSB.2 RedCap FR1: SSB Pattern 2 for SSB SCS=30 kHz in 20 MHz channel

SSB Parameters	Values	
Channel bandwidth	20 MHz	
SSB SCS	30 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2	8-11
Slot numbers containing SSB Note 3	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0	
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1	
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13].		
NOTE 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen.		
NOTE 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10B.1.3 SSB pattern 3 for RedCap in FR1: SSB allocation for SSB SCS=30 kHz starting from odd SFN in 20 MHz

Table A.3.10B.1.3-1: SSB.3 RedCap FR1: SSB Pattern 3 for SSB SCS=30 kHz in 20 MHz channel

SSB Parameters	Values
Channel bandwidth	20 MHz
SSB SCS	30 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2
Slot numbers containing SSB Note 3	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 1
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13].	
NOTE 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen.	
NOTE 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10B.1.4 SSB pattern 4 for RedCap in FR1: SSB allocation for SSB SCS=15 kHz in 10 MHz

Table A.3.10B.1.4-1: SSB.4 RedCap FR1: SSB Pattern 4 for SSB SCS=15 kHz in 10 MHz channel

SSB Parameters	Values
Channel bandwidth	10 MHz
SSB SCS	15 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 2	2-5
Slot numbers containing SSB Note 2	0

SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})[Note 1]
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10B.1.5 SSB pattern 5 for RedCap in FR1: SSB allocation for SSB SCS=30 kHz in 20 MHz

Table A.3.10B.1.5-1: SSB.5 RedCap FR1: SSB Pattern 5 for SSB SCS=30 kHz in 20 MHz channel

SSB Parameters	Values
Channel bandwidth	20 MHz
SSB SCS	30 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB [Note 3]	4-7 or 2-5 [Note 2]
Slot numbers containing SSB [Note 3]	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})[Note 1]
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen. NOTE 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves	

A.3.10B.1.6 SSB pattern 6 for RedCap in FR1: SSB allocation for SSB SCS=15 kHz in 10 MHz

Table A.3.10B.1.6-1: SSB.6 RedCap FR1: SSB Pattern 6 for SSB SCS=15 kHz in 10 MHz channel

SSB Parameters	Values
Channel bandwidth	10 MHz
SSB SCS	15 kHz
SSB periodicity (T_{SSB})	80 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB [Note 2]	2-5
Slot numbers containing SSB [Note 2]	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})[Note 1]
NOTE 1: PRBs containing SSB can be configured in any frequency location within the associated bandwidth part except the PRBs for allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10B.1.7 SSB pattern 7 for RedCap in FR1: SSB allocation for SSB SCS=30 kHz in 20 MHz

Table A.3.10B.1.7-1: SSB.7 RedCap FR1: SSB Pattern 7 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values
Channel bandwidth	20 MHz
SSB SCS	30 kHz
SSB periodicity (T_{SSB})	80 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0

Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2
Slot numbers containing SSB Note 3	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSB within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19}) Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the associated bandwidth part except the PRBs for allowed synchronization raster defined in TS 38.104 [13].	
NOTE 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen.	
NOTE 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves	

A.3.10B.2 SSB Configurations for FR2

A.3.10B.2.1 SSB pattern 1 for RedCap in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10B.2.1-1: SSB.1 RedCap FR2: SSB Pattern 1 for SSB SCS = 120 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	120 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	4-7
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19}) Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13].	
NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10B.2.2 SSB pattern 2 for RedCap in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10B.2.2-1: SSB.2 RedCap FR2: SSB Pattern 2 for SSB SCS = 120 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	120 kHz
SSB periodicity (T_{SSB})	40 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	4-7
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19}) Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the PRBs for allowed synchronization raster defined in TS 38.104 [13].	
NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10B.2.3 SSB pattern 3 for RedCap in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10B.2.3-1: SSB.3 RedCap FR2: SSB Pattern 3 for SSB SCS = 120 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	120 kHz
SSB periodicity (T_{SSB})	80 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	4-7
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the associated bandwidth part except the PRBs for allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10B.2.4 SSB pattern 4 for RedCap in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10B.2.4-1: SSB.4 RedCap FR2: SSB Pattern 4 for SSB SCS = 240 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	240 kHz
SSB periodicity (T_{SSB})	40 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	8-11
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the cell bandwidth according to the PRBs for allowed synchronization raster defined in TS 38.104 [13]. NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10B.2.5 SSB pattern 5 for RedCap in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10B.2.5-1: SSB.5 RedCap FR2: SSB Pattern 5 for SSB SCS = 240 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	240 kHz
SSB periodicity (T_{SSB})	80 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	8-11
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10 ms)/10 ms) = 0
PRB numbers containing SSBs within channel BW	(RB_J, PRB_{J+1},…., PRB_{J+19})Note 1
NOTE 1: PRBs containing SSB can be configured in any frequency location within the associated bandwidth part except the PRBs for allowed synchronization raster defined in TS 38.104 [13].	

NOTE 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.

A.3.11 SMTC Configurations

A.3.11.1 SMTC pattern 1: SMTC period = 20 ms with SMTC duration = 1 ms

Table A.3.11.1-1: SMTC.1: SMTC Pattern 1 for SMTC period = 20 ms and duration = 1 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	0 ms
SMTC duration	1 ms

A.3.11.2 SMTC pattern 2: SMTC period = 20 ms with SMTC duration = 5 ms

Table A.3.11.2-1: SMTC.2: SMTC Pattern 2 for SMTC period = 20 ms and duration = 5 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	0 ms
SMTC duration	5 ms

A.3.11.3 SMTC pattern 3: SMTC period = 160 ms with SMTC duration = 1 ms

Table A.3.11.3-1: SMTC.3: SMTC Pattern 3 for SMTC period = 160 ms and duration = 1 ms

SMTC Parameters	Values
SMTC periodicity	160 ms
SMTC offset	0 ms
SMTC duration	1 ms

A.3.11.4 SMTC pattern 4: SMTC period = 20 ms with SMTC duration = 1 ms

Table A.3.11.4-1: SMTC.4: SMTC Pattern 4 for SMTC period = 20 ms and duration = 1 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	10 ms
SMTC duration	1 ms

A.3.11.5 SMTC pattern 5: SMTC period = 20 ms with SMTC duration = 5 ms

Table A.3.11.5-1: SMTC.5: SMTC Pattern 5 for SMTC period = 20 ms and duration = 5 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	10 ms
SMTC duration	5 ms

A.3.11.6 SMTC pattern 6: SMTC period = 20 ms with SMTC duration = 5 ms

Table A.3.11.6-1: SMTC.6: SMTC Pattern 6 for SMTC period = 20 ms and duration = 5 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	17 ms
SMTC duration	5 ms

A.3.11.7 SMTC pattern 7: SMTC period = 20 ms with SMTC duration = 5 ms

Table A.3.11.7-1: SMTC.7: SMTC Pattern 7 for SMTC period = 20 ms and duration = 5 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	5 ms
SMTC duration	5 ms

A.3.11.8 SMTC pattern 8: SMTC period = 10 ms with SMTC duration = 1 ms

Table A.3.11.8-1: SMTC.8: SMTC Pattern 8 for SMTC period = 10 ms and duration = 1 ms

SMTC Parameters	Values
SMTC periodicity	10 ms
SMTC offset	0 ms
SMTC duration	1 ms

A.3.11.9 SMTC pattern 9: SMTC period = 20 ms with SMTC duration = 1 ms

Table A.3.11.9-1: SMTC.9: SMTC Pattern 6 for SMTC period = 20 ms and duration = 1 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	13 ms
SMTC duration	1 ms

A.3.11.10 SMTC pattern 10: SMTC period = 80 ms with SMTC duration = 1 ms

Table A.3.11.10-1: SMTC.10: SMTC Pattern 10 for SMTC period = 80 ms and duration = 1 ms

SMTC Parameters	Values
SMTC periodicity	80 ms
SMTC offset	0 ms
SMTC duration	1 ms

A.3.11.11 SMTC pattern 11: SMTC period = 80 ms with SMTC duration = 5 ms

Table A.3.11.11-1: SMTC.11: SMTC Pattern 11 for SMTC period = 80 ms and duration = 5 ms

SMTC Parameters	Values
SMTC periodicity	80 ms

SMTC offset	5 ms
SMTC duration	5 ms

A.3.11.12 SMTC pattern 12: SMTC period = 20 ms with SMTC duration = 5 ms

Table A.3.11.12-1: SMTC.12: SMTC Pattern 12 for SMTC period = 20 ms and duration = 4 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	4 ms
SMTC duration	5 ms

A.3.11A SMTC Configurations for RedCap

A.3.11A.0 Introduction

The SMTC configuration for RedCap can also be used in test case for non-RedCap.

A.3.11A.1 SMTC pattern 1 for RedCap: SMTC period = 40 ms with SMTC duration = 1 ms

Table A.3.11A.1-1: SMTC.1 RedCap: SMTC Pattern 1 for SMTC period = 40 ms and duration = 1 ms

SMTC Parameters	Values
SMTC periodicity	40 ms
SMTC offset	0 ms
SMTC duration	1 ms

A.3.11A.2 SMTC pattern 2 for RedCap: SMTC period = 80 ms with SMTC duration = 1 ms

Table A.3.11A.2-1: SMTC.2 RedCap: SMTC Pattern 2 for SMTC period = 80 ms and duration = 1 ms

SMTC Parameters	Values
SMTC periodicity	80 ms
SMTC offset	0 ms
SMTC duration	1 ms

A.3.11A.3 SMTC pattern 3 for RedCap: SMTC period = 40 ms with SMTC duration = 1 ms

Table A.3.11A.3-1: SMTC.3 RedCap: SMTC Pattern 3 for SMTC period = 40 ms and duration = 1 ms

SMTC Parameters	Values
SMTC periodicity	40 ms
SMTC offset	20 ms
SMTC duration	1 ms

A.3.11A.4 SMTC pattern 4 for RedCap: SMTC period = 80 ms with SMTC duration = 5 ms

Table A.3.11A.4-1: SMTC.4 RedCap: SMTC Pattern 4 for SMTC period = 80 ms and duration = 5 ms

SMTC Parameters	Values
SMTC periodicity	80 ms
SMTC offset	0 ms
SMTC duration	5 ms

A.3.12 Test Cases with Different CC Configurations

A.3.12.1 EN-DC Test Cases with Different EN-DC Configurations

A.3.12.1.1 Introduction

In annex A EN-DC test cases may be defined for two component carriers (CCs) as well as for more than two CCs to verify the same RRM requirement.

A.3.12.1.2 Principle of testing

If multiple EN-DC test cases are defined for two CCs as well as for more than two CCs to verify the same type of RRM requirement, which depends on the number of CCs, then from the UE performance point of view the test coverage can be considered fulfilled by executing only the EN-DC test cases with the maximum number of CCs in EN-DC supported by the UE. Otherwise, if the same type of RRM requirement is independent of the number of CCs then from the UE performance point of view the test coverage can be considered fulfilled by executing only the EN-DC test cases with two CCs in EN-DC supported by the UE.

NOTE: The maximum number of CCs that can be used in FR2 tests in EN-DC would depend on the test equipment capability.

A.3.12.2 Carrier Aggregation Test Cases with Different CA Configurations

A.3.12.2.1 Introduction

In annex A carrier aggregation test cases may be defined for two CCs as well as for more than two CCs to verify the same RRM requirement.

A.3.12.2.2 Principle of testing

If multiple carrier aggregation test cases are defined for two CCs as well as for more than two CCs to verify the same RRM requirement, which depends on the number of CCs, then from the UE performance point of view the test coverage can be considered fulfilled by executing only the CA test cases with the maximum number of CCs in CA supported by the UE. Otherwise if the same type of RRM requirement is independent of the number of CCs then from the UE performance point of view the test coverage can be considered fulfilled by executing only the CA test cases with at least two CCs in CA supported by the UE.

NOTE: The maximum number of CCs that can be used in FR2 tests in CA would depend on the test equipment capability.

A.3.13 Test Cases in SA and EN-DC Operations

A.3.13.1 Introduction

This clause defines a principle which is applicable to test cases verifying RRM requirements in standalone (SA) or EN-DC operations.

In annex A test cases may be defined in SA and EN-DC operations to verify the same RRM requirement.

A.3.13.2 Principle of Testing

If test cases are defined in both SA and EN-DC operations to verify the same RRM requirement then the UE capable of both SA and EN-DC operations needs to verify that RRM requirement by performing test case(s) in either SA operation or in EN-DC operation.

If test cases are defined in both SA and EN-DC operations to verify at least one common RRM requirement then the UE capable of both SA and EN-DC operations needs to verify RRM requirements by performing test case(s) in either SA operation or in EN-DC operation provided that the performed test case(s):

- verifies the largest number of RRM requirements and
- verifies at least all RRM requirements covered in the test case(s), which is not performed.

A.3.13A Void

A.3.13A.1 Void

A.3.13A.2 Void

Table A.3.13A.2-1: Void

A.3.13A.3 Void

Table A.3.13A.3-1: Void

A.3.13A.4 Void

Table A.3.13A.4-1: Void

A.3.13A.5 Void

Table A.3.13A.5-1: Void

A.3.13B Test Cases for EN-DC and NE-DC Operations

A.3.13B.1 Active BWP switch Test Cases for EN-DC and NE-DC Operations

A.3.13B.1.1 Introduction

This clause defines a principle which is applicable to test cases verifying active BWP switch requirements for EN-DC operation and NE-DC operations.

In annex A test cases are defined for both EN-DC and NE-DC operations to verify the same type of RRM requirement.

A.3.13B.1.2 Principle of Testing

UE capable of both EN-DC and NE-DC operations needs to be tested with one of the tests in either EN-DC or NE-DC operations.

A.3.13B.2 SFTD accuracy Test Cases for EN-DC and NE-DC Operations

A.3.13B.2.1 Introduction

This clause defines a principle which is applicable to test cases verifying SFTD accuracy requirements for EN-DC operation and NE-DC operations.

In annex A test cases are defined for both EN-DC and NE-DC operations to verify the same type of RRM requirement.

A.3.13B.2.2 Principle of Testing

UE capable of both EN-DC and NE-DC operations needs to be tested with one of the tests in either EN-DC or NE-DC operations.

A.3.14 CSI-RS configurations

A.3.14.1 FDD

Table A.3.14.1-1: CSI-RS Reference Measurement Channels for SCS=15 kHz

	CSI-RS.1.1 FDD	**CSI-RS.1.2 FDD**	**CSI-RS.1.3 FDD**	**CSI-RS.1.4 FDD**	**CSI-RS.1.5 FDD**	**CSI-RS.1.6 FDD**	**CSI-RS.1.7 FDD**
Resource Type	**periodic**	**periodic**	**aperiodic**	**aperiodic**	**aperiodic**	**periodic**	**periodic**
Resource Set Config							
nzp-CSI-ResourceSetId	0	0	0	0	0	0	0
repetition	n.a.	off	off	on	off	n.a.	off
aperiodicTriggeringOffset	n.a.	n.a.	0	0	0	n.a.	n.a.
trs-Info	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Resource Config							
		0 for resource #0	0 for resource #0	0 for resource #0 1 for resource #1	0 for resource #0		2 for resource #0

	CSI-RS.1.1 FDD	CSI-RS.1.2 FDD	CSI-RS.1.3 FDD	CSI-RS.1.4 FDD	CSI-RS.1.5 FDD	CSI-RS.1.6 FDD	CSI-RS.1.7 FDD
Resource Type	**periodic**	**periodic**	**aperiodic**	**aperiodic**	**aperiodic**	**periodic**	**periodic**
nzp-CSI-RS-ResourceId	0 for resource #0	1 for resource #1	1 for resource #1	2 for resource #2 3 for resource #3 4 for resource #4 5 for resource #5 6 for resource #6 7 for resource #7	1 for resource #1	0 for resource #0	3 for resource #1
powerControlOffset	0	0	0	0	0	0	0
powerControlOffsetSS	db0	db0	db0	db0	db0	db0	db0
scramblingID	0	0	0	0	0	0	0
Period (slots)	slot5	slot10	n.a.	n.a.	n.a.	slot40	slot10
Offset	1	1	n.a.	n.a.	n.a.	1	1
qcl-InfoPeriodicCSI-RS	TCI.State.0	TCI.State.0 TCI.State.1	n.a.	n.a.	n.a.	TCI.State.0	TCI.State.0 TCI.State.1
frequencyDomainAllocation	000001	0001	0001	0001	000001	000001	0100
nrofPorts	2	1	1	1	1	2	1
firstOFDMSymbolInTimeDomain	4 for resource #0	6 for resource #0 10 for resource #1	6 for resource #0 10 for resource #1	0 for resource #0 1 for resource #1 2 for resource #2 3 for resource #3 4 for resource #4 5 for resource #5 6 for resource #6 7 for resource #7	Specified in the test case for resource #0 n.a.	5 for resource #0	6 for resource #0 10 for resource #1
cdm-Type	FD-CDM2	noCDM	noCDM	noCDM	noCDM	FD-CDM2	noCDM
density	1	3	3	3	3	1	3
startingRB	0	0	0	0	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)

	CSI-RS.1.1 FDD	CSI-RS.1.2 FDD	CSI-RS.1.3 FDD	CSI-RS.1.4 FDD	CSI-RS.1.5 FDD	CSI-RS.1.6 FDD	CSI-RS.1.7 FDD
Resource Type	**periodic**	**periodic**	**aperiodic**	**aperiodic**	**aperiodic**	**periodic**	**periodic**
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.							

Table A.3.14.1-2: CSI-RS Reference Measurement Channels for SCS=120 kHz

	CSI-RS.2.1 FDD						
Resource Type	**periodic**						
Resource Set Config							
nzp-CSI-ResourceSetId	0						
repetition	n.a.						
aperiodicTriggeringOffset	n.a.						
trs-Info	n.a.						
Resource Config							
nzp-CSI-RS-ResourceId	0 for resource #0						
powerControlOffset	0						
powerControlOffsetSS	db0						
scramblingID	0						
Period (slots)	slot40.						
Offset	8						
qcl-InfoPeriodicCSI-RS	TCL.State.0						
frequencyDomainAllocation	000001						
nrofPorts	2						
firstOFDMSymbolInTimeDomain	5 for resource #0						
cdm-Type	FD-CDM2						
density	1						
startingRB	0						
nrofRBs	276 (Note 1)						
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.							

A.3.14.2 TDD

Table A.3.14.2-1: CSI-RS Reference Measurement Channels for SCS=15 kHz

	CSI-RS.1.1 TDD	CSI-RS.1.2 TDD	CSI-RS.1.3 TDD	CSI-RS.1.4 TDD	CSI-RS.1.5 TDD	CSI-RS.1.6 TDD
Resource Type	periodic	periodic	aperiodic	aperiodic	periodic	periodic
Resource Set Config						
nzp-CSI-ResourceSetId	0	0	0	0	0	0
repetition	n.a.	off	off	on	n.a.	off
aperiodicTriggeringOffset	n.a.	n.a.	0	0	n.a.	n.a.
trs-Info	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Resource Config						
nzp-CSI-RS-ResourceId	0 for resource #0	0 for resource #0 1 for resource #1	0 for resource #0 1 for resource #1	0 for resource #0 1 for resource #1 2 for resource #2 3 for resource #3 4 for resource #4	0 for resource #0	2 for resource #0 3 for resource #1

				5 for resource #5		
				6 for resource #6		
				7 for resource #7		
powerControlOffset	0	0	0	0	0	0
powerControlOffsetSS	db0	db0	db0	db0	db0	db0
scramblingID	0	0	0	0	0	0
Period (slots)	slot5	slot10	n.a.	n.a.	slot40	slot10
Offset	1	1	n.a.	n.a.	1	1
qcl-InfoPeriodicCSI-RS	TCI.State.0	TCI.State.0	n.a.	n.a.	TCI.State.0	TCI.State.0
		TCI.State.1				TCI.State.1
frequencyDomainAllocation	000001	0001	0001	0001	000001	0100
nrofPorts	2	1	1	1	2	1
firstOFDMSymbolInTimeDomain	4 for resource #0	6 for resource #0	6 for resource #0	0 for resource #0	5 for resource #0	6 for resource #0
				1 for resource #1		
				2 for resource #2		
				3 for resource #3		
		10 for resource #1	10 for resource #1	4 for resource #4		10 for resource #1
				5 for resource #5		
				6 for resource #6		
				7 for resource #7		
cdm-Type	FD-CDM2	noCDM	noCDM	noCDM	FD-CDM2	noCDM
density	1	3	3	3	1	3
startingRB	0	0	0	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.						

Table A.3.14.2-1A: CSI-RS Reference Measurement Channels for SCS=15 kHz

	CSI-RS.1.1A TDD	**CSI-RS.1.2A TDD**	**CSI-RS.1.3A TDD**
Resource Type	periodic	aperiodic	periodic
Resource Set Config			
nzp-CSI-ResourceSetId	1	1	1
repetition	off	off	off
aperiodicTriggeringOffset	n.a.	0	n.a.
trs-Info	n.a.	n.a.	n.a.
Resource Config			
nzp-CSI-RS-ResourceId	12 for resource #0	22 for resource #0	14 for resource #0
	13 for resource #1	23 for resource #1	15 for resource #1
powerControlOffset	0	0	0
powerControlOffsetSS	db0	db0	db0
scramblingID	0	0	0
Period (slots)	slot20	n.a.	slot10
Offset	1	n.a.	2
qcl-InfoPeriodicCSI-RS	n.a.	n.a.	n.a.
frequencyDomainAllocation	0001	0001	0001
nrofPorts	1	1	1

firstOFDMSymbolInTimeDomain	6 for resource #0	7 for resource #0	6 for resource #0
	10 for resource #1	11 for resource #1	10 for resource #1
cdm-Type	noCDM	noCDM	noCDM
density	3	3	3
startingRB	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.			

Table A.3.14.2-2: CSI-RS Reference Measurement Channels for SCS=30 kHz

	CSI-RS.2.1 TDD	**CSI-RS.2.2 TDD**	**CSI-RS.2.3 TDD**	**CSI-RS.2.4 TDD**	**CSI-RS.2.5 TDD**	**CSI-RS.2.6 TDD**	**CSI-RS.2.7 TDD**
Resource Type	periodic	periodic	aperiodic	aperiodic	aperiodic	periodic	periodic
Resource Set Config							
nzp-CSI-ResourceSetId	0	0	0	0	0	0	0
repetition	n.a.	off	off	on	off	n.a.	off
aperiodicTriggeringOffset	n.a.	n.a.	0	0	0	n.a.	n.a.
trs-Info	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Resource Config							
nzp-CSI-RS-ResourceId	0 for resource #0	0 for resource #0	0 for resource #0	0 for resource #0	0 for resource #0	0 for resource #0	2 for resource #0
				1 for resource #1			
				2 for resource #2			
				3 for resource #3			
		1 for resource #1	1 for resource #1	4 for resource #4	1 for resource #1		3 for resource #1
				5 for resource #5			
				6 for resource #6			
				7 for resource #7			
powerControlOffset	0	0	0	0	0	0	0
powerControlOffsetSS	db0	db0	db0	db0	db0	db0	db0
scramblingID	0	0	0	0	0	0	0
Period (slots)	slot10	slot20	n.a.	n.a.	n.a.	slot80	slot20
Offset	2	2	n.a.	n.a.	n.a.	2	2
qcl-InfoPeriodicCSI-RS	TCI.State.0	TCI.State.0	n.a.	n.a.	n.a.	TCI.State.0	TCI.State.0
		TCI.State.1					TCI.State.1
frequencyDomainAllocation	000001	0001	0001	0001	000001	000001	0100
nrofPorts	2	1	1	1	1	2	1
		6 for resource #0	6 for resource #0	0 for resource #0	Specified in the test case for resource #0		6 for resource #0

	CSI-RS.2.1 TDD	CSI-RS.2.2 TDD	CSI-RS.2.3 TDD	CSI-RS.2.4 TDD	CSI-RS.2.5 TDD	CSI-RS.2.6 TDD	CSI-RS.2.7 TDD
firstOFDMSymbolInTimeDomain	5 for resource #0	10 for resource #1	10 for resource #1	1 for resource #1	n.a.	5 for resource #0	10 for resource #1
				2 for resource #2			
				3 for resource #3			
				4 for resource #4			
				5 for resource #5			
				6 for resource #6			
				7 for resource #7			
cdm-Type	FD-CDM2	noCDM	noCDM	noCDM	noCDM	FD-CDM2	noCDM
density	1	3	3	3	3	1	3
startingRB	0	0	0	0	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.							

Table A.3.14.2-2A: CSI-RS Reference Measurement Channels for SCS=30 kHz

	CSI-RS.2.1A TDD	CSI-RS.2.2A TDD	CSI-RS.2.3A TDD
Resource Type	periodic	aperiodic	periodic
Resource Set Config			
nzp-CSI-ResourceSetId	1	1	1
repetition	off	off	off
aperiodicTriggeringOffset	n.a.	0	n.a.
trs-Info	n.a.	n.a.	n.a.
Resource Config			
nzp-CSI-RS-ResourceId	12 for resource #0	22 for resource #0	14 for resource #0
	13 for resource #1	23 for resource #1	15 for resource #1
powerControlOffset	0	0	0
powerControlOffsetSS	db0	db0	db0
scramblingID	0	0	0
Period (slots)	slot40	n.a.	slot20
Offset	2	n.a.	4
qcl-InfoPeriodicCSI-RS	n.a.	n.a.	n.a.
frequencyDomainAllocation	0001	0001	0001
nrofPorts	1	1	1
firstOFDMSymbolInTimeDomain	6 for resource #0	7 for resource #0	6 for resource #0
	10 for resource #1	11 for resource #1	10 for resource #1

cdm-Type	noCDM	noCDM	noCDM
density	3	3	3
startingRB	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.			

Table A.3.14.2-3: CSI-RS Reference Measurement Channels for SCS=120 kHz

	CSI-RS.3.1 TDD	CSI-RS.3.2 TDD	CSI-RS.3.3 TDD	CSI-RS.3.4 TDD	CSI-RS.3.5 TDD	CSI-RS.3.6 TDD
Resource Type	**periodic**	**periodic**	**aperiodic**	**aperiodic**	**periodic**	**periodic**
Resource Set Config						
nzp-CSI-ResourceSetId	0	0	0	0	0	0
repetition	n.a.	off	off	on	n.a.	off
aperiodicTriggeringOffset	n.a.	n.a.	4	4	n.a.	n.a.
trs-Info	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Resource Config						
nzp-CSI-RS-ResourceId	0 for resource #0	0 for resource #0	0 for resource #0	0 for resource #0	0 for resource #0	2 for resource #0
				1 for resource #1		
				2 for resource #2		
				3 for resource #3		
		1 for resource #1	1 for resource #1	4 for resource #4		3 for resource #1
				5 for resource #5		
				6 for resource #6		
				7 for resource #7		
powerControlOffset	0	0	0	0	0	0
powerControlOffsetSS	db0	db0	db0	db0	db0	db0
scramblingID	0	0	0	0	0	0
Period (slots)	slot40	slot80	n.a.	n.a.	slot320	slot80
Offset	8	16	n.a.	n.a.	8	16
qcl-InfoPeriodicCSI-RS	TCI.State.0	TCI.State.0	n.a.	n.a.	TCI.State.0	TCI.State.0
		TCI.State.1				TCI.State.1
frequencyDomainAllocation	000001	0001	0001	0001	000001	0100
nrofPorts	2	1	1	1	1	1
firstOFDMSymbolInTimeDomain	5 for resource #0	6 for resource #0	6 for resource #0	0 for resource #0	5 for resource #0	6 for resource #0
				1 for resource #1		
				2 for resource #2		
				3 for resource #3		
		10 for resource #1	10 for resource #1	4 for resource #4		10 for resource #1
				5 for resource #5		
				6 for resource #6		
				7 for resource #7		
cdm-Type	FD-CDM2	noCDM	noCDM	noCDM	FD-CDM2	noCDM
density	1	3	3	3	1	3
startingRB	0	0	0	0	0	0

	CSI-RS.3.1 TDD	CSI-RS.3.2 TDD	CSI-RS.3.3 TDD	CSI-RS.3.4 TDD	CSI-RS.3.5 TDD	CSI-RS.3.6 TDD
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.						

Table A.3.14.2-3A: CSI-RS Reference Measurement Channels for SCS=120 kHz

	CSI-RS.3.1A TDD	CSI-RS.3.2A TDD	CSI-RS.3.3A TDD	CSI-RS.3.4A TDD	CSI-RS.3.5A TDD
Resource Type	periodic	aperiodic	periodic	periodic	periodic
Resource Set Config					
nzp-CSI-ResourceSetId	1	1	1	0	1
repetition	off	off	off	off	off
aperiodicTriggeringOffset	n.a.	6	n.a.	n.a.	n.a.
trs-Info	n.a.	n.a.	n.a.	n.a.	n.a.
Resource Config					
nzp-CSI-RS-ResourceId	12 for resource #0	22 for resource #0	14 for resource #0	0 for resource#0	1 for resource #1
	13 for resource #1	23 for resource #1	15 for resource #1		
powerControlOffset	0	0	0	0	0
powerControlOffsetSS	db0	db0	db0	[db6]	[db6]
scramblingID	0	0	0	0	0
Period (slots)	slot160	n.a.	slot80	Slot80	Slot80
Offset	8	n.a.	16	8	8
qcl-InfoPeriodicCSI-RS	n.a.	n.a.	n.a.	TCI.State.0	TCI.State.1
frequencyDomainAllocation	0001	0001	0001	0001	0010
nrofPorts	1	1	1	1	1
firstOFDMSymbolInTimeDomain	6 for resource #0	7 for resource #0	6 for resource #0	5	5
	10 for resource #1	11 for resource #1	10 for resource #1		
cdm-Type	noCDM	noCDM	noCDM	noCDM	noCDM
density	3	3	3	3	3
startingRB	0	0	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.					

A.3.15 Angle of Arrival (AoA) for FR2 RRM test cases

This clause specifies the AoA setups for FR2 RRM test cases in clause A.5 and A.7. The applicable AoA setup is defined in each test case in clause A.5 and A.7.

A.3.15.1 Setup 1: Single AoA in Rx beam peak direction

There is only one active probe in the test. The DL signals, and noise if applicable, transmitted from the probe, are aligned to the UE Rx beam peak direction (as defined in TS 38.101-2 [19]).

A.3.15.2 Setup 2: Single AoA in non Rx beam peak direction

A.3.15.2.1 Setup 2a: Single AoA in non Rx beam peak direction without change in direction

There is only one active probe in the test. The DL signals, and noise if applicable, transmitted from the probe, align to a direction (AoA) which is from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for each UE power class. The direction (AoA) of the signals shall not be changed between test iterations.

A.3.15.2.2 Setup 2b: Single AoA in non Rx beam peak direction with change in direction

There is only one active probe in the test. The DL signals, and noise if applicable, transmitted from the probe, align to a direction (AoA) which is from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for each UE power class. For UE power class 3, the direction (AoA) of the signals shall be changed for each test iteration.

A.3.15.3 Setup 3: 2 AoAs

There are 2 active probes in the test. The DL signals, and noise if applicable, transmitted from the two active probes, align to directions (AoAs) which are from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for each UE power class. The relative angular offset between the directions (AoAs) of the 2 active probes, shall be changed for each test iteration. The applicable set of relative angular offsets between the 2 active probes is given in table 3.15.3-1 for each UE power class.

Table A.3.15.3-1: Set of relative angular offsets between active probes for each power class

UE Power class	Relative angular offset between active probes
1	30°, 60°, 90° and 120°
2	FFS
3	30°, 60°, 90°, 120° and 150°
4	FFS
5	30°, 60°, 90° and 120°
6	30°, 60°, 90°, 120° and 150°
7	FFS

A.3.15.4 Setup 4: 2 AoAs, 1 AoA in Rx beam peak direction, 1 in non Rx beam peak

A.3.15.4.1 Setup 4a: 2 AoAs, 1 AoA in Rx beam peak direction, 1 in non Rx beam peak without change in direction

There are 2 active probes in the test. The DL signals, and noise if applicable, are transmitted from the two active probes. One probe is aligned to the UE Rx beam peak direction as defined in TS 38.101-2 [19]. The second is aligned to a direction (AoA) which is from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for each UE power class. The direction (AoA) of the non Rx beam peak signal shall not be changed between test iterations.

A.3.15.4.2 Setup 4b: 2 AoAs, 1 AoA in Rx beam peak direction, 1 in non Rx beam peak with change in direction

There are 2 active probes in the test. The DL signals, and noise if applicable, are transmitted from the two active probes. One probe is aligned to the UE Rx beam peak direction as defined in TS 38.101-2 [19]. The second is aligned to a direction (AoA) which is from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for each UE power class.

For UE power class 3, the relative angular offset between the directions (AoAs) of the 2 active probes shall be changed for each test iteration, within the probe alignment described above. The applicable set of relative angular offsets between the 2 active probes is given in table 3.15.3-1 for each UE power class.

A.3.15.4.3 Setup 4c: 2 AoAs, 1 AoA in Rx beam peak direction, 1 in non Rx beam peak for power class 6 UE supporting simultaneous reception from multiple directions

There are 2 active probes in the test. The DL signals, and noise if applicable, are transmitted from the two active probes. One probe is aligned to the UE Rx beam peak direction as defined in TS 38.101-2 [19]. The second is aligned to a direction (AoA) which is from the set of directions corresponding to the 2AoA spherical coverage requirement for simultaneous reception from multiple directions as defined in clause 7.3K.6 of TS 38.101-2 [19] for power class 6.

For power class 6 supporting simultaneous reception from multiple directions, the angular separation between the directions (AoAs) of the 2 active probes is 150°, and the direction (AoA) of the non Rx beam peak signal shall not be changed between test iterations.

A.3.15.5 Setup 5: 2 AoAs for simultaneous reception with QCL Type-D

There are 2 active probes in the test. The DL signals, and noise if applicable, are transmitted from the two active probes. The 2 AoAs (AoA1 and AoA2) for simultaneous reception with different QCL-typeD are from the set of AoA pairs, denoted by (AoA1, AoA2) that can support 2 AoA reception for UE declared AoA angular separation and declared orientation in the positioner of the test system according to the spherical coverage requirement for simultaneous reception from multiple directions as defined in clause 7.3K.3 of TS 38.101-2 [19] for UE power class 3 supporting simultaneous reception from multiple directions. The angular separation between the directions (AoA1 and AoA2) of the 2 active probes is declared from table 7.3K.3-1 in clause 7.3K.3 of TS 38.101-2 [19] and shall not be changed for each test iteration.

AoA1 needs to satisfy the spherical coverage requirement in table 7.3.4.3-1 of TS 38.101-2 [19].

NOTE: The chosen AoA pair (AoA1, AoA2) is up to RAN5.

A.3.15.6 Setup 6: 3 AoAs for simultaneous reception with different QCL Type-D

There are 3 active probes in the test and the DL signals and noise are transmitted from the three active probes.

Out of the three AoAs, one AoA (AoA1) is aligned to a direction which is from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for UE power class 3 and other 2 AoAs (AoA2 and AoA3) are from the set of AoA pairs, denoted by (AoA2, AoA3) that can support 2 AoA reception for UE declared AoA angular separation and declared orientation in the positioner of the test system according to the spherical coverage requirement for simultaneous reception from multiple directions as defined in clause 7.3K.3 of TS 38.101-2 [19] for power class 3 supporting simultaneous reception from multiple directions. The UE positioning shall be such that the UE passes both spherical coverage requirements.

The angular offset between the directions of the AoA pair (AoA2, AoA3) is declared from table 7.3K.3-1 in clause 7.3K.3 of TS 38.101-2 [19] and shall not be changed for each test iteration.

NOTE: The chosen AoA pair (AoA2, AoA3) is up to RAN5.

A.3.15.7 Setup 7: 3 AoAs

There are 3 active probes in the test. The DL signals, and noise if applicable, transmitted from the three active probes, align to directions (AoAs) which are from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for each UE power class. The relative angular offset between the directions (AoAs) of the 3 active probes, shall be changed for each test iteration. Any combinations of two relative angular offsets between 2 active probes specified in table A.3.15.3-1, is considered as a valid applicable relative angular offsets between 3 active probes for the respective power class.

A.3.15C Angle of Arrival (AoA) for FR2-NTN RRM test cases

This clause specifies the AoA setups for FR2-NTN RRM test cases in clause A.14. The applicable AoA setup is defined in each test case in clause A.14.

A.3.15C.1 Setup 1: Single AoA

There is only one active probe in the test. The DL signals, and noise if applicable, transmitted from the probe, are aligned with the satellite epherimis information used in the test case and within the declared minimum elevation angle supported for receiving.

A.3.15C.2 Setup 2: 2 AoAs

There are 2 active probes in the test. The DL signals, and noise if applicable, are transmitted from the two active probes. One probe is aligned with the first satellite epherimis information used in the test case. The second probe is aligned with the second satellite epherimis information used in the test case. Both AoAs are within the declared minimum elevation angle supported for receiving and the relative angular offset between the two AoAs is 30°. The directions (AoAs) of the signals shall not be changed between test iterations.

A.3.16 TCI State Configuration

A.3.16.1 Introduction

This clause provides the configurations for TCI states towards either SSB or CSI-RS. The TCI states defined in this clause are configured in each test when applicable to indicate that certain DL signals are QCL'ed with the referenceSignal configured in the TCI states.

A.3.16.2 TCI states

Table A.3.16.2-1: TCI States

Parameter	TCI.State.0	TCI.State.1	TCI.State.2	TCI.State.3
tci-StateId	Id0	Id1	Id2	Id3
qcl-Type1	typeC	typeC	typeA	typeA
qcl-Type2[Note1]	typeD	typeD	typeD	typeD
referenceSignal	SSB0	SSB1	Resource #4 in TRS resource set 1 [Note3]	Resource #4 in TRS resource set 2 [Note3]

NOTE 1: qcl-Type2 of typeD only where applicable. For RRM test cases, this will be only in FR2
NOTE 2: referenceSignal configurations towards which the TCI states are configured are defined in a test-specific manner.
NOTE 3: Reference TRS resource sets are defined in clause A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1.

Table A.3.16.2-2: Void

A.3.16A Unified TCI State Configuration

A.3.16A.1 Introduction

This clause provides the configurations for unified TCI states towards either SSB or CSI-RS. The DLorJoint TCI states defined in this clause are configured in each test when applicable to indicate that certain DL (and UL, if joint DL/UL operation is configured) signals are QCL'ed with the referenceSignal configured in the TCI states. The UL TCI states defined in this clause are configured in each test when applicable to indicate that certain UL signals are QCL'ed with the referenceSignal configured in the TCI states.

A.3.16A.2 DLorJoint TCI states

Table A.3.16A.2-1: DLorJoint TCI States

Parameter	DLorJoint TCI.State.0	DLorJoint TCI.State.1	DLorJoint TCI.State.2	DLorJoint TCI.State.3	DLorJoint TCI.State.4	DLorJoint TCI.State.5	DLorJoint TCI.State.6	DLorJoint TCI.State.7	DLorJoint TCI.State.8	DLorJoint TCI.State.9	DLorJoint TCI.State.10	DLorJoint TCI.State.11
tci-StateUnifiedId	Id0	Id1	Id2	Id3	Id4	Id5	Id6	Id7	Id8	Id9	Id10	Id11
qcl-Type1	typeA	typeA	typeA	typeA	typeC	typeC	typeA	typeA	typeA	typeC	typeC	typeC
qcl-Type2 Note1	typeD	typeD	typeD	typeD	typeD	typeD	typeD	typeD	typeD	typeD	typeD	typeD
referenceSignal Note2	Resource #4 in TRS resource set 1 Note3	Resource #4 in TRS resource set 2 Note 5	Resource #4 in TRS resource set 1 Note3	Resource #4 in TRS resource set 2 Note3	SSB0	SSB1 from the cell with different PCI	Resource #4 in TRS resource set 3 Note 6	Resource #4 in TRS resource set 4 Note 7	Resource #4 in TRS resource set 5 Note 8	SSB1	SSB2	SSB3
pathlossReferenceRS	N/A	N/A	Resource #4 in TRS resource set 1 Note3	Resource #4 in TRS resource set 1 Note3	N/A	N/A	Resource #4 in TRS resource set 3 Note 6	Resource #4 in TRS resource set 4 Note 7	Resource #4 in TRS resource set 5 Note 8	N/A	N/A	N/A
additionalPCI	N/A	configured Note4	N/A	N/A	N/A	configured Note4	N/A	N/A	N/A	N/A	N/A	N/A

NOTE 1: qcl-Type2 of typeD only where applicable. For RRM test cases, this will be only in FR2
NOTE 2: referenceSignal configurations towards which the TCI states are configured are defined in a test-specific manner.
NOTE 3: Reference TRS resource sets are defined in clause A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DLorJoint TCI.State.4.
NOTE 4: Only one PCI than serving cell PCI is included in the additionalPCIList, and the additionalPCIIndex is configured as 0.
NOTE 5: Reference TRS resource sets are defined in clause A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DLorJoint TCI.State.5.
NOTE 6: Reference TRS resource sets are defined in clause A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DlorJoint TCI.State.9.
NOTE 7: Reference TRS resource sets are defined in clause A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DlorJoint TCI.State.10.
NOTE 7: Reference TRS resource sets are defined in clause A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DLorJoint TCI.State.11.

Table A.3.16A.2-2: DLorJoint TCI States for mTRP FR1

Parameter	DLorJoint TCI.State.1.1	DLorJoint TCI.State.1.2	DLorJoint TCI.State.1.3	DLorJoint TCI.State.1.4
tci-StateUnifiedId	Id1	Id2	Id3	Id4
qcl-Type1	typeA	typeA	typeC	typeC
qcl-Type2	N/A	N/A	N/A	N/A
referenceSignal Note2	Resource #4 in TRS resource set 1 Note2	Resource #4 in TRS resource set 2 Note3	SSB2	SSB3
pathlossReferenceRS	N/A	N/A	N/A	N/A
additionalPCI	N/A	N/A	N/A	N/A

NOTE 1: referenceSignal configurations towards which the TCI states are configured are defined in a test-specific manner.
NOTE 2: Reference TRS resource sets are defined in clause A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DLorJoint TCI.State.1.1.
NOTE 3: Reference TRS resource sets are defined in clause A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1. The TCI state of the TRS is the DLorJoint TCI.State.1.2.

A.3.16A.3 UL TCI states

Table A.3.16A.3-1: UL TCI States

Parameter	UL TCI.State.0	UL TCI.State.1	UL TCI.State.2	UL TCI.State.3	UL TCI.State.4	UL TCI.State.5
ul-TCIState-Id	Id0	Id1	Id2	Id3	Id4	Id5
referenceSignal Note1	SSB0	SSB1	Resource #4 in TRS resource set 1 Note2	Resource #4 in TRS resource set 2 Note2	Resource #4 in TRS resource set 3 Note2	Resource #4 in TRS resource set 4 Note2
pathlossReferenceRS	Resource #4 in TRS resource set 1 Note2	Resource #4 in TRS resource set 1 Note2	Resource #4 in TRS resource set 1 Note2	Resource #4 in TRS resource set 2 Note2	Resource #4 in TRS resource set 3 Note2	Resource #4 in TRS resource set 4 Note2
additionalPCI	N/A	configured Note3	N/A	N/A	N/A	N/A

NOTE 1: referenceSignal configurations towards which the UL TCI states are configured are defined in a test-specific manner.
NOTE 2: Reference TRS resource sets are defined in clause A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1.
NOTE 3: Only one PCI than serving cell PCI is included in the additionalPCIList, and the additionalPCIIndex is configured as 0.

A.3.16B LTM Candidate TCI State Configuration

A.3.16B.1 Introduction

This clause provides the configurations for TCI states of LTM candidate cell(s) towards either SSB or TRS. The LTM candidate DLorJoint TCI states defined in this clause are configured in each test when applicable to indicate that certain DL (and UL, if joint DL/UL operation is configured) signals are QCL'ed with the referenceSignal configured in the TCI states. The UL TCI states defined in this clause are configured in each test when applicable to indicate that certain UL signals are QCL'ed with the referenceSignal configured in the TCI states.

A.3.16B.2 LTM candidate DLorJoint TCI states

Table A.3.16B.2-1: LTM candidate DLorJoint TCI States

Parameter	Candidate DLorJoint TCI.State.0	Candidate DLorJoint TCI.State.1	Candidate DLorJoint TCI.State.2	Candidate DLorJoint TCI.State.3
Candidatetci-StateId	Id0	Id1	Id2	Id3
qcl-Type1	typeA	typeA	typeA	typeA
referenceSignal of qcl-Type 1 Note2	SSB0	Resource #4 in TRS resource set 1 Note3	SSB0	Resource #4 in TRS resource set 1 Note3
qcl-Type2 Note1	typeD	typeD	typeD	typeD
referenceSignal of qcl-Type2 Note2	SSB0	Resource #4 in TRS resource set 1 Note3	SSB0	Resource #4 in TRS resource set 1 Note3
pathlossReferenceRS	SSB0	SSB0	N/A	N/A
additionalPCI	N/A	N/A	N/A	N/A

NOTE 1: qcl-Type2 of typeD only where applicable. For RRM test cases, this will be only in FR2
NOTE 2: referenceSignal configurations towards which the TCI states are configured are defined in a test-specific manner.
NOTE 3: Reference TRS resource sets are defined in clause A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured for a candidate cell in a test case, it is considered as resource set 1. The TCI state of the TRS is the CandidateDLorJoint TCI.State.2.

A.3.16B.3 LTM candidate UL TCI states

Table A.3.16B.3-1: LTM candidate UL TCI States

Parameter	Candidate UL TCI.State.0
Candidateul-TCIState-Id	Id0
referenceSignal Note1	SSB0
pathlossReferenceRS	SSB0
additionalPCI	N/A

NOTE 1: referenceSignal configurations towards which the UL TCI states are configured are defined in a test-specific manner.

A.3.17 Configurations of CSI-RS for tracking

A.3.17.1 Configuration of CSI-RS for tracking for FR1

A.3.17.1.1 FDD

Table A.3.17.1.1-1: CSI-RS for tracking for SCS=15 kHz

Parameter	Unit	Value
Reference channel		TRS.1.1 FDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	15
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	20 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2

TCI state		TCI.State.0 Note 3
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case. NOTE 3: If unified TCI states are configured, the TCI state ID is defined in each test case and from A.3.16A Unified TCI state Configuration.		

Table A.3.17.1.1-2: CSI-RS for tracking for SCS=30 kHz

Parameter	Unit	Value
Reference channel		TRS.1.2 FDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	30
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	40 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	20 for CSI-RS resource 1 and 2 21 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		TCI.State.0
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases NOTE 2: Unless otherwise specified in the test case.		

Table A.3.17.1.1-3: Aperiodic CSI-RS for tracking for SCS=15 kHz

Parameter	Unit	Value
Reference channel		TRS.1.3 FDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	15
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
aperiodicTriggeringOffsetL2	slots	2
Aperiodic CSI-RS offset	slots	2 for CSI-RS resource 1 and 2 3 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		TCI.State.0
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases NOTE 2: Unless otherwise specified in the test case.		

Table A.3.17.1.1-4: Aperiodic CSI-RS for tracking for SCS=30 kHz

Parameter	Unit	Value
Reference channel		TRS.1.4 FDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	30
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
aperiodicTriggeringOffsetL2	slots	2

Aperiodic CSI-RS offset	slots	2 for CSI-RS resource 1 and 2 3 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		TCI.State.0
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases NOTE 2: Unless otherwise specified in the test case.		

Table A.3.17.1.1-5: CSI-RS for tracking for SCS=15 kHz Set 1

Parameter	Unit	Value
Reference channel		TRS.1.5 FDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	15
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	20 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		DLorJoint TCI.State.1.3
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases NOTE 2: Unless otherwise specified in the test case.		

Table A.3.17.1.1-6: CSI-RS for tracking for SCS=15 kHz Set 2

Parameter	Unit	Value
Reference channel		TRS.1.6 FDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	15
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	20 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		DLorJoint TCI.State.1.4
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases NOTE 2: Unless otherwise specified in the test case.		

Table A.3.17.1.1-7: CSI-RS for tracking for SCS=15 kHz

Parameter	Unit	Value
Reference channel		TRS.1.7 FDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	15
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4

CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	20 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		TCI.State.0
NOTE 1: BW of TRS is configured same as the BW size of UE active BP in the RRM test cases NOTE 2: Unless otherwise specified in the test case.		

A.3.17.1.2 TDD

Table A.3.17.1.2-1: CSI-RS for tracking for SCS=15 kHz

Parameter	Unit	Value
Reference channel		TRS.1.1 TDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	15
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	20 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		TCI.State.0 Note 2
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: If unified TCI states are configured, the TCI state ID is defined in each test case and from A.3.16A Unified TCI state Configuration.		

Table A.3.17.1.2-2: CSI-RS for tracking for SCS=30 kHz

Parameter	Unit	Value
Reference channel		TRS.1.2 TDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	30
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	40 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	20 for CSI-RS resource 1 and 2 21 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		TCI.State.0 Note 3
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case. NOTE 3: If unified TCI states are configured, the TCI state ID is defined in each test case and from A.3.16A Unified TCI state Configuration.		

Table A.3.17.1.2-3: Aperiodic CSI-RS for tracking for SCS=15 kHz

Parameter	Unit	Value
Reference channel		TRS.1.3 TDD
Bandwidth		BW of Active BWP Note 1

SCS	kHz	15
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
aperiodicTriggeringOffsetL2	slots	2
Aperiodic CSI-RS offset	slots	2 for CSI-RS resource 1 and 2 3 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		TCI.State.0
NOTE: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases.		

Table A.3.17.1.2-4: Aperiodic CSI-RS for tracking for SCS=30 kHz

Parameter	Unit	Value
Reference channel		TRS.1.4 TDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	30
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
aperiodicTriggeringOffsetL2	slots	2
Aperiodic CSI-RS offset	slots	2 for CSI-RS resource 1 and 2 3 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		TCI.State.0
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case.		

Table A.3.17.1.2-5: CSI-RS for tracking for SCS=15 kHz Set 1

Parameter	Unit	Value
Reference channel		TRS.1.5 TDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	15
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	20 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		DLorJoint TCI.State.1.3
NOTE: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases.		

Table A.3.17.1.2-6: CSI-RS for tracking for SCS=15 kHz Set 2

Parameter	Unit	Value
Reference channel		TRS.1.6 TDD
Bandwidth		BW of Active BWP Note 1

SCS	kHz	15
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	20 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		DLorJoint TCI.State.1.4
NOTE: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases.		

Table A.3.17.1.2-7: CSI-RS for tracking for SCS=30 kHz Set 1

Parameter	Unit	Value
Reference channel		TRS.1.7 TDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	30
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	40 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	20 for CSI-RS resource 1 and 2 21 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		DLorJoint TCI.State.1.3
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case.		

Table A.3.17.1.2-8: CSI-RS for tracking for SCS=30 kHz Set 2

Parameter	Unit	Value
Reference channel		TRS.1.8 TDD
Bandwidth		BW of Active BWP Note 1
SCS	kHz	30
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	40 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	20 for CSI-RS resource 1 and 2 21 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		DLorJoint TCI.State.1.3
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case.		

Table A.3.17.1.2-9: CSI-RS for tracking for SCS=30 kHz

Parameter	Unit	Value
Reference channel		TRS.1.9 TDD
Bandwidth		BW of Active BWP[Note 1]
SCS	kHz	30
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	40 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	20 for CSI-RS resource 1 and 2 21 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0[Note 2]
TCI state		TCI.State.0
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case.		

A.3.17.2 Configuration of CSI-RS for tracking for FR2

A.3.17.2.1 TDD

Table A.3.17.2.1-1: CSI-RS for tracking for SCS=120 kHz Set 1

Parameter	Unit	Value
Reference channel		TRS.2.1 TDD
Bandwidth		BW of Active BWP[Note 1,3]
SCS	kHz	120
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 1 for CSI-RS resource 1 and 3 l_0 = 5 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	80 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	40 for CSI-RS resource 1 and 2 41 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0[Note 2]
TCI state		TCI.State.0 [Note 4]
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case. NOTE 3: If active BWP is larger than 52RBs, BW of TRS is configured as 52RBs. Otherwise, same as active BWP size.. NOTE 4: If unified TCI states are configured, the TCI state ID is defined in each test case and from A.3.16A Unified TCI state Configuration.		

Table A.3.17.2.1-2: CSI-RS for tracking for SCS=120 kHz Set 2

Parameter	Unit	Value
Reference channel		TRS.2.2 TDD
Bandwidth		BW of Active BWP[Note 1,3]
SCS	kHz	120
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 2 for CSI-RS resource 1 and 3 l_0 = 6 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4

Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	80 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	40 for CSI-RS resource 1 and 2 41 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		TCI.State.1 Note 4
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case. NOTE 3: If active BWP is larger than 52RBs, BW of TRS is configured as 52RBs. Otherwise, same as active BWP size.. NOTE 4: If unified TCI states are configured, the TCI state ID is defined in each test case and from A.3.16A Unified TCI state Configuration.		

Table A.3.17.2.1-3: Aperiodic CSI-RS for tracking for SCS=120 kHz Set 1

Parameter	Unit	Value
Reference channel		TRS.2.3 TDD
Bandwidth		BW of Active BWP Note 1,3
SCS	kHz	120
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 1 for CSI-RS resource 1 and 3 l_0 = 5 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
aperiodicTriggeringOffsetL2	slots	2
Aperiodic CSI-RS offset	slots	2 for CSI-RS resource 1 and 2 3 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		TCI.State.0
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case. NOTE 3: If active BWP is larger than 52RBs, BW of TRS is configured as 52RBs. Otherwise, same as active BWP size.		

Table A.3.17.2.1-4: CSI-RS for tracking for SCS=120 kHz Set 3

Parameter	Unit	Value
Reference channel		TRS.2.4 TDD
Bandwidth		BW of Active BWP Note 1,3
SCS	kHz	120
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 3 for CSI-RS resource 1 and 3 l_0 = 7 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	80 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	40 for CSI-RS resource 1 and 2 41 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0 Note 2
TCI state		TCI.State.2
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case. NOTE 3: If active BWP is larger than 52RBs, BW of TRS is configured as 52RBs. Otherwise, same as active BWP size.		

Table A.3.17.2.1-5: CSI-RS for tracking for SCS=120 kHz Set 4

Parameter	Unit	Value
Reference channel		TRS.2.5 TDD

Bandwidth		BW of Active BWP[Note 1,3]
SCS	kHz	120
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 4 for CSI-RS resource 1 and 3 l_0 = 8 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	80 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	40 for CSI-RS resource 1 and 2 41 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0[Note 2]
TCI state		TCI.State.3
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case. NOTE 3: If active BWP is larger than 52RBs, BW of TRS is configured as 52RBs. Otherwise, same as active BWP size.		

Table A.3.17.2.1-6: CSI-RS for tracking for SCS=120 kHz Set 5

Parameter	Unit	Value
Reference channel		TRS.2.6 TDD
Bandwidth		BW of Active BWP[Note 1,3]
SCS	kHz	120
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 4 for CSI-RS resource 1 and 3 l_0 = 8 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	80 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	40 for CSI-RS resource 1 and 2 41 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0[Note 2]
TCI state		TCI.State.3
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case. NOTE 3: If active BWP is larger than 52RBs, BW of TRS is configured as 52RBs. Otherwise, same as active BWP size. NOTE 4: If unified TCI states are configured, the TCI state ID is defined in each test case and from A.3.16A Unified TCI state Configuration.		

A.3.17.2.2 FDD

Table A.3.17.2.2-1: CSI-RS for tracking for SCS=120 kHz Set 1

Parameter	Unit	Value
Reference channel		TRS.2.1 FDD
Bandwidth		BW of Active BWP[Note 1,3]
SCS	kHz	120
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 1 for CSI-RS resource 1 and 3 l_0 = 5 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	80 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	40 for CSI-RS resource 1 and 2 41 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	0[Note 2]

TCI state		TCI.State.0
NOTE 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases. NOTE 2: Unless otherwise specified in the test case. NOTE 3: If active BWP is larger than 52RBs, BW of TRS is configured as 52RBs. Otherwise, same as active BWP size.		

A.3.18 Additional definitions related to OTA testing for FR2 RRM test cases

A.3.18.1Introduction

FR2 RRM test cases are performed over the air (OTA). This clause provides additional definitions and clarifications on the OTA measurements and metrics defined or refered in the test cases.

A.3.18.2 PRACH Power Measurement

PRACH power is measured as EIRP(Link=Link angle, Meas=Link angle) as defined in clause 3.1 of TS 38.101-2 [19].

A.3.19 Test applicability for DAPS handover

A.3.19.1 Introduction

In annex A test cases for DAPS handover may be defined with cells in on same or different carrier frequency to verify intra-frequency, intra-band inter-frequency and inter-band inter-frequency DAPS handover RRM requirements, respectively.

A.3.19.2 Principle of testing

To verify intra-frequency DAPS handover requirements

- The UE capable of intra-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.
- The UE not capable of intra-frequency asynchronous DAPS handover on any band but capable of synchronous DAPS handover on some band needs to be tested only in synchronous scenario.

To verify intra-band inter-frequency DAPS handover requirements

- The UE capable of intra-band inter-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.
- The UE not capable of intra-band inter-frequency asynchronous DAPS handover on any band but capable of intra-band inter-frequency synchronous DAPS handover on some band needs to be tested only in synchronous scenario.

To verify inter-band inter-frequency DAPS handover requirements

- The UE capable of inter-band inter-frequency asynchronous DAPS handover on any band combination needs to be tested only in asynchronous scenario.
- The UE not capable of inter-band inter-frequency asynchronous DAPS handover on any band combination but capable of inter-band inter-frequency synchronous DAPS handover on some band combination needs to be tested only in synchronous scenario.

A.3.20 MsgA configurations

A.3.20.1 Introduction

This clause provides the typical PRACH and PUSCH configurations for MsgA used for RRM test cases defined in annex A. To note that for other parameters not listed in this clause, either it can be derived from the set up of each test or it is subjected to RAN5 specifications.

A.3.20.2 MsgA configurations in FR1

A.3.20.2.1 FR1 MsgA configuration 1

FR1 MsgA configuration 1 in this clause provides the typical MsgA configuration for SSB-based contention based random access for 2-step RA type in FR1.

Table A.3.20.2.1-1: Parameters for FR1 MsgA configuration 1

Field	Value	Comment
msgA-prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msgA-SubcarrierSpacing	Same as UL carrier SCS	
msgA-totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
msgA-PRACH-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
msgA-SSB-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n48	OneFourth: 1 SSB associated with 4 RACH occasions n48: 48 contention based preambles per SSB
msgA-RO-FDM	One	One PRACH transmission occasions FDMed in one time instance.
ra-ContentionResolutionTimer	sf48	48 sub-frames
msgA-PreamblePowerRampingStep	dB2	
msgA-PreambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
msgB-ResponseWindow	sl10	10 slots
msgA-ZeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
msgA-MCS	1	MCS index for MsgA PUSCH
nrofSlotsMsgA-PUSCH	1	Number of slots containing one or multiple PUSCH occasions
nrofMsgA-PO-PerSlot	1	Number of time domain PUSCH occasions in each slot
msgA-PUSCH-TimeDomainOffset	1	A single time offset with respect to the start of each PRACH slot, counted as the number of slots
PUSCH start symbol	0	
PUSCH allocation length	14	
mappingTypeMsgA-PUSCH	typeA	
nrofPRBs-PerMsgA-PO	2	Number of PRBs per PUSCH occasion
nrofMsgA-PO-FDM	One	The number of MsgA PUSCH occasions FDMed in one time instance
msgA-DMRS-AdditionalPosition	pos1	Position for additional DM-RS
msgA-PUSCH-NrofPorts	0	Configure 1 port per CDM group
msgA-DeltaPreamble	2dB	Power offset of msgA PUSCH relative to the preamble received target power
msgA-Alpha	alpha1	Alpha value for MsgA PUSCH. Set 1
deltaMCS	Disabled	Whether to apply delta MCS
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.20.2.2 FR1 MsgA configuration 2

FR1 PRACH configuration 2 in this clause provides the typical MsgA configuration for SSB based non-contention based random access for 2-step RA type in FR1.

Table A.3.20.2.2-1: Parameters for FR1 MsgA configuration 2

Field	Value	Comment
msgA-prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msgA-SubcarrierSpacing	Same as UL carrier SCS	
msgA-totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
msgA-PRACH-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msgA-RO-FDM	One	One PRACH transmission occasions FDMed in one time instance.
msgA-PreamblePowerRampingStep	dB2	
msgA-PreambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
msgB-ResponseWindow	sl10	10 slots
msgA-ZeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
ssb-ResourceList	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE doesn't use this field if is transmitting CFRA to convey BFR.
BFR-SSB-Resource	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE uses this field only if is transmitting CFRA to convey BFR
ra-ssb-OccasionMaskIndex	1	PRACH occasion index 1 is allowed
msgA-MCS	1	MCS index for MsgA PUSCH
nrofSlotsMsgA-PUSCH	1	Number of slots containing one or multiple PUSCH occasions
nrofMsgA-PO-PerSlot	1	Number of time domain PUSCH occasions in each slot
msgA-PUSCH-TimeDomainOffset	1	A single time offset with respect to the start of each PRACH slot, counted as the number of slots
PUSCH start symbol	0	
PUSCH allocation length	14	
mappingTypeMsgA-PUSCH	typeA	
nrofPRBs-PerMsgA-PO	2	Number of PRBs per PUSCH occasion
nrofMsgA-PO-FDM	One	The number of MsgA PUSCH occasions FDMed in one time instance
msgA-DMRS-AdditionalPosition	pos1	Position for additional DM-RS
msgA-PUSCH-NrofPorts	0	Configure 1 port per CDM group
msgA-DeltaPreamble	2dB	Power offset of msgA PUSCH relative to the preamble received target power
msgA-Alpha	alpha1	Alpha value for MsgA PUSCH. Set 1
deltaMCS	Disabled	Whether to apply delta MCS
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.20.3 MsgA configurations in FR2

A.3.20.3.1 FR2 MsgA configuration 1

FR2 MsgA configuration 1 in this clause provides the typical MsgA configuration for SSB-based contention based random access for 2-step RA type in FR2.

Table A.3.20.3.1-1: Parameters for FR2 MsgA configuration 1

Field	Value	Comment
msgA-prach-ConfigurationIndex	190	Preamble Format C2, with 10 ms PRACH periodicity, and other detailed configurations defined in table 6.3.3.2-4 in TS 38.211 [6].
msgA-SubcarrierSpacing	Same as UL carrier SCS	
msgA-totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
msgA-PRACH-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
msgA-SSB-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n48	OneFourth: 1 SSB associated with 4 RACH occasions n48: 48 contention-based preambles per SSB
msgA-RO-FDM	One	One PRACH transmission occasions FDMed in one time instance.
ra-ContentionResolutionTimer	sf48	48 sub-frames
msgA-PreamblePowerRampingStep	dB2	
msgA-PreambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
msgB-ResponseWindow	sl10	10 slots
msgA-ZeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
msgA-MCS	1	MCS index for MsgA PUSCH
nrofSlotsMsgA-PUSCH	1	Number of slots containing one or multiple PUSCH occasions
nrofMsgA-PO-PerSlot	1	Number of time domain PUSCH occasions in each slot
msgA-PUSCH-TimeDomainOffset	1	A single time offset with respect to the start of each PRACH slot, counted as the number of slots
PUSCH start symbol	0	
PUSCH allocation length	10	
mappingTypeMsgA-PUSCH	typeA	
nrofPRBs-PerMsgA-PO	2	Number of PRBs per PUSCH occasion
nrofMsgA-PO-FDM	One	The number of MsgA PUSCH occasions FDMed in one time instance
msgA-DMRS-AdditionalPosition	pos1	Position for additional DM-RS
msgA-PUSCH-NrofPorts	0	Configure 1 port per CDM group
msgA-DeltaPreamble	2dB	Power offset of msgA PUSCH relative to the preamble received target power
msgA-Alpha	alpha1	Alpha value for MsgA PUSCH. Set 1
deltaMCS	Disabled	Whether to apply delta MCS
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.20.3.2 FR2 MsgA configuration 2

FR2 MsgA configuration 2 in this clause provides the typical MsgA configuration for SSB based non-contention based random access for 2-step RA type in FR2.

Table A.3.20.3.2-1: Parameters for FR2 MsgA configuration 2

Field	Value	Comment
msgA-prach-ConfigurationIndex	190	Preamble Format C2, with 10 ms PRACH periodicity, and other detailed configurations defined in table 6.3.3.2-4 in TS 38.211 [6].
msgA-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
msgA-PRACH-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msgA-RO-FDM	One	One PRACH transmission occasions FDMed in one time instance.
msgA-PreamblePowerRampingStep	dB2	
msgA-PreambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
msgB-ResponseWindow	sl10	10 slots
msgA-ZeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
ssb-ResourceList	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE doesn't use this field if is transmitting CFRA to convey BFR.
BFR-SSB-Resource	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE uses this field only if is transmitting CFRA to convey BFR
ra-ssb-OccasionMaskIndex	1	PRACH occasion index 1 is allowed
msgA-MCS	1	MCS index for MsgA PUSCH
nrofSlotsMsgA-PUSCH	1	Number of slots containing one or multiple PUSCH occasions
nrofMsgA-PO-PerSlot	1	Number of time domain PUSCH occasions in each slot
msgA-PUSCH-TimeDomainOffset	1	A single time offset with respect to the start of each PRACH slot, counted as the number of slots
PUSCH start symbol	0	
PUSCH allocation length	10	
mappingTypeMsgA-PUSCH	typeA	
nrofPRBs-PerMsgA-PO	2	Number of PRBs per PUSCH occasion
nrofMsgA-PO-FDM	One	The number of MsgA PUSCH occasions FDMed in one time instance
msgA-DMRS-AdditionalPosition	pos1	Position for additional DM-RS
msgA-PUSCH-NrofPorts	0	Configure 1 port per CDM group
msgA-DeltaPreamble	2dB	Power offset of msgA PUSCH relative to the preamble received target power
msgA-Alpha	alpha1	Alpha value for MsgA PUSCH. Set 1
deltaMCS	Disabled	Whether to apply delta MCS
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.20A MsgA configurations under CCA

A.3.20A.1 Introduction

This clause provides the typical PRACH and PUSCH configurations for MsgA used for RRM test cases defined in annex A. To note that for other parameters not listed in this clause, either it can be derived from the set up of each test or it is subjected to RAN5 specifications.

A.3.20A.2 MsgA configurations in FR1

A.3.20A.2.1 FR1 MsgA configuration 1 under CCA

FR1 MsgA configuration 1 under CCA in this clause provides the typical MsgA configuration for SSB-based contention based random access for 2-step RA type in FR1.

Table A.3.20A.2.1-1: Parameters for FR1 MsgA configuration 1 under CCA

Field	Value	Comment
msgA-prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msgA-SubcarrierSpacing	Same as UL carrier SCS	
msgA-totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
msgA-PRACH-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
msgA-SSB-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n48	OneFourth: 1 SSB associated with 4 RACH occasions n48: 48 contention based preambles per SSB
msgA-RO-FDM	One	One PRACH transmission occasions FDMed in one time instance.
ra-ContentionResolutionTimer	sf48	48 sub-frames
msgA-PreamblePowerRampingStep	dB2	
msgA-PreambleReceivedTargetPower	dBm-114	Increased by 6 dB compared with FR1 MsgA configuration 1 for random access test with UL CCA failures.
preambleTransMax	n20	Max number of RA preamble transmission performed before declaring a failure is 20 to account for CCA failures
msgB-ResponseWindow	sl20	20 slots
msgA-ZeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
msgA-MCS	1	MCS index for MsgA PUSCH
nrofSlotsMsgA-PUSCH	1	Number of slots containing one or multiple PUSCH occasions
nrofMsgA-PO-PerSlot	1	Number of time domain PUSCH occasions in each slot
msgA-PUSCH-TimeDomainOffset	1	A single time offset with respect to the start of each PRACH slot, counted as the number of slots
PUSCH start symbol	0	
PUSCH allocation length	14	
mappingTypeMsgA-PUSCH	typeA	
nrofPRBs-PerMsgA-PO	2	Number of PRBs per PUSCH occasion
nrofMsgA-PO-FDM	One	The number of MsgA PUSCH occasions FDMed in one time instance
msgA-DMRS-AdditionalPosition	pos1	Position for additional DM-RS
msgA-PUSCH-NrofPorts	0	Configure 1 port per CDM group
msgA-DeltaPreamble	3	Power offset of msgA PUSCH relative to the preamble received target power
msgA-Alpha	alpha1	Alpha value for MsgA PUSCH. Set 1
deltaMCS	Disabled	Whether to apply delta MCS

Field	Value	Comment
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.20A.2.2 FR1 MsgA configuration 2 under CCA

FR1 PRACH configuration 2 under CCA in this clause provides the typical MsgA configuration for SSB based non-contention based random access for 2-step RA type in FR1.

Table A.3.20A.2.2-1: Parameters for FR1 MsgA configuration 2 under CCA

Field	Value	Comment
msgA-prach-ConfigurationIndex	102	10 ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msgA-SubcarrierSpacing	Same as UL carrier SCS	
msgA-totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
msgA-PRACH-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msgA-RO-FDM	One	One PRACH transmission occasions FDMed in one time instance.
msgA-PreamblePowerRampingStep	dB2	
msgA-PreambleReceivedTargetPower	dBm-114	Increased by 6 dB compared with FR1 MsgA configuration 2 for random access test with UL CCA failures.
preambleTransMax	n20	Max number of RA preamble transmission performed before declaring a failure is 20 to account for CCA failures
msgB-ResponseWindow	sl20	20 slots
msgA-ZeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
ssb-ResourceList	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE doesn't use this field if is transmitting CFRA to convey BFR.
BFR-SSB-Resource	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE uses this field only if is transmitting CFRA to convey BFR
ra-ssb-OccasionMaskIndex	1	PRACH occasion index 1 is allowed
msgA-MCS	1	MCS index for MsgA PUSCH
nrofSlotsMsgA-PUSCH	1	Number of slots containing one or multiple PUSCH occasions
nrofMsgA-PO-PerSlot	1	Number of time domain PUSCH occasions in each slot
msgA-PUSCH-TimeDomainOffset	1	A single time offset with respect to the start of each PRACH slot, counted as the number of slots
PUSCH start symbol	0	
PUSCH allocation length	14	
mappingTypeMsgA-PUSCH	typeA	
nrofPRBs-PerMsgA-PO	2	Number of PRBs per PUSCH occasion
nrofMsgA-PO-FDM	One	The number of MsgA PUSCH occasions FDMed in one time instance
msgA-DMRS-AdditionalPosition	pos1	Position for additional DM-RS
msgA-PUSCH-NrofPorts	0	Configure 1 port per CDM group
msgA-DeltaPreamble	3	Power offset of msgA PUSCH relative to the preamble received target power
msgA-Alpha	alpha1	Alpha value for MsgA PUSCH. Set 1

Field	Value	Comment
deltaMCS	Disabled	Whether to apply delta MCS
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.21 V2X sidelink communication

A.3.21.1 Introduction

This clause also defines the principle and the reference configurations that are applicable to test cases verifying RRM core requirements for V2X sidelink communication.

A.3.21.2 Reference resource pool configurations for V2X Sidelink Communication

Table A.3.21.2-1: V2X sidelink SL-BWP configuration for NR

Field	Value	Comment
SL-BWP-ConfigCommon-r16		
sl-BWP-Generic-r16		
sl-LengthSymbols-r16	sym14	All 14 symbols in a slot without S-SSB are used for sidelink
sl-StartSymbol-r16	sym0	Symbol #0 is the starting symbol used for sidelink in a slot without S-SSB
sl-BWP-PoolConfigCommon-r16		
sl-RxPool-r16		Indicates the resource pool for reception on the configured BWP. 1 entry
SL-ResourcePool-r16[1]	Set according to Table A.3.21.2-2	Entry 1
sl-TxPoolSelectedNormal-r16		Indicates the resources pool for mode 2 sidelink communication on the configured BWP. 1 entry
SL-ResourcePoolConfig-r16[1]		Entry 1
sl-TxPoolExceptional-r16	Not present	

Table A.3.21.2-2: V2X sidelink resource pool configuration for NR

Field	Value	Comment
SL-ResourcePool-r16		
sl-PSCCH-Config-r16	Set according to Table A.3.21.3-1	
sl-PSSCH-Config-r16	Set according to Table A.3.21.3-2	
sl-PSFCH-Config-r16	Not present	
sl-SyncAllowed-r16		Indicates the allowed synchronization reference(s) which is (are) allowed to use the configured resource pool.
gnss-Sync-r16	true	
gnbEnb-Sync-r16	true	
ue-Sync-r16	true	
sl-SubchannelSize-r16	n10	Subchannel bandwidth is 10 PRB
sl-StartRB-Subchannel-r16	0	The offset of lowest PRB index of the subchannel with the lowest index in the resource pool with respect to the lowest PRB index of a SL BWP
sl-NumSubchannel-r16	1	Number of subchannels in resource pool
sl-UE-SelectedConfigRP-r16		

Field	Value	Comment
sl-Thres-RSRP-List-r16	Set according to the specific test configuration	Indicates a list of 64 thresholds, and the threshold should be selected based on the priority in the decoded SCI and the priority in the SCI to be transmitted. A resource is excluded if it is indicated or reserved by a decoded SCI and PSSCH RSRP in the associated data resource is above a threshold.
sl-MultiReserveResource-r16	Not present	
sl-MaxNumPerReserve-r16	n2	At most 2 PSCCH/PSSCH resources can be reserved by a single SCI.
sl-SensingWindow-r16	ms100	Length of resource sensing window specified in TS 38.214 [26] subclause 8.1.4. which is 100 ms.
sl-SelectionWindowList-r16		Parameter that determines the end of the selection window for each priority level 8 entries
SL-SelectionWindowConfig-r16[k,k=1..8]		entry k
sl-Priority-r16	k	for priority level = k
sl-SelectionWindow-r16	n20	Length of resource selection window specified in TS 38.214 [26] subclause 8.1.4. which is $20 \cdot 2^{\mu}$ slots, where μ=0,1,2,3 refers to SCS 15,30,60,120 kHz respectively
sl-ResourceReservePeriodList-r16	Not present	
sl-RS-ForSensing-r16	pssch	PSSCH-RSRP measurement is used in the sensing operation.
sl-RxParametersNcell	Not present	
sl-ZoneConfigMCR-List-r16	Not present	
sl-PreemptionEnable-r16	enabled	
sl-MinMaxMCS-List-r16		1 entry
SL-MinMaxMCS-Config-r16[1]		Entry 1
sl-MCS-Table-r16	qam64	TS 38.214 [26] Table 5.1.3.1-1 is the MCS table used in the resource pool.
sl-TimeResource-r16	1111111111 1111111111	Every slot in a period of 20 slots during a SFN or DFN cycle can be used for sidelink
SL-TxPercentageList-r16		
SL-TxPercentageConfig-r16		
sl-TxPercentage-r16	p20	Indicates the portion of candidate single-slot PSSCH resources over the toal resources. Value p20 corresponds to 20%, and so on.

Table A.3.21.2-3: V2X sidelink UE autonomous resource selection configuration for NR

Field	Value	Comment
SL-UE-SelectedConfig-r16		
sl-PSSCH-TxConfigList-r16		1 entry
SL-PSSCH-TxConfig-r16[1]		Entry 1
sl-TypeTxSync-r16	Not present	When this filed is absent, the configuration is applicable for all synchronization reference types.
sl-ThresUE-Speed-r16	kmph200	UE shall apply the parameters in sl-ParametersAboveThres-r16 if UE absolute speed is higher than 200 km/h, otherwise UE shall apply the parameters in sl-ParametersBelowThres-r16
sl-ParametersAboveThres-r16		
sl-MinMCS-PSSCH-r16	0	The minimum MCS index value can be used for PSSCH transmission.
sl-MaxMCS-PSSCH-r16	15	The maximum MCS index value can be used for PSSCH transmission.
sl-MinSubChannelNumPSSCH-r16	1	The minimum number of subchannels can be used for PSSCH transmission.
sl-MaxSubchannelNumPSSCH-r16	1	The maximum number of subchannels can be used for PSSCH transmission.
sl-MaxTxTransNumPSSCH-r16	1	The maximum transmission number for PSSCH (including new transmission and retransmission).
sl-MaxTxPower-r16	Not present	Not applicable

sl-ParametersBelowThres-r16		
sl-MinMCS-PSSCH-r16	4	Same as above
sl-MaxMCS-PSSCH-r16	25	Same as above
sl-MinSubChannelNumPSSCH-r16	1	Same as above
sl-MaxSubchannelNumPSSCH-r16	1	Same as above
sl-MaxTxTransNumPSSCH-r16	1	Same as above
sl-MaxTxPower-r16	Not present	Same as above
sl-ProbResourceKeep-r16	v0dot8	The probability of UE keeping current resource is 80% when the resource reselection counter reaches 0 (see TS 38.321 [7]).
sl-ReselectAfter-r16	n1	Resource reselection is triggered after 1 sidelink transmission is skipped (see TS 38.321 [7]).

A.3.21.3 Reference measurement channels for V2X Sidelink Communication

Table A.3.21.3-1: PSCCH Reference Measurement Channels

Parameter		Unit	Value
Reference channel			CC.1A HD
Channel bandwidth		MHz	Note2
Number of PSCCH symbols per slot			2
Number of PSCCH PRB			10
Modulation			QPSK
Information Bit Payload (without CRC)		Bits	26
Information Bit	Number of DMRS ports		0 (1 port)
	Priority		As set by higher layers
	Resource reservation period		N/A
	Modulation and coding scheme		Set as the PSSCH MCS specified in the test
	DMRS pattern		0 (2 DMRS)
	2nd stage SCI format		00 (SCI format 2-A)
	Beta offset indicator		Set as specified in the test
	Frequency resource assignment		Set as per PSSCH PRB allocation specific in the test
	Time resource assignment		Set as per PSSCH slot allocation specific in the test
	Reserved bits		Set all these bits to 0
Transport block CRC		Bits	24
Binary Channel Bits (see Note 1)		Bits	360
NOTE 1: Binary channel bits calculated under assumption of 2 CP-OFDM symbols per subframe. NOTE 2: Channel bandwidth depends on test configuration.			

Table A.3.21.3-2: PSSCH Reference Measurement Channels

Parameter	Unit	Value
Reference channel		CD.1A HD
Sidelink transmission mode		2
Channel bandwidth	MHz	Note1
Allocated PSSCH resource blocks		10
Number of PSSCH symbols per slot		10
Modulation		QPSK
Target Code Rate		1/3
Information Bit Payload (Transport block size)	Bits	672
Transport block CRC	Bits	24
Number of PSSCH HARQ retransmissions		0
Binary Channel Bits	Bits	2160
NOTE 1: Channel bandwidth depends on test configuration. NOTE 2: 2nd state SCI and PSFCH are not allocated per slot.		

A.3.21.4 Reference SL-DRX configurations

A.3.21.4.1 SL-DRX Configuration 1: SL-DRX cycle = 40 ms

Table A.3.21.4.1-1: SL-DRX.1: SL-DRX cycle = 40 ms

Field	Value
sl-DRX-GC-BC-OnDurationTimer	2 ms
sl-DRX-GC-InactivityTimer	2 ms
sl-DRX-GC-RetransmissionTimer	16 slot
sl-DRX-GC-BC-CyclelongDRX	40 ms
NOTE: This SL-DRX configuration is applicable for V2X sidelink communication. For further information see clause 6.3.5 in TS 38.331.	

A.3.21.4.2 SL-DRX Configuration 2: SL-DRX cycle = 320 ms

Table A.3.21.4.2-1: SL-DRX.2: SL-DRX cycle = 320 ms

Field	Value
sl-DRX-GC-BC-OnDurationTimer	2 ms
sl-DRX-GC-InactivityTimer	2 ms
sl-DRX-GC-RetransmissionTimer	16 slot
sl-DRX-GC-BC-CyclelongDRX	320 ms
NOTE: This SL-DRX configuration is applicable for V2X sidelink communication. For further information see clause 6.3.5 in TS 38.331 [2].	

A.3.21.4.3 SL-DRX Configuration 3: SL-DRX cycle = 640 ms

Table A.3.21.4.3-1: SL-DRX.3: SL-DRX cycle = 640 ms

Field	Value
sl-DRX-GC-BC-OnDurationTimer	2 ms
sl-DRX-GC-InactivityTimer	2 ms
sl-DRX-GC-RetransmissionTimer	16 slot
sl-DRX-GC-BC-CyclelongDRX	640 ms
NOTE: This SL-DRX configuration is applicable for V2X sidelink communication. For further information see clause 6.3.5 in TS 38.331 [2].	

A.3.21A NR Sidelink Measurements for Positioning

A.3.21A.1 Introduction

This clause defines the principles and the reference configurations that are applicable to test cases verifying RRM requirements for NR sidelink measurements for positioning.

A.3.21A.2 NR SL-PRS configurations

A.3.21A.2.1 NR SL-PRS configurations for FR1

Table A.3.21A.2.1-1: SL PRS.1 FR1: SL-PRS configuration

SL PRS Parameters	Values			
Reference channel	SL PRS.1.1 FR1	SL PRS.1.2 FR1	SL PRS.1.3 FR1	SL PRS.1.4 FR1
SCS	15 kHz, 30 kHz			

SL-PRS comb size	4		4	
Number of SL-PRS symbols	2		4	
SL-PRS comb offset Note 1	1		1	
SL-PRS resource slot offset (slot) Note 1	0	1 Note 2	0	1 Note 2
PRB numbers containing SL PRS within channel Bandwidth Note 1	24		48	
SL-PRS starting PRB	4		4	
NOTE 1: Unless otherwise specified in the test case. NOTE 2: Unless otherwise specified in the test case. If reported value for *maxNumOfSlotsWithActiveSL-PRS-Resources* is 'n1', then slot offset is *minTimeAfterEndofSlotCarryActiveSL-PRS-Resources* for SCS 15 kHz and 2**minTimeAfterEndofSlotCarryActiveSL-PRS-Resources* for SCS 30 kHz.				

A.3.22 CSI-IM configurations

A.3.22.1 FDD

Table A.3.22.1-1: CSI-IM Reference Measurement Channels for SCS=15 kHz

	CSI-IM.1.1 FDD	**CSI-IM.1.2 FDD**	**CSI-IM.1.3 FDD**
Resource Type	periodic	aperiodic	periodic
Resource Set Config			
csi-IM-ResourceSetId	0	0	0
Resource Config			
csi-IM-ResourceId	0 for resource #0	10 for resource #0	2 for resource #0
	1 for resource #1	11 for resource #1	3 for resource #1
csi-IM-ResourceElementPattern	pattern1	pattern1	pattern1
subcarrierLocation-p1	s0	s0	s0
symbolLocation-p1	6 for resource #0	7 for resource #0	6 for resource #0
	10 for resource #1	11 for resource #1	10 for resource #1
Period (slots)	slot20	n.a.	slot10
Offset	1	n.a.	2
startingRB	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the test Equipment shall implement CSI-RS only in the width of that BWP.			

A.3.22.2 TDD

Table A.3.22.2-1: CSI-IM Reference Measurement Channels for SCS=15 kHz

	CSI-IM.1.1 TDD	**CSI-IM.1.2 TDD**	**CSI-IM.1.3 TDD**
Resource Type	periodic	aperiodic	periodic
Resource Set Config			
csi-IM-ResourceSetId	0	0	0
Resource Config			
csi-IM-ResourceId	0 for resource #0	10 for resource #0	2 for resource #0
	1 for resource #1	11 for resource #1	3 for resource #1
csi-IM-ResourceElementPattern	pattern1	pattern1	pattern1
subcarrierLocation-p1	s0	s0	s0
symbolLocation-p1	6 for resource #0	7 for resource #0	6 for resource #0
	10 for resource #1	11 for resource #1	10 for resource #1
Period (slots)	slot20	n.a.	slot10
Offset	1	n.a.	2
startingRB	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the test Equipment shall implement CSI-RS only in the width of that BWP.			

Table A.3.22.2-2: CSI-IM Reference Measurement Channels for SCS=30 kHz

	CSI-IM.2.1 TDD	CSI-IM.2.2 TDD	CSI-IM.2.3 TDD
Resource Type	periodic	aperiodic	periodic
Resource Set Config			
csi-IM-ResourceSetId	0	0	0
Resource Config			
csi-IM-ResourceId	0 for resource #0	10 for resource #0	2 for resource #0
	1 for resource #1	11 for resource #1	3 for resource #1
csi-IM-ResourceElementPattern	pattern1	pattern1	pattern1
subcarrierLocation-p1	s0	s0	s0
symbolLocation-p1	6 for resource #0	7 for resource #0	6 for resource #0
	10 for resource #1	11 for resource #1	10 for resource #1
Period (slots)	slot40	n.a.	slot40
Offset	2	n.a.	4
startingRB	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the test Equipment shall implement CSI-RS only in the width of that BWP.			

Table A.3.22.2-3: CSI-RS Reference Measurement Channels for SCS=120 kHz

	CSI-IM.3.1 TDD	CSI-IM.3.2 TDD	CSI-IM.3.3 TDD
Resource Type	periodic	aperiodic	periodic
Resource Set Config			
csi-IM-ResourceSetId	0	0	0
Resource Config			
csi-IM-ResourceId	0 for resource #0	10 for resource #0	2 for resource #0
	1 for resource #1	11 for resource #1	3 for resource #1
csi-IM-ResourceElementPattern	pattern1	pattern1	pattern1
subcarrierLocation-p1	s0	s0	s0
symbolLocation-p1	6 for resource #0	7 for resource #0	6 for resource #0
	10 for resource #1	11 for resource #1	10 for resource #1
Period (slots)	slot160	n.a.	slot80
Offset	8	n.a.	16
startingRB	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)
NOTE 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the test Equipment shall implement CSI-RS only in the width of that BWP.			

A.3.23 Spatial Relation Configuration

A.3.23.1 Introduction

This clause provides the configurations for spatial relation towards either SSB or CSI-RS. The spatial relation defined in this clause are configured in each test when applicable to indicate spatial setting for certain UL signals with the referenceSignal configured in the spatial relation.

A.3.23.2 Spatial Relation

Table A.3.23.2-1: PUCCH Spatial Relation

Parameter	PUCCH.SRI.0	PUCCH.SRI.1
pucch-SpatialRelationInfoId	Id0	Id1
referenceSignal	SSB0	SSB1
PUCCH-PathlossReferenceRS	SSB0	SSB1
NOTE 1: referenceSignal configurations towards which the spatial relation are configured in a test-specific manner.		

Table A.3.23.2-2: SRS Spatial Relation

Parameter	SRS.SRI0	SRS.SRI1
srs-SpatialRelationInfoId	Id0	Id1
referenceSignal	SSB0	SSB1
NOTE 1: referenceSignal configurations towards which the spatial relation are configured in a test-specific manner.		

A.3.24 SRS configuration

Table A.3.24-1: Sounding Reference Symbol Configuration for SCS=15 kHz

Field	SRS.1 TDD	SRS.4 TDD	PDC-SRS.1	POS-SRS.1	Comment
	Value				
c-SRS	12	12	Same as $N_{RB,c}$ in the test case	Same as $N_{RB,c}$ in the test case	
b-SRS	0	0	0	n.a.	
b-hop	0	0	0	n.a.	Frequency hopping is disabled
groupOrSequenceHopping	neither	neither	neither	neither	No group or sequence hopping
freqDomainPosition	0	0	0	0	Frequency domain position of SRS
freqDomainShift	0	0	0	0	
pathlossReferenceRS ssb-Index	0	0	0	0	SSB #0 is used for SRS path loss estimation
usage	antennaSwitching	antennaSwitching	usagePDC-r17	n.a.	
startPosition Note 1	1	1	5	5	resourceMapping setting
nrofSymbols Note 1	1	1	4	4	
repetitionFactor	n1	n1	n.a.	n.a.	without repetition.
transmissionComb	n2	n2	n4	n4	
combOffset-n2	0	0	0	0	transmissionComb setting
cyclicShift-n2	0	0	0	0	
nrofSRS-Ports Note 1	port1	port1	port1	port1	Number of antenna ports used for SRS transmission
resourceType	Periodic	Aperiodic	Periodic	Periodic	
periodicityAndOffset-p Note 1	sl40, 1	N/A	sl160, 20	sl160, 20	SRS transmission periodicity
NOTE 1: For test cases in clauses A.4.5.2.11, A.4.5.2.12, A.6.5.2.3, A.6.5.2.4, the startPosition, nrofSymbols, nrofSRS-Ports, periodicityAndOffset-p are specified in each test cases.					

Table A.3.24-2: Sounding Reference Symbol Configuration for SCS=30 kHz

Field	SRS.2 TDD	SRS.5 TDD	PDC-SRS.2	POS-SRS.2	Comment
	Value				
c-SRS	24	24	Same as NRB,c in the test case	Same as NRB,c in the test case	
b-SRS	0	0	0	n.a.	
b-hop	0	0	0	n.a.	Frequency hopping is disabled

Field	SRS.2 TDD	SRS.5 TDD	PDC-SRS.2	POS-SRS.2	Comment
	Value				
groupOrSequenceHopping	neither	neither	neither	neither	No group or sequence hopping
freqDomainPosition	0	0	0	0	Frequency domain position of SRS
freqDomainShift	0	0	0	0	
pathlossReferenceRS ssb-Index	0	0	0	0	SSB #0 is used for SRS path loss estimation
usage	antennaSwitching	antennaSwitching	usagePDC-r17	n.a.	
startPosition Note 1	3	3	5	5	resourceMapping setting
nrofSymbols Note 1	1	1	4	4	SRS symbols belong to the same SRS resource.
repetitionFactor	n1	n1	n.a.	n.a.	without repetition.
transmissionComb	n2	n2	n4	n4	
combOffset-n2	0	0	0	0	transmissionComb setting
cyclicShift-n2	0	0	0	0	
nrofSRS-Ports Note 1	port1	port1	port1	port1	Number of antenna ports used for SRS resource transmission
resourceType	Periodic	Aperiodic	Periodic	Periodic	
periodicityAndOffset-p Note 1	sl80, 3	N/A	Sl320, 40	Sl320, 40	SRS transmission periodicity
NOTE 1: For test cases in clauses A.4.5.2.11, A.4.5.2.12, A.6.5.2.3, A.6.5.2.4, the startPosition, nrofSymbols, nrofSRS-Ports, periodicityAndOffset-p are specified in each test cases.					

Table A.3.24-3: Sounding Reference Symbol Configuration for SCS=120 kHz

Field	SRS.3 TDD	SRS.6 TDD	PDC-SRS.3	POS-SRS.3	Comment
	Value				
c-SRS	17	17	Same as NRB,c in the test case	Same as NRB,c in the test case	
b-SRS	0	0	0	n.a.	
b-hop	0	0	0	n.a.	Frequency hopping is disabled
groupOrSequenceHopping	neither	neither	neither	neither	No group or sequence hopping
freqDomainPosition	0	0	0	0	Frequency domain position of SRS
freqDomainShift	0	0	0	0	
pathlossReferenceRS ssb-Index	0	0	0	0	SSB #0 is used for SRS path loss estimation
usage	antennaSwitching	antennaSwitching	usagePDC-r17	n.a.	
startPosition	1	1	5	5	resourceMapping setting
nrofSymbols	1	1	4	4	SRS symbols belong to the same SRS resource.
repetitionFactor	n1	n1	n1	n.a.	without repetition.
transmissionComb	n2	n2	n4	n4	
combOffset-n2	0	0	0	0	transmissionComb setting
cyclicShift-n2	0	0	0	0	

	SRS.3 TDD	SRS.6 TDD	PDC-SRS.3	POS-SRS.3	
Field	**Value**				**Comment**
nrofSRS-Ports	port1	port1	port1	port1	Number of antenna ports used for SRS resource transmission
resourceType	Periodic	Aperiodic	Periodic	Periodic	
periodicityAndOffset-p	sl320, 3	N/A	Sl1280, 160	Sl1280, 160	SRS transmission periodicity

A.3.25 Channel bandwidth (CBW) configurations

A.3.25.1 DL UE specific CBW

Table A.3.25.1-1: DL CBW patterns for UE specific CBW configuration

BWP Parameters	Unit	Values	
Reference CBW		DLCBW.1.1	DLCBW.1.2
OffsetToCarrier	PRB	RB_y Note 2	RB_x Note 1
carrierBandwidth	PRB	Same as RF channel defined in each test	Same as RF channel defined in each test
NOTE 1: RB_x is offset in frequency domain between Point A (lowest subcarrier of common PRB 0) and the lowest usable subcarrier on this carrier. Note that PRB_x has to be within the CBW of BS. NOTE 2: RB_y is offset in frequency domain between Point A (lowest subcarrier of common PRB 0) and the lowest usable subcarrier on this carrier. Note that PRB_y has to be within the CBW of BS and different with PRB_x, and CBW should include SSB and CORESET#0.			

A.3.25.2 UL UE specific CBW

Table A.3.25.2-1: UL CBW patterns for UE specific CBW configuration

BWP Parameters	Unit	Values	
Reference CBW		ULCBW.1.1	ULCBW.1.2
OffsetToCarrier	PRB	RB_y Note 2	RB_x Note 1
carrierBandwidth	PRB	Same as RF channel defined in each test	Same as RF channel defined in each test
NOTE 1: RB_x is offset in frequency domain between Point A (lowest subcarrier of common PRB 0) and the lowest usable subcarrier on this carrier. Note that PRB_x has to be within the CBW of BS. NOTE 2: RB_y is offset in frequency domain between Point A (lowest subcarrier of common PRB 0) and the lowest usable subcarrier on this carrier. Note that PRB_y has to be within the CBW of BS and different with PRB_x.			

A.3.26 CCA model

A.3.26.1 Introduction

The CCA model is used in some RRM test cases with at least one cell on a carrier frequency with CCA. The intention with the CCA model is to emulate in the test equipment the behaviour of a gNB or UE which performs channel measurement to check that the channel is clear prior to performing one or more downlink, uplink or sidelink transmissions.

A.3.26.2 CCA model for operation on a carrier frequency with CCA in FR1

A.3.26.2.1 DL CCA model

The same DL CCA model is applicable regardless of whether DRX cycle is used or not with the following differences:

- The counter, $l_{CCA,}$ is used to monitor the number of unavailable DBT samples withing an evaluation window, $W_{CCA_DL.}$ DBT samples outside of the evaluation window W_{CCA_DL} are discarded.

  If DRX cycle is not used then prior to each DBT window, the test equipment shall determine whether the DL CCA attempt is successful (i.e., the corresponding signals have to be transmitted), based on probability P_{CCA_DL} of successful DL CCA configured in the corresponding test case. If DRX cycle is not used, then the DL CCA model shall increment the counter l_{CCA} for every unavailable DBT sample due to DL CCA failure.

- If DRX cycle is used, then the DL CCA model shall increment the counter, l_{CCA}, once per DRX cycle for a DRX cycle if the first DBT sample in that DRX cycle is unavailable due to DL CCA failure. DL CCA failures in a DRX cycle are determined as follows:

- The test system *in the first DBT window of each DRX cycle* determines whether the DL CCA attempt is successful or not using the principle as follows:

  - If the DL CCA is successful then the test system shall transmit in all DBT windows within that DRX cycle.

  - If the DL CCA is not successful then the test system shall not transmit in any of the DBT windows within that DRX cycle. In this case l_{CCA} is increased by 1.

- The parameters, L_{CCA_DL}, L_{CCA_UL}, W_{CCA_DL} and W_{CCA_UL} can be used as in non-DRX tests.

If the CCA attempt is successful for a transmission, then the test equipment shall transmit also other remaining transmissions, according to the configuration, within the same DBT window.

If the CCA attempt is not successful for a transmission within the DBT window, the test equipment shall determine whether the CCA attempt is successful for the next configured transmission, based on probability P_{CCA_DL}.

The probability can be different in different time intervals T_i during a test case. One probability value (per cell) applies at any time point during a test; one or more probability values can be configured in the entire test, one value P_{CCA_DL} per time interval T_i where $i \geq 1$, and the multiple time intervals (when $i>1$) do not overlap (e.g., $P_{CCA_DL}=1.0$ in T_1 and $P_{CCA_DL}=0.75$ in T_2).

For semi-static channel access configuration, a single value P_{CCA_DL} is used to configure the probability of CCA success in different time intervals T_i during a test realization. An additional limit L_{CCA_DL} is used to determine the maximum number of unavailable DBT samples within an evaluation window W_{CCA_DL}. If the number of unavailable DBT samples on the last W_{CCA_DL} DBT samples is larger or equal to L_{CCA_DL}, the CCA attempt is considered successful for transmission.

For dynamic channel access configuration, the parameters $P_{CCA_DL_1}$ and $P_{CCA_DL_2}$ are used to configure the probability of CCA success on the first and second SSB candidate positions, respectively, in different time intervals T_i during a test realization. An additional limit L_{CCA_DL} is used to determine the maximum number of unavailable DBT samples within an evaluation window W_{CCA_DL}. If the number of unavailable DBT samples on the last W_{CCA_DL} DBT samples is larger or equal to L_{CCA_DL}, the CCA attempt is considered successful for transmission.

For semi-static channel access configuration or for dynamic channel access configuration where one candidate SSB position is modelled, prior to each discovery burst transmission window within a time interval T_i of the test, the test equipment shall:

1 Generate a uniform random variable *p1* from the range [0, 1] for the first candidate position.

2 Transmit the discovery burst based on *p1* in the first candidate position. If $p1 \leq P_{CCA_DL}$, the discovery burst is transmitted at the first candidate SSB location; else if l_{CCA} is larger than or equal to $L_{CCA_DL,}$ the discovery burst is transmitted at the first candidate SSB location, otherwise the discovery burst is muted. If DRX cycle is used, then the decision whether the discover burst is muted or not is repeated for the rest of the DRX cycle.

For dynamic channel access configuration where two candidate SSB positions are modelled, prior to each discovery burst transmission window within a time interval T_i of the test, the test equipment shall:

1 Generate a uniform random variable *p1* from the range [0, 1] for the first candidate position.

2 Transmit the discovery burst based on *p1* in the first candidate position: if $p1 \leq P_{CCA_DL1}$, the discovery burst is transmitted at first candidate SSB location, else the test equipment shall:

   a Generate a uniform random variable *p2* from the range [0, 1] for the second candidate SSB position.

   b Transmit the discovery burst based on *p2* in the second candidate position. If $p2 \leq P_{CCA_DL2}$, the discovery burst is transmitted at the second candidate SSB location; else if l_{CCA} is larger than or equal to L_{CCA_DL}, the discovery burst is transmitted at the second candidate SSB location, otherwise the discovery burst is muted. If DRX cycle is used, then the decision whether the discover burst is muted or not is repeated for the rest of the DRX cycle.

The above steps are repeated for each discovery burst transmission window in each time interval T_i of the test. The limit L_{CCA_DL} and window W_{CCA_DL} is a configuration parameter for each test case.

In many test cases, the requirement under a test depends on the number of configured SSB transmissions which are not available during the test due to CCA failure, so the test equipment shall track how many such signal occasions are not transmitted in DL during the test period.

A.3.26.2.2 UL CCA model

For UL CCA, the modelling approach is based on probability P_{CCA_UL} of successful CCA. Probability P_{CCA_UL} is configured in the corresponding test case, based on a set S_{CCA_UL} of possible values including 75 % and 87% as typical values for dynamic and semi-static channel access configurations, 0% to model consistent UL CCA failures, and 100% to model no UL CCA failures.

Consistent UL CCA failures are modelled by configuring a low value for P_{CCA_UL}, e.g., P_{CCA_UL} = 0%.

In the same time interval T_i during the same test case, P_{CCA_UL} can be different from P_{CCA_DL}.

The probability can be different in different time intervals T_i during a test case. One probability value applies at any time point during a test; one or more probability values can be configured in the entire test, one value P_{CCA_UL} per time interval T_i where $i \geq 1$, and the multiple time intervals (when $i > 1$) do not overlap (e.g., P_{CCA_UL} = 1.0 in T_1 and P_{CCA_UL} = 0.75 in T_2).

T_{CCA} µs prior to each UL transmission burst in the test, the test equipment (TE) shall generate a uniform random variable p from the range [0, 1]. If $p>P_{CCA_UL}$, the TE transmits an OCNG noise pattern with an energy level X per LBT measurement BW, within the UE BW scheduled/configured for the UL transmission for at-least T_{CCA} µs. Where T_{CCA} µs is energy detection time for accessing the uplink channel as defined in section 5.1.1 of TS 37.106 [36]. Where:

- X is 9 dB above the energy detection threshold defined in section 5.1.1 of TS 37.106 [36].
- T_{CCA} is the channel sensing period depending on CCA category for the next UL transmission.

The TE shall count the number of UL CCA failures, and no further UL CCA failures are modelled if the number of failures exceeds the limit L_{CCA_UL} within a window W_{CCA_UL}. For each UL CCA failure generated by the model, the TE shall monitor the corresponding UL resource for the desired UL signal, and based on when and/or whether the TE received the desired UL signal, it deems the test case to pass or fail.

In many cases, the requirement under a test depends on the number of configured signal occasions which are not available during the test, so the test equipment shall track how many such signal occasions are not transmitted in UL during the test period.

A.3.26.3 CCA model for operation on a carrier frequency with CCA in FR2-2

A.3.26.3.1 DL CCA model

For DL CCA, the modelling approach is based on probability P_{CCA_DL} of successful CCA.

If the CCA attempt is successful for a transmission, then the test equipment shall transmit also other remaining transmissions, according to the configuration, within the same DBT window.

If the CCA attempt is not successful for a transmission within the DBT window, the test equipment shall determine whether the CCA attempt is successful for the next configured transmission, based on probability P_{CCA_DL}.

To decide whether the CCA attempt for one SSB/SMTC occasion within one SSB/SMTC occasion group, where one SSB/SMTC occasion group consists of 12 consecutive SSB/SMTC occasions is successful or not, TE shall:

1 - Generate a uniform random variable *p* from the range [0, 1].

2 - If $p > P_{CCA_DL}$,

- TE picks one SSB/SMTC occasion out of a group of 12 consecutive SSB/SMTC occasions based on a fixed pattern, where one SSB/SMTC occasion is equivalent to one SSB burst Set.
- TE models CCA failure in this SSB/SMTC occasion. Note that other 11 SSB/SMTC occasions shall be transmitted by the TE.
- Whole SSB/SMTC occasion group is considered as unavailable to the UE.

2 - If $p \leq P_{CCA_DL}$,

- TE transmit 12 consecutive SSB/SMTC occasions.
- Whole SSB/SMTC occasion group is considered as available to the UE.

In many test cases, the requirement under a test depends on the number of configured SSB transmissions which are not available during the test due to CCA failure, so the test equipment shall track how many such signal occasions are not transmitted in DL during the test period.

A.3.26.3.2 UL CCA model

For UL CCA, the modelling approach is based on probability P_{CCA_UL} of successful CCA. Probability P_{CCA_UL} is configured in the corresponding test case.

Consistent UL CCA failures are modelled by configuring a low value for P_{CCA_UL}, e.g., $P_{CCA_UL} = 0\%$.

In the same time interval T_i during the same test case, P_{CCA_UL} can be different from P_{CCA_DL}.

The probability can be different in different time intervals T_i during a test case. One probability value applies at any time point during a test; one or more probability values can be configured in the entire test, one value P_{CCA_UL} per time interval T_i where $i \geq 1$, and the multiple time intervals (when $i > 1$) do not overlap (e.g., $P_{CCA_UL} = 1.0$ in T_1 and $P_{CCA_UL} = 0.75$ in T_2).

T_{CCA} µs prior to each UL transmission burst in the test, the test equipment (TE) shall generate a uniform random variable p from the range [0, 1]. If $p > P_{CCA_UL}$, the TE transmits an OCNG noise pattern with an energy level X within the UE BW scheduled/configured for the UL transmission for at-least T_{CCA} µs. Where T_{CCA} µs is energy detection time for accessing the uplink channel as defined in section 5.1.1 of TS 37.106 [36]. Where:

- X is 3 dB above the energy detection threshold defined in section 5.1.1 of TS 37.106 [36].
- T_{CCA} is the channel sensing period depending on CCA category for the next UL transmission.

In many cases, the requirement under a test depends on the number of configured signal occasions which are not available during the test, so the test equipment shall track how many such signal occasions are not transmitted in UL during the test period.

A.3.26.4 CCA model for operation on a sidelink carrier frequency with CCA

A.3.26.4.1 CCA model for SyncRef UE

For the SyncRef UE transmitting S-SSB in sidelink carrier frequency with CCA, the modelling approach is based on probability $P_{CCA_SL_SyncRefUE}$ of successful CCA.

If the CCA attempt is successful for a S-SSB transmission, then the test equipment shall transmit S-SSB on S-SSB transmission occasion, according to the configuration.

If the CCA attempt is not successful for a S-SSB transmission, the test equipment shall determine whether the CCA attempt is successful for the next S-SSB occasion, based on probability $P_{CCA_SL_SyncRefUE}$.

A counter, denoted by $l_{CCA,}$ tracks the number of unavailable S-SSB periods. In the SL CCA model, the counter l_{CCA} is incremented when CCA failures led to an unavailable S-SSB period.

The probability can be different in different time intervals T_i during a test case. One probability value applies at any time point during a test; one or more probability values can be configured in the entire test, one value $P_{CCA_SL_SyncRefUE}$ per time interval T_i where $i \geq 1$, and the multiple time intervals (when $i > 1$) do not overlap (e.g., $P_{CCA_SL_SyncRefUE} = 1.0$ in T_1 and $P_{CCA_SL_SyncRefUE} = 0.75$ in T_2).

The parameters $P_{CCA_SL_SyncRefUE_1}$ and $P_{CCA_SL_SyncRefUE_2}$ are used to configure the probability of CCA success on the first and second S-SSB candidate occasions, respectively, in different time intervals T_i during a test realization. An additional limit L_{CCA_SL} determines the maximum number of unavailable S-SSB periods. If $l_{CCA} \geq L_{CCA_SL}$, the CCA attempt is considered successful for S-SSB transmissions.

Two candidate SSB occasions are modelled within each S-SSB period. To decide whether the CCA attempt for the two S-SSB occasions within each of S-SSB period is successful, TE shall:

1 - Generate a uniform random variable *p1* from the range [0, 1] for the first candidate S-SSB occasion.

2 - Transmit the S-SSB based on *p1* in the first candidate occasion:

- if $p1 \leq P_{CCA_SL_SyncRefUE_1}$, the S-SSB is transmitted in first candidate SSB occasion and this S-SSB period is considered as available to the DUT,
- else TE shall generate a uniform random variable *p2* from the range [0, 1] for the second candidate SSB occasion
  - If $p2 \leq P_{CCA_SL_SyncRefUE_2}$ or if $l_{CCA} \geq L_{CCA_SL}$, the S-SSB is transmitted in the second candidate SSB occasion;
  - else this S-SSB period is muted.

The above steps are repeated for each S-SSB periods in each time interval T_i of the test. The limit L_{CCA_SL} is a configuration parameter for each test case.

In many test cases, the requirement under a test depends on the counter l_{CCA}, so the test equipment shall track how many such S-SSB periods are not transmitted by TE during the test period.

A.3.27 Void

A.3.27.1 Void

A.3.27.2 Void

A.3.27.3 Void

A.3.27.4 Void

A.3.27.5 Void

A.3.28 Discovery Burst Transmission Window configuration under CCA

A.3.28.1 DBT Window pattern 1: DBT Window period = 20 ms with DBT Window duration = 1 ms

Table A.3.28.1-1: DBT.1: DBT Window Pattern 1 for DBT Window period = 20 ms and duration = 1 ms

SMTC Parameters	Values
Discovery burst transmission window periodicity	20 ms
Discovery burst transmission window offset	0 ms
Discovery burst transmission window duration	1 ms

A.3.29 Testing principles for UE capable of only NR bands with shared spectrum access

A.3.29.1 Introduction

In annex A test cases are defined involving one or more NR cells operating on NR band(s) with shared spectrum channel access. The NR bands with shared spectrum channel access are defined in clause 5.2 of TS 38-101-1 [18].

A.3.29.2 Principle of testing for UE capable of EN-DC with only NR bands with shared spectrum access

In annex A, test cases in table A.3.29.2-1 are defined for UE capable of EN-DC with only NR band(s) with shared spectrum access and are not required for UE supporting also other NR band(s) (i.e. band with no shared spectrum access). The EN-DC configurations are defined in clause of 5.5B of TS 38.101-3 [20].

Table A.3.29.2-1: Test cases applicable to UE supporting EN-DC with only NR bands with shared spectrum access

Test category	Section	Test case
Active BWP switching	A.10.3.5.2.1	E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in synchronous EN-DC
	A.10.3.5.2.2	E-UTRAN – NR PSCell FR1 DL active BWP switch with FR1 SCell in non-DRX in synchronous EN-DC
	A.10.3.5.3.1	E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in synchronous EN-DC

A.3.29.3 Principle of testing for UE capable of SA operation with only NR bands with shared spectrum access

In annex A, test cases in table A.3.29.3-1 are defined for UE capable of NR SA operation with only NR band(s) with shared spectrum access and are not required for UE supporting also other NR band(s) (i.e. band with no shared spectrum access).

Table A.3.29.3-1: Test cases applicable to UE supporting SA operation with only NR bands with shared spectrum access

Test category	Section	Test case
Active BWP switching	A.11.4.5.2.1	NR FR1- NR FR1 DL active BWP switch of PCell with non-DRX in SA
	A.11.4.5.2.2	NR FR1 DL active BWP switch with non-DRX in SA
	A.11.4.5.3.1	NR FR1 DL active BWP switch of Cell with non-DRX in SA

A.3.30 CSI-RS configurations for RRM

A.3.30.1 FDD

Table A.3.30.1-1: CSI-RS RRM Reference Measurement Channels for SCS=15 kHz

	CSI-RS.RRM.FR1.1 FDD
CSI-RS-ResourceConfigMobility	
subcarrierSpacing, kHz	15
CSI-RS-CellMobility	
cellId[note1]	0
nrofPRBs	48
startPRB	0
density	3
CSI-RS-Resource-Mobility	
csi-RS-Index	0
slotConfig: ms20 [note2]	slot1
associatedSSB	True
ssb-Index [note3]	0
isQuasiColocated	True
firstOFDMSymbolInTimeDomain [note4]	10
sequenceGenerationConfig	0
Others	
nrofPorts	1
CDM Type	NoCDM
EPRE ratio to SSS, dB	0
Note1: unless specified otherwise. Note2: unless specified otherwise. Note3: assume the same SS/PBCH block index of the corresponding cell in the test case. Note4: unless specified otherwise.	

A.3.30.2 TDD

Table A.3.30.2-1: CSI-RS RRM Reference Measurement Channels for SCS=15 kHz

	CSI-RS.RRM.FR1.1 TDD
CSI-RS-ResourceConfigMobility	
subcarrierSpacing, kHz	15
CSI-RS-CellMobility	
cellId[note1]	0
nrofPRBs	48
startPRB	0
density	3

CSI-RS-Resource-Mobility	
csi-RS-Index	0
slotConfig: ms20 note2	slot1
associatedSSB	True
ssb-Index note3	0
isQuasiColocated	True
firstOFDMSymbolInTimeDomain note4	10
sequenceGenerationConfig	0
Others	
nrofPorts	1
CDM Type	NoCDM
EPRE ratio to SSS, dB	0
Note1: unless specified otherwise. Note2: unless specified otherwise. Note3: assume the same SS/PBCH block index of the corresponding cell in the test case. Note4: unless specified otherwise.	

Table A.3.30.2-2: CSI-RS RRM Reference Measurement Channels for SCS=30 kHz

	CSI-RS.RRM.FR1.2 TDD
CSI-RS-ResourceConfigMobility	
subcarrierSpacing, kHz	30
CSI-RS-CellMobility	
cellId note1	0
nrofPRBs	48
startPRB	0
density	3
CSI-RS-Resource-Mobility	
csi-RS-Index	0
slotConfig: ms20 note2	slot1
associatedSSB	True
ssb-Index note3	0
isQuasiColocated	True
firstOFDMSymbolInTimeDomain note4	10
sequenceGenerationConfig	0
Others	
nrofPorts	1
CDM Type	NoCDM
EPRE ratio to SSS, dB	0
Note1: unless specified otherwise. Note2: unless specified otherwise. Note3: assume the same SS/PBCH block index of the corresponding cell in the test case. Note4: unless specified otherwise.	

Table A.3.30.2-3: CSI-RS RRM Reference Measurement Channels for SCS=120 kHz

	CSI-RS.RRM.FR2.1 TDD
CSI-RS-ResourceConfigMobility	
subcarrierSpacing, kHz	120
CSI-RS-CellMobility	
cellId note1	0
nrofPRBs	48
startPRB	0
density	3
CSI-RS-Resource-Mobility	
csi-RS-Index	0
slotConfig: ms20 note2	slot1
associatedSSB	True
ssb-Index note3	0
isQuasiColocated	True
firstOFDMSymbolInTimeDomain note4	10

sequenceGenerationConfig	0
Others	
nrofPorts	1
CDM Type	NoCDM
EPRE ratio to SSS, dB	0
Note1: unless specified otherwise. Note2: unless specified otherwise. Note3: assume the same SS/PBCH block index of the corresponding cell in the test case. Note4: unless specified otherwise.	

A.3.31 PRS Configurations

A.3.31.1 PRS Configurations for FR1

A.3.31.1.1 PRS pattern 1 in FR1: SCS=15 kHz

Table A.3.31.1.1-1: PRS.1 FR1: PRS Pattern 1 for SCS=15 kHz

PRS Parameters	Values						
Reference channel	PRS.1.1 FR1	PRS.1.2 FR1	PRS.1.3 FR1		PRS.1.4 FR1		PRS.1.5 FR1
Resource index in resource set	0	0	0	1	0	1	1
PRS periodicity	160ms						
PRS Resource set slot offset Note 1	10 ms						
PRS Resource slot offset (slot) Note 1	0	4	0		4		4
PRS RE offset Note 1	0		0	1	0	1	1
SCS	15kHz						
PRS comb size	2	4	2		4		4
Number of PRS symbol	4	4	4		4		4
Repetion factor	2	1	2		1		6
PRS resource time gap (slot)	1	1	1		1		1
PRB numbers containing PRS within channel BW Note 1	0-23	0-103	0-23		0-103		0-267
PRS Start PRB	0						
NOTE 1: Unless otherwise specified in the test case.							

A.3.31.1.2 PRS pattern 2 in FR1: SCS=30 kHz

Table A.3.31.1.2-1: PRS.2 FR1: PRS Pattern 2 for SCS=30 kHz

PRS Parameters	Values							
Reference channel	PRS.2.1 FR1	PRS.2.2 FR1	PRS.2.3 FR1		PRS.2.4 FR1		PRS.2.5 FR1	PRS.2.6 FR1
Resource index in resource set	0	0	0	1	0	1	0	0
PRS periodicity	160 ms							
PRS Resource set slot offset Note 1	10 ms							
PRS Resource slot offset (slot) Note 1	0	4	0		4		0	0
PRS RE offset Note 1	0		0	1	0	1	0	0

SCS	30 kHz					
PRS comb size	2	4	2	4	4	4
Number of PRS symbol	4	4	4	4	4	4
Repetion factor	2	1	2	1	1	6
PRS resource time gap (slot)	1	1	1	1	1	1
PRB numbers containing PRS within channel BW Note 1	0-23	0-131	0-23	0-131	0-47	0-271
PRS Start PRB	0					
NOTE 1: Unless otherwise specified in the test case.						

A.3.31.2 PRS Configurations for FR2

A.3.31.2.1 PRS pattern 1 in FR2: SCS=120 kHz

Table A.3.31.2.1-1: PRS.1 FR2: PRS Pattern 1 for SCS=120 kHz

PRS Parameters	Values							
Reference channel	PRS.1.1 FR2	PRS.1.2 FR2	PRS.1.3 FR2		PRS.1.4 FR2		PRS.1.5 FR2	PRS.1.6 FR2
Resource index in resource set	0	0	0	1	0	1	0	0
PRS periodicity	160 ms							
PRS Resource set slot offset Note 1	10 ms							
PRS Resource slot offset (slot) Note 1	0	4	0		4		0	0
PRS RE offset Note 1	0		0	1	0	1	0	0
SCS	120 kHz							
PRS comb size	2	4	2		4		4	4
Number of PRS symbol	4	4	4		4		4	4
Repetion factor	2	1	2		1		1	6
PRS resource time gap (slot)	1	1	1		1		1	1
PRB numbers containing PRS within channel BW Note 1	0-31	0-127	0-31		0-127		0-63	0-263
PRS Start PRB	0							
NOTE 1: Unless otherwise specified in the test case.								

A.3.32 NR sidelink discovery

A.3.32.1 Introduction

This clause also defines the principle and the reference configurations that are applicable to test cases verifying RRM core requirements for NR sidelink discovery.

A.3.32.2 Reference resource pool configurations for NR Sidelink Discovery

Table A.3.32.2-1: SL-BWP configuration for NR sidelink discovery

Field	Value	Comment
SL-BWP-ConfigCommon-r16		
sl-BWP-Generic-r16		
sl-LengthSymbols-r16	sym14	All 14 symbols in a slot without S-SSB are used for sidelink
sl-StartSymbol-r16	sym0	Symbol #0 is the starting symbol used for sidelink in a slot without S-SSB
sl-BWP-DiscPoolConfigCommon-r17		
sl-DiscRxPool-r17		Indicates the resource pool for reception on the configured BWP. 1 entry
SL-ResourcePool-r16[1]	Set according to Table A.3.21.2-2	Entry 1
sl-DiscTxPoolSelected-r17		Indicates the resources pool for mode 2 sidelink communication on the configured BWP. 1 entry
SL-ResourcePoolConfig-r16[1]		Entry 1

A.3.32.3 Principle of Testing

The UE capable of both V2X sidelink communication and NR sidelink discovery does not have to pass the test for interruption at NR sidelink discovery configuration defined in clause 9.1.6.1, if this UE has already passed the test case for interruption due to V2X sidelink communication defined in clause 9.1.6.1.

A.3.33 PRS Processing Window (PPW) configurations

Table A.3.33-1: Reference PPW configuration

PPW Parameters	Unit	Values
Reference PPW		PPW.1
Periodicity	slot	Note 1
Offset	slot	Note 2
Length	ms	10
Type		Same as the value reported in *prsProcessingType-r17*
Priority		st1
NOTE 1: Same as PRS resource set periodicity as used in the test case. NOTE 2: Same as PRS resource with smallest offset as used in the test case.		

A.3.34 Testing principles for test cases related to PRS measurements

A.3.34.1 Introduction

In annex A test cases are defined for verifying various type of PRS measurement and accuracy requirements.

A.3.34.2 Test cases in RRC_INACTIVE state

In annex A, PRS measurement test cases are defined with 4 samples and with reduced number of samples in RRC_INACTIVE state. The testing principle for these test cases is as follows:

- A UE capable of *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34] is only required to pass the test cases with reduced number of samples.

- A UE not capable of *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34] is required to pass the test cases with 4 samples.

In Annex A, PRS measurement delay test cases are defined for both PRS-RSRP and PRS-RSRPP measurements in RRC_INACTIVE state when UE is configured with DRX cycle and eDRX cycle > 10.24s for positioning measurements. The testing principle for these test cases is as follows:

- A UE capable of both PRS-RSRP and PRS-RSRPP measurements is required to pass either PRS-RSRP measurement delay test or PRS-RSRPP measurement delay test.

In Annex A, PRS measurement delay test cases are defined for both RSTD and UE Rx-Tx time difference measurements in RRC_INACTIVE state when UE is configured with DRX cycle and eDRX cycle > 10.24s for positioning measurements. The testing principle for these test cases is as follows:

- A UE capable of both RSTD and UE Rx-Tx time difference measurements is required to pass either RSTD measurement delay test or UE Rx-Tx time difference measurement delay test.

A.3.34.3 Test cases for PRS measurements with gaps in RRC_CONNECTED state

In annex A, PRS measurement test cases are defined with 4 samples and with reduced number of samples with measurement gaps in RRC_CONNECTED state. The testing principle for these test cases is as follows:

- A UE capable of *supportedDL-PRS-ProcessingSamples* [34] is only required to pass the test cases with reduced number of samples.

- A UE not capable of *supportedDL-PRS-ProcessingSamples* [34] is required to pass the test cases with 4 samples.

In annex A, PRS measurement delay test cases are defined for both PRS-RSRP and PRS-RSRPP measurements with measurement gaps in RRC_CONNECTED state. The testing principle for these test cases is as follows:

- A UE capable of both PRS-RSRP and PRS-RSRPP measurements is required to pass either PRS-RSRP measurement delay test or PRS-RSRPP measurement delay test.

A.3.34.4 Test cases for PRS measurements without gaps in RRC_CONNECTED state

In annex A, PRS measurement test cases are defined with 4 samples and with reduced number of samples without measurement gaps in RRC_CONNECTED state. The testing principle for these test cases is as follows:

- A UE capable of *supportedDL-PRS-ProcessingSamples* [34] is only required to pass the test cases with reduced number of samples.

- A UE not capable of *supportedDL-PRS-ProcessingSamples* [34] is required to pass the test case with 4 samples.

In annex A, PRS measurement delay test cases are defined for both PRS-RSRP and PRS-RSRPP measurements without measurement gaps in RRC_CONNECTED state. The testing principle for these test cases is as follows:

- A UE capable of both PRS-RSRP and PRS-RSRPP measurements is required to pass either PRS-RSRP measurement delay test or PRS-RSRPP measurement delay test.

In annex A, PRS measurement delay test cases are defined for both RSTD and UE Rx-Tx time difference measurements without measurement gaps in RRC_CONNECTED state. The testing principle for these test cases is as follows:

- A UE capable of both RSTD and UE Rx-Tx time difference measurements is required to pass either RSTD measurement delay test or UE Rx-Tx time difference measurement delay test.

A.3.34.5 Testing principles for positioning measurements by aggregating PRS resources from multiple PFLs

In annex A, test cases for measurement delay requirement and accuracy requirement for positioning measurements by aggregating PRS resources from multiple PLFs are defined. While verifying the UE capability to meet the requirements defined for the positioning measurements by aggregating PRS resources from multiple PFLs, a UE capable of both RSTD and UE Rx-Tx time difference measurements by aggregating PRS resources from multiple PFLs is required to

pass either PRS aggregation based RSTD measurement delay test or PRS aggregation-based UE Rx-Tx time difference measurement delay test.

A.3.34.6 Testing principles for carrier phase measurement for positioning

In annex A, test cases for measurement delay requirement and accuracy requirement for carrier phase measurement reported together with legacy positioning measurement are defined.

While verifying the UE capability to meet the requirements defined for the carrier phase measurement reported together with the legacy positioning measurement, a UE capable of both RSCPD with RSTD and RSCP with UE Rx-Tx time difference measurements is required to pass either RSCPD with RSTD measurement delay test or RSCP with UE Rx-Tx time difference measurement delay test.

When a UE is tested for DL RSCPD with RSTD measurement, then the UE shall pass tests for RSTD measurement and RSCPD measurement.

When a UE is tested for DL RSCP with UE Rx-Tx measurement, then the UE shall pass tests for UE Rx-Tx measurement and DL RSCP measurement.

A.3.34.7 Test cases in RRC_IDLE state

For the measurements supported by the UE in both RRC_IDLE and RRC_INACTIVE modes, UE shall pass the test cases for RRC_IDLE mode and does not need to be tested for the same measurement in RRC_INACTIVE mode.

A.3.35 Testing principle for RedCap UE

A.3.35.1 Introduction

This clause defines testing principles which are applicable to test cases verifying RRM requirements for RedCap UE and test cases verifying PRS measurement requirements for RedCap UE.

A.3.35.2 Principle of testing for FR1

For RedCap and eRedCap UEs supporting 1 Rx branch, all single carrier tests specified in clause A.16 and A.18 except for tests defined for 2 Rx and/or FR2 shall be tested on any band.

For RedCap and eRedCap UEs supporting 2Rx branches, all single carrier tests specified in clause A.16 and A.18 except for tests defined for 1 Rx and/or FR2 shall be tested on any band.

A.3.35.3 Principle of testing for FR2

For RedCap UEs, all single carrier tests specified in clause A.17 and A.18 except for tests defined for FR1 shall be tested on any band.

A.3.35.4 Principle of testing for PRS measurement

In annex A, test cases for measurement delay requirement and accuracy requirement for PRS measurement for RedCap UE are defined. The following testing principles are applied while verifying the RedCap UE capability to meet the PRS measurement requirements.

- A UE capable of both PRS-RSRP and PRS-RSRPP measurements is required to pass either PRS-RSRP measurement delay test or PRS-RSRPP measurement delay test.
- A UE capable of both RSTD and UE Rx-Tx time difference measurements is required to pass either RSTD measurement delay test or UE Rx-Tx time difference measurement delay test.

- A UE capable of performing PRS measurement with RX FH is only required to pass the measurement delay test cases for PRS measurement with RX FH.

- For the measurements supported by the UE in both RRC_IDLE and RRC_INACTIVE modes, UE shall pass the test cases for RRC_IDLE mode and does not need to be tested for the same measurement in RRC_INACTIVE mode.

A.3.36 Testing related to Satellite access

A.3.36.1 Introduction

In annex A test cases are defined for verifying various type of RRM requirements related to satellite access.

A.3.36.2 Principle of testing GSO and NGSO scenarios

In annex A, RRM test cases related to satellite access are defined for both GSO and NGSO. The testing principle for these test cases is as follows:

- A UE capable of GSO only is required to pass the test cases with GSO.

- A UE capable of NGSO only is required to pass the test cases with NGSO.

- A UE capable of both GSO and NGSO is required to pass the test cases with NGSO only.

Support of GSO and NGSO scenario is indicated via *ntn-ScenarioSupport-r17*.

A.3.36.3 Principle of testing different RRM requirements

In annex A, RRM test cases related to satellite access are defined for all applicable RRM requirements. The testing principle for these test cases is as follows:

- A UE capable of NTN only is required to pass all the test cases defined in clause A.14.

- A UE capable of both TN and NTN is required to pass the test cases for NTN specific requirements in table A.3.36.2-1.

Table A.3.36.3-1: Test cases for NTN specific requirements

Clause	Test case slogan
A.14.1.2	Cell reselection to FR1 intra-frequency NR cell for UE configured with the feature for enhanced requirements
A.14.1.3	Time-based measurement initiation to FR1 intra-frequency NR cell reselection
A.14.1.4	Location-based measurement initiation to FR1 intra-frequency NR cell reselection
A.14.1.6	Cell reselection to FR1 inter-frequency NR cell for UE configured with feature for enhanced requirements
A.14.1.7	Time-based measurement initiation to FR1 inter-frequency cell reselection
A.14.1.8	Location-based measurement initiation to FR1 inter-frequency cell reselection
A.14.2.1.3	Intra-frequency SAN time-based conditional Handover from FR1 to FR1
A.14.2.1.4	Inter-frequency SAN time-based conditional Handover from FR1 to FR1
A.14.2.1.5	Intra-frequency SAN distance-based conditional Handover from FR1 to FR1
A.14.2.1.6	Inter-frequency SAN distance-based conditional Handover from FR1 to FR1
A.14.3.1.1	NR UE Transmit Timing Test for FR1
A.14.5.1.1	SA event triggered reporting tests without gap under non-DRX
A.14.5.1.2	SA event triggered reporting tests without gap under DRX
A.14.5.1.3	SA event triggered reporting tests without gap under non-DRX with SSB index reading
A.14.5.1.4	SA event triggered reporting tests with single measurement gap under non-DRX for satellite access
A.14.5.1.5	SA event triggered reporting tests with FNO concurrent gaps under DRX for satellite access
A.14.5.1.6	SA event triggered reporting tests with PPO concurrent gaps under non-DRX with SSB index reading for satellite access
A.14.5.2.4	SA event triggered reporting tests for FR1 without SSB time index detection when DRX is not used with two gaps in fully non-overlapped for satellite access

A.14.5.2.6	SA event triggered reporting tests for FR1 without SSB time index detection when DRX is not used with two gaps in partially partial overlapping for satellite access
A.14.6.3.1	SA intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell
A.14.6.3.2	SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell
A.14.6.4.1	SSB based L1-RSRP measurement
A.14.6.4.2	CSI-RS based L1-RSRP measurement on resource set with repetition off

For UEs that declare capabilities to support channel bandwidth of 3 MHz (clause 4.2.7.2 in TS 38.306 [14]), the UE shall also pass the following test cases indicated in Table A.3.36.2-2.

Table A.3.36.3-2: Test cases for NTN UEs supporting operation with 3 MHz channel bandwith

Clause	Test case slogan
A.14.2.1.x	Intra-frequency SAN time-based conditional Handover from FR1 to FR1 for UE operating on a cell with less than 5 MHz BW
A.14.2.2.x	RACH-based hard Satellite switching with re-synchronization from FR1 to FR1 for less than 5MHz with NTN
A.14.4.1.x	Radio Link Monitoring Out-of-sync Test for FR1 SAN PCell configured with SSB-based RLM RS in non-DRX mode
A.14.4.2.x	Beam Failure Detection and Link Recovery Test for FR1 PCell for satellite access configured with SSB-based BFD and LR in non-DRX mode for a UE operating on a cell with less than 5 MHz BW
A.14.2.2.x	Location-based Cell reselection to FR1 inter-frequency NR satellite access case
A.14.5.	SA event triggered reporting tests for FR1 with SSB time index detection when DRX is used with single gap for 3 MHz channel bandwidth in satellite access
A.14.1.x	Cell reselection to FR1 intra-frequency NR case for UE operating on a cell with less than 5 MHz BW

A.3.36.4 Principle of testing different ephemeris formats

Satellite access RRM test cases are defined such that satellite ephemeris information is sent to UE in each test case, according to tables A.3.36.34-1 and A.3.36.34-2.

Table A.3.36.4-1: Test cases configuring EphemerisInfo as PositionVelocity

Functional Area	Test Case
RRC_IDLE state mobility	A.14.1.3
	A.14.1.4
	A.14.1.5
	A.14.1.6
	A.14.1.9
	A.14.1.10
Handover	A.14.2.1.3
	A.14.2.1.4
	A.14.2.1.5
	A.14.2.1.6
Timing	A.14.3.1
Radio Link Monitoring	A.14.4.1.1
	A.14.4.1.2
	A.14.4.1.5
	A.14.4.1.6
BFD and LR procedures	A.14.4.2.1
	A.14.4.2.3
	A.14.4.2.5
Active BWP switch	A.14.4.3.1
UE specific CBW change	A.14.4.4.1
PL-RS switching delay	A.14.4.5.1
Intra-frequency measurements	A.14.5.1.1
	A.14.5.1.3
	A.14.5.1.5
Inter-frequency measurements	A.14.5.2.1
	A.14.5.2.3

Functional Area	Test Case
	A.14.5.2.7
L1-RSRP measurements	A.14.5.3.1
	A.14.5.3.3
SS-RSRP accuracy	A.14.6.1.1
SS-RSRQ accuracy	A.14.6.2.1
SS-SINR accuracy	A.14.6.3.1
L1-RSRP accuracy	A.14.6.4.1

Table A.3.36.4-2: Test cases configuring EphemerisInfo as Orbital

Functional Area	Test Case
RRC_IDLE state mobility	A.14.1.1
	A.14.1.2
	A.14.1.5
	A.14.1.6
Handover	A.14.2.1.1
	A.14.2.1.2
RRC Connection Mobility Control	A.14.2.2.1
	A.14.2.2.2
	A.14.2.2.3
Timing	A.14.3.2
Radio Link Monitoring	A.14.4.1.3
	A.14.4.1.4
	A.14.4.1.7
	A.14.4.1.8
BFD and LR procedures	A.14.4.2.2
	A.14.4.2.4
	A.14.4.2.6
Active BWP switch	A.14.4.3.2
Intra-frequency measurements	A.14.5.1.2
	A.14.5.1.4
	A.14.5.1.6
Inter-frequency measurements	A.14.5.2.2
	A.14.5.2.4
	A.14.5.2.6
	A.14.5.2.8
L1-RSRP measurements	A.14.5.3.2
	A.14.5.3.4
SS-RSRP accuracy	A.14.6.1.2
SS-RSRQ accuracy	A.14.6.2.2
SS-SINR accuracy	A.14.6.3.2
L1-RSRP accuracy	A.14.6.4.2

A.3.36.5 General setup for SIB19

The general parameters for SIB19 setup is specified in table A.3.36.5-1.

Table A.3.36.5-1: Test cases for NTN specific requirements

Parameter	Unit	Test 1
Interval between adjacent epoch time	s	LEO: 2.56 GEO: 10.24
ntn-UlSyncValidityDuration	s	LEO: 5 GEO: 900
cellSpecificKoffset	slot	LEO: 14 GEO: 258
kmac	slot	Not configured
ta-Common		0
ta-CommonDrift		0
ta-CommonDriftVariant		0
ntn-PolarizationDL		linear

ntn-PolarizationUL		linear
ephemerisInfo		Detailed ephemeris information is provided in TS 38.508-1 [38].
ta-Report		Not configured

A.3.36.6 Satellite specific parameters configuration

A.3.36.6.1 Satellite specific configuration for serving cell

Table A.3.36.6.1-1: Satellite specific configuration pattern 1 for serving cell in GSO scenario

Parameter	SSC.1
Interval between adjacent epoch time	10.24 s
ntn-UlSyncValidityDuration	900 s
cellSpecificKoffset	258 slots
ta-Common	0
ta-CommonDrift	0
ta-CommonDriftVariant	0
ntn-PolarizationDL	linear
ntn-PolarizationUL	linear
ephemerisInfo	Detailed ephemeris information is provided in TS 38.508-1 [38].

Table A.3.36.6.1-2: Satellite specific configuration pattern 2 for serving cell in NGSO scenario

Parameter	SSC.2
Interval between adjacent epoch time	2.56 s
ntn-UlSyncValidityDuration	5 s
cellSpecificKoffset	14 slots
ta-Common	0
ta-CommonDrift	0
ta-CommonDriftVariant	0
ntn-PolarizationDL	linear
ntn-PolarizationUL	linear
ephemerisInfo	Detailed ephemeris information is provided in TS 38.508-1 [38].

A.3.36.6.2 Satellite specific configuration for neighbour cell

Table A.3.36.6.2-1: Satellite specific configuration pattern 1 for neighbour cell in GSO scenario

Parameter	NSC.1
Interval between adjacent epoch time	10.24 s
ntn-UlSyncValidityDuration	900 s
cellSpecificKoffset	258 slots
ta-Common	0
ta-CommonDrift	0
ta-CommonDriftVariant	0
ntn-PolarizationDL	linear
ntn-PolarizationUL	linear
ephemerisInfo	Detailed ephemeris information is provided in TS 38.508-1 [38].

.

Table A.3.36.6.2-2: Satellite specific configuration pattern 2 for neighbour cell in NGSO scenario

Parameter	NSC.2

Interval between adjacent epoch time	2.56 s
ntn-UlSyncValidityDuration	5 s
cellSpecificKoffset	14 slots
ta-Common	0
ta-CommonDrift	0
ta-CommonDriftVariant	0
ntn-PolarizationDL	linear
ntn-PolarizationUL	linear
ephemerisInfo	Detailed ephemeris information is provided in TS 38.508-1 [38].

A.3.37 Reference Cell DTX configurations

A.3.37.1 Cell DTX Configuration 1: Cell DTX cycle = 160 ms and TAT = Infinity

Table A.3.37.1-1: DTX.1: Cell DTX cycle = 160 ms and time alignment timer (TAT) = Infinity

Field	Value
cellDTXDRX-onDurationTimer	1 ms
cellDTXDRX-CycleStartOffset	160 ms
cellDTXDRXconfigType-r18	dtx
cellDTXDRXactivationStatus	activated
NOTE: This Cell DTX configuration is applicable for NR serving cell. The Cell DTX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2].	

A.3.38 DL-PRS Measurement Time Window configurations

Table A.3.38-1: Reference configuration for DL-PRS Measurement Time Window

DL-PRS Measurement Time Window Parameters	Unit	Values	
Reference DL-PRS Measurement Time Window		MTW.1	MTW.2
Number of configuration elements		1	1
Start SFN		0	0
Periodicity	slot	Note 1	Note 4
Slot and Symbol Offset	slot	Note 2	Note 2
Duration	slot	4	4
Associated PFL index		0	0
Associated PRS resource set index		Note 3	Note 3
NOTE 1: Same as 2*(PRS resource set periodicity as used in the test case). NOTE 2: Same as PRS resource with smallest slot and symbol offset as used in the test case. NOTE 3: Include all PRS resource sets of all TRPs used in the test case. NOTE 4: Same as 2*(DRX cycle as used in the test case).			

A.4 EN-DC tests with all NR cells in FR1

A.4.1 Void

A.4.2 Void

A.4.3 RRC_CONNECTED state mobility

A.4.3.1 Void

A.4.3.2 RRC Connection Mobility Control

A.4.3.2.1 Void

A.4.3.2.2 Random Access

A.4.3.2.2.1 4-step RA type contention based random access test in FR1 for PSCell in EN-DC

A.4.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Supported test parameters are shown in table A.4.3.2.2.1.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in table A.4.3.2.2.1.1-2.

Table A.4.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR1 for PSCell in EN-DC

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.4.3.2.2.1.1-2: General test parameters for contention based random access test in FR1 for PSCell in EN-DC

Parameter		Unit	Test 1	Comments
SSB Configuration	Config 1,2		SSB pattern 3 in FR1	As defined in A.3.10
	Config 3,4		SSB pattern 4 in FR1	
Duplex Mode for Cell 2	Config 1,2		FDD	
	Config 3,4		TDD	
TDD Configuration	Config 3,4		TDDConf.2.1	
OCNG Pattern Note 1			OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 4	Config 1,2		SR.1.1 FDD	As defined in A.3.1.1.
	Config 3,4		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,2		CR.1.1 FDD	
	Config 3,4		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,2		CCR.1.1 FDD	
	Config 3,4		CCR.2.1 TDD	
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB		
EPRE ratio of PBCH_DMRS to SSS		dB		

Parameter			Unit	Test 1	Comments
EPRE ratio of PBCH to PBCH_DMRS			dB	0	
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP Note 3		dBm/SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP Note 3		dBm/SCS	-115	
Io Note 2		Config 1,2	dBm	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 3,4		-62.2/38.16 MHz	
ss-PBCH-BlockPower			dBm/SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1 [18].
PRACH Configuration				FR1 PRACH configuration 1	As defined in A.3.8.2.
Propagation Condition			-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: Void
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.4.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via the dedicated signalling in the downlink.

A.4.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in clause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2.2.1.4, the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission..

A.4.3.2.2.1.2.5 Void

A.4.3.2.2.1.2.6 Void

A.4.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in clause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.4.3.2.2.2 4-step RA type n on-contention based random access test in FR1 for PSCell in EN-DC

A.4.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Supported test parameters are shown in table A.4.3.2.2.2.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in table A.4.3.2.2.2.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports *csi-RSRP-AndRSRQ-MeasWithSSB* or *csi-RSRP-AndRSRQ-MeasWithoutSSB*.

Table A.4.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR1 for PSCell in EN-DC

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.4.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR1 for PSCell in EN-DC

Parameter			Unit	Test 1	Test 2	Comments
SSB Configuration		Config 1,2		SSB pattern 3 in FR1	SSB pattern 3 in FR1	As defined in A.3.10
		Config 3,4		SSB pattern 4 in FR1	SSB pattern 4 in FR1	
CSI-RS Configuration		Config 1,2		N/A	CSI-RS.1.1 FDD	As defined in A.3.1.4
		Config 3,4			CSI-RS.2.1 TDD	
Duplex Mode for Cell 2		Config 1,2		FDD	FDD	
		Config 3,4		TDD	TDD	
TDD Configuration		Config 3,4		TDDConf.2.1	TDDConf.2.1	
OCNG Pattern Note 1				OCNG pattern 1	OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 4		Config 1,2		SR.1.1 FDD	SR.1.1 FDD	As defined in A.3.1.1.
		Config 3,4		SR.2.1 TDD	SR.2.1 TDD	
RMSI CORESET Reference Channel		Config 1,2		CR.1.1 TDD	CR.1.1 TDD	
		Config 3,4		CR.2.1 TDD	CR.2.1 TDD	
Dedicated CORESET Reference Channel		Config 1,2		CCR.1.1 TDD	CCR.1.1 TDD	
		Config 3,4		CCR.2.1 TDD	CCR.2.1 TDD	
NR RF Channel Number				1	1	
EPRE ratio of PSS to SSS			dB	0	0	
EPRE ratio of PBCH_DMRS to SSS			dB			
EPRE ratio of PBCH to PBCH_DMRS			dB			
EPRE ratio of PDCCH_DMRS to SSS			dB			
EPRE ratio of PDCCH to PDCCH_DMRS			dB			
EPRE ratio of PDSCH_DMRS to SSS			dB			
EPRE ratio of PDSCH to PDSCH_DMRS			dB			
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-98	-98	
		Config 3,4		-101	-101	
	$\hat{E}_s / N_{oc}$		dB	3	3	
	SS-RSRP Note 3		dBm/SCS	-95	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-98	-98	
		Config 3,4		-101	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	-17	
	SS-RSRP Note 3		dBm/SCS	-115	-115	
Io Note 2		Config 1,2	dBm	-65.3/9.36 MHz	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 3,4		-62.2/38.16 MHz	-62.2/38.16 MHz	

Parameter	Unit	Test 1	Test 2	Comments
ss-PBCH-BlockPower	dBm/SCS	-5	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)	dBm	23	23	As defined in clause 6.2.4 in TS 38.101-1 [18].
PRACH Configuration		FR1 PRACH configuration 2	FR1 PRACH configuration 3	As defined in A.3.8.2.
Propagation Condition	-	AWGN	AWGN	
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel. NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters. NOTE 3: Void NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.				

A.4.3.2.2.2.2 Test Requirements

Non-contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.4.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in clause 6.2.2.2.2.1 for SSB-based Random Access Preamble transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2.. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in clause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.3 2-step RA type contention based random access test in FR1 for PSCell in EN-DC

A.4.3.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behaviour of the random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Supported test parameters are shown in table A.4.3.2.2.3.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in table A.4.3.2.2.3.1-2.

Table A.4.3.2.2.3.1-1: Supported test configurations for 2-step RA type contention based random access test in FR1 for PSCell in EN-DC

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.4.3.2.2.3.1-2: General test parameters for 2-step RA type contention based random access test in FR1 for PSCell in EN-DC

Parameter		Unit	Test 1	Comments
SSB Configuration	Config 1,2		SSB pattern 3 in FR1	As defined in A.3.10
	Config 3,4		SSB pattern 4 in FR1	
Duplex Mode for Cell 2	Config 1,2		FDD	
	Config 3,4		TDD	
TDD Configuration	Config 3,4		TDDConf.2.1	
OCNG Pattern Note 1			OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3	Config 1,2		SR.1.1 FDD	As defined in A.3.1.1.
	Config 3,4		SR.2.1 TDD	

Parameter			Unit	Test 1	Comments
RMSI CORESET Reference Channel		Config 1,2		CR.1.1 FDD	
		Config 3,4		CR.2.1 TDD	
Dedicated CORESET Reference Channel		Config 1,2		CCR.1.1 FDD	
		Config 3,4		CCR.2.1 TDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP Note 2		dBm/SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP Note 2		dBm/SCS	-115	
Io		Config 1,2	dBm	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 3,4		-62.2/38.16 MHz	
ss-PBCH-BlockPower			dBm/SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1 [18].
MsgA Configuration				FR1 MsgA configuration 1	As defined in A.3.20.2.1.
msgA-RSRP-ThresholdSSB			dBm	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
Propagation Condition			-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.4.3.2.2.3.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.4.3.2.2.3.2.1 MsgA Transmission

To test the UE behaviour specified in clause 6.2.2.3.1.1 the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB.*

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first MsgA preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 3 dB lower than first MsgA PRACH power for test

configuration 1 & 2 and same as first MsgA PRACH power for test configuration 3 & 4 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.3.2.2 MsgB Reception

To test the UE behaviour specified in clause 6.2.2.3.1.2 the System Simulator shall transmit a MsgB with fallbackRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB's contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first MsgA preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 3 dB lower than first MsgA PRACH power for test configuration 1 & 2 and same as first MsgA PRACH power for test configuration 3 & 4 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.3.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.3 the System Simulator shall transmit a MsgB with fallbackRAR containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first MsgA preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 3 dB lower than first MsgA PRACH power for test configuration 1 & 2 and same as first MsgA PRACH power for test configuration 3 & 4 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.4 2-step RA type non-contention based random access test in FR1 for PSCell in EN-DC

A.4.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Supported test parameters are shown in table A.4.3.2.2.4.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in table A.4.3.2.2.4.1-2.

Table A.4.3.2.2.4.1-1: Supported test configurations for non-contention based random access test for 2-step RA type in FR1 for PSCell in EN-DC

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.4.3.2.2.4.1-2: General test parameters for non-contention based random access test for 2-step RA type in FR1 for PSCell in EN-DC

Parameter			Unit	Test 1	Comments
SSB Configuration		Config 1,2		SSB pattern 3 in FR1	As defined in A.3.10
		Config 3,4		SSB pattern 4 in FR1	
Duplex Mode for Cell 2		Config 1,2		FDD	
		Config 3,4		TDD	
TDD Configuration		Config 3,4		TDDConf.2.1	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1,2		SR.1.1 FDD	As defined in A.3.1.1.
		Config 3,4		SR.2.1 TDD	
RMSI CORESET Reference Channel		Config 1,2		CR.1.1 TDD	
		Config 3,4		CR.2.1 TDD	
Dedicated CORESET Reference Channel		Config 1,2		CCR.1.1 TDD	
		Config 3,4		CCR.2.1 TDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP		dBm/SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP		dBm/SCS	-115	
Io Note 2		Config 1,2	dBm	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 3,4		-62.2/38.16 MHz	
ss-PBCH-BlockPower			dBm/SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1 [18].

Parameter	Unit	Test 1	Comments
MsgA Configuration		FR1 MsgA configuration 2	As defined in A.3.20.2.
msgA-RSRP-ThresholdSSB	dBm	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
Propagation Condition	-	AWGN	
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.			
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.			
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.			

A.4.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.4.3.2.2.4.2.1 MsgA Transmission

In Test-1, to test the UE behavior specified in clause 6.2.2.3.2.1 for MsgA transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 3 dB lower than first MsgA PRACH power for test configuration 1 & 2 and same as first MsgA PRACH power for test configuration 3 & 4 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.4.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble after 5 MsgA transmissions have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB if the MsgB contains a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power if Random Access Responses Reception has not been considered as successful.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 3 dB lower than first MsgA PRACH power for test configuration 1 & 2 and same as first MsgA PRACH power for test configuration 3 & 4 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.2.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA*.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 3 dB lower than first MsgA PRACH power for test configuration 1 & 2 and same as first MsgA PRACH power for test configuration 3 & 4 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.4.3.2.3 Void

A.4.3.3 Handover with PSCell from EN-DC to EN-DC with known target PSCell in FR1

A.4.3.3.1 Test Purpose and Environment

This test is to verify the requirements for E-UTRA intra frequency handover with NR FR1 PSCell change specified in clause 5.8 in E-UTRA RRM specification [15] for the case when the target PSCell is known by the UE. Supported test configurations are shown in table A.4.3.3.1-1.

The general test parameters are given in table A.4.3.3.1-2. E-UTRA cells and NR cells specific test parameters are given in table A.4.3.3.1-3 and A.4.3.3.1-4. In the test there are four cells: Cell 1 and Cell 2 are PCell and target PCell on E-UTRA carrier, Cell 3 and Cell 4 are PSCell and target PSCell on NR FR1 carrier. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. Before the test starts the UE is connected to Cell 1 (E-UTRA PCell) and Cell 3 (NR PSCell) with EN-DC mode. At the start of time duration T1, the UE has not any timing information of cell 2 and cell 4. During T1, the UE is configured in the measurement control information that event-triggered reporting with Event A3 for neighbour cells on E-UTRA carrier and NR carrier.

The Cell 2 and Cell 4 becomes known to the UE, and E-UTRA PCell (Cell 1) shall send an RRC message implying handover with PSCell to cell 2 and cell4 during T2. The RRC message implying handover with PSCell shall be sent to the UE after the UE has reported Event A3 for SpCells. The start of T3 is defined as the end of the last TTI containing the RRC message implying handover with PSCell.

Table A.4.3.3.1-1: Handover with PSCell from EN-DC to EN-DC test configurations in FR1

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, PSCell FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, PSCell TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, SCell FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, SCell TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.3.3.1-2: General test parameters for Handover with PSCell from EN-DC to EN-DC

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	One is E-UTRA RF channel and one is NR RF channel
Initial conditions	Active PCell		Cell 1	On E-UTRA RF channel number 1.
	E-UTRA Neighbouring cell		Cell 2	On E-UTRA RF channel number 1.
	Active PSCell		Cell 3	On NR RF channel number 1.

	NR Neighbouring cell		Cell 4	On NR RF channel number 1.
Final conditions	Active PCell		Cell 2	
	Active PSCell		Cell 4	
CP length			Normal	Applicable to Cell 1, Cell 2, Cell 3 and Cell 4.
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Continuous monitoring of primary cell
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between same RAT cells		μs	3	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.4.3.3.1-3: E-UTRAN cell specific test parameters for Handover with PSCell from EN-DC to EN-DC

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
Duplex mode		FDD or TDD			FDD or TDD		
TDD special subframe configuration[Note1]		6			6		
TDD uplink-downlink configuration[Note1]		1			1		
$BW_{channel}$		5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100			5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100		
PDSCH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD			5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD			5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note2]		5 MHz: OP.20 FDD 10 MHz: OP.1 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		OP.18 FDD OP.2 FDD OP.14 FDD OP.10 TDD OP.2 TDD OP.8 TDD	5 MHz: OP.18 FDD 10 MHz: OP.2 FDD 20 MHz: OP.14 FDD 5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD		OP.20 FDD OP.1 FDD OP.17 FDD OP.9 TDD OP.1 TDD OP.7 TDD
PRACH configuration		-			4, As specified in table 5.7.1-2 in TS 36.211 [23]		
PBCH_RA	dB	0			0		
PBCH_RB	dB						
PSS_RA	dB						
SSS_RA	dB						
PCFICH_RB	dB						
PHICH_RA	dB						
PHICH_RB	dB						
PDCCH_RA	dB						
PDCCH_RB	dB						
PDSCH_RA	dB						
PDSCH_RB	dB						
OCNG_RA[Note3]	dB						
OCNG_RB[Note3]	dB						
N_{oc}[Note4]	dBm/15 kHz	-98					

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
$\hat{E}_s/N_{oc}$	dB	8	8	8	-infinite	11	11
$\hat{E}_s/I_{ot}$	dB	8	-3.3	-3.3	-infinite	2.36	2.36
RSRP Note5	dBm/15 kHz	-90	-90	-90	-infinite	-87	-87
SCH_RP Note5	dBm/15 kHz	-90	-90	-90	-infinite	-87	-87
Io Note5	dBm/Ch BW	-61.58+10·log($N_{RB,c}$ /50)	-57.23+10·log($N_{RB,c}$ /50)		-61.58+10·log($N_{RB,c}$ /50)	-57.23+10·log($N_{RB,c}$ /50)	
Propagation Condition		AWGN					
Antenna Configuration		1x2					

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively. respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: E_s/I_{ot}, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.4.3.3.1-4: NR cell specific test parameters for Handover with PSCell from EN-DC to EN-DC

Parameter		Unit	Cell 3			Cell 4		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			1		
Duplex mode	Config 1, 4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1, 4		Not Applicable					
	Config 2, 5		TDDConf.1.1					
	Config 3, 6		TDDConf.2.1					
$BW_{channel}$	Config 1,2,4,5	MHz	10: $N_{RB,c}$ = 52					
	Config 3,6		40: $N_{RB,c}$ = 106					
BWP BW	Config 1,2,4,5	MHz	10: $N_{RB,c}$ = 52					
	Config 3,6		40: $N_{RB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD					
	Config 2,5		SR.1.1 TDD					
	Config 3,6		SR.2.1 TDD					
CORESET Reference Channel	Config 1,4		CR.1.1 FDD					
	Config 2,5		CR.1.1 TDD					
	Config 3,6		CR.2.1 TDD					
TRS configuration	Config 1,4		TRS.1.1 FDD					
	Config 2,5		TRS.1.1 TDD					
	Config 3,6		TRS.1.2 TDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
SSB Configuration	Config 1,2,4,5		SSB.1 FR1					
	Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz					
	Config 3,6		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz					
	Config 3,6		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								

Parameter		Unit	Cell 3			Cell 4		
			T1	T2	T3	T1	T2	T3
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15 kHz	-98					
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-98					
	Config 3,6		-95					
$\hat{E}_s / I_{ot}$		dB	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s / N_{oc}$		dB	8	8	8	-Infinity	11	11
SSB_RP	Config 1,2,4,5	dBm/SCS	-90	-90	-90	-Infinity	-87	-87
	Config 3,6	dBm/SCS	-87	-87	-87	-Infinity	-84	-84
Io Note3	Config 1,2,4,5	dBm/ 9.36 MHz	-61.41	-57.06	-57.06	-61.41	-57.06	-57.06
	Config 3,6	dBm/ 38.16 MHz	-55.31	-50.96	-50.96	-55.31	-50.96	-50.96
Propagation condition		-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.3.3.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 60 ms from the beginning of time period T3.

The UE shall transmit the PRACH preamble to Cell 4 less than 87 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90%.

The rate of correct PSCell addition observed during repeated tests shall be at least 90%.

NOTE: The handover requirements for handover with PSCell for EN-DC is defined in clause 5.8 in [15] as:

$D_{HOwithPSCel_PSCell} = T_{RRC_delay} + T_{search} + T_{IU} + T_{processing}$

Where:

T_{RRC_delay} = 20 ms for 'RRC connection reconfiguration (NR SCG establishment/ /modification/release)'.

T_{search} = 0 ms for known cell.

T_{IU} = 15 ms in the test configuration.

$T_{processing}$ = 25 ms for source Cell and target Cell are in the same FR.

This gives a total of 60 ms for handover delay.

NOTE: The PSCell change delay for handover with PSCell for EN-DC is defined in clause 5.8 in TS 36.133 [15] as:

$D_{HOwithPSCel_PSCell} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell_DU} + T_{PCell_DU} + 2$ ms

Where:

T_{RRC_delay} = 20 ms for 'RRC connection reconfiguration (NR SCG establishment/ /modification/release)'.

$T_{processing}$ = 25 ms for source Cell and target Cell are in the same FR.

T_{search} = 0 ms for known cell.

T_{Δ} = 20 ms for fine time tracking and acquiring full timing information of the target cell. 1 SMTC period.

T_{PSCell_DU} = 20 ms based on PSCell addition test in TS 38.133 A.4.5.7.

T_{PCell_DU} = 0 ms, no clolliding with PCell RACH.

This gives a total of 87 ms for handover delay.

A.4.4 Timing

A.4.4.1 UE transmit timing

A.4.4.1.1 NR UE Transmit Timing Test for FR1

A.4.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNB and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2. Supported test configurations are shown in table 4.4.1.1.1-1.

Table A.4.4.1.1.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	LTE FDD, NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	LTE FDD, NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
4	LTE TDD, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
5	LTE TDD, NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
6	LTE TDD, NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

The test consists of E-UTRA PCell and NR PSCell. The configuration for E-UTRA is given in clause A.3.7.2.1. Table A.4.4.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.4.4.1.1.1-3.

Table A.4.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2	Band Group
SSB ARFCN		1,2,3,4,5,6	Freq1	Freq1	
Duplex Mode		1,4	FDD		
		2,3,5,6	TDD		
TDD configuration		1,4	Not Applicable		
		2,5	TDDConf.1.1		
		3,6	TDDConf.2.1		
$BW_{channel}$	MHz	1,4	10: $N_{RB,c}$ = 52		
		2,5	10: $N_{RB,c}$ = 52		
		3,6	40: $N_{RB,c}$ = 106		
Initial BWP Configuration		1,2,3,4,5,6	DLBWP.0.1 ULBWP.0.1		
Dedicated BWP Configuration		1,2,3,4,5,6	DLBWP.1.1 ULBWP.1.1		
DRX Cycle	ms	1,2,3,4,5,6	N/A	DRX.8[Note5]	
PDSCH Reference measurement channel		1,4	SR.1.1 FDD		
		2,5	SR.1.1 TDD		
		3,6	SR.2.1 TDD		
RMSI CORESET Reference Channel		1,4	CR.1.1 FDD		
		2,5	CR.1.1 TDD		
		3,6	CR.2.1 TDD		
Dedicated CORESET Reference Channel		1,4	CCR.1.1 FDD		
		2,5	CCR.1.1 TDD		
		3,6	CCR.2.1 TDD		
OCNG Patterns		1,2,3,4,5,6	OP.1		

Parameter	Unit	Config	Test1	Test2	Band Group
SSB configuration		1,4	SSB.1 FR1		
		2,5	SSB.1 FR1		
		3,6	SSB.2 FR1		
SMTC configuration		1,2,3,4,5,6	SMTC.2		
TRS configuration		1,4	TRS.1.1 FDD		
		2,5	TRS.1.1 TDD		
		3,6	TRS.1.2 TDD		
PDSCH/PDCCH subcarrier spacing	kHz	1,2,4,5	15		
		3,6	30		
EPRE ratio of PSS to SSS	dB	1,2,3,4,5,6	0	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	-98	-98	
N_{oc} Note2	dBm/SCS	1,2,4,5	-98	-98	
		3,6	-95	-95	
$\hat{E}_s / I_{ot}$		1,2,3,4,5,6	3	3	
$\hat{E}_s / N_{oc}$		1,2,3,4,5,6	3	3	
SS-RSRP Note3	dBm/SCS	1,2,4,5	-95	-95	
		3,6	-92	-92	
Io Note3	dBm/9.36 MHz	1,2,4,5	-65.2	-65.2	
	dBm/38.1 MHz	3,6	-59.2	-59.2	
Propagation condition		1,2,3,4,5,6	AWGN		
SRS Config		1,2,4,5	SRSConf.1 Note6	SRSConf.3 Note6	
		3, 6	SRSConf.1 Note6	SRSConf.2 Note6	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: DRX related parameters are given in Table A.3.3.8-1
NOTE 6: SRS configs are given in Table A.4.4.1.1.1-3

Table A.4.4.1.1.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	SRSConf.3	Comments
SRS-ResourceSet	*srs-ResourceSetId*	0	0	0	
	srs-ResourceIdList	0	0	0	
	resourceType	Periodic	Periodic	Periodic	
	Usage	Codebook	Codebook	Codebook	
SRS-Resource	*SRS-ResourceId*	0	0	0	
	nrofSRS-Ports	Port1	Port1	Port1	
	transmissionComb	n2	n2	n2	

	combOffset-n2	0	0	0	
	cyclicShift-n2	0	0	0	
	resourceMapping startPosition	0	0	0	
	resourceMapping nrofSymbols	n1	n1	n1	
	resourceMapping repetitionFactor	n1	n1	n1	
	freqDomainPosition	0	0	0	
	freqDomainShift	0	0	0	
	freqHopping c-SRS	14 for test configuration 1,2,4,5 25 for test configuration 3,6	25	14	Matches $N_{RB,c}$
	freqHopping b-SRS	0	0	0	
	freqHopping b-hop	0	0	0	
	groupOrSequenceHopping	Neither	Neither	Neither	
	resourceType	Periodic	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl640, 5	sl320, 3	Offset to align with DRX periodicity
	sequenceId	0	0	0	Any 10 bit number

A.4.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up E-UTRA PCell according to parameters given in table A.3.7.2.1-1 and setup NR PSCell according to parameters given in table A.4.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset})\times T_c \pm T_e$ of the first detected path of DL SSB.

   a. The N_{TA} offset value (in T_c units) is 25600

   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in table A.4.4.1.1.2-1

Table A.4.4.1.1.2-1: Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
15	$+64*64T_c$	$+32*64T_c$
30	$+32*64T_c$	$+16*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

A.4.4.1.2 NR UE Transmit Timing Test for two TRPs in FR1

A.4.4.1.2.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timings change of the connected gNB and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits for both TRPs. The test is configured with two TRPs in NR PSCell. This test will verify the requirements in clause 7.1.2. Supported test configurations are shown in table A.4.4.1.2.1-1.

Table A.4.4.1.2.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	LTE FDD, NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	LTE FDD, NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
4	LTE TDD, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
5	LTE TDD, NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
6	LTE TDD, NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

The test consists of E-UTRA PCell and NR PSCell. For NR PSCell, two TRPs are configured. The configuration for E-UTRA is given in A.3.7.2.1. Table A.4.4.1.2.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.4.4.1.2.1-3.

For UE not supporting the capability of “rxTimingDiff-r18”, the UE is only required to be tested in Test1 and Test3.

For UE supports the capability of “rxTimingDiff-r18”, the UE is only required to be tested in Test2 and Test4.

Table A.4.4.1.2.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1		Test2		Test3		Test4		Band Group
			TRP# 1	TRP# 2	TRP# 1	TRP# 2	TRP# 1	TRP# 2	TRP# 1	TRP# 2	
SSB ARFCN		1,2,3,4,5, 6	Freq1								
Duplex Mode		1,4	FDD								
		2,3,5,6	TDD								
TDD configuration		1,4	Not Applicable								
		2,5	TDDConf.1.1								
		3,6	TDDConf.2.1								
$BW_{channel}$	MHz	1,4	10: $N_{RB,c}$ = 52								
		2,5	10: $N_{RB,c}$ = 52								
		3,6	40: $N_{RB,c}$ = 106								
Initial BWP Configuration		1,2,3,4,5, 6	DLBWP.0.1 ULBWP.0.1								
Dedicated BWP Configuration		1,2,3,4,5, 6	DLBWP.1.1 ULBWP.1.1								
DRX Cycle	ms	1,2,3,4,5, 6	N/A				DRX.8 Note5				
PDSCH Reference measurement channel		1,4	SR.1.1 FDD								
		2,5	SR.1.1 TDD								
		3,6	SR.2.1 TDD								
RMSI CORESET Reference Channel		1,4	CR.1.1 FDD								
		2,5	CR.1.1 TDD								
		3,6	CR.2.1 TDD								
Dedicated CORESET Reference Channel		1,4	CCR.1.1 FDD								
		2,5	CCR.1.1 TDD								
		3,6	CCR.2.1 TDD								

Parameter	Unit	Config	Test1		Test2		Test3		Test4		Band Group
			TRP# 1	TRP# 2	TRP# 1	TRP# 2	TRP# 1	TRP# 2	TRP# 1	TRP# 2	
coresetPoolIndex for dedicated CORESET Reference Channel		1,2,3,4,5,6	0	1	0	1	0	1	0	1	
Timing difference compared to TRP#1	us	1,2,4,5	0	3	0	30	0	3	0	30	
		3,6		1.5				1.5			
OCNG Patterns		1,2,3,4,5,6	OP.1								
SSB configuration		1,4	SSB.3 FR1								
		2,5	SSB.3 FR1								
		3,6	SSB.4 FR1								
SSB index		1,4	0	1	0	1	0	1	0	1	
		2,5	0	1	0	1	0	1	0	1	
		3,6	0	1	0	1	0	1	0	1	
SMTC configuration		1,2,3,4,5,6	SMTC.2								
TRS configuration		1,4	TRS.1.1 FDD for DLorJoint TCI.State.1.3 & DLorJoint TCI.State.1.4								
		2,5	TRS.1.1 TDD for DLorJoint TCI.State.1.3 & DLorJoint TCI.State.1.4								
		3,6	TRS.1.2 TDD for DLorJoint TCI.State.1.3 & DLorJoint TCI.State.1.4								
PDSCH/PDCCH subcarrier spacing	kHz	1,2,4,5	15								
		3,6	30								
EPRE ratio of PSS to SSS	dB	1,2,3,4,5,6	0				0				
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of PDCCH DMRS to SSS											
EPRE ratio of PDCCH to PDCCH DMRS											
EPRE ratio of PDSCH DMRS to SSS											
EPRE ratio of PDSCH to PDSCH											
EPRE ratio of OCNG DMRS to SSS(Note 1)											
EPRE ratio of OCNG to OCNG DMRS (Note 1)											
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	-98				-98				
N_{oc} Note2	dBm/SCS	1,2,4,5	-98				-98				
		3,6	-95				-95				
$\hat{E}_s / I_{ot}$		1,2,3,4,5,6	3				3				
$\hat{E}_s / N_{oc}$		1,2,3,4,5,6	3				3				
SS-RSRP Note3	dBm/SCS	1,2,4,5	-95				-95				

Parameter	Unit	Config	Test1		Test2		Test3		Test4		Band
			TRP# 1	TRP# 2	TRP# 1	TRP# 2	TRP# 1	TRP# 2	TRP# 1	TRP# 2	Group
		3,6	-92				-92				
Io[Note3]	dBm/9.36 MHz	1,2,4,5	-65.2				-65.2				
	dBm/38.1 MHz	3,6	-59.2				-59.2				
Propagation condition		1,2,3,4,5, 6	AWGN								
SRS Config		1,2,4,5	SRSConf.1[Note6]				SRSConf.3[Note6]				
		3, 6	SRSConf.1[Note6]				SRSConf.2[Note6]				

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: DRX related parameters are given in Table A.3.3.8-1
NOTE 6: SRS configs are given in Table A.4.4.1.2.1-3

Table A.4.4.1.2.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	SRSConf.3	Comments
SRS-ResourceSet	*srs-ResourceSetId*	0	0	0	
	srs-ResourceIdList	0	0	0	
	resourceType	Periodic	Periodic	Periodic	
	Usage	Codebook	Codebook	Codebook	
SRS-Resource	*SRS-ResourceId*	0	0	0	
	nrofSRS-Ports	Port1	Port1	Port1	
	transmissionComb	n2	n2	n2	
	combOffset-n2	0	0	0	
	cyclicShift-n2	0	0	0	
	resourceMapping startPosition	0	0	0	
	resourceMapping nrofSymbols	n1	n1	n1	
	resourceMapping repetitionFactor	n1	n1	n1	
	freqDomainPosition	0	0	0	
	freqDomainShift	0	0	0	
	freqHopping c-SRS	14 for test configuration 1,2,4,5 25 for test configuration 3,6	25	14	Matches $N_{RB,c}$
	freqHopping b-SRS	0	0	0	
	freqHopping b-hop	0	0	0	
	groupOrSequenceHopping	Neither	Neither	Neither	
	resourceType	Periodic	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl640, 5	sl320, 3	Offset to align with DRX periodicity
	sequenceId	0	0	0	Any 10 bit number

A.4.4.1.2.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up E-UTRA PCell according to parameters given in table A.3.7.2.1-1 and setup NR PSCell according to parameters given in table A.4.4.1.2.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset})\times T_c \pm T_e$ of the first detected path of DL SSB of TRP#1 and TRP#2.

   a. The N_{TA} offset value (in T_c units) is 25600

   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in table A.4.4.1.2.2-1 for only TRP#1. The timing of the DL path of TRP#2 is not changed.

Table A.4.4.1.2.2-1: Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1&2	Test3&Test4
15	$+64*64T_c$	$+32*64T_c$
30	$+32*64T_c$	$+16*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first detected path (in time) of DL SSB for TRP#1. For TRP#2, the test system shall verify there is no adjustment.

5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB of TRP#1.

A.4.4.2 UE timer accuracy

A.4.4.3 Timing advance

A.4.4.3.1 EN-DC FR1 timing advance adjustment accuracy

A.4.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.4.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.4.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in tables A.4.4.3.1.2-2, A.4.4.3.1.2-3 and A.4.4.3.1.2-4. The configuration of Cell 1 (LTE PCell) is specified in clause A.3.7.2.1.

In all test cases, two cells are used. Cell 1 is the PCell in the primary Timing Advance Group (pTAG) and cell 2 is the PSCell is in the secondary Timing Advance Group (sTAG). Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands for sTAG are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.4.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured for PSCell in sTAG.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element for sTAG, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance for sTAG used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value specified in table A.4.4.3.1.2-2. This value shall result in changes of the timing advance for sTAG used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.4.4.3.1.2-1: Timing advance supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.4.3.1.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		Cell 1: 1 Cell 2: 2	1 for E-UTRAN PCell 2 for NR PSCell
Initial DL BWP		DLBWP.0.1	As specified in Table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in Table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in Table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in Table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	*For 15 kHz SCS* $N_{TA_new} = N_{TA_old} + 8192*T_c$ *For 30 kHz SCS* $N_{TA_new} = N_{TA_old} + 4096*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.4.4.3.1.2-3: Cell specific test parameters for timing advance

Parameter		Unit	Test1	
			T1	T2
Duplex mode	Config 1,4		FDD	
	Config 2,3,5,6		TDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2,5		TDDConf.1.1	
	Config 3,6		TDDConf.2.1	
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52	
	Config 2,5		10: $N_{RB,c}$ = 52	
	Config 3,6		40: $N_{RB,c}$ = 106	
BWP BW	Config 1,4	MHz	10: $N_{RB,c}$ = 52	
	Config 2,5		10: $N_{RB,c}$ = 52	
	Config 3,6		40: $N_{RB,c}$ = 106	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD	
	Config 3,6		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD	

Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
OCNG Patterns			OCNG pattern 1
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
SMTC configuration	Config 1,2,4,5		SMTC.1 FR1
	Config 3,6		SMTC.2 FR1
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz
	Config 3,6		30 kHz
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz
	Config 3,6		30 kHz
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2		dBm/15 kHz	-98
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-98
	Config 3,6		-95
$\hat{E}_s / I_{ot}$		dB	3
$\hat{E}_s / N_{oc}$		dB	3
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-67.57
	Config 3,6	dBm/38.16 MHz	-62.58
Propagation condition		-	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.4.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance

Field		Value	Comment
c-SRS	Config 1,2,4,5	12	Frequency hopping is disabled
	Config 3,6	24	
b-SRS		0	
b-hop		0	
freqDomainPosition		0	Frequency domain position of SRS
freqDomainShift		0	
groupOrSequenceHopping		neither	No group or sequence hopping
SRS-PeriodicityAndOffset		sl5=2 for SCS 15 kHz sl5=4 for SCS 30 kHz	Once every 5 slots
pathlossReferenceRS		ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage		Codebook	Codebook based UL transmission
startPosition		0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols		n1	
repetitionFactor		n1	
combOffset-n2		0	transmissionComb setting

cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.4.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value for PSCell in sTAG to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy for PSCell in sTAG shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

A.4.5 Signaling characteristics

A.4.5.1 Radio link Monitoring

In the following clause, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

For intra-band contiguous carrier aggregation, transmit OFF power is measured as the mean power per component carrier.

For UE with multiple transmit antennas, transmit OFF power is measured as the mean power at each transmit connector.

- UE output power higher than Transmit OFF power -50 dBm (as defined in TS 38.101-3 [20]) means uplink signal.
- UE output power equal to or less than Transmit OFF power -50 dBm (as defined in TS 38.101-3 [20]) means no uplink signal.

A.4.5.1.1 Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with SSB-based RLM RS in non-DRX mode

A.4.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out-of-sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR1 PSCell radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.4.5.1.1.1-1. The test parameters are given in tables A.4.5.1.1.1-2, A.4.5.1.1.1-3, and A.4.5.1.1.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-1. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.1.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

Table A.4.5.1.1.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.1.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
$BW_{channel}$	Config 1, 4	MHz	10: $N_{RB,c}$ = 52
	Config 2, 5		10: $N_{RB,c}$ = 52
	Config 3, 6		40: $N_{RB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 kHz
	Config 3, 6		30 kHz
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.1-1
	Config 3, 6		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
T1		s	0.2

Parameter	Unit	Value
		Test 1
T2	s	0.48
T3	s	0.48
D1	s	0.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.		

Table A.4.5.1.1.1-3: Cell specific test parameters for FR1 (Cell 2) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2, 5		1	-7	-15
	Config 3, 6		1	-7	-15
N_{oc}	Config 1, 4	dBm/15 kHz	-98		
	Config 2, 5		-98		
	Config 3, 6		-98		
N_{oc}	Config 1, 4	dBm/SCS	-98		
	Config 2, 5		-98		
	Config 3, 6		-95		
Propagation condition			TDL-C 300 ns 100 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.					

Table A.4.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap).	

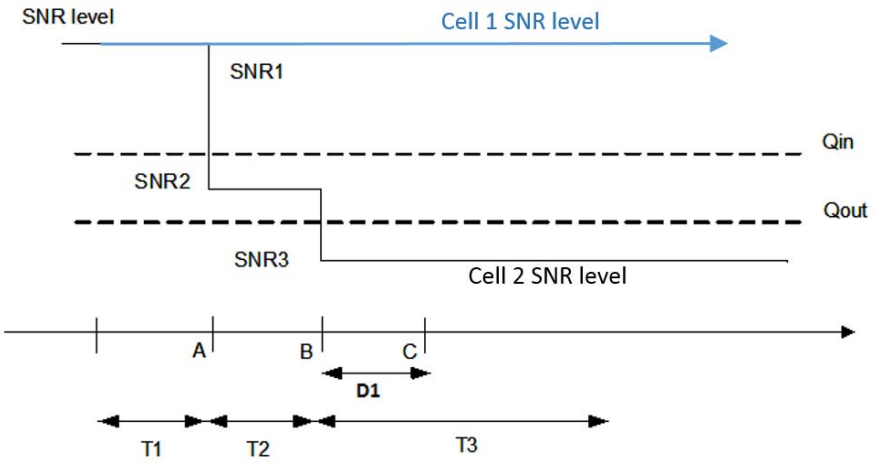


Figure A.4.5.1.1.1-1: SNR variation for out-of-sync testing

A.4.5.1.1.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 seconds after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.2 Radio Link Monitoring In-sync Test for FR1 PSCell configured with SSB-based RLM RS in non-DRX mode

A.4.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out-of-sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR1 PSCell radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.4.5.1.2.1-1. The test parameters are given in tables A.4.5.1.2.1-2, and A.4.5.1.2.1-3 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-1. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.2.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Table A.4.5.1.2.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.2.1-2: General test parameters for FR1 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
$BW_{channel}$	Config 1, 4	MHz	10: $N_{RB,c}$ = 52
	Config 2, 5		10: $N_{RB,c}$ = 52
	Config 3, 6		40: $N_{RB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 kHz
	Config 3, 6		30 kHz
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.1-1
	Config 3, 6		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6

Parameter		Unit	Value
			Test 1
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.2.1-3: Cell specific test parameters for FR1 (Cell 2) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15	-4.5	1
	Config 2, 5		1	-7	-15	-4.5	1
	Config 3, 6		1	-7	-15	-4.5	1
N_{oc}	Config 1, 4	dBm/15 kHz	-98				
	Config 2, 5		-98				

	Config 3, 6		-98
N_{oc}	Config 1, 4	dBm/SCS	-98
	Config 2, 5		-98
	Config 3, 6		-95
Propagation condition			TDL-C 300 ns 100 Hz
NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.4.5.1.2.1-1. NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in clause A.3.6.			

Table A.4.5.1.2.1-4: Void

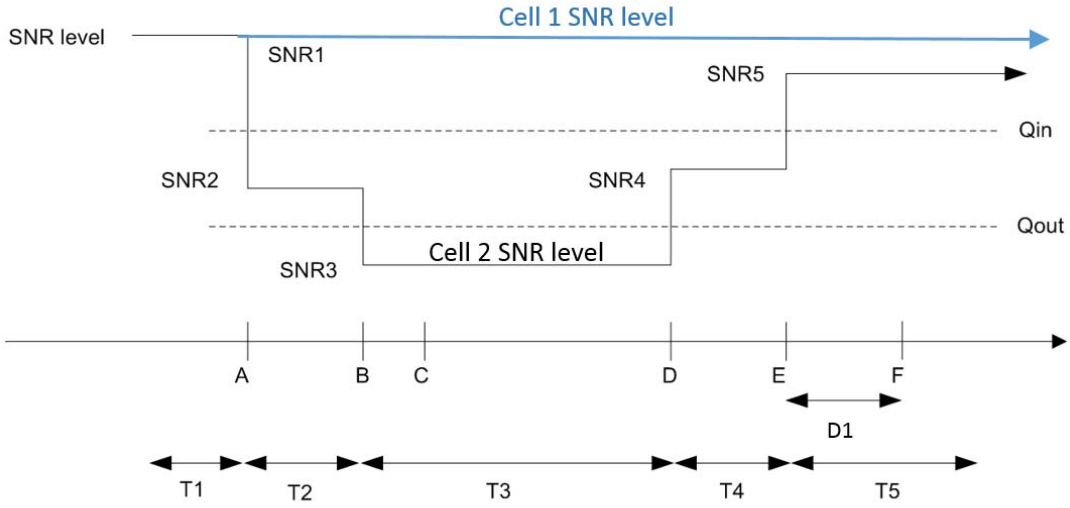


Figure A.4.5.1.2.1-1: SNR variation for in-sync testing

A.4.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 seconds after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.3 Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with SSB-based RLM RS in DRX mode

A.4.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out-of-sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.4.5.1.3.1-1. The test parameters are given in tables A.4.5.1.3.1-2 and A.4.5.1.3.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-1. The test consists of three successive time

periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.3.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.4.5.1.3.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.3.1-2: General test parameters for FR1 out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
$BW_{channel}$	Config 1, 4	MHz	10: $N_{RB,c}$ = 52
	Config 2, 5		10: $N_{RB,c}$ = 52
	Config 3, 6		40: $N_{RB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 kHz
	Config 3, 6		30 kHz
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.1-1
	Config 3, 6		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy	dB	4

Parameter		Unit	Value
			Test 1
	to average SSS RE energy		
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
T1		s	0.2
T2		s	0.68
T3		s	0.68
D1		s	0.64
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.3.1-3: Cell specific test parameters for FR1 (Cell 2) for out-of-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2, 5		1	-7	-15
	Config 3, 6		1	-7	-15
N_{oc}	Config 1, 4	dBm/15 kHz	-98		
	Config 2, 5		-98		
	Config 3, 6		-98		
N_{oc}	Config 1, 4	dBm/SCS	-98		
	Config 2, 5		-98		
	Config 3, 6		-95		
Propagation condition			TDL-C 300 ns 100 Hz		

NOTE 1:	OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2:	The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 3:	SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4:	The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.4.5.1.3.1-1.
NOTE 5:	The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.

Table A.4.5.1.3.1-4: Void

Table A.4.5.1.3.1-5: Void

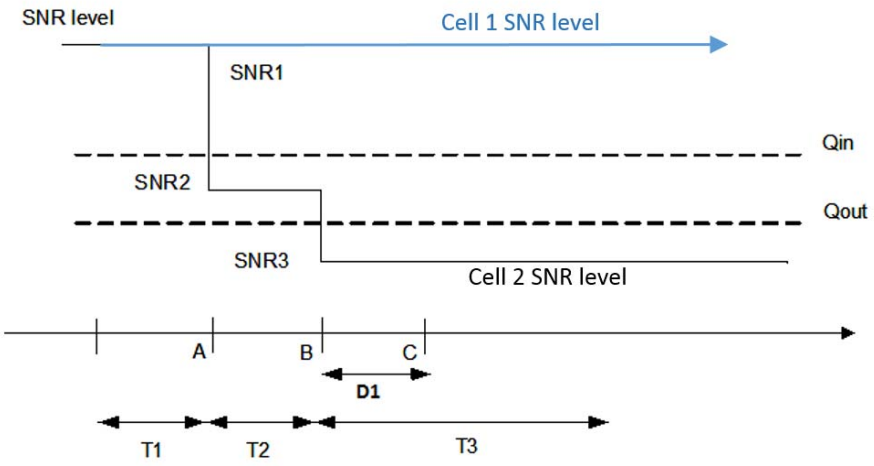


Figure A.4.5.1.3.1-1: SNR variation for out-of-sync testing

A.4.5.1.3.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 seconds after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.4 Radio Link Monitoring In-sync Test for FR1 PSCell configured with SSB-based RLM RS in DRX mode

A.4.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out-of-sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.4.5.1.4.1-1. The test parameters are given in tables A.4.5.1.4.1-2, and A.4.5.1.4.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-1. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.4.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been

expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.4.5.1.4.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.4.1-2: General test parameters for FR1 in-sync testing in DRX mode

Parameter			Unit	Value
				Test 1
Active E-UTRA PCell				Cell 1
E-UTRA RF Channel Number				1
Active PSCell				Cell 2
RF Channel Number				2
Duplex mode		Config 1, 4		FDD
		Config 2, 3, 5, 6		TDD
$BW_{channel}$		Config 1, 4	MHz	10: $N_{RB,c}$ = 52
		Config 2, 5		10: $N_{RB,c}$ = 52
		Config 3, 6		40: $N_{RB,c}$ = 106
DL initial BWP configuration		Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration		Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
TDD Configuration		Config 1, 4		Not Applicable
		Config 2, 5		TDDConf.1.1
		Config 3, 6		TDDConf.2.1
CORESET Reference Channel		Config 1, 4		CR.1.1 FDD
		Config 2, 5		CR.1.1 TDD
		Config 3, 6		CR.2.1 TDD
SSB Configuration		Config 1, 4		SSB.1 FR1
		Config 2, 5		SSB.1 FR1
		Config 3, 6		SSB.2 FR1
SMTC Configuration		Config 1, 2, 4, 5		SMTC.1
		Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1, 2, 4, 5		15 kHz
		Config 3, 6		30 kHz
PRACH Configuration		Config 1, 2, 4, 5		Table A.3.8.2.1-1
		Config 3, 6		Table A.3.8.2.1-1
SSB index assigned as RLM RS				0
OCNG parameters				OP.1
CP length				Normal
Correlation Matrix and Antenna Configuration				2x2 Low
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy		dB	0

Parameter			Unit	Value
				Test 1
		to average SSS RE energy		
		DMRS precoder granularity		REG bundle size
		REG bundle size		6
Out of sync transmission parameters		DCI format		1-0
		Number of Control OFDM symbols		2
		Aggregation level	CCE	8
		Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
		Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
		DMRS precoder granularity		REG bundle size
		REG bundle size		6
DRX Configuration				DRX.3
Gap pattern ID				N.A.
Layer 3 filtering				*Enabled*
T310 timer			ms	1000
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1, 4		CSI-RS.1.1 FDD
		Config 2, 5		CSI-RS.1.1 TDD
		Config 3, 6		CSI-RS.2.1 TDD
CSI-RS for tracking		Config 1, 4		TRS.1.1 FDD
		Config 2, 5		TRS.1.1 TDD
		Config 3, 6		TRS.1.2 TDD
T1			s	0.2
T2			s	0.2
T3			s	0.64
T4			s	0.2
T5			s	0.88
D1			s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.				

Table A.4.5.1.4.1-3: Cell specific test parameters for FR1 (Cell 2) for in-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15	-4.5	1
	Config 2, 5		1	-7	-15	-4.5	1
	Config 3, 6		1	-7	-15	-4.5	1
N_{oc}	Config 1, 4	dBm/15 kHz	-98				
	Config 2, 5		-98				

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
	Config 3, 6		-98				
N_{oc}	Config 1, 4	dBm/SCS	-98				
	Config 2, 5		-98				
	Config 3, 6		-95				
Propagation condition			TDL-C 300 ns 100 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.							
NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.4.5.1.4.1-1.							
NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in clause A.3.6.							

Table A.4.5.1.4.1-4: Void

Table A.4.5.1.4.1-5: Void

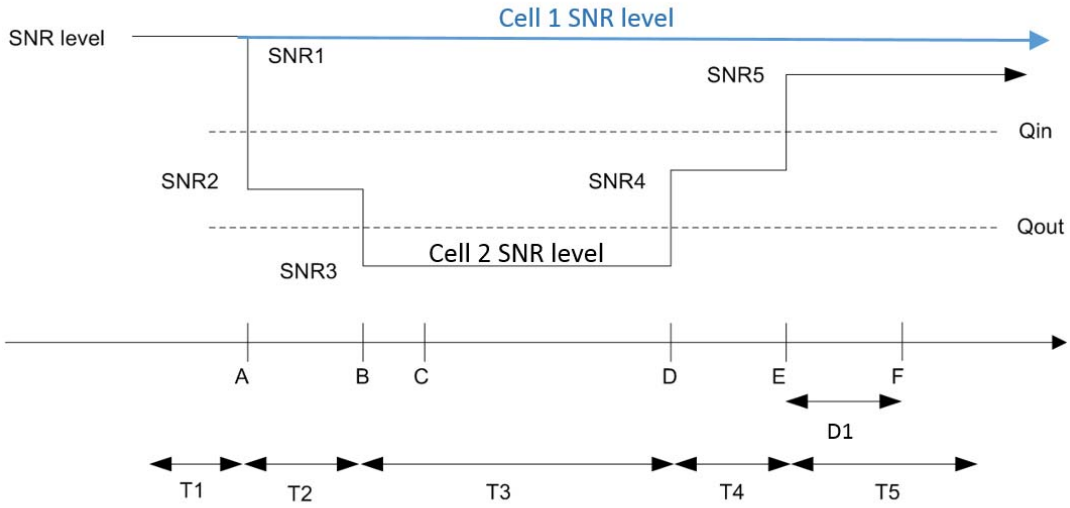


Figure A.4.5.1.4.1-1: SNR variation for in-sync testing

A.4.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 seconds after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.5 EN-DC Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with CSI-RS-based RLM in non-DRX mode

A.4.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out-of-sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in tables A.4.5.1.5.1-1, A.4.5.1.5.1-2, A.4.5.1.5.1-3, and A.4.5.1.5.1-3A below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.5.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms). In the test, SSB0 is configured as the BFD-RS.

Table A.4.5.1.5.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.5.1-2: General test parameters for FR1 PSCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
RMC CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz
	Config 3, 6		30 KHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2, 5		Resource #4 in TRS.1.1 TDD
	Config 3, 6		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to	dB	4

Parameter		Unit	Value
			Test 1
	average CSI-RS RE energy		
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for reporting	Config 1, 4		CSI-RS1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts. NOTE 2: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.5.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB			
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2, 5		1	-7	-15
	Config 3, 6		1	-7	-15
N_{oc}	Config 1, 4	dBm/15KHz	-98		
	Config 2, 5		-98		
	Config 3, 6		-98		
Propagation condition			TDL-C 300 ns 100 Hz		

Parameter	Unit	Test 1		
		T1	T2	T3
NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1. NOTE 3: NZP CSI-RS resource set configuration for CSI reporting is assigned to the UE prior to the start of time period T1. NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1. NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.1.5.1-1. NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1..				

Table A.4.5.1.5.1-3A: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned.	

Table A.4.5.1.5.1-4: Void

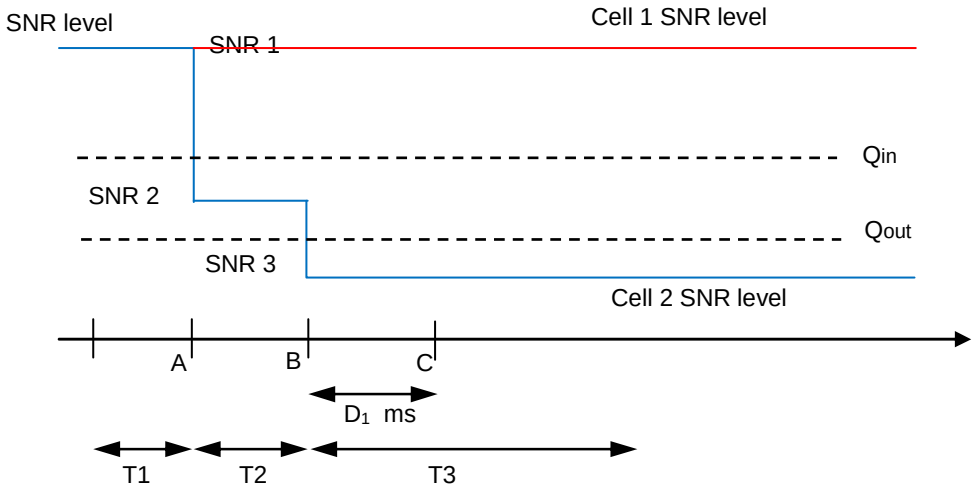


Figure A.4.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing

A.4.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C (D_1 after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.6 EN-DC Radio Link Monitoring In-sync Test for FR1 PSCell configured with CSI-RS-based RLM in non-DRX mode

A.4.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in tables A.4.5.1.6.1-1, A.4.5.1.6.1-2, and A.4.5.1.6.1-3 below. There are two cells, cell 1which is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.6.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. In the test, SSB0 is configured as the BFD-RS.

Table A.4.5.1.6.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.6.1-2: General test parameters for FR1 PSCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
RMC CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz
	Config 3, 6		30 KHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2, 5		Resource #4 in TRS.1.1 TDD
	Config 3, 6		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1

Parameter		Unit	Value
			Test 1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.44
T4		s	0.2
T5		s	0.88
T6		s	0.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts. NOTE 2: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.6.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta	dB	0				
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta	dB					
EPRE ratio of PBCH DMRS to SSSPBCH_beta	dB					
EPRE ratio of PSS to SSSPSS_beta	dB					
EPRE ratio of PBCH to PBCH DMRSSSS_beta	dB			0		

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDSCH to PDSCH DMRSPDSCH_beta		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15	-4.5	1
	Config 2, 5		1	-7	-15	-4.5	1
	Config 3, 6		1	-7	-15	-4.5	1
N_{oc}	Config 1, 4	dBm/15KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.4.5.1.6.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1..

Table A.4.5.1.6.1-3A: Void

Table A.4.5.1.6.1-4: Void

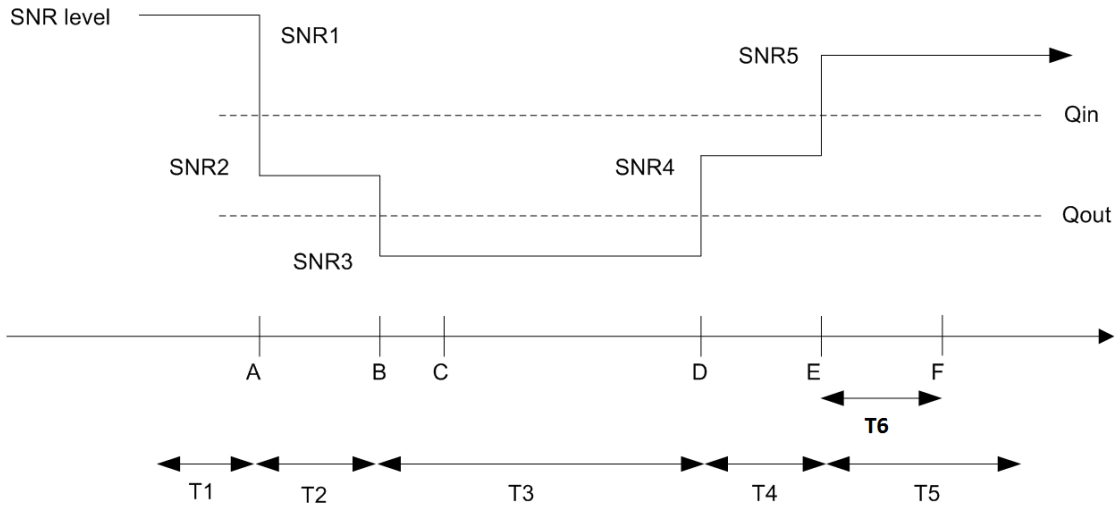


Figure A.4.5.1.6.1-1: SNR variation for CSI-RS in-sync testing

A.4.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.7 EN-DC Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with CSI-RS-based RLM in DRX mode

A.4.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out-of-sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in tables A.4.5.1.7.1-1, A.4.5.1.7.1-2, and A.4.5.1.7.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.7.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. In the test, SSB0 is configured as the BFD-RS.

Table A.4.5.1.7.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.7.1-2: General test parameters for FR1 PSCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
RMC CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz
	Config 3, 6		30 KHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD

Parameter		Unit	Value
			Test 1
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2, 5		Resource #4 in TRS.1.1 TDD
	Config 3, 6		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts. NOTE 2: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.7.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4		
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta		dB			
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB	0		
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB			
EPRE ratio of PBCH to PBCH DMRSSSS_beta		dB			
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMR		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2, 5		1	-7	-15
	Config 3, 6		1	-7	-15

Parameter		Unit	Test 1		
			T1	T2	T3
N_{oc}	Config 1, 4	dBm/15KHz	-98		
	Config 2, 5		-98		
	Config 3, 6		-98		
Propagation condition			TDL-C 300 ns 100 Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.1.7.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1..

Table A.4.5.1.7.1-3A: Void

Table A.4.5.1.7.1-4: Void

Table A.4.5.1.7.1-5: Void

Table A.4.5.1.7.1-6: Void

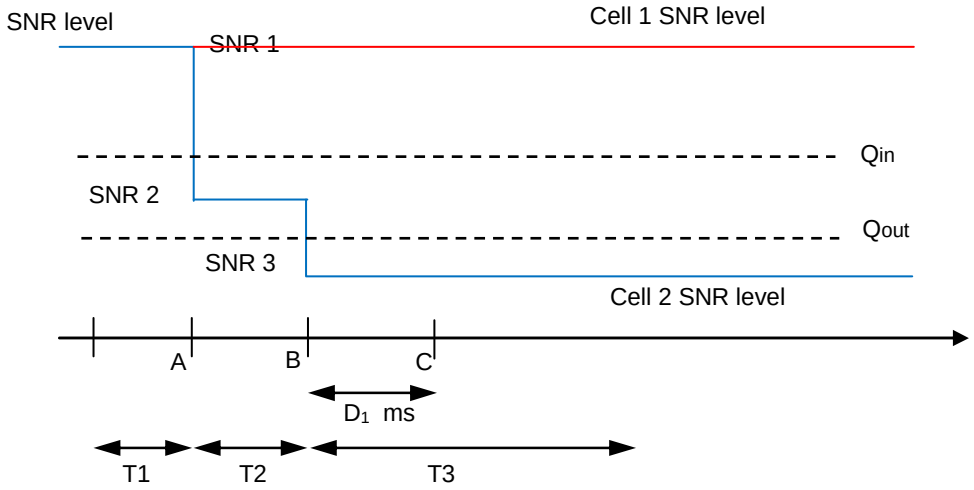


Figure A.4.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing

A.4.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C (D_1 after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.8 EN-DC Radio Link Monitoring In-sync Test for FR1 PSCell configured with CSI-RS-based RLM in DRX mode

A.4.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS in-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.4.5.1.8.1-1, A.4.5.1.8.1-2, A.4.5.1.8.1-3 and A.4.5.1.8.1-3A below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the NR PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.8.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms). In the test, SSB0 is configured as the BFD-RS.

Table A.4.5.1.8.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.8.1-2: General test parameters for FR1 PSCell for CSI-RS in-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
RMC CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz
	Config 3, 6		30 KHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2, 5		Resource #4 in TRS.1.1 TDD
	Config 3, 6		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1

Parameter		Unit	Value
			Test 1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	1.24
T4		s	0.2
T5		s	1.88
T6		s	1.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts. NOTE 2: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.8.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta	dB	0				
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta	dB					
EPRE ratio of PBCH DMRS to SSSPBCH_beta	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB	0				
EPRE ratio of PSS to SSSSSS_beta		dB					
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15	-4.5	1
	Config 2, 5		1	-7	-15	-4.5	1
	Config 3, 6		1	-7	-15	-4.5	1
N_{oc}	Config 1, 4	dBm/15KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting is assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.4.5.1.8.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.

Table A.4.5.1.8.1-3A: Measurement gap configuration for FR1 CSI-RS in-sync radio link monitoring in DRX mode

Field	Test 1
	Value
gapOffset	0

NOTE 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned.

Table A.4.5.1.8.1-4: Void

Table A.4.5.1.8.1-5: Void

Table A.4.5.1.8.1-6: Void

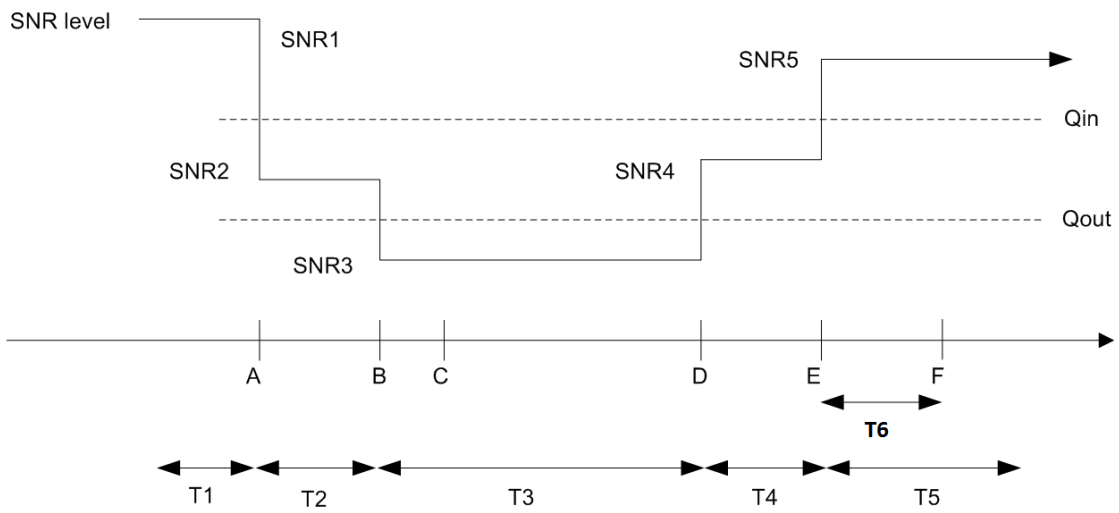


Figure A.4.5.1.8.1-1: SNR variation for CSI-RS in-sync testing

A.4.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.9 Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

A.4.5.1.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out-of-sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements specified in clause 8.1.2.4 for UE fulfilling good serving cell quality criterion and low mobility criterion, if configured.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.4.5.1.9.1-1. The test parameters are given in tables A.4.5.1.9.1-2 and A.4.5.1.9.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-1. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.9.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.4.5.1.9.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.9.1-2: General test parameters for FR1 out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
BWchannel	Config 1, 4	MHz	10: NRB,c = 52
	Config 2, 5		10: NRB,c = 52
	Config 3, 6		40: NRB,c = 106
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 kHz
	Config 3, 6		30 kHz
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.1-1
	Config 3, 6		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
T1		s	5.2

Parameter	Unit	Value
		Test 1
T2	s	0.68
T3	s	2.48
D1	s	2.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.		

Table A.4.5.1.91-3: Cell specific test parameters for FR1 (Cell 2) for out-of-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 4	dB	1	1	-15
	Config 2, 5		1	1	-15
	Config 3, 6		1	1	-15
N_{oc}	Config 1, 4	dBm/15 kHz	-98		
	Config 2, 5		-98		
	Config 3, 6		-98		
N_{oc}	Config 1, 4	dBm/SCS	-98		
	Config 2, 5		-98		
	Config 3, 6		-95		
goodServingCellEvaluationRLM			configured		
offset in goodServingCellEvaluationRLM		dB	Not configured		
goodServingCellEvaluationRLM		dB	0		
s-SearchDeltaP-Connected		dB	3		
t-SearchDeltaP-Connected		s	5		
Propagation condition			TDL-C 300 ns 100 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.4.5.1.9.1-1. NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.					

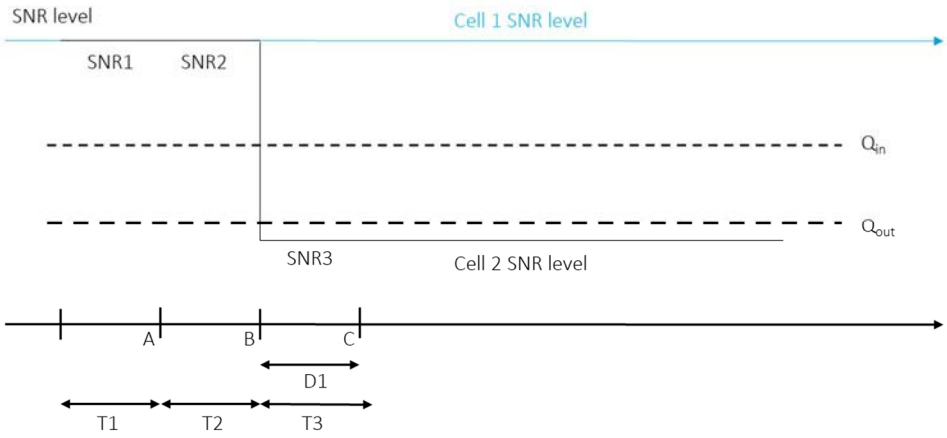


Figure A.4.5.1.9.1-1: SNR variation for out-of-sync testing

A.4.5.1.9.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 seconds after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.10 EN-DC Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with CSI-RS-based RLM in non-DRX mode when CD-SSB is outside active BWP

A.4.5.1.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out-of-sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used and when CD-SSB is outside active BWP. This test will partly verify the FR1 PSCell CSI-RS out-of-sync radio link monitoring requirements in clause 8.1.

The test is for UE supporting *rlm-BM-BFD-CSI-RS-OutsideActiveBWP-r18* and the UE is not required past legacy test in clause A.4.5.1.5.

The test environment is the same as in clause A.4.5.1.5 with following exceptions in Table A.4.5.1.5.1-2.

The value of parameter “DL dedicated BWP configuration” is DLBWP.1.2. The value of parameter “UL dedicated BWP configuration” is ULBWP.1.2.

NOTE: The starting PRB index of the SSB can be any possible PRB index of the RF channel BW occurring after the last PRB of the DL active BWP.

The test requirements are the same as for A.4.5.1.5.2.

A.4.5.1.11 Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with SSB-based RLM RS in non-DRX mode when CD-SSB is outside active BWP

A.4.5.1.11.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* properly detects the out-of-sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when CD-SSB is outside active BWP. This test will partly verify the FR1 PSCell radio link monitoring requirements in clause 8.1.

The test environment is the same as in clause A.4.5.1.1 with following exceptions in Table A.4.5.1.1.1-2.

Parameter		Unit	Value
			Test 1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.2
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.2

A.4.5.1.11.2 Test Requirements

The test requirements are the same as in clause A.4.5.1.1.2.

A.4.5.1.12 EN-DC Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with SSB-based RLM RS in non-DRX mode for UE supporting NCD-SSB based measurement outside active BWP

A.4.5.1.12.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out-of-sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell for UE supporting FG 53-3. This test will partly verify the FR1 PSCell radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.4.5.1.12.1-1. The test parameters are given in tables A.4.5.1.12.1-2, A.4.5.1.12.1-3, and A.4.5.1.12.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-1. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.12-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

Table A.4.5.1.12.1-1: Supported test configurations for FR1 PSCell for UE supporting NCD-SSB based measurement outside active BWP

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.12.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode for UE supporting NCD-SSB based measurement outside active BWP

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
$BW_{channel}$	Config 1, 4	MHz	10: $N_{RB,c}$ = 52
	Config 2, 5		10: $N_{RB,c}$ = 52
	Config 3, 6		20: $N_{RB,c}$ = 51
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1

Parameter			Unit	Value
				Test 1
		Config 3, 6		TDDConf.2.1
CORESET Reference Channel		Config 1, 4		CR.1.1 FDD
		Config 2, 5		CR.1.1 TDD
		Config 3, 6		CR.2.1 TDD
SSB Configuration		Config 1, 4		SSB.1 FR1
		Config 2, 5		SSB.1 FR1
		Config 3, 6		SSB.2 FR1
NCD-SSB Configuration		Config 1		SSB.9 FR1
		Config 2		SSB.9 FR1
		Config 3		SSB.10 FR1
SMTC Configuration		Config 1, 2, 4, 5		SMTC.10
		Config 3, 6		SMTC.10
PDSCH/PDCCH subcarrier spacing		Config 1, 2, 4, 5		15 kHz
		Config 3, 6		30 kHz
PRACH Configuration		Config 1, 2, 4, 5		Table A.3.8.2.1-1
		Config 3, 6		Table A.3.8.2.1-1
SSB index assigned as RLM RS				0
OCNG parameters				OP.1
CP length				Normal
Correlation Matrix and Antenna Configuration				2x2 Low
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				*gp0*
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1, 4		CSI-RS.1.1 FDD
		Config 2, 5		CSI-RS.1.1 TDD
		Config 3, 6		CSI-RS.2.1 TDD
CSI-RS for tracking		Config 1, 4		TRS.1.1 FDD
		Config 2, 5		TRS.1.1 TDD
		Config 3, 6		TRS.1.2 TDD
T1			s	0.2
T2			s	0.48
T3			s	0.48
D1			s	0.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.				

Table A.4.5.1.12.1-3: Cell specific test parameters for FR1 (Cell 2) for out-of-sync radio link monitoring tests in non-DRX mode for UE supporting NCD-SSB based measurement outside active BWP

Parameter	Unit	Test 1		
		T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS	dB	4		
EPRE ratio of PDCCH to PDCCH DMRS	dB	0		
EPRE ratio of PBCH DMRS to SSS	dB			
EPRE ratio of PBCH to PBCH DMRS	dB			
EPRE ratio of PSS to SSS	dB			

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDSCH DMRS to SSS		dB	0		
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2, 5		1	-7	-15
	Config 3, 6		1	-7	-15
N_{oc}	Config 1, 4	dBm/15 kHz	-98		
	Config 2, 5		-98		
	Config 3, 6		-98		
N_{oc}	Config 1, 4	dBm/SCS	-98		
	Config 2, 5		-98		
	Config 3, 6		-95		
Propagation condition			TDL-C 300 ns 100 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.					

Table A.4.5.1.12.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap).	

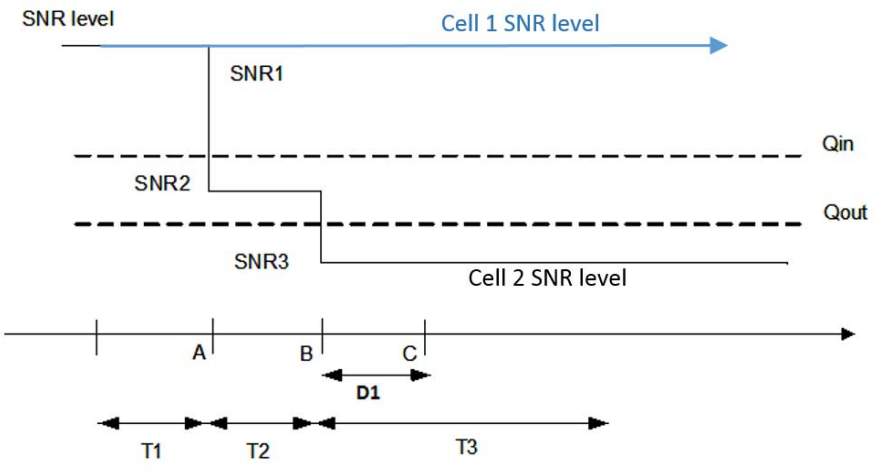


Figure A.4.5.1.12-1: SNR variation for out-of-sync testing

A.4.5.1.12.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 seconds after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2 Interruption

A.4.5.2.1 E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

A.4.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in TS 38.133 clause 8. 2.1.2.1. Supported test configurations are shown in table A.4.5.2.1.1-1.

The general test parameters and NR cell specific test parameters are given in Tables A.4.5.2.1.1-2 and A.4.5.2.1.1-3. The E-UTRAN PCell DRX configuration parameters are given in Table A.4.5.2.1.1-2 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are two cells: Cell 1 and Cell 2. Cell 1 is LTE PCell and Cell 2 is NR FR1 PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. Cell 1 shall be configured as LTE PCell and Cell 2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. CORESET indicating a new transmission on PSCell shall be sent continuously during the entire time duration to ensure UE would not enter DRX state on PSCell.

Table A.4.5.2.1.1-1: Interruption at transitions between active and non-active during DRX supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.1.1-2: General test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other is NR RF channel
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell 2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell 1 and Cell 2
DRX		DRX.4	DRX related parameters are defined in Table A.3.3.4-1
Measurement gap pattern Id		OFF	
T1	s	10	

Table A.4.5.2.1.1-3: NR cell specific test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106

Parameter		Unit	Cell 2
Initial DL BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1
	Config 3,6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS (Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96
	Config 3,6	dBm/38.16 MHz	-52.86
Time offset to Cell 1 Note 4		µs	33
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells

Table A.4.5.2.1.1-4: Void

A.4.5.2.1.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed X slots as defined in Table A.4.5.2.1.2-1.

Table A.4.5.2.1.2-1: Interruption length X at transition between active and non-active during DRX

μ	NR Slot length (ms)	Interruption length X (slot)
		Sync
0	1	1
1	0.5	1

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.2 E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

A.4.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in TS 38.133 clause 8.2.1.2.1. Supported test configurations are shown in table A.4.5.2.2.1-1.

The general test parameters and NR cell specific test parameters are given in Tables A.4.5.2.2.1-2 and A.4.5.2.2.1-3. The E-UTRAN PCell DRX configuration parameters are given in Table A.4.5.2.2.1-2 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are two cells: Cell 1 and Cell 2. Cell 1 is LTE PCell and Cell 2 is NR FR1 PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, Cell 1 shall be configured as LTE PCell and Cell 2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. PDCCH indicating a new transmission on PSCell shall be sent continuously during the entire time duration to ensure UE would not enter DRX state on PSCell.

Table A.4.5.2.2.1-1: Interruption at transitions between active and non-active during DRX supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.2.1-2: General test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other is NR RF channel
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell 2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell 1 and Cell 2
DRX		DRX.4	DRX related parameters are defined in Table A.3.3.4-1
Measurement gap pattern Id		OFF	
T1	s	10	

Table A.4.5.2.2.1-3: NR cell specific test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Unit	Cell 2
Frequency Range		FR1

Parameter		Unit	Cell 2
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
Initial DL BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1
	Config 3,6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96
	Config 3,6	dBm/38.16 MHz	-52.86
Time offset to Cell 1 Note 4		µs	500
Propagation Condition			AWGN

Parameter	Unit	Cell 2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells		

Table A.4.5.2.2.1-4: Void

A.4.5.2.2.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed X slots as defined in Table A.4.5.2.2.2-1.

Table A.4.5.2.2.2-1: Interruption length X at transition between active and non-active during DRX

μ	NR Slot length (ms)	Interruption length X (slots) Async
0	1	2
1	0.5	2

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.3 E-UTRAN – NR FR1 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

A.4.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in TS 38.133 clause 8.2.1.2. Supported test configurations for LTE PCell and NR PSCell are shown in table A.4.5.2.3.1-1. Supported test configurations for NR SCell are shown in table A.4.5.2.3.1-1A. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCell are chosen independently.

The general test parameters and NR cell specific test parameters are given in Tables A.4.5.2.3.1-2, A.4.5.2.3.1-3 and A.4.5.2.3.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are three cells: Cell 1, Cell 2 and Cell 3. Cell 1 is LTE PCell, Cell 2 and Cell 3 is NR PSCell and NR deactivated SCell. Cell 1 shall be configured as LTE PCell and Cell 2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell 1 and Cell 2 and the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector. During T1, LTE PCell and NR PSCell are continuously scheduled in DL

Table A.4.5.2.3.1-1: Interruptions during measurements on deactivated NR SCC supported test configurations for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.4.5.2.3.1-1A: Interruptions during measurements on deactivated NR SCC supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.4.5.2.3.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Active PSCell		Cell 2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Deactivated SCell on NR RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (*measCycleSCell)*	ms	640	
T1	s	10	

Table A.4.5.2.3.1-3: NR cell specific test parameters for NR PSCell for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		Note 8
	Config 2,5		Note 8
	Config 3,6		Note 8
$BW_{occupied}$	Config 1,4	RB	52 Note 6
	Config 2,5		52 Note 6
	Config 3,6		106 Note 7
Initial DL BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1
	Config 3,6		ULBWP.1.1
	Config 1,4		SR.1.1 FDD

Parameter		Unit	Cell 2
PDSCH Reference measurement channel	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
OCNG Patterns	Config 1,2,4,5		OP.1 Note 6
	Config 3,6		OP.1 Note 7
SMTC Configuration			SMTC.1
TCI state			TCI.State.0
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/ 9.36 MHz	-58.96
	Config 3,6	dBm/ 38.16 MHz	-52.86
Time offset to Cell 1 Note 4		µs	3 for intra-band EN-DC, 33 for inter-band EN-DC
Time offset to Cell 2 Note 5		µs	-
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells

NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.

NOTE 7: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.

NOTE 8: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.

Table A.4.5.2.3.1-4: NR cell specific test parameters for NR SCell for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter		Unit	Cell 3
Frequency Range			FR1
Duplex mode	$Config_{SCell}$ 1		FDD
	$Config_{SCell}$ 2,3		TDD
TDD configuration	$Config_{SCell}$ 1		Not Applicable
	$Config_{SCell}$ 2		TDDConf.1.1
	$Config_{SCell}$ 3		TDDConf.2.1
$BW_{channel}$	$Config_{SCell}$ 1		Note 8
	$Config_{SCell}$ 2		Note 8
	$Config_{SCell}$ 3		Note 8
$BW_{occupied}$	$Config_{SCell}$ 1	RB	52 Note 6
	$Config_{SCell}$ 2		52 Note 6
	$Config_{SCell}$ 3		106 Note 7
Initial DL BWP Configuration	$Config_{SCell}$ 1		DLBWP.0.1
	$Config_{SCell}$ 2		DLBWP.0.1
	$Config_{SCell}$ 3		DLBWP.0.1
Dedicated DL BWP Configuration	$Config_{SCell}$ 1		DLBWP.1.1
	$Config_{SCell}$ 2		DLBWP.1.1
	$Config_{SCell}$ 3		DLBWP.1.1
Initial UL BWP Configuration	$Config_{SCell}$ 1		ULBWP.0.1
	$Config_{SCell}$ 2		ULBWP.0.1
	$Config_{SCell}$ 3		ULBWP.0.1
Dedicated UL BWP Configuration	$Config_{SCell}$ 1		ULBWP.1.1
	$Config_{SCell}$ 2		ULBWP.1.1
	$Config_{SCell}$ 3		ULBWP.1.1
PDSCH Reference measurement channel	$Config_{SCell}$ 1		-
	$Config_{SCell}$ 2		-
	$Config_{SCell}$ 3		-
RMSI CORESET parameters	$Config_{SCell}$ 1		CR.1.1 FDD
	$Config_{SCell}$ 2		CR.1.1 TDD
	$Config_{SCell}$ 3		CR.2.1 TDD
PDCCH CORESET parameters	$Config_{SCell}$ 1		CCR.1.1 FDD
	$Config_{SCell}$ 2		CCR.1.1 TDD
	$Config_{SCell}$ 3		CCR.2.1 TDD
TRS configuration	$Config_{SCell}$ 1		TRS.1.1 FDD
	$Config_{SCell}$ 2		TRS.1.1 TDD
	$Config_{SCell}$ 3		TRS.1.2 TDD
OCNG Patterns	$Config_{SCell}$ 1,2		OP.1 Note 6
	$Config_{SCell}$ 3		OP.1 Note 7
SMTC Configuration			SMTC.1
TCI state			TCI.State.0
SSB Configuration	$Config_{SCell}$ 1,2		SSB.1 FR1
	$Config_{SCell}$ 3		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104

Parameter		Unit	Cell 3
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	$Config_{SCell}$ 1,2	dBm/9.36 MHz	-58.96
	$Config_{SCell}$ 3	dBm/38.16 MHz	-52.86
Time offset to Cell 1 Note 4		µs	3 + Time offset to Cell 2 for intra-band EN-DC, 33 + Time offset to Cell 2 for inter-band EN-DC
Time offset to Cell 2 Note 5		µs	3
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells

NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.

NOTE 7: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.

NOTE 8: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.

A.4.5.2.3.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell.

If the NR PSCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on NR PSCell immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in table A.4.5.2.3.2-1.

If the NR PSCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on PSCell no earlier than 1 slot before an SMTC and no later than 1 slot after the SMTC. The interruption on NR PSCell shall not exceed the value defined in Table A.4.5.2.3.2-2.

Table A.4.5.2.3.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
0	1	1
1	0.5	1

Table A.4.5.2.3.2-2: Interruption duration if the NR PSCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length
0	1	2 + SMTC duration
1	0.5	2 + SMTC duration

For synchronous inter-band EN-DC, the UE is only allowed to cause interruptions on E-UTRA PCell immediately before and immediately after an SMTC. Each interruption on E-UTRA PCell shall not exceed 1 subframe.

For synchronous intra-band EN-DC, the UE is only allowed to cause an interruption on E-UTRA PCell no earlier than 1 subframe before an SMTC and no later than 1 subframe after the SMTC. The interruption on E-UTRA PCell shall not exceed SMTC duration + 2 subframes.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.4 E-UTRAN – NR FR1 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

A.4.5.2.4.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in TS 38.133 clause 8.2.1.2.5. Supported test configurations for LTE PCell and NR PSCell are shown in table A.4.5.2.4.1-1. Supported test configurations for NR SCell are shown in table A.4.5.2.4.1-1. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCell are chosen independently.

The general test parameters and NR cell specific test parameters are given in Tables A.4.5.2.4.1-2, A.4.5.2.4.1-3 and A.4.5.2.4.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are three cells: Cell 1, Cell 2 and Cell 3. Cell 1 is LTE PCell, Cell 2 and Cell 3 is NR PSCell and NR deactivated SCell. Cell 1 shall be configured as LTE PCell and Cell 2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell 1 and Cell 2and the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.4.5.2.4.1-1: Interruptions during measurements on deactivated NR SCC supported test configurations for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.4.5.2.4.1-1A: Interruptions during measurements on deactivated NR SCC supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.4.5.2.4.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell 2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Deactivated SCell on NR RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3

DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (*measCycleSCell)*	ms	640	
T1	s	10	

Table A.4.5.2.4.1-3: NR cell specific test parameters for NR PSCell for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		Note 8
	Config 2,5		Note 8
	Config 3,6		Note 8
$BW_{occupied}$	Config 1,4	RB	52 Note 6
	Config 2,5		52 Note 6
	Config 3,6		106 Note 7
Initial BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1
	Config 3,6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
OCNG Patterns	Config 1,2,4,5		OP.1 Note 6
	Config 3,6		OP.1 Note 7
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
SMTC Configuration			SMTC.1
TCI state			TCI.State.0
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 Hz	-104
SS-RSRP Note 3		dBm/15 kHz	-87

Parameter		Unit	Cell 2
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io^{Note3}	Config 1,2,4,5	dBm/9.36 MHz	-58.96
	Config 3,6	dBm/38.16 MHz	-52.86
Time offset to Cell 1 Note 4	Config 1,2,4,5	µs	500
	Config 3,6		250
Time offset to Cell 2 Note 5		µs	-
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells
NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 8: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.

Table A.4.5.2.4.1-4: NR cell specific test parameters for NR SCell for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter		Unit	Cell 3
Frequency Range			FR1
Duplex mode	$Config_{SCell}$ 1		FDD
	$Config_{SCell}$ 2,3		TDD
TDD configuration	$Config_{SCell}$ 1		Not Applicable
	$Config_{SCell}$ 2		TDDConf.1.1
	$Config_{SCell}$ 3		TDDConf.2.1
$BW_{channel}$	$Config_{SCell}$ 1		Note 8
	$Config_{SCell}$ 2		Note 8
	$Config_{SCell}$ 3		Note 8
$BW_{occupied}$	$Config_{SCell}$ 1	RB	52 Note 6
	$Config_{SCell}$ 2		52 Note 6
	$Config_{SCell}$ 3		106 Note 7
Initial BWP Configuration	$Config_{SCell}$ 1		DLBWP.0.1
	$Config_{SCell}$ 2		DLBWP.0.1
	$Config_{SCell}$ 3		DLBWP.0.1
Dedicated DL BWP Configuration	$Config_{SCell}$ 1		DLBWP.1.1
	$Config_{SCell}$ 2		DLBWP.1.1
	$Config_{SCell}$ 3		DLBWP.1.1
Initial UL BWP Configuration	$Config_{SCell}$ 1		ULBWP.0.1
	$Config_{SCell}$ 2		ULBWP.0.1
	$Config_{SCell}$ 3		ULBWP.0.1
Dedicated UL BWP Configuration	$Config_{SCell}$ 1		ULBWP.1.1
	$Config_{SCell}$ 2		ULBWP.1.1
	$Config_{SCell}$ 3		ULBWP.1.1
PDSCH Reference measurement channel	$Config_{SCell}$ 1		-
	$Config_{SCell}$ 2		-
	$Config_{SCell}$ 3		-
RMSI CORESET parameters	$Config_{SCell}$ 1		CR.1.1 FDD
	$Config_{SCell}$ 2		CR.1.1 TDD
	$Config_{SCell}$ 3		CR.2.1 TDD
PDCCH CORESET parameters	$Config_{SCell}$ 1		CCR.1.1 FDD
	$Config_{SCell}$ 2		CCR.1.1 TDD
	$Config_{SCell}$ 3		CCR.2.1 TDD
TRS configuration	$Config_{SCell}$ 1		TRS.1.1 FDD
	$Config_{SCell}$ 2		TRS.1.1 TDD

Parameter		Unit	Cell 3
	$Config_{SCell}$ 3		TRS.1.2 TDD
OCNG Patterns	$Config_{SCell}$ 1,2		OP.1 Note 6
	$Config_{SCell}$ 3		OP.1 Note 7
SSB Configuration	$Config_{SCell}$ 1,2		SSB.1 FR1
	$Config_{SCell}$ 3		SSB.2 FR1
SMTC Configuration			SMTC.1
TCI state			TCI.State.0
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	$Config_{SCell}$ 1,2	dBm/ 9.36 MHz	-58.96
	$Config_{SCell}$ 3	dBm/ 38.16 MHz	-52.86
Time offset to Cell 1 Note 4	$Config_{SCell}$ 1,2	µs	500 + Time offset to Cell 2
	$Config_{SCell}$ 3		250 + Time offset to Cell 2
Time offset to Cell 2 Note 5		µs	3
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells
NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 8: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.

A.4.5.2.4.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell.

If the NR PSCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on NR PSCell immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in table A.4.5.2.4.2-1.

If the NR PSCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on PSCell no earlier than 1 slot before an SMTC and no later than 1 slot after the SMTC. The interruption on NR PSCell shall not exceed the value defined in Table A.4.5.2.4.2-2.

Table A.4.5.2.4.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
0	1	1
1	0.5	1

Table A.4.5.2.4.2-2: Interruption duration if the NR PSCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length
0	1	2 + SMTC duration
1	0.5	2 + SMTC duration

For asynchronous inter-band EN-DC, the UE is only allowed to cause interruptions on E-UTRA PCell immediately before and immediately after an SMTC. Each interruption on E-UTRA PCell shall not exceed 2 subframe.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.5 E-UTRAN – NR FR1 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

A.4.5.2.5.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in TS 38.133 clause 8.2.1.2.5. Supported test configurations are shown in table A.4.5.2.5.1-1.

The general test parameters and NR cell specific test parameters are given in table A.4.5.2.5.1-2 and A.4.5.2.5.1-3 below. And the E-UTRAN cell specific test parameters can refer to table A.3.7.2.1-1. In the test there are three cells: Cell 1, Cell 2 and Cell 3. Cell 1 and Cell 3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell 2 is NR FR1 PSCell. Cell 1 shall be configured as LTE PCell and Cell 2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell 1 and Cell 2 and the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated E-UTRAN SCells is received at the UE antenna connector. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.4.5.2.5.1-1: Interruptions during measurements on deactivated E-UTRAN SCC supported test configurations

Config	Description
	LTE PCell + NR PSCell Note 2
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The duplex mode of the LTE SCell is determined based on the band combination to be tested.	

Table A.4.5.2.5.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is NR RF channel and the other two are E-UTRAN RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Active PSCell		Cell 2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Deactivated SCell on E-UTRAN RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (*measCycleSCell)*	ms	640	
T1	s	10	

Table A.4.5.2.5.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
Initial DL BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1
	Config 3,6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
TCI state			TCI.State.0
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96
	Config 3,6	dBm/38.16 MHz	-52.86
Time offset to Cell 1 Note 4		µs	33
Propagation Condition			AWGN

Parameter	Unit	Cell 2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells		

A.4.5.2.5.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed X defined in Table A.4.5.2.5.2-1 if the NR PSCell is not in the same band as the E-UTRAN deactivated SCell or Y in Table A.4.5.2.5.2-1 if the NR PSCell is in the same band as the E-UTRAN deactivated SCell.

Table A.4.5.2.5.2-1: Interruption length X and Y at measurements on deactivated E-UTRA SCC

μ	NR Slot length (ms)	Interruption length X slot	Interruption length Y slot
		Sync	
0	1	1	1
1	0.5	1	1

Each interruption on E-UTRAN PCell shall not exceed 1 subframe if the PCell is not in the same band as the deactivated SCell, or 5 subframes if the PCell is in the same band as the deactivated SCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.6 E-UTRAN – NR FR1 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

A.4.5.2.6.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in TS 38.133 clause 8.2.1.2.5. Supported test configurations are shown in table A.4.5.2.6.1-1.

The general test parameters and NR cell specific test parameters are given in table A.4.5.2.6.1-1 and A.4.5.2.6.1-2 below. And the E-UTRAN cell specific test parameters can refer to table A.3.7.2.1-1. In the test there are three cells: Cell 1, Cell 2 and Cell 3. Cell 1 and Cell 3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell 2 is NR FR1 PSCell. Cell 1 shall be configured as LTE PCell and Cell 2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell 1 and Cell 2 and the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

T antenna connector. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.4.5.2.6.1-1: Interruptions during measurements on deactivated E-UTRAN SCC supported test configurations

Config	Description
	LTE PCell + NR PSCell Note 2
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

NOTE 1: The UE is only required to be tested in one of the supported test configurations
NOTE 2: The duplex mode of the LTE SCell is determined based on the band combination to be tested.

Table A.4.5.2.6.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is NR RF channel and the other two are E-UTRAN RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell 2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Deactivated SCell on E-UTRAN RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (*measCycleSCell)*	ms	640	
T1	s	10	

Table A.4.5.2.6.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
Initial DL BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1
	Config 3,6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
TCI state			TCI.State.0
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS			

Parameter		Unit	Cell 2
EPRE ratio of PBCH DMRS to SSS		dB	0
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96
	Config 3,6	dBm/38.16 MHz	-52.86
Time offset to Cell 1 Note 4		µs	500
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells

A.4.5.2.6.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on E-UTRAN PCell and NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.4.5.2.6.2-1 and Table A.4.5.2.6.2-2.

Table A.4.5.2.6.2-1: Interruption duration if the NR PSCell is not in the same band as the E-UTRAN deactivated SCell

μ	NR Slot length (ms)	Interruption length (slots)
0	1	2
1	0.5	2

Table A.4.5.2.6.2-2: Interruption duration if the NR PSCell is in the same band as the E-UTRAN deactivated SCell

μ	NR Slot length (ms)	Interruption length
0	1	2 slots + SMTC duration
1	0.5	2 slots + SMTC duration

Each interruption on E-UTRAN PCell shall not exceed 1 subframe if the PCell is not in the same band as the deactivated SCell, or 5 subframes if the PCell is in the same band as the deactivated SCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.7 Void

A.4.5.2.8 E-UTRAN - NR FR1 interruptions at NR SRS carrier based switching in asynchronous EN-DC

A.4.5.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that when a UE needs to transmit aperiodic SRS, the UE can perform carrier based switching to one carrier not configured for PUCCH/PUSCH transmission from a CC with PUCCH/PUSCH transmission. The test will verify the UE missed ACK/NACK does not exceed the interruption requirements on E-UTRAN PCell and NR PSCell in clause 8.2.1.2.12. Supported test configurations are shown in table A.4.5.2.8.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.8.1-2 and A 4.5.2.8.1-3 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are three cells: Cell 1, Cell 2 and Cell 3. Cell 1 is E-UTRAN PCell, Cell 2 is NR PSCell in FR1 with PUCCH/PUSCH transmission, and Cell 3 is an activated NR SCell in FR1 which operates in downlink without PUCCH/PUSCH transmission. The UE is configured with the SRS carrier based switching between PSCell and SCell.

The test consists of two successive time periods, with duration of T1 and T2, respectively. Throughout the test the UE shall be continuously scheduled on PCell and PSCell. Immediately at the beginning of T2, a PDCCH with TPC-SRS-RNTI is sent to the UE to initiate NR SRS switching.

Table A.4.5.2.8.1-1: Interruptions at SRS carrier switching supported test configurations in FR1

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, PSCell FDD duplex mode, SCell TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, PSCell TDD duplex mode, SCell TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, PSCell FDD duplex mode, SCell TDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, PSCell TDD duplex mode, SCell TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.8.1-2: General test parameters for E-UTRAN – NR FR1 interruptions at SRS carrier based switching in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell 2	Configured PSCell on NR RF channel number 2.
Configured SCell		Cell 3	Configured activated secondary cell on NR RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3.
DRX		OFF	Continuous monitoring of primary cell
Filter coefficient		0	L3 filtering is not used
T1	s	5	
T2	ms	40	UE shall perform SRS switching during T2

Table A.4.5.2.8.1-3: NR Cell specific test parameters for E-UTRAN – NR FR1 interruptions at SRS carrier based switching in asynchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Frequency Range			FR1	FR1
Duplex mode	Config 1,4		FDD	TDD
	Config 2,3,5,6		TDD	TDD
TDD configuration	Config 1,4		Not Applicable	TDDConfig.1.1
	Config 2,5		TDDConf.1.1	TDDConfig.1.1
	Config 3,6		TDDConf.2.1	TDDConfig.2.1
$BW_{channel}$	Config 1,2,4,5	MHz	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52

Parameter		Unit	Cell 2	Cell 3
	Config 3,6		40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106
DL Initial BWP configuration	Config 1-6		DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1-6		DLBWP.1.1	DLBWP.1.1
UL Initial BWP configuration	Config 1-6		ULBWP.0.1	-
UL dedicated BWP configuration	Config 1-6		ULBWP.1.1	-
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	SR.1.1 TDD
	Config 2,5		SR.1.1 TDD	SR.1.1 TDD
	Config 3,6		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	CR.1.1 TDD
	Config 2,5		CR.1.1 TDD	CR.1.1 TDD
	Config 3,6		CR.2.1 TDD	CR.2.1 TDD
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	CCR.1.1 TDD
	Config 2,5		CCR.1.1 TDD	CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1
TRS configuration	Config 1,4		TRS.1.1 FDD	TRS.1.1 TDD
	Config 2,5		TRS.1.1 TDD	TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD	TRS.1.2 TDD
SMTC configuration			SMTC.1	SMTC.1
SSB configuration	Config 1,2,4,5		SSB.1 FR1	SSB.1 FR1
	Config 3,6		SSB.2 FR1	SSB.2 FR1
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz	15 kHz
	Config 3,6		30 kHz	30 kHz
SRS Configuration	Config 1,2,4,5	kHz	-	SRS.4 TDD
	Config 3,6		-	SRS.5 TDD
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz	-
	Config 3,6		30 kHz	-
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-104	-104
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-104	-104
	Config 3,6		-101	-101
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87	-87
	Config 3,6		-84	-84
$\hat{E}_s / I_{ot}$		dB	17	17
$\hat{E}_s / N_{oc}$		dB	17	17
Io Note3	Config 1,2,4,5	dBm/ 9.36 MHz	-58.96	-58.96
	Config 3,6	dBm/ 38.16 MHz	-52.86	-52.86

Parameter	Unit	Cell 2	Cell 3
Time offset to Cell 1 Note 5	μs	-	3
Propagation condition	-	AWGN	AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.			

Table A.4.5.2.8.1-4: Void

A.4.5.2.8.2 Test Requirements

During the time duration T2, the missed ACK/NACK interruption on NR PSCell during the switching from NR PSCell to NR SCell shall not exceed the value as defined in table A.4.5.2.8.2-1 dependent on the applied SRS carrier switching time.

Table A4.5.2.8.2-1: Interruption length on NR active serving cells at NR SRS carrier switching (slot)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us)Note 1	Interruption length X1 (slots)	
			Sub carrier spacing for aggressor cell (kHz)	
			15	30
0	1	≤ 200	2	2
		300, 500	2	2
		900	3	3
1	0.5	≤ 200	3	2
		300, 500	3	3
		900	4	4
NOTE 1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.				

During the time duration T2, the missed ACK/NACK interruption on E-UTRAN PCell during the switching from NR PSCell to NR SCell shall not exceed the value as defined in table A.4.5.2.8.2-2 dependent on the applied SRS carrier switching time.

Table A4.5.2.8.2-2: Interruption length on E-UTRAN active serving cells at NR SRS carrier switching

NR SRS carrier switching time (us)note1	Interruption length X1 (subframes)
≤500	2
900	3
NOTE 1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.	

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.9 E-UTRAN – NR interruptions at E-UTRA SRS carrier based switching

A.4.5.2.9.1 Test Purpose and Environment

The purpose of this test is to verify that when a UE needs to transmit aperiodic SRS on a PUSCH-less carrier of SCell, the UE can perform carrier based switching to one PUSCH-less SCCs from a CC with PUSCH. The test will verify the UE missed ACK/NACK does not exceed the interruption requirements on active serving cell in SCG in clause 8.2.1.2.13. Supported test configurations are shown in table A.4.5.2.9.1-1.

In the test there are three cells: Cell 1, Cell 2 and Cell 3. Cell 1 is E-UTRAN PCell on the primary component carrier. Cell 3 is E-UTRAN SCell on the TDD secondary component carrier which operates in downlink without PUCCH/PUSCH. Cell 2 is NR FR1 PSCell. The UE is configured with the SRS switching between E-UTRAN PCell and E-UTRAN SCell. The general test parameters, NR cell specific test parameters and E-UTRA SRS configurations

are given in table A.4.5.2.9.1-2, A.4.5.2.9.1-3 and table A.4.5.2.9.1-4 below. And the E-UTRAN cell specific test parameters (for Cell 1 and Cell 3) can refer to table A.3.7.2.1-1. The test consists of two successive time periods, with duration of T1 and T2, respectively. During T1 LTE PCell and NR PSCell are continuously scheduled in DL. Immediately at the beginning of T2, the UE is triggered for SRS switching by DCI 2_3 scheduling. After T2, the UE is expected to transmit aperiodic SRS on a special slot in the configured TDD UL/DL configuration, as scheduled by DCI 2_3.

Table A.4.5.2.9.1-1: E-UTRAN – NR interruptions at E-UTRA SRS carrier based switching supported test configurations

Config	Description
1	LTE FDD(Cell 1), LTE TDD (Cell 3), NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD(Cell 1), LTE TDD (Cell 3), NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD(Cell 1), LTE TDD (Cell 3), NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD(Cell 1), LTE TDD (Cell 3), NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD(Cell 1), LTE TDD (Cell 3), NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD(Cell 1), LTE TDD (Cell 3), NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.9.1-2: General test parameters for E-UTRAN – NR interruptions at E-UTRA SRS carrier based switching

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is NR RF channel and the other two are E-UTRAN RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Active PSCell		Cell 2	PSCell on NR RF channel number 2.
Activated SCell		Cell 3	SCell on E-UTRAN RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3
DRX		OFF	
Measurement gap pattern Id		OFF	
T1	s	0.2	
T2	s	0.2	UE shall perform SRS switching during T2

Table A.4.5.2.9.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions at E-UTRA SRS carrier based switching

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
Initial DL BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1

Parameter		Unit	Cell 2
	Config 3,6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
TCI state			TCI.State.0
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96
	Config 3,6	dBm/38.16 MHz	-52.86
Time offset to Cell 1 Note 4		µs	33
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells

Table A.4.5.2.9.1-4: Sounding Reference Symbol Configuration for E-UTRAN – NR interruptions at E-UTRA SRS carrier based switching

Field	Value	Comment
srsBandwidthConfiguration	bw5	
srsSubframeConfiguration	Sc8	Once every 5 subframes
ackNackSrsSimultaneousTransmission	FALSE	
srsMaxUpPTS	N/A	Not applicable
srsBandwidth	0	No hopping
srsHoppingBandwidth	hbw0	
frequencyDomainPosition	0	
Duration	TRUE	Indefinite duration
Srs-ConfigIndexAp	17	SRS periodicity of 10ms. See Table 8.2-5 in TS 36.213 [39] for aperiodic SRS transmission.
transmissionComb	0	
cyclicShift	cs0	No cyclic shift

SRS-AntennaPort	an1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 36.331 [16].		

A.4.5.2.9.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell throughout the test and during the time duration T2. Each missed ACK/NACK interruption on NR PSCell shall not exceed X defined in Table A.4.5.2.9.2-1.

Table A.4.5.2.9.2-1: Interruption length X (slot) E-UTRAN – NR at E-UTRA SRS carrier based switching

μ	NR Slot length (ms)	Interruption length X3 (slots)
0	1	2
1	0.5	3

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.10 E-UTRAN – NR FR1 interruptions due to RRM and RLM/BFD measurements on deactivated NR PSCell

A.4.5.2.10.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell interruptions due to RRM measurements and RLM/BFD measurements on the deactivated NR PSCell, and the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell in EN-DC according to the requirements specified in TS 36.133 [15] clause 7.32.2.20 for RRM measurements, and BFD measurements. Supported test configurations are shown in table A.4.5.2.10.1-1.

The general test parameters and NR cell specific test parameters are given in Tables A.4.5.2.10.1-2 and A.4.5.2.10.1-3 below. And the E-UTRAN cell specific test parameters can be referred to in Table A.3.7.2.1-1. In the test there are two cells: Cell 1 and Cell 2. Cell 1 is E-UTRAN PCell, and Cell 2 is deactivated NR FR1 PSCell. The test consists of one single period, T1.

Prior to the start of the time duration T1, the UE is connected to Cell 1 and Cell 2. At the start of T1, the RRC message including *measCyclePSCell* or *allowInterruptions* is received at the UE antenna connector and Cell 2 is deactivated. During T1, Cell 1 continuously schedules data in DL and the UE is configured with RRM and bfd-and-RLM measurements on the deactivated Cell 2. It is assumed that Cell 1 and Cell 2 are synchronized with a timing difference not larger than 3 ms between the two cells.

Table A.4.5.2.10.1-1: Interruptions due to RRM and RLM/BFD measurements on deactivated NR PSCell supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.10.1-2: General test parameters for E-UTRAN – NR interruptions due to measurements on deactivated PSCell in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is NR RF channel and the other is E-UTRAN RF channel
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell 2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell 1, Cell 2

Parameter	Unit	Value	Comment
DRX		OFF	
Measurement gap pattern Id		OFF	
PSCell measurement cycle (measCyclePSCell)	ms	640	
T1	s	10	

Table A.4.5.2.10.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions due to measurements on deactivated PSCell in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
Initial DL BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1
	Config 3,6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
TCI state			TCI.State.0
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96

Parameter		Unit	Cell 2
	Config 3,6	dBm/38.16 MHz	-52.86
Time offset to Cell 1 Note 4		µs	500
Propagation Condition			AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells			

A.4.5.2.10.2 Test Requirements

The UE shall be continuously scheduled in Cell 1 during the entire length of T1 and the UE is configured with RRM and RLM/BFD measurements on the deactivated Cell 2. During the time duration T1 the UE shall transmit at least 98.5% of ACK/NACK on E-UTRAN PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.11 E-UTRAN - NR FR1 interruptions at NR SRS antenna port switching with 1 SRS symbol in a slot in synchronous EN-DC

A.4.5.2.11.1 Test Purpose and Environment

The purpose of this test is to verify that the UE can perform SRS antenna port switching when the UE is configured with the higher layer parameter *usage* in *SRS-ResourceSet* set as 'antennaSwitching'. The test will verify the interruption requirements on E-UTRAN PCell and NR PSCell at SRS antenna switching in synchronous EN-DC as specified in table 8.2.1.2.18-1 of clause 8.2.1.2.18. Supported test configurations for LTE PCell and NR PSCell are shown in table A.4.5.2.11.1-1. Supported test configurations for NR SCell are shown in table A.4.5.2.11.1-1A. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCell are chosen independently.

The general test parameters and NR cell specific test parameters are given in table A.4.5.2.11.1-2 and A 4.5.2.11.1-3 below. The dedicated SRS configuration for antenna port switching with 1 SRS symbol in a slot is given in table A 4.5.2.11.1-3. And the E-UTRAN cell specific test parameters can refer to table A.3.7.2.1-1. In the test there are three cells: Cell 1, Cell 2 and Cell 3. Cell 1 is E-UTRAN PCell, Cell 2 is NR PSCell in FR1 and Cell 3 is an activated NR SCell in FR1. The UE is configured with SRS antenna port switching on NR PSCell.

The test consists of two successive time periods, with duration of T1 and T2, respectively. Throughout the test the UE shall be continuously scheduled on PCell and SCell. Immediately at the beginning of T2, a PDCCH with TPC-SRS-RNTI is sent to the UE to initiate NR SRS switching.

Table A.4.5.2.11.1-1: Interruptions at SRS antenna port switching supported test configurations in FR1 for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR PSCell 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode, NR SCell 15 kHz SSB SCS, =10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR PSCell 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode, NR SCell 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR PSCell 30 kHz SSB SCS, =40 MHz bandwidth, TDD duplex mode, NR SCell 30 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR PSCell 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode, NR SCell 15 kHz SSB SCS, =10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR PSCell 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode, NR SCell 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR PSCell 30 kHz SSB SCS, =40 MHz bandwidth, TDD duplex mode, NR SCell 30 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.11.1-1A: Void

Table A.4.5.2.11.1-1A: Interruptions at SRS antenna port switching supported test configurations for NR SCell

Config	Description
1	NR 15 kHz SSB SCS, =10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, =40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.11.1-2: General test parameters for E-UTRAN – NR FR1 interruptions at SRS antenna port switching in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell 2	Configured PSCell on NR RF channel number 2.
Configured SCell		Cell 3	Configured activated secondary cell on NR RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3.
DRX		OFF	Continuous monitoring of primary cell
Filter coefficient		0	L3 filtering is not used
T1	s	0.2	
T2	ms	40	UE shall perform SRS switching during T2

Table A.4.5.2.11.1-3: NR Cell specific test parameters for E-UTRAN – NR FR1 interruptions at SRS antenna port switching in synchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Frequency Range			FR1	FR1
Duplex mode	Config 1,4		FDD	TDD
	Config 2,3,5,6		TDD	TDD
TDD configuration	Config 1,4		Not Applicable	TDDConfig.1.2 Note6
	Config 2,5		TDDConf.1.2	TDDConfig.1.2 Note6
	Config 3,6		TDDConf.2.3	TDDConfig.2.3 Note6
$BW_{channel}$	Config 1,2,4,5	MHz	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106
DL Initial BWP configuration	Config 1-6		DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1-6		DLBWP.1.1	DLBWP.1.1
UL Initial BWP configuration	Config 1-6		ULBWP.0.1	-
UL dedicated BWP configuration	Config 1-6		ULBWP.1.1	-
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	SR.1.1 TDD
	Config 2,5		SR.1.1 TDD	SR.1.1 TDD
	Config 3,6		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	CR.1.1 TDD
	Config 2,5		CR.1.1 TDD	CR.1.1 TDD
	Config 3,6		CR.2.1 TDD	CR.2.1 TDD
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	CCR.1.1 TDD
	Config 2,5		CCR.1.1 TDD	CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1
TRS configuration	Config 1,4		TRS.1.1 FDD	TRS.1.1 TDD
	Config 2,5		TRS.1.1 TDD	TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD	TRS.1.2 TDD

Parameter		Unit	Cell 2	Cell 3
SMTC configuration			SMTC.1	SMTC.1
SSB configuration	Config 1,2,4,5		SSB.1 FR1	SSB.1 FR1
	Config 3,6		SSB.2 FR1	SSB.2 FR1
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz	15 kHz
	Config 3,6		30 kHz	30 kHz
SRS Configuration	Config 1,2,4,5	kHz	SRS.x1	-
	Config 3,6		SRS.x2	-
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz	-
	Config 3,6		30 kHz	-
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-104	-104
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-104	-104
	Config 3,6		-101	-101
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87	-87
	Config 3,6		-84	-84
$\hat{E}_s / I_{ot}$		dB	17	17
$\hat{E}_s / N_{oc}$		dB	17	17
Io Note3	Config 1,2,4,5	dBm/ 9.36 MHz	-58.96	-58.96
	Config 3,6	dBm/ 38.16 MHz	-52.86	-52.86
Time offset to Cell 1 Note 4		µs	33	33 + Time offset to Cell 2
Time offset to Cell 2 Note 5		µs	-	3
Propagation condition		-	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

NOTE 6: The test configuration for NR SCell is selected from Table A.4.5.2.11.1-1A.

Table A.4.5.2.11.1-4: SRS.X1 Dedicated SRS Configuration for antenna port switching with 1 SRS symbol in a slot in synchronous EN-DC

15 kHz, scenario 1	1T2R		2T4R		1T4R			
srs-ResourceId	0	1	0	1	0	1	2	3
startPosition	3	3	3	3	3	3	3	3
nrofSymbols	1	1	1	1	1	1	1	1
nrofSRS-Ports	port1	port1	port2	port2	port1	port1	port1	port1
periodicityAndOffset-p	sl40, 1	sl40, 6	sl40, 1	sl40, 6	sl40, 1	sl40, 6	sl40, 11	sl40, 16

NOTE 1: 'xTxR' depends on indicated UE capability for SRS antenna port switching
NOTE 2: SRS configurations follow (the dedicated configuration table) if the entries are included in Table A.4.5.2.11.1-4, otherwise following corresponding common configuration in A.3.24 as specified in Table A.4.5.2.11.1-3

30 kHz, scenario 1	1T2R		2T4R		1T4R			
srs-ResourceId	0	1	0	1	0	1	2	3
startPosition	3	3	3	3	3	3	3	3
nrofSymbols	1	1	1	1	1	1	1	1
nrofSRS-Ports	port1	port1	port2	port2	port1	port1	port1	port1
periodicityAndOffset-p	sl80, 3	sl80, 13	sl80, 3	sl80, 13	sl80, 3	sl80, 13	sl80, 23	sl80, 33

NOTE 1: 'xTxR' depends on indicated UE capability for SRS antenna port switching
NOTE 2: SRS configurations follow (the dedicated configuration table) if the entries are included in Table A. 4.5.2.11.1-4, otherwise following corresponding common configuration in A.3.24 as specified in Table A.4.5.2.11.1-3

A.4.5.2.11.2 Test Requirements

In the test, the interruption is verified by monitoring ACK/NACK sent in E-UTRAN PCell and NR SCell during the SRS antenna switching on NR PSCell.

During the time duration T2, the DL interruption on NR SCell during the SRS antenna switching in each SRS transmission slot on NR PSCell shall not exceed 1 slot if SCell is indicated in *txSwitchImpactToRx*, and the UL interruption on NR SCell during the SRS antenna switching in each SRS transmission slot on NR PSCell shall not exceed 1 slot if SCell is indicated in *txSwitchWithAnotherBand*. Otherwise, the NR SCell shall not be interrupted.

During the time duration T2, the DL interruption on E-UTRAN PCell during the SRS antenna switching in each SRS transmission slot on NR PSCell shall not exceed 1 subframe if PCell is indicated in *txSwitchImpactToRx*, and the UL interruption on E-UTRAN PCell during the SRS antenna switching in each SRS transmission slot on NR PSCell shall not exceed 1 subframe if SCell is indicated in *txSwitchWithAnotherBand.* Otherwise, the EUTRAN PCell shall not be interrupted.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.12 E-UTRAN - NR FR1 interruptions at NR SRS antenna port switching in asynchronous EN-DC

A.4.5.2.12.1 Test Purpose and Environment

The purpose of this test is to verify the interruption during NR SRS antenna port switching on E-UTRAN PCell and NR SCell in TS 36.133 [15] clause 7.32.2.18 and clause 8.2.1.2.18. Supported test configurations for LTE PCell and NR PSCell are shown in table A.4.5.2.12.1-1. Supported test configurations for NR SCell are shown in table A.4.5.2.12.1-1A. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCell are chosen independently.

The general test parameters and NR cell specific test parameters are given in table A.4.5.2.12.1-2, A.4.5.2.12.1-3 and A.4.5.2.12.1-4 below. And the E-UTRAN cell specific test parameters can refer to table A.3.7.2.1-1. In the test there are three cells: Cell 1, Cell 2 and Cell 3. Cell 1 is E-UTRAN PCell, Cell 2 is NR PSCell in FR1, Cell 3 NR SCell in FR1. The UE is configured with the SRS antenna port switching on Cell 2.

The test consists of two time period, with duration of T1 and T2. Prior to the start of the time duration T1, the UE is connected to Cell 1, Cell 2 and Cell 3. LTE PCell and NR PSCell are continuously scheduled in DL during T1 and T2. UE receives RRC message to trigger periodic SRS for antenna switching and it ready for SRS antenna switching before T2.

Table A.4.5.2.12.1-1: Interruptions at SRS antenna port switching supported test configurations in FR1 for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode, NR SCell 15 kHz SSB SCS, =10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode, NR SCell 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode

3	LTE FDD, NR 30 kHz SSB SCS, =40 MHz bandwidth, TDD duplex mode, NR SCell 30 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode, NR SCell 15 kHz SSB SCS, =10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode, NR SCell 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, =40 MHz bandwidth, TDD duplex mode, NR SCell 30 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.12.1-1A: Void

Table A.4.5.2.12.1-1A: Interruptions at SRS antenna port switching supported test configurations for NR SCell

Config	Description
1	NR 15 kHz SSB SCS, =10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, =10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, =40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.12.1-2: General test parameters for E-UTRAN – NR FR1 interruptions at SRS antenna port switching in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell 2	Configured PSCell on NR RF channel number 2.
Configured SCell		Cell 3	Configured activated secondary cell on NR RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3.
DRX		OFF	Continuous monitoring of primary cell
Filter coefficient		0	L3 filtering is not used
T1	s	0.2	
T2	ms	40	

Table A.4.5.2.12.1-3: NR Cell specific test parameters for E-UTRAN – NR FR1 interruptions at SRS antenna port switching in asynchronous EN-DC for NR PSCell

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.2
	Config 3,6		TDDConf.2.3
$BW_{channel}$	Config 1,2,4,5	MHz	10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
DL Initial BWP configuration	Config 1-6		DLBWP.0.1
DL dedicated BWP configuration	Config 1-6		DLBWP.1.1
UL Initial BWP configuration	Config 1-6		ULBWP.0.1
UL dedicated BWP configuration	Config 1-6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD

Parameter		Unit	Cell 2
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
OCNG Patterns			OP.1
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
SMTC configuration			SMTC.1
SSB configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz
	Config 3,6		30 kHz
SRS Configuration	Config 1,2,4,5		SRSConf.1
	Config 3,6		SRSConf.2
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz
	Config 3,6		30 kHz
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS (Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2		dBm/15 kHz	-104
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-104
	Config 3,6		-101
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87
	Config 3,6		-84
$\hat{E}_s / I_{ot}$		dB	17
$\hat{E}_s / N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/ 9.36 MHz	-58.96
	Config 3,6	dBm/ 38.16 MHz	-52.86
Time offset to Cell 1 Note 4		µs	500
Time offset to Cell 2 Note 5		µs	-
Propagation condition		-	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells.

NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

Table A.4.5.2.12.1-4: NR Cell specific test parameters for E-UTRAN – NR FR1 interruptions at SRS antenna port switching in asynchronous EN-DC for NR SCell

Parameter		Unit	Cell 3
Frequency Range			FR1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable

Parameter		Unit	Cell 3
	Config 2		TDDConfig.1.2
	Config 3		TDDConfig.2.3
$BW_{channel}$	Config 1		10: $N_{RB,c}$ = 52
	Config 2		10: $N_{RB,c}$ = 52
	Config 3		40: $N_{RB,c}$ = 106
Initial DL BWP Configuration	Config 1		DLBWP.0.1
	Config 2		DLBWP.0.1
	Config 3		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1		DLBWP.1.1
	Config 2		DLBWP.1.1
	Config 3		DLBWP.1.1
Initial UL BWP Configuration	Config 1		ULBWP.0.1
	Config 2		ULBWP.0.1
	Config 3		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1		ULBWP.1.1
	Config 2		ULBWP.1.1
	Config 3		ULBWP.1.1
PDSCH Reference measurement channel	Config 1		-
	Config 2		-
	Config 3		-
RMSI CORESET parameters	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
PDCCH CORESET parameters	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
OCNG Patterns	Config 1,2		OP.1
	Config 3		OP.1
SMTC Configuration			SMTC.1
TCI state			TCI.State.0
SSB Configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io^{Note3}	Config 1,2	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86
Time offset to Cell 1 Note 4		µs	500 + Time offset to Cell 2
Time offset to Cell 2 Note 5		µs	3
Propagation Condition			AWGN

Parameter	Unit	Cell 3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.		

Table A.4.5.2.12.1-5: SRSConf.1 Dedicated SRS Configuration for antenna port switching

SRSConf.1	1T2R[Note 1]		2T4R[Note 1]		1T4R[Note 1]			
srs-ResourceId	0	1	0	1	0	1	2	3
startPosition	5	[3]	5	[3]	5	[3]	5	[3]
nrofSymbols	1	1	1	1	1	1	1	1
nrofSRS-Ports	port1	port1	port2	port2	port1	port1	port1	port1
periodicityAndOffset-p	sl40, [1]	sl40, [1]	sl40, [1]	sl40, [1]	sl40, [1]	sl40, [1]	sl40, [6]	sl40, [6]
NOTE 1: 'xTxR' depends on indicated UE capability for SRS antenna port switching NOTE 2: SRS configurations follow (the dedicated configuration table) if the entries are included, otherwise following corresponding common configuration in A.3.24								

Table A.4.5.2.12.1-6: SRSConf.2 Dedicated SRS Configuration for antenna port switching

SRSConf.2	1T2R [Note 1]		2T4R [Note 1]		1T4R [Note 1]			
srs-ResourceId	0	1	0	1	0	1	2	3
startPosition	5	[3]	5	[3]	5	[3]	5	[3]
nrofSRS-Ports	port1	port1	port2	port2	port1	port1	port1	port1
nrofSymbols	1	1	1	1	1	1	1	1
periodicityAndOffset-p	sl80, [3]	sl80, [3]	sl80, [3]	sl80, [3]	sl80, [3]	sl80, [3]	sl80, [13]	sl80, [13]
NOTE 1: 'xTxR' depends on indicated UE capability for SRS antenna port switching NOTE 2: SRS configurations follow (the dedicated configuration table) if the entries are included, otherwise following corresponding common configuration in A.3.24								

A.4.5.2.12.2 Test Requirements

The UE shall be scheduled on Cell 1 and Cell 3 continuously throughout the test. During the time duration T2, the interruption on Cell 1 shall not be more than the values specified in clause 7.32.2.18 in TS 36.133 [15] for each SRS transmission slot, and the interruption on Cell 3 shall not be more than the values specified in clause 8.2.1.2.18 for each SRS transmission slot

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.3 SCell Activation and Deactivation Delay

A.4.5.3.1 SCell Activation and deactivation of known SCell in FR1 for 160 ms SCell measurement cycle

A.4.5.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell in FR1 is known by the UE at the time of activation.

The supported test configurations for LTE PCell and NR PSCell are shown in table A.4.5.3.1.1-1 below. Supported test configurations for NR SCell are shown in table A.4.5.3.1.1-1A below. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCell are chosen independently. The test parameters are given in Tables A.4.5.3.1.1-2 and cell-specific parameters in table A.4.5.3.1.1-3 and A.4.5.3.1.1-4 below. The test consists of three successive time

periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. The UE now starts monitoring the SCell. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2. The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot m + $\frac{T_{\text{HARQ}}+T_{\text{activation_time}}+T_{\text{CSI_Reporting}}}{\text{NR slot length}}$, as defined in clause 8.3. The UE shall start reporting CSI in PSCell after at least one CSI-RS transmission occasion for channel measurement plus n_{CSI_ref} slots, as defined in clause 5.2.2.5 in TS 38.214 [26], and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption due to activation of SCell shall occur in the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to slot $m + 1 + \frac{T_{\text{HARQ}}+3\text{ms}+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2. Any E-UTRA PCell interruption due to activation of SCell shall occur in the subframe $m_1 + 1 + \frac{T_{\text{HARQ}}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{\text{HARQ}}+3\text{ms}+T_{\text{X}}}{\text{EUTRA slot length}} + N_{\text{interruption}}$, where m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m, and $N_{\text{interruption}}$ is the interruption length given in TS 36.133 [15] clause 7.32.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot n + $\frac{T_{\text{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3. The starting point of any PSCell interruption due to the deactivation shall occur in the slot $n + 1 + \frac{T_{\text{HARQ}}}{NR\ slot\ length}$ to $n + 1 + \frac{T_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3. The starting point of any E-UTRA PCell interruption due to the deactivation shall occur in the subframe $n_1 + 1 + \frac{T_{\text{HARQ}}}{EUTRA\ subframe\ length}$ to subframe $n_2 + 1 + \frac{T_{\text{HARQ}}+3\ ms}{EUTRA\ subframe\ length}$, where n_1 and n_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot n.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for SCell is discontinued.

Table A.4.5.3.1.1-1: known FR1 SCell activation in non-DRX for 160 ms SCell measurement cycle supported test configurations for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.4.5.3.1.1-1A: known FR1 SCell activation in non-DRX for 160 ms SCell measurement cycle supported test configurations for NR SCell

$Config_{SCell}$	Description

1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.4.5.3.1.1-2: General test parameters for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.1
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on E-UTRA RF channel number	dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on secondary component carrier.
SCell measurement cycle (*measCycleSCell)*	ms	160	
Cell 3 timing offset to Cell 2	µs	0	
Time alignment error between Cell 3 and Cell 2	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PSCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
A3-offset	dB	-15	
T_{HARQ}	ms	k_1NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
k	slot	$k_1 + 3 \cdot N_{\text{slot}}^{\text{subframe},\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.4.5.3.1.1-3: Cell specific test parameters for NR PSCell for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 2		
			T1	T2	T3
SSB ARFCN			freq1		
Duplex mode	Config 1,4		FDD		
	Config 2,3,5,6		TDD		
TDD configuration	Config 1,4		Not Applicable		
	Config 2,5		TDDConf.1.1		
	Config 3,6		TDDConf.2.1		
$BW_{channel}$	Config 1,4	MHz	Note 7		
	Config 2,5		Note 7		
	Config 3,6		Note 7		
$BW_{occupied}$	Config 1,4	RB	52 Note 5		
	Config 2,5		52 Note 5		
	Config 3,6		106 Note 6		
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1		
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1		
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1		
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1		
DRX Cycle		ms	Not Applicable		
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD		
	Config 2,5		SR.1.1 TDD		
	Config 3,6		SR.2.1 TDD		
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD		
	Config 2,5		CR.1.1 TDD		
	Config 3,6		CR.2.1 TDD		
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD		
	Config 2,5		CCR.1.1 TDD		
	Config 3,6		CCR.2.1 TDD		
TRS configuration	Config 1,4		TRS.1.1 FDD		
	Config 2,5		TRS.1.1 TDD		
	Config 3,6		TRS.1.2 TDD		
OCNG Patterns	Config 1,2,4,5		OP.1 Note 5		
	Config 3,6		OP.1 Note 6		
SMTC configuration			SMTC.1		
SSB configuration	Config 1,2,4,5		SSB.1 FR1		
	Config 3,6		SSB.2 FR1		
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD		
	Config 2,5		CSI-RS.1.1 TDD		
	Config 3,6		CSI-RS.2.1 TDD		
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15		
	Config 3,6		30		
reportConfigType	Config 1-6		periodic		
reportQuantity	Config 1-6		cri-RI-PMI-CQI		
CSI reporting periodicity	Config 1,2,4,5	slot	5		
	Config 3,6		10		
CSI reporting offset	Config 1,2,4,5	slot	2		
	Config 3,6		4		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2		dBm/15 kHz	-104		
	Config 1,2,4,5	dBm/SCS	-104		

Parameter		Unit	Cell 2		
			T1	T2	T3
N_{oc} Note2	Config 3,6		-101		
$\hat{E}_s / I_{ot}$		dB	17		
$\hat{E}_s / N_{oc}$		dB	17		
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87		
	Config 3,6		-84		
SCH_RP Note 3		dBm/15 kHz	-87		
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96		
	Config 3,6	dBm/38.16 MHz	-52.87		
Propagation condition		-	AWGN		
Correlation Matrix and Antenna Configuration		-	2x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: All UL/DL transmission shall be confined within $BW_{channel_actual\text{-}occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{channel_actual\text{-}occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.

Table A.4.5.3.1.1-4: Cell specific test parameters for NR SCell for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 3		
			T1	T2	T3
SSB ARFCN			freq2		
Duplex mode	$Config_{SCell}$ 1		FDD		
	$Config_{SCell}$ 2,3		TDD		
TDD configuration	$Config_{SCell}$ 1		Not Applicable		
	$Config_{SCell}$ 2		TDDConf.1.1		
	$Config_{SCell}$ 3		TDDConf.2.1		
$BW_{channel}$	$Config_{SCell}$ 1	MHz	Note 7		
	$Config_{SCell}$ 2		Note 7		
	$Config_{SCell}$ 3		Note 7		
$BW_{occupied}$	$Config_{SCell}$ 1	RB	52 Note 5		
	$Config_{SCell}$ 2		52 Note 5		
	$Config_{SCell}$ 3		106 Note 6		
DL initial BWP configuration	$Config_{SCell}$ 1-3		DLBWP.0.1		
DL dedicated BWP configuration	$Config_{SCell}$ 1-3		DLBWP.1.1		
UL initial BWP configuration	$Config_{SCell}$ 1-3		ULBWP.0.1		
UL dedicated BWP configuration	$Config_{SCell}$ 1-3		ULBWP.1.1		
DRX Cycle		ms	Not Applicable		
PDSCH Reference measurement channel	$Config_{SCell}$ 1		SR.1.1 FDD		
	$Config_{SCell}$ 2		SR.1.1 TDD		
	$Config_{SCell}$ 3		SR.2.1 TDD		
RMSI CORESET Reference Channel	$Config_{SCell}$ 1		CR.1.1 FDD		
	$Config_{SCell}$ 2		CR.1.1 TDD		
	$Config_{SCell}$ 3		CR.2.1 TDD		

Parameter		Unit	Cell 3		
			T1	T2	T3
RMC CORESET Reference Channel	$Config_{SCell}$ 1		CCR.1.1 FDD		
	$Config_{SCell}$ 2		CCR.1.1 TDD		
	$Config_{SCell}$ 3		CCR.2.1 TDD		
TRS configuration	$Config_{SCell}$ 1		TRS.1.1 FDD		
	$Config_{SCell}$ 2		TRS.1.1 TDD		
	$Config_{SCell}$ 3		TRS.1.2 TDD		
OCNG Patterns	$Config_{SCell}$ 1,2		OP.1 Note 5		
	$Config_{SCell}$ 3		OP.1 Note 6		
SMTC configuration			SMTC.1		
SSB configuration	$Config_{SCell}$ 1,2		SSB.1 FR1		
	$Config_{SCell}$ 3		SSB.2 FR1		
CSI-RS configuration for CSI reporting	$Config_{SCell}$ 1		CSI-RS.1.1 FDD		
	$Config_{SCell}$ 2		CSI-RS.1.1 TDD		
	$Config_{SCell}$ 3		CSI-RS.2.1 TDD		
PDSCH/PDCCH subcarrier spacing	$Config_{SCell}$ 1,2	kHz	15		
	$Config_{SCell}$ 3		30		
reportConfigType	$Config_{SCell}$ 1-3		periodic		
reportQuantity	$Config_{SCell}$ 1-3		cri-RI-PMI-CQI		
CSI reporting periodicity	$Config_{SCell}$ 1,2	slot	5		
	$Config_{SCell}$ 3		10		
CSI reporting offset	$Config_{SCell}$ 1,2	slot	2		
	$Config_{SCell}$ 3		4		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS Note1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2		dBm/15 kHz	-104		
N_{oc} Note2	$Config_{SCell}$ 1,2	dBm/SCS	-104		
	$Config_{SCell}$ 3		-101		
$\hat{E}_s / I_{ot}$		dB	17		
$\hat{E}_s / N_{oc}$		dB	17		
SS-RSRP Note3	$Config_{SCell}$ 1,2	dBm/SCS	-87		
	$Config_{SCell}$ 3		-84		
SCH_RP Note 3		dBm/15 kHz	-87		
Io Note3	$Config_{SCell}$ 1,2	dBm/9.36 MHz	-58.96		
	$Config_{SCell}$ 3	dBm/38.16 MHz	-52.87		
Propagation condition		-	AWGN		
Correlation Matrix and Antenna Configuration		-	2x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.

NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.]

NOTE 5: All UL/DL transmission shall be confined within $BW_{channel_actual\text{-}occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.

NOTE 6: All UL/DL transmission shall be confined within $BW_{channel_actual\text{-}occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.

NOTE 7: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.

A.4.5.3.1.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available uplink resource if an available uplink resource is subject to interruption. Whether CSI report in slot (m+k) was interrupted is checked by monitoring ACK/NACK sent in PCell in slot (m+k).

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, $T_{activation_time} = T_{FirstSSB}$+ 5 ms, as defined in clause 8.3.

During T3 the UE shall stop sending CSI reports for SCell at latest in a slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{interruption}$, and interruption of E-UTRA PCell during SCell activation shall not happen outside the subframe $m_1 + 1 + \frac{T_{HARQ}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{EUTRA slot length}} + N_{interruption}$, as defined in clause 8.3.

During T3 the starting point of interruption of PSCell during SCell deactivation shall not happen outside the slot n + $1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to n + $1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3 and the starting point of interruption of E-UTRA PCell during SCell deactivation shall not happen outside the subframe $n_1 + 1 + \frac{T_{HARQ}}{EUTRA\ subframe\ length}$ to subframe n_2 + $1 + \frac{T_{HARQ}+3\ ms}{EUTRA\ subframe\ length}$.

The interruption of PSCell shall not be more than the values specified for EN-DC in clause 8.2.1.2.4.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90%.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.4.5.3.2 SCell Activation and deactivation of known SCell in FR1 for 640 ms SCell measurement cycle

A.4.5.3.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.4.5.3.1.1. The supported test configurations are the same as defined in clause A.4.5.3.1.1. The test parameters are the same except those described in the following clause. The listed parameter values in tables A.4.5.3.2.1-1 will replace the values of corresponding parameters in tables A.4.5.3.1.1-2.

Table A.4.5.3.2.1-1: General test parameters for known FR1 SCell activation case, 640 ms SCell measurement cycle

Parameter	Unit	Value	Comment
SCell measurement cycle (*measCycleSCell)*	ms	640	

A.4.5.3.2.2 Test Requirements

The test requirements defined in clause A.4.5.3.1.2 shall apply to this test case, except $T_{activation_time}$ will be replaced with the value $T_{FirstSSB_MAX} + T_{rs}$ + 5 ms.

A.4.5.3.3 SCell Activation and deactivation of unknown SCell in FR1

A.4.5.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell in FR1 is unknown by the UE at the time of activation.

The supported test configurations are defined in clause A.4.5.3.1.1. The test parameters are the same except those described in the following clause. The listed parameter values in tables A.4.5.3.3.1-1 will replace the values of corresponding parameters in tables A.4.5.3.1.1-2. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. Cell 1 and Cell 2 have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRAN and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment 100ms after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2. The UE shall be able to report valid CSI for the activated SCell at latest in slot m + $\frac{T_{\text{HARQ}}+T_{\text{activtion_time}}+T_{\text{CSI_Reporting}}}{NR\ slot\ length}$ as defined in clause 8.3 provided the SCell can be successfully detected on the first attempt. The UE shall start reporting CSI after at least one CSI-RS transmission occasion for channel measurement plus n_{CSI_ref} slots, as defined in clause 5.2.2.5 in TS 38.214 [26], and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption due to activation of SCell shall occur in the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to slot $m + 1 + \frac{T_{\text{HARQ}}+3\text{ms}+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2. Any E-UTRA PCell interruption due to activation of SCell shall occur in the subframe $m_1 + 1 + \frac{T_{\text{HARQ}}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{\text{HARQ}}+3\text{ms}+T_{\text{X}}}{\text{EUTRA slot length}} + N_{\text{interruption}}$, where m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m, and $N_{\text{interruption}}$ is the interruption length given in TS 36.133 [15] clause 7.32.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell at latest in slot n + $\frac{T_{\text{HARQ}}+3ms}{NR\ slot\ length}$ as defined in clause 8.3. The starting point of any PSCell interruption due to the deactivation shall occur in the slot n + 1 + $\frac{T_{\text{HARQ}}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3. The starting point of any E-UTRA PCell interruption due to the deactivation shall occur in the subframe $n_1 + 1 + \frac{T_{\text{HARQ}}}{EUTRA\ subframe\ length}$ to subframe $n_2 + 1 + \frac{T_{\text{HARQ}}+3\ ms}{EUTRA\ subframe\ length}$, where n_1 and n_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot n.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell 1 deactivation command is sent until CSI reporting for SCell 1 is discontinued.

Table A.4.5.3.3.1-1: General test parameters for unknown FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
T1	ms	100	During this time the PSCell shall be known and the SCell configured, but not detected.

A.4.5.3.3.2 Test Requirements

The test requirements defined in clause A.4.5.3.1.2 shall apply to this test case, except $T_{activation_time}$ will be replaced with the value $T_{FirstSSB_MAX}$ + T_{SMTC_MAX} + 2*T_{rs} + 5 ms as defined in clause 8.3.

A.4.5.3.4 SCell Activation and deactivation of multiple unknown SCells in FR1 with single activation/deactivation command

A.4.5.3.4.1 Test Purpose and Environment

The purpose of this test is to verify that the multiple SCell activation and deactivation times are within the requirements stated in clause 8.3.7 and 8.3.8, when the two configured deactivated SCells in FR1 are unknown by the UE at the time of activation.

The supported test configurations are the same as defined in clause A.4.5.3.1.1. The test parameters are the same except those described in the following clause. The listed parameter values in table A.4.5.3.4.1-1 will replace the values of corresponding parameters in table A.4.5.3.1.1-2. The cell specific test parameter values in table A.4.5.3.4.1-2 will replace the values of corresponding parameters in table A.4.5.3.1.1-3.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are four carriers, E-UTRA has one cell, and NR has three cells. Cell 1 and Cell 2 have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRAN and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) and Cell 4(SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCells (Cell 3 and Cell 4) become configured on NR. During T1 the SCells (Cell 3 and Cell 4) are powered off and UE is not aware of SCells.

A MAC message for activation of SCells(Cell 3 and Cell 4) is sent by the test equipment 100ms after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCells is received at the UE antenna connector defines the start of time period T2. Immediately at beginning of T2 the transmission power of cell 3 and cell 4 are increased to same level as for cell 2. The UE shall be able to report valid CSI for the activated SCells (Cell 3 and Cell 4) at latest in slot m + $\frac{T_{HARQ}+T_{activation_time_multiple_scells}+T_{CSI_Reporting}}{NR\ slot\ length}$ respectively as defined in clause 8.3.7 provided the SCells can be successfully detected on the first attempt. The UE shall start reporting CSI for cell 3 and cell 4 after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation for cell 3 and cell 4 has been completed, respectively. Any PSCell interruption due to activation of SCells shall occur in the slot $m + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to slot $m + 1 + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in section 8.2. Any E-UTRA PCell interruption due to activation of SCells shall occur in the subframe $m_1 + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{EUTRA\ slot\ length}}$ to subframe $m_2 + 1 + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}+T_{\mathrm{X}}}{\mathrm{EUTRA\ slot\ length}} + N_{\mathrm{interruption}}$, where m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m, and $N_{\mathrm{interruption}}$ is the interruption length given in TS 36.133 [15] clause 7.32.

Time period T3 starts when a MAC message for deactivation of the SCells (Cell 3 and Cell 4), sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the SCells at latest in slot n + $\frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$ as defined in clause 8.3. The starting point of any PSCell interruption due to the deactivation shall occur in the slot n + 1 + $\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to n + 1 + $\frac{\mathrm{T_{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3. The starting point of any E-UTRA PCell interruption due to the deactivation shall occur in the subframe $n_1 + 1 + \frac{T_{\mathrm{HARQ}}}{EUTRA\ subframe\ length}$ to subframe $\mathrm{n}_2 + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms}{EUTRA\ subframe\ length}$, where n_1 and n_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot n.

The test equipment verifies the activation time for Cell 3 by counting the slots from the time when the SCell activation command is sent until CSI report of activated Cell 3 with other than CQI index 0 is received.

The test equipment verifies the activation time for Cell 4 by counting the slots from the time when the SCell activation command is sent until CSI report of activated Cell 4 with other than CQI index 0 is received.

The test equipment verifies the deactivation time for Cell 3 by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for Cell 3 is discontinued.

The test equipment verifies the deactivation time for Cell 4by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for Cell 4 is discontinued.

Table A.4.5.3.4.1-1: General test parameters for unknown FR1 SCell activation case with 2 deactivated SCells, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment

Configured deactivated SCell 1		Cell 3	Configured deactivated secondary cell on NR RF channel number 3 which is an intra-band contiguous CC to PSCC of Cell 2; *ssb-PositionInBurst* of Cell 3 is same as the one for Cell 2
Configured deactivated SCell 2		Cell 4	Configured deactivated secondary cell on NR RF channel number 4 which is an inter-band CC to PSCC of Cell 2
Cell 3 timing offset to Cell 2	µs	0	
Cell 4 timing offset to Cell 2	µs	0	
Time alignment error between Cell 3 and Cell 2	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
Time alignment error between cell4 and Cell 2	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	ms	100	During this time the PSCell shall be known and the SCell configured, but not detected.

Table A. 4.5.3.4.1-2: Cell specific test parameters for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 3		Cell 4	
			T2	T3	T2	T3
SSB ARFCN			Freq2		Freq3	
Duplex mode	Config 1,4		FDD			
	Config 2,3,5,6		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2,5		TDDConf.1.1			
	Config 3,6		TDDConf.2.1			
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52			
	Config 2,5		10: $N_{RB,c}$ = 52			
	Config 3,6		40: $N_{RB,c}$ = 106			
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1			
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1			
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1			
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD	
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD		CCR.1.1 FDD	
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD		TRS.1.1 FDD	
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns			OP.1			
SMTC configuration			SMTC.1			
SSB configuration	Config 1,2,4,5		SSB.1 FR1			
	Config 3,6		SSB.2 FR1			

Parameter		Unit	Cell 3		Cell 4	
			T2	T3	T2	T3
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz			
	Config 3,6		30 kHz			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-104			
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-104			
	Config 3,6		-101			
$\hat{E}_s / I_{ot}$		dB	17			
$\hat{E}_s / N_{oc}$		dB	17			
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87			
	Config 3,6		-84			
SCH_RP Note 3		dBm/15 kHz	-87			
Propagation condition		-	AWGN			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.

A.4.5.3.4.2 Test Requirements

The test requirements defined in clause A.4.5.3.1.2 shall apply to this test case for both Cell 3 and Cell 4, except the followings:

- For Cell 3 activation delay, $T_{activation_time}$ will be replaced with the value $T_{activation_time_multiple_scells} = T_{FirstSSB_MAX_multiple_scells} + T_{SMTC_MAX_multiple_scells} + T_{rs}$ +5 ms as defined in clause 8.3.7.
- For Cell 4 activation delay, $T_{activation_time}$ will be replaced with the value $T_{activation_time_multiple_scells} = T_{FirstSSB_MAX_multiple_scells} + T_{SMTC_MAX_multiple_scells} + 2*T_{rs}$ +5 ms as defined in clause 8.3.7.

A.4.5.3.5 Direct SCell activation at SCell addition of known SCell in FR1

A.4.5.3.5.1 Test Purpose and Environment

The purpose of this test is to verify that the direct SCell activation time is within the requirements stated in clause 8.3.4, when the SCell in FR1 is known by the UE at the time of activation.

The supported test configurations for LTE PCell and NR PSCell are shown in table A.4.5.3.5.1-1 below. The supported test configurations for NR SCell are shown in table A.4.5.3.5.1-1A below. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCell are chosen independently. The test parameters are given in tables A.4.5.3.5.1-2 and cell-specific parameters in A.4.5.3.5.1-3 and A.4.5.3.5.1-4 below. The test consists of two successive time periods, with duration of T1 and T2, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the measurement on Cell 3 is configured. The UE now starts measuring the Cell 3. During T1, Cell 3 should be detected and measured by the UE such that it meets the

condition for known cell defined in clause 8.3.4 for direct SCell activation. At the end of T1, the test equipment sends an RRC message for direct SCell activation of the Cell 3.

The point in time at which the RRC message for direct SCell activation is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2. The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot $m + \frac{N_{\text{direct}}}{\text{NR slot length}}$, as defined in clause 8.3.4. The UE shall start reporting CSI in PSCell in slot ($m+k+T_{RRC_process}$) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption due to activation of SCell shall occur in the slot $m + 1$ to slot $m + 1 + \frac{T_{RRC_Process}+T_1+T_X}{NR\ slot\ length} + N_{\text{interruption}}$, as defined in clause 8.3.4, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2. Any E-UTRA PCell interruption due to activation of SCell shall occur in the subframe $m_1 + 1$ to subframe $m_2 + 1 + \frac{T_{RRC_Process}+T_1+T_X}{NR\ slot\ length} + N_{\text{interruption}}$, where m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m, and $N_{\text{interruption}}$ is the interruption length given in TS 36.133 [15] clause 7.32.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation of SCell.

The test equipment verifies the activation time by counting the slots from the time when the direct SCell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.4.5.3.5.1-1: known FR1 direct SCell activation supported test configurations for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration.	

Table A.4.5.3.5.1-1A: known FR1 direct SCell activation supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.4.5.3.5.1-2: General test parameters for known FR1 direct SCell activation

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.1
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2.
SCell		Cell 3	Secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every four slots.

Parameter	Unit	Value	Comment
Cell-individual offset for cells on E-UTRA RF channel number	dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on secondary component carrier.
SCell measurement cycle (*measCycleSCell)*	ms	160	
Cell 3 timing offset to Cell 2	µs	0	
Time alignment error between Cell 3 and Cell 2	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the Cell 3 shall be known.
T2	s	1	During this time the UE shall activate the SCell.
A3-offset	dB	-15	
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
$T_{CSI_Reporting}$	ms	2	the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
k	ms	$k_1 + 3 \cdot N_{slot}^{subframe,\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.4.5.3.5.1-3: Cell specific test parameters for NR PSCell for known FR1 direct SCell activation

Parameter		Unit	Cell 2	
			T1	T2
SSB ARFCN			**freq1**	
Duplex mode	Config 1,4		FDD	
	Config 2,3,5,6		TDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2,5		TDDConf.1.1	
	Config 3,6		TDDConf.2.1	
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52	
	Config 2,5		10: $N_{RB,c}$ = 52	
	Config 3,6		40: $N_{RB,c}$ = 106	
DL initial BWP configuration	Config 1,2,3,4,5,6		DLBWP.0.1	
DL dedicated BWP configuration	Config 1,2,3,4,5,6		DLBWP.1.1	
UL initial BWP configuration	Config 1,2,3,4,5,6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1,2,3,4,5,6		ULBWP.1.1	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD	
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	
	Config 2,5		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD	
	Config 2,5		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD	
OCNG Patterns			OP.1	

Parameter		Unit	Cell 2	
			T1	T2
SMTC configuration			SMTC.1	
SSB configuration	Config 1,2,4,5		SSB.1 FR1	
	Config 3,6		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz	
	Config 3,6		30 kHz	
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD	
	Config 2,5		CSI-RS.1.1 TDD	
	Config 3,6		CSI-RS.2.1 TDD	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15	
	Config 3,6		30	
reportConfigType	Config 1-6		periodic	
reportQuantity	Config 1-6		cri-RI-PMI-CQI	
CSI reporting periodicity	Config 1,2,4,5	slot	5	
	Config 3,6		10	
CSI reporting offset	Config 1,2,4,5	slot	2	
	Config 3,6		4	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2		dBm/15 kHz	-104	
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-104	
	Config 3,6		-101	
$\hat{E}_s / I_{ot}$		dB	17	
$\hat{E}_s / N_{oc}$		dB	17	
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87	
	Config 3,6		-84	
SCH_RP Note 3		dBm/15 kHz	-87	
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.

Table A.4.5.3.5.1-4: Cell specific test parameters for NR SCell for known FR1 direct SCell activation

Parameter		Unit	Cell 3	
			T1	T2
SSB ARFCN			**freq2**	
Duplex mode	$Config_{SCell}$ 1		FDD	
	$Config_{SCell}$ 2,3		TDD	
TDD configuration	$Config_{SCell}$ 1		Not Applicable	
	$Config_{SCell}$ 2		TDDConf.1.1	
	$Config_{SCell}$ 3		TDDConf.2.1	
$BW_{channel}$	$Config_{SCell}$ 1	MHz	10: $N_{RB,c}$ = 52	
	$Config_{SCell}$ 2		10: $N_{RB,c}$ = 52	
	$Config_{SCell}$ 3		40: $N_{RB,c}$ = 106	

Parameter		Unit	Cell 3	
			T1	T2
DL initial BWP configuration	$Config_{SCell}$ 1,2,3		DLBWP.0.1	
DL dedicated BWP configuration	$Config_{SCell}$ 1,2,3		DLBWP.1.1	
UL initial BWP configuration	$Config_{SCell}$ 1,2,3		ULBWP.0.1	
UL dedicated BWP configuration	$Config_{SCell}$ 1,2,3		ULBWP.1.1	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	$Config_{SCell}$ 1		SR.1.1 FDD	
	$Config_{SCell}$ 2		SR.1.1 TDD	
	$Config_{SCell}$ 3		SR.2.1 TDD	
RMSI CORESET Reference Channel	$Config_{SCell}$ 1		CR.1.1 FDD	
	$Config_{SCell}$ 2		CR.1.1 TDD	
	$Config_{SCell}$ 3		CR.2.1 TDD	
RMC CORESET Reference Channel	$Config_{SCell}$ 1		CCR.1.1 FDD	
	$Config_{SCell}$ 2		CCR.1.1 TDD	
	$Config_{SCell}$ 3		CCR.2.1 TDD	
TRS configuration	$Config_{SCell}$ 1		TRS.1.1 FDD	
	$Config_{SCell}$ 2		TRS.1.1 TDD	
	$Config_{SCell}$ 3		TRS.1.2 TDD	
OCNG Patterns			OP.1	
SMTC configuration			SMTC.1	
SSB configuration	$Config_{SCell}$ 1,2		SSB.1 FR1	
	$Config_{SCell}$ 3		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	$Config_{SCell}$ 1,2	kHz	15	
	$Config_{SCell}$ 3		30	
CSI-RS configuration for CSI reporting	$Config_{SCell}$ 1		CSI-RS.1.1 FDD	
	$Config_{SCell}$ 2		CSI-RS.1.1 TDD	
	$Config_{SCell}$ 3		CSI-RS.2.1 TDD	
PDSCH/PDCCH subcarrier spacing	$Config_{SCell}$ 1,2	kHz	15	
	$Config_{SCell}$ 3		30	
reportConfigType	$Config_{SCell}$ 1-3		periodic	
reportQuantity	$Config_{SCell}$ 1-3		cri-RI-PMI-CQI	
CSI reporting periodicity	$Config_{SCell}$ 1,2	slot	5	
	$Config_{SCell}$ 3		10	
CSI reporting offset	$Config_{SCell}$ 1,2	slot	2	
	$Config_{SCell}$ 3		4	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2		dBm/15 kHz	-104	
N_{oc} Note2	$Config_{SCell}$ 1,2	dBm/SCS	-104	
	$Config_{SCell}$ 3		-101	
$\hat{E}_s / I_{ot}$		dB	17	
$\hat{E}_s / N_{oc}$		dB	17	
SS-RSRP Note3	$Config_{SCell}$ 1,2	dBm/SCS	-87	
	$Config_{SCell}$ 3		-84	
SCH_RP Note 3		dBm/15 kHz	-87	
Propagation condition		-	AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Parameter	Unit	Cell 3	
		T1	T2
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.			

A.4.5.3.5.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot ($m+k+T_{RRC_process}$). UE is allowed to postpone CSI report to next available uplink resource if an available uplink resource is subject to interruption. Whether CSI report in slot ($m+k+T_{RRC_process}$) was interrupted is checked by monitoring ACK/NACK sent in PCell in slot ($m+k+T_{RRC_process}$).

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot $m + \frac{N_{direct}}{NR\ slot\ length}$. $N_{direct} = T_{RRC_Process} + T_1 + T_{activation_time} + T_{CSI_Reporting}$ - 3 ms, where $T_{RRC_Process}$ = 20 ms and other components are defined in clause 8.3.4.

During T2 interruption of PSCell during direct SCell activation shall not happen outside the slot $m + 1$ to $m + 1 + \frac{T_{RRC_Process}+T_1+T_X}{NR\ slot\ length} + N_{\text{interruption}}$, and interruption of E-UTRA PCell during SCell activation shall not happen outside the subframe $m_1 + 1$ to subframe $m_2 + 1 + \frac{T_{RRC_Process}+T_1+T_X}{NR\ slot\ length} + N_{\text{interruption}}$, as defined in clause 8.3.4.

The interruption of PSCell shall not be more than the values specified for EN-DC in clause 8.2.1.2.8.

All of the above test requirements shall be fulfilled in order for the observed direct SCell activation delay to be counted as correct. The rate of correct observed direct SCell activation delay during repeated tests shall be at least 90%.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $m + \frac{T_{RRC_Process}+T_1+T_X}{NR\ slot\ length}$ as defined in clause 8.3.4 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.4.5.3.6 Fast SCell Activation of known SCell in FR1 for 160 ms SCell measurement cycle

A.4.5.3.6.1 Test Purpose and Environment

The purpose of this test is to verify that the fast SCell activation times are within the requirements stated in clause 8.3.16, when the SCell in FR1 is known by the UE at the time of activation.

The supported test configurations are shown in table A.4.5.3.6.1-1 below. The test parameters are given in tables A.4.5.3.6.1-2 and cell-specific parameters in A.4.5.3.6.1-3 below. The test consists of two successive time periods, with duration of T1 and T2, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. The UE now starts monitoring the SCell. The test equipment sends a MAC message for activation of the SCell and triggering the aperiodic CSI-RS for fast SCell activation.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2. The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot m + $\frac{T_{\text{HARQ}}+T_{\text{activation_time}}+T_{\text{CSI_Reporting}}}{\text{NR slot length}}$, as defined in clause 8.3. The UE shall start reporting CSI in PSCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption due to activation of SCell shall occur in the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to slot $m + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2. Any E-UTRA PCell interruption due to activation of SCell shall occur in the subframe $m_1 + 1 + \frac{T_{\text{HARQ}}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{EUTRA slot length}} + N_{\text{interruption}}$, where m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m, and $N_{\text{interruption}}$ is the interruption length given in TS 36.133 [15] clause 7.32.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.4.5.3.6.1-1: fast known FR1 SCell activation in non-DRX for 160 ms SCell measurement cycle supported test configurations

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.4.5.3.6.1-2: General test parameters for fast known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.1
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on E-UTRA RF channel number	dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on secondary component carrier.
SCell measurement cycle (*measCycleSCell)*	ms	160	
Cell 3 timing offset to Cell 2	µs	0	
Time alignment error between Cell 3 and Cell 2	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PSCell shall be known and the SCell configured and detected.

Parameter	Unit	Value	Comment
T2	s	1	During this time the UE shall activate the SCell.
A3-offset	dB	-15	
T_{HARQ}	ms	k_1NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in TS 38.213 [3]
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
k	slot	$k_1 + 3 \cdot N_{\text{slot}}^{\text{subframe},\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.4.5.3.6-3: Cell specific test parameters for fast known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 2		Cell 3	
			T1	T2	T1	T2
SSB ARFCN			freq1		freq2	
Duplex mode	Config 1,4		FDD			
	Config 2,3,5,6		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2,5		TDDConf.1.1			
	Config 3,6		TDDConf.2.1			
$BW_{channel}$	Config 1,4	MHz	Note 7			
	Config 2,5		Note 7			
	Config 3,6		Note 7			
$BW_{occupied}$	Config 1,4	RB	52 Note 5			
	Config 2,5		52 Note 5			
	Config 3,6		106 Note 6			
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1			
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1			
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1			
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1			
Aperiodic CSI-RS for Scell activation	Config 1,4		N/A		TRS.1.3 FDD	
	Config 2,5		N/A		TRS.1.3 TDD	
	Config 3,6		N/A		TRS.1.4 TDD	
gapBetweenBursts		Slot	N/A			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD	
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD		CCR.1.1 FDD	
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD		TRS.1.1 FDD	
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns	Config 1,2,4,5		OP.1 Note 5			
	Config 3,6		OP.1 Note 6			

Parameter		Unit	Cell 2		Cell 3	
			T1	T2	T1	T2
SMTC configuration			SMTC.1			
SSB configuration	Config 1,2,4,5		SSB.1 FR1			
	Config 3,6		SSB.2 FR1			
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD			
	Config 2,5		CSI-RS.1.1 TDD			
	Config 3,6		CSI-RS.2.1 TDD			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15			
	Config 3,6		30			
reportConfigType	Config 1-6		periodic			
reportQuantity	Config 1-6		cri-RI-PMI-CQI			
CSI reporting periodicity	Config 1,2,4,5	slot	5		N/A	
CSI reporting offset	Config 3,6	slot	10		N/A	
	Config 1,2,4,5		2		N/A	
	Config 3,6		4		N/A	
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-104			
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-104			
	Config 3,6		-101			
$\hat{E}_s / I_{ot}$		dB	17			
$\hat{E}_s / N_{oc}$		dB	17			
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87		NA	
	Config 3,6		-84		NA	
CSI-RSRP Note3	Config 1,2,4,5	dBm/SCS	NA		-87	
	Config 3,6		NA		-84	
SCH_RP Note 3		dBm/15 kHz	-87			
Propagation condition		-	AWGN			
Io Note3	Config 1,2,4,5	dBm/ 9.36 MHz	-58.96			
	Config 3,6	dBm/ 38.16 MHz	-52.87			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.]
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.

A.4.5.3.6.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available uplink resource if an available uplink resource is subject to interruption. Whether CSI report in slot (m+k) was interrupted is checked by monitoring ACK/NACK sent in PCell in slot (m+k).

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, $T_{activation_time} = T_{FirstATRS} + 5$ ms, as defined in clause 8.3.

During T2 interruption of PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{interruption}$, and interruption of E-UTRA PCell during SCell activation shall not happen outside the subframe $m_1 + 1 + \frac{T_{HARQ}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{EUTRA slot length}} + N_{interruption}$, as defined in clause 8.3.

The interruption of PSCell shall not be more than the values specified for EN-DC in clause 8.2.1.2.19.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay during repeated tests shall be at least 90%.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.4.5.3.7 Fast SCell Activation of known SCell in FR1 for 640 ms SCell measurement cycle

A.4.5.3.7.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.4.5.3.6.1. The supported test configurations are the same as defined in clause A.4.5.3.6.1. The test parameters are the same except those described in the following clause. The listed parameter values in tables A.4.5.3.7.1-1 will replace the values of corresponding parameters in tables A.4.5.3.6.1-2. The listed parameter values in tables A.4.5.3.7.1-2 will replace the values of corresponding parameters in tables A.4.5.3.6.1-3.

Table A.4.5.3.7.1-1: General test parameters for known FR1 SCell activation case, 640 ms SCell measurement cycle

Parameter	Unit	Value	Comment
SCell measurement cycle (*measCycleSCell)*	ms	640	

Table A.4.5.3.7-2: Cell specific test parameters for known FR1 Scell activation case, 640 ms Scell measurement cycle

Parameter		Unit	Cell 2		Cell 3	
			T1	T2	T1	T2
gapBetweenBursts		Slot	2			

A.4.5.3.7.2 Test Requirements

The test requirements defined in clause A.4.5.3.6.2 shall apply to this test case, except $T_{activation_time}$ will be replaced with the value $T_{FirstATRS} + T_{gap} + T_{ATRS} + 5$ ms.

A.4.5.3.8 SCell Activation and deactivation of unknown SCell in FR1 for UE capable of short measurement interval

A.4.5.3.8.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell in FR1 is unknown by the UE at the time of activation and when UE supports *shortMeasInterval-r18* capability.

The supported test configurations are defined in clause A.4.5.3.1.1. The test parameters are the same except those described in the following clause. The listed parameter values in Tables A.4.5.3.8.1-1 will replace the values of corresponding parameters in Tables A.4.5.3.1.1-2. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell, and NR has two cells. Cell 1 and Cell 2 have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRAN and Cell 2 (PSCell) on NR but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment 100 ms after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2. The UE shall be able to report valid CSI for the activated SCell at latest in slot m + $\frac{T_{\text{HARQ}}+T_{\text{activtion_time}}+T_{\text{CSI_Reporting}}}{NR\ slot\ length}$ as defined in clause 8.3 provided the SCell can be successfully detected on the first attempt. The UE shall start reporting CSI after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption due to activation of SCell shall occur in the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to slot $m + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2. Any E-UTRA PCell interruption due to activation of SCell shall occur in the subframe $m_1 + 1 + \frac{T_{\text{HARQ}}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{EUTRA slot length}} + N_{\text{interruption}}$, where m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m, and $N_{\text{interruption}}$ is the interruption length given in TS 36.133 [15] clause 7.32.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell at latest in slot n + $\frac{T_{\text{HARQ}}+3ms}{NR\ slot\ length}$ as defined in clause 8.3. The starting point of any PSCell interruption due to the deactivation shall occur in the slot n + 1 + $\frac{T_{\text{HARQ}}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3. The starting point of any E-UTRA PCell interruption due to the deactivation shall occur in the subframe $n_1 + 1 + \frac{T_{\text{HARQ}}}{EUTRA\ subframe\ length}$ to subframe $n_2 + 1 + \frac{T_{\text{HARQ}}+3\ ms}{EUTRA\ subframe\ length}$, where n_1 and n_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot n.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell 1 deactivation command is sent until CSI reporting for SCell 1 is discontinued.

Table A.4.5.3.8.1-1: General test parameters for unknown FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
DRX		DRX.8	DRX cycle = 320 ms and TAT = Infinity
T1	ms	100	During this time the PSCell shall be known and the SCell configured, but not detected.
T2	s	[1]	During this time the UE shall activate the SCell.

A.4.5.3.8.2 Test Requirements

The test requirements defined in clause A.4.5.3.1.2 shall apply to this test case, except $T_{activation_time}$ will be replaced with the value below as defined in clause 8.3.2 when UE supports *shortMeasInterval-r18* capability:

$T_{activation_time}$ = 3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + $T_{SMTC_MAX,\ enhanced}$ + $T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP\ ,report}$ + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}), for which $T_{FirstSSB_MAX,\ enhanced}$ = $T_{SMTC_MAX,\ enhanced}$ = $T_{rs,\ enhanced}$ =20 ms; $T_{L1\text{-}RSRP,\ enhanced_measure}$ = 60 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms.

A.4.5.3.9 SCell Activation of unknown SCell with valid L3 measurement results in FR1 for 160 ms SCell measurement cycle

A.4.5.3.9.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation time are within the requirements stated in clause 8.3.17, when the SCell in FR1 is unknown by the UE at the time of activation, but UE has valid L3 measurement results of the SCell.

The supported test configurations for LTE PCell and NR PSCell are shown in table A.4.5.3.9.1-1 below. Supported test configurations for NR SCell are shown in table A.4.5.3.9.1-1A below. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCell are chosen independently. The test parameters are given in Tables A.4.5.3.9.1-2 and cell-specific parameters in A.4.5.3.9.1-3 and A.4.5.3.9.1-4 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell, and NR has two cells. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell.

The test consists of three sub tests. The slot at which the MAC message is received at the UE antenna connector, is denoted slot #n. TE continuously schedules the downlink data to UE on PCell and PSCell. TE shall schedule DCI format 0_1 at slot n + $\frac{T_{\text{HARQ}}+7ms}{\text{NR slot length}}$. In Sub-test 2, TE shall schedule DCI format 0_1 at slot n + $\frac{T_{\text{HARQ}}+3ms+M-k2}{\text{NR slot length}}$, where M is defined in 8.3.17 and k2 = 1. In Sub-test 3, UE shall tranmsit scheduling request on the first SR resource by 7ms+ T_{HARQ} + $T_{SR_Periodicity}$ to obtain the UL grant for L3 report transmission.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. The UE now starts monitoring the SCell. T1 is sufficiently long enough so that UE is able to complete the L3 detection and measurements on the SCell to be activated. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2. UE is expected to report L3 measurement result at the first PUSCH scheduled by TE.

The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot m + $\frac{T_{\text{HARQ}}+T_{\text{activation_time}}+T_{\text{CSI_Reporting}}}{\text{NR slot length}}$, as defined in clause 8.3. TE shall also indicate the TCI based on L3 report of the UE. The UE shall start reporting CSI in PSCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed.

During T2, any PSCell interruption due to activation of SCell shall occur in the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to slot $m + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2. Any E-UTRA PCell interruption due to activation of SCell shall occur in the subframe $m_1 + 1 + \frac{T_{\text{HARQ}}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{EUTRA slot length}} + N_{\text{interruption}}$, where m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m, and $N_{\text{interruption}}$ is the interruption length given in TS 36.133 [15] clause 7.32.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment. T3 shall be long enough to ensure UE completes the SCell de-activation.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation of SCell.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.4.5.3.9.1-1: known FR1 SCell activation in non-DRX for 160 ms SCell measurement cycle supported test configurations for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode

5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.4.5.3.9.1-1A: known FR1 SCell activation in non-DRX for 160 ms SCell measurement cycle supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.4.5.3.9.1-2: General test parameters for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.1
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on E-UTRA RF channel number	dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on secondary component carrier.
SCell measurement cycle (*measCycleSCell)*	ms	160	
Cell 3 timing offset to Cell 2	µs	0	
Time alignment error between Cell 3 and Cell 2	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PSCell shall be known and the SCell is configured and detected.
T2	ms	<200 ms	
T3	ms	200 ms	
A2-threshold	dBm	-130	
ReportCofing		reportConfigId = 0: A2-event-triggered reportConfig = 1: reportOnScellActivation-r18	
T_{HARQ}	ms	k_1NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]

Parameter	Unit	Value	Comment
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
$T_{uncertainty_RRC}$	ms	0	The CSI reporting for SCell being activated is provided during SCell addition.

Table A.4.5.3.9.1-3: Cell specific test parameters for NR PSCell for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 2		
			T1	T2-T3	T4
SSB ARFCN			freq1		
Duplex mode	Config 1,4		FDD		
	Config 2,3,5,6		TDD		
TDD configuration	Config 1,4		Not Applicable		
	Config 2,5		TDDConf.1.1		
	Config 3,6		TDDConf.2.1		
$BW_{channel}$	Config 1,4	MHz	Note 7		
	Config 2,5		Note 7		
	Config 3,6		Note 7		
$BW_{occupied}$	Config 1,4	RB	52 Note 5		
	Config 2,5		52 Note 5		
	Config 3,6		106 Note 6		
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1		
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1		
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1		
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1		
DRX Cycle		ms	Not Applicable		
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD		
	Config 2,5		SR.1.1 TDD		
	Config 3,6		SR.2.1 TDD		
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD		
	Config 2,5		CR.1.1 TDD		
	Config 3,6		CR.2.1 TDD		
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD		
	Config 2,5		CCR.1.1 TDD		
	Config 3,6		CCR.2.1 TDD		
TRS configuration	Config 1,4		TRS.1.1 FDD		
	Config 2,5		TRS.1.1 TDD		
	Config 3,6		TRS.1.2 TDD		
OCNG Patterns	Config 1,2,4,5		OP.1 Note 5		
	Config 3,6		OP.1 Note 6		
SMTC configuration			SMTC.1		
SSB configuration	Config 1,2,4,5		SSB.1 FR1		
	Config 3,6		SSB.2 FR1		
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD		
	Config 2,5		CSI-RS.1.1 TDD		
	Config 3,6		CSI-RS.2.1 TDD		
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15		
	Config 3,6		30		
reportConfigType	Config 1-6		periodic		
reportQuantity	Config 1-6		cri-RI-PMI-CQI		
CSI reporting periodicity	Config 1,2,4,5	slot	5		
	Config 3,6		10		
CSI reporting offset	Config 1,2,4,5	slot	2		
	Config 3,6		4		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					

Parameter		Unit	Cell 2		
			T1	T2-T3	T4
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2		dBm/15 kHz	-104		
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-104		
	Config 3,6		-101		
$\hat{E}_s/I_{ot}$		dB	17		
$\hat{E}_s/N_{oc}$		dB	17		
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87		
	Config 3,6		-84		
SCH_RP Note 3		dBm/15 kHz	-87		
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96		
	Config 3,6	dBm/38.16 MHz	-52.87		
Propagation condition		-	AWGN		
Correlation Matrix and Antenna Configuration		-	2x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.]
NOTE 5: All UL/DL transmission shall be confined within $BW_{channel_actual\text{-}occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{channel_actual\text{-}occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.

Table A.4.5.3.9.1-4: Cell specific test parameters for NR SCell for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 3		
			T1	T2-T3	T4
SSB ARFCN			freq2		
Duplex mode	$Config_{SCell}$ 1		FDD		
	$Config_{SCell}$ 2,3		TDD		
TDD configuration	$Config_{SCell}$ 1		Not Applicable		
	$Config_{SCell}$ 2		TDDConf.1.1		
	$Config_{SCell}$ 3		TDDConf.2.1		
$BW_{channel}$	$Config_{SCell}$ 1	MHz	Note 7		
	$Config_{SCell}$ 2		Note 7		
	$Config_{SCell}$ 3		Note 7		
$BW_{occupied}$	$Config_{SCell}$ 1	RB	52 Note 5		
	$Config_{SCell}$ 2		52 Note 5		
	$Config_{SCell}$ 3		106 Note 6		
DL initial BWP configuration	$Config_{SCell}$ 1-3		DLBWP.0.1		
DL dedicated BWP configuration	$Config_{SCell}$ 1-3		DLBWP.1.1		
UL initial BWP configuration	$Config_{SCell}$ 1-3		ULBWP.0.1		
UL dedicated BWP configuration	$Config_{SCell}$ 1-3		ULBWP.1.1		
DRX Cycle		ms	Not Applicable		
	$Config_{SCell}$ 1		SR.1.1 FDD		

Parameter		Unit	Cell 3		
			T1	T2-T3	T4
PDSCH Reference measurement channel	$Config_{SCell}$ 2		SR.1.1 TDD		
	$Config_{SCell}$ 3		SR.2.1 TDD		
RMSI CORESET Reference Channel	$Config_{SCell}$ 1		CR.1.1 FDD		
	$Config_{SCell}$ 2		CR.1.1 TDD		
	$Config_{SCell}$ 3		CR.2.1 TDD		
RMC CORESET Reference Channel	$Config_{SCell}$ 1		CCR.1.1 FDD		
	$Config_{SCell}$ 2		CCR.1.1 TDD		
	$Config_{SCell}$ 3		CCR.2.1 TDD		
TRS configuration	$Config_{SCell}$ 1		TRS.1.1 FDD		
	$Config_{SCell}$ 2		TRS.1.1 TDD		
	$Config_{SCell}$ 3		TRS.1.2 TDD		
OCNG Patterns	$Config_{SCell}$ 1,2		OP.1 Note 5		
	$Config_{SCell}$ 3		OP.1 Note 6		
SMTC configuration			SMTC.1		
SSB configuration	$Config_{SCell}$ 1,2		SSB.3 FR1		
	$Config_{SCell}$ 3		SSB.4 FR1		
CSI-RS configuration for CSI reporting	$Config_{SCell}$ 1		CSI-RS.1.1 FDD		
	$Config_{SCell}$ 2		CSI-RS.1.1 TDD		
	$Config_{SCell}$ 3		CSI-RS.2.1 TDD		
PDSCH/PDCCH subcarrier spacing	$Config_{SCell}$ 1,2	kHz	15		
	$Config_{SCell}$ 3		30		
reportConfigType	$Config_{SCell}$ 1-3		periodic		
reportQuantity	$Config_{SCell}$ 1-3		cri-RI-PMI-CQI		
CSI reporting periodicity	$Config_{SCell}$ 1,2	slot	5		
	$Config_{SCell}$ 3		10		
CSI reporting offset	$Config_{SCell}$ 1,2	slot	2		
	$Config_{SCell}$ 3		4		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS Note1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2		dBm/15 kHz	-104		
N_{oc} Note2	$Config_{SCell}$ 1,2	dBm/SCS	-104		
	$Config_{SCell}$ 3		-101		
$\hat{E}_s / I_{ot}$		dB	17		
$\hat{E}_s / N_{oc}$		dB	17		
SS-RSRP Note3	$Config_{SCell}$ 1,2	dBm/SCS	-87		
	$Config_{SCell}$ 3		-84		
SCH_RP Note 3		dBm/15 kHz	-87		
Io Note3	$Config_{SCell}$ 1,2	dBm/9.36 MHz	-58.96		
	$Config_{SCell}$ 3	dBm/38.16 MHz	-52.87		
Propagation condition		-	AWGN		
Correlation Matrix and Antenna Configuration		-	2x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.

NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.]

NOTE 5: All UL/DL transmission shall be confined within $BW_{channel_actual\text{-}occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.

Parameter	Unit	Cell 3		
		T1	T2-T3	T4
NOTE 6: All UL/DL transmission shall be confined within $BW_{channel_actual\text{-}occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.				
NOTE 7: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.				

Table A.4.5.3.9.1-5: Scheduling request parameters

Parameter		Value
schedulingRequestId		0
sr-ProhibitTimer		16ms
sr-TransMax		n4
periodicityAndOffset		Sl2
PUCCH resource ID		0
PUCCH resource	Starting PRB	To be determined by RAN5
	intraSlotFrequencyHopping	disabled
	Format	format 2
	nrofPRBs	2
	nrofSymbols	1
	startingSymbolIndex	0

A.4.5.3.9.2 Test Requirements

During T2, the UE shall send the first CSI report for SCell in the first available uplink resource after slot ($m + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$). UE is allowed to postpone CSI report to next available uplink resource if an available uplink resource is subject to interruption.

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot $m + \frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$,

For Sub-test 1, $T_{activation_time}$ = 7 ms + k2/SCS + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.17, where k2/SCS is 1 ms for config 1,2 and 0.5 ms for config 3.

For Sub-test 2, $T_{activation_time}$ = 3 ms + M + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.17.

For Sub-test 3, [$T_{activation_time}$ = 7ms + $T_{uncertainity_ULgrant}$ + max (T_{HARQ} + $T_{uncertainty_MAC}$ + 5ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.17. Where, $T_{uncertainity_ULgrant}$ is uncertainty in acquiring UL grant after sending scheduling request].

During T2, interruption of PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{\text{interruption}}$, and interruption of E-UTRA PCell during SCell activation shall not happen outside the subframe $m_1 + 1 + \frac{T_{HARQ}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{EUTRA slot length}} + N_{\text{interruption}}$, as defined in clause 8.3.

The interruption of PSCell shall not be more than the values specified for EN-DC in clause 8.2.1.2.4.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90%.

NOTE: During T2, if there are no uplink resources for reporting the valid CSI in a slot $m + \frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.4.5.3.10 SCell Activation of multiple unknown SCells in FR1 with L3 reporting with single activation/deactivation command in non-DRX

A.4.5.3.10.1 Test Purpose and Environment

The purpose of this test is to verify that the multiple SCell activation times are within the requirements stated in clause 8.3.18 when the two configured deactivated SCells in FR1 are unknown by the UE at the time of activation.

The supported test configurations for LTE PCell, NR PSCell and NR SCell are the same as defined in clause A.4.5.3.9.1. The test parameters are the same except those described in the following clause. The listed parameter values in table A.4.5.3.10.1-1 will replace the values of corresponding parameters in table A.4.5.3.9.1-2. The cell specific test parameter values in table A.4.5.3.10.1-2 will replace the values of corresponding parameters in table A.4.5.3.9.1-3.

The test consists of two successive time periods, with duration of T1 and T2, respectively. There are four carriers, E-UTRA has one cell, and NR has three cells. Cell 1 and Cell 2 have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRAN and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) and Cell 4 (SCell) on NR. The UE is monitoring the PCell and PSCell. TE continuously schedules the downlink data to UE on PCell and PSCell throughout the whole test.

The test consists of two sub tests. The slot at which the MAC message is received at the UE antenna connector, is denoted slot #n.

At the beginning of T1 the UE receives an RRC message by which the Cell 3 and Cell 4 becomes configured on radio channel 3 and 4 respectively. During T1 the SCells (Cell 3 and Cell 4) are powered off and UE is not aware of SCells. The UE starts monitoring the SCC1(Cell 3 CC) and SCC2 (Cell 4 CC). The test equipment sends a MAC message for activation of the Cell 3 and Cell 4 simultaneously.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2.

In sub test 1,TE shall transmit DCI 0-1 on PCell to schedule the PUSCH at slot $n + \frac{T_{\text{HARQ}}+7\ ms}{\text{NR slot length}}$, and the UE shall be able to transmit L3 measurement report of SCells at slot $n + \frac{T_{\text{HARQ}}+7\ ms+\text{k2}}{\text{NR slot length}}$, where k2 = 1.

In sub test 2, TE shall transmit DCI 0-1 on PCell to schedule the PUSCH at slot $n + \frac{T_{\text{HARQ}}+3\text{ms}+\text{M}-\text{k2}}{\text{NR slot length}}$, where M is defined in clause 8.3.17 and k2 = 1, and the UE shall be able to transmit L3 measurement report of SCells at slot $n + \frac{T_{\text{HARQ}}+3\text{ms}+\text{M}}{\text{NR slot length}}$. For sub test 2, TE will send TCI activation command after receiving L3 measurement report of the SCell.

The UE shall be able to report valid CSI for the activated SCells (Cell 3 and Cell 4) at latest in slot n + $\frac{T_{HARQ}+T_{activation_time_multiple_scells}+T_{CSI_Reporting}}{NR\ slot\ length}$ respectively as defined in clause 8.3.18 provided the SCells can be successfully detected on the first attempt.

The UE shall start reporting CSI for cell 3 and cell 4 after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $n + \frac{T_{\text{HARQ}}+3\text{ms}}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation for cell 3 and cell 4 has been completed, respectively. Any PSCell interruption due to activation of SCells shall occur in the slot $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to slot $n + 1 + \frac{T_{\text{HARQ}}+3\text{ms}+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3.18, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2. Any E-UTRA PCell interruption due to activation of SCells shall occur in the subframe $n_1 + 1 + \frac{T_{\text{HARQ}}}{\text{EUTRA slot length}}$ to subframe $n_2 + 1 + \frac{T_{\text{HARQ}}+3\text{ms}+T_{\text{X}}}{\text{EUTRA slot length}} + N_{\text{interruption}}$, where n_1 and n_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot n, and $N_{\text{interruption}}$ is the interruption length given in TS 36.133 [15] clause 7.32.

The test equipment verifies the activation time for Cell 3 by counting the slots from the time when the SCell activation command is sent until CSI report of activated Cell 3 with other than CQI index 0 is received.

The test equipment verifies the activation time for Cell 4 by counting the slots from the time when the SCell activation command is sent until CSI report of activated Cell 4 with other than CQI index 0 is received.

Table A.4.5.3.10.1-1: General test parameters for multiple unknown FR1 SCell activation case with 2 deactivated SCells, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
Configured deactivated SCell 1		Cell 3	Configured deactivated secondary cell on NR RF channel number 3 which is an intra-band contiguous CC to PSCC of Cell 2; *ssb-PositionInBurst* of Cell 3 is same as the one for Cell 2
Configured deactivated SCell 2		Cell 4	Configured deactivated secondary cell on NR RF channel number 4 which is an inter-band CC to PSCC of Cell 2
Cell 3 timing offset to Cell 2	μs	0	
Cell 4 timing offset to Cell 2	μs	0	
Time alignment error between Cell 3 and Cell 2	μs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
Time alignment error between cell4 and Cell 2	μs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	ms	100	During this time the PSCell shall be known and the SCell configured, but not detected.
T2	s	1	During this time the UE shall activate the SCell 1 and SCell 2.
A2-threshold	dBm	-130	
ReportConfig		reportConfigId = 0: A2-event-triggered reportConfig = 1: reportOnScellActivation-r18	
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
$T_{uncertainty_RRC}$	$T_{uncertainty_RRC}$	$T_{uncertainty_RRC}$	The CSI reporting for SCell being activated is provided during SCell addition.

Table A.4.5.3.10.1-2: Cell specific test parameters for NR SCell for multiple unknown FR1 SCell activation case, 160ms SCell measurement cycle

Parameter		Unit	Cell 3	Cell 4
			T2	T2
SSB ARFCN			Freq2	Freq3
Duplex mode	Config 1,4		FDD	
	Config 2,3,5,6		TDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2,5		TDDConf.1.1	
	Config 3,6		TDDConf.2.1	
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52	
	Config 2,5		10: $N_{RB,c}$ = 52	
	Config 3,6		40: $N_{RB,c}$ = 106	

Parameter		Unit	Cell 3	Cell 4
			T2	T2
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	SR.1.1 FDD
	Config 2,5		SR.1.1 TDD	SR.1.1 TDD
	Config 3,6		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	CR.1.1 FDD
	Config 2,5		CR.1.1 TDD	CR.1.1 TDD
	Config 3,6		CR.2.1 TDD	CR.2.1 TDD
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD	CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD	CCR.2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD	TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD	TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD	TRS.1.2 TDD
OCNG Patterns			OP.1	
SMTC configuration			SMTC.1	
SSB configuration	Config 1,2,4,5		SSB.3 FR1	
	Config 3,6		SSB.4 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz	
	Config 3,6		30 kHz	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-104	
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-104	
	Config 3,6		-101	
$\hat{E}_s / I_{ot}$		dB	17	
$\hat{E}_s / N_{oc}$		dB	17	
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87	
	Config 3,6		-84	
SCH_RP Note 3		dBm/15 kHz	-87	
Propagation condition		-	AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.

A.4.5.3.10.2 Test Requirements

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot n + $\frac{T_{HARQ}+Tactivation_time_multiple_scells+T_{CSI_Reporting}}{NR\ slot\ length}$, where as defined in clause 8.3.18, in

sub test 1, $T_{activation_time_multiple_scells}$ = 7 ms + $\frac{k2}{NR\ slot\ length}$+ max ($T_{HARQ}$ + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}), where $\frac{k2}{NR\ slot\ length}$= 1 ms for SCS of PSCell =15 kHz, and 0.5 ms for SCS of PSCell = 30 kHz,

In sub test 2, $T_{activation_time_multiple_scells}$ = 3 ms + M + max (T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}).

A.4.5.3.11 TRS-based SCell Activation of SSB-less SCell in FR1 collocated inter-band

A.4.5.3.11.1 Test Purpose and Environment

The purpose of this test is to verify that the TRS based SCell activation times are within the requirements stated in clause 8.3.2, when the SCell is an SSB-less SCell on a FR1 band different from the reference cell (i.e., PSCell) and provided with periodic CSI-RS for tracking instead of SSB. The SCell and PSCell are collocated.

The supported test configurations are shown in table A.4.5.3.11.1-1 below. The test parameters are given in tables A.4.5.3.11.1-2 and cell-specific parameters in A.4.5.3.11.1-3 below. The test consists of two successive time periods, with duration of T1 and T2, respectively. There are three carriers, E-UTRA has one cell; NR has two cells, where each NR cell has one carrier and these two carriers are collocated and on different FR1 bands. SSB is not transmitted on the SCell hence the UE is not provided with SSB configuration (*absoluteFrequencySSB*) in the SCell (FrequencyInfoDL) nor SMTC configuration. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. The test equipment sends a MAC message for activation of the SCell and triggering the periodic CSI-RS for TRS-based SCell activation.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2. The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot m + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{\text{NR slot length}}$, as defined in clause 8.3.2. The UE shall start reporting CSI in PSCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed.

Any PSCell interruption due to activation of SCell shall occur in the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to slot $m + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2. Any E-UTRA PCell interruption due to activation of SCell shall occur in the subframe $m_1 + 1 + \frac{T_{\text{HARQ}}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{EUTRA slot length}} + N_{\text{interruption}}$, where m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m, and $N_{\text{interruption}}$ is the interruption length given in TS 36.133 [15] clause 7.32.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation of SCell.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.4.5.3.11.1-1: TRS-based SCell activation of SSB-less SCell in FRI inter-band supported test configurations

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,

Table A.4.5.3.11.1-2: General test parameters for TRS-based SCell activation of SSB-less SCell in FR1 inter-band

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.1
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on E-UTRA RF channel number	dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on secondary component carrier.
Cell 3 timing offset to Cell 2	μs	Length of CP of Cell 3	
Time alignment error between Cell 3 and Cell 2	μs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	ms	100	During this time the PSCell shall be known and the SCell is configured but not detected.
T2	s	1	During this time the UE shall activate the SCell.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in TS38.213 [3]
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
k	slot	$k_1 + 3 \cdot N_{\text{slot}}^{\text{subframe},\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.4.5.3.11-3: Cell specific test parameters for TRS-based SCell activation of SSB-less SCell in FR1 inter-band

Parameter		Unit	Cell 2		Cell 3	
			T1	T2	T1	T2
SSB ARFCN			freq1		freq2	
Duplex mode	Config 1,4		FDD			
	Config 2,3,5,6		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2,5		TDDConf.1.1			
	Config 3,6		TDDConf.2.1			

Parameter		Unit	Cell 2		Cell 3	
			T1	T2	T1	T2
$BW_{channel}$	Config 1,4	MHz	Note 7			
	Config 2,5		Note 7			
	Config 3,6		Note 7			
$BW_{occupied}$	Config 1,4	RB	52 Note 5			
	Config 2,5		52 Note 5			
	Config 3,6		106 Note 6			
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1			
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1			
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1			
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1			
gapBetweenBursts		Slot	N/A			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD	
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD		CCR.1.1 FDD	
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD		TRS.1.1 FDD	
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns	Config 1,2,4,5		OP.1 Note 5			
	Config 3,6		OP.1 Note 6			
TCI state	Config 1, 2, 3, 4, 5, 6		TCI.State.0		TCI.State.0 Note 8	
SMTC configuration	Config 1, 2, 3, 4, 5, 6		SMTC.1		Not Applicable	
SSB configuration	Config 1,2,4,5		SSB.1 FR1		Not Applicable	
	Config 3,6		SSB.2 FR1		Not Applicable	
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD			
	Config 2,5		CSI-RS.1.1 TDD			
	Config 3,6		CSI-RS.2.1 TDD			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15			
	Config 3,6		30			
reportConfigType	Config 1-6		periodic			
reportQuantity	Config 1-6		cri-RI-PMI-CQI			
CSI reporting periodicity	Config 1,2,4,5	slot	5		N/A	
	Config 3,6		10		N/A	
CSI reporting offset	Config 1,2,4,5	slot	2		N/A	
	Config 3,6		4		N/A	
EPRE ratio of PSS to SSS			0		N/A	
EPRE ratio of PBCH DMRS to SSS			0		N/A	
EPRE ratio of PBCH to PBCH DMRS			0		N/A	
EPRE ratio of PDCCH DMRS to SSS			0		N/A	
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		N/A	
EPRE ratio of PDSCH DMRS to SSS			0		N/A	
EPRE ratio of PDSCH to PDSCH			0			

Parameter		Unit	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of OCNG DMRS to SSS(Note 1)			0		N/A	
EPRE ratio of OCNG to OCNG DMRS (Note 1)			0			
N_{oc} Note2		dBm/15 kHz	-104		-120	
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-104		-120	
	Config 3,6		-101		-117	
$\hat{E}_s / I_{ot}$		dB	19		35-Δ_{EPRE} Note 9	
$\hat{E}_s / N_{oc}$		dB	19		35-Δ_{EPRE} Note 9	
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-85		NA	
	Config 3,6		-82		NA	
SCH_RP Note 3		dBm/15 kHz	-85		NA	
Propagation condition		-	AWGN			
Io Note3	Config 1,2,4,5	dBm/ 9.36 MHz	-56.99		-69.03 (Δ_{EPRE} = 12dB) -85.85 (Δ_{EPRE} = 30dB)	
	Config 3,6	dBm/ 38.16 MHz	-50.90		-62.92 (Δ_{EPRE} = 12dB) -79.75 (Δ_{EPRE} = 30dB)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.]
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.
NOTE 8: The SSB in referenceSignal in the TCI state is configured as the SSB in Cell 2.
NOTE 9: Δ_{EPRE} is configured as different values to verify different requirements defined in clause A.4.5.3.11.2.

A.4.5.3.11.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available uplink resource if an available uplink resource is subject to interruption. Whether CSI report in slot (m+k) was interrupted is checked by monitoring ACK/NACK sent in PCell in slot (m+k).

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where $T_{activation_time}$ =

- T_{first_TRS} + T_{TRS} + 5 ms, if aperiodic CSI-RS resources are not configured for SCell activation or UE do not support *aperiodicCSI-RS-FastScellActivation-r17*, when the EPRE difference(Δ_{EPRE}) is equal to 12 dB

- T_{first_TRS} + 2*T_{TRS} +5 ms, when the EPRE difference(Δ_{EPRE}) is equal to 30 dB

as defined in clause 8.3.2.

During T2 interruption of PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{\text{interruption}}$, and interruption of E-UTRA PCell during SCell activation shall not happen outside the subframe $m_1 + 1 + \frac{T_{HARQ}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{EUTRA slot length}} + N_{\text{interruption}}$, as defined in clause 8.3.

The interruption of PSCell shall not be more than the values specified for EN-DC in clause 8.3.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay to be counted as correct. The rate of correct observed SCell activation delay during repeated tests shall be at least 90%.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot m + $\frac{T_{\mathrm{HARQ}}+T_{\mathrm{activtion_time}}+T_{\mathrm{CSI_Reporting}}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.4.5.3.12 Inter-band SSB-less Scell activation using A-TRS

A.4.5.3.12.1 Test Purpose and Environment

The purpose of this test is to verify the SSB less SCell activation delay is within the requirements stated in clause 8.3.2.

The supported test configurations are shown in table A.4.5.3.12.1-1 below. The test parameters are given in tables A.4.5.3.12.1-2 and cell-specific parameters in A.4.5.3.12.1-3 below. The test consists of two successive time periods, with duration of T1 and T2, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes added. The configuration for the SCell (Cell 3) is not provided with SSB configuration (*absoluteFrequencySSB*) in the SCell *FrequencyInfoDL* nor SMTC configuration for the SCell and PSCell (Cell 2) is indicated as reference cell by higherlayer parameter *referenceCell-r18*. Cell 3 is configured with aperiodic-TRS as shown in table A.4.5.3.12.1-3. The RS(s) of the Cell 3 is QCL-TypeA with TRS(s) of the Cell 3, and the TRS(s) of the Cell 3 is QCL-TypeC with SSB(s) of Cell 2.

The test equipment sends a MAC message for activation of the SCell and triggering the aperiodic CSI-RS for fast SCell activation. The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2.

The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot m + $\frac{T_{\mathrm{HARQ}}+T_{\mathrm{activation_time}}+T_{\mathrm{CSI_Reporting}}}{\mathrm{NR\ slot\ length}}$, as defined in clause 8.3. The UE shall start reporting CSI in PSCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption due to activation of SCell shall occur in between slot $m + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to slot $m + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+\mathrm{Tfirst_ATRS}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$ as defined in clause 8.3. Any E-UTRA PCell interruption due to activation of SCell shall occur in between subframe $m_1 + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{EUTRA\ slot\ length}}$ to subframe $m_2 + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+\mathrm{Tfirst_ATRS}}{\mathrm{EUTRA\ slot\ length}} + N_{\mathrm{interruption}}$ where m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation and deactivation of Scell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the Scell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.4.5.3.12.1-1: Inter-band SSB less SCell SCell activation in FR1 supported test configurations

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.4.5.3.12.1-2: General test parameters for Inter-band SSB less SCell SCell activation in FR1

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.1
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on E-UTRA RF channel number	dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on secondary component carrier.
Cell 3 timing offset to Cell 2	µs	Length of CP of Cell 3	
Time alignment error between Cell 3 and Cell 2	µs	≤ 3	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PSCell shall be known and the SCell is configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T_{HARQ}	ms	k_1 NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in TS 38.213 [3]
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
k	slot	$k_1 + 3 \cdot N_{\text{slot}}^{\text{subframe},\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.4.5.3.12-3: Cell specific test parameters for Inter-band SSB less SCell activation in FR1

Parameter		Unit	Cell 2		Cell 3	
			T1	T2	T1	T2
SSB ARFCN			freq1		Not applicable	
Duplex mode	Config 1,4		FDD			
	Config 2,3,5,6		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2,5		TDDConf.1.1			
	Config 3,6		TDDConf.2.1			
Reference Channel			N/A		Cell 2	
$BW_{channel}$	Config 1,4	MHz	Note 7			
	Config 2,5		Note 7			
	Config 3,6		Note 7			
$BW_{occupied}$	Config 1,4	RB	52 Note 5			
	Config 2,5		52 Note 5			
	Config 3,6		106 Note 6			
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1			

Parameter		Unit	Cell 2		Cell 3	
			T1	T2	T1	T2
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1			
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1			
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1			
TCI state			TCI.State.0		TCI.State.0 Note 8	
Aperiodic CSI-RS for SCell activation	Config 1,4		N/A		TRS.1.3 FDD	
	Config 2,5		N/A		TRS.1.3 TDD	
	Config 3,6		N/A		TRS.1.4 TDD	
gapBetweenBursts		Slot	N/A			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD	
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD		CCR.1.1 FDD	
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD		TRS.1.1 FDD	
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns	Config 1,2,4,5		OP.1 Note 5			
	Config 3,6		OP.1 Note 6			
SMTC configuration			SMTC.1		Not Applicable	
SSB configuration	Config 1,2,4,5		SSB.1 FR1		Not Applicable	
	Config 3,6		SSB.2 FR1		Not Applicable	
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD			
	Config 2,5		CSI-RS.1.1 TDD			
	Config 3,6		CSI-RS.2.1 TDD			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15			
	Config 3,6		30			
reportConfigType	Config 1-6		periodic			
reportQuantity	Config 1-6		cri-RI-PMI-CQI			
CSI reporting periodicity	Config 1,2,4,5	slot	5		N/A	
CSI reporting offset	Config 3,6	slot	10		N/A	
	Config 1,2,4,5		2		N/A	
	Config 3,6		4		N/A	
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-107			
	Config 3,6		-104			
$\hat{E}_s / I_{ot}$		dB	10		22	
$\hat{E}_s / N_{oc}$		dB	10		22	
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-97		NA	
	Config 3,6		-94		NA	
SCH_RP Note 3		dBm/15 kHz	-97		NA	
Propagation condition		-	AWGN			
Io Note3	Config 1,2,4,5	dBm/ 9.36 MHz	-68.63		-57.02	
	Config 3,6	dBm/ 38.16 MHz	-62.54		-50.92	

Parameter	Unit	Cell 2		Cell 3	
		T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.					
NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.]					
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.					
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.					
NOTE 7: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.					
NOTE 8: The SSB in referenceSignal in the TCI state is configured as the SSB in Cell 2.					

A.4.5.3.12.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available uplink resource if an available uplink resource is subject to interruption. Whether CSI report in slot (m+k) was interrupted is checked by monitoring ACK/NACK sent in PCell in slot (m+k).

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, $T_{activation_time} = T_{first_ATRS} + T_{gap} + T_{ATRS} + 5$ ms, as defined in clause 8.3.

During T2 interruption of PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{interruption}$, and interruption of E-UTRA PCell during SCell activation shall not happen outside the subframe $m_1 + 1 + \frac{T_{HARQ}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{EUTRA slot length}} + N_{interruption}$, as defined in clause 8.3.

The interruption of PSCell shall not be more than the values specified for EN-DC in clause 8.2.1.2.19.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay during repeated tests shall be at least 90%.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.4.5.4 UE UL carrier RRC reconfiguration Delay

A.4.5.4.1 UE UL carrier RRC reconfiguration Delay

Table A.4.5.4.1-1 - Table A.4.5.4.1-4 : Void

A.4.5.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that when the UE receives an RRC message implying NR UL or Supplementary UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within the time limits specified in clause 8.4.2 and 8.4.3 for configuring and deconfiguring, respectively.

There are three cells: E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and FR1 SCell (Cell 3). For SCell, both NR uplink and supplementary uplink are broadcast by *ServingCellConfigCommonSIB.* The test parameters for PSCell and SCell are given in Table A. 4.5.4.1.1-1, Table A. 4.5.4.1.1-2, Table A. 4.5.4.1.1-3 and Table A. 4.5.4.1.1-4 below. The test parameters and applicability for E-UTRAN PCell are defined in clause A.3.7.2. The test consists of two separate tests. The test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, NR uplink of cell 3 is configured to UE. At the start of T2, a supplementary uplink of Cell 3 is configured to UE through

RRCReconfiguration, then UE shall start transmission on the supplementary uplink. At the start of T3, the supplementary uplink is released through *RRCReconfiguration*.

Table A.4.5.4.1.1-1: Supported test configurations

Configuration	PSCell (Cell 2)	SCell (Cell 3)
1	15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode	DL and UL: 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode; SUL: 15 kHz SCS, ≥10 MHz bandwidth, SUL duplex mode
2	15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode	DL and UL: 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode; SUL: 15 kHz SCS, ≥10 MHz bandwidth, SUL duplex mode
3	15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode	DL and UL: 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode; SUL: 30 kHz SCS, ≥40 MHz bandwidth, SUL duplex mode
4	15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode	DL and UL: 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode; SUL: 15 kHz SCS, ≥10 MHz bandwidth, SUL duplex mode
5	15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode	DL and UL: 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode; SUL: 15 kHz SCS, ≥10 MHz bandwidth, SUL duplex mode
6	15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode	DL and UL: 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode; SUL: 30 kHz SCS, ≥40 MHz bandwidth, SUL duplex mode
7	30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode	DL and UL: 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode; SUL: 15 kHz SCS, ≥10 MHz bandwidth, SUL duplex mode
8	30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode	DL and UL: 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode; SUL: 15 kHz SCS, ≥10 MHz bandwidth, SUL duplex mode
9	30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode	DL and UL: 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode; SUL: 30 kHz SCS, ≥40 MHz bandwidth, SUL duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,		

Table A.4.5.4.1.1-2: General test parameters for EN-DC UE UL carrier RRC reconfiguration Delay

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1,2,3, 4, 5, 6, 7, 8, 9	1, 2, 3	Three radio channels are used for this test.
Active cell		Config 1,2,3, 4, 5, 6, 7, 8, 9	Cell 1: E-UTRAN PCell Cell 2: FR1 PSCell Cell 3: FR1 SCell	E-UTRAN PCell on RF channel number 1 FR1 PSCell on RF channel number 2 FR1 SCell on RF channel number 3
CP length		Config 1,2,3, 4, 5, 6, 7, 8, 9	Normal	
DRX		Config 1,2,3, 4, 5, 6, 7, 8, 9	OFF	
Measurement gap pattern Id		Config 1,2,3, 4, 5, 6, 7, 8, 9	OFF	
Filter coefficient		Config 1,2,3, 4, 5, 6, 7, 8, 9	0	L3 filtering is not used

T1	s	Config 1,2,3, 4, 5, 6, 7, 8, 9	5	
T2	s	Config 1,2,3, 4, 5, 6, 7, 8, 9	5	
T3	s	Config 1,2,3, 4, 5, 6, 7, 8, 9	5	

Table A.4.5.4.1.1-3: NR Cell specific test parameters for EN-DC UE UL carrier RRC reconfiguration Delay on PSCell (Cell 2)

Parameter	Unit	Test Configuration	Test 1		
			T1	T2	T3
Channel number		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	2		
TDD configuration		Conf 1, 2, 3	N/A		
		Conf 4, 5, 6	TDD Conf.1.1		
		Conf 7, 8, 9	TDD Conf.2.1		
$BW_{channel}$	MHz	Conf 1, 2, 3	Note 6		
		Conf 4, 5, 6	Note 6		
		Conf 7, 8, 9	Note 6		
$BW_{occupied}$	RB	Conf 1, 2, 3	52 Note 4		
		Conf 4, 5, 6	52 Note 4		
		Conf 7, 8, 9	106 Note 5		
PDSCH reference measurement channel		Conf 1, 2, 3	SR.1.1 FDD		
		Conf 4, 5, 6	SR.1.1 TDD		
		Conf 7, 8, 9	SR 2.1 TDD		
RMSI CORESET reference measurement channel		Conf 1, 2, 3	CR.1.1 FDD		
		Conf 4, 5, 6	CR.1.1 TDD		
		Conf 7, 8, 9	CR.2.1 TDD		
RMC CORESET reference measurement channel		Conf 1, 2, 3	CCR.1.1 FDD		
		Conf 4, 5, 6	CCR.1.1 TDD		
		Conf 7, 8, 9	CCR.2.1 TDD		
OCNG Pattern Note 1		Conf 1, 2, 3, 4, 5, 6	OP.1 Note 4		
		Config 7, 8, 9	OP.1 Note 5		
SSB configuration		Conf 1, 2, 3, 4, 5, 6	SSB.1 FR1		
		Conf 7, 8, 9	SSB.2 FR1		
SMTC configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	SMTC.1		
CSI-RS for tracking		Conf 1	TRS.1.1 FDD		
		Conf 2	TRS.1.1 FDD		
		Conf 3	TRS.1.1 FDD		
		Conf 4	TRS.1.1 TDD		
		Conf 5	TRS.1.1 TDD		
		Conf 6	TRS.1.1 TDD		
		Conf 7	TRS.1.2 TDD		
		Conf 8	TRS.1.2 TDD		
		Conf 9	TRS.1.2 TDD		
DL initial BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.0.1		
DL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.1.1		
UL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	ULBWP.1.1		
EPRE ratio of PSS to SSS	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	0		
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					

Parameter	Unit	Test Configuration	Test 1		
			T1	T2	T3
N_{oc} Note 2	dBm / 15 kHz	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	-102		
	dBm/SCS	Conf 1,2,3,4,5,6	-102		
		Conf 7,8,9	-99		
$\hat{E}_s / N_{oc}$	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16
$\hat{E}_s / I_{ot}$ Note 3	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16
SS-RSRP Note 3	dBm/SCS	Conf 1,2,3,4,5,6	-86	-86	-86
		Conf 7,8,9	-83	-83	-83
Io Note 3	dBm/ 9.36 MHz	Conf 1,2,3,4,5,6	-57.9	-57.9	-57.9
	dBm/ 38.16 MHz	Conf 7,8,9	-51.8	-51.8	-51.8
Propagation Condition		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	AWGN		
Antenna configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	1 x 2		

NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: $\hat{E}_s / I_{ot}$, Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.

Table A.4.5.4.1.1-4: NR Cell specific test parameters for EN-DC UE UL carrier RRC reconfiguration Delay on SCell (Cell 3)

Parameter	Unit	Test Configuration	Test 1		
			T1	T2	T3
Channel number		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	3		
TDD configuration		Conf 1, 4, 7	N/A		
		Conf 2, 5, 8	TDDConf.1.1		
		Conf 3, 6, 9	TDDConf.2.1		
$BW_{channel}$	MHz	Conf 1, 4, 7	Note 6		
		Conf 2, 5, 8	Note 6		
		Conf 3, 6, 9	Note 6		
$BW_{occupied}$	RB	Conf 1, 4, 7	52 Note 4		
		Conf 2, 5, 8	52 Note 4		
		Conf 3, 6, 9	106 Note 5		
PUSCH parameters for NR UL carrier		Conf 1, 4, 7	G-FR1-A3-10 in TS 38.104 [13]	G-FR1-A3-10 in TS 38.104 [13]	G-FR1-A3-10 in TS 38.104 [13]
		Conf 2, 5, 8	G-FR1-A3-10 in TS 38.104 [13]	G-FR1-A3-10 in TS 38.104 [13]	G-FR1-A3-10 in TS 38.104 [13]
		Conf 3, 6, 9	G-FR1-A3-14 in TS 38.104 [13]	G-FR1-A3-14 in TS 38.104 [13]	G-FR1-A3-14 in TS 38.104 [13]
PUCCH parameters For NR UL carrier		Conf 1, 4, 7	Table 8.3.3.1.2-1 in TS 38.104 [13]	Table 8.3.3.1.2-1 in TS 38.104 [13]	Table 8.3.3.1.2-1 in TS 38.104 [13]

Parameter	Unit	Test Configuration	Test 1		
			T1	T2	T3
		Conf 2, 5, 8	Table 8.3.3.1.2-1 in TS 38.104 [13]	Table 8.3.3.1.2-1 in TS 38.104 [13]	Table 8.3.3.1.2-1 in TS 38.104 [13]
		Conf 3, 6, 9	Table 8.3.3.1.2-2 in TS 38.104 [13]	Table 8.3.3.1.2-2 in TS 38.104 [13]	Table 8.3.3.1.2-2 in TS 38.104 [13]
PUSCH parameters for supplementary UL		Conf 1, 4, 7	N/A	G-FR1-A3-10 in TS 38.104 [13]	N/A
		Conf 2, 5, 8	N/A	G-FR1-A3-10 in TS 38.104 [13]	N/A
		Conf 3, 6, 9	N/A	G-FR1-A3-14 in TS 38.104 [13]	N/A
PUCCH parameters for supplementary UL		Conf 1, 4, 7	N/A	N/A	N/A
		Conf 2, 5, 8	N/A	N/A	N/A
		Conf 3, 6, 9	N/A	N/A	N/A
PDSCH reference measurement channel		Conf 1, 4, 7	SR.1.1 FDD		
		Conf 2, 5, 8	SR.1.1 TDD		
		Conf 3, 6, 9	SR 2.1 TDD		
RMSI CORESET reference measurement channel		Conf 1, 4, 7	CR.1.1 FDD		
		Conf 2, 5, 8	CR.1.1 TDD		
		Conf 3, 6, 9	CR.2.1 TDD		
RMC CORESET reference measurement channel		Conf 1, 4, 7	CCR.1.1 FDD		
		Conf 2, 5, 8	CCR.1.1 TDD		
		Conf 3, 6, 9	CCR.2.1 TDD		
OCNG Pattern Note 1		Conf 1, 2, 4, 5, 7, 8	OP.1 Note 4		
		Conf 3, 6, 9	OP.1 Note 5		
SSB configuration		Conf 1, 2, 4, 5, 7,8	SSB.1 FR1		
		Conf 3, 6, 9	SSB.2 FR1		
SMTC configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	SMTC.1		
CSI-RS for tracking		Conf 1	TRS.1.1 FDD		
		Conf 2	TRS.1.1 TDD		
		Conf 3	TRS.1.2 TDD		
		Conf 4	TRS.1.1 FDD		
		Conf 5	TRS.1.1 TDD		
		Conf 6	TRS.1.2 TDD		
		Conf 7	TRS.1.1 FDD		
		Conf 8	TRS.1.1 TDD		
		Conf 9	TRS.1.2 TDD		
DL initial BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.0.1		
DL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.1.1		
UL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	ULBWP.1.1		
EPRE ratio of PSS to SSS	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	0		
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					

Parameter	Unit	Test Configuration	Test 1		
			T1	T2	T3
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc} Note 2	dBm / 15 kHz	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	-102		
	dBm/SCS	Conf 1, 2, 4, 5, 7,8	-102		
		Conf 3, 6, 9	-99		
$\hat{E}_s / N_{oc}$	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16
$\hat{E}_s / I_{ot}$ Note 3	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16
SS-RSRP Note 3	dBm/SCS	Conf 1, 2, 4, 5, 7,8	-86	-86	-86
		Conf 3, 6, 9	-83	-83	-83
Io Note 3	dBm/ 9.36 MHz	Conf 1, 2, 4, 5, 7,8	-57.9	-57.9	-57.9
	dBm/ 38.16 MHz	Conf 3, 6, 9	-51.8	-51.8	-51.8
Propagation Condition		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	AWGN		
Antenna configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	1 x 2		
SUL RSRP threshold (*rsrp-ThresholdSSB-SUL*)	dBm	Conf 1,2,3,4,5,6	-75		
		Conf 7,8,9	-72		

NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: $\hat{E}_s / I_{ot}$, Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: $N_{RB,c}$. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured $BW_{channel}$.

A.4.5.4.1.2 Test Requirements

The UE shall be ready to start transmission on the supplementary uplink carrier on SCell within 20 ms from the start of T2.

The UE shall stop the transmission on the supplementary uplink carrier on SCell within 20 ms from the start of T3.

All of the above test requirements shall be fulfilled in order for the observed UE UL carrier configuration delay and UE UL carrier release delay to be counted as correct. The rate of correct observed UE UL carrier configuration delay and UE UL carrier release delay during repeated tests shall be at least 90%.

A.4.5.5 Beam Failure Detection and Link recovery procedures

A.4.5.5.1 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with SSB-based BFD and LR in non-DRX mode

A.4.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.1.1-1, A.4.5.5.1.1-2, and A.4.5.5.1.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.1.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PSCell to emulate SSB based beam failure. Figure A.4.5.5.1.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 1.

Table A.4.5.5.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.1.1-2: General test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1, 4		FDD	
	Config 2, 3, 5, 6		TDD	
BWchannel	Config 1, 4	MHz	10: NRB,c = 52	
	Config 2, 5		10: NRB,c = 52	
	Config 3, 6		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1	
TDD Configuration	Config 1, 4		Not Applicable	
	Config 2, 5		TDDConf.1.1	
	Config 3, 6		TDDConf.2.1	
CORESET	Config 1, 4		CR.1.1 FDD	
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	
	Config 2, 5		CR.1.1 TDD	
	Config 3, 6		CR.2.1 TDD	
Dedicated CORESET Reference	Config 1, 4		CCR.1.1 FDD	
	Config 2, 5		CCR.1.1 TDD	
	Config 3, 6		CCR.2.1 TDD	
SSB Configuration	Config 1, 4		SSB.3 FR1	
	Config 2, 5		SSB.3 FR1	
	Config 3, 6		SSB.4 FR1	
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1	
	Config 3, 6		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz	
	Config 3, 6		30 KHz	
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.2-1	

Parameter		Unit	Value	Comment
			Test 1	
	Config 3, 6		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			gp0	
gapOffset			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2, 4, 5	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3, 6		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD	
	Config 2, 5		CSI-RS.1.1 TDD	
	Config 3, 6		CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
SSB Index assigned as RLM RS			0,1	
T310 timer		ms	1000	
N310			2	
T1		s	0.2	During this time the the UE shall be fully synchronized to cell 1
T2		s	0.37	
T3		s	0.24	
T4		s	0	
T5		s	0.17	
D1		s	0.14	

NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.
NOTE 3: E-UTRAN is in non-DRX mode under test.

Table A.4.5.5.1.1-3: Cell specific test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1, 4	dB	5	-3	-12	-12	-12
	Config 2, 5		5	-3	-12	-12	-12
	Config 3, 6		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1, 4	dB	-10	-10	10	10	10
	Config 2, 5		-10	-10	10	10	10
	Config 3, 6		-10	-10	10	10	10
SSB_RP of set q_1	Config 1, 4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-85	-85	-85
N_{oc}	Config 1, 4	dBm/15 KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.4.5.5.1.1-4: Void

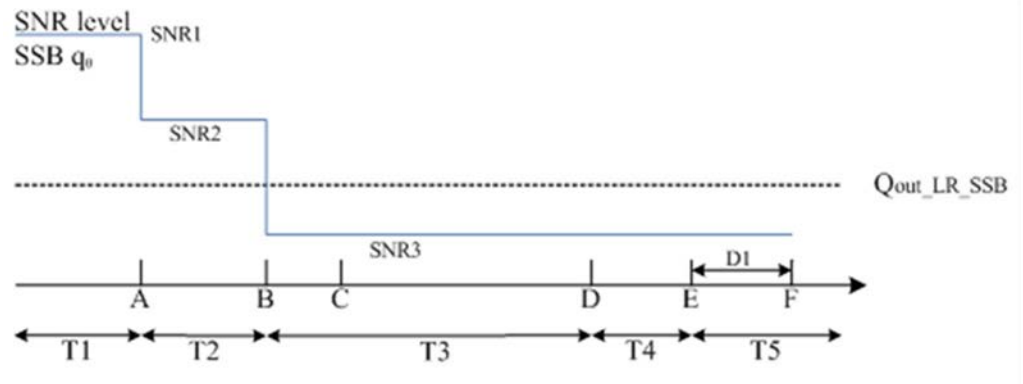


Figure A.4.5.5.1.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

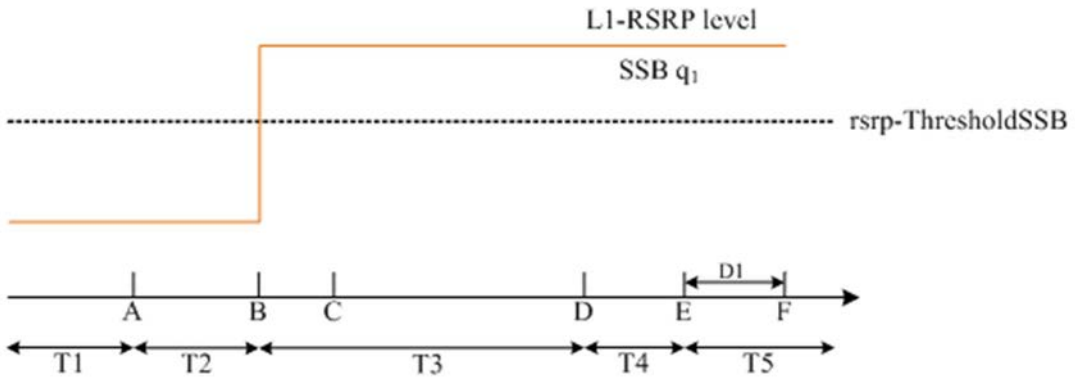


Figure A.4.5.5.1.1-2: L1-RSRP level variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.4.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.5.2 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with SSB-based BFD and LR in DRX mode

A.4.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.2.1-1, A.4.5.5.2.1-2, and A.4.5.5.2.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.2.1-1 shows the variation of the downlink SNR of the PSCell and the SNR of the SSB in set q_0 in the active PSCell to emulate SSB based beam failure. Figure A.4.5.5.2.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.4.5.5.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode

3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.2.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1, 4		FDD	
	Config 2, 3, 5, 6		TDD	
BWchannel	Config 1, 4	MHz	10: NRB,c = 52	
	Config 2, 5		10: NRB,c = 52	
	Config 3, 6		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1	
TDD Configuration	Config 1, 4		Not Applicable	
	Config 2, 5		TDDConf.1.1	
	Config 3, 6		TDDConf.2.1	
CORESET Reference	Config 1, 4		CR.1.1 FDD	
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	
	Config 2, 5		CR.1.1 TDD	
	Config 3, 6		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD	
	Config 2, 5		CCR.1.1 TDD	
	Config 3, 6		CCR.2.1 TDD	
SSB Configuration	Config 1, 4		SSB.3 FR1	
	Config 2, 5		SSB.3 FR1	
	Config 3, 6		SSB.4 FR1	
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1	
	Config 3, 6		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz	
	Config 3, 6		30 KHz	
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.2-1	
	Config 3, 6		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0	

Parameter		Unit	Value	Comment
			Test 1	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2, 4, 5	dBm/SCS	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3, 6		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD	
	Config 2, 5		CSI-RS.1.1 TDD	
	Config 3, 6		CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
SSB Index assigned as RLM RS			0,1	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	5.17	
T3		s	3.24	
T4		s	0	
T5		s	1.97	
D1		s	1.94	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.				

Table A.4.5.5.2.1-3: Cell specific test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1, 4	dB	5	-3	-12	-12	-12
	Config 2, 5		5	-3	-12	-12	-12
	Config 3, 6		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1, 4	dB	-10	-10	10	10	10
	Config 2, 5		-10	-10	10	10	10
	Config 3, 6		-10	-10	10	10	10

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
SSB_RP of set q_1	Config 1, 4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-85	-85	-85
N_{oc}	Config 1, 4	dBm/15 KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.4.5.5.2.1-4: Void

Table A.4.5.5.2.1-5: Void

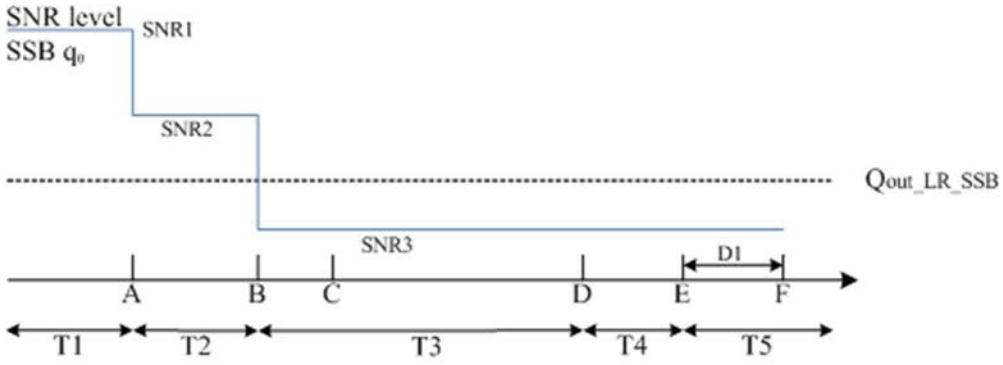


Figure A.4.5.5.2.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in DRX mode

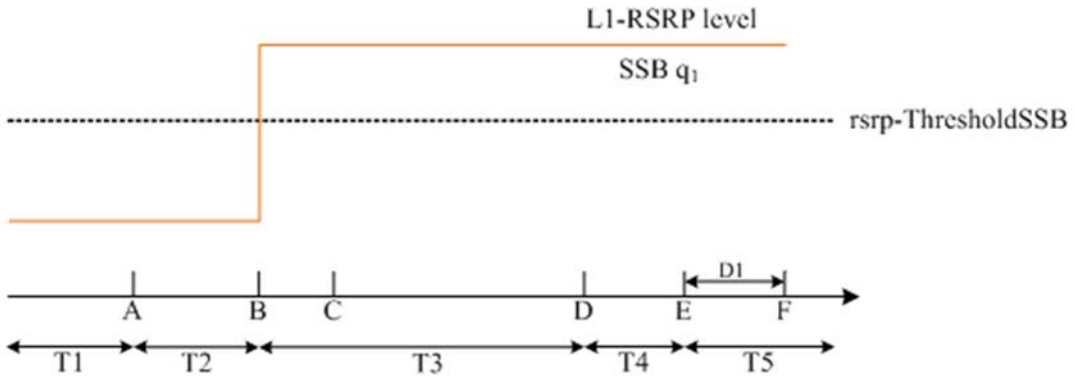


Figure A.4.5.5.2.1-2: L1-RSRP level variation for SSB-based beam failure detection and link recovery testing in DRX mode

A.4.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.5.3 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.4.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.4.5.5.3.1-1, A.4.5.5.3.1-2, and A.4.5.5.3.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.3.1-1 shows the variation of the downlink SNR of the PSCell and the SNR of the CSI-RS in set q_0 in the active PSCell to emulate CSI-RS based beam failure. Figure A.4.5.5.3.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.4.5.5.3.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.3.1-2: General test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1, 4		FDD	
	Config 2, 3, 5, 6		TDD	
BWchannel	Config 1, 4	MHz	10: NRB,c = 52	
	Config 2, 5		10: NRB,c = 52	
	Config 3, 6		40: NRB,c = 106	

Parameter		Unit	Value	Comment
			Test 1	
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1	
TDD Configuration	Config 1, 4		Not Applicable	
	Config 2, 5		TDDConf.1.1	
	Config 3, 6		TDDConf.2.1	
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	A.3.1.2
	Config 2, 5		CR.1.1 TDD	
	Config 3, 6		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD	A.3.1.3
	Config 2, 5		CCR.1.1 TDD	
	Config 3, 6		CCR.2.1 TDD	
SSB Configuration	Config 1, 4		SSB. 3 FR1	A.3.10
	Config 2, 5		SSB. 3 FR1	
	Config 3, 6		SSB. 4 FR1	
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1	A.3.11
	Config 3, 6		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz	
	Config 3, 6		30 KHz	
PRACH Configuration	Config 1, 2, 4, 5		FR1 PRACH configuration 4	A.3.8.2
	Config 3, 6		FR1 PRACH configuration 4	A.3.8.2
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdCSI-RS	Config 1, 2, 4, 5	dBm/SCS	-98	Threshold used for $Q_{in_LR_CSI-RS}$
	Config 3, 6		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17

Parameter		Unit	Value	Comment
			Test 1	
CSI-RS configuration for q_0 and q_1	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD	A.3.14
	Config 2, 5		CSI-RS.1.1 TDD	
	Config 3, 6		CSI-RS.2.1 TDD	
TRS configuration	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
csi-RS-Index assigned as RLM RS	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	0.18	
T3		s	0.14	
T4		s	0	
T5		s	0.08	
D1		s	0.05	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.4.5.5.3.1-3: Cell specific test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1, 4	dB	5	-3	-12	-12	-12
	Config 2, 5		5	-3	-12	-12	-12
	Config 3, 6		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1, 4	dB	-10	-10	10	10	10
	Config 2, 5		-10	-10	10	10	10
	Config 3, 6		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1, 4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-85	-85	-85
N_{oc}	Config 1, 4	dBm/15 KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting is assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Void						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.3.1-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.						

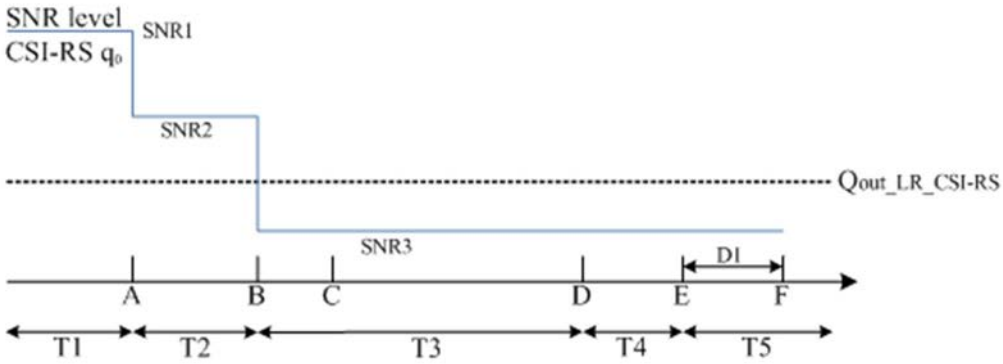


Figure A.4.5.5.3.1-1: SNR variation for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

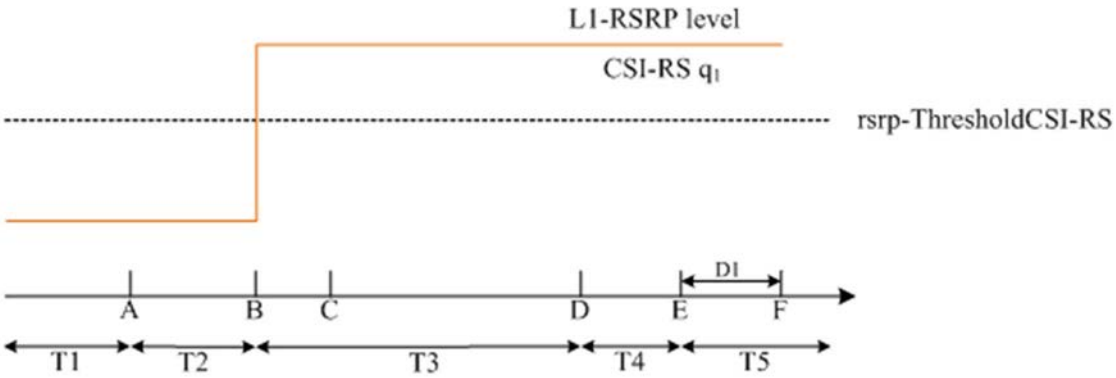


Figure A.4.5.5.3.1-2: L1-RSRP level variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

A.4.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 30+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.5.4 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with CSI-RS-based BFD and LR in DRX mode

A.4.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.4.1-1, A.4.5.5.4.1-2, and A.4.5.5.4.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.4.1-1 shows the variation of the downlink SNR of the PSCell and the SNR of the CSI-RS in set q_0 in the active PSCell to emulate CSI-RS based beam failure. Figure A.4.5.5.4.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.4.5.5.4.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.4.1-2: General test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1, 4		FDD	
	Config 2, 3, 5, 6		TDD	
BWchannel	Config 1, 4	MHz	10: NRB,c = 52	
	Config 2, 5		10: NRB,c = 52	
	Config 3, 6		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1	
TDD Configuration	Config 1, 4		Not Applicable	

Parameter		Unit	Value	Comment
			Test 1	
	Config 2, 5		TDDConf.1.1	
	Config 3, 6		TDDConf.2.1	
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	A.3.1.2
	Config 2, 5		CR.1.1 TDD	
	Config 3, 6		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD	A.3.1.3
	Config 2, 5		CCR.1.1 TDD	
	Config 3, 6		CCR.2.1 TDD	
SSB Configuration	Config 1, 4		SSB. 3 FR1	A.3.10
	Config 2, 5		SSB. 3 FR1	
	Config 3, 6		SSB. 4 FR1	
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1	A.3.11
	Config 3, 6		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz	
	Config 3, 6		30 KHz	
PRACH Configuration	Config 1, 2, 4, 5		FR1 PRACH configuration 4	A.3.8.2
	Config 3, 6		FR1 PRACH configuration 4	A.3.8.2
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdCSI-RS	Config 1, 2, 4, 5	dBm/SCS	-98	Threshold used for $Q_{in_LR_CSI-RS}$
	Config 3, 6		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17

Parameter		Unit	Value	Comment
			Test 1	
CSI-RS configuration for q_0 and q_1	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD	A.3.14
	Config 2, 5		CSI-RS.1.1 TDD	
	Config 3, 6		CSI-RS.2.1 TDD	
TRS configuration	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
csi-RS-Index assigned as RLM RS	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	8.37	
T3		s	6.44	
T4		s	0	
T5		s	1.97	
D1		s	1.94	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.4.5.5.4.1-3: Cell specific test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1, 4	dB	5	-3	-12	-12	-12
	Config 2, 5		5	-3	-12	-12	-12
	Config 3, 6		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1, 4	dB	-10	-10	10	10	10
	Config 2, 5		-10	-10	10	10	10
	Config 3, 6		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1, 4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-85	-85	-85
N_{oc}	Config 1, 4	dBm/15 KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1:	OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2:	The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3:	NZP CSI-RS resource set configuration for CSI reporting is assigned to the UE prior to the start of time period T1.
NOTE 4:	Void
NOTE 5:	The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6:	The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7:	SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8:	The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.4.1-1.
NOTE 9:	The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.4.5.5.4.1-4: Void

Table A.4.5.5.4.1-5: Void

Table A.4.5.5.4.1-6: Void

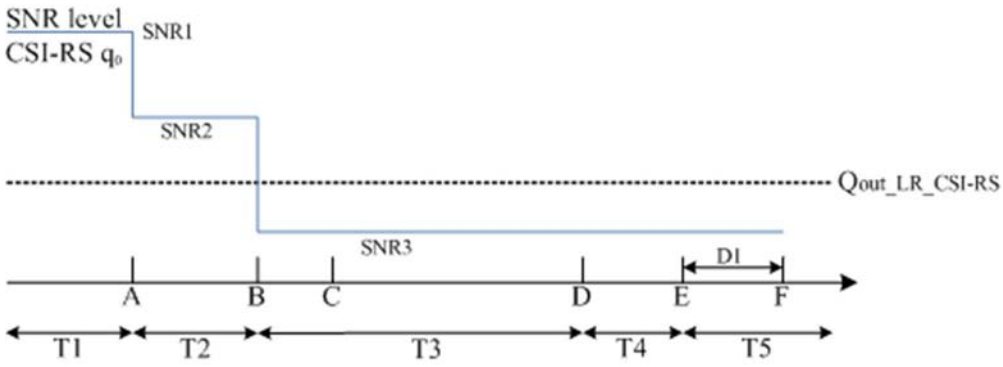


Figure A.4.5.5.4.1-1: SNR variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

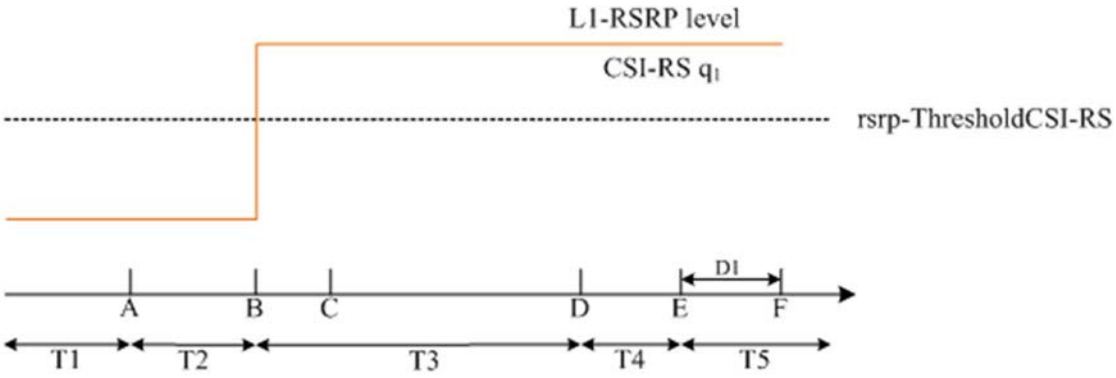


Figure A.4.5.5.4.1-2: L1-RSRP level variation for CSI-RS based beam failure detection and link recovery testing in DRX mode

A.4.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.5.5 EN-DC Beam Failure Detection and Link Recovery Test for FR1 SCell configured with CSI-RS-based BFD and SSB-based LR in non-DRX mode

A.4.5.5.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving SCell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the SCell without *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.4.5.5.5.1-1, A.4.5.5.5.1-2, and A.4.5.5.5.1-3 below. There are three cells, cell 1 is the E-UTRAN PCell, cell 2 is the PSCell and cell 3 is the SCell, in the test. UE is not provided by *schedulingRequestID-BFR-SCell-r16*, i.e., no configuration for PUCCH transmission resources, and UE shall perform the random access procedure to recover the beam failure. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.5.1-1 shows the SNR of the CSI-RS in set q_0 in the active SCell to emulate beam failure. Figure A.4.5.5.5.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1, cell 2 and Cell 3. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.4.5.5.5.1-1: Supported test configurations for FR1 PCell and SCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.5.1-2: General test parameters for FR1 SCell for beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number for PSCell			2	
Active SCell			Cell 3	
RF Channel Number for SCell			3	
Duplex mode	Config 1, 4		FDD	
	Config 2, 3, 5, 6		TDD	
BW channel	Config 1, 4	MHz	10: NRB,c = 52	
	Config 2, 5		10: NRB,c = 52	
	Config 3, 6		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1	

Parameter		Unit	Value	Comment
			Test 1	
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1	
TDD Configuration	Config 1, 4		Not Applicable	
	Config 2, 5		TDDConf.1.1	
	Config 3, 6		TDDConf.2.1	
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	A.3.1.2
	Config 2, 5		CR.1.1 TDD	
	Config 3, 6		CR.2.1 TDD	
SSB Configuration	Config 1, 4		SSB.1 FR1	A.3.10
	Config 2, 5		SSB.1 FR1	
	Config 3, 6		SSB.2 FR1	
SMTC Configuration	Config 1, 2, 3, 4, 5, 6		SMTC.1	A.3.11
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5	kHz	15	
	Config 3, 6		30	
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.2-1	
	Config 3, 6		Table A.3.8.2.2-1	
csi-RS-Index assigned as beam failure detection RS in set q_0 in activated SCell			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			N.A.	
schedulingRequestID-BFR-SCell-r16			absent	When the field is absent, the random access procedure will be triggered for SCell BFR
SSB Index assigned as CBD RS (q1) in activated SCell			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdBFR	Config 1, 2, 4, 5	dBm/SCS	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3, 6		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for q_0 in activated SCell	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
CSI-RS	Config 1, 4		CSI-RS.1.1 FDD	A.3.14

Parameter		Unit	Value	Comment
			Test 1	
configuration for CSI reporting	Config 2, 5		CSI-RS.1.1 TDD	
	Config 3, 6		CSI-RS.2.1 TDD	
TRS configuration	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
csi-RS-Index assigned as RLM RS in PSCell	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	0.18	
T3		s	0.14	
T4		s	0	
T5		s	0.17	
D1		s	0.13	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.4.5.5.5.1-3: Cell specific test parameters for FR1 PSCell and SCell for beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Cell 2	Test 1 Cell 3				
			T1 to T5	T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR_CSI-RS of set q_0	Config 1, 4	dB	5	5	-3	-12	-12	-12
	Config 2, 5		5	5	-3	-12	-12	-12
	Config 3, 6		5	5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1, 4	dB	-10	-10	-10	10	10	10
	Config 2, 5		-10	-10	-10	10	10	10
	Config 3, 6		-10	-10	-10	10	10	10
SSB_RP of set q_1	Config 1, 4	dBm/SCS	-108	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-105	-85	-85	-85
N_{oc}	Config 1, 4	dBm/15 kHz	-98	-98				
	Config 2, 5		-98	-98				
	Config 3, 6		-98	-98				
Propagation condition			TDL-C 300 ns 100 Hz	TDL-C 300 ns 100 Hz				

Parameter	Unit	Cell 2	Test 1 Cell 3				
		T1 to T5	T1	T2	T3	T4	T5

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting is assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.5.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

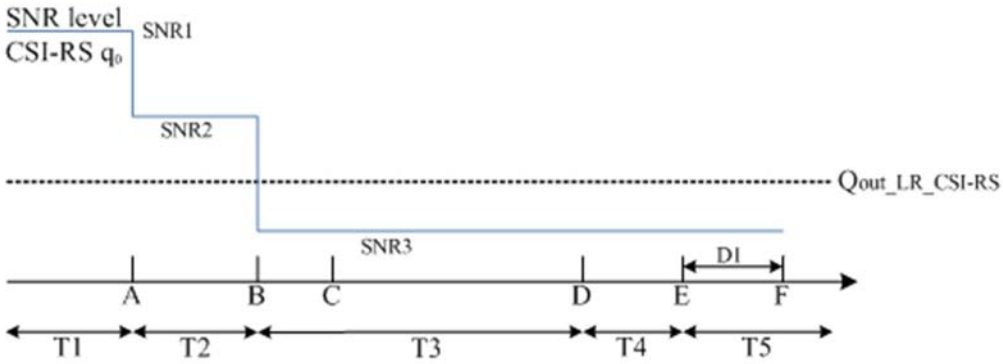


Figure A.4.5.5.5.1-1: SNR variation for beam failure detection and link recovery testing for SCell in non-DRX mode

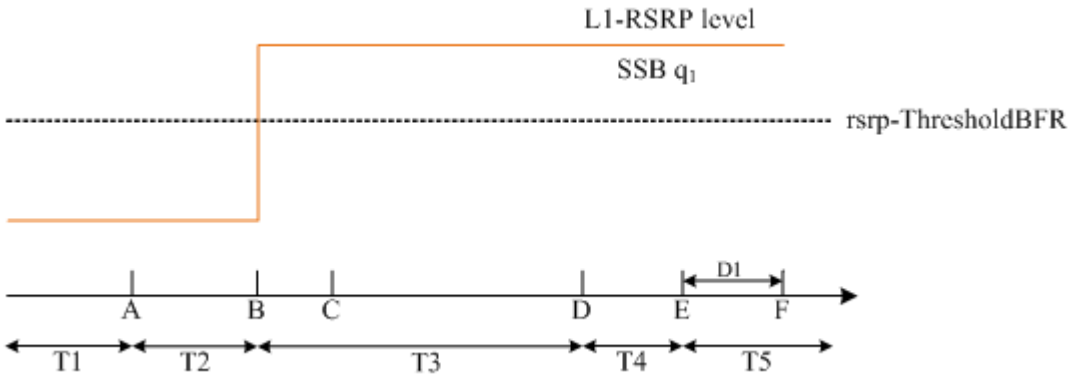


Figure A.4.5.5.5.1-2: L1-RSRP level variation for beam failure detection and link recovery testing for SCell in non-DRX mode

A.4.5.5.5.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+10 ms after the start of T5, the UE shall transmit preamble for UL-SCH resource application, followed by MAC-CE on the assigned uplink resources containing a beam associated with the candidate beam set q_1. The UE shall not transmit preamble earlier than time point B.

During T5, the System Simulator shall transmit a Random Access Response to UE after the System Simulator receives the preamble from UE. The UE shall transmit the msg.3 containing candidate beam set q1 for SCell BFR if UE receives the Random Access Response.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.5.6 EN-DC Beam Failure Detection and Link Recovery Test for FR1 SCell configured with CSI-RS-based BFD and SSB-based LR in DRX mode

A.4.5.5.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS based beam failure in the set q_0 configured for a serving SCell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the SCell without *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.4.5.5.6.1-1, A.4.5.5.6.1-2, and A.4.5.5.6.1-3below. There are three cells, cell 1 is the E-UTRAN PCell, cell 2 is the PSCell and cell 3 is the SCell, in the test. UE is not provided by *schedulingRequestID-BFR-SCell-r16*, i.e., no configuration for PUCCH transmission resources, and UE shall perform the random access procedure to recover the beam failure. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.6.1-1 shows the SNR of the CSI-RS in set q_0 in the active SCell to emulate beam failure. Figure A.4.5.5.6.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1, cell 2 and cell 3. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in SCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.4.5.5.6.1-1: Supported test configurations for FR1 PCell and SCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.6.1-2: General test parameters for FR1 SCell for beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number for PSCell			2	
Active SCell			Cell 3	
RF Channel Number for SCell			3	
Duplex mode	Config 1, 4		FDD	
	Config 2, 3, 5, 6		TDD	
BWchannel	Config 1, 4	MHz	10: NRB,c = 52	
	Config 2, 5		10: NRB,c = 52	
	Config 3, 6		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1	

Parameter		Unit	Value	Comment
			Test 1	
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1	
TDD Configuration	Config 1, 4		Not Applicable	
	Config 2, 5		TDDConf.1.1	
	Config 3, 6		TDDConf.2.1	
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	A.3.1.2
	Config 2, 5		CR.1.1 TDD	
	Config 3, 6		CR.2.1 TDD	
SSB Configuration	Config 1, 4		SSB.1 FR1	A.3.10
	Config 2, 5		SSB.1 FR1	
	Config 3, 6		SSB.2 FR1	
SMTC Configuration	Config 1, 2, 3, 4, 5, 6		SMTC.1	A.3.11
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5	kHz	15	
	Config 3, 6		30	
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.2-1	
	Config 3, 6		Table A.3.8.2.2-1	
csi-RS-Index assigned as beam failure detection RS in set q_0 in activated SCell			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
schedulingRequestID-BFR-SCell-r16			absent	When the field is absent, the random access procedure will be triggered for SCell BFR
SSB Index assigned as CBD RS (q1) in activated SCell			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdBFR	Config 1, 2, 4, 5	dBm/SCS	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3, 6		-95	

Parameter		Unit	Value	Comment
			Test 1	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for q_0 in activated SCell	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD	A.3.14
	Config 2, 5		CSI-RS.1.1 TDD	
	Config 3, 6		CSI-RS.2.1 TDD	
TRS configuration	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
csi-RS-Index assigned as RLM RS in PSCell	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	8.37	
T3		s	6.44	
T4		s	0	
T5		s	1.97	
D1		s	1.93	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.4.5.5.6.1-3: Cell specific test parameters for FR1 SCell for beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Cell 2	Test 1 Cell 3				
			T1 to T5	T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR_CSI-RS of set q_0	Config 1, 4	dB	5	5	-3	-12	-12	-12
	Config 2, 5		5	5	-3	-12	-12	-12
	Config 3, 6		5	5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1, 4	dB	-10	-10	-10	10	10	10

Parameter		Unit	Cell 2	Test 1 Cell 3				
			T1 to T5	T1	T2	T3	T4	T5
	Config 2, 5		-10	-10	-10	10	10	10
	Config 3, 6		-10	-10	-10	10	10	10
SSB_RP of set q_1	Config 1, 4	dBm/SCS kHz	-108	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-105	-85	-85	-85
N_{oc}	Config 1, 4	dBm/ 15 kHz	-98	-98				
	Config 2, 5		-98	-98				
	Config 3, 6		-98	-98				
Propagation condition			TDL-C 300 ns 100 Hz	TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.6.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

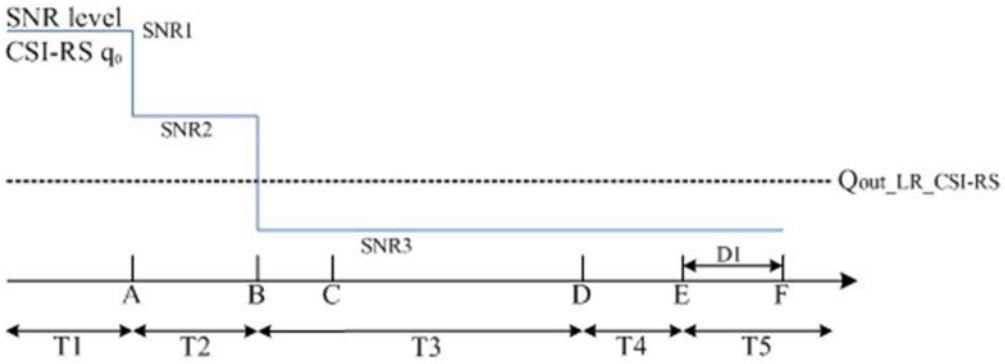


Figure A.4.5.5.6.1-1: SNR variation for beam failure detection and LR testing for SCell in DRX mode

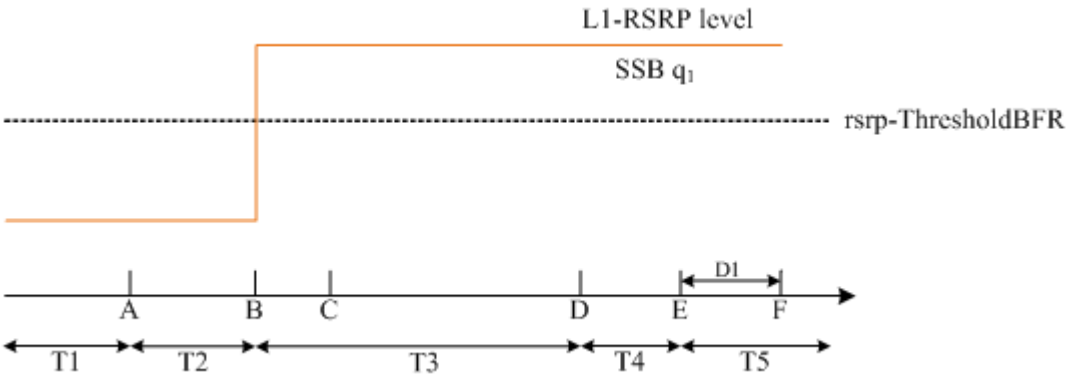


Figure A.4.5.5.6.1-2: L1-RSRP level variation for beam failure detection and link recovery testing for SCell in DRX mode

A.4.5.5.6.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+10 ms after the start of T5, the UE shall transmit preamble for UL-SCH resource application, followed by MAC-CE on the assigned uplink resources containing a beam associated with the candidate beam set q_1. The UE shall not transmit preamble earlier than time point B.

During T5, the System Simulator shall transmit a Random Access Response to UE after the System Simulator receives the preamble from UE. The UE shall transmit the msg.3 containing candidate beam set q1 for SCell BFR if UE receives the Random Access Response.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.5.7 EN-DC TRP specific Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with SSB-based BFD and LR in non-DRX mode

A.4.5.5.7.1 Test Purpose and Environment

The test scenario is EN-DC and NR configured in the test contains two TRPs (i.e., TRP0 and TRP1). Each TRP is configured with different SSB for beam failure detection and candidate beam detection. SSB is configured as BFD-RS and CBD-RS.

The purpose of this test is to verify that the UE properly detects the TRP specific SSB-based beam failure in the set ($q_{0,0}$) for TRP0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set ($q_{1,0}$). The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell with *schedulingRequestID-BFR-r17* configured, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.7.1-1, A.4.5.5.7.1-2, and A.4.5.5.7.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the active PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.7.1-1 shows the variation of the downlink SNR of the PSCell and the SNR of the SSB in set q0 in the active PSCell to emulate SSB based beam failure. Figure A.4.5.5.7.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 1.

Table A.4.5.5.7.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.7.1-2: General test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number for PSCell			2	
Duplex mode	Config 1, 4		FDD	
	Config 2, 3, 5, 6		TDD	
BW channel	Config 1, 4	MHz	10: NRB,c = 52	
	Config 2, 5		10: NRB,c = 52	
	Config 3, 6		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1	
TDD Configuration	Config 1, 4		Not Applicable	
	Config 2, 5		TDDConf.1.1	
	Config 3, 6		TDDConf.2.1	
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	A.3.1.2
	Config 2, 5		CR.1.1 TDD	
	Config 3, 6		CR.2.1 TDD	
SSB Configuration for TRP0	Config 1, 4		SSB.3 FR1	A.3.10
	Config 2, 5		SSB.3 FR1	
	Config 3, 6		SSB.4 FR1	
SSB Configuration for TRP1	Config 1, 4		SSB.7 FR1	A.3.10
	Config 2, 5		SSB.7 FR1	
	Config 3, 6		SSB.8 FR1	
SMTC Configuration	Config 1, 2, 3, 4, 5, 6		SMTC.1	A.3.11
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5	kHz	15	
	Config 3, 6		30	
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.2-1	
	Config 3, 6		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS ($q_{0,0}$)			0	
SSB Index assigned as CBD RS ($q_{1,0}$)			1	
SSB Index assigned as BFD RS ($q_{0,1}$)			2	
SSB Index assigned as CBD RS ($q_{1,1}$)			3	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			gp0	
gapOffset			0	
schedulingRequestID-BFR- r17			Configured	
	Config 1, 2, 4, 5	slot	5	5 ms

Parameter		Unit	Value	Comment
			Test 1	
Periodicity of PUCCH for SR configuration for BFR on PSCell	Config 3, 6		10	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2, 4, 5	dBm/SCS	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3, 6		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
SSB Index assigned as RLM RS			0,1,2,3	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	0.37	
T3		s	0.24	
T4		s	0	
T5		s	0.17	
D1		s	0.13	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.				

Table A.4.5.5.7.1-3: Cell specific test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set $q_{0,0}$	Config 1, 4	dB	5	-3	-12	-12	-12
	Config 2, 5		5	-3	-12	-12	-12
	Config 3, 6		5	-3	-12	-12	-12
SNR_SSB of set $q_{0,1}$	Config 1,4	dB	5	5	5	5	5
	Config 2, 5		5	5	5	5	5
	Config 3, 6		5	5	5	5	5
SNR_SSB of set $q_{1,0}$	Config 1, 4	dB	-10	-10	10	10	10
	Config 2, 5		-10	-10	10	10	10
	Config 3, 6		-10	-10	10	10	10
SNR_SSB of set $q_{1,1}$	Config 1, 4	dB	-10	-10	10	10	10
	Config 2, 5		-10	-10	10	10	10
	Config 3, 6		-10	-10	10	10	10
SSB_RP of set $q_{1,0}$	Config 1, 4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-85	-85	-85
SSB_RP of set $q_{1,1}$	Config 1, 4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-85	-85	-85

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
N_{oc}	Config 1, 4	dBm/15 KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: he SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.7.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

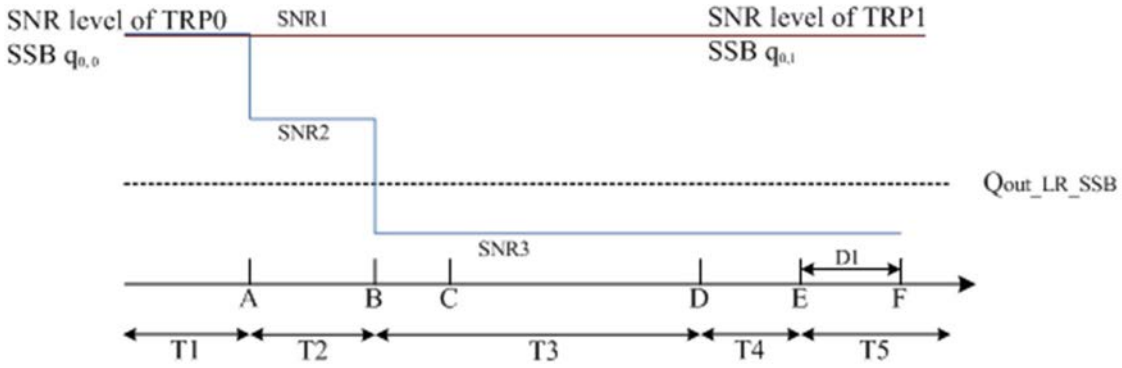


Figure A.4.5.5.7.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

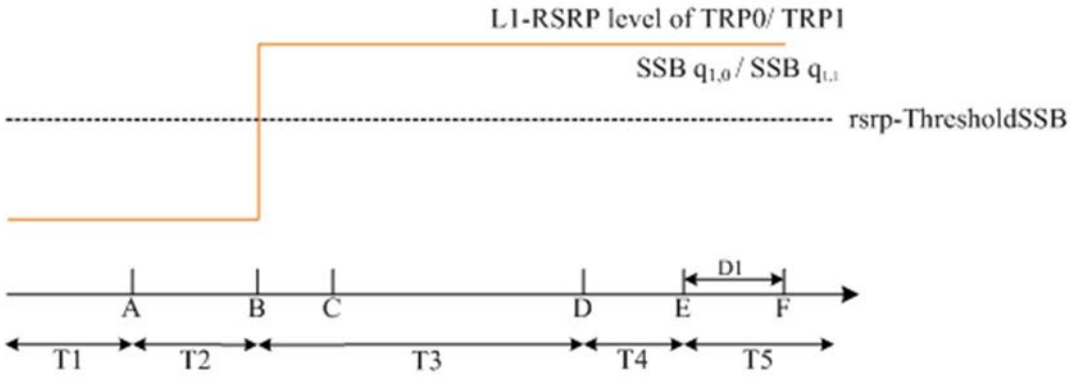


Figure A.4.5.5.7.1-2: L1-RSRP level variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.4.5.5.7.2 Test Requirements

Test requirements are applied to TRP specific report respectively on ($q_{0,0}$), ($q_{1,0}$) for TRP 0 and ($q_{0,1}$), ($q_{1,1}$) for TRP 1 respectively as Figure A.4.5.5.7.1-1.

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_{1,0}$.

No later than time point F occurring no later than D1 = 120+10 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set $q_{1,0}$. The UE shall not transmit PUCCH with an LRR with the candidate beam set $q_{1,0}$ earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.5.8 EN-DC TRP specific Beam Failure Detection and Link Recovery Test for FR1 SCell configured with CSI-RS-based BFD and SSB-based LR in non-DRX mode

A.4.5.5.8.1 Test Purpose and Environment

The test scenario is EN-DC and a NR SCell configured in the test contains two TRPs (i.e., TRP0 and TRP1). Each TRP is configured with different CSI-RS and SSB for beam failure detection and candidate beam detection. CSI-RS is configured as BFD-RS and SSB is configured as CBD-RS.

The purpose of this test is to verify that the UE properly detects the CSI-RS-based beam failure on the TRP using the respective configured BFD set $\bar{q}_{0,0}$ for TRP0. After the BFD is detected for the TRP, the test further verifies whether the UE performs the correct SSB-based link recovery based on the configured beam candidate set $\bar{q}_{1,0}$ for TRP0. In the test two TRPs (TRP0 and TRP1) are provided with *schedulingRequestID-BFR-r17*. This test will partly verify the beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.18.

Supported test configuration are provided in table A.4.5.5.8.1-1, general test parameters for FR1 SCell is provided in table A.4.5.5.8.1-2, and Cell specific test parameter are provided in table A.4.5.5.8.1-3. There are three cells in the test, cell 1 is the E-UTRAN PCell, cell 2 is the NR PSCell and cell 3 is the NR SCell. CSI report for SCell (cell 3) are transmitted on PSCell (cell 2).

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.8.1-1 shows the SNR of the CSI-RS in set $q_{0,0}$ in the TRP0 to emulate beam failure. Figure A.4.5.5.8.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_{10} and q_{11} of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1, cell 2 and Cell 3. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.4.5.5.8.1-1: Supported test configurations for FR1 PCell and SCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.8.1-2: General test parameters for FR1 SCell for beam failure detection and link recovery testing in non-DRX mode

Parameter	Unit	Value	Comment
		Test 1	Same configuration for both TRP whereever applicbale
Active PCell		Cell 1	
E-UTRA RF Channel Number		1	
Active PSCell		Cell 2	

Parameter		Unit	Value Test 1	Comment Same configuration for both TRP whereever applicbale
RF Channel Number for PSCell			2	
Active SCell			Cell 3	
RF Channel Number for SCell			3	
Duplex mode	Config 1, 4		FDD	
	Config 2, 3, 5, 6		TDD	
BW channel	Config 1, 4	MHz	10: NRB,c = 52	
	Config 2, 5		10: NRB,c = 52	
	Config 3, 6		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1	
TDD Configuration	Config 1, 4		Not Applicable	
	Config 2, 5		TDDConf.1.1	
	Config 3, 6		TDDConf.2.1	
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	A.3.1.2
	Config 2, 5		CR.1.1 TDD	
	Config 3, 6		CR.2.1 TDD	
SSB Configuration	Config 1, 4		SSB.1 FR1	A.3.10 Same configuration for both TRP
	Config 2, 5		SSB.1 FR1	
	Config 3, 6		SSB.2 FR1	
SMTC Configuration	Config 1, 2, 3, 4, 5, 6		SMTC.1	A.3.11, Same configuration for both TRP
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5	kHz	15	
	Config 3, 6		30	
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.2-1	
	Config 3, 6		Table A.3.8.2.2-1	
csi-RS-Index assigned as beam failure detection RS in set q_{00} in activated SCell			0	
csi-RS-Index assigned as beam failure detection RS in set q_{01} in activated SCell			2	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			N.A.	
schedulingRequestID-BFR-r17			Configured, 1-2	
Periodicity of PUCCH for SR configuration for BFR on SCell	Config 1, 2, 4, 5	slot	5	5 ms
	Config 3, 6		10	
schedulingRequestID-BFR2-r17			absent	When the field is absent, the random access procedure will be triggered for TRP BFR

Parameter		Unit	Value Test 1	Comment Same configuration for both TRP whereever applicbale
Periodicity of PUCCH for SR configuration for BFR on TRP0		Slot	5	
SSB Index assigned as CBD RS (q10) in activated SCell			1	
SSB Index assigned as CBD RS (q11) in activated SCell			3	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2, 4, 5	dBm/SCS	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3, 6		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
BFD-RS (CSI-RS) configuration for q_{00} in activated SCell	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
BFD-RS (CSI-RS) configuration for q_{01} in activated SCell	Config 1, 4		CSI-RS.1.7 FDD	A.3.14
	Config 2, 5		CSI-RS.1.6 TDD	
	Config 3, 6		CSI-RS.2.7 TDD	
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD	A.3.14
	Config 2, 5		CSI-RS.1.1 TDD	
	Config 3, 6		CSI-RS.2.1 TDD	
TRS configuration	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
csi-RS-Index assigned as RLM RS in PSCell	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	0.18	
T3		s	0.14	
T4		s	0	
T5		s	0.17	
D1		s	0.06	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.4.5.5.8.1-3: Cell specific test parameters for FR1 PSCell and SCell for beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Cell 2	TRP 0/1 Cell 3				
			T1 to T5	T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR_CSI-RS of set q_{00}	Config 1, 4	dB	5	5	-3	-12	-12	-12
	Config 2, 5		5	5	-3	-12	-12	-12

Parameter		Unit	Cell 2	TRP 0/1 Cell 3				
			T1 to T5	T1	T2	T3	T4	T5
	Config 3, 6		5	5	-3	-12	-12	-12
SNR_CSI-RS of set q_{01}	Config 1, 4	dB	5	5	5	5	5	5
	Config 2, 5		5	5	5	5	5	5
	Config 3, 6		5	5	5	5	5	5
SNR_SSB of set q_{10}	Config 1, 4	dB	-10	-10	-10	10	10	10
	Config 2, 5		-10	-10	-10	10	10	10
	Config 3, 6		-10	-10	-10	10	10	10
SNR SSB of set q_{11}	Config 1, 4	dB	-10	-10	-10	10	10	10
	Config 2, 5		-10	-10	-10	10	10	10
	Config 3, 6		-10	-10	-10	10	10	10
SSB_RP of set q_{10}	Config 1, 4	dBm/SCS kHz	-108	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-105	-85	-85	-85
SSB_RP of set q_{11}	Config 1, 4	dBm/SCS kHz	-108	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-105	-85	-85	-85
N_{oc}	Config 1, 4	dBm/15 kHz	-98	-98				
	Config 2, 5		-98	-98				
	Config 3, 6		-98	-98				
Propagation condition			TDL-C 300 ns 100 Hz	TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.8.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause [A.3.6].

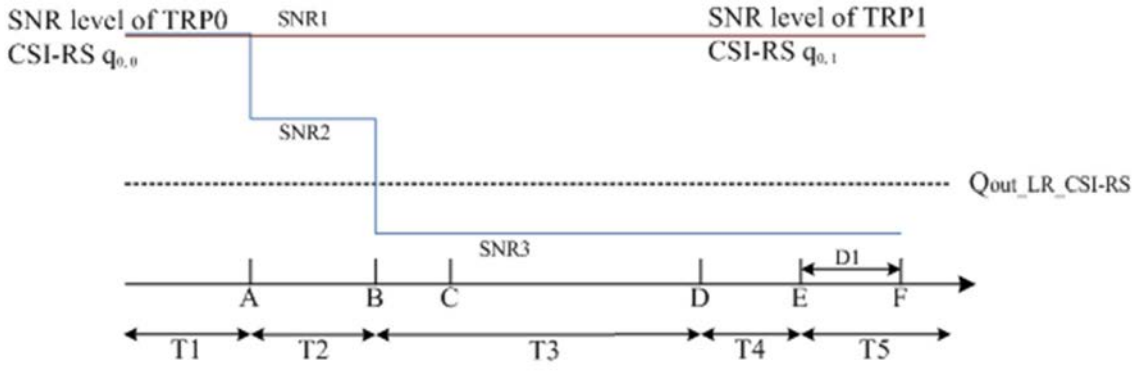


Figure A.4.5.5.8.1-1: SNR variation for beam failure detection and link recovery testing for TRP0 in non-DRX mode

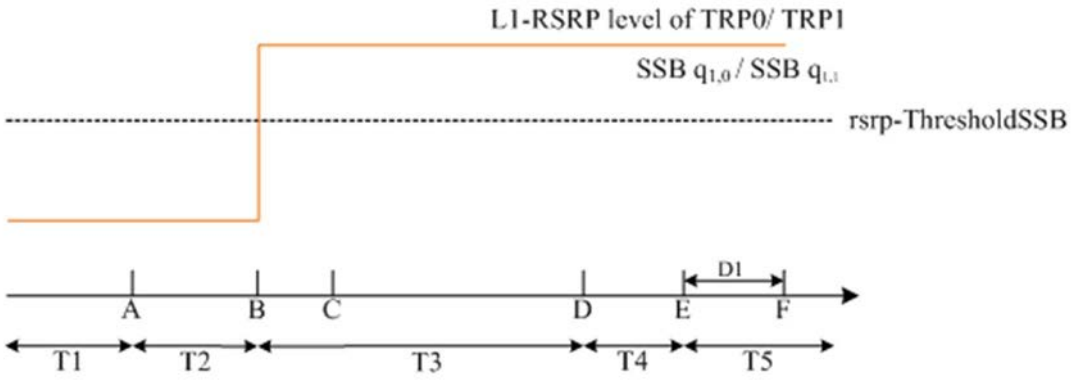


Figure A.4.5.5.8.1-2: L1-RSRP level variation for beam failure detection and link recovery testing for TRP 0 in non-DRX mode

A.4.5.5.8.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure on TRP0 and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_{1,0}$.

For TRP0, no later than time point F occurring no later than D1 = 60 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set $q_{1,0}$. The UE shall not transmit PUCCH with an LRR with the candidate beam set $q_{1,0}$ earlier than time point B.

Test is concluded once the test equipment has received the BFR MAC CE from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.6 Active BWP switch

A.4.5.6.1 DCI-based and Timer-based Active BWP Switch

A.4.5.6.1.1 E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in synchronous EN-DC

A.4.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in TS 38.133 clause 8.6, and interruption requirement for E-UTRA victim cell defined in TS 36.133 [15] clause 7.32.2.7. Supported test configurations are shown in table A.4.5.6.1.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in table A.4.5.6.1.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in table A.4.5.6.1.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).

- UE is configured with 2 different UE-specific downlink bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6.2 and starts to report valid ACK/NACK for the PSCell no later than at the beginning of the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from the beginning of the DL slot right after DL slot ($i+T_{BWPswitchDelay}$).

The starting time of PCell (Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

During T2, the test equipment will not transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j*, where j is the beginning slot of the DL subframe immediately after the *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6.2 and starts to report valid ACK/NACK for the PSCell at latest at the beginning of the DL slot right after DL slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after DL slot ($j+T_{BWPswitchDelay}$).

The starting time of PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of PSCell, respectively.

Table A.4.5.6.1.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: A UE which fulfils the requirements in test case A.4.5.6.1.2 can skip the test cases in A.4.5.6.1.1.	

Table A.4.5.6.1.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.

CP length		Normal	
DRX		OFF	For both PCell and PSCell
bwp-InactivityTimer	ms	200	
PDCCH and PDSCH maximum number of HARQ transmission		1	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell 2 timing offset to Cell 1	µs	3	Synchronous EN-DC
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.4.5.6.1.1.1-3.: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		10 MHz: $N_{RB,c}$ = 52
	Config 2,5		10 MHz: $N_{RB,c}$ = 52
	Config 3,6		40 MHz: $N_{RB,c}$ = 106
Active BWP ID			1, 2
Initial DL BWP Configuration	Config 1,4		DLBWP.0.2 Note 4
	Config 2,5		
	Config 3,6		
Active DL BWP-1 Configuration	Config 1,4		DLBWP.1.1 Note 4
	Config 2,5		
	Config 3,6		
Active DL BWP-2 Configuration	Config 1,4		DLBWP.1.3 Note 4
	Config 2,5		
	Config 3,6		
Initial UL BWP Configuration	Config 1,4		ULBWP.0.2 Note 4
	Config 2,5		
	Config 3,6		
Active UL BWP-1 Configuration	Config 1,4		ULBWP.1.1 Note 4
	Config 2,5		
	Config 3,6		
Active UL BWP-2 Configuration	Config 1,4		N/A
	Config 2,5		ULBWP.1.3 Note 4
	Config 3,6		ULBWP.1.3 Note 4
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
Dedicated CORESET parameters	Config 1,4		CCR.1.2 FDD
	Config 2,5		CCR.1.2 TDD
	Config 3,6		CCR.2.4 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
EPRE ratio of PSS to SSS			
EPRE ratio of PBCH DMRS to SSS			

Parameter		Unit	Cell 2
EPRE ratio of PBCH to PBCH DMRS		dB	0
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1,2,4,5	dBm/SCS	-104
	Config 3,6		-101
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3	Config 1,2,4,5	dBm/SCS	-87
	Config 3,6		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96
	Config 3,6	dBm/38.16 MHz	-52.86
Propagation Condition			AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

A.4.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, $k1$ is the timing between DL data receiving and acknowledgement as specified in TS 38.321 [7].

Depending on UE capability *bwp-SwitchingDelay* TS 38.331 [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start time of PCell interruption during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start time of PCell interruption of during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS 36.133 [15] clause 7.32.2.7.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.4.5.6.1.2 E-UTRAN – NR PSCell FR1 DL active BWP switch with FR1 SCell in non-DRX in synchronous EN-DC

A.4.5.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6.2, and interruption requirements for NR victim cell defined in clause 8.2.1.2.7 and interruption requirement for E-UTRA victim cell defined in clause 7.32.2.7 of TS 36.133 [15]. Supported test configurations for LTE PCell and NR PSCell are shown in Table A.4.5.6.1.2.1-1. Supported test configurations for NR SCell are shown in table A.4.5.6.1.2.1-1A. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCell are chosen independently.

The test scenario comprises of one E-UTRA PCell (Cell 1), one PSCell (Cell 2) and one SCell (Cell 3) as given in table A.4.5.6.1.2.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of PSCell and SCell are specified in table A.4.5.6.1.2.1-3 and table A.4.5.6.1.2.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on E-UTRA PCell (Cell 1) and PSCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 3) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 3 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC) and Cell 3 (SCell) on radio channel 3 (SCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2, in Cell 3 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for PSCell, BWP-0 in Cell 2 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in SCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in PSCell.
- UE is configured with a *bwp-InactivityTimer* timer value for SCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for SCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in SCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of SCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6.2 and starts to report valid ACK/NACK for the SCell on PSCell no later than on the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-2 starting from the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).
>
> E-UTRA PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.
>
> PSCell(Cell 2) interruption due to BWP switch on SCell shall occur within the BWP switch delay.

During T2, the test equipment will not transmit DCI format for PDSCH reception on SCell(Cell 3).

During T3,

> The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of SCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell on PSCell no later than on the first UL slot that occurs after the beginning of the slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-1 starting from the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

E-UTRA PCell (Cell 1) interruption due to BWP switch of SCell shall occur within the BWP switch delay.

PSCell (Cell 2) interruption due to BWP switch of SCell shall occur within the BWP switch delay.The test equipment verifies the DL BWP switch time in SCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell and NR PSCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during BWP switch of SCell, respectively.

Table A.4.5.6.1.2.1-1: DL BWP switch supported test configurations for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which fulfils the requirements in test case A.4.5.6.1.2 can skip the test cases in A.4.5.6.1.1. NOTE 3: Void NOTE 4: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.4.5.6.1.2.1-1A: DL BWP switch supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which fulfils the requirements in test case A.4.5.6.1.2 can skip the test cases in A.4.5.6.1.1. NOTE 3: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.4.5.6.1.2.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2, 3	Two NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
Active SCell		Cell 3	SCell on RF channel number 3.
CP length		Normal	
DRX		OFF	
bwp-InactivityTimer	ms	200	
PDCCH and PDSCH maximum number of HARQ transmission		1	For PCell, PSCell and SCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for cells on SCC.

Parameter	Unit	Value	Comment
Cell 2 timing offset to Cell 1	µs	3	Synchronous EN-DC
Cell 3 timing offset to Cell 2	µs	3	Synchronous cells
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.4.5.6.1.2.1-3: NR Cell specific test parameters for NR PSCell for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,2,3,4,5,6		Note 7
$BW_{occupied}$	Config 1,2,4,5	RB	52 Note 5
	Config 3,6		106 Note 6
Active BWP ID			0
Initial DL BWP Configuration	Config 1,2,3,4,5,6		DLBWP.0.2
Active DL BWP-0 Configuration	Config 1,2,3,4,5,6		DLBWP.0.2
Active DL BWP-1 Configuration	Config 1,2,3,4,5,6		N.A.
Active DL BWP-2 Configuration	Config 1,2,3,4,5,6		N.A.
Initial UL BWP Configuration	Config 1,2,3,4,5,6		ULBWP.0.2
Active UL BWP-0 Configuration	Config 1,2,3,4,5,6		ULBWP.0.2
Active UL BWP-1 Configuration	Config 1,2,3,4,5,6		N.A.
Active UL BWP-2 Configuration	Config 1,2,3,4,5,6		N.A.
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
Dedicated CORESET parameters	Config 1,4		CCR.1.2 FDD
	Config 2,5		CCR.1.2 TDD
	Config 3,6		CCR.2.4 TDD
OCNG Patterns	Config 1,2,4,5		OP.1 Note 5
	Config 3,6		OP.1 Note 6
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
SMTC Configuration			SMTC.1
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io^{Note3}	Config 1,2,4,5	dBm/9.36 MHz	-58.96

Parameter		Unit	Cell 2
	Config 3,6	dBm/38.16 MHz	-52.86

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: NRB,c. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured BWchannel.

Table A.4.5.6.1.2.1-4: NR Cell specific test parameters for NR SCell for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 3
Frequency Range			FR1
Duplex mode	$Config_{SCell}$ 1		FDD
	$Config_{SCell}$ 2,3		TDD
TDD configuration	$Config_{SCell}$ 1		Not Applicable
	$Config_{SCell}$ 2		TDDConf.1.1
	$Config_{SCell}$ 3		TDDConf.2.1
$BW_{channel}$	$Config_{SCell}$ 1,2,3		Note 7
$BW_{occupied}$	$Config_{SCell}$ 1,2	RB	52 Note 5
	$Config_{SCell}$ 3		106 Note 6
Active BWP ID			1,2
Initial DL BWP Configuration	$Config_{SCell}$ 1,2,3		DLBWP.0.2
Active DL BWP-0 Configuration	$Config_{SCell}$ 1,2,3		N.A.
Active DL BWP-1 Configuration	$Config_{SCell}$ 1,2,3		DLBWP.1.3
Active DL BWP-2 Configuration	$Config_{SCell}$ 1,2,3		DLBWP.1.1
Initial UL BWP Configuration	$Config_{SCell}$ 1,2,3		N.A.
Active UL BWP-0 Configuration	$Config_{SCell}$ 1,2,3		N.A.
Active UL BWP-1 Configuration	$Config_{SCell}$ 1,2,3		N.A.
Active UL BWP-2 Configuration	$Config_{SCell}$ 1,2,3		N.A.
PDSCH Reference measurement channel	$Config_{SCell}$ 1		SR.1.1 FDD
	$Config_{SCell}$ 2		SR.1.1 TDD
	$Config_{SCell}$ 3		SR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell}$ 1		CR.1.1 FDD
	$Config_{SCell}$ 2		CR.1.1 TDD
	$Config_{SCell}$ 3		CR.2.1 TDD
Dedicated CORESET parameters	$Config_{SCell}$ 1		CCR.1.2 FDD
	$Config_{SCell}$ 2		CCR.1.2 TDD
	$Config_{SCell}$ 3		CCR.2.4 TDD
OCNG Patterns	$Config_{SCell}$ 1,2		OP.1 Note 5
	$Config_{SCell}$ 3		OP.1 Note 6
SSB Configuration	$Config_{SCell}$ 1,2		SSB.1 FR1
	$Config_{SCell}$ 3		SSB.2 FR1
SMTC Configuration			SMTC.1
TRS Configuration	$Config_{SCell}$ 1		TRS.1.1 FDD
	$Config_{SCell}$ 2		TRS.1.1 TDD
	$Config_{SCell}$ 3		TRS.1.2 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			

Parameter		Unit	Cell 3
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	$Config_{SCell}$ 1,2	dBm/9.36 MHz	-58.96
	$Config_{SCell}$ 3	dBm/38.16 MHz	-52.86
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.			
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 RBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.			
NOTE 7: NRB,c. is derived from Table 5.3.2-1 in TS 38.101-1[18] with configured BWchannel.			

A.4.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK for SCell on PSCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for SCell on PSCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

All of the above test requirements shall be fulfilled in order for the observed SCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start of the interruption of PCell during SCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PCell during SCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in clause 7.32.2.7 of TS 36.133 [15].

During T1, the start of the interruption of PSCell during SCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PSCell during SCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PSCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.6.2.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.4.5.6.2 RRC-based Active BWP Switch

A.4.5.6.2.1 E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in synchronous EN-DC

A.4.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6.3. Supported test configurations are shown in table A.4.5.6.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1) and one NR PSCell (Cell 2) as given in table A.4.5.6.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell are specified in table A.4.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PSCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PSCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

If the *RRCReconfiguration* is embedded in E-UTRA RRC message, time period T1 starts when a E-UTRA RRC message *RRCConnectionReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side from PCell in PSCell's slot # denoted *i*. Otherwise, i.e., if the *RRCReconfiguration* is not embedded in E-UTRA RRC message, time period T1 starts when the *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side in from PSCell in PSCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$) as defined in clause 8.6.3 and be ready for the reception of uplink grant for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$).

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in PSCell by counting the time from the time when the RRC Reconfiguration message including updated BWP configurations sent till the time when RRC Reconfiguration Complete message is received.

Table A.4.5.6.2.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

NOTE 1: The UE is only required to be tested in one of the supported test configurations

Table A.4.5.6.2.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	
PDCCH and PDSCH maximum number of HARQ transmission		1	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell 2 timing offset to Cell 1	μs	3	Synchronous EN-DC
T1	s	[0.2]	

Table A.4.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter			Unit	Cell 2
Frequency Range				FR1
Duplex mode		Config 1,4		FDD
		Config 2,3,5,6		TDD
TDD configuration		Config 1,4		Not Applicable
		Config 2,5		TDDConf.1.1
		Config 3,6		TDDConf.2.1
$BW_{channel}$		Config 1,4		10 MHz: $N_{RB,c}$ = 52
		Config 2,5		10 MHz: $N_{RB,c}$ = 52
		Config 3,6		40 MHz: $N_{RB,c}$ = 106
Active DL BWP ID				1, 2
Initial DL BWP Configuration		Config 1,4		DLBWP.0.2
		Config 2,5		
		Config 3,6		
Initial UL BWP Configuration		Config 1,4		ULBWP.0.2
		Config 2,5		
		Config 3,6		
Initial Condition	Active DL BWP-1 Configuration	Config 1,4		DLBWP.1.3
		Config 2,5		
		Config 3,6		
	Active UL BWP-1 Configuration	Config 1,4		ULBWP.1.3
		Config 2,5		
		Config 3,6		
Final Condition	Active DL BWP-1 Configuration	Config 1,4		DLBWP.1.1
		Config 2,5		
		Config 3,6		
	Active UL BWP-1 Configuration	Config 1,4		ULBWP.1.1
		Config 2,5		
		Config 3,6		
Initial UL BWP Configuration		Config 1,4		ULBWP.0.2
		Config 2,5		
		Config 3,6		
Active UL BWP-1 Configuration		Config 1,4		ULBWP.1.3
		Config 2,5		
		Config 3,6		
Active UL BWP-2 Configuration		Config 1,4		ULBWP.1.1
		Config 2,5		
		Config 3,6		

Parameter		Unit	Cell 2
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR2.1 TDD
Dedicated CORESET parameters	Config 1,4		CCR.1.2 FDD
	Config 2,5		CCR.1.2 TDD
	Config 3,6		CCR.2.4 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
SMTC Configuration			SMTC.1
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96
	Config 3,6	dBm/38.16 MHz	-52.86

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

A.4.5.6.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PSCell in the beginning of the DL slot right after slot ($i+ T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$).

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.6.3 Simultaneous DCI-based and Timer-based Active BWP Switch on multiple CCs

A.4.5.6.3.1 Simultaneous E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in EN-DC on multiple CCs

A.4.5.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the requirement of DL BWP switch delay on multiple CCs in TS 38.133 clause 8.6.2A.1, and interruption requirement for E-UTRA victim cell defined in TS 36.133 [15] clause 7.32.2.7. Supported test configurations for LTE PCell and NR PSCell are shown in table A.4.5.6.3.1.1-1. Supported test configurations for NR

SCell are shown in table A.4.5.6.3.1.1-1A. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCell are chosen independently.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and one NR SCell (Cell 3) as given in table A.4.5.6.3.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and NR SCell are specified in table A.4.5.6.3.1.1-3 and table A.4.5.6.3.1.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) and SCell (Cell 3) to ensure that the UE would have ACK/NACK sending except for the time duration T2 when BWPs are switching on Cell 2 and Cell 3.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC) and Cell 3 (SCell) on radio channel 3.
- UE is configured with 2 different UE-specific downlink bandwidth parts for PSCell, BWP-1 and BWP-2, before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 2 different UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2, before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in SCell
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell and SCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall switch its PSCell bandwidth part from BWP-1 to BWP-2. On the same slot on Cell 3 test equipment shall send a DCI format 1_1 command for SCell DL BWP switch. The UE shall switch its SCell bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH on PSCell and SCell at the beginning of the DL slot right after DL slot ($i+ T_{MultipleBWPswitchDelay}$) as defined in clause 8.6.2A.1 and starts to report valid ACK/NACK for the PSCell and SCell no later than at the beginning of the DL slot right after DL slot ($i+ T_{MultipleBWPswitchDelay}+k1$). The UE shall be continuously scheduled on both PCell's and SCell's BWP-2 starting from the beginning of the DL slot right after DL slot ($i+ T_{MultipleBWPswitchDelay}$).
>
> The starting time of PCell(Cell 1) interruption due to BWP switch on PSCell and SCell shall occur within the BWP switch delay.

During T2, the test equipment will not transmit DCI format for PDSCH reception on PSCell(Cell 2) and SCell(Cell 3).

During T3,

> The time period T3 starts from the slot #*j*, where *j* is the beginning slot of the DL subframe immediately after the *bwp-InactivityTimer* timer expires on PSCell. *bwp-InactivityTimer* timer on SCell shall also expire on slot #*j*. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1 on both PSCell and SCell. The UE shall be able to receive PDSCH on both PSCell and SCell at the beginning of the DL slot right after DL slot ($j+ T_{MultipleBWPswitchDelay}$) as defined in clause 8.6.2B.1 and starts to report valid ACK/NACK for the PSCell and SCell at latest at the beginning of the DL slot right after DL slot ($j+ T_{MultipleBWPswitchDelay} +k1$). The UE shall be continuously scheduled on both PSCell's and SCell's BWP-1 starting from the beginning of the DL slot right after DL slot ($j+ T_{MultipleBWPswitchDelay}$).
>
> The starting time of PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell and SCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of PSCell and SCell.

Table A.4.5.6.3.1.1-1: DL BWP switch supported test configurations for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration.	

Table A.4.5.6.3.1.1-1A: DL BWP switch supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.4.5.6.3.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2,3	Two NR radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
Active SCell		Cell 3	SCell on RF channel number 3.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
bwp-InactivityTimer	ms	200	For both PSCell and SCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for cells on SCC.
Cell 2 timing offset to Cell 1	µs	3	Synchronous EN-DC
Cell 3 timing offset to Cell 2	µs	3	Synchronous EN-DC
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.4.5.6.3.1.1-3: NR Cell specific test parameters for NR PSCell for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable

Parameter		Unit	Cell 2
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		10 MHz: $N_{RB,c}$ = 52
	Config 2,5		10 MHz: $N_{RB,c}$ = 52
	Config 3,6		40 MHz: $N_{RB,c}$ = 106
Active BWP ID			1,2
Initial DL BWP Configuration	Config 1,4		DLBWP.0.2 Note 4
	Config 2,5		
	Config 3,6		
Active DL BWP-1 Configuration	Config 1,4		DLBWP.1.1 Note 4
	Config 2,5		
	Config 3,6		
Active DL BWP-2 Configuration	Config 1,4		DLBWP.1.3 Note 4
	Config 2,5		
	Config 3,6		
Initial UL BWP Configuration	Config 1,4		ULBWP.0.2 Note 4
	Config 2,5		
	Config 3,6		
Active UL BWP-1 Configuration	Config 1,4		ULBWP.1.1 Note 4
	Config 2,5		
	Config 3,6		
Active UL BWP-2 Configuration	Config 1,4		ULBWP.1.3 Note 4
	Config 2,5		
	Config 3,6		
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
Dedicated CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2	Config 1,2,4,5	dBm/SCS	-104
	Config 3,6		-101
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3	Config 1,2,4,5	dBm/SCS	-87
	Config 3,6		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/ 9.36 MHz	-58.96
	Config 3,6	dBm/ 38.16 MHz	-52.86
Propagation Condition			AWGN

Parameter	Unit	Cell 2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].		

Table A.4.5.6.3.1.1-4: NR Cell specific test parameters for NR SCell for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 3
Frequency Range			FR1
Duplex mode	$Config_{SCell}$ 1		FDD
	$Config_{SCell}$ 2,3		TDD
TDD configuration	$Config_{SCell}$ 1		Not Applicable
	$Config_{SCell}$ 2		TDDConf.1.1
	$Config_{SCell}$ 3		TDDConf.2.1
$BW_{channel}$	$Config_{SCell}$ 1		10 MHz: $N_{RB,c}$ = 52
	$Config_{SCell}$ 2		10 MHz: $N_{RB,c}$ = 52
	$Config_{SCell}$ 3		40 MHz: $N_{RB,c}$ = 106
Active BWP ID			1,2
Initial DL BWP Configuration	$Config_{SCell}$ 1		DLBWP.0.2 Note 4
	$Config_{SCell}$ 2		
	$Config_{SCell}$ 3		
Active DL BWP-1 Configuration	$Config_{SCell}$ 1		DLBWP.1.1 Note 4
	$Config_{SCell}$ 2		
	$Config_{SCell}$ 3		
Active DL BWP-2 Configuration	$Config_{SCell}$ 1		DLBWP.1.3 Note 4
	$Config_{SCell}$ 2		
	$Config_{SCell}$ 3		
Initial UL BWP Configuration	$Config_{SCell}$ 1		ULBWP.0.2 Note 4
	$Config_{SCell}$ 2		
	$Config_{SCell}$ 3		
Active UL BWP-1 Configuration	$Config_{SCell}$ 1		ULBWP.1.1 Note 4
	$Config_{SCell}$ 2		
	$Config_{SCell}$ 3		
Active UL BWP-2 Configuration	$Config_{SCell}$ 1		ULBWP.1.3 Note 4
	$Config_{SCell}$ 2		
	$Config_{SCell}$ 3		
PDSCH Reference measurement channel	$Config_{SCell}$ 1		SR.1.1 FDD
	$Config_{SCell}$ 2		SR.1.1 TDD
	$Config_{SCell}$ 3		SR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell}$ 1		CR.1.1 FDD
	$Config_{SCell}$ 2		CR.1.1 TDD
	$Config_{SCell}$ 3		CR.2.1 TDD
Dedicated CORESET parameters	$Config_{SCell}$ 1		CCR.1.1 FDD
	$Config_{SCell}$ 2		CCR.1.1 TDD
	$Config_{SCell}$ 3		CCR.2.1 TDD
OCNG Patterns			OP.1
SSB Configuration	$Config_{SCell}$ 1,2		SSB.1 FR1
	$Config_{SCell}$ 3		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
TRS Configuration	$Config_{SCell}$ 1		TRS.1.1 FDD
	$Config_{SCell}$ 2		TRS.1.1 TDD
	$Config_{SCell}$ 3		TRS.1.2 TDD
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			

Parameter		Unit	Cell 3
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2	$Config_{SCell}$ 1,2	dBm/SCS	-104
	$Config_{SCell}$ 3		-101
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3	$Config_{SCell}$ 1,2	dBm/SCS	-87
	$Config_{SCell}$ 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	$Config_{SCell}$ 1,2	dBm/ 9.36 MHz	-58.96
	$Config_{SCell}$ 3	dBm/ 38.16 MHz	-52.86
Propagation Condition			AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

A.4.5.6.3.1.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell and SCell from the first UL slot that occurs after the beginning of DL slot ($i+ T_{MultipleBWPswitchDelay} +k1$).

During T3, the UE shall start to send the ACK for PSCell and SCell from the first UL slot that occurs after the beginning of DL slot ($j+ T_{MultipleBWPswitchDelay} +k1$).

Where, $k1$ is the timing between DL data receiving and acknowledgement as specified in TS 38.321 [7].

Depending on UE capability, UE shall finish BWP switch within the time duration $T_{MultipleBWPswitchDelay}$ defined in clause 8.6.2A.1.

All of the above test requirements shall be fulfilled in order for the observed PSCell and SCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start time of PCell interruption during PSCell and SCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start time of PCell interruption of during PSCell and SCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS 36.133 [15] clause 7.32.2.7.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after DL slot ($i+ T_{MultipleBWPswitchDelay} +k1$), ($j+ T_{MultipleBWPswitchDelay} +k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.4.5.6.4 Simultaneous RRC-based Active BWP Switch on multiple CCs

A.4.5.6.4.1 E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in synchronous EN-DC on multiple CCs

A.4.5.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL dormant BWP switch delay requirement defined in clause 8.6.3A.1, and interruption requirements for NR victim cell defined in clause 8.2.1.2.15 and interruption requirement for E-UTRA victim cell defined in clause 7.32.2.7 of TS 36.133 [15]. Supported test configurations for LTE PCell and NR PSCell are shown in Table A.4.5.6.4.1.1-1. Supported test configurations for NR SCell are shown in Table A.4.5.6.4.1.1-1A. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCell are chosen independently.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and one NR SCell (Cell 3) as given in table A.4.5.6.4.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and SCell are specified in table A.4.5.6.4.1.1-3 and table A.4.5.6.4.1.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), PSCell (Cell 2) on radio channel 2 (PSCC) and SCell (Cell 3) on radio channel 3 (SCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for PSCell (Cell 2) and SCell (Cell 3)
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell (Cell 2) and SCell (Cell 3).

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

> Time period T1 starts when the *RRCReconfiguration* with updated bandwidth part configuration for both PSCell(Cell 2) and SCell(Cell 3), sent from the test equipment to the UE, is completely received at the UE side in PSCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part configuration on PSCell(Cell 2) and SCell(Cell 3).
>
> The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$) as defined in clause 8.6.3A.1 and be ready for the reception of uplink grant for the PSCell(Cell 2) and SCell(Cell 3) no later than at the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$). The UE shall be continuously scheduled on PSCell's BWP-1 and SCell's BWP-1 starting from the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$).
>
> $T_{RRCprocessingDelay}$, $T_{BWPswitchDelayRRC}$, D_{RRC} are defined in clause 8.6.3A.1 .

The test equipment verifies the DL BWP switch time in PSCell (Cell 2) and SCell (Cell 3) by counting the time from the time when the RRC Reconfiguration message including updated BWP configuration sent till the time when RRC Reconfiguration Complete message is received.

Table A.4.5.6.4.1.1-1: DL BWP switch supported test configurations for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which fulfils the requirements in the test case in clause A.4.5.6.4.2 can skip the test cases in current clause A.4.5.6.4.1.	

NOTE 3: Void
NOTE 4: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration

Table A.4.5.6.4.1.1-1A: DL BWP switch supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which fulfils the requirements in the test case in clause A.4.5.6.4.2 can skip the test cases in current clause A.4.5.6.4.1. NOTE 3: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.4.5.6.4.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2,3	Two NR radio channel is used for this test
Active PCell		Cell 1	Pcell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
Active SCell		Cell 3	SCell on RF channel number 3.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for cells on SCC.
Cell 2 timing offset to Cell 1	µs	3	Synchronous EN-DC
Cell 3 timing offset to Cell 2	µs	3	Synchronous cells
T1	s	[0.2]	

Table A.4.5.6.4.1.1-3: NR Cell specific test parameters for NR PSCell for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.1.2
$BW_{channel}$	Config 1,4		10 MHz: $N_{RB,c}$ = 52
	Config 2,5		10 MHz: $N_{RB,c}$ = 52
	Config 3,6		40 MHz: $N_{RB,c}$ = 106
Active BWP ID			1,2
Initial BWP Configuration	Config 1,4		DLBWP.0.2
	Config 2,5		
	Config 3,6		
Active BWP-0 Configuration	Config 1,4		N/A
	Config 2,5		
	Config 3,6		
Active BWP-1 Configuration	Config 1,4		DLBWP.1.3
	Config 2,5		
	Config 3,6		

Parameter		Unit	Cell 2
Active BWP-2 Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		
	Config 3,6		
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
Dedicated CORESET parameters, Test 1	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
Dedicated CORESET parameters, Test 2	Config 1,4		CCR.1.5 FDD
	Config 2,5		CCR.1.5 TDD
	Config 3,6		CCR.2.3 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
SMTC Configuration			SMTC.1
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96
	Config 3,6	dBm/38.16 MHz	-52.86

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.4.5.6.4.1.1-4: NR Cell specific test parameters for NR SCell for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 3
Frequency Range			FR1
Duplex mode	$Config_{SCell}$ 1		FDD
	$Config_{SCell}$ 2,3		TDD
TDD configuration	$Config_{SCell}$ 1		Not Applicable
	$Config_{SCell}$ 2		TDDConf.1.1
	$Config_{SCell}$ 3		TDDConf.1.2
$BW_{channel}$	$Config_{SCell}$ 1		10 MHz: $N_{RB,c}$ = 52
	$Config_{SCell}$ 2		10 MHz: $N_{RB,c}$ = 52
	$Config_{SCell}$ 3		40 MHz: $N_{RB,c}$ = 106
Active BWP ID			0
Initial BWP	$Config_{SCell}$ 1		DLBWP.0.2

Parameter		Unit	Cell 3
Configuration	$Config_{SCell}$ 2		
	$Config_{SCell}$ 3		
Active BWP-0 Configuration	$Config_{SCell}$ 1		DLBWP.0.2
	$Config_{SCell}$ 2		
	$Config_{SCell}$ 3		
Active BWP-1 Configuration	$Config_{SCell}$ 1		N/A
	$Config_{SCell}$ 2		
	$Config_{SCell}$ 3		
Active BWP-2 Configuration	$Config_{SCell}$ 1		N/A
	$Config_{SCell}$ 2		
	$Config_{SCell}$ 3		
PDSCH Reference measurement channel	$Config_{SCell}$ 1		SR.1.1 FDD
	$Config_{SCell}$ 2		SR.1.1 TDD
	$Config_{SCell}$ 3		SR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell}$ 1		CR.1.1 FDD
	$Config_{SCell}$ 2		CR.1.1 TDD
	$Config_{SCell}$ 3		CR.2.1 TDD
Dedicated CORESET parameters, Test 1	$Config_{SCell}$ 1		CCR.1.1 FDD
	$Config_{SCell}$ 2		CCR.1.1 TDD
	$Config_{SCell}$ 3		CCR.2.1 TDD
Dedicated CORESET	$Config_{SCell}$ 1		CCR.1.5 FDD
parameters, Test 2	$Config_{SCell}$ 2		CCR.1.5 TDD
	$Config_{SCell}$ 3		CCR.2.3 TDD
OCNG Patterns			OP.1
SSB Configuration	$Config_{SCell}$ 1,2		SSB.1 FR1
	$Config_{SCell}$ 3		SSB.2 FR1
SMTC Configuration			SMTC.1
TRS Configuration	$Config_{SCell}$ 1		TRS.1.1 FDD
	$Config_{SCell}$ 2		TRS.1.1 TDD
	$Config_{SCell}$ 3		TRS.1.2 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	$Config_{SCell}$ 1,2	dBm/9.36 MHz	-58.96
	$Config_{SCell}$ 3	dBm/38.16 MHz	-52.86

A.4.5.6.4.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PSCell and SCell in the beginning of the DL slot right after slot $(i+\frac{T_{RRC processing Delay}+T_{BWP switch Delay RRC}+D_{RRC}}{NR\ slot\ length})$.

All of the above test requirements shall be fulfilled in order for the observed PSCell and SCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.6.4.2 E-UTRAN – NR FR1 PSCell SCell dormancy switch of two FR1 SCells inside active time

A.4.5.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify the delay requirement of BWP switching from dormancy to non-dormancy and from non-dormancy to dormancy on SCell defined in clause 8.6.2, and interruption requirements for NR victim cell defined in clause 8.2.1.2.15 and interruption requirement for E-UTRA victim cell defined in clause 7.32.2.7 of TS 36.133 [15]. Supported test configurations for LTE PCell and NR PSCell are shown in table A.4.5.6.4.2.1-1. Supported test configurations for NR SCells are shown in table A.4.5.6.4.2.1-1A. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCells are chosen independently. Test configurations for two NR SCells are chosen independently.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and two NR SCells (Cell 3, and Cell 4) as given in table A.4.5.6.4.2.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and SCells are specified in table A.4.5.6.4.2.1-3, table A.4.5.6.4.2.1-4 and table A.4.5.6.4.2.1-5 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) and PSCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 3, and Cell 4) to ensure that the UE would have ACK/NACK sending except for the time duration when SCell (Cell 2) performs the dormancy switching and stays in the dormant BWP.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC),, Cell 3 (SCell) on radio channel 3 (SCC) and Cell 4 (SCell) on radio channel 4 (SCC).
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for PSCell, BWP-0, in Cell 2 before starting the test. BWP-0 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 2 UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2 in Cell 3 and Cell 4 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in PSCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in all SCells.
- UE is indicated in *dormantBWP -Id* that the dormant BWP is BWP-2 in all SCells.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for enterning dormant BWP in SCell, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. Upon reception of the PDCCH indicating entering dormant BWP in PCell, UE shall switch the DL BWP-1 to DL BWP-2 in all SCells, i.e., switching from non-dormant BWP to dormant BWP.
>
> The UE shall be able to receive PDSCH and report valid ACK/NACK on the PCell and PSCell all the time except interruption.
>
> The starting time of PCell (Cell 1) interruption due to dormancy switching on SCells shall occur within the dormant BWP switch delay.
>
> The starting time of PSCell (Cell 2) interruption due to dormancy switching on SCells shall occur within the dormant BWP switch delay.

During T2, the test equipment will not transmit DCI format for PDSCH reception on all SCells.

> The UE shall be able to receive PDSCH and report valid ACK/NACK on the PCell and PSCell all the time except interruption.

During T3,

> Time period T3 starts when a DCI format 1_1 command for leaving dormant BWP in SCells, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *j*. Upon reception of the PDCCH

indicating leaving dormant BWP in PSCell, UE shall switch the DL BWP-2 to DL BWP-1 in SCells, i.e., switching from dormant BWP to non-dormant BWP.

The UE shall be able to receive PDSCH on all SCells no later than the first DL slot that occurs after the beginning of PSCell's DL slot (j+ $T_{mutipledormantBWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK on all SCells no later than the first UL slot that occurs after the beginning of slot (j+N) as defined in clause 10.3 in TS 38.213.

The UE shall be able to receive PDSCH and report valid ACK/NACK on the PCell and PSCell all the time except interruption.

The starting time of PCell (Cell 1) interruption due to dormancy switching on SCells shall occur within the dormant BWP switch delay.

The starting time of PSCell (Cell 2) interruption due to dormancy switching on SCells shall occur within the dormant BWP switch delay.

The test equipment verifies that potential interruption to E-UTRA PCell and NR PSCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during dormant BWP switch of SCells, respectively.

Table A.4.5.6.4.2.1-1: Dormant BWP switch supported test configurations for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which fulfils the requirements in the test case in current clause A.4.5.6.4.2 can skip the test cases in clause A.4.5.6.4.1 NOTE 3: Void. NOTE 4: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.4.5.6.4.2.1-1A: Dormant BWP switch supported test configurations for NR SCells

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which fulfils the requirements in the test case in current clause A.4.5.6.4.2 can skip the test cases in clause A.4.5.6.4.1 NOTE 3: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration NOTE 4: Test configurations for two NR SCells are chosen independently.	

Table A.4.5.6.4.2.1-2: General test parameters for Dormant BWP switch in synchronous EN-DC

Parameter	Unit	Value		Comment
		Test 1	Test 2	
E-UTRA RF Channel Number		1		One E-UTRA radio channel is used for this test
NR RF Channel Number		2, 3, 4		Three NR radio channels are used for this test
Active PCell		Cell 1		PCell on RF channel number 1.
Active PSCell		Cell 2		PSCell on RF channel number 2.
Active SCell		Cell 3		SCell on RF channel number 3.
Active SCell		Cell 4		SCell on RF channel number 4.
CP length		Normal		

DRX		OFF		
bwp-InactivityTimer	ms	200		
Cell-individual offset for cells on RF channel number 1	dB	0		Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0		Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0		Individual offset for cells on SCC.
Cell 2 timing offset to Cell 1	µs	3		Synchronous EN-DC
Cell 3 timing offset to Cell 2	µs	3		Synchronous cells
Cell 4 timing offset to Cell 2	µs	3		Synchronous cells
OFDM symbol range in slot for transmission of DCI with dormancy indication		0 – 2	3 – 11	
T1	s	0.2		
T2	s	0.2		
T3	s	0.2		

Table A.4.5.6.4.2.1-3: NR Cell specific test parameters for NR PSCell for Dormant BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.1.2
$BW_{channel}$	Config 1,4		10 MHz: $N_{RB,c}$ = 52
	Config 2,5		10 MHz: $N_{RB,c}$ = 52
	Config 3,6		40 MHz: $N_{RB,c}$ = 106
Active BWP ID			0
Initial BWP Configuration	Config 1,4		DLBWP.0.2
	Config 2,5		
	Config 3,6		
Active BWP-0 Configuration	Config 1,4		DLBWP.0.2
	Config 2,5		
	Config 3,6		
Active BWP-1 Configuration	Config 1,4		N/A
	Config 2,5		
	Config 3,6		
Active BWP-2 Configuration	Config 1,4		N/A
	Config 2,5		
	Config 3,6		
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR2.1 TDD
Dedicated CORESET parameters, Test 1	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
Dedicated CORESET parameters, Test 2	Config 1,4		CCR.1.5 FDD
	Config 2,5		CCR.1.5 TDD
	Config 3,6		CCR.2.3 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
SMTC Configuration			SMTC.1
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD

Parameter		Unit	Cell 2
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96
	Config 3,6	dBm/38.16 MHz	-52.86

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.4.5.6.4.2.1-4: NR Cell specific test parameters for NR SCell (Cell 3) for Dormant BWP switch in synchronous EN-DC

Parameter		Unit	Cell 3
Frequency Range			FR1
Duplex mode	$Config_{SCell\ 1}$ 1		FDD
	$Config_{SCell\ 1}$ 2,3		TDD
TDD configuration	$Config_{SCell\ 1}$ 1		Not Applicable
	$Config_{SCell\ 1}$ 2		TDDConf.1.1
	$Config_{SCell\ 1}$ 3		TDDConf.1.2
$BW_{channel}$	$Config_{SCell\ 1}$ 1		10 MHz: $N_{RB,c}$ = 52
	$Config_{SCell\ 1}$ 2		10 MHz: $N_{RB,c}$ = 52
	$Config_{SCell\ 1}$ 3		40 MHz: $N_{RB,c}$ = 106
Active BWP ID			1,2
Initial BWP Configuration	$Config_{SCell\ 1}$ 1		N/A
	$Config_{SCell\ 1}$ 2		
	$Config_{SCell\ 1}$ 3		
Active BWP-0 Configuration	$Config_{SCell\ 1}$ 1		N/A
	$Config_{SCell\ 1}$ 2		
	$Config_{SCell\ 1}$ 3		
Active BWP-1 Configuration	$Config_{SCell\ 1}$ 1		DLBWP.1.1
	$Config_{SCell\ 1}$ 2		
	$Config_{SCell\ 1}$ 3		
Active BWP-2 Configuration	$Config_{SCell\ 1}$ 1		DLBWP.1.3
	$Config_{SCell\ 1}$ 2		
	$Config_{SCell\ 1}$ 3		
PDSCH Reference measurement channel	$Config_{SCell\ 1}$ 1		SR.1.1 FDD
	$Config_{SCell\ 1}$ 2		SR.1.1 TDD
	$Config_{SCell\ 1}$ 3		SR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell\ 1}$ 1		CR.1.1 FDD
	$Config_{SCell\ 1}$ 2		CR.1.1 TDD
	$Config_{SCell\ 1}$ 3		CR.2.1 TDD
Dedicated CORESET parameters, Test 1	$Config_{SCell\ 1}$ 1		CCR.1.1 FDD
	$Config_{SCell\ 1}$ 2		CCR.1.1 TDD
	$Config_{SCell\ 1}$ 3		CCR.2.1 TDD
Dedicated CORESET	$Config_{SCell\ 1}$ 1		CCR.1.5 FDD

Parameter		Unit	Cell 3
parameters, Test 2	$Config_{SCell\ 1}$ 2		CCR.1.5 TDD
	$Config_{SCell\ 1}$ 3		CCR.2.3 TDD
OCNG Patterns			OP.1
SSB Configuration	$Config_{SCell\ 1}$ 1,2		SSB.1 FR1
	$Config_{SCell\ 1}$ 3		SSB.2 FR1
SMTC Configuration			SMTC.1
TRS Configuration	$Config_{SCell\ 1}$ 1		TRS.1.1 FDD
	$Config_{SCell\ 1}$ 2		TRS.1.1 TDD
	$Config_{SCell\ 1}$ 3		TRS.1.2 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	$Config_{SCell\ 1}$ 1,2	dBm/9.36 MHz	-58.96
	$Config_{SCell\ 1}$ 3	dBm/38.16 MHz	-52.86
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

Table A.4.5.6.4.2.1-5: NR Cell specific test parameters for NR SCell (Cell 4) for Dormant BWP switch in synchronous EN-DC

Parameter		Unit	Cell 4
Frequency Range			FR1
Duplex mode	$Config_{SCell2}$ 1		FDD
	$Config_{SCell2}$ 2,3		TDD
TDD configuration	$Config_{SCell2}$ 1		Not Applicable
	$Config_{SCell2}$ 2		TDDConf.1.1
	$Config_{SCell2}$ 3		TDDConf.1.2
$BW_{channel}$	$Config_{SCell2}$ 1		10 MHz: $N_{RB,c}$ = 52
	$Config_{SCell2}$ 2		10 MHz: $N_{RB,c}$ = 52
	$Config_{SCell2}$ 3		40 MHz: $N_{RB,c}$ = 106
Active BWP ID			1,2
Initial BWP Configuration	$Config_{SCell2}$ 1		N/A
	$Config_{SCell2}$ 2		
	$Config_{SCell2}$ 3		
Active BWP-0 Configuration	$Config_{SCell2}$ 1		N/A
	$Config_{SCell2}$ 2		
	$Config_{SCell2}$ 3		
Active BWP-1 Configuration	$Config_{SCell2}$ 1		DLBWP.1.1
	$Config_{SCell2}$ 2		
	$Config_{SCell2}$ 3		
Active BWP-2 Configuration	$Config_{SCell2}$ 1		DLBWP.1.3
	$Config_{SCell2}$ 2		
	$Config_{SCell2}$ 3		
PDSCH Reference measurement channel	$Config_{SCell2}$ 1		SR.1.1 FDD
	$Config_{SCell2}$ 2		SR.1.1 TDD

Parameter		Unit	Cell 4
	$Config_{SCell2}$ 3		SR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell2}$ 1		CR.1.1 FDD
	$Config_{SCell2}$ 2		CR.1.1 TDD
	$Config_{SCell2}$ 3		CR.2.1 TDD
Dedicated CORESET parameters, Test 1	$Config_{SCell2}$ 1		CCR.1.1 FDD
	$Config_{SCell2}$ 2		CCR.1.1 TDD
	$Config_{SCell2}$ 3		CCR.2.1 TDD
Dedicated CORESET parameters, Test 2	$Config_{SCell2}$ 1		CCR.1.5 FDD
	$Config_{SCell2}$ 2		CCR.1.5 TDD
	$Config_{SCell2}$ 3		CCR.2.3 TDD
OCNG Patterns			OP.1
SSB Configuration	$Config_{SCell2}$ 1,2		SSB.1 FR1
	$Config_{SCell2}$ 3		SSB.2 FR1
SMTC Configuration			SMTC.1
TRS Configuration	$Config_{SCell2}$ 1		TRS.1.1 FDD
	$Config_{SCell2}$ 2		TRS.1.1 TDD
	$Config_{SCell2}$ 3		TRS.1.2 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	$Config_{SCell2}$ 1,2	dBm/9.36 MHz	-58.96
	$Config_{SCell2}$ 3	dBm/38.16 MHz	-52.86
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

A.4.5.6.4.2.2 Test Requirements

During T1, the UE shall be able to to send the ACK/NACK for all SCells before UE PDCCH indicating entering dormant BWP is received in PSCell's slot # denoted.

During T3, the UE shall start to send the ACK/NACK for all SCells from the first UL slot that occurs after the beginning of DL slot ($j+N$).

Where, N is the timing that UE provide HARQ-ACK information in response to a detection of a DCI format 1_1 indicating SCell dormancy as specified in [3].

All of the above test requirements shall be fulfilled in order for the observed SCell dormant BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start of the interruption of PCell during SCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PCell during SCell active BWP switch shall not happen outside the BWP switch delay.

During T1, the start of the interruption of PSCell during SCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PSCell during SCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in clause 7.32.2.7 of TS 36.133 [15].

The interruption of PSCell shall not be longer than the interruption duration specified for dormant BWP switch in clause 8.6.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first DL slot that occurs after the beginning of DL slot ($i+N$), ($j+N$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.4.5.6.5 SCell dormancy switch

A.4.5.6.5.1 E-UTRAN – NR FR1 PSCell SCell dormancy switch of single FR1 SCell outside active time

A.4.5.6.5.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement on multiple CCs for RRC-based BWP switch defined in clause 8.6.3A.1. Supported test configurations for LTE PCell and NR PSCell are shown in table A.4.5.6.5.1.1-1. Supported test configurations for NR SCell are shown in table A.4.5.6.5.1.1-1A. Test configuration for LTE PCell and NR PSCell and test configuration for NR SCell are chosen independently.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and one NR SCell(Cell 3) as given in table A.4.5.6.5.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and NR SCell are specified in table A.4.5.6.5.1.1-3 and table A.4.5.6.5.1.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) and PSCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 3) to ensure that the UE would have ACK/NACK sending except for the time duration when the SCell is in dormancy during T2.

The UE is configured to monitor PDCCH for DCI format 2_6 at *ps-Offset* before the start of *onDuration*. Two tests are specified, where a UE that only supports triggering within the first three OFDM symbols of a slot shall undergo Test1 only, and a UE that supports triggering also in remaining OFDM symbols of a slot shall undergo both Test1 and Test2. In the tested scenario, *ps-Offset* is selected to correspond to the dormancy switching time specified in clause 8.6.2A.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC) and Cell 3 (SCell) on radio channel 3 (SCC).
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for PSCell, BWP-1 in Cell 3 before starting the test.
- UE is configured with 2 different UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2, in Cell 3 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB. BWP-1 is configured in *OutsideActiveTimeConfig* as *firstOutsideActiveTimeBWP*. BWP-2 is configured as *dormantBWP*.
- UE is configured with RRM measurement on SCC.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in SCell.
- UE is configured to monitor DCI format 2_6, and to be active during onDuration even when no DCI format 2_6 is detected (ps-WakeUp).

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

Time period T1 starts when a DCI format 2_6 command for SCell switch from non-dormany to dormancy, sent from the test equipment to the UE, is received at the UE side at *ps-Offset* before *onDuration*. The UE shall switch its SCell bandwidth part from BWP-1 to BWP-2 into dormancy. During T1, test equipement verifies that:

The UE shall be able to receive CSI-RS on SCell BWP-2 at the beginning of the DL slot right after SCell's DL slot ($i+T_{dormantBWPswitchDelay}$) as defined in clause 8.6. TE shall observe the periodic reporting of CQI for SCell starting from slot ($i+T_{dormantBWPswitchDelay}$).

PCell (Cell 1) interruption due to dormancy switch on SCell shall occur within the dormancy switch delay.

PSCell (Cell 2) interruption due to dormancy switch on SCell shall occur within the dormancy switch delay.

Time period T2 starts when T1 is completed. During T2, the test equipment continues to schedule the UE continuously in PCell and PSCell. The UE shall carry out CSI and RRM measurements on the dormant SCells. The UE shall report ACK/NACK in PCell and PSCell in response to scheduled PDSCH, with the maximum loss of transmitted ACK/NACKs fulfilling the requirement in clause 8.2.1.2.15. The test equipment verifies that the loss of ACK/NACKs is no larger than 1.5%.

Time period T3 starts when T2 is completed. During T3, the test equipment does not schedule the UE, by which the inactivity timer expires and the UE stops monitoring PDCCH except for signalling using DCI format 2_6 at wake-up signalling occasions.

Time period T4 starts when the UE at *ps-Offset* before *onDuration* detects a DCI format 2_6 carrying dormancy indication that indicates that SCell 1 and SCell2 are to be switched from dormancy to non-dormancy. During T4, the test equipment schedules the UE with new data indication in PCell, PSCell and SCell during *onDuration.* The test equipment verifies that:

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($j+T_{dormantBWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell at latest at the beginning of the DL slot right after slot ($j+T_{dormantBWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-1 starting from the beginning of the DL slot right after slot ($j+T_{dormantBWPswitchDelay}$).

PCell (Cell 1) interruption due to dormancy switch on SCell shall occur within the dormancy switch delay.

PSCell (Cell 2) interruption due to dormancy switch on SCell shall occur within the dormancy switch delay.

Table A.4.5.6.5.1.1-1: DL BWP switch supported test configurations for LTE PCell and NR PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.4.5.6.5.1.1-1A: DL BWP switch supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.4.5.6.5.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value		Comment
		Test1	Test2	
E-UTRA RF Channel Number		1		One E-UTRA radio channel is used for this test
NR RF Channel Number		2, 3		Two NR radio channel is used for this test
Active PCell		Cell 1		PCell on RF channel number 1.
Active PSCell		Cell 2		PSCell on RF channel number 2.
Active SCell		Cell 3		SCell on RF channel number 3.
CP length		Normal		
CSI reporting periodicity, Non-dormant BWP	ms	2		CSI reporting periodicity for periodic reporting of CQI for PCell and non-dormant SCells
CSI reporting periodicity, Dormant BWP	ms	40		CSI reporting periodicity for periodic reporting of CQI for dormant SCells
ps-Offset		Depending on UE capability		Monitoring of DCI 2_6 ahead of start of drx-onDurationTimer. Value of ps-Offset shall correspond to SCell dormancy switching time for switching of two SCells, as specified in clause 8.6.2A. Actual value depends on reported UE capabilities.
ps-WakeUp		true		Wake up for onDuration in case DCI format 2_6 is not detected.
DRX		DRX.1		
'bwp-InactivityTimer	ms	200		
Cell-individual offset for cells on RF channel number 1	dB	0		Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0		Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0		Individual offset for cells on SCC.
Cell2 timing offset to Cell 1	µs	3		Synchronous EN-DC
Cell 3 timing offset to Cell 2	µs	3		Synchronous cells
Number of CSI-RS ports		4		The number of CSI-RS ports in a single resource without CRI report
OFDM symbol range in slot for transmission of DCI with dormancy indication		0 – 2	3 – 11	Test1 is based on that triggering DCI is received within the first three OFDM symbols of a slot. Test2 is based on that the triggering DCI is received later than within the first three OFDM symbols of a slot.
T1	s	10		
T2	s	0.2		
T3	s	0.2		
T4	s	10		

Table A.4.5.6.5.1.1-3: NR Cell specific test parameters for NR PSCell for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.1.2
$BW_{channel}$	Config 1,4		10 MHz: $N_{RB,c}$ = 52
	Config 2,5		10 MHz: $N_{RB,c}$ = 52
	Config 3,6		40 MHz: $N_{RB,c}$ = 106
Active DL BWP ID			1
Initial DL BWP Configuration	Config 1,4		DLBWP.0.2
	Config 2,5		
	Config 3,6		
Initial UL BWP Configuration	Config 1,4		ULBWP.0.2
	Config 2,5		

Parameter			Unit	Cell 2
		Config 3,6		
Initial Condition	Active DL BWP-1 Configuration	Config 1,4		DLBWP.1.3
		Config 2,5		
		Config 3,6		
	Active UL BWP-1 Configuration	Config 1,4		ULBWP.1.3
		Config 2,5		
		Config 3,6		
Final Condition	Active DL BWP-1 Configuration	Config 1,4		DLBWP.1.1
		Config 2,5		
		Config 3,6		
	Active UL BWP-1 Configuration	Config 1,4		ULBWP.1.1
		Config 2,5		
		Config 3,6		
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD
		Config 2,5		SR.1.1 TDD
		Config 3,6		SR2.1 TDD
RMSI CORESET parameters		Config 1,4		CR.1.1 FDD
		Config 2,5		CR.1.1 TDD
		Config 3,6		CR2.1 TDD
Dedicated CORESET parameters		Config 1,4		CCR.1.1 FDD
		Config 2,5		CCR.1.1 TDD
		Config 3,6		CCR.2.1 TDD
OCNG Patterns				OP.1
SSB Configuration		Config 1,2,4,5		SSB.1 FR1
		Config 3,6		SSB.2 FR1
SMTC Configuration				SMTC.1
TRS Configuration		Config 1,4		TRS.1.1 FDD
		Config 2,5		TRS.1.1 TDD
		Config 3,6		TRS.1.2 TDD
Antenna Configuration				1x2
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note 2			dBm/15 kHz	-104
SS-RSRP Note 3			dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$			dB	17
$\hat{E}_s/N_{oc}$			dB	17
Io Note3		Config 1,2,4,5	dBm/ 9.36 MHz	-58.96
		Config 3,6	dBm/ 38.16 MHz	-52.86

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.4.5.6.5.1.1-4: NR Cell specific test parameters for NR SCell for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 3
Frequency Range			FR1
Duplex mode	$Config_{SCell}$ 1		FDD

Parameter			Unit	Cell 3
		$Config_{SCell}$ 2,3		TDD
TDD configuration		$Config_{SCell}$ 1		Not Applicable
		$Config_{SCell}$ 2		TDDConf.1.1
		$Config_{SCell}$ 3		TDDConf.1.2
$BW_{channel}$		$Config_{SCell}$ 1		10 MHz: $N_{RB,c}$ = 52
		$Config_{SCell}$ 2		10 MHz: $N_{RB,c}$ = 52
		$Config_{SCell}$ 3		40 MHz: $N_{RB,c}$ = 106
Active DL BWP ID				1
Initial DL BWP Configuration		$Config_{SCell}$ 1		DLBWP.0.2
		$Config_{SCell}$ 2		
		$Config_{SCell}$ 3		
Initial UL BWP Configuration		$Config_{SCell}$ 1		ULBWP.0.2
		$Config_{SCell}$ 2		
		$Config_{SCell}$ 3		
Initial Condition	Active DL BWP-1 Configuration	$Config_{SCell}$ 1		DLBWP.1.3
		$Config_{SCell}$ 2		
		$Config_{SCell}$ 3		
	Active UL BWP-1 Configuration	$Config_{SCell}$ 1		ULBWP.1.3
		$Config_{SCell}$ 2		
		$Config_{SCell}$ 3		
Final Condition	Active DL BWP-1 Configuration	$Config_{SCell}$ 1		DLBWP.1.1
		$Config_{SCell}$ 2		
		$Config_{SCell}$ 3		
	Active UL BWP-1 Configuration	$Config_{SCell}$ 1		ULBWP.1.1
		$Config_{SCell}$ 2		
		$Config_{SCell}$ 3		
PDSCH Reference measurement channel		$Config_{SCell}$ 1		SR.1.1 FDD
		$Config_{SCell}$ 2		SR.1.1 TDD
		$Config_{SCell}$ 3		SR 2.1 TDD
RMSI CORESET parameters		$Config_{SCell}$ 1		CR.1.1 FDD
		$Config_{SCell}$ 2		CR.1.1 TDD
		$Config_{SCell}$ 3		CR 2.1 TDD
Dedicated CORESET parameters		$Config_{SCell}$ 1		CCR.1.1 FDD
		$Config_{SCell}$ 2		CCR.1.1 TDD
		$Config_{SCell}$ 3		CCR.2.1 TDD
OCNG Patterns				OP.1
SSB Configuration		$Config_{SCell}$ 1,2		SSB.1 FR1
		$Config_{SCell}$ 3		SSB.2 FR1
SMTC Configuration				SMTC.1
TRS Configuration		$Config_{SCell}$ 1		TRS.1.1 FDD
		$Config_{SCell}$ 2		TRS.1.1 TDD
		$Config_{SCell}$ 3		TRS.1.2 TDD
Antenna Configuration				1x2
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note 2			dBm/15 kHz	-104
SS-RSRP Note 3			dBm/15 kHz	[87
$\hat{E}_s/I_{ot}$			dB	17
$\hat{E}_s/N_{oc}$			dB	17
Io Note3		$Config_{SCell}$ 1,2	dBm/ 9.36 MHz	-58.96
		$Config_{SCell}$ 3	dBm/ 38.16 MHz	-52.86

Parameter	Unit	Cell 3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].		

A.4.5.6.5.1.2 Test Requirements

During T1, any interruption on PCell and PSCell due to dormancy switching of SCell shall be within the requirement specified in in clause 8.2.1.2.15.1 for NR victim cell, and clause 7.32.2.14.1 of 36.133 [15] for E-UTRA victim cell. Starting from *onDuration* in time period T1, the UE shall transmit ACK/NACK in response to scheduling in PCell and PSCell. There shall be no loss of ACK/NACK.

During time period T2, the UE shall transmit ACK/NACKs in response to scheduling in PCell and the rate of missed ACK/NACKs shall be no more than 1.5%.

During T1, any interruption on PCell and PSCell due to dormancy switching of SCell shall be within the requirement specified in in clause 8.2.1.2.15.1 for NR victim cell, and clause 7.32.2.14.1 of 36.133 [15] for E-UTRA victim cell. Starting from *onDuration* in time period T4, the UE shall transmit ACK/NACK in response to scheduling in PCell, SCell 1 and SCell2. There shall be no loss of ACK/NACK.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.6.5.2 E-UTRAN – NR FR1 PSCell SCell dormancy switch of two FR1 SCells inside active time

A.4.5.6.5.2.1 Test Purpose and Environment

The purpose of this test is to verify the delay requirement of BWP switching from dormancy to non-dormancy and from non-dormancy to dormancy on SCell defined in clause 8.6.2, and interruption requirements for NR victim cell defined in clause 8.2.1.2.15 and interruption requirement for E-UTRA victim cell defined in clause 7.32.2.7 of TS 36.133 [15]. Supported test configurations are shown in table A.4.5.6.5.2.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and two NR SCells (Cell 3, and Cell 4) as given in table A.4.5.6.5.2.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and SCells are specified in table A.4.5.6.5.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) and PSCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 3, and Cell 4) to ensure that the UE would have ACK/NACK sending except for the time duration when SCell (Cell2) performs the dormancy switching and stays in the dormant BWP.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC), Cell 3 (SCell) on radio channel 3 (SCC) and Cell 4 (SCell) on radio channel 4 (SCC).
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for PSCell, BWP-0, in Cell 2 before starting the test. BWP-0 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 2 UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2 in Cell 3 and Cell 4 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in PSCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in all SCells.
- UE is indicated in *dormantBWP -Id* that the dormant BWP is BWP-2 in all SCells.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for enterning dormant BWP in SCell, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. Upon reception of the PDCCH indicating entering dormant BWP in PCell, UE shall switch the DL BWP-1 to DL BWP-2 in all SCells, i.e., switching from non-dormant BWP to dormant BWP.

The UE shall be able to receive PDSCH and report valid ACK/NACK on the PCell and PSCell all the time except interruption.

The starting time of PCell (Cell 1) interruption due to dormancy switching on SCells shall occur within the dormant BWP switch delay.

The starting time of PSCell (Cell 2) interruption due to dormancy switching on SCells shall occur within the dormant BWP switch delay.

During T2, the test equipment will not transmit DCI format for PDSCH reception on all SCells.

The UE shall be able to receive PDSCH and report valid ACK/NACK on the PCell and PSCell all the time except interruption.

During T3,

Time period T3 starts when a DCI format 1_1 command for leaving dormant BWP in SCells, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *j*. Upon reception of the PDCCH indicating leaving dormant BWP in PSCell, UE shall switch the DL BWP-2 to DL BWP-1 in SCells, i.e., switching from dormant BWP to non-dormant BWP.

The UE shall be able to receive PDSCH on all SCells no later than the first DL slot that occurs after the beginning of PSCell's DL slot ($j+ T_{mutipledormantBWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK on all SCells no later than the first UL slot that occurs after the beginning of slot ($j+N$) as defined in clause 10.3 in TS 38.213 [3].

The UE shall be able to receive PDSCH and report valid ACK/NACK on the PCell and PSCell all the time except interruption.

The starting time of PCell (Cell 1) interruption due to dormancy switching on SCells shall occur within the dormant BWP switch delay.

The starting time of PSCell (Cell 2) interruption due to dormancy switching on SCells shall occur within the dormant BWP switch delay.

The test equipment verifies that potential interruption to E-UTRA PCell and NR PSCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during dormant BWP switch of SCells, respectively.

Table A.4.5.6.5.2.1-1: Dormant BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which fulfils the requirements in the test case in current clause A.4.5.6.5.2 can skip the test cases in clause A.4.5.6.5.1. NOTE 3: NR configuration is the same for PSCell and SCells.	

Table A.4.5.6.5.2.1-2: General test parameters for Dormant BWP switch in synchronous EN-DC

Parameter	Unit	Value		Comment
		Test 1	Test 2	
E-UTRA RF Channel Number		1		One E-UTRA radio channel is used for this test
NR RF Channel Number		2, 3, 4		Three NR radio channels are used for this test
Active PCell		Cell 1		PCell on RF channel number 1.
Active PSCell		Cell 2		PSCell on RF channel number 2.
Active SCell		Cell 3		SCell on RF channel number 3.
Active SCell		Cell 4		SCell on RF channel number 4.
CP length		Normal		
DRX		OFF		
bwp-InactivityTimer	ms	200		
Cell-individual offset for cells on RF channel number 1	dB	0		Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0		Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0		Individual offset for cells on SCC.
Cell2 timing offset to Cell 1	µs	3		Synchronous EN-DC
Cell 3 timing offset to Cell 2	µs	3		Synchronous cells
Cell 4 timing offset to Cell 2	µs	3		Synchronous cells
OFDM symbol range in slot for transmission of DCI with dormancy indication		0 – 2	3 – 11	
T1	s	0.2		
T2	s	0.2		
T3	s	0.2		

Table A.4.5.6.5.2.1-3: NR Cell specific test parameters for Dormant BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2	Cell 3	Cell 4
Frequency Range			FR1		
Duplex mode	Config 1,4		FDD		
	Config 2,3,5,6		TDD		
TDD configuration	Config 1,4		Not Applicable		
	Config 2,5		TDDConf.1.1		
	Config 3,6		TDDConf.1.2		
$BW_{channel}$	Config 1,4		10 MHz: $N_{RB,c}$ = 52		
	Config 2,5		10 MHz: $N_{RB,c}$ = 52		
	Config 3,6		40 MHz: $N_{RB,c}$ = 106		
Active BWP ID			0	1, 2	
Initial BWP Configuration	Config 1,4		DLBWP.0.2	NA	
	Config 2,5				
	Config 3,6				
Active BWP-0 Configuration	Config 1,4		DLBWP.0.2	NA	
	Config 2,5				
	Config 3,6				
Active BWP-1 Configuration	Config 1,4		NA	DLBWP.1.1	
	Config 2,5				
	Config 3,6				
Active BWP-2 Configuration	Config 1,4		NA	DLBWP.1.3	
	Config 2,5				
	Config 3,6				
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD		
	Config 2,5		SR.1.1 TDD		
	Config 3,6		SR2.1 TDD		
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD		
	Config 2,5		CR.1.1 TDD		
	Config 3,6		CR2.1 TDD		
Dedicated CORESET parameters, Test 1	Config 1,4		CCR.1.1 FDD		
	Config 2,5		CCR.1.1 TDD		

Parameter		Unit	Cell 2	Cell 3	Cell 4
	Config 3,6		CCR.2.1 TDD		
Dedicated CORESET parameters, Test 2	Config 1,4		CCR.1.5 FDD		
	Config 2,5		CCR.1.5 TDD		
	Config 3,6		CCR.2.3 TDD		
OCNG Patterns			OP.1		
SSB Configuration	Config 1,2,4,5		SSB.1 FR1		
	Config 3,6		SSB.2 FR1		
SMTC Configuration			SMTC.1		
TRS Configuration	Config 1,4		TRS.1.1 FDD		
	Config 2,5		TRS.1.1 TDD		
	Config 3,6		TRS.1.2 TDD		
Antenna Configuration			1x2		
Propagation Condition			AWGN		
EPRE ratio of PSS to SSS		dB	0	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note 2		dBm/15 kHz	-104	-104	
SS-RSRP Note 3		dBm/15 kHz	-87	-87	
$\hat{E}_s/I_{ot}$		dB	17	17	
$\hat{E}_s/N_{oc}$		dB	17	17	
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-59	-58.96	
	Config 3,6	dBm/38.16 MHz	-61.9	-52.86	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

A.4.5.6.5.2.2 Test Requirements

During T1, the UE shall be able to to send the ACK/NACK for all SCells before UE PDCCH indicating entering dormant BWP is received in PSCell's slot # denoted.

During T3, the UE shall start to send the ACK/NACK for all SCells from the first UL slot that occurs after the beginning of DL slot ($j+N$).

Where, N is the timing that UE provide HARQ-ACK information in response to a detection of a DCI format 1_1 indicating SCell dormancy as specified in [3].

All of the above test requirements shall be fulfilled in order for the observed SCell dormant BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start of the interruption of PCell during SCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PCell during SCell active BWP switch shall not happen outside the BWP switch delay.

During T1, the start of the interruption of PSCell during SCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PSCell during SCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in clause 7.32.2.7 of TS 36.133 [15].

The interruption of PSCell shall not be longer than the interruption duration specified for dormant BWP switch in clause 8.6.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first DL slot that occurs after the beginning of DL slot ($i+N$), ($j+N$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.4.5.7 PSCell addition and release delay

A.4.5.7.1 Addition and Release Delay of known NR PSCell

A.4.5.7.1.1 Test purpose and environment

The purpose of this test is to verify that the NR PSCell addition and release delays under EN-DC are within the requirements stated in clause 7.31.2 TS 36.133 [15] for the case when the PSCell is known by the UE at the time of addition.

Supported test configurations are shown in table A.4.5.7.1.1-1. The test parameters for the E-UTRA cell are given in Table A.3.7.2.1-1. The E-UTRA cell once set up is not changed across time.

The test parameters for NR cell are given in Tables A.4.5.7.1.1-2 and cell-specific parameters in table A.4.5.7.1.1-3 below. The test consists of six successive time periods with duration of T1, T2, T3, T4, T5 and T6 respectively. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell1 is known to the UE.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event B1 is configured for neighbour cell (Cell2). Before the start of T2 the UE is configured with the measurement gaps (gap pattern Id # 0). The Cell2 becomes known to the UE during T2. Therefore, during T2 the UE shall report Event B1. The point in time at which the RRC message to release measurement gap is transmitted from the test system defines the start of period T3. During T3, after measurement gap is released, the test system transmits the RRC message to the UE to add PSCell on radio channel 2.

The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added. The point in time at which the RRC message to add PSCell (Cell2) is received at the UE antenna connector defines the start of period T4.

The test system shall observe the periodic reporting of CSI for PSCell during T5. The point in time at which the UE has sent PRACH to the PSCell (Cell 2) defines the start of period T5.

The test system shall send an RRC message to the UE to release PSCell (Cell 2) on radio channel 2. The RRC message to release PSCell (Cell2) shall be sent to the UE during period T5, after the UE has sent at least one CQI report with non-zero CQI index for PSCell (Cell 2). The point in time at which the RRC message to release PSCell (Cell2) is received at the UE antenna connector defines the start of period T6.

Table A.4.5.7.1.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR SCS 15 kHz, BW 10 MHz, FDD
2	LTE FDD, NR SCS 15 kHz, BW 10 MHz, TDD
3	LTE FDD, NR SCS 30 kHz, BW 40 MHz, TDD
4	LTE TDD, NR SCS 15 kHz, BW 10 MHz, FDD
5	LTE TDD, NR SCS 15 kHz, BW 10 MHz, TDD
6	LTE TDD, NR SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.7.1.1-2: General Test Parameters for PSCell Addition and Release

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell
Initial	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell2	Neighbour cell on RF channel number 2.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour Cell		Cell2	PSCell released on RF channel number 2.
B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	Threshold RSRP	dBm	-93	Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin.
	Time to Trigger	S	0	
DRX			OFF	Continuous monitoring of primary cell
Measurement gap pattern Id			0	Gaps are configured before T2 and released before T3.
PRACH configuration on Cell 2			FR1 PRACH configuration 1	Captured in A.3.8.2.1
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on carrier frequency of Cell 2.
T1		s	1	During this time the PCell shall be known and Cell 2 shall be unknown.
T2		s	1.5	During this time the UE shall identify neighbour cell (Cell 2) and report event B1.
T3		s	3	During this time the test system transmits the RRC messages to release measurement gap and add PSCell.
T4		s	0.5	During this time the UE adds the PSCell.
T5		s	0.5	During this time the UE sends CSI reports for PSCell.
T6		s	0.5	During this time the UE releases the PSCell.

Table A.4.5.7.1.1-3: Cell Specific Parameters for PSCell Addition and Release

Parameter	Unit	Config	Test					
			T1	T2	T3	T4	T5	T6
E-UTRA RF Channel Number		1,2,3,4,5,6	1					
NR RF Channel Number		1,2,3,4,5,6	2					
TDD configuration		1,4	Not Applicable					
		2,5	TDDConf.1.1					
		3,6	TDDConf.2.1					
$BW_{channel}$	MHz	1,4	10: $N_{RB,c}$ = 52					
		2,5	10: $N_{RB,c}$ = 52					
		3,6	40: $N_{RB,c}$ = 106					
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1					
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1					
PDSCH Reference measurement channel		1,4	SR.1.1 FDD					
		2,5	SR.1.1 TDD					
		3,6	SR.2.1 TDD					
RMSI CORESET Reference Channel		1,4	CR.1.1 FDD					
		2,5	CR.1.1 TDD					
		3,6	CR.2.1 TDD					
Dedicated CORESET Reference Channel		1,4	CCR.1.1 FDD					
		2,5	CCR.1.1 TDD					
		3,6	CCR.2.1 TDD					
OCNG Patterns		1,2,3,4,5,6	OP.1					
SSB configuration		1,2,4,5	SSB.1 FR1					
		3,6	SSB.2 FR1					
SMTC configuration		1,2,4,5	SMTC.1					
		3,6	SMTC.1					
TRS Configuration		1,4	TRS.1.1 FDD					

Parameter	Unit	Config	Test					
			T1	T2	T3	T4	T5	T6
		2,5	TRS.1.1 TDD					
		3,6	TRS.1.2 TDD					
CSI-RS configuration for CSI reporting		1,4	CSI-RS.1.1 FDD					
		2,5	CSI-RS.1.1 TDD					
		3,6	CSI-RS.2.1 TDD					
reportConfigType		1,2,3,4,5,6	periodic					
reportQuantity		1,2,3,4,5,6	cri-RI-PMI-CQI					
CSI reporting periodicity	slot	1,2,4,5	5					
		3,6	10					
CSI reporting offset	slot	1,2,4,5	2					
		3,6	4					
EPRE ratio of PSS to SSS	dB	1,2,3,4,5,6	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	N/A	-85				
N_{oc} Note2	dBm/SCS	1,2,4,5	N/A	-85				
		3,6	N/A	-82				
$\hat{E}_s/I_{ot}$		1,2,3,4,5,6	-infinity	0				
$\hat{E}_s/N_{oc}$		1,2,3,4,5,6	-infinity	0				
SS-RSRP Note3	dBm/SCS	1,2,4,5	-infinity	-85				
		3,6	-infinity	-82				
Io Note3	dBm/9.36 MHz	1,2,4,5	N/A	-54.04				
	dBm/38.1 MHz	3,6	N/A	-47.94				
Propagation condition		1,2,3,4,5,6	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.4.5.7.1.2 Test Requirements

The UE shall transmit the PRACH to PSCell no later than 82 ms Note1 from the start of T4.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T5.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T5

The UE shall stop sending CSI reports for PSCell no later than 20 ms from the start of T6.

All the above test requirements shall be fulfilled in order for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90%.

Note1: The PSCell addition delay can be expressed as follows as specified in clause 7.31.2 TS 36.133 [15]:

$$T_{config_PSCell} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell_DU} + 2 \text{ ms}$$

Where:

T_{RRC_delay} = 20 ms

$T_{processing}$ = 20 ms

T_{search} = 0

T_{Δ} = 20 ms

T_{PSCell_DU} = 1*10+10 = 20 ms

A.4.5.8 DL Interruptions at switching between two uplink carriers

A.4.5.8.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink carriers defined in clause 8.2.1.2.14. The test case is applicable for an uplink band pair of an inter-band EN-DC configuration when the capability *uplinkTxSwitchingPeriod* is present.

There are two cells: E-UTRAN FDD PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters for PSCell are given in Table A.4.5.8.1-1, Table A.4.5.8.1-2 and Table A.4.5.8.1-3 below.

Aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6 dB on following symbol on the 1 s^{t} special slot of every radio frame on NR TDD carrier (Cell 2):

symbol#10 if UE does not report uplinkTxSwitching-DL-Interruption-r16;

otherwise,

symbol#5 if UE capability *uplinkTxSwitchingPeriod* is 140 us or

symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 35 us.

The test parameters and applicability for E-UTRAN FDD PCell are defined in clause A.3.7.2. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitching* is indicated to UE. This test verifies that the UE correctly report the L1-RSRP reporting.

Table A.4.5.8.1-1: Supported test configurations

Configuration	PSCell (Cell2)
1	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A. 4.5.8.1-2: General test parameters for DL Interruptions at switching between two uplink carriers in EN-DC

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2	Two radio channels are used for the test.
Active cell		Config 1	Cell 1: E-UTRAN FDD PCell Cell 2: FR1 PSCell	E-UTRAN FDD PCell on RF channel number 1 FR1 PSCell on RF channel number 2
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	

Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A. 4.5.8.1-3: NR Cell specific test parameters for DL Interruptions at switching between two uplink carriers in EN-DC (Cell 2)

Parameter		Unit	Cell2
Frequency Range			FR1
Duplex mode	Config 1		TDD
TDD configuration	Config 1		TDDConf.2.1 except that: S='11DL:1GP:2UL'; *nrofDownlinkSymbols:11 nrofUplinkSymbols: 2*
$BW_{channel}$	Config 1		40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL dedicated BWP configuration			ULBWP.1.1
SRS configuration			SRSConf.4 in Table A.4.5.8.1-4
PDSCH Reference measurement channel	Config 1		SR.2.1 TDD
RMSI CORESET parameters	Confiq 1		CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.2.1 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
SSB Configuration	Config 1		SSB.2 FR1
Correlation Matrix and Antenna Configuration			2x2 low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
powerControlOffsetSS		dB	6
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/SSB SCS	-87
CSI-RS RSRP Note6		dBm/SCS	-81
$\hat{E}_s/I_{ot}$		dB	14
$\hat{E}_s/N_{oc}$		dB	14
N_{oc} Note 2	Config 1	dBm/SCS	-101
Io Note3 on symbols without CSI-RS	Config 1	dBm/ 38.16MHz	-55.78
Io Note6 on symbols with CSI-RS	Config 1	dBm/ 38.16MHz	-53.43
Time offset to Cell1 Note 5		µs	0
Propagation Condition			AWGN

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	Void
Note 5:	Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.
Note 6:	CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.4.5.8.1-4: SRS Configuration for DL Interruptions at switching between two uplink carriers

	Field	SRSConf.4	Comments
SRS-*ResourceSet*	*srs-ResourceSetId*	0	
	srs-ResourceIdList	0	
	resourceType	Periodic	
	Usage	Codebook	
SRS-Resource	*SRS-ResourceId*	0	
	nrofSRS-Ports	Port2	
	transmissionComb	n2	
	combOffset-n2	0	
	cyclicShift-n2	0	
	resourceMapping startPosition	1	
	resourceMapping nrofSymbols	n2	
	resourceMapping repetitionFactor	n1	
	freqDomainPosition	0	
	freqDomainShift	0	
	freqHopping c-SRS	0	Matches $N_{RB,c}$
	freqHopping b-SRS	0	
	freqHopping b-hop	0	
	groupOrSequenceHopping	Neither	
	resourceType	Periodic	
	periodicityAndOffset-p	sl20, 3	
	sequenceId	0	

A.4.5.8.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.1.2.14.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.9 UE specific CBW change

A.4.5.9.1 UE specific CBW change on FR1 NR PSCell with non-DRX in synchronous EN- DC

A.4.5.9.1.1 Test Purpose and Environment

The purpose of this test is to verify the UE specific CBW change delay requirement defined in clause 8.13.1. Supported test configurations are shown in table A.4.5.9.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1) and one NR PSCell (Cell 2) as given in table A.4.5.9.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell are specified in table A.4.5.9.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PSCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PSCell.
- UE is indicated in *SCS-SpecificCarrier* that the active CBW is CBW-1 of initial condition in PSCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when the *RRCReconfiguration* with updated CBW configuration, sent from the test equipment to the UE, is completely received at the UE side in PSCell's slot # denoted *i*. The UE shall reconfigure its CBW with the updated CBW of final condition (CBW-2).

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$) as defined in clause 8.13.1 and be ready for the reception of uplink grant for the PSCell no later than at the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$). The UE shall be continuously scheduled on PSCell's BWP-1 of CBW-2 starting from the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$).

$T_{RRCprocessingDelay}$ and $T_{CBWchangeDelayRRC}$ are defined in clause 8.13.1.

The test equipment verifies the UE specific CBW change time in PSCell by counting the time from the time when the RRC Reconfiguration message including updated CBW configurationis sent till the time when RRC Reconfiguration Complete message is received.

Table A.4.5.9.1.1-1: UE specific CBW change supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.9.1.1-2: General test parameters for UE specific CBW change in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.

Cell2 timing offset to Cell 1	µs	3	Synchronous EN-DC
T1	s	0.2	

A.4.5.9.1.1-3: NR Cell specific test parameters for UE specific CBW change in synchronous EN-DC

Parameter			Unit	Cell 2
Frequency Range				**FR1**
Duplex mode		Config 1,4		FDD
		Config 2,3,5,6		TDD
TDD configuration		Config 1,4		Not Applicable
		Config 2,5		TDDConf.1.1
		Config 3,6		TDDConf.1.2
$BW_{channel}$		Config 1,4		10 MHz: $N_{RB,c}$ = 52
		Config 2,5		10 MHz: $N_{RB,c}$ = 52
		Config 3,6		40 MHz: $N_{RB,c}$ = 106
Active DL BWP ID				0
Initial DL BWP Configuration (BWP-1) before and after UE specific CBW change		Config 1,4		DLBWP.0.2
		Config 2,5		
		Config 3,6		
Initial UL BWP (BWP-1) Configuration before and after UE specific CBW change		Config 1,4		ULBWP.0.2
		Config 2,5		
		Config 3,6		
Initial Condition	Active DL CBW Configuration (CBW-1)	Config 1,4		DLCBW.1.1
		Config 2,5		
		Config 3,6		
	Active UL CBW Configuration (CBW-1)	Config 1,4		ULCBW.1.1
		Config 2,5		
		Config 3,6		
Final Condition	Active DL CBW Configuration (CBW-2)	Config 1,4		DLCBW.1.2
		Config 2,5		
		Config 3,6		
	Active UL CBW Configuration (CBW-2)	Config 1,4		ULCBW.1.2
		Config 2,5		
		Config 3,6		
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD
		Config 2,5		SR.1.1 TDD
		Config 3,6		SR2.1 TDD
RMSI CORESET parameters		Config 1,4		CR.1.1 FDD
		Config 2,5		CR.1.1 TDD
		Config 3,6		CR2.1 TDD
Dedicated CORESET parameters		Config 1,4		CCR.1.1 FDD
		Config 2,5		CCR.1.1 TDD
		Config 3,6		CCR.2.1 TDD
OCNG Patterns				OP.1
SSB Configuration		Config 1,2,4,5		SSB.1 FR1
		Config 3,6		SSB.2 FR1
SMTC Configuration				SMTC.1
TRS Configuration		Config 1,4		TRS.1.1 FDD
		Config 2,5		TRS.1.1 TDD
		Config 3,6		TRS.1.2 TDD
Antenna Configuration				1x2 low
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				

Parameter		Unit	Cell 2
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-58.96
	Config 3,6	dBm/38.16 MHz	-52.86
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

A.4.5.9.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PSCell in the beginning of the DL slot right after slot ($i+ \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$).

All of the above test requirements shall be fulfilled in order for the observed PSCell UE specific CBW change delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.10 PSCell activation and deactivation delay

A.4.5.10.1 PSCell activation and deactivation delay

A.4.5.10.1.1 Test purpose and environment

The purpose of this test is to verify that the NR PSCell activation and deactivation delay under EN-DC are within the requirements stated in clause 7.38 in TS 36.133 [15] for the case when UE configured with one deactivated SCG and when PScell in one SCG is being activated where the PSCell is known by the UE at the time of activation.

Supported test configurations are shown in table A.4.5.10.1.1-1. The test parameters for the E-UTRA cell are given in Table A.3.7.2.2-1. The E-UTRA cell once set up is not changed across time.

The test parameters for NR cell are given in Tables A.4.5.10.1.1-2, cell-specific parameters in table A.4.5.10.1.1-3 below. The test consists of four successive time periods with duration of T1, T2, T3 and T4. There are two carriers each with one cell. The UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) and PSCell (Cell2) is in deactivated state. During T1, both Cell1 and Cell2 are known to UE and UE performs measurement on deactivated PCell. Before the test starts the UE is configured RLM and BFD on deactivated PSCell. During T1, UE performs RLM and BFD on the deactivated PSCell and TCI state is known.

The test system shall send a RRC message to the UE to activate PSCell (Cell 2) on radio channel 2, where no any PSCell parameter is modified in the RRC message. The RRC message (to activate PSCell) also includes a request for the UE to transmit scheduling request on PUCCH for the PSCell after the PSCell has been successfully activated. The RRC message to activate PSCell shall be sent to the UE during period T1. The point in time at which the RRC message to activate PSCell (Cell2) is received at the UE antenna connector defines the start of period T2.

The test system shall observe the periodic reporting of CSI for PSCell during T3. The point in time at which the UE has sent scheduling request on PUCCH for PSCell (Cell 2) defines the start of period T3.

The test system shall send a RRC message to the UE to deactivate PSCell (Cell 2) on radio channel 2. The RRC message to deactivate PSCell (Cell2) shall be sent to the UE during period T3, after the UE has sent at least one CQI report with non-zero CQI index for PSCell (Cell 2). The point in time at which the RRC message to deactivate PSCell (Cell2) is received at the UE antenna connector defines the start of period T4.

Table A.4.5.10.1.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR SCS 15 kHz, BW 10 MHz, FDD
2	LTE FDD, NR SCS 15 kHz, BW 10 MHz, TDD
3	LTE FDD, NR SCS 30 kHz, BW 40 MHz, TDD
4	LTE TDD, NR SCS 15 kHz, BW 10 MHz, FDD
5	LTE TDD, NR SCS 15 kHz, BW 10 MHz, TDD
6	LTE TDD, NR SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.10.1.1-2: General Test Parameters for PSCell activation and deactivation

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell
Initial Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Deactivated cell		Cell2	To be activated PSCell on RF channel number 2.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Deactivated cell		Cell2	PSCell deactivated on RF channel number 2.
DRX			OFF	Continuous monitoring of primary cell
Scheduling request resource periodicity			20 ms	At the starting of period T3, UE sends a SR on PUCCH for PSCell
T1		s	1	During this time the PCell shall be known and Cell 2 shall be unknown.
T2		s	1	During this time the UE adds the PSCell.
T3		s	1	During this time the UE sends CSI reports for PSCell.
T4		s	1	During this time the UE releases the PSCell.

Table A.4.5.10.1.1-3: Cell Specific Parameters for PSCell activation and deactivation

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
E-UTRA RF Channel Number		1,2,3,4,5,6	1			
NR RF Channel Number		1,2,3,4,5,6	2			
TDD configuration		1,4	Not Applicable			
		2,5	TDDConf.1.1			
		3,6	TDDConf.2.1			
$BW_{channel}$	MHz	1,4	10: $N_{RB,c}$ = 52			
		2,5	10: $N_{RB,c}$ = 52			
		3,6	40: $N_{RB,c}$ = 106			
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1			
PDSCH Reference measurement channel		1,4	SR.1.1 FDD			
		2,5	SR.1.1 TDD			
		3,6	SR.2.1 TDD			
RMSI CORESET Reference Channel		1,4	CR.1.1 FDD			
		2,5	CR.1.1 TDD			
		3,6	CR.2.1 TDD			
Dedicated CORESET Reference Channel		1,4	CCR.1.1 FDD			
		2,5	CCR.1.1 TDD			
		3,6	CCR.2.1 TDD			
OCNG Patterns		1,2,3,4,5,6	OP.1			
SSB configuration		1,2,4,5	SSB.1 FR1			
		3,6	SSB.2 FR1			
SMTC configuration		1,2,4,5	SMTC.1			
		3,6	SMTC.1			
TRS Configuration		1,4	TRS.1.1 FDD			
		2,5	TRS.1.1 TDD			
		3,6	TRS.1.2 TDD			
		1,4	CSI-RS.1.1 FDD			

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
CSI-RS configuration for CSI reporting		2,5	CSI-RS.1.1 TDD			
		3,6	CSI-RS.2.1 TDD			
reportConfigType		1,2,3,4,5,6	periodic			
reportQuantity		1,2,3,4,5,6	cri-RI-PMI-CQI			
CSI reporting periodicity	slot	1,2,4,5	5			
		3,6	10			
CSI reporting offset	slot	1,2,4,5	2			
		3,6	4			
EPRE ratio of PSS to SSS	dB	1,2,3,4,5,6	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	N/A	-85		
N_{oc} Note2	dBm/SCS	1,2,4,5	N/A	-85		
		3,6	N/A	-82		
$\hat{E}_s / I_{ot}$		1,2,3,4,5,6	-infinity	0		
$\hat{E}_s / N_{oc}$		1,2,3,4,5,6	-infinity	0		
SS-RSRP Note3	dBm/SCS	1,2,4,5	-infinity	-85		
		3,6	-infinity	-82		
Io Note3	dBm/9.36 MHz	1,2,4,5	N/A	-54.04		
	dBm/38.1 MHz	3,6	N/A	-47.94		
Propagation condition		1,2,3,4,5,6	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.4.5.10.1.2 Test Requirements

The UE performs RACH-less based PSCell activation. UE shall transmit the SR on PUCCH for PSCell at latest 67 ms Note1 into T2.

The UE shall send at least one PUSCH on PSCell during T3.

The UE shall stop transmit PUSCH for PSCell in at latest 20 ms into T4.

All the above test requirements shall be fulfilled for the observed PSCell activation delay and PSCell deactivation delay to be counted as correct. The rate of correct observed PSCell activation delay and PSCell deactivation delay during repeated tests shall be at least 90%.

Note1: The PSCell activation delay can be expressed as follows as specified in clause 7.38 in TS 36.133 [15]:

$T_{activation_time} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{IU} + 2$ ms

Where:

$T_{RRC_delay} = 20$ ms

$T_{processing} = 5$ ms

$T_{search} = 0$ ms

$T_{\Delta} = 20$ ms

T_{IU}= max 20 ms

A.4.5.11 Conditional PSCell addition and release delay (FR1 EN-DC)

A.4.5.11.1 Conditional PSCell Addition and Release Delay

A.4.5.11.1.1 Test purpose and environment

The purpose of this test is to verify that the NR conditional PSCell addition and release delay under EN-DC is within the requirements stated in clause 8.9A.2.

A.4.5.11.1.2 Test Parameters

Supported test configurations are shown in table A.4.5.11.1.2-1. The test parameters for the E-UTRA cell are given in Table A.4.5.11.1.2-2. The E-UTRA cell once set up is not changed across time.

The test parameters for NR cell are given in Tables A.4.5.11.1.2-2 and cell-specific parameters in table A.4.5.11.1.2-3 below. The test consists of four successive time periods with duration of T1, T2, T3 and T4 respectively. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell1 is known to the UE.

At the start of time duration T1, the UE does not have any timing information of Cell 2. The network shall configure a condition and the target PSCell configuration implying addition to cell 2 during T1, at a time earlier than T_{RRC_delay} before the beginning of T2.

At the start of T2, cell 2 becomes detectable and meets the addition condition. UE shall be able to measure and detect that the condition is fulfilled during time Tmeasure. After which it will transmit the PRACH preamble. Reception by the test system of the PRACH preamble defines the start of T3.

During T3, the UE shall send periodic CSI reports in PSCell. After having received at least one such report, the test system shall send an RRC message instructing the UE to release the PSCell. Reception by the UE of the RRC message defines the start of T4.

During T4, the UE shall release the PSCell.

Table A.4.5.11.1.2-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR SCS 15 kHz, BW 10 MHz, FDD
2	LTE FDD, NR SCS 15 kHz, BW 10 MHz, TDD
3	LTE FDD, NR SCS 30 kHz, BW 40 MHz, TDD
4	LTE TDD, NR SCS 15 kHz, BW 10 MHz, FDD
5	LTE TDD, NR SCS 15 kHz, BW 10 MHz, TDD
6	LTE TDD, NR SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.11.1.2-2: General Test Parameters for Conditional PSCell Addition and Release

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell

Initial	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell2	Neighbour cell on RF channel number 2.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour Cell		Cell2	PSCell released on RF channel number 2.
B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	Threshold RSRP	dBm	-93	Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin.
	Time to Trigger	s	0	
DRX			OFF	Continuous monitoring of primary cell
Measurement gap pattern Id			0	Gaps are configured before T2 and released before T3.
PRACH configuration on Cell 2			FR1 PRACH configuration 1	Captured in A.3.8.2.1
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on carrier frequency of Cell 2.
T1		s	5	During this time the PCell is known and Cell 2 is unknown.
T2		s	≤7	During this time Cell 2 meets the addition condition and UE adds this PSCell.
T3		s	1	During this time the UE sends CSI reports for Cell 2. And the test system shall send an RRC message instructing the UE to release the PSCell.
T4		s	1	During this time the UE releases the Cell 2.

Table A.4.5.11.1.2-3: Cell Specific Parameters for Conditional PSCell Addition and Release

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
E-UTRA RF Channel Number		1,2,3,4,5,6	1			
NR RF Channel Number		1,2,3,4,5,6	2			
TDD configuration		1,4	Not Applicable			
		2,5	TDDConf.1.1			
		3,6	TDDConf.2.1			
$BW_{channel}$	MHz	1,4	10: $N_{RB,c}$ = 52			
		2,5	10: $N_{RB,c}$ = 52			
		3,6	40: $N_{RB,c}$ = 106			
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1			
PDSCH Reference measurement channel		1,4	SR.1.1 FDD			
		2,5	SR.1.1 TDD			
		3,6	SR.2.1 TDD			
RMSI CORESET Reference Channel		1,4	CR.1.1 FDD			
		2,5	CR.1.1 TDD			
		3,6	CR.2.1 TDD			
Dedicated CORESET Reference Channel		1,4	CCR.1.1 FDD			
		2,5	CCR.1.1 TDD			
		3,6	CCR.2.1 TDD			
OCNG Patterns		1,2,3,4,5,6	OP.1			
SSB configuration		1,2,4,5	SSB.1 FR1			
		3,6	SSB.2 FR1			
SMTC configuration		1,2,4,5	SMTC.1			
		3,6	SMTC.1			
TRS Configuration		1,4	TRS.1.1 FDD			
		2,5	TRS.1.1 TDD			
		3,6	TRS.1.2 TDD			
CSI-RS configuration for CSI reporting		1,4	CSI-RS.1.1 FDD			
		2,5	CSI-RS.1.1 TDD			
		3,6	CSI-RS.2.1 TDD			
reportConfigType		1,2,3,4,5,6	periodic			

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
reportQuantity		1,2,3,4,5,6	cri-RI-PMI-CQI			
CSI reporting periodicity	slot	1,2,4,5	5			
		3,6	10			
CSI reporting offset	slot	1,2,4,5	2			
		3,6	4			
EPRE ratio of PSS to SSS	dB	1,2,3,4,5,6	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	N/A	-85		
N_{oc} Note2	dBm/SCS	1,2,4,5	N/A	-85		
		3,6	N/A	-82		
$\hat{E}_s / I_{ot}$		1,2,3,4,5,6	-infinity	0		
$\hat{E}_s / N_{oc}$		1,2,3,4,5,6	-infinity	0		
SS-RSRP Note3	dBm/SCS	1,2,4,5	-infinity	-85		
		3,6	-infinity	-82		
Io Note3	dBm/9.36 MHz	1,2,4,5	N/A	-54.04		
	dBm/38.1 MHz	3,6	N/A	-47.94		
Propagation condition		1,2,3,4,5,6	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.4.5.11.1.3 Test Requirements

T_{RRC_delay} + T_{Event_DU} occurs during T1 as the addition condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure}$ + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ} + T_{PSCell_DU} + 2 ms = 1040 ms+10 ms +62ms=1112 ms from the start of T2.

The UE shall transmit at least one periodic CSI report for PSCell during T3.

The UE shall stop transmitting CSI reports for PSCell at latest 20 ms into T4.

All of the above test requirements shall be fulfilled in order for the observed conditional PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.6 Measurement procedure

A.4.6.1 Intra-frequency Measurements

A.4.6.1.1 EN-DC event triggered reporting tests without gap under non-DRX

A.4.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.4.6.1.1.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.1.2-1, A.4.6.1.1.2-2, A.4.6.1.1.2-3 below and the test parameters and applicability for the E-UTRAN cell are defined in clause A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

Table A.4.6.1.1.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.1.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4, 5, 6	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3, 4, 5, 6	1: Cell 1 2: Cell 2 and Cell 3	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC.2	
		2, 5	SMTC.1	
		3, 6	SMTC.1	
A3-Offset	dB	1, 2, 3, 4, 5, 6	-4.5	
CP length		1, 2, 3, 4, 5, 6	Normal	
Hysteresis	dB	1, 2, 3, 4, 5, 6	0	
Time To Trigger	s	1, 2, 3, 4, 5, 6	0	
Filter coefficient		1, 2, 3, 4, 5, 6	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	N/A	OFF
Time offset between PCell and PSCell		1, 2, 3, 4, 5, 6	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		2, 5	3 μs	Synchronous cells
		3, 6	3 μs	Synchronous cells
T1	s	1, 2, 3, 4, 5, 6	5	
T2	s	1, 2, 3, 4, 5, 6	5	

Table A.4.6.1.1.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2, 5	TDDConf.1.1		TDDConf.1.1	
		3, 6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2, 5	SR.1.1 TDD			
		3, 6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2, 5	CR.1.1 TDD		N/A	
		3, 6	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2, 5	CCR.1.1 TDD		N/A	
		3, 6	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2, 5	TRS.1.1 TDD		N/A	
		3, 6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2, 5	-98			
		3, 6	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2, 5				
		3, 6				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2, 5				
		3, 6				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2, 5				
		3, 6				
SS-RSRP Note 3	dBm/SCS	1, 4	-94	-94	-Infinity	-94
		2, 5	-94	-94	-Infinity	-94
		3, 6	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2, 5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3, 6	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.2 EN-DC event triggered reporting tests without gap under DRX

A.4.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.4.6.1.2.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.2.2-1, A.4.6.1.2.2-2, and A.4.6.1.2.2-3 below and the test parameters and applicability for the E-UTRAN cell are defined in clause A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

UE needs to be provided 500 ms with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.4.6.1.2.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.2.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2, 3, 4, 5, 6	E-UTRAN Cell 1 and NR Cell 2		
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 3		Cell to be identified.
RF Channel Number		1, 2, 3, 4, 5, 6	1: Cell 1 2: Cell 2 and Cell 3		
SSB configuration		1, 4	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.2 FR1		
SMTC configuration		1, 4	SMTC.2		
		2, 5	SMTC.1		
		3, 6	SMTC.1		
A3-Offset	dB	1, 2, 3, 4, 5, 6	-4.5		
CP length		1, 2, 3, 4, 5, 6	Normal		
Hysteresis	dB	1, 2, 3, 4, 5, 6	0		

Time To Trigger	s	1, 2, 3, 4, 5, 6	0		
Filter coefficient		1, 2, 3, 4, 5, 6	0		L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.1	DRX. 7	
Time offset between PCell and PSCell		1, 2, 3, 4, 5, 6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		1, 4	3 ms		Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		2, 5	3 μs		Synchronous cells
		3, 6	3 μs		Synchronous cells
T1	s	1, 2, 3, 4, 5, 6	5		
T2	s	1, 2, 3, 4, 5, 6	5	10	

Table A.4.6.1.2.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2, 5	TDDConf.1.1		TDDConf.1.1	
		3, 6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2, 5	SR.1.1 TDD			
		3, 6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2, 5	CR.1.1 TDD		N/A	
		3, 6	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2, 5	CCR.1.1 TDD		N/A	
		3, 6	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2, 5	TRS.1.1 TDD		N/A	
		3, 6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2, 5	-98			
		3, 6	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2, 5				
		3, 6				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2, 5				
		3, 6				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2, 5				
		3, 6				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2, 5	-94	-94	-Infinity	-94
		3, 6	-91	-91	-Infinity	-91

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2, 5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.1.2.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 6400 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.3 EN-DC event triggered reporting tests with per-UE gaps under non-DRX

A.4.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.4.6.1.3.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell.The test parameters for PSCell are given in Table A.4.6.1.3.2-1 and A.4.6.1.3.2-2 below and the test parameters and applicability for the E-UTRAN cell are defined in clause A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.4.6.1.3.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.3.2-2: General test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4, 5, 6	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3, 4, 5, 6	1: Cell 1 2: Cell 2 and Cell 3	
Measurement gap type		1, 2, 3, 4, 5, 6	Per-UE gaps	
Measurement gap repitition periodicity	ms	1, 2, 3, 4, 5, 6	40	
Measurement gap length	ms	1, 2, 3, 4, 5, 6	6	
Measurement gap offset	ms	1, 2, 3, 4, 5, 6	39	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC.2	
		2, 5	SMTC.1	
		3, 6	SMTC.1	
CSI-RS parameters		1, 4	CSI-RS.1.2 FDD resource #0	
		2, 5	CSI-RS.1.2 TDD resource #0	
		3, 6	CSI-RS.2.2 TDD resource #0	
A3-Offset	dB	1, 2, 3, 4, 5, 6	-4.5	
CP length		1, 2, 3, 4, 5, 6	Normal	
Hysteresis	dB	1, 2, 3, 4, 5, 6	0	
Time To Trigger	s	1, 2, 3, 4, 5, 6	0	
Filter coefficient		1, 2, 3, 4, 5, 6	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	N/A	OFF
Time offset between PCell and PSCell		1, 2, 3, 4, 5, 6	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		2, 5	3 μs	Synchronous cells
		3, 6	3 μs	Synchronous cells
T1	s	1, 2, 3, 4, 5, 6	5	
T2	s	1, 2, 3, 4, 5, 6	5	

Table A.4.6.1.3.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2, 5	TDDConf.1.1		TDDConf.1.1	
		3, 6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2, 5	SR.1.1 TDD			
		3, 6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2, 5	CR.1.1 TDD		N/A	
		3, 6	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.2 FDD		N/A	
		2, 5	CCR.1.2 TDD		N/A	
		3, 6	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2, 5	TRS.1.1 TDD		N/A	
		3, 6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
Active DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2, 3, 4, 5, 6	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2, 5	-98			
		3, 6	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2, 5				
		3, 6				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2, 5				
		3, 6				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2, 5				
		3, 6				
SS-RSRP Note 3	dBm/SCS	1, 4	-94	-94	-Infinity	-94
		2, 5	-94	-94	-Infinity	-94
		3, 6	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2, 5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3, 6	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.1.3.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.4 EN-DC event triggered reporting tests with per-UE gaps under DRX

A.4.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.4.6.1.4.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.4.2-1, A.4.6.1.4.2-2, and A.4.6.1.4.2-3 below and the test parameters and applicability for the E-UTRAN cell are defined in clause A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two

successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

UE needs to be provided with new Timing Advance Command MAC control at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.4.6.1.4.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.4.2-2: General test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1 with DRX

Parameter	Unit	Test	Value		Comment
		configuration	Test 1	Test 2	
Active cell		1, 2, 3, 4, 5, 6	E-UTRAN Cell 1 and NR Cell 2		
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 3		Cell to be identified.
RF Channel Number		1, 2, 3, 4, 5, 6	1: Cell 1 2: Cell 2 and Cell 3		
Measurement gap type		1, 2, 3, 4, 5, 6	Per-UE gaps		
Measurement gap repitition periodicity	ms	1, 2, 3, 4, 5, 6	40		
Measurement gap length	ms	1, 2, 3, 4, 5, 6	6		
Measurement gap offset	ms	1, 2, 3, 4, 5, 6	39		
SSB configuration		1, 4	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.2 FR1		
SMTC configuration		1, 4	SMTC.2		
		2, 5	SMTC.1		
		3, 6	SMTC.1		
CSI-RS parameters		1, 4	CSI-RS.1.2 FDD resource #0		
		2, 5	CSI-RS.1.2 TDD resource #0		
		3, 6	CSI-RS.2.2 TDD resource #0		
A3-Offset	dB	1, 2, 3, 4, 5, 6	-4.5		
CP length		1, 2, 3, 4, 5, 6	Normal		
Hysteresis	dB	1, 2, 3, 4, 5, 6	0		
Time To Trigger	s	1, 2, 3, 4, 5, 6	0		
Filter coefficient		1, 2, 3, 4, 5, 6	0		L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.1	DRX. 7	
Time offset between PCell and PSCell		1, 2, 3, 4, 5, 6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		1, 4	3 ms		Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		2, 5	3 μs		Synchronous cells
		3, 6	3 μs		Synchronous cells
T1	s	1, 2, 3, 4, 5, 6	5		
T2	s	1, 2, 3, 4, 5, 6	5	10	

Table A.4.6.1.4.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2, 5	TDDConf.1.1		TDDConf.1.1	
		3, 6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2, 5	SR.1.1 TDD			
		3, 6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2, 5	CR.1.1 TDD		N/A	
		3, 6	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.2 FDD		N/A	
		2, 5	CCR.1.2 TDD		N/A	
		3, 6	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2, 5	TRS.1.1 TDD		N/A	
		3, 6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2, 3, 4, 5, 6	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2, 5	-98			
		3, 6	-95			
N_{oc} Note 2	dBm/15 KHz	1, 4	-98			
		2, 5				
		3, 6				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2, 5				
		3, 6				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2, 5				
		3, 6				
SS-RSRP Note 3	dBm/SCS KHz	1, 4	-94	-94	-Infinity	-94
		2, 5	-94	-94	-Infinity	-94
		3, 6	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2, 5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3, 6	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.1.4.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 6400 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.5 EN-DC event triggered reporting tests without gap under non-DRX with SSB index reading

A.4.6.1.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.4.6.1.5.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell.The test parameters for FDD PSCell are given in Table A.4.6.1.5.2-2 and A.4.6.1.5.2-3 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

Table A.4.6.1.5.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.5.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for FDD PSCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 2: Cell 2 and Cell 3	
SSB configuration		1, 2	SSB.1 FR1	
SMTC configuration		1, 2	SMTC.2	
A3-Offset	dB	1, 2	-4.5	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	N/A	OFF
Time offset between PCell and PSCell		1, 2	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		1, 2	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.4.6.1.5.1-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for FDD PSCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 2	N/A		N/A	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.1.5.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.6 EN-DC event triggered reporting tests with SSB index reading with per-UE gaps

A.4.6.1.6.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.4.6.1.6.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.6.2-1 A.4.6.1.6.2-2 and A.4.6.1.6.2-3 below and the test parameters and applicability for the E-UTRAN cell are defined in clause A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two

successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.4.6.1.6.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.6.2-2: General test parameters for EN-DC intra-frequency event triggered reporting with gap for PSCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 2: Cell 2 and Cell 3	
Measurement gap type		1, 2	Per-UE gaps	
Measurement gap repitition periodicity	ms	1, 2	40	
Measurement gap length	ms	1, 2	6	
Measurement gap offset	ms	1, 2	39	
SSB configuration		1, 2	SSB.1 FR1	
SMTC configuration		1, 2	SMTC.2	
CSI-RS parameters		1, 2	CSI-RS.1.2 FDD resource #0	
A3-Offset	dB	1, 2	-4.5	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	N/A	OFF
Time offset between PCell and PSCell		1, 2	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		1, 2	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.4.6.1.6.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting with gap for PSCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 2	N/A		N/A	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.2 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.1.6.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.7 EN-DC event triggered reporting tests under DRX for UE configured with highSpeedMeasFlag-r16

A.4.6.1.7.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event for UE configured with highSpeedMeasFlag-r16. This test will partly verify the intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.4.6.1.7.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.7.2-1, A.4.6.1.7.2-2, and A.4.6.1.7.2-3 below and the test parameters and applicability for the E-UTRAN cell are defined in clause A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.4.6.1.7.2-1: Supported test configurations

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.7.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Test configuration	Value	Comment
highSpeedMeasFlag-r16		1,2,3,4,5,6	Present	To enable high speed measurement enhancements
Active cell		1, 2, 3,4,5,6	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2, 3,4,5,6	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3,4,5,6	1: Cell 1 2: Cell 2 and Cell 3	
SSB configuration		1,4	SSB.1 FR1	
		2,5	SSB.1 FR1	
		3,6	SSB.2 FR1	
SMTC configuration		1,4	SMTC.2	
		2,5	SMTC.1	
		3,6	SMTC.1	
A3-Offset	dB	1, 2, 3,4,5,6	-4.5	
CP length		1, 2, 3,4,5,6	Normal	
Hysteresis	dB	1, 2, 3,4,5,6	0	
Time To Trigger	s	1, 2, 3,4,5,6	0	
Filter coefficient		1, 2, 3,4,5,6	0	L3 filtering is not used
DRX		1, 2, 3,4,5,6	DRX. 7.	640 ms DRX cycle
Time offset between PCell and PSCell		1, 2, 3,4,5,6	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		1,4	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		2,5	3 μs	Synchronous cells
		3,6	3 μs	Synchronous cells
T1	s	1, 2, 3,4,5,6	5	
T2	s	1, 2, 3,4,5,6	6	

Table A.4.6.1.7.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1,4	N/A		N/A	
		2,5	TDDConf.1.1		TDDConf.1.1	
		3,6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1,4	SR.1.1 FDD		N/A	
		2,5	SR.1.1 TDD			
		3,6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1,4	CR.1.1 FDD		CR.1.1 FDD	
		2,5	CR.1.1 TDD		CR.1.1 TDD	
		3,6	CR.2.1 TDD		CR.2.1 TDD	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
Dedicated CORESET RMC configuration		1,4	CCR.1.1 FDD		CCR.1.1 FDD	
		2,5	CCR.1.1 TDD		CCR.1.1 TDD	
		3,6	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3,4,5,6	OP.1		OP.1	
TRS configuration		1,4	TRS.1.1 FDD		N/A	
		2,5	TRS.1.1 TDD		N/A	
		3,6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3,4,5,6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3,4,5,6	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3,4,5,6	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3,4,5,6	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1,4	-98			
		2,5	-98			
		3,6	-95			
N_{oc} Note 2	dBm/15 kHz	1,4	-98			
		2,5				
		3,6				
$\hat{E}_s/I_{ot}$	dB	1,4	4	-1.46	-Infinity	-1.46
		2,5				
		3,6				
$\hat{E}_s/N_{oc}$	dB	1,4	4	4	-Infinity	4
		2,5				
		3,6				
SS-RSRP Note 3	dBm/SCS kHz	1,4	-94	-94	-Infinity	-94
		2,5	-94	-94	-Infinity	-94
		3,6	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1,4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2,5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3,6	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2,4,5	AWGN		AWGN 1944 Hz Note 4	
		3,6	AWGN		AWGN 3334 Hz Note 5	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.
NOTE 5: The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334 Hz.

A.4.6.1.7.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 5120 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.8 EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is used for UE configured with *highSpeedMeasCA-Scell-r17*

A.4.6.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC intra-frequency NR measurement requirements in clause 9.2.5.

In this test, there are four cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1, NR cell 3 as deactivated SCell in FR1 on NR RF channel 2, and NR cell 4 as neighbour cell on the same frequency as cell 3. The test parameters and configurations are given in Tables A.4.6.1.8.1-1, A.4.6.1.8.1-1A, A.4.6.1.8.1-2, and A.4.6.1.8.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A6 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.1.8.1-1.

Table A.4.6.1.8.1-1: Supported PCell and PSCell configurations in EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is used for UE configured with *highSpeedMeasCA-Scell-r17*

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one of the supported test configurations with the smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration	

Table 4.6.1.8. 1-1A: Supported SCell test configurations in EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is used for UE configured with *highSpeedMeasCA-Scell-r17*

$Config_{SCell}$	Description
1A	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2A	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3A	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: The UE is only required to be tested in one of the supported test configurations with the smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration. NOTE 3: NR Cell 4 has the same SCS, BW and duplex mode as NR Cell 3.	

Table A.4.6.1.8.1-2: General test parameters for EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is used for UE configured with *highSpeedMeasCA-Scell-r17*

Parameter	Unit	Test configuration	Value	Comment
highSpeedMeasCA-Scell-r17		Config 1,2,3,4,5,6	Present	To enable high speed measurement enhancements
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1	One E-UTRAN carrier frequencies is used.

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2	Two FR1 NR carrier frequencies are used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Deactivated Scell		Config 1A,2A,3A	NR cell 3	NR cell 3 is on NR RF channel number 2.
Neighbour cell		Config 1A,2A,3A	NR cell 4	NR cell 4 is on NR RF channel number 2.
A6-Offset	dB	Config 1,2,3,4,5,6	-4.5	
Hysteresis	dB	Config 1,2,3,4,5,6	0	
CP length		Config 1,2,3,4,5,6	Normal	
Measurement gap pattern Id			OFF	
SCell measurement cycle (*measCycleSCell*)		Config 1,2,3,4,5,6	160 ms	
TimeToTrigger	s	Config 1,2,3,4,5,6	0	
Filter coefficient		Config 1,2,3,4,5,6	0	As specified in clause A.3.3
DRX		Config 1,2,3,4,5,6	DRX.4	
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 µs	Synchronous EN-DC
Time alignment error between Cell 2 and Cell 3	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.	Time alignment error between Cell 2 and Cell 3
Time offset between serving l and neighbour cells		Config 1,4	3 ms	Asynchronous cells. The timing of Cell 4 is 3 ms later than the timing of Cell 3.
		Config 2,3,5,6	3 µs	Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5	
T2	s	Config 1,2,3,4,5,6	1	

Table A.4.6.1.8.1-3: Cell specific test parameters for EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is used for UE configured with *highSpeedMeasCA-Scell-r17*

Parameter	Unit	Test configuration	Cell 2		Cell 3		Cell 4	
			T1	T2	T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6,1A,2A,3A	1		2		2	
Duplex mode		Config 1,4,1A	FDD				FDD	
		Config 2,3,5,6,2A,3A	TDD				TDD	
$BW_{channel}$	MHz	Config 1,4,1A	10: $N_{RB,c}$ = 52				10: $N_{RB,c}$ = 52	
		Config 2,5,2A	10: $N_{RB,c}$ = 52				10: $N_{RB,c}$ = 52	
		Config 3,6,3A	40: $N_{RB,c}$ = 106				40: $N_{RB,c}$ = 106	
BWP BW	MHz	Config 1,4,1A	10: $N_{RB,c}$ = 52				10: $N_{RB,c}$ = 52	
		Config 2,5,2A	10: $N_{RB,c}$ = 52				10: $N_{RB,c}$ = 52	
		Config 3,6,3A	40: $N_{RB,c}$ = 106				40: $N_{RB,c}$ = 106	
TDD configuration		Config 2,5,2A	TDDConf.1.1		TDDConf.1.1		TDDConf.1.1	
		Config 3,6,3A	TDDConf.2.1		TDDConf.2.1		TDDConf.2.1	
Initial DL BWP		Config 1,2,3,4,5,6,1A,2A,3A	DLBWP.0.1		DLBWP.0.1		DLBWP.0.1	
Initial UL BWP		Config 1,2,3,4,5,6,1A,2A,3A	ULBWP.0.1		NA		NA	

Parameter	Unit	Test configuration	Cell 2		Cell 3		Cell 4	
			T1	T2	T1	T2	T1	T2
Dedicated DL BWP		Config 1,2,3,4,5,6,1A,2A,3A	DLBWP.1.1		DLBWP.1.1		DLBWP.1.1	
Dedicated UL BWP		Config 1,2,3,4,5,6,1A,2A,3A	ULBWP.1.1		NA		NA	
TRS configuration		Config 1,4,1A	TRS.1.1 FDD		NA		NA	
		Config 2,5,2A	TRS.1.1 TDD		NA		NA	
		Config 3,6,3A	TRS.1.2 TDD		NA		NA	
OCNG Patterns		Config 1,2,3,4,5,6, ,1A,2A,3A	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4,1A	SR.1.1 FDD		SR.1.1 FDD		SR.1.1 FDD	
		Config 2,5,2A	SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
		Config 3,6,3A	SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel		Config 1,4,1A	CR.1.1 FDD		CR.1.1 FDD		CR.1.1 FDD	
		Config 2,5,2A	CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
		Config 3,6,3A	CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Dedicated CORESET Reference Channel		Config 1,4,1A	CCR.1.1 FDD		CCR.1.1 FDD		CCR.1.1 FDD	
		Config 2,5,2A	CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
		Config 3,6,3A	CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
SSB parameters		Config 1,4,1A	SSB.1 FR1		SSB.5 FR1		SSB.5 FR1	
		Config 2,5,2A	SSB.1 FR1		SSB.5 FR1		SSB.5 FR1	
		Config 3,6,3A	SSB.2 FR1		SSB.6 FR1		SSB.6 FR1	
SMTC configuration		Config 1,4,1A	SMTC.2		SMTC.5		SMTC.5	
		Config 2,3,5,6,2A,3A	SMTC.1		SMTC.4		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5,1A,2A	15					
		Config 3,6,3A	30					
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6,1A,2A,3A	0		0		0	
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz		-98		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4,5,1A,2A	-98		-98		-98	
		Config 3,6,3A	-95		-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5,1A,2A	-94	-94	-94	-94	-Infinity	-94
		Config 3,6,3A	-91	-91	-91	-91	-Infinity	-91
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6,1A,2A,3A	4	4	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6,1A,2A,3A	4	4	4	4	-Infinity	4
Io Note3	dBm/9.36 MHz	Config 1,2,4,5,1A,2A	-64.59	-64.59	-64.59	-62.26	-64.59	-62.26
	dBm/38.16 MHz	Config 3,6,3A	-58.49	-58.49	-58.49	-56.15	-58.49	-56.15

Parameter	Unit	Test configuration	Cell 2		Cell 3		Cell 4	
			T1	T2	T1	T2	T1	T2
Propagation Condition		Config 1,2,4,5,1A,2A	AWGN		AWGN		AWGN 1944 Hz Note 5	
		Config 3,6,3A	AWGN		AWGN		AWGN 3334 Hz Note 6	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.								
NOTE 5: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.								
NOTE 6: The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334 Hz.								

A.4.6.1.8.2 Test Requirements

The UE shall send one Event A6 triggered measurement report, with a measurement reporting delay less than 1600 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.9 EN-DC event triggered reporting tests without gap under non-DRX with NCD-SSB

A.4.6.1.9.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements when NCD-SSB is configured in clause 9.2.5.1 and 9.2.5.2.

A.4.6.1.9.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.9.2-1, A.4.6.1.9.2-2, and A.4.6.1.9.2-3 below and the test parameters and applicability for the E-UTRAN cell are defined in clause A.3.7.2. The CD-SSB is configured outside active DL BWP and NCD-SSB is configured fully within active DL BWP of FR1 PSCell. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

Table A.4.6.1.9.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.9.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4, 5, 6	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3, 4, 5, 6	1: Cell 1 2: Cell 2 and Cell 3	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
NCD-SSB configuration		1, 4	SSB.9 FR1	
		2, 5	SSB.9 FR1	
		3, 6	SSB.10 FR1	
SMTC configuration for NCD-SSB		1, 4	SMTC.11	
		2, 5	SMTC.10	
		3, 6	SMTC.10	
A3-Offset	dB	1, 2, 3, 4, 5, 6	-4.5	
CP length		1, 2, 3, 4, 5, 6	Normal	
Hysteresis	dB	1, 2, 3, 4, 5, 6	0	
Time To Trigger	s	1, 2, 3, 4, 5, 6	0	
Filter coefficient		1, 2, 3, 4, 5, 6	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	N/A	OFF
Time offset between PCell and PSCell		1, 2, 3, 4, 5, 6	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		2, 5	3 μs	Synchronous cells
		3, 6	3 μs	Synchronous cells
T1	s	1, 2, 3, 4, 5, 6	5	
T2	s	1, 2, 3, 4, 5, 6	5	

Table A.4.6.1.9.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2, 5	TDDConf.1.1		TDDConf.1.1	
		3, 6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2, 5	SR.1.1 TDD			
		3, 6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2, 5	CR.1.1 TDD		N/A	
		3, 6	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2, 5	CCR.1.1 TDD		N/A	
		3, 6	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2, 5	TRS.1.1 TDD		N/A	
		3, 6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2, 5	-98			

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
		3, 6	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2, 5				
		3, 6				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2, 5				
		3, 6				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2, 5				
		3, 6				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2, 5	-94	-94	-Infinity	-94
		3, 6	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2, 5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3, 6	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.1.9.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1000 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.10 EN-DC event triggered reporting tests without gap under non-DRX when CD-SSB is outside active BWP

A.4.6.110.1 Test purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* makes correct reporting of an event when CD-SSB is outside active BWP. This test will partly verify the intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

The test environment is the same as in clause A.4.6.1.1 with following exceptions in Table A.4.6.1.1.2-3.

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
Initial BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1 ULBWP.0.1		-	
Active DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.1.2		-	
Active UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.1.2		-	

A.4.6.1.10.2 Test Requirements

The test requirements are the same as in clause A.4.6.1.1.3.

A.4.6.2 Inter-frequency Measurements

A.4.6.2.1 EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is not used

A.4.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in tables A.4.6.2.1.1-1, A.4.6.2.1.1-2, and A.4.6.2.1.1-3.

Measurement gap pattern configuration is defined in table A.4.6.2.1.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.1.1-1.

Table A.4.6.2.1.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.2.1.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1	One E-UTRAN carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3	NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9	
A3-Offset	dB	Config 1,2,3,4,5,6	-6	
Hysteresis	dB	Config 1,2,3,4,5,6	0	
CP length		Config 1,2,3,4,5,6	Normal	
TimeToTrigger	s	Config 1,2,3,4,5,6	0	

Parameter	Unit	Test configuration	Value	Comment
Filter coefficient		Config 1,2,3,4,5,6	0	L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF	DRX is not used
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 2,3,5,6	3 μs	Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5	
T2	s	Config 1,2,3,4,5,6	1	

Table A.4.6.2.1.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD			
		Config 2,3,5,6	TDD			
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.1.1	
		Config 3,6	TDDConf.2.1		TDDConf.2.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
TRS configuration		Config 1,4	TRS.1.1 FDD		NA	
		Config 2,5	TRS.1.1 TDD		NA	
		Config 3,6	TRS.1.2 TDD		NA	
OCNG Patterns		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR2.1 TDD			
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD		-	
		Config 2,5	CCR.1.1 TDD			
		Config 3,6	CCR.2.1 TDD			
SSB parameters		Config 1,4	SSB.1 FR1		SSB.5 FR1	
		Config 2,5	SSB.1 FR1		SSB.5 FR1	
		Config 3,6	SSB.2 FR1		SSB.6 FR1	
SMTC configuration		Config 1,4	SMTC.2		SMTC.5	
		Config 2,3,5,6	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15			
		Config 3,6	30			
EPRE ratio of PSS to SSS						

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of PBCH DMRS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98		-98	
		Config 3,6	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-91
		Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4,5	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3,4,5,6	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.4.6.2.1.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.2.2 EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is used

A.4.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in tables A.4.6.2.2.1-1, A.4.6.2.2.1-2, and A.4.6.2.2.1-3.

Measurement gap pattern configuration is defined in table A.4.6.2.2.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.2.1-1.

UE needs to be provided with new Timing Advance Command MAC control at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.4.6.2.2.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.2.2.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9		
A3-Offset	dB	Config 1,2,3,4,5,6	-6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX	ms	Config 1,2,3,4,5,6	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 µs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3 ms		Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 2,3,5,6	3µs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
T2	s	Config 1,2,3,4,5,6	1.1	11	

Table A.4.6.2.2.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD			
		Config 2,3,5,6	TDD			
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
TDD configuration		Config 2,5	TDDConf.1.1			
		Config 3,6	TDDConf.2.1			
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
TRS configuration		Config 1,4	TRS.1.1 FDD		NA	
		Config 2,5	TRS.1.1 TDD		NA	
		Config 3,6	TRS.1.2 TDD		NA	
OCNG Patterns		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR2.1 TDD			
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD		-	
		Config 2,5	CCR.1.1 TDD			
		Config 3,6	CCR.2.1 TDD			
SSB parameters		Config 1,4	SSB.1 FR1		SSB.5 FR1	
		Config 2,5	SSB.1 FR1		SSB.5 FR1	
		Config 3,6	SSB.2 FR1		SSB.6 FR1	
SMTC configuration		Config 1,4	SMTC.2		SMTC.5	
		Config 2,3,5,6	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15			
		Config 3,6	30			
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc}^{Note2}	dBm/15 kHz		-98		-98	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98		-98	
		Config 3,6	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-91
		Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4,5	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3,4,5,6	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.4.6.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement In test 1 and 2, UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.2.3 Void

A.4.6.2.4 Void

A.4.6.2.5 EN-DC event triggered reporting tests for FR1 cell with SSB time index detection when DRX is not used

A.4.6.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in tables A.4.6.2.5.1-1, A.4.6.2.5.1-2, and A.4.6.2.5.1-3.

Measurement gap pattern configuration is defined in table A.4.6.2.5.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.5.1-1.

Table A.4.6.2.5.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.2.5.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1	One E-UTRAN carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3	NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9	
A3-Offset	dB	Config 1,2,3,4,5,6	-6	
Hysteresis	dB	Config 1,2,3,4,5,6	0	
CP length		Config 1,2,3,4,5,6	Normal	
TimeToTrigger	s	Config 1,2,3,4,5,6	0	
Filter coefficient		Config 1,2,3,4,5,6	0	L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF	DRX is not used
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs	Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5	
T2	s	Config 1,2,3,4,5,6	1.1	

Table A.4.6.2.5.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD			
		Config 2,3,5,6	TDD			
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
TDD configuration		Config 2,5	TDDConf.1.1			
		Config 3,6	TDDConf.2.1			
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
TRS configuration		Config 1,4	TRS.1.1 FDD		NA	
		Config 2,5	TRS.1.1 TDD		NA	
		Config 3,6	TRS.1.2 TDD		NA	
OCNG Patterns		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD			
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR.2.1 TDD			
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD		-	
		Config 2,5	CCR.1.1 TDD			
		Config 3,6	CCR.2.1 TDD			
SSB parameters		Config 1,4	SSB.1 FR1		SSB.5 FR1	
		Config 2,5	SSB.1 FR1		SSB.5 FR1	
		Config 3,6	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2		SMTC.5	
		Config 2,3,5,6	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15			
		Config 3,6	30			
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98		-98	
		Config 3,6	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-91
		Config 3,6	-91	-91	-Infinity	-88

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
$\hat{E}_s / I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io[Note3]	dBm/9.36 MHz	Config 1,2,4,5	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3,4,5,6	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.4.6.2.5.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1040 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.2.6 EN-DC event triggered reporting tests for FR1 cell with SSB time index detection when DRX is used

A.4.6.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in tables A.4.6.2.6.1-1, A.4.6.2.6.1-2, and A.4.6.2.6.1-3.

Measurement gap pattern configuration is defined in table A.4.6.2.6.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.6.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.4.6.2.6.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

NOTE 1: The UE is only required to be tested in one of the supported test configurations
NOTE 2: target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2

Table A.4.6.2.6.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9		
A3-Offset	dB	Config 1,2,3,4,5,6	-6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX	ms	Config 1,2,3,4,5,6	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3 ms		Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	1.3	13.5	

Table A.4.6.2.6.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD			
		Config 2,3,5,6	TDD			
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
OCNG Patterns		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
		Config 3,6	SR2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR.2.1 TDD			
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD		-	
		Config 2,5	CCR.1.1 TDD			
		Config 3,6	CCR.2.1 TDD			
TDD configuration		Config 2,5	TDDConf.1.1			
		Config 3,6	TDDConf.2.1			
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1			
TRS configuration		Config 1,4	TRS.1.1 FDD		N/A	
		Config 2,5	TRS.1.1 TDD		N/A	
		Config 3,6	TRS.1.2 TDD		N/A	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1			
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1			
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1			
SSB parameters		Config 1,4	SSB.1 FR1			
		Config 2,5	SSB.1 FR1			
		Config 3,6	SSB.2 FR1			
SMTC configuration		Config 1,4	SMTC.2			
		Config 2,3,5,6	SMTC.1			
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15			
		Config 3,6	30			
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98		-98	
		Config 3,6	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-91
		Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4,5	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3,4,5,6	AWGN			

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.4.6.2.6.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 12160 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2, UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.2.7 Void

A.4.6.2.8 Void

A.4.6.2.9 EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is used for UE configured with highSpeedMeasInterFreq-r17

A.4.6.2.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event for UE configured with highSpeedMeasInterFreq-r17. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in tables A.4.6.2.9.1-1, A.4.6.2.9.1-2, and A.4.6.2.9.1-3.

Measurement gap pattern configuration is defined in table A.4.6.2.9.1-2 In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.9.1-1.

UE needs to be provided with new Timing Advance Command MAC control at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.4.6.2.9.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1 for UE configured with highSpeedMeasInterFreq-r17

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.2.9.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection for UE configured with highSpeedMeasInterFreq-r17

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1	One E-UTRAN carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3	NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9	
A3-Offset	dB	Config 1,2,3,4,5,6	-6	
Hysteresis	dB	Config 1,2,3,4,5,6	0	
CP length		Config 1,2,3,4,5,6	Normal	
TimeToTrigger	s	Config 1,2,3,4,5,6	0	
Filter coefficient		Config 1,2,3,4,5,6	0	L3 filtering is not used
DRX	ms	Config 1,2,3,4,5,6	DRX.14	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 µs	Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 2,3,5,6	3µs	Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5	
T2	s	Config 1,2,3,4,5,6	3	

Table A.4.6.2.9.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection for UE configured with highSpeedMeasInterFreq-r17

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD			
		Config 2,3,5,6	TDD			
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		Config 2,5	TDDConf.1.1			
		Config 3,6	TDDConf.2.1			
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
TRS configuration		Config 1,4	TRS.1.1 FDD		NA	
		Config 2,5	TRS.1.1 TDD		NA	
		Config 3,6	TRS.1.2 TDD		NA	
OCNG Patterns		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR2.1 TDD			
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD		-	
		Config 2,5	CCR.1.1 TDD			
		Config 3,6	CCR.2.1 TDD			
SSB parameters		Config 1,4	SSB.1 FR1		SSB.5 FR1	
		Config 2,5	SSB.1 FR1		SSB.5 FR1	
		Config 3,6	SSB.2 FR1		SSB.6 FR1	
SMTC configuration		Config 1,4	SMTC.2		SMTC.5	
		Config 2,3,5,6	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15			
		Config 3,6	30			
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98		-98	
		Config 3,6	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-91
		Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4,5	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2, 4,5	AWGN		AWGN 1944 Hz Note 5	
		Config 3,6			AWGN 3334 Hz Note 6	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.						
NOTE 6: The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334 Hz.						

A.4.6.2.9.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 2240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.3 Void

A.4.6.4 L1-RSRP measurement for beam reporting

A.4.6.4.1 SSB based L1-RSRP measurement when DRX is not used

A.4.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.4.6.4.1.1-1.

Table A.4.6.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.4.6.4.1.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.4.1.2-1 and Table A.4.6.4.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.4.6.4.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
OCNG Patterns	1~6		OP.1
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
DRX configuration	1~6		Off
reportConfigType	1~6		periodic
reportQuantity	1~6		ssb-Index-RSRP
Number of reported RS	1~6		2
L1-RSRP reporting period	1~6	slot	80
T1	1~6	s	5
T2	1~6	s	1
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.4.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~6	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2,4,5	dBm/SSB SCS	-94.65			
	3,6		-91.65			
$\hat{E}_s / I_{ot}$	1~6	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2,4,5	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3,6		-91.65	-91.65	-Infinity	-88.65

Io Note3	1,2,4,5	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3,6	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1~6	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.4.1.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.4.2 SSB based L1-RSRP measurement when DRX is used

A.4.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.4.6.4.2.1-1.

Table A.4.6.4.2.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.4.6.4.2.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.4.2.2-1 and Table A.4.6.4.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.4.6.4.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1

Parameter	Config	Unit	Value
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
OCNG Patterns	1~6		OP.1
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
DRX configuration	1~6		DRX.3
reportConfigType	1~6		periodic
reportQuantity	1~6		ssb-Index-RSRP
Number of reported RS	1~6		2
L1-RSRP reporting period	1~6	slot	80
T1	1~6	s	5
T2	1~6	s	1
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.4.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~6	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2,4,5	dBm/SSB SCS	-94.65			
	3,6		-91.65			
$\hat{E}_s / I_{ot}$	1~6	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2,4,5	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3,6		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,4,5	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3,6	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1~6	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.4.2.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.4.3 CSI-RS based L1-RSRP measurement when DRX is not used

A.4.6.4.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.4.6.4.3.1-1.

Table A.4.6.4.3.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.4.6.4.3.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.4.3.2-1 and Table A.4.6.4.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (0 for Config 1,2,4,5 and 8 for Config 3,6) of a frame and UE provides the report back based on the reporting configuration as defined in table A.4.6.4.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.4.6.4.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement	1,4		SR.1.1 FDD

Parameter	Config	Unit	Value
channel	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
CSI-RS configuration	1,4		CSI-RS 1.3 FDD
	2,5		CSI-RS 1.3 TDD
	3,6		CSI-RS 2.3 TDD
OCNG Patterns	1~6		OP.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
DRX configuration	1~6		Off
reportConfigType	1~6		aperiodic
reportQuantity	1~6		cri-RSRP
Number of reported RS	1~6		2
qcl-Info	1~6		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~6	slots	8
T1	1~6	s	5
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.4.3.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~6	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2,4,5	dBm/SSB SCS	-94.65	
	3,6		-91.65	
$\hat{E}_s / I_{ot}$	1~6	dB	0	3
CSI-RS RSRP Note2	1,2,4,5	dBm/SSB SCS	-94.65	-91.65
	3,6		-91.65	-88.65
Io Note2	1,2,4,5	dBm/9.36 MHz	-63.69	-61.93
	3,6	dBm/38.16 MHz	-57.59	-55.84
$\hat{E}_s / N_{oc}$	1~6	dB	0	3
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.4.3.3 Test Requirements

After 80 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.20.1.1 and relative accuracy requirement in clause 10.1.20.1.2.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.4.4 CSI-RS based L1-RSRP measurement when DRX is used

A.4.6.4.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.4.6.4.4.1-1.

Table A.4.6.4.4.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.4.6.4.4.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.4.4.2-1 and Table A.4.6.4.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (0 for Config 1,2,4,5 and 8 for Config 3,6) of a frame and UE provides the report back based on the reporting configuration as defined in table A.4.6.4.4.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.4.6.4.4.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement	1,4		SR.1.1 FDD

Parameter	Config	Unit	Value
channel	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
CSI-RS configuration	1,4		CSI-RS 1.3 FDD
	2,5		CSI-RS 1.3 TDD
	3,6		CSI-RS 2.3 TDD
OCNG Patterns	1~6		OP.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
DRX configuration	1~6		DRX.3
reportConfigType	1~6		aperiodic
reportQuantity	1~6		cri-RSRP
Number of reported RS	1~6		2
qcl-Info	1~6		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~6	slots	8
T1	1~6	s	5
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.4.4.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~6	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2,4,5	dBm/SSB SCS	-94.65	
	3,6		-91.65	
$\hat{E}_s/I_{ot}$	1~6	dB	0	3
CSI-RS RSRP Note2	1,2,4,5	dBm/SSB SCS	-94.65	-91.65
	3,6		-91.65	-88.65
Io Note2	1,2,4,5	dBm/9.36 MHz	-63.69	-61.93
	3,6	dBm/38.16 MHz	-57.59	-55.84
$\hat{E}_s/N_{oc}$	1~6	dB	0	3
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.4.4.3 Test Requirements

After 80 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting absolute accuracy requirement in clause 10.1.20.1.1 and relative accuracy requirement in clause 10.1.20.1.2.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.4.5 SSB based L1-RSRP measurement when DRX is used for UE configured with *highSpeedMeasFlag-r16*

A.4.6.4.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement when UE is configured with *highSpeedMeasFlag-r16*. This test will partly verify the L1-RSRP measurement requirements for UE configured with *highSpeedMeasFlag-r16* in clause 9.5.4.1, with the testing configurations for NR cells in table A.4.6.4.5.1-1.

Table A.4.6.4.5.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.4.6.4.5.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.4.5.2-1 and Table A.4.6.4.5.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.4.6.4.5.2-1: General test parameters for UE configured with *highSpeedMeasFlag-r16*

Parameter	Config	Unit	Value
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD

Parameter	Config	Unit	Value
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
OCNG Patterns	1~6		OP.1
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
DRX configuration	1~6		DRX.3
reportConfigType	1~6		periodic
reportQuantity	1~6		ssb-Index-RSRP
Number of reported RS	1~6		2
L1-RSRP reporting period	1~6	slot	80
T1	1~6	s	5
T2	1~6	s	2
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.4.5.2-2: SSB specific test parameters for UE configured with *highSpeedMeasFlag-r16*

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~6	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2,4,5	dBm/SSB SCS	-94.65			
	3,6		-91.65			
$\hat{E}_s / I_{ot}$	1~6	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2,4,5	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3,6		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,4,5	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3,6	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1~6	dB	0	0	-Infinity	3
Propagation condition	1,2,4,5		AWGN		AWGN 1944 Hz	
	3,6		AWGN		AWGN 3334 Hz	
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.4.5.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.4.6 CSI-RS based L1-RSRP measurement when DRX is not used when CD-SSB is outside active BWP

A.4.6.4.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement when CD-SSB is outside active BWP. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.4.6.4.3.1-1.

The test is for UE supporting *rlm-BM-BFD-CSI-RS-OutsideActiveBWP-r18* and the UE is not required past legacy test in clause A.4.6.4.3.

The test environment is the same as in clause A.4.6.4.3.2 with following exceptions in Table Table A.4.6.4.3.2-1.

The value of parameter “Dedicated BWP configuration” is DLBWP.1.2 and ULBWP.1.2.

Note: The starting PRB index of the SSB can be any possible PRB index of the RF channel BW occurring after the last PRB of the DL active BWP.

The test requirements are the same as in clause A.4.6.4.3.3.

A.4.6.4.7 SSB based L1-RSRP measurement when DRX is not used when CD-SSB is outside active BWP

A.4.6.4.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* makes correct reporting of L1-RSRP measurement when CD-SSB is outside active BWP. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.4.6.4.1.1-1.

The test environment is the same as in clause A.4.6.4.1 with following exceptions in Table A.4.6.4.1.2-1.

Parameter	Config	Unit	Value
Dedicated BWP configuration	1~6		DLBWP.1.2 ULBWP.1.2

A.4.6.4.7.2 Test Requirements

The test requirements are the same as in clause A.4.6.4.1.3.

A.4.6.4.8 SSB based L1-RSRP measurement for UE supporting NCD-SSB based L1 measurement outside active BWP when DRX is not used

A.4.6.4.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.4.6.4.8.1-1.

Table A.4.6.4.8.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.4.6.4.8.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.4.8.2-1 and Table A.4.6.4.8.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured. During time duration T1, the UE shall not have any timing information of NR cell 2.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.4.6.4.8.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
CD-SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
NCD-SSB configuration	1,4		SSB.9 FR1
	2,5		SSB.9 FR1
	3,6		SSB.10 FR1
OCNG Patterns	1~6		OP.1
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 RedCap ULBWP.1.1 RedCap
SMTC configuration	1~6		SMTC.2 RedCap
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD

Parameter	Config	Unit	Value
DRX configuration	1~6		Off
reportConfigType	1~6		periodic
reportQuantity	1~6		ssb-Index-RSRP
Number of reported RS	1~6		2
L1-RSRP reporting period	1~6	slot	80
T1	1~6	s	5
T2	1~6	s	1
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.4.8.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~6	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2,4,5	dBm/SSB SCS	-94.65			
	3,6		-91.65			
$\hat{E}_s / I_{ot}$	1~6	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2,4,5	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3,6		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,4,5	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3,6	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1~6	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.4.8.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than [620ms] plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.5 CLI measurements

A.4.6.5.1 SRS-RSRP measurement with non-DRX

A.4.6.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of SRS-RSRP measurement. This test will verify the SRS-RSRP measurement requirements in clause 9.7.2.5 with the testing configurations for NR cells in table A.4.6.5.1.1-1.

Table A.4.6.5.1.1-1: Applicable NR configurations for FR1 SRS-RSRP test

Configuration	Description
1	NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.4.6.5.1.2 Test Parameters

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters for PSCell is given in Table A.4.6.5.1.2-1 and A.4.6.5.1.2-2 below and applicability for the E-UTRAN cell are defined in clause A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system transmits SRS resource for measurement in the DL slot according to the SRS configuration in table A.4.6.5.1.2-4 and the test parameters for the (virtual) neighbour cell UE in table A.4.6.5.1.2-3. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 1 data symbol before SRS to be transmitted.

Table A.4.6.5.1.2-1: General test parameters for SRS-RSRP event triggered reporting for PSCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	E-UTRAN Cell 1 and NR Cell 2	
RF Channel Number		1, 2	1: Cell 1 2: Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.2 FR1	
SMTC configuration		1	SMTC.1	
		2	SMTC.1	
SRS configuration		1	SRSConf.1	Table A.4.6.5.1.2-3
		2	SRSConf.2	
CP length		1, 2	Normal	
i1-Threshold	dBm	1	-97	
		2	-95	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	Non-DRX
Time offset between DL from serving cell and SRS from test system	µs	1,2	17.67	
T1	s	1, 2	5	
T2	s	1, 2	1	

Table A.4.6.5.1.2-2: NR Cell specific test parameters for SRS-RSRP event triggered reporting for PSCell in FR1

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
TDD configuration		1	TDDConf.1.1	
		2	TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 TDD	
		2	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 TDD	
		2	CR.2.1 TDD	
Dedicated CORESET		1	CCR.1.1 TDD	

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
RMC configuration		2	CCR.2.1 TDD	
OCNG Patterns		1, 2	OP.1	
TRS Configuration		1	TRS.1.1 TDD	
		2	TRS.1.2 TDD	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1	
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-95	
Propagation Condition		1, 2	AWGN	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Table A.4.6.5.1.2-3: NR Cell specific test parameters for SRS-RSRP event triggered reporting for neighbour cell UE

Parameter	Unit	Test configuration	Neighbour cell UE	
			T1	T2
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-95	
$\hat{E}_s / I_{ot}$	dB	1	-infinity	4
		2		
$\hat{E}_s / N_{oc}$	dB	1	-infinity	4
		2		
SRS-RSRP Note 3	dBm/SCS kHz	1	-infinity	-94
		2	-infinity	-91
Io	dBm/9.36 MHz	1	-70.05	-64.59
	dBm/38.16 MHz	2	-63.96	-58.50
Propagation Condition		1, 2	AWGN	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.4.6.5.1.2-4: SRS configuration for measurement reporting

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	*srs-ResourceSetId*	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	*SRS-ResourceId*	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	

	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	12	12	
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset	sl20, 9	sl40, 19	
	sequenceId	0	0	Any 10 bit number

A.4.6.5.1.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 60 ms from the beginning of time period T2.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.5.2 CLI-RSSI measurement with non-DRX

A.4.6.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of CLI-RSSI measurement. This test will verify the CLI-RSSI measurement requirements in clause 9.7.3.5 with the testing configurations for NR cells in table A.4.6.5.2.1-1.

Table A.4.6.5.2.1-1: Applicable NR configurations for FR1 CLI-RSSI test

Configuration	Description
1	NR 15 kHz SCS, 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.4.6.5.2.2 Test Parameters

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters for PSCell is given in Table A.4.6.5.2.2-1 and A.4.6.5.2.2-2 below and applicability for the E-UTRAN cell are defined in clause A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI measurement resource and on 1 data symbol before. The CLI-RSSI measurement resource configuration is in table A.4.6.5.2.2-3.

Table A.4.6.5.2.2-1: General test parameters for CLI-RSSI event triggered reporting for PSCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	E-UTRAN Cell 1 and NR Cell 2	

RF Channel Number		1, 2	1: Cell 1 2: Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.2 FR1	
SMTC configuration		1	SMTC.1	
		2	SMTC.1	
CLI-RSSI configuration		1	CLI-RSSIConf.1	Table A.4.6.5.2.2-3
		2	CLI-RSSIConf.2	
CP length		1, 2	Normal	
i1-Threshold	dBm	1	-93	
		2	-93	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	Non-DRX
Time offset between DL from serving cell and OCNG from test system	μs	1,2	17.67	
T1	s	1, 2	5	
T2	s	1, 2	1	

Table A.4.6.5.2.2-2: NR Cell specific test parameters for CLI-RSSI event triggered reporting for PSCell in FR1

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
TDD configuration		1	TDDConf.1.1	
		2	TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 TDD	
		2	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 TDD	
		2	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 TDD	
		2	CCR.2.1 TDD	
OCNG Patterns Note 3		1, 2	OP.1	
TRS Configuration		1	TRS.1.1 TDD	
		2	TRS.1.2 TDD	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1	
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/15 kHz	1	-116	-108
		2		
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/SCS	1	-116	-108
		2	-113	-105
Io on CLI-RSSI measurement resource	dBm/9.36 MHz	1	-88.05	-80.05
	dBm/38.16 MHz	2	-81.96	-74.00
Io on CLI-RSSI measurement resource	dBm/1.08 MHz	1	-97.43	-89.43
	dBm/1.08 MHz	2	-97.44	-89.44
Propagation Condition		1, 2	AWGN	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: OCNG is not transmitted in the CLI-RSSI measurement resources.

Table A.4.6.5.2.2-3: CLI-RSSI measurement resource configuration for measurement reporting

	Field	CLI-RSSIConf.1	CLI-RSSIConf.2
RSSI-Resource	*rssi-ResourceId*	0	0
	rssi-SCS	15	30
	startPRB	0	0

	nrofPRBs	52	106
	startPosition	3	3
	nrofSymbols	11	11
	rssi-PeriodicityAndOffset	sl20, 9	sl40, 19

A.4.6.5.2.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 20 ms from the beginning of time period T2. The nominal RSSI used to evaluate the requirement shall be based on Io.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.6 Measurements with autonomous gaps

A.4.6.6.1 EN-DC-intra-frequency CGI identification of NR FR1 cell with autonomous gaps in synchronous EN-DC

A.4.6.6.1.1 Test Purpose and Environment

The purpose of this test is to verify the requirements for intra-frequency identification of a new CGI of NR FR1 cell with autonomous gaps in clause 9.11 for EN-DC.

The test scenario comprises of one E-UTRA carrier and one NR FR1 carrier. Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1) on E-UTRA RF channel 1, NR FR1 PSCell (Cell 2) and NR FR1 neighbour cell (Cell 3) on NR RF channel 1. The supported test configurations are shown in table A.4.6.6.1.1-1 below. The test parameters for NR Cells are given in Tables A.4.6.6.1.2-2 and A.4.6.6.1.2-3 below. The test parameters and applicability for the E-UTRAN PCell are defined in clause A.3.7.2.1. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 3. Starting T2, Cell 3 becomes detectable and the UE is expected to detect and send a measurement report.

An RRC message implying SI reading shall be sent to the UE during period T2, after the UE has reported Event A3. The RRC message shall create a measurement report configuration with purpose *reportCGI* which *cellForWhichToReportCGI* set to the physical cell identity of Cell 3. The start of T3 is the instant when the last TTI containing the RRC message implying SI reading of the neighbour cell (Cell 3) using autonomous gap is sent to the UE.

Table A.4.6.6.1.1-1: intra-frequency CGI identification of NR FR1 cell with autonomous gaps in synchronous EN-DC

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.6.1.1-2: General test parameters for intra-frequency CGI identification of NR FR1 cell with autonomous gaps in synchronous EN-DC

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1	One E-UTRAN radio channel is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1	One NR FR1 radio channel is used.

Parameter	Unit	Test configuration	Value	Comment
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR Cell 2 (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR Cell 3	NR Cell 3 is on NR RF channel number 1.
A3-Offset	dB	Config 1,2,3,4,5,6	-4.5	
Hysteresis	dB	Config 1,2,3,4,5,6	0	
CP length		Config 1,2,3,4,5,6	Normal	
TimeToTrigger	s	Config 1,2,3,4,5,6	0	
Filter coefficient		Config 1,2,3,4,5,6	0	L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF	DRX is not used
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 2,3,5,6	3 μs	Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5	
T2	s	Config 1,2,3,4,5,6	≤10	
T3	s	Config 1,2,3,4,5,6	5	

Table A.4.6.6.1.1-3: Cell specific test parameters for intra-frequency CGI identification of NR FR1 cell with autonomous gaps in synchronous EN-DC

Parameter	Unit	Test configuration	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Duplex mode		Config 1,4	FDD					
		Config 2,3,5,6	TDD					
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52					
		Config 2,5	10: $N_{RB,c}$ = 52					
		Config 3,6	40: $N_{RB,c}$ = 106					
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52					
		Config 2,5	10: $N_{RB,c}$ = 52					
		Config 3,6	40: $N_{RB,c}$ = 106					
TDD configuration		Config 1,4	N/A			N/A		
		Config 2,5	TDDConf.1.1			TDDConf.1.1		
		Config 3,6	TDDConf.2.1			TDDConf.2.1		
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1			NA		
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1			NA		
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1			NA		
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1			NA		
TRS configuration		Config 1,4	TRS.1.1 FDD			NA		
		Config 2,5	TRS.1.1 TDD					
		Config 3,6	TRS.1.2 TDD					
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1			OP.1		
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD			NA		
		Config 2,5	SR.1.1 TDD					
		Config 3,6	SR.2.1 TDD					
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD			NA		
		Config 2,5	CR.1.1 TDD			NA		
		Config 3,6	CR.2.1 TDD			NA		

Parameter	Unit	Test configuration	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
RMC CORESET Reference Channel		Config 1, 4	CCR.1.1 FDD			NA		
		Config 2, 5	CCR.1.1 TDD			NA		
		Config 3, 6	CCR.2.1 TDD			NA		
SSB parameters		Config 1,2,4,5	SSB.1 FR1					
		Config 3,6	SSB.2 FR1					
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2					
		Config 2,3,5,6	SMTC.1					
RMSI scheduling periodicity	ms	Config 1,2,3,4,5,6	20ms					
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15					
		Config 3,6	30					
RLM-RS		Config 1,2,3,4,5,6	SSB			SSB		
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0			0		
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz		-98			-98		
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98			-98		
		Config 3,6	-95			-95		
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-94	-Infinity	-94	-94
		Config 3,6	-91	-91	-91	-Infinity	-91	-91
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	-1.46	-1.46	-Infinity	-1.46	-1.46
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	4	-Infinity	4	4
Io Note3	dBm/9.36MHz	Config 1,2,4,5	-64.60	-62.25	-62.25	-64.60	-62.25	-62.25
	dBm/38.16MHz	Config 3,6	-58.50	-56.16	-56.16	-58.50	-56.16	-56.16
Propagation Condition		Config 1,2,3,4,5,6	AWGN					

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.4.6.6.1.2 Test Requirements

The UE shall transmit a measurement report containing the cell global identifier of Cell 3 within 260 ms from the start of T3.

Test requirement = RRC Procedure delay + $T_{identify_CGI_NR}$ + TTI insertion uncertainty

= 15 + 240 + 2

= 257 ms, allow 260 ms.

The UE shall be scheduled continuously throughout the test, and from the start of T3 until 260 ms the number of interrupted slots shall not exceed the allowed number specified in clause 8.2.1.2.16.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.7 L1-SINR measurement for beam reporting

A.4.6.7.1 L1-SINR measurement with CSI-RS based CMR and no dedicated IMR when DRX is not used

A.4.6.7.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement based on CSI-RS CMR without dedicated IMR. This test will partly verify the L1-SINR measurement requirements in clause 9.8.4.1, with the testing configurations for NR cells in table A.4.6.7.1.1-1.

Table A.4.6.7.1.1-1: Applicable NR configurations for FR1 CSI-RS based L1-SINR test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.4.6.7.1.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.7.1.2-1 and Table A.4.6.7.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (1 Config 1,2,4,5 and 8 for Config 3,6) of a frame and UE provides the report back based on the reporting configuration as defined in table A.4.6.7.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.4.6.7.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD

Parameter	Config	Unit	Value
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
CSI-RS configuration	1,4		CSI-RS.1.3 FDD
	2,5		CSI-RS.1.3 TDD
	3,6		CSI-RS.2.3 TDD
OCNG Patterns	1~6		OP.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
DRX configuration	1~6		Off
reportConfigType	1~6		aperiodic
reportQuantity-r16	1~6		cri-SINR-r16
Number of reported RS	1~6		2
qcl-Info	1~6		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1~6	slots	26
T1	1~6	s	5
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.7.1.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~6	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2,4,5	dBm/SSB SCS	-94.65	
	3,6		-91.65	

$\hat{E}_s/I_{ot}$	1~6	dB	0	3
CSI-RS RSRP Note3	1,2,4,5	dBm/SSB SCS	-94.65	-91.65
	3,6		-91.65	-88.65
Io Note2	1,2,4,5	dBm/9.36 MHz	-63.69	-61.93
	3,6	dBm/38.16 MHz	-57.59	-55.84
$\hat{E}_s/N_{oc}$	1~6	dB	0	3
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.4.6.7.1.3 Test Requirements

After 80 ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.27.1.1 and relative accuracy requirement in clause 10.1.27.1.2.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.7.2 L1-SINR measurement with SSB based CMR and dedicated IMR when DRX is used

A.4.6.7.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements with SSB based CMR and CSI-IM based IMR in clause 9.8.4.2, with the testing configurations for NR cells in table A.4.6.7.2.1-1.

Table A.4.6.7.2.1-1: Applicable NR configurations for FR1 L1-SINR measurement test with SSB based CMR and CSI-IM based IMR

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.4.6.7.2.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.7.2.2-1 and Table A.4.6.7.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the SSBs and the associated CSI-IM resources, and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD measurements based on the SSBs, and UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-IM resources as IMR.

Table A.4.6.7.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
CSI-IM configuration	1,4		CSI-IM.1.1 FDD
	2,5		CSI-IM.1.1 TDD
	3,6		CSI-IM.2.1 TDD
OCNG Patterns	1~6		OP.1
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
DRX configuration	1~6		DRX.3
reportConfigType	1~6		periodic
reportQuantity-r16	1~6		ssb-Index-SINR-r16
Number of reported RS	1~6		2
L1-SINR reporting period	1~6	slot	80
T1	1~6	s	5
T2	1~6	s	1
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.4.6.7.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~6	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2,4,5	dBm/SSB SCS	-94.65			
	3,6		-91.65			
$\hat{E}_s/I_{ot}$	1~6	dB	0	0	-Infinity	3
SS-RSRP Note3	1,2,4,5	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3,6		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,4,5	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3,6	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~6	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.7.2.3 Test Requirements

The UE shall send L1-SINR report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-SINR report including results of both SSB#0+CSI-IM#0 and SSB#1+CSI-IM#1 while meeting the accuracy requirement in clause 10.1.27.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.7.3 L1-SINR measurement with CSI-RS based CMR and dedicated IMR configured when DRX is used

A.4.6.7.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements with CSI-RS based CMR and dedicated IMR cofigured in clause 9.8.4.3, with the testing configurations for NR cells in table A.4.6.7.3.1-1.

Table A. A.4.6.7.3.1-1: Applicable NR configurations for FR1 L1-SINR test with CMR and dedicated IMR

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.4.6.7.3.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.7.3.2-1 and Table A.4.6.7.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the configured CSI-RS as CMR and an associated CSI-RS as IMR, and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources and the associated IMR. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (1 Config 1,2,4,5 and 8 for Config 3,6) of a frame and UE provides the report back based on the reporting configuration as defined in table A.4.6.7.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs, and UE is configured to perform L1-SINR measurement based on the CSI-RS as CMR and the CSI-RS as IMR.

Table A.4.6.7.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
CSI-RS configuration as CMR	1,4		CSI-RS.1.3 FDD
	2,5		CSI-RS.1.3 TDD
	3,6		CSI-RS.2.3 TDD
CSI-RS configuration as IMR	1,4		CSI-RS.1.2A FDD
	2,5		CSI-RS.1.2A TDD
	3,6		CSI-RS.2.2A TDD
OCNG Patterns	1~6		OP.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
DRX configuration	1~6		DRX.3
reportConfigType	1~6		aperiodic
reportQuantity-r16	1~6		cri-SINR-r16
Number of reported RS	1~6		2
qcl-Info	1~6		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~6	slots	26
T1	1~6	s	5
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			

Parameter	Config	Unit	Value
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.7.3.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~6	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2,4,5	dBm/SSB SCS	-94.65	
	3,6		-91.65	
$\hat{E}_s / I_{ot}$	1~6	dB	0	3
$\hat{E}_s / N_{oc}$	1~6	dB	0	3
CSI-RS RSRP Note2	1,2,4,5	dBm/SSB SCS	-94.65	-91.65
	3,6		-91.65	-88.65
Io Note2	1,2,4,5	dBm/9.36 MHz	-63.69	-61.93
	3,6	dBm/38.16 MHz	-57.59	-55.84
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.4.6.7.3.3 Test Requirements

After 80 ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 as CMR + CSI-RS#0 as IMR and CSI-RS#1 as CMR + CSI-RS#1 as IMR while meeting the accuracy requirement in clause 10.1.27.3.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.8 CSI-RS based intra-frequency Measurement

A.4.6.8.1 EN-DC event triggered reporting tests without gap under DRX

A.4.6.8.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the CSI-RS based L3 intra-frequency requirements in clause 9.10.2.

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.8.1.1-1, A.4.6.8.1.1-2, and A.4.6.8.1.1-3 below and the test parameters and applicability for the E-UTRAN cell are defined in clause A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used for the CSI-RS based L3 intra-frequency measurements. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

UE is allocated with PUSCH resource at every DRX cycle.

NOTE: TAT= infinite based on the DRX configuration used in test.

Table A.4.6.8.1.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.8.1.1-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
Active cell		1, 2, 3, 4, 5, 6	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3, 4, 5, 6	1: Cell 1 2: Cell 2 and Cell 3	
SMTC configuration		1, 4	SMTC.2	
		2, 5	SMTC.1	
		3, 6	SMTC.1	
A3-Offset	dB	1, 2, 3, 4, 5, 6	-4.5	
CP length		1, 2, 3, 4, 5, 6	Normal	
Hysteresis	dB	1, 2, 3, 4, 5, 6	0	
Time To Trigger	s	1, 2, 3, 4, 5, 6	0	
Filter coefficient		1, 2, 3, 4, 5, 6	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.5	
Time offset between PCell and PSCell	µs	1, 2, 3, 4, 5, 6	3	Synchronous EN-DC
Time offset between serving and neighbour cells	µs	1, 4	4.7	The timing of Cell 3 is CP later than the timing of Cell 2.
		2, 5	4.7	
		3, 6	2.35	
T1	s	1, 2, 3, 4, 5, 6	5	
T2	s	1, 2, 3, 4, 5, 6	11	

Table A.4.6.8.1.1-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2, 5	TDDConf.1.1		TDDConf.1.1	
		3, 6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2, 5	SR.1.1 TDD			
		3, 6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2, 5	CR.1.1 TDD		CR.1.1 TDD	
		3, 6	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD		CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2, 5	TRS.1.1 TDD		N/A	
		3, 6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
Active DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.1.1		ULBWP.1.1	
SSB parameters		1,4	SSB.1 FR1		SSB.5 FR1	
		2,5	SSB.1 FR1		SSB.5 FR1	
		3,6	SSB.2 FR1		SSB.6 FR1	
CSI-RS configuration for RRM		1,4	CSI-RS.RRM.FR1.1 FDD			
		2,5	CSI-RS.RRM.FR1.1 TDD			
		3,6	CSI-RS.RRM.FR1.2 TDD			
RLM-RS		1, 2, 3, 4, 5, 6	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1,2,4,5	-98			
		3, 6	-95			
N_{oc} Note 2	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98			
$\hat{E}_s/I_{ot}$ for SSB	dB	1, 2, 3, 4, 5, 6	4	-1.46	-Infinity	-1.46
$\hat{E}_s/I_{ot}$ for CSI-RS	dB	1, 2, 3, 4, 5, 6	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$ for SSB	dB	1, 2, 3, 4, 5, 6	4	4	-Infinity	4
$\hat{E}_s/N_{oc}$ for CSI-RS	dB	1, 2, 3, 4, 5, 6	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS	1, 4	-94	-94	-Infinity	-94
		2, 5	-94	-94	-Infinity	-94
		3, 6	-91	-91	-Infinity	-91
CSI-RSRP Note 3	dBm/SCS	1, 4	-94	-94	-Infinity	-94
		2, 5	-94	-94	-Infinity	-94
		3, 6	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2, 5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and CSI-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.8.1.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE is not required to read the SSB index indicated by associatedSSB in the neighbour cell in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.9 CSI-RS based inter-frequency Measurement

A.4.6.9.1 EN-DC event triggered reporting tests for FR1 cell when non-DRX is used

A.4.6.9.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell measurement requirements in clause 9.10.3.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in tables A.4.6.9.1.1-1, A.4.6.9.1.1-2, and A.4.6.9.1.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.4.6.9.1.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.4.6.2.2.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 2. Otherwise, it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.9.1.1-1.

Table A.4.6.9.1.1-1: EN-DC event triggered reporting tests with SSB index reading for FR1-FR1

Config	Description
1	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.9.1.1-2: General test parameters for EN-DC inter-frequency event triggered reporting

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		Two FR1 NR carrier frequencies are used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	4	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39	19	
A3-Offset	dB	Config 1,2,3,4,5,6	-6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
DRX	ms	Config 1,2,3,4,5,6	OFF		DRX is not used
Time offset between PCell and PSCell	µs	Config 1,2,3,4,5,6	3		Synchronous EN-DC
Time offset between serving and neighbour cells	µs	Config 1,4	4.7		The timing of Cell 3 is CP later than the timing of Cell 2.
		Config 2,5	4.7		
		Config 3,6	2.35		
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	3	3	

Table A.4.6.9.1.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD			
		Config 2,3,5,6	TDD			
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
TDD configuration		Config 2,5	TDDConf.1.1			
		Config 3,6	TDDConf.2.1			
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
TRS configuration		Config 1,4	TRS.1.1 FDD		NA	
		Config 2,5	TRS.1.1 TDD		NA	
		Config 3,6	TRS.1.2 TDD		NA	
OCNG Patterns		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR. 2.1 TDD			
CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR.2.1 TDD			
SSB parameters		Config 1,4	SSB.1 FR1		SSB.5 FR1	
		Config 2,5	SSB.1 FR1		SSB.5 FR1	
		Config 3,6	SSB.2 FR1		SSB.6 FR1	
SMTC configuration		Config 1,4	SMTC.2			
		Config 2,3,5,6	SMTC.1			
CSI-RS configuration for RRM		Config 1,4	CSI-RS.RRM.FR1.1 FDD			
		Config 2,5	CSI-RS.RRM.FR1.1 TDD			
		Config 3,6	CSI-RS.RRM.FR1.2 TDD			
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15			
		Config 3,6	30			
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98		-98	
		Config 3,6	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-91
		Config 3,6	-91	-91	-Infinity	-88
CSI-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-91
		Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$ for SSB	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/I_{ot}$ for CSI-RS	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$ for SSB	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$ for CSI-RS	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4,5	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3,4,5,6	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP, CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.4.6.9.1.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 2240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 2000 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

The UE is required to read the SSB index indicated by associatedSSB in the neighbour cell in this test.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.7 Measurement Performance requirements

Unless explicitly stated otherwise:

- Reported measurements shall be within defined range of accuracy limits defined in clause 10 for at least 90 % of the reported cases. If multiple measurement performance requirements are verified in the same test, the reported measurements for each requirement shall be within defined range of accuracy limits of the corresponding requirement defined in clause 10 for at least 90 % of the reported cases.
- Measurements are performed in RRC_CONNECTED state.
- The reference channels assume transmission of PDSCH with a maximum number of 5 HARQ transmissions unless otherwise specified.

A.4.7.1 SS-RSRP

A.4.7.1.1 EN-DC Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.2.1.1 and 10.1.2.1.2 for intra-frequency measurements.

A.4.7.1.1.2 Test parameters

In this set of test cases all NR cells are on the same carrier frequency. Supported test configurations are shown in table A.4.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in A.4.7.1.1.2-2. The configuration of Cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1 In all test cases, Cell 2 is the PSCell, and Cell 3 is the target cell.

Table A.4.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations for each supported band	

Table A.4.7.1.1.2-2: SS-RSRP Intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
Physical cell ID			489	0	489	0	489	0
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1,4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
TRS configuration	Config 1,4			TRS.1.1 FDD	NA	TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
	Config 2,5			TRS.1.1 TDD	NA	TRS.1.1 TDD	NA	TRS.1.1 TDD	NA
	Config 3,6			TRS.1.2 TDD	NA	TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4			SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5			SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6			SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4			CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2,5			CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6			CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Control Channel RMC	Config 1,4			CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5			CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6			CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
SSB configuration	Config 1,4			SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2,5			SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3,6			SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Time offset with Cell 2	Config 1,4		ms	-	3	-	3	-	3
	Config 2,3,5,6		µs	-	3	-	3	-	3
SMTC configuration	Config 1,4			SMTC.2					
	Config 2,3,5,6			SMTC.1					
OCNG Patterns				OP.1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5		kHz	15 kHz					
	Config 3,6			30 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15KhZ	-106		-88		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-94		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-106		-88		Same as Noc/15 kHz	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-91		-111	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$			dB	2.46	-5.97	2.46	-5.97	-0.01	-4.76
$\hat{E}_s/N_{oc}$			dB	6	1	6	1	3	0
SS-RSRP Note 3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-100	-105	-82	-87	-111.00	-114.00
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.50	-113.50
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110.00	-113.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.50	-112.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109.00	-112.00
		NR_FDD_FR1_F						-108.50	-111.50
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108.00	-111.00
		NR_FDD_FR1_H						-107.50	-110.50
		NR_FDD_FR1_N						-104.50	-107.50
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		- Not applicable Note 5	Not applicable Note 5	-85	-90	-108.00	-111.00
		NR_FDD_FR1_B, NR_TDD_FR1_B						-107.50	-110.50
		NR_FDD_FR1_C, NR_TDD_FR1_C						-107.00	-110.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-106.50	-109.50
		NR_FDD_FR1_E,						-106.00	-109.00

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_TDD_FR1_E							
		NR_FDD_FR1_F						-105.50	-108.50
		NR_FDD_FR1_G, NR_TDD_FR1_G						-105.00	-108.00
		NR_FDD_FR1_H						-104.50	-107.50
		NR_FDD_FR1_N						-101.50	-104.50
Io[Note3]	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A [NOTE 6]	dBm/ 9.36 MHz	-70.09		-52.09		-80.03	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-79.53	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-79.03	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-78.53	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-78.03	
		NR_FDD_FR1_F						-77.53	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-77.03	
		NR_FDD_FR1_H						-76.53	
		NR_FDD_FR1_N						-73.53	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A [NOTE 6]	dBm/ 38.16 MHz	Not applicable[Note 5]		-51.99		-73.94	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-73.44	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-72.94	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-72.44	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-71.94	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_F						-71.44	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-70.94	
		NR_FDD_FR1_H						-70.44	
		NR_FDD_FR1_N						-67.44	
Propagation condition			-	AWGN					
Antenna configuration				1x2					
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: Subtest 1 is not used when testing with 30 kHz SSB SCS NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification									

A.4.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil absolute requirement in clause 10.1.2.1.1 and relative requirement in clause 10.1.2.1.2.

A.4.7.1.2 EN-DC inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.4.1.1 and 10.1.4.1.2 for inter-frequency measurements with the testing configurations in table A.4.7.1.2.1-1.

Table A.4.7.1.2.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations on each supported band	

A.4.7.1.2.2 Test parameters

In this set of test cases there are three cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.4.7.1.2.2-1 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in table A.4.7.1.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.4.7.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter		Config	Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		1~6		freq1	freq2	freq1	freq2
$BW_{channel}$		1,4	MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
		2,5		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
		3,6		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
Gap pattern ID				0		0	
Duplex mode		1,4		FDD		FDD	
		2,5		TDD		TDD	
		3,6		TDD		TDD	
TDD configuration		1,4		N/A		N/A	
		2,5		TDDConf.1.1		TDDConf.1.1	
		3,6		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel		1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
		2,5		SR.1.1 TDD		SR.1.1 TDD	
		3,6		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel		1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
		2,5		CR.1.1 TDD	-	CR.1.1 TDD	-
		3,6		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel		1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
		2,5		CCR.1.1 TDD	-	CCR.1.1 TDD	-
		3,6		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration		1,4		SSB.1 FR1		SSB.1 FR1	
		2,5		SSB.1 FR1		SSB.1 FR1	
		3,6		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns		1~6		OP.1		OP.1	
TRS configuration		1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-
		2,5		TRS.1.1 TDD		TRS.1.1 TDD	
		3,6		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration		1~6		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration		1~6		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 2		1,4	ms	-	3	-	3
		2,3,5,6	µs	-	3	-	3
SMTC configuration		1,4		SMTC.2		SMTC.2	
		2,3,5,6		SMTC.1		SMTC.1	
EPRE ratio of PSS to SSS EPRE ratio of PBCH DMRS to SSS EPRE ratio of PBCH to PBCH DMRS EPRE ratio of PDCCH DMRS to SSS EPRE ratio of PDCCH to PDCCH DMRS EPRE ratio of PDSCH DMRS to SSS EPRE ratio of PDSCH to PDSCH DMRS EPRE ratio of OCNG DMRS to SSS Note 1 EPRE ratio of OCNG to OCNG DMRS Note 1		1~6	dB	0	0	0	0
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1~6	dBm/15 kHz	-94.65		(N_{oc} for Cell 3 +8 dB)	-115
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NF_FDD_FR1_F						-112.5
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_N						-108.5

Parameter		Config	Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2,4,5	dBm/SSB SCS	-94.65		(N_{oc} for Cell 3 +8 dB)	-115
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_N						-108.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5, NR_SDL_FR1_A	3,6		-91.65		(N_{oc} for C 3 +8 dB)	-112.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-111.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-111.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-110.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-110.00
	NR_FDD_FR1_F						-109.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-109.00
	NR_FDD_FR1_H						-108.50
	NR_FDD_FR1_N						-105.50
$\hat{E}_s/I_{ot}$		1~6	dB	10	10	13	-3
SS-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SCS	-84.65		(RSRP for Cell 3 +24 dB)	-118.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-117.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-117.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-116.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-116.00
	NR_FDD_FR1_F						-115.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-115.00
	NR_FDD_FR1_H						-114.50
	NR_FDD_FR1_N						-111.50
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3,6		-81.65		(RSRP for Cell 3 +24 dB)	-115.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113.00
	NR_FDD_FR1_F						-112.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112.00
	NR_FDD_FR1_H						-111.50
	NR_FDD_FR1_N						-108.50
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6,	1,2,4,5	dBm/ 9.36 MHz	-56.28		(Io for Channel 3 +19.45 dB)	-85.28
	NR_FDD_FR1_B, NR_TDD_FR1_B						-84.78
	NR_FDD_FR1_C, NR_TDD_FR1_C						-84.28

Parameter		Config	Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
	NR_FDD_FR1_D, NR_TDD_FR1_D						-83.78
	NR_FDD_FR1_E, NR_TDD_FR1_E						-83.28
	NR_FDD_FR1_F						-82.78
	NR_FDD_FR1_G, NR_TDD_FR1_G						-82.28
	NR_FDD_FR1_H						-81.78
	NR_FDD_FR1_N						-78.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6,	3,6	dBm/ 38.16 MHz	-50.19		(Io for Channel 3 +19.45 dB)	-79.19
	NR_FDD_FR1_B, NR_TDD_FR1_B						-78.69
	NR_FDD_FR1_C, NR_TDD_FR1_C						-78.19
	NR_FDD_FR1_D, NR_TDD_FR1_D						-77.69
	NR_FDD_FR1_E, NR_TDD_FR1_E						-77.19
	NR_FDD_FR1_F						-76.69
	NR_FDD_FR1_G, NR_TDD_FR1_G						-76.19
	NR_FDD_FR1_H						-75.69
	NR_FDD_FR1_N						-72.69
$\hat{E}_s / N_{oc}$		1~6	dB	10	10	13	-3
Propagation condition		1~6	-	AWGN		AWGN	
Antenna configuration				1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5 The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil the Absolute requirement in clause 10.1.4.1.1 and Relative requirement in clause 10.1.4.1.2.

A.4.7.1.3 Void

A.4.7.2 SS-RSRQ

A.4.7.2.1 EN-DC Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.7.1.1.

A.4.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.4.7.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in table A.4.7.2.1.2-

2. The configuration of Cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.4.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.4.7.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
Cell ID			489	0	489	0	489	0
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1,4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Control Channel RMC	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns			OP. 1					
SS-RSSI-Measurement			Not Applicable					
Time offset with Cell 2	Config 1,4	ms	-	3	-	3	-	3
	Config 2,3,5,6	µs	-	3	-	3	-	3
SMTC configuration	Config 1,4		SMTC.2					
	Config 2,3,5,6		SMTC.1					
SSB configuration	Config 1,2,4,5		SSB.1 FR1					
	Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz					
	Config 3,6		30 kHz					

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/15 kHz	-85		-101		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7		-91		-		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/SCS	-85		-101		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7		-88		-		-111	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$			dB	-1.76		-4.7		-5.46	-5.46
$\hat{E}_s/N_{oc}$			dB	3	3	-2.9	-2.9	-4	-4
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/SCS	-82	-82	-103.9	-103.9	-118	-118
		NR_FDD_FR1_B, NR_TDD_FR1_B						-117.5	-117.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-117	-117
		NR_FDD_FR1_D, NR_TDD_FR1_D						-116.5	-116.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-116	-116
		NR_FDD_FR1_F						-115.5	-115.5
		NR_FDD_FR1_G, NR_TDD_FR1_G						-115	-115
		NR_FDD_FR1_H						-114.5	-114.5
		NR_FDD_FR1_N						-111.5	-111.5
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7		-85	-85	-	-	-115	-115
		NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5	-114.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-114	-114
		NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5	-113.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-113	-113
		NR_FDD_FR1_F						-112.5	-112.5
		NR_FDD_FR1_G, NR_TDD_FR1_G						-112	-112
		NR_FDD_FR1_H						-111.5	-111.5
		NR_FDD_FR1_N						-108.5	-108.5
SS-RSRQ Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dB	-14.77	-14.77	-16.76	-16.76	-17.34	-17.34
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D, NR_TDD_FR1_D							
		NR_FDD_FR1_E, NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G, NR_TDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/ 9.36 MHz	-50		-70		-83.5	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_B, NR_TDD_FR1_B						-83	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-82.5	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-82	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-81.5	
		NR_FDD_FR1_F						-81	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-80.5	
		NR_FDD_FR1_H						-80	
		NR_FDD_FR1_N						-77	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/ 38.16 MHz	-50		-		-77.4	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-76.9	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-76.4	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-75.9	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-75.4	
		NR_FDD_FR1_F						-74.9	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-74.4	
		NR_FDD_FR1_H						-73.9	
		NR_FDD_FR1_N						-70.9	
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: Subtest 2 is not used when testing with 30 kHz SSB SCS
NOTE 7: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.7.1.1.

A.4.7.2.2 EN-DC Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.9.1.1 and 10.1.9.1.2 for inter frequency measurement.

A.4.7.2.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.4.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in table A.4.7.2.2.2-2. In all

test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1.

Table A.4.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.7.2.2.2-2: SS-RSRQ Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1,4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns			OCNG pattern 1					
Time offset with Cell 2	Config 1,4	ms	-	3	-	3	-	3
	Config 2,3,5,6	µs	-	3	-	3	-	3
SMTC configuration	Config 1,4		SMTC pattern 2					
	Config 2,3,5,6		SMTC pattern 1					
SSB configuration	Config 1,2,4,5		SSB pattern 1 in FR1					
	Config 3,6		SSB pattern 2 in FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz					
	Config 3,6		30 kHz					
EPRE ratio of PSS to SSS		dB	0	0	0	0	0	0

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/15 kHz	-80.18	-80.18	-106	-106	-116	-116
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	-115.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	-115
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	-114.5
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	-114
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	-113
		NR_FDD_FR1_H						-112.5	-112.5
		NR_FDD_FR1_N						-109.5	-109.5
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/15 kHz	-86.27	-86.27	-113	-113	-116	-116
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	-115.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	-115
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	-114.5
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	-114
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	-113
		NR_FDD_FR1_H						-112.5	-112.5
		NR_FDD_FR1_N						-109.5	-109.5
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/SCS	-80.18	-80.18	-106	-106	-116	-116
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	-115.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	-115
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	-114.5
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	-114
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	-113
		NR_FDD_FR1_H						-112.5	-112.5
		NR_FDD_FR1_H						-112.5	-112.5
		NR_FDD_FR1_N						-109.5	-109.5
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A		-83.27	-83.27	-110	-110	-113	-113
		NR_FDD_FR1_B, NR_TDD_FR1_B						-112.5	-112.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-112	-112
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	-111.5
		NR_FDD_FR1_E						-111	-111

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_TDD_FR1_E							
		NR_FDD_FR1_G, NR_TDD_FR1_G						-110	-110
		NR_FDD_FR1_H						-109.5	-109.5
		NR_FDD_FR1_N						-106.5	-106.5
$\hat{E}_s / I_{ot}$			dB	-1.75	-1.75	-1.75	-1.75	3	-1.75
$\hat{E}_s / N_{oc}$			dB	-1.75	-1.75	-1.75	-1.75	3	-1.75
SS-RSRP[Note3]	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/SCS	-81.93	-81.93	-107.75	-107.75	-113	-117.75
		NR_FDD_FR1_B, NR_TDD_FR1_B						-112.5	-117.25
		NR_FDD_FR1_C, NR_TDD_FR1_C						-112	-116.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	-116.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	-115.75
		NR_FDD_FR1_G, NR_TDD_FR1_G						-110	-114.75
		NR_FDD_FR1_H						-109.5	-114.25
		NR_FDD_FR1_N						-106.5	-111.25
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A		-85.02	-85.02	-111.75	-111.75	-110	-114.75
		NR_FDD_FR1_B, NR_TDD_FR1_B						-109.5	-114.25
		NR_FDD_FR1_C, NR_TDD_FR1_C						-109	-113.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-108.5	-113.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-108	-112.75
		NR_FDD_FR1_G, NR_TDD_FR1_G						-107	-111.75
		NR_FDD_FR1_H						-106.5	-111.25
		NR_FDD_FR1_N						-103.5	-108.25
SS-RSRQ [Note3]		NR_FDD_FR1_A NR_TDD_FR1_A	dB	-14.77	-14.77	-14.77	-14.77	-12.56	-14.76
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_G, NR_TDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io[Note3]	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/ 9.36 MHz	-50	-50	-75.83	-75.83	-83.28	-85.83
		NR_FDD_FR1_B, NR_TDD_FR1_B						-82.78	-85.33
		NR_FDD_FR1_C, NR_TDD_FR1_C						-82.28	-84.83
		NR_FDD_FR1_D NR_TDD_FR1_D						-81.78	-84.33

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_E NR_TDD_FR1_E						-81.28	-83.83
		NR_FDD_FR1_G, NR_TDD_FR1_G						-80.28	-82.83
		NR_FDD_FR1_H						-79.78	-82.33
		NR_FDD_FR1_N						-76.78	-79.33
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/ 38.16 MHz	-50	-50	-76.73	-76.73	-77.19	-79.73
		NR_FDD_FR1_B, NR_TDD_FR1_B						-76.69	-79.23
		NR_FDD_FR1_C, NR_TDD_FR1_C						-76.19	-78.73
		NR_FDD_FR1_D NR_TDD_FR1_D						-75.69	-78.23
		NR_FDD_FR1_E NR_TDD_FR1_E						-75.19	-77.73
		NR_FDD_FR1_G, NR_TDD_FR1_G						-74.19	-76.73
		NR_FDD_FR1_H						-73.69	-76.53
		NR_FDD_FR1_N						-70.69	-73.53
Propagation condition				AWGN	AWGN	AWGN	AWGN	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.

A.4.7.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.9.1.1 and 10.1.9.1.2.

A.4.7.3 SS-SINR

A.4.7.3.1 EN-DC Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.12.1.1.

A.4.7.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.4.7.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in table A.4.7.3.1.2-2. The configuration of Cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.4.7.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.7.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1,4		FDD			
	Config 2,3,5,6		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2,5		TDDConf.1.1			
	Config 3,6		TDDConf.2.1			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
DRX Cycle configuration		ms	Not Applicable			
TRS Configuration	Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns			OP.1			
SS-RSSI-Measurement			Not Applicable			
Time offset with Cell 2	Config 1,4	ms	-	3	-	3
	Config 2,3,5,6	µs	-	3	-	3
SMTC configuration	Config 1,4		SMTC.2			
	Config 2,3,5,6		SMTC.1			
SSB configuration	Config 1,2,4,5		SSB.1 FR1			
	Config 3,6		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15			
	Config 3,6		30			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-93		-116	
	NR_FDD_FR1_B, NR_TDD_FR1_B				-115.5	

Parameter			Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_C, NR_TDD_FR1_C				-115	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-114.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-114	
		NR_FDD_FR1_F				-113.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-113	
		NR_FDD_FR1_H				-112.5	
		NR_FDD_FR1_N				-109.5	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-93		Same as Noc for 15 kHz	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-90		-113	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-112.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-112	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-111.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-111	
		NR_FDD_FR1_F				-110.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-110	
		NR_FDD_FR1_H				-109.5	
		NR_FDD_FR1_N				-106.5	
$\hat{E}_s/I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s/N_{oc}$			dB	4.54	2.66	-4	-4
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A	dBm/SCS	-88.46	-90.34	-120	-120
		NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5	-119.5
		NR_FDD_FR1_C, NR_TDD_FR1_C				-119	-119
		NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5	-118.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-118	-118
		NR_FDD_FR1_F				-117.5	-117.5
		NR_FDD_FR1_G, NR_TDD_FR1_G				-117	-117
		NR_FDD_FR1_H				-116.5	-116.5
		NR_FDD_FR1_N				-113.5	-113.5
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85.46	-87.34	-117	-117
		NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5	-116.5
		NR_FDD_FR1_C, NR_TDD_FR1_C				-116	-116
		NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5	-115.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-115	-115
		NR_FDD_FR1_F				-114.5	-114.5
		NR_FDD_FR1_G, NR_TDD_FR1_G				-114	-114
		NR_FDD_FR1_H				-113.5	-113.5
		NR_FDD_FR1_N				-110.5	-110.5

Parameter			Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
SS-SINR Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	0	-3.19	-5.46	-5.46
		NR_FDD_FR1_B, NR_TDD_FR1_B					
		NR_FDD_FR1_C, NR_TDD_FR1_C					
		NR_FDD_FR1_D, NR_TDD_FR1_D					
		NR_FDD_FR1_E, NR_TDD_FR1_E					
		NR_FDD_FR1_F					
		NR_FDD_FR1_G, NR_TDD_FR1_G					
		NR_FDD_FR1_H					
		NR_FDD_FR1_N					
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.5		-85.51	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-85.01	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-84.51	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-84.01	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-83.51	
		NR_FDD_FR1_F				-83.01	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-82.51	
		NR_FDD_FR1_H				-82.01	
		NR_FDD_FR1_N				-79.01	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-51.41		-79.41	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-78.91	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-78.41	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-77.91	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-77.41	
		NR_FDD_FR1_F				-76.91	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-76.41	
		NR_FDD_FR1_H				-75.91	
		NR_FDD_FR1_N				-72.91	
Propagation condition			-	AWGN			
Antenna configuration			-	1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: NR operating band groups are as defined in clause 3.5.2.

NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.3.1.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.12.1.1.

A.4.7.3.2 EN-DC Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.14.1.1 and 10.1.14.1.2 for interfrequency measurement.

A.4.7.3.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.4.7.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in table A.4.7.3.2.2-2. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell of which specific test parameters for this test case are specified in table A.3.7.2.1-1.

Table A.4.7.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.7.3.2.2-2: SS-SINR Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1,4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
DRX Cycle configuration		ms	Not Applicable					
Gap pattern ID			0	-	0	-	0	-
TRS configuration	Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
	Config 3,6			CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4			CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5			CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6			CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 2	Config 1,4		ms	-	3	-	3	-	3
	Config 2,3,5,6		μs	-	3	-	3	-	3
SMTC configuration	Config 1,4			SMTC.2					
	Config 2,3,5,6			SMTC.1					
SSB configuration	Config 1,2,4,5			SSB.1 FR1					
	Config 3,6			SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5		kHz	15					
	Config 3,6			30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-88		-108.5		-119.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-119	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-118.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-118	
		NR_FDD_FR1_E NR_TDD_FR1_E						-117.5	
		NR_FDD_FR1_F						-117	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-116.5	
		NR_FDD_FR1_H						-116	
		NR_FDD_FR1_N						-113	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-88		-108.5		Same as Noc for 15 kHz	
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85		-105.5		-116.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-116	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-115	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114.5	
		NR_FDD_FR1_F						-114	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-114.5	
		NR_FDD_FR1_H						-113	
		NR_FDD_FR1_N						-110	
$\hat{E}_s/I_{ot}$			dB	-1.75		20		-4.0	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
$\hat{E}_s / N_{oc}$			dB	-1.75		20		-4.0	
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-89.75		-88.5		-123.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-123	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-122.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-122	
		NR_FDD_FR1_E NR_TDD_FR1_E						-121.5	
		NR_FDD_FR1_F						-121	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-120.5	
		NR_FDD_FR1_H						-120	
		NR_FDD_FR1_N						-117	
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-86.75		-85.5		-120.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-120	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-119.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-119	
		NR_FDD_FR1_E NR_TDD_FR1_E						-118.5	
		NR_FDD_FR1_F						-118	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-117.5	
		NR_FDD_FR1_H						-117	
		NR_FDD_FR1_N						-114	
SS-SINR Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-1.75		20		-4.0	
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G, NR_TDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.83		-60.5		-90.09	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-89.59	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-89.09	
		NR_FDD_FR1_D NR_TDD_FR1_D						-88.59	
		NR_FDD_FR1_E NR_TDD_FR1_E						-88.09	
		NR_FDD_FR1_F						-87.59	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-87.09	
		NR_FDD_FR1_H						-86.59	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_N						-83.59	
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-51.73		-54.41		-84	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-83.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-83	
		NR_FDD_FR1_D NR_TDD_FR1_D						-82.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-82	
		NR_FDD_FR1_F						-81.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-81	
		NR_FDD_FR1_H						-80.5	
		NR_FDD_FR1_N						-77.5	
Propagation condition			-	AWGN					
Antenna configuration			-	1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.3.2.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.14.1.1 and 10.1.14.1.2.

A.4.7.4 L1-RSRP measurement for beam reporting

A.4.7.4.1 SSB based L1-RSRP measurement

A.4.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.5.2 and clause 10.1.19.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.4.7.4.1.1-1.

Table A.4.7.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.4.7.4.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in table A.4.7.4.1.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.4.7.4.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.4.7.4.1.2-1: FR1 SSB based L1-RSRP test parameters

Parameter		Config	Unit	Test 1	Test 2
SSB ARFCN		1~6		freq1	freq1
Duplex mode		1,4		FDD	FDD
		2,5		TDD	TDD
		3,6		TDD	TDD
TDD Configuration		1,4		N/A	N/A
		2,5		TDDConf.1.1	TDDConf.1.1
		3,6		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$		1,4	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
		2,5		10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
		3,6		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel		1,4		SR.1.1 FDD	SR.1.1 FDD
		2,5		SR.1.1 TDD	SR.1.1 TDD
		3,6		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel		1,4		CR.1.1 FDD	CR.1.1 FDD
		2,5		CR.1.1 TDD	CR.1.1 TDD
		3,6		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel		1,4		CCR.1.1 FDD	CCR.1.1 FDD
		2,5		CCR.1.1 TDD	CCR.1.1 TDD
		3,6		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration		1,4		SSB.3 FR1	SSB.3 FR1
		2,5		SSB.3 FR1	SSB.3 FR1
		3,6		SSB.4 FR1	SSB.4 FR1
OCNG Patterns		1~6		OP.1	OP.1
TRS configuration		1,4		TRS.1.1 FDD	TRS.1.1 FDD
		2,5		TRS.1.1 TDD	TRS.1.1 TDD
		3,6		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration		1~6		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration		1~6		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration		1~6		SMTC.1	SMTC.1
reportConfigType		1~6		periodic	periodic
reportQuantity		1~6		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS		1~6		2	2
L1-RSRP reporting period		1~6		slot80	slot80
EPRE ratio of PSS to SSS		1~6	dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SSB SCS	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-91.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
$\hat{E}_s/I_{ot}$		1~6	dB	10	-3
SSB RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SSB SCS	-84.65	-120
	NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_N				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-81.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B, NR_TDD_FR1_B				-86.78
	NR_FDD_FR1_C, NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G, NR_TDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_N				-80.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6	dBm/38.16 MHz	-50.19	-81.19
	NR_FDD_FR1_B, NR_TDD_FR1_B				-80.69
	NR_FDD_FR1_C, NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G, NR_TDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
	NR_FDD_FR1_N				-74.69
$\hat{E}_s / N_{oc}$		1~6	dB	10	-3
Propagation condition		1~6		AWGN	AWGN
Antenna configuration		1~6		1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.4.1.3 Test Requirements

The L1-RSRP measurement accuracy for SSB resource reported by UE in L1-RSRP report (SSB#0 or SSB#1) of Cell 2 shall fulfil the requirements in clauses 10.1.19.1.

A.4.7.4.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.4.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.5.3 and clause 10.1.19.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in table A.4.7.4.2.1-1.

Table A.4.7.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.4.7.4.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in table A.4.7.4.2.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.4.7.4.2.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.4.7.4.2.2-1: FR1 CSI-RS based L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~6		freq1	freq1
Duplex mode	1,4		FDD	FDD
	2,5		TDD	TDD
	3,6		TDD	TDD
TDD Configuration	1,4		N/A	N/A
	2,5		TDDConf.1.1	TDDConf.1.1
	3,6		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	2,5		10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	3,6		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD	SR.1.1 FDD
	2,5		SR.1.1 TDD	SR.1.1 TDD
	3,6		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD	CR.1.1 FDD
	2,5		CR.1.1 TDD	CR.1.1 TDD
	3,6		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD	CCR.1.1 FDD
	2,5		CCR.1.1 TDD	CCR.1.1 TDD
	3,6		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1	SSB.3 FR1
	2,5		SSB.3 FR1	SSB.3 FR1
	3,6		SSB.4 FR1	SSB.4 FR1
OCNG Patterns	1~6		OP.1	OP.1
TRS configuration	1,4		TRS.1.1 FDD	TRS.1.1 FDD
	2,5		TRS.1.1 TDD	TRS.1.1 TDD
	3,6		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1	SMTC.1
CSI-RS	1,4		CSI-RS 1.2 FDD	CSI-RS 1.2 FDD
	2,5		CSI-RS 1.2 TDD	CSI-RS 1.2 TDD
	3,6		CSI-RS 2.2 TDD	CSI-RS 2.2 FDD

Parameter		Config	Unit	Test 1	Test 2
reportConfigType		1~6		periodic	periodic
reportQuantity		1~6		cri-RSRP	cri-RSRP
Number of reported RS		1~6		2	2
L1-RSRP reporting period		1~6		slot80	slot80
EPRE ratio of PSS to SSS		1~6	dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/CSI-RS SCS	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-91.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
$\hat{E}_s/I_{ot}$		1~6	dB	10	10

Parameter		Config	Unit	Test 1	Test 2
CSI-RS RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/CSI-RS SCS	-84.65	-120
	NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_N				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-81.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B, NR_TDD_FR1_B				-86.78
	NR_FDD_FR1_C, NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G, NR_TDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_N				-80.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6	dBm/38.16 MHz	-50.19	-81.19
	NR_FDD_FR1_B, NR_TDD_FR1_B				-80.69
	NR_FDD_FR1_C, NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G, NR_TDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
	NR_FDD_FR1_N				-74.69
$\hat{E}_s / N_{oc}$		1~6	dB	10	-3
Propagation condition		1~6		AWGN	AWGN
Antenna configuration		1~6		1x2	1x2

Parameter	Config	Unit	Test 1	Test 2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification				

A.4.7.4.2.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS resource reported by UE in L1-RSRP report (CSI-RS#0 or CSI-RS#1) of Cell 2 shall fulfil the requirements in clauses 10.1.19.2.

A.4.7.5 SFTD accuracy

A.4.7.5.1 SFTD accuracy

A.4.7.5.1.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the SFTD measurement accuracy is within the specified limits. This test will verify the requirements as specified in clause 9.1.27 in TS 36.133 [15] for EN-DC SFTD measurements.

A.4.7.5.1.2 Test Parameters

Supported test configurations are shown in table A.4.7.5.1.2-1. In this set of test cases there are two cells on different carriers. Cell 1 is E-UTRAN PCell and Cell 2 is NR FR1 PSCell. The test parameters of Cell 1 are given in clause A.3.7.2.1. The test parameters of Cell 2 are given in table A.4.7.5.1.2-2. The SFTD between PCell and PSCell shall be set by the test equipment to one of the time differences in table A.4.7.5.1.2-3.

Table A.4.7.5.1.2-1: Supported test configurations for SFTD accuracy

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.7.5.1.2-2: Test parameters for SFTD accuracy

Parameter	Config	Unit	Test 1
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2,5		10: $N_{PRB,c}$ = 52
	3,6		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD

Parameter		Config	Unit	Test 1
		3,6		SR.2.1 TDD
RMSI CORESET Reference Channel		1,4		CR.1.1 FDD
		2,5		CR.1.1 TDD
		3,6		CR.2.1 TDD
RMC CORESET Reference Channel		1,4		CCR.1.1 FDD
		2,5		CCR.1.1 TDD
		3,6		CCR.2.1 TDD
SSB configuration		1,4		SSB.1 FR1
		2,5		SSB.1 FR1
		3,6		SSB.2 FR1
SMTC configuration		1~6		SMTC.1
DL BWP configuration		1~6		DLBWP.1.1
UL BWP configuration		1~6		ULBWP.1.1
CSI-RS for tracking		1,4		TRS.1.1 FDD
		2,5		TRS.1.1 TDD
		3,6		TRS.1.2 TDD
OCNG Patterns		1~6		OP.1
EPRE ratio of PSS to SSS		1~6	dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15 kHz	-104
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SSB SCS	-104
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-101
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			

Parameter		Config	Unit	Test 1
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
$\hat{E}_s/I_{ot}$		1~6	dB	-3
$\hat{E}_s/N_{oc}$		1~6	dB	-3
SS-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SCS	-107
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-104
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/9.36 MHz	-74.28
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6	dBm/38.16 MHz	-68.18
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			

Parameter		Config	Unit	Test 1
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
Propagation condition		1~6		AWGN
Antenna configuration		1~6		1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification				

Table A.4.7.5.1.2-3: Timing offsets for SFTD accuracy test

Condition	SFN offset between PCell and PSCell	Frame boundary offset between PCell and PSCell (Ts)
1	100	-122000
2	300	-60540
3	500	1000
4	700	62540
5	900	124000

A.4.7.5.1.3 Test Requirements

The SFTD reported by the UE consists of 2 elements, SFN offset and frame boundary offset between PCell and PSCell. The reported SFTD accuracy shall fulfil the requirement in clause 9.1.27 in TS 36.133 [15].

A.4.7.5.2 Void

A.4.7.5.3 Void

A.4.7.6 CLI measurements

A.4.7.6.1 EN-DC SRS-RSRP measurement accuracy with FR1 serving cell

A.4.7.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SRS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.22.1.1 with the testing configurations for NR cells in table A.4.7.6.1.1-1.

Table A.4.7.6.1.1-1: Applicable NR configurations for FR1 SRS-RSRP accuracy test

Config	Description
1	LTE FDD, NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 30 kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
3	LTE TDD, NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30 kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.4.7.6.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in table A.4.7.6.1.2-1 below. The test parameter for the (virtual) neighbor cell UE transmitting SRS are given in table A.4.7.6.1.2-2.

Before the test UE is configured to perform SRS-RSRP measurement. During the test, the test system transmits SRS resources for measurement in the DL slots according to the SRS configuration in table A.4.7.6.1.2-3. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 1 data symbol before SRS to be transmitted.

Table A.4.7.6.1.2-1: FR1 test parameters for SRS-RSRP accuracy for PSCell

Parameter		Config	Unit	Test 1	Test 2	Test 3
SSB ARFCN		1~4		freq1	freq1	freq1
Duplex mode		1~4		TDD	TDD	TDD
TDD configuration		1,3		TDDConf.1.1	TDDConf.1.1	TDDConf.1.1
		2,4		TDDConf.2.1	TDDConf.2.1	TDDConf.2.1
$BW_{channel}$		1,3	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
		2,4		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel		1,3		SR.1.1 TDD	SR.1.1 TDD	SR.1.1 TDD
		2,4		SR.2.1 TDD	SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel		1,3		CR.1.1 TDD	CR.1.1 TDD	CR.1.1 TDD
		2,4		CR.2.1 TDD	CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel		1,3		CCR.1.1 TDD	CCR.1.1 TDD	CCR.1.1 TDD
		2,4		CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration		1,3		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
		2,4		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
OCNG Patterns		1~4		OP.1	OP.1	OP.1
TRS configuration		1,3		TRS.1.1 TDD	TRS.1.1 TDD	TRS.1.1 TDD
		2,4		TRS.1.2 TDD	TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration		1~4		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration		1~4		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration		1~4		SMTC.1	SMTC.1	SMTC.1
Time offset between DL from serving cell and SRS from test system		1~4	μs	17.67	17.67	17.67
EPRE ratio of PSS to SSS		1~4	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
N_{oc} Note2	NR_TDD_FR1_A Note3	1,3	dBm/15 kHz	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A Note3	2,4		Not applicable Note4	-91	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5

Parameter		Config	Unit	Test 1	Test 2	Test 3
	NR_TDD_FR1_E					-112
N_{oc} Note2	NR_TDD_FR1_A Note3	1,3	dBm/SRS SCS	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A Note3	2,4		Not applicable Note4	-88	-111
	NR_TDD_FR1_C					-110
	NR_TDD_FR1_D					-109.5
	NR_TDD_FR1_E					-109
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification						
NOTE 4: Test 1 is not used when testing with 30 kHz SSB SCS						

Table A.4.7.6.1.2-2: FR1 test parameters for SRS-RSRP accuracy for neighbour cell UE

Parameter		Config	Unit	Test 1	Test 2	Test 3
N_{oc} Note2	NR_TDD_FR1_A NOTE 3	1,3	dBm/15 kHz	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A NOTE 5	2,4		Not applicable Note 6	-91	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
N_{oc} Note2	NR_TDD_FR1_A NOTE 5	1,3	dBm/SRS SCS	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A NOTE 5	2,4		Not applicable Note 6	-88	-111
	NR_TDD_FR1_C					-110
	NR_TDD_FR1_D					-109.5
	NR_TDD_FR1_E					-109
$\hat{E}_s/I_{ot}$ on SRS		1~4	dB	1	1	1
SRS RSRP Note3	NR_TDD_FR1_A NOTE 5	1,3	dBm/SRS SCS	-105	-87	-113
	NR_TDD_FR1_C					-112
	NR_TDD_FR1_D					-111.5
	NR_TDD_FR1_E					-111
	NR_TDD_FR1_A NOTE 5	2,4		Not applicable Note 6	-87	-110
	NR_TDD_FR1_C					-109
	NR_TDD_FR1_D					-108.5
	NR_TDD_FR1_E					-108
Io Note3	NR_TDD_FR1_A NOTE 5	1,3	dBm/9.36 MHz	-74.51	-56.51	-82.51
	NR_TDD_FR1_C					-81.51
	NR_TDD_FR1_D					-81.01
	NR_TDD_FR1_E					-79.51
	NR_TDD_FR1_A NOTE 5	2,4	dBm/38.16 MHz	Not applicable Note 6	-53.42	-76.42
	NR_TDD_FR1_C					-75.42

Parameter		Config	Unit	Test 1	Test 2	Test 3
	NR_TDD_FR1_D					-74.92
	NR_TDD_FR1_E					-74.42
$\hat{E}_s / N_{oc}$ on SRS		1~4	dB	1	1	1
Propagation condition		1~4		AWGN	AWGN	AWGN
Antenna configuration		1~4		1x2	1x2	1x2
SRS configuration		1,3		SRSConf.1	SRSConf.1	SRSConf.1
		2,4		SRSConf.2	SRSConf.2	SRSConf.2

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of the test.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification
NOTE 6: Test 1 is not used when testing with 30 kHz SSB SCS

Table A.4.7.6.1.2-3: SRS configuration parameters for FR1 SRS-RSRP accuracy

	Field	SRSConf.1	SRSConf.2
SRS-ResourceSet	*srs-ResourceSetId*	0	0
	srs-ResourceIdList	0	0
	resourceType	Periodic	Periodic
	Usage	Codebook	Codebook
SRS-Resource	*SRS-ResourceId*	0	0
	nrofSRS-Ports	Port1	Port1
	transmissionComb	n2	n2
	combOffset-n2	0	0
	cyclicShift-n2	0	0
	resourceMapping startPosition	0	0
	resourceMapping nrofSymbols	n1	n1
	resourceMapping repetitionFactor	n1	n1
	freqDomainPosition	0	0
	freqDomainShift	0	0
	freqHopping c-SRS	12	12
	freqHopping b-SRS	0	0
	freqHopping b-hop	0	0
	groupOrSequenceHopping	Neither	Neither
	resourceType	Periodic	Periodic
	periodicityAndOffset-p	sl20, 9	sl40, 19
	sequenceId	0	0

A.4.7.6.1.3 Test Requirements

The SRS-RSRP measurement accuracy shall fulfil the requirements in clauses 10.1.22.1.1.

A.4.7.6.2 EN-DC CLI-RSSI measurement accuracy with FR1 serving cell

A.4.7.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CLI-RSSI measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.22.2.1 with the testing configurations for NR cells in table A.4.7.6.2.1-1.

Table A.4.7.6.2.1-1: Applicable NR configurations for FR1 CLI-RSSI accuracy test

Config	Description
1	LTE FDD, NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 30 kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
3	LTE TDD, NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30 kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.4.7.6.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in table A.4.7.6.2.2-1 below.

Before the test UE is configured to perform CLI-RSSI measurement. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI resource and on 1 data symbol before. The CLI-RSSI measurement resource configuration is in table A.4.7.6.2.2-2.

Table A.4.7.6.2.2-1: FR1 test parameters for CLI-RSSI accuracy

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1~4		TDD
TDD configuration	1,3		TDDConf.1.1
	2,4		TDDConf.2.1
$BW_{channel}$	1,3	MHz	10: $N_{PRB,c}$ = 52
	2,4		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,3		SR.1.1 TDD
	2,4		SR.2.1 TDD
RMSI CORESET Reference Channel	1,3		CR.1.1 TDD
	2,4		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,3		CCR.1.1 TDD
	2,4		CCR.2.1 TDD
SSB configuration	1,3		SSB.1 FR1
	2,4		SSB.2 FR1
OCNG Patterns Note6	1~4		OP.1
TRS configuration	1,3		TRS.1.1 TDD
	2,4		TRS.1.2 TDD
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~4		SMTC.1
Time offset between DL from serving cell and OCNG from test system	1~4	µs	17.67
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} on CLI-RSSI measurement resource Note2	1,3	dBm/15 kHz	-106
	2,4		-106
N_{oc} on CLI-RSSI measurement resource Note2	1,3	dBm/ BWP SCS	-106
	2,4		-103
$\hat{E}_s/I_{ot}$ on CLI-RSSI measurement resource	1~4	dB	-Infinity
RSRP on CLI-RSSI measurement resource Note3	1~4	dBm/ BWP SCS	-Infinity

Parameter	Config	Unit	Value
Io on CLI-RSSI measurement resource Note3	1,3	dBm/9.36 MHz	-78.05
	2,4	dBm/38.16 MHz	-71.96
Io on CLI-RSSI measurement resource Note3	1,3	dBm/1.08 MHz	-87.43
	2,4		-87.44
$\hat{E}_s / N_{oc}$ on CLI-RSSI measurement resource	1~4	dB	-Infinity
Propagation condition	1~4		AWGN
Antenna configuration	1~4		1x2
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification			
NOTE 6: OCNG is not transmitted in the CLI-RSSI measurement resources.			

Table A.4.7.6.2.2-2: CLI-RSSI measurement resource configuration for FR1 CLI-RSSI accuracy

	Field	Config	SRSConf.1
CLI-RSSI measurement resource	rssi-ResourceId	1~4	0
	rssi-SCS	1,3	15 kHz
		2,4	30 kHz
	startPRB	1~4	0
	nrofPRBs	1,3	52
		2,4	106
	startPosition	1~4	3
	nrofSymbols	1~4	11
	rssi-PeriodicityAndOffset	1,3	sl20, 9
		2,4	sl40, 19

A.4.7.6.2.3 Test Requirements

The CLI-RSSI measurement accuracy shall fulfil the requirements in clauses 10.1.22.2.1.

A.4.7.7 L1-SINR measurement for beam reporting

A.4.7.7.1 L1-SINR measurement with CSI-RS based CMR and no dedicated IMR configured and CSI-RS resource set with repetition off

A.4.7.7.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.8.4.1 and clause 10.1.27.1 for FR1 L1-SINR measurements based on CSI-RS with the testing configurations for NR cells in table A.4.7.7.1.1-1, which configures the measurement resources for the CSI-RS based CMR and no dedicated IMR.

Table A.4.7.7.1.1-1: Applicable NR configurations for FR1 L1-SINR test with CSI-RS based CMR and no dedicated IMR configured

Config	Description
1	LTE FDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode

4	LTE TDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.4.7.7.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in table A.4.7.7.1.2-1 below. The absolute and relative accuracy of L1-SINR measurements are tested by using the parameters in table A.4.7.7.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.4.7.7.1.2-1: FR1 CSI-RS based L1-SINR test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~6		freq1	freq1
Duplex mode	1,4		FDD	FDD
	2,5		TDD	TDD
	3,6		TDD	TDD
TDD Configuration	1,4		N/A	N/A
	2,5		TDDConf.1.1	TDDConf.1.1
	3,6		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	2,5		10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	3,6		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD	SR.1.1 FDD
	2,5		SR.1.1 TDD	SR.1.1 TDD
	3,6		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD	CR.1.1 FDD
	2,5		CR.1.1 TDD	CR.1.1 TDD
	3,6		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD	CCR.1.1 FDD
	2,5		CCR.1.1 TDD	CCR.1.1 TDD
	3,6		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1,4		SSB.1 FR1	SSB.1 FR1
	2,5		SSB.1 FR1	SSB.1 FR1
	3,6		SSB.2 FR1	SSB.2 FR1
OCNG Patterns	1~6		OP.1	OP.1
TRS configuration	1,4		TRS.1.1 FDD	TRS.1.1 FDD
	2,5		TRS.1.1 TDD	TRS.1.1 TDD
	3,6		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1	SMTC.1
CSI-RS	1,4		CSI-RS 1.2 FDD	CSI-RS 1.2 FDD
	2,5		CSI-RS 1.2 TDD	CSI-RS 1.2 TDD
	3,6		CSI-RS 2.2 TDD	CSI-RS 2.2 FDD
reportConfigType	1~6		periodic	periodic
reportQuantity-r16	1~6		cri-SINR-r16	cri-SINR-r16
nrofReportedRS	1~6		2	2
L1-RSRP reporting period	1~6		slot80	slot80
EPRE ratio of PSS to SSS	1~6	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				

Parameter		Config	Unit	Test 1	Test 2
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/CSI-RS SCS	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-91.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
$\hat{E}_s/I_{ot}$		1~6	dB	10	-3
CSI-RS RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/CSI-RS SCS	-84.65	-120
	NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-119

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_N				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5				-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D	3,6		-81.65	-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5				-87.28
	NR_FDD_FR1_B, NR_TDD_FR1_B				-86.78
	NR_FDD_FR1_C, NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D	1,2,4,5	dBm/9.36 MHz	-56.28	-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G, NR_TDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_N				-80.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5				-81.19
	NR_FDD_FR1_B, NR_TDD_FR1_B				-80.69
	NR_FDD_FR1_C, NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D	3,6	dBm/38.16 MHz	-50.19	-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G, NR_TDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
	NR_FDD_FR1_N				-74.69
$\hat{E}_s / N_{oc}$		1~6	dB	10	-3
Propagation condition		1~6		AWGN	AWGN
Antenna configuration		1~6		1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Parameter	Config	Unit	Test 1	Test 2
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification				

A.4.7.7.1.3 Test Requirements

The L1-SINR measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 2 shall fulfil the requirements in clauses 10.1.27.1.

A.4.7.7.2 L1-SINR measurement with SSB based CMR and dedicated IMR

A.4.7.7.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.8.4.2 and clause 10.1.27.2 for L1-SINR measurements with SSB based CMR and CSI-IM based IMR, with the testing configurations for NR cells in table A.4.7.7.2.1-1.

Table A.4.7.7.2.1-1: Applicable NR configurations for FR1 L1-SINR measurement test with SSB based CMR and CSI-IM based IMR

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.4.7.7.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in table A.4.7.7.2.2-1 below. The absolute accuracy of L1-SINR measurements are tested by using the parameters in table A.4.7.7.2.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources and one CSI-IM resource set with two CSI-IM resource. UE is configured to perform RLM and BFD measurement based on the SSB resources 0 and 1. UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-IM resources as IMR.

Table A.4.7.7.2.2-1: FR1 L1-SINR measurement test parameters with SSB based CMR and CSI-IM based IMR

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~6		freq1	freq1
Duplex mode	1,4		FDD	FDD
	2,5		TDD	TDD
	3,6		TDD	TDD
TDD Configuration	1,4		N/A	N/A
	2,5		TDDConf.1.1	TDDConf.1.1
	3,6		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52

Parameter		Config	Unit	Test 1	Test 2
		2,5		10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
		3,6		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel		1,4		SR.1.1 FDD	SR.1.1 FDD
		2,5		SR.1.1 TDD	SR.1.1 TDD
		3,6		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel		1,4		CR.1.1 FDD	CR.1.1 FDD
		2,5		CR.1.1 TDD	CR.1.1 TDD
		3,6		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel		1,4		CCR.1.1 FDD	CCR.1.1 FDD
		2,5		CCR.1.1 TDD	CCR.1.1 TDD
		3,6		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration		1,4		SSB.3 FR1	SSB.3 FR1
		2,5		SSB.3 FR1	SSB.3 FR1
		3,6		SSB.4 FR1	SSB.4 FR1
CSI-IM configuration		1,4		CSI-IM 1.1 FDD	CSI-IM 1.1 FDD
		2,5		CSI-IM 1.1 TDD	CSI-IM 1.1 TDD
		3,6		CSI-IM 2.1 TDD	CSI-IM 2.1 TDD
OCNG Patterns		1~6		OP.1	OP.1
TRS configuration		1,4		TRS.1.1 FDD	TRS.1.1 FDD
		2,5		TRS.1.1 TDD	TRS.1.1 TDD
		3,6		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration		1~6		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration		1~6		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration		1~6		SMTC.1	SMTC.1
reportConfigType		1~6		periodic	periodic
reportQuantity-r16		1~6		ssb-Index-SINR-r16	ssb-Index-SINR-r16
Number of reported RS		1~6		2	2
L1-SINR reporting period		1~6		slot80	slot80
EPRE ratio of PSS to SSS		1~6	dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SSB SCS	-94.65	-117

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-91.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
$\hat{E}_s/I_{ot}$		1~6	dB	10	-3
SSB RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SSB SCS	-84.65	-120
	NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_N				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-81.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/9.36 MHz	-56.28	-87.28

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_B, NR_TDD_FR1_B				-86.78
	NR_FDD_FR1_C, NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G, NR_TDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_N				-80.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6	dBm/38.16 MHz	-50.19	-81.19
	NR_FDD_FR1_B, NR_TDD_FR1_B				-80.69
	NR_FDD_FR1_C, NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G, NR_TDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
	NR_FDD_FR1_N				-74.69
$\hat{E}_s / N_{oc}$		1~6	dB	10	-3
Propagation condition		1~6		AWGN	AWGN
ntenna configuration		1~6		1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.7.2.3 Test Requirements

The L1-SINR measurement accuracy for SSB#0+CSI-IM#0 and SSB#1+CSI-IM#1 of Cell 2 shall fulfil the requirements in clauses 10.1.27.2.

A.4.7.7.3 L1-SINR measurement with CSI-RS based CMR and dedicated IMR

A.4.7.7.3.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will partly verify the requirements in clauses 9.8.4.3 and clause 10.1.27.3 for L1-SINR measurements based on CSI-RS as both CMR and IMR with the testing configurations for NR cells in table A.4.7.7.3.1-1.

Table A.4.7.7.3.1-1: Applicable NR configurations for FR1 L1-SINR measurement test with CSI-RS based both CMR based IMR

Config	Description
1	LTE FDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band.	

A.4.7.7.3.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in table A.4.7.7.3.2-1 below. The absolute and relative accuracy of L1-SINR measurements are tested by using the parameters in table A.4.7.7.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured two CSI-RS resource sets with two CSI-RS resources for each set. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB. UE is configured to perform L1-SINR measurement based on the configured CSI-RS as both CMR and IMR.

Table A.4.7.7.3.2-1: FR1 L1-SINR measurement test with CSI-RS based both CMR and IMR

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~6		freq1	freq1
Duplex mode	1,4		FDD	FDD
	2,5		TDD	TDD
	3,6		TDD	TDD
TDD Configuration	1,4		N/A	N/A
	2,5		TDDConf.1.1	TDDConf.1.1
	3,6		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	2,5		10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	3,6		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD	SR.1.1 FDD
	2,5		SR.1.1 TDD	SR.1.1 TDD
	3,6		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD	CR.1.1 FDD
	2,5		CR.1.1 TDD	CR.1.1 TDD
	3,6		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD	CCR.1.1 FDD
	2,5		CCR.1.1 TDD	CCR.1.1 TDD
	3,6		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1,4		SSB.1 FR1	SSB.1 FR1
	2,5		SSB.1 FR1	SSB.1 FR1
	3,6		SSB.2 FR1	SSB.2 FR1
OCNG Patterns	1~6		OP.1	OP.1
TRS configuration	1,4		TRS.1.1 FDD	TRS.1.1 FDD
	2,5		TRS.1.1 TDD	TRS.1.1 TDD
	3,6		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1	SMTC.1
CSI-RS configuration as CMR	1,4		CSI-RS 1.2 FDD	CSI-RS 1.2 FDD
	2,5		CSI-RS 1.2 TDD	CSI-RS 1.2 TDD
	3,6		CSI-RS 2.2 TDD	CSI-RS 2.2 FDD
CSI-RS configuration as IMR	1,4		CSI-RS 1.3A FDD	CSI-RS 1.3A FDD
	2,5		CSI-RS 1.3A TDD	CSI-RS 1.3A TDD

Parameter		Config	Unit	Test 1	Test 2
		3,6		CSI-RS 2.3A TDD	CSI-RS 2.3A TDD
reportConfigType		1~6		periodic	periodic
reportQuantity-r16		1~6		cri-SINR-r16	cri-SINR-r16
nrofReportedRS		1~6		2	2
L1-RSRP reporting period		1~6		slot80	slot80
EPRE ratio of PSS to SSS		1~6	dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/CSI-RS SCS	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-91.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_N				-107.5
$\hat{E}_s/I_{ot}$		1~6	dB	10	0
CSI-RS RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/CSI-RS SCS	-84.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-81.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B, NR_TDD_FR1_B				-86.78
	NR_FDD_FR1_C, NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G, NR_TDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_N				-80.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6	dBm/38.16 MHz	-50.19	-81.19
	NR_FDD_FR1_B, NR_TDD_FR1_B				-80.69
	NR_FDD_FR1_C, NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G, NR_TDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
	NR_FDD_FR1_N				-74.69
$\hat{E}_s/N_{oc}$		1~6	dB	10	0

Parameter	Config	Unit	Test 1	Test 2
Propagation condition	1~6		AWGN	AWGN
Antenna configuration	1~6		1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.7.3.3 Test Requirements

The L1-SINR measurement accuracy for CSI-RS#0+CSI-RS#2 and CSI-RS#1+CSI-RS#3 of Cell 2 shall fulfil the requirements in clauses 10.1.27.3.

A.4.7.8 CSI-RSRP

A.4.7.8.1 EN-DC Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.8.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.2.3.1 and 10.1.2.3.2 for intra-frequency CSI-RS based L3 measurements.

A.4.7.8.1.2 Test parameters

In this set of test cases all NR cells are on the same carrier frequency. Supported test configurations are shown in table A.4.7.8.1.2-1. Both absolute and relative accuracy of CSI-RSRP intra-frequency measurements are tested by using the parameters in table A.4.7.8.1.2-2. The configuration of Cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.4.7.8.1.2-1: CSI-RSRP Intra frequency CSI-RSRP supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations for each supported band	

Table A.4.7.8.1.2-2: CSI-RSRP Intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
Physical cell ID			489	0	489	0	489	0
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1,4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
TRS configuration	Config 1,4		TRS.1.1 FDD	NA	TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
	Config 2,5		TRS.1.1 TDD	NA	TRS.1.1 TDD	NA	TRS.1.1 TDD	NA
	Config 3,6		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Control Channel RMC	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
SSB configuration	Config 1,4		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2,5		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3,6		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
CSI-RS configuration for RRM	Config 1,4		CSI-RS.RRM.FR1.1 FDD					
	Config 2,5		CSI-RS.RRM.FR1.1 TDD					
	Config 3,6		CSI-RS.RRM.FR1.2 TDD					
Time offset with Cell 2	Config 1,2,4,5	µs	-	4.7	-	4.7	-	4.7
	Config 3,6	µs	-	2.35	-	2.35	-	2.35
SMTC configuration	Config 1,4		SMTC.2					
	Config 2,3,5,6		SMTC.1					
OCNG Patterns			OP.1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz					
	Config 3,6		30 kHz					
EPRE ratio of PSS to SSS		dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4, 5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15KhZ	-106		-88		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-94		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-106		-88		Same as Noc/15 kHz	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-91		-111	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$ for SSB			dB	2.46	-5.97	2.46	-5.97	-0.01	-4.76
$\hat{E}_s/I_{ot}$ for CSI-RS			dB	2.46	-5.97	2.46	-5.97	-0.01	-4.76

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
$\hat{E}_s/N_{oc}$ for SSB			dB	6	1	6	1	3	0
$\hat{E}_s/N_{oc}$ for CSI-RS			dB	6	1	6	1	3	0
CSI-RSRP Note 3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-100	-105	-82	-87	-111.00	-114.00
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.50	-113.50
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110.00	-113.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.50	-112.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109.00	-112.00
		NR_FDD_FR1_F						-108.50	-111.50
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108.00	-111.00
		NR_FDD_FR1_H						-107.50	-110.50
		NR_FDD_FR1_N						-104.50	-107.50
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		- Not applicable Note 5	Not applicable Note 5	-85	-90	-108.00	-111.00
		NR_FDD_FR1_B, NR_TDD_FR1_B						-107.50	-110.50
		NR_FDD_FR1_C, NR_TDD_FR1_C						-107.00	-110.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-106.50	-109.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-106.00	-109.00
		NR_FDD_FR1_F						-105.50	-108.50
		NR_FDD_FR1_G, NR_TDD_FR1_G						-105.00	-108.00
		NR_FDD_FR1_H						-104.50	-107.50
		NR_FDD_FR1_N						-101.50	-104.50
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-70.09		-52.09		-80.03	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-79.53	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_C, NR_TDD_FR1_C						-79.03	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-78.53	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-78.03	
		NR_FDD_FR1_F						-77.53	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-77.03	
		NR_FDD_FR1_H						-76.53	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	Not applicable Note 5		-51.99		-73.94	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-73.44	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-72.94	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-72.44	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-71.94	
		NR_FDD_FR1_F						-71.44	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-70.94	
		NR_FDD_FR1_H						-70.44	
		NR_FDD_FR1_N						-67.44	
Propagation condition			-	AWGN					
Antenna configuration				1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Subtest 1 is not used when testing with 30 kHz SSB SCS
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.8.1.3 Test Requirements

The CSI-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfill absolute requirement in clause 10.1.2.3.1 and relative requirement in clause 10.1.2.3.2.

A.4.7.8.2 EN-DC inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.8.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.4.3.1 and 10.1.4.3.2 for inter-frequency measurements with the testing configurations in table A.4.7.8.2.1-1.

Table A.4.7.8.2.1-1: Applicable NR configurations for FR1 inter-frequency CSI-RSRP accuracy test

Config	Description
1	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations on each supported band	

A.4.7.8.2.2 Test parameters

In this set of test cases there are three cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.4.7.8.2.2-1 below. Both absolute and relative accuracy of CSI-RSRP inter-frequency measurements are tested by using the parameters in table A.4.7.8.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.4.7.8.2.2-1: CSI-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN	1~6		freq1	freq2	freq1	freq2
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	2,5		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	3,6		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
Gap pattern ID			0		0	
Duplex mode	1,4		FDD		FDD	
	2,5		TDD		TDD	
	3,6		TDD		TDD	
TDD configuration	1,4		N/A		N/A	
	2,5		TDDConf.1.1		TDDConf.1.1	
	3,6		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	2,5		SR.1.1 TDD		SR.1.1 TDD	
	3,6		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
	2,5		CR.1.1 TDD	-	CR.1.1 TDD	-
	3,6		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2,5		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3,6		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1,4		SSB.1 FR1		SSB.1 FR1	
	2,5		SSB.1 FR1		SSB.1 FR1	
	3,6		SSB.2 FR1		SSB.2 FR1	
CSI-RS configuration for RRM	1,4		CSI-RS.RRM.FR1.1 FDD			
	2,5		CSI-RS.RRM.FR1.1 TDD			
	3,6		CSI-RS.RRM.FR1.2 TDD			
OCNG Patterns	1~6		OP.1		OP.1	
TRS configuration	1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-
	2,5		TRS.1.1 TDD		TRS.1.1 TDD	
	3,6		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 2	1,2,4,5	µs	-	4.7	-	4.7
	3,6	µs	-	2.35	-	2.35
SMTC configuration	1,4		SMTC.2		SMTC.2	

Parameter		Config	Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
		2,3,5,6		SMTC.1		SMTC.1	
EPRE ratio of PSS to SSS		1~6	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSSNote 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1~6	dBm/15 kHz	-94.65		(N_{oc} for Cell 3 +8 dB)	-115
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NF_FDD_FR1_F						-112.5
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_N						-108.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2,4,5	dBm/SSB SCS	-94.65		(N_{oc} for Cell 3 +8 dB)	-115
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_N						-108.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5, NR_SDL_FR1_A	3,6		-91.65		(N_{oc} for Cell 3 +8dB)	-112.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-112.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-112.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-111.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-111.00
	NR_FDD_FR1_F						-110.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-110.00
	NR_FDD_FR1_H						-110.50
	NR_FDD_FR1_N						-107.50

Parameter		Config	Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
$\hat{E}_s/I_{ot}$ for SSB		1~6	dB	10	10	13	-3
$\hat{E}_s/I_{ot}$ for CSI-RS		1~6	dB	10	10	13	-3
CSI-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SCS	-84.65		(RSRP for Cell 3 +24dB)	-118.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-117.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-117.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-116.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-116.00
	NR_FDD_FR1_F						-115.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-115.00
	NR_FDD_FR1_H						-114.50
	NR_FDD_FR1_N						-111.50
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3,6		-81.65		(RSRP for Cell 3 +24dB)	-115.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113.00
	NR_FDD_FR1_F						-112.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112.00
	NR_FDD_FR1_H						-111.50
	NR_FDD_FR1_N						-108.50
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6,	1,2,4,5	dBm/ 9.36 MHz	-56.28		(Io for Channel 3 +19.45dB)	-85.28
	NR_FDD_FR1_B, NR_TDD_FR1_B						-84.78
	NR_FDD_FR1_C, NR_TDD_FR1_C						-84.28
	NR_FDD_FR1_D, NR_TDD_FR1_D						-83.78
	NR_FDD_FR1_E, NR_TDD_FR1_E						-83.28
	NR_FDD_FR1_F						-82.78
	NR_FDD_FR1_G, NR_TDD_FR1_G						-82.28
	NR_FDD_FR1_H						-81.78
	NR_FDD_FR1_N						-78.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6,	3,6	dBm/ 38.16 MHz	-50.19		(Io for Channel 3 +19.45dB)	-79.19
	NR_FDD_FR1_B, NR_TDD_FR1_B						-78.69
	NR_FDD_FR1_C, NR_TDD_FR1_C						-78.19
	NR_FDD_FR1_D, NR_TDD_FR1_D						-77.69
	NR_FDD_FR1_E, NR_TDD_FR1_E						-77.19
	NR_FDD_FR1_F						-76.69

Parameter		Config	Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
	NR_FDD_FR1_G, NR_TDD_FR1_G						-76.19
	NR_FDD_FR1_H						-75.69
	NR_FDD_FR1_N						-72.69
$\hat{E}_s/N_{oc}$ for SSB		1~6	dB	10	10	13	-3
$\hat{E}_s/N_{oc}$ for CSI-RS		1~6	dB	10	10	13	-3
Propagation condition		1~6	-	AWGN		AWGN	
Antenna configuration				1x2		1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 3: CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
Note 5 The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification							

A.4.7.8.2.3 Test Requirements

The CSI-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil the Absolute requirement in clause 10.1.4.2.1 and Relative requirement in clause 10.1.4.2.2.

A.4.7.9 CSI-RSRQ

A.4.7.9.1 EN-DC Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.9.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.7.

A.4.7.9.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.4.7.9.1.2-1. The absolute accuracy of CSI-RSRQ intra-frequency measurement is test by using the parameters in table A.4.7.9.1.2-2. The configuration of Cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.4.7.9.1.2-1: CSI-RSRQ Intra frequency CSI-RSRQ supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.4.7.9.1.2-2: CSI-RSRQ Intra frequency test parameters

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN				freq1		freq1		freq1	
Duplex mode		Config 1,4		FDD					
		Config 2,3,5,6		TDD					
TDD configuration		Config 1,4		Not Applicable					
		Config 2,5		TDDConf.1.1					
		Config 3,6		TDDConf.2.1					
$BW_{channel}$		Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
		Config 2,5		10: $N_{PRB,c}$ = 52					
		Config 3,6		40: $N_{PRB,c}$ = 106					
BWP configuration		Initial DL BWP		DLBWP.0.1					
		Dedicated DL BWP		DLBWP.1.1					
		Initial UL BWP		ULBWP.0.1					
		Dedicated UL BWP		ULBWP.1.1					
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
		Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
		Config 3,6		SR2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel		Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
		Config 2,5		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
		Config 3,6		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Control Channel RMC		Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
		Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
		Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
TRS configuration		Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
		Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
		Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OP. 1					
Time offset with Cell 2		Config 1,2,4,5	µs	-	4.7	-	4.7	-	4.7
		Config 3,6	µs	-	2.35	-	2.35	-	2.35
SMTC configuration		Config 1,4		SMTC.2					
		Config 2,3,5,6		SMTC.1					
SSB configuration		Config 1,2,4,5		SSB.1 FR1					
		Config 3,6		SSB.2 FR1					
CSI-RS configuration for RRM		Config 1,4		CSI-RS.RRM.FR1.1 FDD					
		Config 2, 5		CSI-RS.RRM.FR1.1 TDD					
		Config 3, 6		CSI-RS.RRM.FR1.2 TDD					
PDSCH/PDCCH subcarrier spacing		Config 1,2,4,5	kHz	15 kHz					
		Config 3,6		30 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/15 kHz	-85		-101		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7		-91		-		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/SCS	-85		-101		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7		-88		-		-111	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$ for SSB			dB	-1.76		-4.7		-5.46	-5.46
$\hat{E}_s/I_{ot}$ for CSI-RS			dB	-1.76		-4.7		-5.46	-5.46

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
$\hat{E}_s/N_{oc}$ for SSB			dB	3	3	-2.9	-2.9	-4	-4
$\hat{E}_s/N_{oc}$ for CSI-RS			dB	3	3	-2.9	-2.9	-4	-4
CSI-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/SCS	-82	-82	-103.9	-103.9	-118	-118
		NR_FDD_FR1_B, NR_TDD_FR1_B						-117.5	-117.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-117	-117
		NR_FDD_FR1_D, NR_TDD_FR1_D						-116.5	-116.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-116	-116
		NR_FDD_FR1_F						-115.5	-115.5
		NR_FDD_FR1_G, NR_TDD_FR1_G						-115	-115
		NR_FDD_FR1_H						-114.5	-114.5
		NR_FDD_FR1_N						-111.5	-111.5
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7		-85	-85	-	-	-115	-115
		NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5	-114.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-114	-114
		NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5	-113.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-113	-113
		NR_FDD_FR1_F						-112.5	-112.5
		NR_FDD_FR1_G, NR_TDD_FR1_G						-112	-112
		NR_FDD_FR1_H						-111.5	-111.5
		NR_FDD_FR1_N						-108.5	-108.5
CSI-RSRQ Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dB	-14.77	-14.77	-16.76	-16.76	-17.34	-17.34
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D, NR_TDD_FR1_D							
		NR_FDD_FR1_E, NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G, NR_TDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/ 9.36 MHz	-50		-70		-83.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-83	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-82.5	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-82	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-81.5	
		NR_FDD_FR1_F						-81	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_G, NR_TDD_FR1_G						-80.5	
		NR_FDD_FR1_H						-80	
		NR_FDD_FR1_N						-77	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/ 38.16 MHz	-50		-		-77.4	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-76.9	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-76.4	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-75.9	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-75.4	
		NR_FDD_FR1_F						-74.9	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-74.4	
		NR_FDD_FR1_H						-73.9	
		NR_FDD_FR1_N						-70.9	
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-RSRQ, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-RSRQ, CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: Subtest 2 is not used when testing with 30 kHz SSB and CSI-RS SCS
NOTE 7: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.9.1.3 Test Requirements

The CSI-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.7.

A.4.7.9.2 EN-DC Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.9.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.9.1.1 and 10.1.9.1.2 for inter frequency measurement.

A.4.7.9.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.4.7.9.2.2-1. Both absolute accuracy and relative accuracy requirements of CSI-RSRQ inter-frequency measurement are tested by using test parameters in table A.4.7.9.2.2-2. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1.

Table A.4.7.9.2.2-1: CSI-RSRQ Inter frequency CSI-RSRQ supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode

3	LTE FDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.7.9.2.2-2: CSI-RSRQ Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1,4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
CSI-RS configuration for RRM	Config 1,4		CSI-RS.RRM.FR1.1 FDD					
	Config 2,5		CSI-RS.RRM.FR1.1 TDD					
	Config 3,6		CSI-RS.RRM.FR1.2 TDD					
OCNG Patterns			OCNG pattern 1					
Time offset with Cell 2	Config 1,2,4,5	µs	-	4.7	-	4.7	-	4.7
	Config 3,6	µs	-	2.35	-	2.35	-	2.35
SMTC configuration	Config 1,4		SMTC.2					
	Config 2,3,5,6		SMTC.1					
SSB configuration	Config 1,2,4,5		SSB.1 FR1					
	Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz					
	Config 3,6		30 kHz					
EPRE ratio of PSS to SSS		dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS								

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/15 kHz	-80.18	-80.18	-106	-106	-116	-116
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	-115.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	-115
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	-114.5
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	-114
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	-113
		NR_FDD_FR1_H						-112.5	-112.5
		NR_FDD_FR1_N						-109.5	-109.5
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/15 kHz	-86.27	-86.27	-113	-113	-116	-116
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	-115.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	-115
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	-114.5
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	-114
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	-113
		NR_FDD_FR1_H						-112.5	-112.5
		NR_FDD_FR1_N						-109.5	-109.5
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/SCS	-80.18	-80.18	-106	-106	-116	-116
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	-115.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	-115
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	-114.5
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	-114
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	-113
		NR_FDD_FR1_H						-112.5	-112.5
		NR_FDD_FR1_N						-109.5	-109.5
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A		-83.27	-83.27	-110	-110	-113	-113
		NR_FDD_FR1_B, NR_TDD_FR1_B						-112.5	-112.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-112	-112
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	-111.5
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	-111

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_G, NR_TDD_FR1_G						-110	-110
		NR_FDD_FR1_H						-109.5	-109.5
		NR_FDD_FR1_N						-106.5	-106.5
$\hat{E}_s/I_{ot}$ for SSB			dB	-1.75	-1.75	-1.75	-1.75	3	-1.75
$\hat{E}_s/I_{ot}$ for CSI-RS			dB	-1.75	-1.75	-1.75	-1.75	3	-1.75
$\hat{E}_s/N_{oc}$ for SSB			dB	-1.75	-1.75	-1.75	-1.75	3	-1.75
$\hat{E}_s/N_{oc}$ for CSI-RS			dB	-1.75	-1.75	-1.75	-1.75	3	-1.75
CSI-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/SCS	-81.93	-81.93	-107.75	-107.75	-113	-117.75
		NR_FDD_FR1_B, NR_TDD_FR1_B						-112.5	-117.25
		NR_FDD_FR1_C, NR_TDD_FR1_C						-112	-116.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	-116.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	-115.75
		NR_FDD_FR1_G, NR_TDD_FR1_G						-110	-114.75
		NR_FDD_FR1_H						-109.5	-114.25
		NR_FDD_FR1_N						-106.5	-111.25
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A		-85.02	-85.02	-111.75	-111.75	-110	-114.75
		NR_FDD_FR1_B, NR_TDD_FR1_B						-109.5	-114.25
		NR_FDD_FR1_C, NR_TDD_FR1_C						-109	-113.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-108.5	-113.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-108	-112.75
		NR_FDD_FR1_G, NR_TDD_FR1_G						-107	-111.75
		NR_FDD_FR1_H						-106.5	-111.25
		NR_FDD_FR1_N						-103.5	-108.25
CSI-RSRQ Note3		NR_FDD_FR1_A NR_TDD_FR1_A	dB	-14.77	-14.77	-40.59	-40.59	-12.56	-14.76
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_G, NR_TDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/ 9.36 MHz	-50	-50	-75.83	-75.83	-83.28	-85.83
		NR_FDD_FR1_B, NR_TDD_FR1_B						-82.78	-85.33
		NR_FDD_FR1_C, NR_TDD_FR1_C						-82.28	-84.83
		NR_FDD_FR1_D NR_TDD_FR1_D						-81.78	-84.33
		NR_FDD_FR1_E NR_TDD_FR1_E						-81.28	-83.83

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_G, NR_TDD_FR1_G						-80.28	-82.83
		NR_FDD_FR1_H						-79.78	-82.33
		NR_FDD_FR1_N						-76.78	-79.33
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/ 38.16 MHz	-50	-50	-76.73	-76.73	-77.19	-79.73
		NR_FDD_FR1_B, NR_TDD_FR1_B						-76.69	-79.23
		NR_FDD_FR1_C, NR_TDD_FR1_C						-76.19	-78.73
		NR_FDD_FR1_D NR_TDD_FR1_D						-75.69	-78.23
		NR_FDD_FR1_E NR_TDD_FR1_E						-75.19	-77.73
		NR_FDD_FR1_G, NR_TDD_FR1_G						-74.19	-76.73
		NR_FDD_FR1_H						-73.69	-76.53
		NR_FDD_FR1_N						-70.69	-73.53
Propagation condition				AWGN	AWGN	AWGN	AWGN	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-RSRQ, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-RSRQ, CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.

A.4.7.9.2.3 Test Requirements

The CSI-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.9.

A.4.7.10 CSI-SINR

A.4.7.10.1 EN-DC Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.10.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.12.

A.4.7.10.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.4.7.10.1.2-1. The absolute accuracy of CSI-SINR intra-frequency measurement is tested by using the parameters in table A.4.7.10.1.2-2. The configuration of Cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell. CSI-RS for mobility configured for Cell 2 is associated to the SSB of Cell 2, and CSI-RS for mobility configured for Cell 3 is associated to the SSB of Cell 3.

Table A.4.7.10.1.2-1: CSI-SINR Intra frequency CSI-SINR supported test configurations

Configuration	Description
1	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode

5	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.7.10.1.2-2: CSI-SINR Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1,4		FDD			
	Config 2,3,5,6		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2,5		TDDConf.1.1			
	Config 3,6		TDDConf.2.1			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
DRX Cycle configuration		ms	Not Applicable			
TRS configuration	Config 1, 4		TRS.1.1 FDD			
	Config 2, 5		TRS.1.1 TDD			
	Config 3, 6		TRS.1.2 TDD			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns			OP.1			
SS-RSSI-Measurement			Not Applicable			
Time offset with Cell 2	Config 1,2,4,5	µs	2.35	2.35	2.35	2.35
	Config 3.6	µs	1.17	1.17	1.17	1.17
SMTC configruation	Config 1,4		SMTC.2			
	Config 2,3,5,6		SMTC.1			
SSB configuration	Config 1,2,4,5		SSB.1 FR1			
	Config 3,6		SSB.2 FR1			
CSI-RS configuration for RRM	Config 1,4		CSI-RS.RRM.FR1.1 FDD			
	Config 2,5		CSI-RS.RRM.FR1.1 TDD			
	Config 3,6		CSI-RS.RRM.FR1.2 TDD			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15			
	Config 3,6		30			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-93		-116	

Parameter			Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_B, NR_TDD_FR1_B				-115.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-115	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-114.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-114	
		NR_FDD_FR1_F				-113.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-113	
		NR_FDD_FR1_H				-112.5	
		NR_FDD_FR1_N				-109.5	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-93		Same as Noc for 15 kHz	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-90		-113	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-112.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-112	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-111.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-111	
		NR_FDD_FR1_F				-110.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-110	
		NR_FDD_FR1_H				-109.5	
		NR_FDD_FR1_N				-106.5	
$\hat{E}_s/I_{ot}$ for SSB			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s/I_{ot}$ for CSI-RS			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s/N_{oc}$ for SSB			dB	4.54	2.66	-4	-4
$\hat{E}_s/N_{oc}$ for CSI-RS			dB	4.54	2.66	-4	-4
CSI-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A	dBm/SCS	-88.46	-90.34	-120	-120
		NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5	-119.5
		NR_FDD_FR1_C, NR_TDD_FR1_C				-119	-119
		NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5	-118.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-118	-118
		NR_FDD_FR1_F				-117.5	-117.5
		NR_FDD_FR1_G, NR_TDD_FR1_G				-117	-117
		NR_FDD_FR1_H				-116.5	-116.5
		NR_FDD_FR1_N				-113.5	-113.5
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85.46	-87.34	-117	-117
		NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5	-116.5
		NR_FDD_FR1_C, NR_TDD_FR1_C				-116	-116
		NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5	-115.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-115	-115
		NR_FDD_FR1_F				-114.5	-114.5

Parameter			Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_G, NR_TDD_FR1_G				-114	-114
		NR_FDD_FR1_H				-113.5	-113.5
		NR_FDD_FR1_N				-110.5	-110.5
CSI-SINR Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	0	-3.19	-5.46	-5.46
		NR_FDD_FR1_B, NR_TDD_FR1_B					
		NR_FDD_FR1_C, NR_TDD_FR1_C					
		NR_FDD_FR1_D, NR_TDD_FR1_D					
		NR_FDD_FR1_E, NR_TDD_FR1_E					
		NR_FDD_FR1_F					
		NR_FDD_FR1_G, NR_TDD_FR1_G					
		NR_FDD_FR1_H					
		NR_FDD_FR1_N					
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.5		-85.51	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-85.01	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-84.51	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-84.01	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-83.51	
		NR_FDD_FR1_F				-83.01	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-82.51	
		NR_FDD_FR1_H				-82.01	
		NR_FDD_FR1_N				-79.01	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-51.41		-79.41	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-78.91	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-78.41	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-77.91	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-77.41	
		NR_FDD_FR1_F				-76.91	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-76.41	
		NR_FDD_FR1_H				-75.91	
		NR_FDD_FR1_N				-72.91	
Propagation condition			-	AWGN			
Antenna configuration			-	1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: CSI-SINR, CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: NR operating band groups are as defined in clause 3.5.2.

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification					

A.4.7.10.1.3 Test Requirements

The CSI-SINR measurement accuracy shall fulfil the requirements in clause 10.1.12.

A.4.7.10.2 EN-DC Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.10.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.14.2.1 and 10.1.14.2.2 for inter-frequency measurement.

A.4.7.10.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.4.7.10.2.2-1. Both absolute accuracy and relative accuracy requirements of CSI-SINR inter-frequency measurement are tested by using test parameters in table A.4.7.10.2.2-2. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell of which specific test parameters for this test case are specified in table A.3.7.2.1-1. CSI-RS for mobility configured for Cell 2 is associated to the SSB of Cell 2, and CSI-RS for mobility configured for Cell 3 is associated to the SSB of Cell 3.

Table A.4.7.10.2.2-1: CSI-SINR Inter frequency CSI-SINR supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4.7.10.2.2-2: CSI-SINR Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1,4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
DRX Cycle configuration		ms	Not Applicable					
TRS configuration	Config 1, 4		TRS.1.1 FDD					
	Config 2, 5		TRS.1.1 TDD					
	Config 3, 6		TRS.1.2 TDD					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
RMSI CORESET Reference Channel	Config 1,4			CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2,5			CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6			CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4			CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5			CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6			CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 2	Config 1,2,4,5		µs	-	2.35	-	2.35	-	2.35
	Config 3,6		µs	-	1.17	-	1.17	-	1.17
SMTC configuration	Config 1,4			SMTC.2					
	Config 2,3,5,6			SMTC.1					
SSB configuration	Config 1,2,4,5			SSB.1 FR1					
	Config 3,6			SSB.2 FR1					
CSI-RS configuration for RRM	Config 1,4			CSI-RS.RRM.FR1.1 FDD					
	Config 2,5			CSI-RS.RRM.FR1.1 TDD					
	Config 3,6			CSI-RS.RRM.FR1.2 TDD					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5		kHz	15					
	Config 3,6			30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-88		-108.5		-119.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-119	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-118.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-118	
		NR_FDD_FR1_E NR_TDD_FR1_E						-117.5	
		NR_FDD_FR1_F						-117	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-116.5	
		NR_FDD_FR1_H						-116	
		NR_FDD_FR1_N						-113	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-88		-108.5		Same as Noc for 15 kHz	
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85		-105.5		-116.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-116	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-115	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114.5	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_F						-114	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-114.5	
		NR_FDD_FR1_H						-113	
		NR_FDD_FR1_N						-110	
$\hat{E}_s/I_{ot}$ for SSB			dB	-1.75		20		-4.0	
$\hat{E}_s/I_{ot}$ for CSI-RS			dB	-1.75		20		-4.0	
$\hat{E}_s/N_{oc}$ for SSB			dB	-1.75		20		-4.0	
$\hat{E}_s/N_{oc}$ for CSI-RS			dB	-1.75		20		-4.0	
CSI-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-89.75		-88.5		-123.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-123	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-122.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-122	
		NR_FDD_FR1_E NR_TDD_FR1_E						-121.5	
		NR_FDD_FR1_F						-121	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-120.5	
		NR_FDD_FR1_H						-120	
		NR_FDD_FR1_N						-117	
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-86.75		-85.5		-120.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-120	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-119.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-119	
		NR_FDD_FR1_E NR_TDD_FR1_E						-118.5	
		NR_FDD_FR1_F						-118	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-117.5	
		NR_FDD_FR1_H						-117	
		NR_FDD_FR1_N						-114	
CSI-SINR Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-1.75		20		-4.0	
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G, NR_TDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.83		-60.5		-90.09	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-89.59	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
		NR_FDD_FR1_C, NR_TDD_FR1_C						-89.09	
		NR_FDD_FR1_D NR_TDD_FR1_D						-88.59	
		NR_FDD_FR1_E NR_TDD_FR1_E						-88.09	
		NR_FDD_FR1_F						-87.59	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-87.09	
		NR_FDD_FR1_H						-86.59	
		NR_FDD_FR1_N						-83.59	
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-51.73		-54.41		-84	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-83.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-83	
		NR_FDD_FR1_D NR_TDD_FR1_D						-82.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-82	
		NR_FDD_FR1_F						-81.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-81	
		NR_FDD_FR1_H						-80.5	
		NR_FDD_FR1_N						-77.5	
Propagation condition			-	AWGN					
Antenna configuration			-	1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: CSI-SINR, CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: NR operating band groups are as defined in clause 3.5.2.

NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.10.2.3 Test Requirements

The CSI-SINR measurement accuracy shall fulfil the requirements in clause 10.1.14.2.1 and 10.1.14.2.2.

A.4.7.11 TDCP amplitude measurement accuracy

A.4.7.11.1 TDCP amplitude measurement accuracy in EN-DC

A.4.7.11.1.1 Test Purpose and Environment

The purpose of this test is to verify that the TRS based TDCP amplitude measurement accuracy is within the specified limits in the test requirements clause. The configurations for the test are specified in table A.4.7.11.1.1-1.

The test consists of two tests, Test 1 and Test 2. Each test further consists of two subtests Test 1A, 1B and Test 2A, 2B.

Test 1A: 10 Hz doppler + 15 kHz SCS FDD + 20 dB SNR

Test 1B: 300 Hz doppler + 15 kHz SCS FDD + 10 dB SNR

Test 2A: 10 Hz doppler + 30 kHz SCS TDD + 20 dB SNR

Test 2B: 300 Hz doppler + 30 kHz SCS TDD + 10 dB SNR

Relevant parameters for each test are provided in the table A.4.7.11.1.2-1. UE needs to pass Test 1A, 1B, 2A, 2B.

Table A.4.7.11.1.1-1: Applicable NR configurations for FR1 TRS based TDCP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode

A.4.7.11.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in clause A.3.7.2. The test parameters for the Cell 2 are given in table A.4.7.11.1.2-1. Ampliutude of TDCP is tested by using the parameters in table A.4.7.11.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured with 1 TRS set with the TRS resources in the set are configured in adjacent slot. UE is configured to perform L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.4.7.11.1.2-1: FR1 TRS based TDCP test parameters

Parameter	Config	Unit	Test 1 (FDD)		Test 2 (TDD)	
			1A	1B	2A	2B
SSB ARFCN	1~4		freq1		freq1	
Duplex mode	1,3		FDD		N/A	
	2,4		N/A		TDD	
TDD Configuration	1,3		N/A		N/A	
	2,4		N/A		TDDConf.1.1	
$BW_{channel}$	1,3	MHz	10: $N_{PRB,c}$ = 52		N/A	
	2,4		N/A		40: $N_{PRB,c}$ = 106	
PDSCH Reference measurement channel	1,3		SR.1.1 FDD		N/A	
	2,4		N/A		SR.2.1 TDD	
RMSI CORESET Reference Channel	1,3		CR.1.1 FDD		N/A	
	2,4		N/A		CR.2.1 TDD	
Dedicated CORESET Reference Channel	1,3		CCR.1.1 FDD		N/A	
	2,4		N/A		CCR.2.1 TDD	
SSB configuration	1,3		SSB.3 FR1		N/A	
	2,4		N/A		SSB.4 FR1	
OCNG Patterns	1~4		OP.1		OP.1	
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
TRS configuration	1,3		TRS.1.5 FDD		N/A	
	2,4		N/A		TRS.1.5 TDD	
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
SMTC configuration	1~4		SMTC.1		SMTC.1	
reportConfigType	1~4		periodic		periodic	
reportQuantity	1~4		ssb-Index-RSRP		ssb-Index-RSRP	
Number of reported RS	1~4		2		2	
L1-RSRP reporting period	1~4		slot80		slot80	
EPRE ratio of PSS to SSS	1~4	dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						

Parameter	Config	Unit	Test 1 (FDD)		Test 2 (TDD)	
			1A	1B	2A	2B
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
N_{oc}	dBm/15 kHz	1	-98		-98	
		2				
N_{oc} Note 2	dBm/SCS	1	-98		-98	
		2	-95		-95	
$\hat{E}_s/I_{ot}$	1~4	dB	TBD		TBD	
$\hat{E}_s/N_{oc}$	1~4	dB	20	10	20	10
SSB_RP	1,4		-78	-88	-78	-88
Propagation condition	1~4		TDL-A 30ns 10 Hz	TDL-A 30ns 300 Hz	TDL-A 30ns 10 Hz	TDL-A 30ns 300 Hz
Antenna configuration	1~4		1x2		1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						

A.4.7.11.1.3 Test Requirements

For Test 1A, the reported TDCP index shall be smaller than or equal to 6 for the 80 % of the times over repeated tests.

For Test 1B: the reported TDCP index shall be smaller than or equal to 5 for the 80 % of the times over repeated tests.

For Test 2A: the reported TDCP index shall be larger than 8 for the 80% of the times over repeated tests.

For Test 2B: the reported TDCP index shall be larger than 6 for the 80 % of the times over repeated tests.

A.4.8 Void

A.4A NE-DC test with all NR cells in FR1

A.4A.1 Signaling characteristics

A.4A.1.1 E-UTRAN PSCell addition

A.4A.1.1.1 Test purpose and environment

The purpose of this test is to verify that the LTE PSCell addition/release delay and interruption under NE-DC are within the requirements stated in clause 8.8 and clause 8.2.3.2.3 for the case when the PSCell is known by the UE at the time of addition.

Supported test configurations are shown in table A.4A.1.1.1-1. The test parameters for the E-UTRA cell are given in table A.3.7.2.1-1.

The test parameters for NR cell are given in Tables A.4A.1.1.1-2 and cell-specific parameters in table A.4A.1.1.1-3 below. The test consists of six successive time periods with duration of T1, T2, T3, T4, T5 and T6 respectively. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (NR PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (E-UTRAN PSCell) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell1 is known to the UE.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event B1 is configured for neighbour cell (Cell2). Before the start of T2 the UE is configured with the measurement gaps (gap pattern Id # 0). The Cell2 becomes known to the UE during T2. Therefore, during T2 the UE shall report Event B1. The point in time at which the RRC message to release measurement gap is transmitted from the test system defines the start of period T3. During T3, after measurement gap is released, the test system transmits the RRC message to the UE to add PSCell on radio channel 2.

The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added. The point in time at which the RRC message to add PSCell (Cell2) is received at the UE antenna connector defines the start of period T4.

The test system shall observe the periodic reporting of CSI for PSCell during T5. The point in time at which the UE has sent PRACH to the PSCell (Cell 2) defines the start of period T5.

The test system shall send an RRC message to the UE to release PSCell (Cell 2) on radio channel 2. The RRC message to release PSCell (Cell2) shall be sent to the UE during period T5, after the UE has sent at least one CQI report with non-zero CQI index for PSCell (Cell 2). The point in time at which the RRC message to release PSCell (Cell2) is received at the UE antenna connector defines the start of period T6.

Table A.4A.1.1.1-1: Applicable E-UTRA and NR configurations for NE-DC PSCell addition and Release test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4A.1.1.1-2: General Test Parameters for PSCell Addition and Release

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for NR cell and second for E-UTRAN Cell
Initial	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell2	Neighbour cell on RF channel number 2.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour Cell		Cell2	PSCell released on RF channel number 2.
B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	Threshold RSRP (Config 1,2,4,5)	dBm	-96	Actual RSRP threshold for event B1.
	Threshold RSRP (Config 3,6)	dBm	-93	Actual RSRP threshold for event B1.
	Time to Trigger	s	0	
DRX			OFF	Continuous monitoring of primary cell
Measurement gap pattern Id			0	Gaps are configured before T2 and released before T3.
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on carrier frequency of Cell 2.
T1		s	1	During this time the PCell shall be known and Cell 2 shall be unknown.
T2		s	1	During this time the UE shall identify neighbour cell (Cell 2) and report event B1.
T3		s	3.5	During this time the test system transmits the RRC messages to release measurement gap and add PSCell.
T4		s	0.5	During this time the UE adds the PSCell.
T5		s	0.5	During this time the UE sends CSI reports for PSCell.
T6		s	0.5	During this time the UE releases the PSCell.

Table A.4A.1.1.1-3: NR Cell Specific Parameters for PSCell Addition and Release

Parameter	Unit	Config	Test
NR RF Channel Number		1,2,3,4,5,6	1
E-UTRA RF Channel Number		1,2,3,4,5,6	2
TDD configuration		1,4	Not Applicable
		2,5	TDDConf.1.1
		3,6	TDDConf.2.1
$BW_{channel}$	MHz	1,4	10: $N_{PRB,c}$ = 52
		2,5	10: $N_{PRB,c}$ = 52
		3,6	40: $N_{PRB,c}$ = 106
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1
PDSCH Reference measurement channel		1,4	SR.1.1 FDD
		2,5	SR.1.1 TDD
		3,6	SR.2.1 TDD
RMSI CORESET Reference Channel		1,4	CR.1.1 FDD
		2,5	CR.1.1 TDD
		3,6	CR.2.1 TDD
Dedicated CORESET Reference Channel		1,4	CCR.1.1 FDD
		2,5	CCR.1.1 TDD
		3,6	CCR.2.1 TDD
OCNG Patterns		1,2,3,4,5,6	OP.1
SSB configuration		1,2,4,5	SSB.1 FR1
		3,6	SSB.2 FR1
SMTC configuration		1,2,4,5	SMTC.1
		3,6	SMTC.1
TRS Configuration		1,4	TRS.1.1 FDD
		2,5	TRS.1.1 TDD
		3,6	TRS.1.2 TDD
CSI-RS configuration for CSI reporting		1,4	CSI-RS.1.1 FDD
		2,5	CSI-RS.1.1 TDD
		3,6	CSI-RS.2.1 TDD
reportConfigType		1,2,3,4,5,6	periodic
reportQuantity		1,2,3,4,5,6	cri-RI-PMI-CQI
CSI reporting periodicity	slot	1,2,4,5	5
		3,6	10
CSI reporting offset	slot	1,2,4,5	2
		3,6	4
EPRE ratio of PSS to SSS	dB	1,2,3,4,5,6	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	-88
N_{oc} Note2	dBm/SCS	1,2,4,5	-88
		3,6	-85
$\hat{E}_s / I_{ot}$		1,2,3,4,5,6	0
$\hat{E}_s / N_{oc}$		1,2,3,4,5,6	0
SS-RSRP Note3	dBm/SCS	1,2,4,5	-88

Parameter	Unit	Config	Test
		3,6	-85
Io[Note3]	dBm/9.36 MHz	1,2,4,5	-57
	dBm/38.1 MHz	3,6	-51
Propagation condition		1,2,3,4,5,6	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.4A.1.1.1-4: E-UTRAN cell specific test parameters for PSCell Addition and Release tests

Parameter	Unit	E-UTRAN Cell					
		T1	T2	T3	T4	T5	T6
Duplex mode		FDD or TDD					
TDD special subframe configuration[Note1]		6					
TDD uplink-downlink configuration[Note1]		1					
$BW_{channel}$		5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100					
PDSCH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD					
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD					
OCNG Patterns[Note2]		5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD					
PBCH_RA	dB	0					
PBCH_RB	dB						
PSS_RA	dB						
SSS_RA	dB						
PCFICH_RB	dB						
PHICH_RA	dB						
PHICH_RB	dB						
PDCCH_RA	dB						
PDCCH_RB	dB						
PDSCH_RA	dB						
PDSCH_RB	dB						
OCNG_RA[Note3]	dB						
OCNG_RB[Note3]	dB						
N_{oc}[Note4]	dBm/15 kHz	N/A	-104				
$\hat{E}_s/N_{oc}$	dB	-infinite	17				
$\hat{E}_s/I_{ot}$	dB	-infinite	17				
RSRP [Note5]	dBm/15 kHz	-infinite	-87				
SCH_RP [Note5]	dBm/15 kHz	-infinite	-87				
Io [Note5]	dBm/Ch BW	N/A	-59.13+10log($N_{PRB,c}$ /50)				
Propagation Condition		AWGN					
Antenna Configuration		1x2					

Parameter	Unit	E-UTRAN Cell					
		T1	T2	T3	T4	T5	T6
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].							
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.							
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 5: E_s/I_{ot}, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							

A.4A.1.1.2 Test Requirements

The UE shall transmit the PRACH to PSCell at latest 120 ms[Note1] into T4.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T5.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T5

The UE shall stop sending CSI reports for PSCell in at latest 20 ms into T6.

Interruption on PCell during PSCell addition and release shall not exceed the values specified for NE-DC in clause 8.2.3.2.3.

All the above test requirements shall be fulfilled in order for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90 %.

Note1: The PSCell addition delay can be expressed as follows as specified in clause 8.8 TS 36.133 [15]:

$$T_{config_EUTRAN\text{-}PSCell} = 20\ ms + T_{activation_time} + 50\ ms + T_{PCell_DU} + T_{E\text{-}UTRAN\text{-}PSCell_DU}$$

Where:

$T_{activation_time} = 20\ ms$

$T_{PSCell_DU} = 0\ ms$

$T_{E\text{-}UTRAN\text{-}PSCell_DU} = 30\ ms$

A.4A.1.2 Active BWP switch

A.4A.1.2.1 E-UTRAN PSCell – NR PCell FR1 DCI-based and Timer-based DL active BWP switch in non-DRX in synchronous NE-DC

A.4A.1.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in TS 38.133 clause 8.6, and interruption requirement for E-UTRA victim cell defined in TS 36.133 [15] clause 7.36.2.6. Supported test configurations are shown in table A.4A.1.2.1.1-1.

The test scenario comprises of one NR PCell (Cell 1), and one E-UTRA PSCell (Cell 2) as given in table A.4A.1.2.1.1-2. Cell-specific parameters of NR PCell is specified in table A.4A.1.2.1.1-3. below, and cell-specific parameters of E-UTRA PSCell are specified in table A.3.7.2.1-1.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 1 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for PCell, BWP-1 and BWP-2, in Cell 1 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH at the beginning of the DL slot right after PCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PCell no later than at the beginning of the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-2 starting from the beginning of the DL slot right after DL slot ($i+T_{BWPswitchDelay}$).
>
> The starting time of PSCell(Cell 2) interruption due to BWP switch on PCell shall occur within the BWP switch delay.

During T2, the test equipment will not transmit DCI format for PDSCH reception on PCell (Cell 1).

During T3,

> The time period T3 starts from the slot #*j*, where j is the beginning slot of the DL subframe immediately after the *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.
>
> The UE shall be able to receive PDSCH at the beginning of the DL slot right after PCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PCell at latest at the beginning of the DL slot right after DL slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-1 starting from the beginning of the DL slot right after DL slot ($j+T_{BWPswitchDelay}$).
>
> The starting time of PSCell (Cell 2) interruption due to BWP switch of PCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PSCell is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during BWP switch of PCell, respectively.

Table A.4A.1.2.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.4A.1.2.1.1-2: General test parameters for DL BWP switch in synchronous NE-DC

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test

E-UTRA RF Channel Number		2	One E-UTRA radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
bwp-InactivityTimer	ms	200	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to Cell 1	μs	3	Synchronous NE-DC
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.4A.1.2.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous NE-DC

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		10 MHz: $N_{PRB,c}$ = 52
	Config 2,5		10 MHz: $N_{PRB,c}$ = 52
	Config 3,6		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID			1, 2
Initial DL BWP Configuration	Config 1,4		DLBWP.0.2 Note 4
	Config 2,5		
	Config 3,6		
Active DL BWP-1 Configuration	Config 1,4		DLBWP.1.1 Note 4
	Config 2,5		
	Config 3,6		
Active DL BWP-2 Configuration	Config 1,4		DLBWP.1.3 Note 4
	Config 2,5		
	Config 3,6		
Initial UL BWP Configuration	Config 1,4		ULBWP.0.2 Note 4
	Config 2,5		
	Config 3,6		
Active UL BWP-1 Configuration	Config 1,4		ULBWP.1.1 Note 4
	Config 2,5		
	Config 3,6		
Active UL BWP-2 Configuration	Config 1,4		ULBWP.1.3 Note 4
	Config 2,5		
	Config 3,6		
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
Dedicated CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.3 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD

Parameter		Unit	Cell 1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1,2,4,5	dBm/SCS	-104
	Config 3,6		-101
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3	Config 1,2,4,5	dBm/SCS	-87
	Config 3,6		-90
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36 MHz	-59
	Config 3,6	dBm/38.16 MHz	-61.9
Propagation Condition			AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

A.4A.1.2.1.2 Test Requirements

During T1, the UE shall start to send the ACK for PCell in the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PCell in the DL slot right after DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T1, the start time of PSCell interruption during PCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start time of PSCell interruption of during PCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PSCell shall not be longer than the interruption duration specified for active BWP switch in TS 36.133 [15] Clause 7.36.2.6.

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.4A.1.3 Intra-frequency handover with E-UTRAN PSCell

A.4A.1.3.1 Test purpose and environment

The purpose of this test is to verify that the intra-frequency handover with PSCell addition/change delay and interruption under NE-DC are within the requirements stated in clause 6.1.5.3 for the case when the PCell and PSCell are known by the UE.

Supported test configurations are shown in table A.4A.1.3.1-1. The test parameters for the E-UTRA cell are given in table A.3.7.2.1-1.

The test parameters for NR cells are given in Tables A.4A.1.3.1-2 and cell-specific parameters in table A.4A.1.3.1-3 below. The test consists of three time periods with duration of T1, T2 and T3 respectively. There are two carriers and two cells on each carrier. Before the test starts the UE is connected to Cell 1 (NR PCell) on radio channel 1 (PCC) and Cell 2 (E-UTRAN PSCell) on radio channel 2. During T1 only Cell1 and Cell 2 are known to the UE.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event A3 is configured for NR neighbour cell (Cell 3), and event-triggered reporting with Event A3 is configured for neighbour cell (Cell4). The Cell3 and Cell4 become known to the UE during T2. Therefore, during T2 the UE shall report Event A3 for the PCC frequency layer and Event A3 for the PSCC frequency layer.

The test system shall send a RRC message to the UE implying handover with PSCell, with targe PCell as Cell 3 and target PSCell as Cell 4 at the end of T2 duration. The point in time at which the RRC message implying handover with PSCell is received at the UE antenna connector defines the start of period T3. UE shall complete PRACH transmission to PCell and PSCell by end of T3.

Table A.4A.1.3.1-1: Applicable E-UTRA and NR configurations for NE-DC Handover with PSCell test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4A.1.3.1-2: General Test Parameters for Intra-frequency handover with PSCell

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for NR cell and second for E-UTRAN Cell
Initial	Active PCell		Cell 1	PCell on RF channel number 1.
	Active PSCell		Cell2	PSCell cell on RF channel number 2.
	Neighbour PCell		Cell3	Neighbor PCell on RF channel number 1.
	Neighbour PSCell		Cell4	Neighbor PSCell on RF channel number 2.
Final Condition	Active PCell		Cell3	PCell on RF channel number 1.
	Active PSCell		Cell4	PSCell on RF channel number 2.
A3 for PCC frequency layer	A3-Offset	dB	0	
	Hysteresis	dB	0	Hysteresis for evaluation of event A3.
	Time To Trigger	s	0	Time to Trigger event A3
A3 for PSCC frequency layer	A3-Offset	dB	0	Hysteresis for evaluation of event A3.
	Hysteresis	dB	0	Actual RSRP threshold for event A3.
	Time to Trigger	s	0	Time to Trigger of event A3
DRX			OFF	Continuous monitoring of primary cell
Measurement gap pattern Id			0	Gaps are configured before T2 and released before T3.
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on carrier frequency of Cell 2.

Parameter	Unit	Value	Comment
T1	s	1	During this time the PCell shall be known and Cell 2 shall be unknown.
T2	s	≤5	During this time the UE shall identify neighbour cell (Cell 3 and cell 4) and report event A3 and B1, and RRC message implying handover with PSCell at the end of this duration
T3	s	1	During this time the UE finishes PCell handover and PSCell change.

Table A.4A.1.3.1-3: NR Cell Specific Parameters for Intra-frequency handover with PSCell

Parameter	Unit	Config	Cell 1			Cell 3		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number		1,2,3,4,5,6	1					
E-UTRA RF Channel Number		1,2,3,4,5,6	2					
TDD configuration		1,4	Not Applicable					
		2,5	TDDConf.1.1					
		3,6	TDDConf.2.1					
$BW_{channel}$	MHz	1,4	10: $N_{PRB,c}$ = 52					
		2,5	10: $N_{PRB,c}$ = 52					
		3,6	40: $N_{PRB,c}$ = 106					
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1					
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1					
PDSCH Reference measurement channel		1,4	SR.1.1 FDD					
		2,5	SR.1.1 TDD					
		3,6	SR.2.1 TDD					
CORESET Reference Channel		1,4	CR.1.1 FDD					
		2,5	CR.1.1 TDD					
		3,6	CR.2.1 TDD					
OCNG Patterns		1,2,3,4,5,6	OP.1					
SSB configuration		1,2,4,5	SSB.1 FR1					
		3,6	SSB.2 FR1					
SMTC configuration		1,2,4,5	SMTC.1					
		3,6	SMTC.1					
TRS Configuration		1,4	TRS.1.1 FDD					
		2,5	TRS.1.1 TDD					
		3,6	TRS.1.2 TDD					
PRACH configuration			FR1 PRACH configuration 1					
PDSCH/PDCCH subcarrier spacing	kHz	1,2,4,5	15 kHz					
		3,6	30 kHz					
PUCCH/PUSCH subcarrier spacing	kHz	1,2,4,5	15 kHz					
		3,6	30 kHz					
EPRE ratio of PSS to SSS	dB	1,2,3,4,5,6	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								

Parameter	Unit	Config	Cell 1			Cell 3		
			T1	T2	T3	T1	T2	T3
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	-98					
N_{oc} Note2	dBm/SCS	1,2,4,5	-98					
		3,6	-95					
$\hat{E}_s/I_{ot}$		1,2,3,4,5,6	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s/N_{oc}$		1,2,3,4,5,6	8	8	8	-Infinity	11	11
SS-RSRP Note3	dBm/SCS	1,2,4,5	-90	-90	-90	-Infinity	-87	-87
		3,6	-87	-87	-87	-Infinity	-84	-84
Io Note3	dBm/9.36 MHz	1,2,4,5	-61.41	-57.06	-57.06	-61.41	-57.06	-57.06
	dBm/38.1 MHz	3,6	-55.31	-50.96	-50.96	-55.31	-50.96	-50.96
Propagation condition		1,2,3,4,5,6	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.4A.1.3.1-4: E-UTRAN cell specific test parameters for Intra-frequency handover with PSCell

Parameter	Unit	Cell 2			Cell 4		
		T1	T2	T3	T1	T2	T3
Duplex mode		FDD or TDD					
TDD special subframe configuration Note1		6					
TDD uplink-downlink configuration Note1		1					
$BW_{channel}$		5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100					
PDSCH parameters: DL Reference Measurement Channel Note2		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD					
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel Note2		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD					
OCNG Patterns Note2		5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD					
PBCH_RA	dB						
PBCH_RB	dB						
PSS_RA	dB						
SSS_RA	dB						
PCFICH_RB	dB						
PHICH_RA	dB						
PHICH_RB	dB	0					

Parameter	Unit	Cell 2			Cell 4		
		T1	T2	T3	T1	T2	T3
PDCCH_RA	dB						
PDCCH_RB	dB						
PDSCH_RA	dB						
PDSCH_RB	dB						
OCNG_RA Note3	dB						
OCNG_RB Note3	dB						
N_{oc} Note4	dBm/15 kHz	-104					
$\hat{E}_s/N_{oc}$	dB	14	14	14	-Infinity	17	17
$\hat{E}_s/I_{ot}$	dB	14	14	14	-Infinity	17	17
RSRP Note5	dBm/15 kHz	-90	-90	-90	-Infinity	-87	-87
SCH_RP Note5	dBm/15 kHz	-90	-90	-90	-Infinity	-87	-87
Io Note5	dBm/Ch BW	-56.13+10log($N_{PRB,c}$/50)	-56.13+10log($N_{PRB,c}$/50)	-56.13+10log($N_{PRB,c}$/50)	N/A	-59.13+10log($N_{PRB,c}$/50)	-59.13+10log($N_{PRB,c}$/50)
Propagation Condition		AWGN					
Antenna Configuration		1x2					

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: E_s/I_{ot}, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4A.1.3.2 Test Requirements

The UE shall transmit the PRACH to PCell at latest $D_{HOwithPSCell_PCell}$ = 83 ms into T3.

The UE shall transmit the PRACH to PSCell at latest $D_{HOwithPSCell_PSCell}$ = 121 ms into T3.

The PCell handover delay, $D_{HOwithPSCell_PCell}$, is equals the applicable RRC procedure delay (16 ms) defined in clause 12 in TS 38.331 [2] plus the PCell interruption time ($T_{interrupt}$ = 67 ms) define in clause 6.1.5.3.2.

PSCell addition/change delay, $D_{HOwithPSCell_PSCell}$ is defined in clause 6.1.5.3.3 as below.

$D_{HOwithPSCel_PSCell} = T_{config_EUTRAN\text{-}PSCell} + T_{processing_margin}$

$T_{config_EUTRAN\text{-}PSCell} = T_{RRC_delay} + T_{activation_time}$ + 50 ms + $T_{E\text{-}UTRAN\text{-}PSCell_DU}$

Where:

$T_{processing_margin}$ = 5 ms

T_{RRC_delay} = 16 ms

$T_{activation_time}$ = 20 ms

$T_{E\text{-}UTRAN\text{-}PSCell_DU}$ = 30 ms

All the above test requirements shall be fulfilled in order for the observed handover with PSCell delay to be counted as correct. The rate of correct observed handover with PSCell delay during repeated tests shall be at least 90 %.

A.4A.1.4 Handover with PSCell from NE-DC to NE-DC with unknown target PSCell

A.4A.1.4.1 Test Purpose and Environment

This test is to verify the requirement for the requirements of HO with PSCell requirements specified in clause 6.1.5.3. HO from NR FR1 to NR FR1 and E-UTRAN PSCell change are tested independently in the same test, with different end points.

A.4A.1.4.2 Test Parameters

Supported test configurations are shown in table A.4A.1.4.2-1. Both handover delay and interruption length are tested by using the parameters in tables A.4A.1.4.2-2, and A.4A.1.4.2-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, UE is connected to Cell 1 (NR PCell) and Cell 3 (LTE PSCell 1). The UE may not have any timing information of Cell 2 at the start of T1. Starting of T1, Cell 2 becomes detectable and known to UE for entire T1 duration.

Cell 4 is turned on at the end of T1. At the start of T2, UE do not have timing information of Cell 4 (LTE PSCell 2).

During T2, UE reports Event A3 to TE and TE shall send an RRC message implying handover from Cell 1 to Cell 2 and PSCell change from Cell 3 to Cell 4 in the same RRC message implying handover with PSCell change during T2.

Start of T3 is defined as the end of the last TTI containing the RRC message implying handover with PSCell change. UE shall complete PRACH transmission to PCell and PSCell by end of T3.

Table A.4A.1.4.2-1: NE-DC test configurations for NE-DC to NE-DC HO with PSCell

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.4A.1.4.2-2: General test parameters NE-DC to NE-DC HO with PSCell

Parameter		Unit	Value	Comment
RF Channel Number			1, 2, 3	Three radio channels are used for this test. One for NR cell and second for E-UTRAN Cell
Initial conditions	Active cell		Cell 1	PCell on RF channel number 1.
	Active PSCell		Cell 3	PSCell released on RF channel number 3.
Final Condition	Active PCell		Cell2	PCell on RF channel number 2.
	Active PSCell		Cell4	PSCell released on RF channel number 3.
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.4A.1.4.2-3: Cell specific test parameters for NR for NE-DC to NE-DC HO with PSCell test

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			1		
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD					
	Config 2		SR.1.1 TDD					
	Config 3		SR2.1 TDD					
CORESET Reference Channel	Config 1		CR.1.1 FDD					
	Config 2		CR.1.1 TDD					
	Config 3		CR2.1 TDD					
TRS configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15 kHz	-98					
N_{oc} Note2	Config 1,2	dBm/SCS	-98					
	Config 3		-95					
$\hat{E}_s / I_{ot}$		dB	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s / N_{oc}$		dB	8	8	8	-Infinity	11	11
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-Infinity	-87	-87
	Config 3	dBm/SCS	-87	-87	-87	-Infinity	-84	-84
Io Note3	Config 1,2	dBm/ 9.36 MHz	-61.41	-57.06	-57.06	-61.41	-57.06	-57.06
	Config 3	dBm/ 38.16 MHz	-55.31	-50.96	-50.96	-55.31	-50.96	-50.96
Propagation condition		-	AWGN			AWGN		

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							

Table A.4A.1.4.2-4: E-UTRAN cell specific test parameters for EUTRA PSCell addition/change

Parameter	Unit	E-UTRAN Cell 3		E-UTRAN Cell 4
		T1	T2	T3
Duplex mode		FDD or TDD		
TDD special subframe configuration[Note1]		6		
TDD uplink-downlink configuration[Note1]		1		
$BW_{channel}$		5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PDSCH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note2]		5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		
PBCH_RA	dB	0		
PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			
PHICH_RA	dB			
PHICH_RB	dB			
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA[Note3]	dB			
OCNG_RB[Note3]	dB			
N_{oc}[Note4]	dBm/15 kHz	N/A	-104	
$\hat{E}_s/N_{oc}$	dB	-infinite	17	
$\hat{E}_s/I_{ot}$	dB	-infinite	17	
RSRP [Note5]	dBm/15 kHz	-infinite	-87	
SCH_RP [Note5]	dBm/15 kHz	-infinite	-87	
Io [Note5]	dBm/Ch BW	N/A	-59.13+10log($N_{PRB,c}$ /50)	
Propagation Condition		AWGN		
Antenna Configuration		1x2		

Parameter	Unit	E-UTRAN Cell 3		E-UTRAN Cell 4
		T1	T2	T3
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].				
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.				
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 5: E_s/I_{ot}, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.4A.1.4.3 Test Requirements

A.4A.1.4.3.1 Test Requirements for NR HO

The UE shall start to transmit the PRACH to Cell 2 less than 83 ms from the beginning of time period T3.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 16 ms and is specified in clause 12 in TS 38.331 [2], RRC reconfiguration (LTE/NR SCG establishment/ modification/ release).

$T_{interrupt}$ = 67 ms in the test. $T_{interrupt}$ is defined in clause 6.1.5.3.2.

This gives a total of 83 ms.

A.4A.1.4.3.2 Test Requirements for LTE PSCell Change

The UE shall transmit the PRACH to PSCell at latest 131 ms[Note1] into T3.

There cannot be any interruptions on PCell during PSCell change.

All the above test requirements shall be fulfilled in order for the observed PSCell change delay to be counted as correct.
The rate of correct observed PSCell change delay during repeated tests shall be at least 90 %.

Note1: The PSCell change delay can be expressed as follows as specified in clause 6.1.5.3.3 of TS 38.133 is

$D_{HOwithPSCel_PSCell} = T_{config_EUTRAN\text{-}PSCell} + 5$ ms,

$T_{config_EUTRAN\text{-}PSCell} = T_{RRC_delay} + T_{activation_time} + 50$ ms $+ T_{E\text{-}UTRAN\text{-}PSCell_DU,}$

$T_{activation_time}$ is the PSCell activation delay. If the PSCell is known, then $T_{activation_time}$ is 20 ms. If the PSCell is unknown, then $T_{activation_time}$ is 30 ms provided the PSCell can be successfully detected on the first attempt.

$T_{E\text{-}UTRAN\text{-}PSCell_DU}$ is the delay uncertainty in acquiring the first available PRACH occasion in the E-UTRAN PSCell. $T_{E\text{-}UTRAN\text{-}PSCell_DU}$ is up to 30 ms.

Where:

T_{RRC_delay} = 16 ms

$T_{activation_time}$ = 30 ms

$T_{E\text{-}UTRAN\text{-}PSCell_DU}$ = 30 ms

A.4A.2 Measurement performance

A.4A.2.1 SFTD accuracy

A.4A.2.1.1 SFTD accuracy

A.4A.2.1.1.1 Test Purpose

The purpose of this set of tests is to verify that the SFTD measurement accuracy is within the specified limits. This test will verify the requirements as specified in clause 10.21.1.1 for NE-DC SFTD measurements.

A.4A.2.1.1.2 Test Environment

Supported test configurations are shown in table A.4A.2.1.1.2-1. In this set of test cases there are two cells on different carriers. Cell 1 is NR FR1 PCell and Cell 2 is E-UTRAN target cell. The test parameters of Cell 1 are given in clause A.4A.2.1.1.2-2. The test parameters of Cell 2 are given in table A.3.7.2.1. The SFTD between PCell and target cell shall be set by the test equipment to one of the time differences in table A.4A.2.1.1.2-3.

Table A.4A.2.1.1.2-1: Supported test configurations for SFTD accuracy

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.4A.2.1.1.2-2: Test parameters for SFTD accuracy (Cell 1)

Parameter	Config	Unit	Test 1
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2,5		10: $N_{PRB,c}$ = 52
	3,6		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
RMC CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.1 FR1
	2,5		SSB.1 FR1
	3,6		SSB.2 FR1
SMTC configuration	1~6		SMTC.1
DL BWP configuration	1~6		DLBWP.1.1
UL BWP configuration	1~6		ULBWP.1.1
OCNG Patterns	1~6		OP.1
EPRE ratio of PSS to SSS	1~6	dB	0

Parameter		Config	Unit	Test 1
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15 kHz	-104
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SSB SCS	-104
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-101
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
$\hat{E}_s / I_{ot}$		1~6	dB	-3
$\hat{E}_s / N_{oc}$		1~6	dB	-3
SS-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SCS	-107
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-104

Parameter		Config	Unit	Test 1
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/9.36 MHz	-74.28
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6	dBm/38.16 MHz	-68.18
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
Propagation condition		1~6		AWGN
Antenna configuration		1~6		1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

Table A.4A.2.1.1.2-3: Timing offsets for SFTD accuracy test

Configuration	SFN offset between PCell and PSCell	Frame boundary offset between PCell and PSCell (Ts)
1	100	-122000
2	300	-60540
3	500	1000
4	700	62540
5	900	124000

A.4A.2.1.1.3 Test Requirements

The SFTD reported by the UE consists of 2 elements, SFN offset and frame boundary offset between PCell and E-UTRAN target cell. The reported SFTD accuracy shall fulfil the requirement in clause 10.1.21.1.

A.5 EN-DC tests with one or more NR cells in FR2

A.5.1 Void

A.5.2 Void

A.5.3 RRC_CONNECTED state mobility

A.5.3.1 Void

A.5.3.2 RRC Connection Mobility Control

A.5.3.2.1 Void

A.5.3.2.2 Random Access

A.5.3.2.2.1 4-step RA type c ontention based random access test in FR2 for PSCell/SCell in EN-DC

A.5.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell or SCell in FR2. Supported test parameters are shown in table A.5.3.2.2.1.1-1. UE capable of EN-DC with PSCell or SCell in FR2 needs to be tested by using the parameters in table A.5.3.2.2.1.1-2 and table A.5.3.2.2.1.1-3.

Table A.5.3.2.2.1.1-1: Supported test configurations for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Config	Description
1	LTE FDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.5.3.2.2.1.1-2: General test parameters for contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1,2		SSB.1 FR2	As defined in A.3.10
CSI-RS for tracking	Config 1,2		TRS.2.1 TDD	
Duplex Mode for Cell 2	Config 1,2		TDD	
TDD Configuration	Config 1,2		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 24	
OCNG Pattern Note 1			OP.3	As defined in A.3.2.1.

Parameter		Unit	Test-1	Comments
PDSCH Reference Channel Note 2	Config 1,2		SR.3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD	As defined in A.3.1.2
Dedicated CORESET Reference Channel	Config 1,2		CCR.3.1 TDD	
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
PRACH Configuration			FR2 PRACH configuration 1	As defined in A.3.8.3, with exceptions as defined below.
rsrp-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88 dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

NOTE 3: The Δ_{UL} value is calculated as -ROUND(P_{PRACH0} -1), where P_{PRACH0} is the measured first PRACH power with -80.6 dBm/SCS applied, *preambleReceivedTargetPower* = -100 dBm and *ss-PBCH-BlockPower* = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.

NOTE 4: The Δ_{DL} value is calculated as ($RSRP_{_REP}$ – RSRP_76), where $RSRP_{_REP}$ is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.5.3.2.2.1.1-3: OTA-related test parameters for contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 3			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1

Parameter	Unit	Test-1	Comments
Propagation Condition	-	No external noise (Note 4)	
NOTE 1: No artificial noise is applied in this test. NOTE 2: Void. NOTE 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation NOTE 4: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].			

A.5.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.5.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in clause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS

38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2.2.1.4 the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.5.3.2.2.1.2.5 Void

A.5.3.2.2.1.2.6 Void

A.5.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in clause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.5.3.2.2.2 4-step RA type non-contention based random access test in FR2 for PSCell/SCell in EN-DC

A.5.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell or SCell in FR2. Supported test parameters are shown in table A.5.3.2.2.2.1-1. UE capable of EN-DC withPSCell or SCell in FR2 needs to be tested by using the parameters in table A.5.3.2.2.2.1-2 and table A.5.3.2.2.2.1-3 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports *csi-RSRP-AndRSRQ-MeasWithSSB* or *csi-RSRP-AndRSRQ-MeasWithoutSSB*.

Table A.5.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Config	Description
1	LTE FDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.5.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Test-2	Comments
SSB Configuration	Config 1,2		SSB.1 FR2	SSB.1 FR2	As defined in A.3.10
CSI-RS Configuration	Config 1,2		N/A	CSI-RS.3.1 TDD	As defined in A.3.1.4
CSI-RS for tracking	Config 1,2		TRS.2.1 TDD	TRS.2.1 TDD	
Duplex Mode for Cell 2	Config 1,2		TDD	TDD	
TDD Configuration	Config 1,2		TDDConf.3.1	TDDConf.3.1	
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 24	100: $N_{PRB,c}$ = 24	

Parameter		Unit	Test-1	Test-2	Comments
OCNG Pattern Note 1			OCNG pattern 1	OCNG pattern 1	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1,2		SR3.1 TDD	SR3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD	CR.3.1 TDD	As defined in A.3.1.2
Dedicated CORESET Reference Channel	Config 1,2		CCR.3.1 TDD	CCR.3.1 TDD	
NR RF Channel Number			1	1	
EPRE ratio of PSS to SSS		dB	0	0	
EPRE ratio of PBCH_DMRS to SSS		dB			
EPRE ratio of PBCH to PBCH_DMRS		dB			
EPRE ratio of PDCCH_DMRS to SSS		dB			
EPRE ratio of PDCCH to PDCCH_DMRS		dB			
EPRE ratio of PDSCH_DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH_DMRS		dB			
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)		dBm	maximum value configurable for certain power class	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
PRACH Configuration			FR2 PRACH configuration 2	FR2 PRACH configuration 3	As defined in A.3.8.3, with exceptions as defined below
rsrp-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88 dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower		dBm	-100	-100	As defined in TS 38.331 [2]

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

NOTE 3: The Δ_{UL} value is calculated as -ROUND(P_{PRACH0} -1), where P_{PRACH0} is the measured first PRACH power with -80.6 dBm/SCS applied, *preambleReceivedTargetPower* = -100 dBm and *ss-PBCH-BlockPower* = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.

NOTE 4: The Δ_{DL} value is calculated as ($RSRP_{REP}$ – RSRP_76), where $RSRP_{REP}$ is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.5.3.2.2.2.1-3: OTA-related test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Test-2	Comments
AoA setup			Setup 1	Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 3			Rough	Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	-80.6	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	-80.6	
	Es/Iot_{BB}	dB	21.09	21.09	
	Io	dBm/95.04 MHz	-56.01	-56.01	Io in symbols containing SSB index 0
SSB with	Es Note1	dBm/SCS	-95.0	-95.0	

index 1	SSB_RP	dBm/SCS	-95.0	-95.0	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	Es/Iot_{BB}	dB	6.69	6.69	
	Io	dBm/95.04 MHz	-70.41	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	No external noise (Note 4)	No external noise (Note 4)	

NOTE 1: No artificial noise is applied in this test.
NOTE 2: void.
NOTE 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 4: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.5.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.5.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in clause 6.2.2.2.2.1 for SSB-based Random Access Preamble transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in clause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3

preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.3 2-step RA type contention based random access test in FR2 for PSCell/SCell in EN-DC

A.5.3.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell or SCell in FR2. Supported test parameters are shown in table A.5.3.2.2.3.1-1. UE capable of EN-DC with PSCell or SCell in FR2 needs to be tested by using the parameters in table A.5.3.2.2.3.1-2 and table A.5.3.2.2.3.1-3.

Table A.5.3.2.2.3.1-1: Supported test configurations for 2-step RA type contention based random access test in FR2 for PSCell/SCell in EN-DC

Config	Description
1	LTE FDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.5.3.2.2.3.1-2: General test parameters for 2-step RA type contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1,2		SSB.1 FR2	As defined in A.3.10

Parameter		Unit	Test-1	Comments
Duplex Mode for Cell 2	Config 1,2		TDD	
TDD Configuration	Config 1,2		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: NRB,c = 24	
OCNG Pattern Note 1			OP.3	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1,2		SR.3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD	As defined in A.3.1.2
RMC CORESET Reference Channel	Config 1,2		CCR.3.1 TDD	
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +ΔUL	As defined in TS 38.331 [2]. ΔUL is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
MsgA Configuration			FR2 MsgA configuration 1	As defined in A.3.20.3.1, with exceptions as defined below.
msgA-RSRP-ThresholdSSB		dBm	RSRP_69 +ΔDL	RSRP_69 corresponds to -88 dBm. ΔDL is derived from the downlink calibration process Note 4
msgA-PreambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

NOTE 3: The Δ_{UL} value is calculated as -ROUND(P_{MsgA0} -1), where P_{MsgA0} is the measured first MsgA PRACH power with -80.6 dBm/SCS applied, *msgA-PreambleReceivedTargetPower* = -100 dBm and *ss-PBCH-BlockPower* = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send MsgA.

NOTE 4: The Δ_{DL} value is calculated as ($RSRP_{REP}$ – RSRP_76), where $RSRP_{REP}$ is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.5.3.2.2.3.1-3: OTA-related test parameters for 2-step RA type contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 2			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below
	SSB_RP	dBm/SCS	-95.0	

				configured *msgA-RSRP-ThresholdSSB*
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	No external noise (Note 3)	

NOTE 1: No artificial noise is applied in this test.
NOTE 2: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 3: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].

A.5.3.2.2.3.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.5.3.2.2.3.2.1 MsgA Transmission

To test the UE behaviour specified in clause 6.2.2.3.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB.*

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first MsgA preamble transmission shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA PRACH and MsgA PUSCH transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.3.2.2 MsgB Reception

To test the UE behaviour specified in clause 6.2.2.3.1.2 the System Simulator shall transmit a MsgB with successRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit an ACK if the MsgB with a successRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble and if the Contention Resolution is successful.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgBs contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first MsgA preamble transmission shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.3.2.3 No MsgB Reception

To test the UE behaviour specified in clause 6.2.2.3.1.3 the System Simulator shall transmit a MsgB with successRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the RA Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first MsgA preamble transmission shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA PRACH and MsgA PUSCH transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.4 2-step RA type non-contention based random access test in FR2 for PSCell/SCell in EN-DC

A.5.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell or SCell in FR2. Supported test parameters are shown in table A.5.3.2.2.4.1-1. UE capable of EN-DC with PSCell or SCell in FR2 needs to be tested by using the parameters in table A.5.3.2.2.4.1-2 and table A.5.3.2.2.4.1-3 for SSB-based non-contention based random access test.

Table A.5.3.2.2.4.1-1: Supported test configurations for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Config	Description
1	LTE TDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: Void	

Table A.5.3.2.2.4.1-2: General test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.1 FR2	As defined in A.3.10
Duplex Mode for Cell 2	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 24	
OCNG Pattern Note 1			OCNG pattern 1	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD	As defined in A.3.1.2
RMC CORESET Reference Channel	Config 1		CCR.3.1 TDD	
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3

Parameter	Unit	Test-1	Comments
Configured UE transmitted power ($P_{CMAX,\ f,c}$)	dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
MsgA Configuration		FR2 MsgA configuration 2	As defined in A.3.20.3.2, with exceptions as defined below
msgA-*RSRP-ThresholdSSB*	dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88 dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower	dBm	-100	As defined in TS 38.331 [2]

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 3: The Δ_{UL} value is calculated as -ROUND(PMsgA0 -1), where PMsgA0 is the measured first MsgA PRACH power with -80.6 dBm/SCS applied, *msgA-PreambleReceivedTargetPower* = -100 dBm and *ss-PBCH-BlockPower* = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send MsgA.
NOTE 4: The Δ_{DL} value is calculated as (RSRP_REP – RSRP_76), where RSRP_REP is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.5.3.2.2.4.1-3: OTA-related test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 2			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot$_{BB}$	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot$_{BB}$	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	No external noise (Note 3)	

NOTE 1: No articial noise is applied in this test.
NOTE 2: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 3: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.5.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.5.3.2.2.4.2.1 MsgA Transmission

To test the UE behavior specified in clause 6.2.2.3.2.1, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA PRACH on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belong to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.4.2.3 MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a fallbackRAR MAC subPDU.

The UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH and monitoring contention resolution as described in clause 8.2A in TS 38.213 [3].

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA and msg3 transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.2.4.2.4 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.5.3.2.3 Void

A.5.3.3 Handover with PSCell with known FR2 target PSCell

A.5.3.3.1 Test purpose and environment

The purpose of this test is to verify that the NR PSCell change delays in handover with PSCell from EN-DC to EN-DC are within the requirements stated in clause 5.8 of TS 36.133 [15] for the case when the source PSCell is in FR1 and the target PSCell in FR2 is known by the UE at the time of handover with PSCell.

Supported test configurations are shown in A.5.3.3.1-1. The test parameters for the E-UTRA cells are given in table A.3.7.2.2-1. The E-UTRA Cell 1 will handover to E-UTRA Cell 2 in this test case. The test parameters for NR cells are given in tables A.5.3.3.1-2, cell-specific parameters in A.5.3.3.1-3 and OTA parameters in A.5.3.3.1-4 below. The test consists of three successive time periods with duration of T1, T2 and T3. There are four carriers each with one cell.

Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on E-UTRA and Cell 4 (SCell) on NR. The UE is monitoring the PCell and PSCell.

The test system shall send a RRC message to the UE to handover with PSCell (target PCell Cell 2, target PSCell Cell 4). The RRC message (to handover with PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added. The RRC message to handover with PSCell shall be sent to the UE during period T1. The point in time at which the RRC message to handover with PSCell (Cell2, Cell 4) is received at the UE antenna connector defines the start of period T2.

The test system shall observe the periodic reporting of CSI for the target PSCell during T3. The point in time at which the UE has sent PRACH to the target PSCell (Cell 4) defines the start of period T3.

Table A.5.3.3.1-1: Supported test configurations for Handover with PSCell

Configuration	Description
1	Cell 1 LTE FDD, Cell 2 LTE FDD, Cell 3 NR FDD 15 kHz SSB SCS, 10 MHz bandwidth, Cell 4 NR TDD 120 kHz SSB SCS, 100 MHz bandwidth
2	Cell 1 LTE FDD, Cell 2 LTE FDD, Cell 3 NR TDD 15 kHz SSB SCS, 10 MHz bandwidth, Cell 4 NR TDD 120 kHz SSB SCS, 100 MHz bandwidth
3	Cell 1 LTE FDD, Cell 2 LTE FDD, Cell 3 NR TDD 30 kHz SSB SCS, 40 MHz bandwidth, Cell 4 NR TDD 120 kHz SSB SCS, 100 MHz bandwidth
4	Cell 1 LTE TDD, Cell 2 LTE TDD, Cell 3 NR FDD 15 kHz SSB SCS, 10 MHz bandwidth, Cell 4 NR TDD 120 kHz SSB SCS, 100 MHz bandwidth
5	Cell 1 LTE TDD, Cell 2 LTE TDD, Cell 3 NR TDD 15 kHz SSB SCS, 10 MHz bandwidth, Cell 4 NR TDD 120 kHz SSB SCS, 100 MHz bandwidth
6	Cell 1 LTE TDD, Cell 2 LTE TDD, Cell 3 NR TDD 30 kHz SSB SCS, 40 MHz bandwidth, Cell 4 NR TDD 120 kHz SSB SCS, 100 MHz bandwidth
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.3.3.1-2: General Test Parameters for Handover with PSCell

Parameter		Unit	Value	Comment
RF Channel Number			1, 2,3,4	Two E-UTRAN radio channel (1,2) and two NR radio channel (3,4) are used for this test
Initial Condition	Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.1
	Neighbour Cell		Cell 2	Neighbour cell on E-UTRAN RF channel number 2. As specified in clause A.3.7.2.1
	Active PSCell		Cell 3	PSCell on NR RF channel number 3.
	Neighbour Cell		Cell 4	Neighbour cell on NR RF channel number 4.
Final Condition	Active PCell		Cell 2	
	Neighbour Cell		Cell 1	
	Active PSCell		Cell 4	
	Neighbour Cell		Cell 3	
Access Barring Information			Not Sent	No additional delays in random access procedure.
DRX			OFF	Continuous monitoring of primary cell
PRACH configuration on Cell 4			FR2 configuration 2	Captured in A.3.8.3.2
Cell-individual offset for cells on E-UTRAN RF channel		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on NR RF channel		dB	0	Individual offset for cells on second component carrier

Parameter	Unit	Value	Comment
T1	s	1	During this time the PCell and PSCell shall be known and SCells configured and detected.
T2	s	0.5	During this time the UE change the PSCell.
T3	s	1	During this time the UE sends CSI reports for PSCell.

Table A.5.3.3.1-3: Cell specific test parameters for Handover with PSCell

Parameter		Unit	Cell 3			Cell 4		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			Freq1			Freq2		
Duplex mode	Config 1,4		FDD			TDD		
	Config 2,3,5,6		TDD			TDD		
TDD configuration	Config 1,4		Not Applicable			TDDConf.3.1		
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
Data PRBs allocated	Config 1,4		52			66		
	Config 2,5		52					
	Config 3,6		106					
DL initial BWP configuration	Config 1~6		DLBWP.0.1					
DL dedicated BWP configuration	Config 1~6		DLBWP.1.1					
UL initial BWP configuration	Config 1~6		ULBWP.0.1					
UL dedicated BWP configuration	Config 1~6		ULBWP.1.1					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD			SR.3.1 TDD		
	Config 2,5		SR.1.1 TDD					
	Config 3,6		SR.2.1 TDD					
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD			CR.3.1 TDD		
	Config 2,5		CR.1.1 TDD					
	Config 3,6		CR.2.1 TDD					
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD			CCR.3.1 TDD		
	Config 2,5		CCR.1.1 TDD					
	Config 3,6		CCR.2.1 TDD					
OCNG Patterns			OP.1					
SMTC configuration			SMTC.1					
TCI state			NA			TCI.State.0		
TRS configuration	Config 1,4		TRS.1.1 FDD			TRS.2.1 TDD		
	Config 2,5		TRS.1.1 TDD					
	Config 3,6		TRS.1.2 TDD					
SSB configuration	Config 1,2,4,5		SSB.1 FR1			SSB.1 FR2		
	Config 3,6		SSB.2 FR1					
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD			CSI-RS.3.1 TDD		
	Config 2,5		CSI-RS.1.1 TDD					
	Config 3,6		CSI-RS.2.1 TDD					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz			120 kHz		
	Config 3,6		30 kHz					
reportConfigType	Config 1~6		N/A			Periodic		
reportQuantity	Config 1~6		N/A			cri-RI-PMI-CQI		
CSI reporting periodicity	Config 1~6	slot	N/A			40		
CSI reporting offset	Config 1~6	slot	N/A			4		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								

Parameter	Unit	Cell 3			Cell 4		
		T1	T2	T3	T1	T2	T3
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
Propagation condition		NA Link only, see clause A.3.7A			AWGN		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							

Table A.5.3.3.1-4: OTA related test parameters for Handover with PSCell

Parameter		Unit	Cell 3			Cell 4		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			NA Link only, see clause A.3.7A			Setup 1 according to clause A.3.15.1		
Assumption for UE beams[Note 5]						Rough		
N_{oc} [Note1]		dBm/15 kHz				-104.7		
N_{oc} [Note1]	Config 1,2,4,5	dBm/SCS				-95.7		
	Config 3,6							
SSB_RP[Note2]	Config 1,2,4,5	dBm/SCS Note3				-88.7		
	Config 3,6							
$\hat{E}_s / N_{oc}$	Config 1~12	dB				7		
$\hat{E}_s / I_{ot}$ [Note2]		dB				7		
Io[Note2]	Config 1~12	dBm/ChBw[Note3,Note4]				-58.92		
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone								
NOTE 4: ChBW is 94.04 MHz for Cell4, 9.36 MHz for Cell 3 in configurations 1,2,4,5,7,8,10,11, 38.1 MHz in configurations 3,6,9,12.								
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation								

A.5.3.3.2 Test Requirements

The UE shall transmit the PRACH to PSCell at latest 107 ms[Note1] into T2.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T3.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T3

All the above test requirements shall be fulfilled for the observed PSCell change delay to be counted as correct. The rate of correct observed PSCell change delay during repeated tests shall be at least 90 %.

Note1: The PSCell change delay can be expressed as follows as specified in clause 5.8.1.2 of TS 36.133 [15]:

$$D_{HOwithPSCel_PSCell} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell_DU} + T_{PCell_DU} + 2 \text{ ms}$$

Where:

T_{RRC_delay} = 20 ms

$T_{processing}$ = 45 ms

T_{search} = 0 ms

T_{Δ} = 20 ms

T_{PSCell_DU} = 1*10+10 = 20 ms

T_{PCell_DU} = 0 ms

A.5.3.3.3 Void

A.5.3.3.4 Void

A.5.3.3.5 Void

A.5.3.3.6 Void

A.5.4 Timing

A.5.4.1 UE transmit timing

A.5.4.1.1 NR UE Transmit Timing Test for FR2

A.5.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeB and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in table 5.4.1.1.1-1.

Table A.5.4.1.1.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
2	LTE TDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz

The test consists of E-UTRA PCell and NR PSCell. The configuration for E-UTRA is given in A.3.7.2.1. Tables A.5.4.1.1.1-2 and A.5.4.1.1.1-2A define the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.5.4.1.1.1-3.

Table A.5.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2	Band Group
SSB ARFCN		1,2	Freq1	Freq1	
Duplex Mode		1,2	TDD		
TDD configuration		1,2	TDDConf.3.1		
$BW_{channel}$	MHz	1,2	100: $N_{PRB,c}$ = 66		
Data PRBs allocated		1,2	66		
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1		
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1		
TRS Configuration		1,2	TRS.2.1 TDD		
PDSCH/PDCCH TCI state		1,2	TCI.State.2		
DRX Cycle	ms	1,2	N/A	DRX.8[Note5]	
PDSCH Reference measurement channel		1,2	SR.3. 3 TDD		
RMSI CORESET Reference Channel		1,2	CR.3. 2 TDD		
Dedicated CORESET Reference Channel		1,2	CCR.3.7 TDD		
OCNG Patterns		1,2	O P. 1		
SSB Configuration		1,2	SSB.4 FR2		
SMTC Configuration		1,2	SMTC.1		

Parameter	Unit	Config	Test1	Test2	Band Group
PDSCH/PDCCH subcarrier spacing	kHz	1,2	120		
EPRE ratio of PSS to SSS	dB	1,2	0	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
Propagation condition		1,2	AWGN		
SRS Config		1,2	SRSConf.1 Note6	SRSConf.2 Note6	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.5.4.1.1.1-3

Table A.5.4.1.1.1-2A: OTA related test parameters

Parameter	Unit	Test 1	Test 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 6		Fine	
N_{oc} Note1	dBm/15 kHz Note4	-112	
N_{oc} Note1	dBm/SCS Note3	-100	
$\hat{E}_s / N_{oc}$	dB	4	
SSB_RP Note2	dBm/SCS Note4	-99	
$\hat{E}_s / I_{ot}$	dB	4	
Io Note2	dBm/95.04 MHz Note4	-68.5	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.4.1.1.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	

	Field	SRSConf.1	SRSConf.2	Comments
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	17	17	Matches $N_{PRB,c}$
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset-p	sl1,0	sl2560,4	Offset to align with DRX periodicity
	sequenceId	0	0	Any 10 bit number

Table A.5.4.1.1.1-4: Void

A.5.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up E-UTRA PCell according to parameters given in table A.3.7.2.2-1 and setup NR PSCell according to parameters given in table A.5.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.

   a. The N_{TA} offset value (in T_c units) is 13792

   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in table A.5.4.1.1.2-1

Table A.5.4.1.1.2-1 Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
240	$+8*64T_c$	$+4*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna. Skip this step for test 2 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment

A.5.4.1.2 NR UE Transmit Timing Test with 2-TA for FR2 UE supporting *multiDCI-IntraCellMultiTRP-TwoTA-r18*

A.5.4.1.2.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits, for UE supporting *multiDCI-IntraCellMultiTRP-TwoTA-r18* and is configured with 2 TAGs for multi-DCI multi-TRP operation. UE is also configured with *dl-OrJointTCI-StateList* or *ul-TCI-State-List*. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in table A.5.4.1.2.1-1.

Table A.5.4.1.2.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
2	LTE TDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz

The test consists of E-UTRA PCell and NR PSCell. The configuration for E-UTRA is given in A.3.7.2.1. Tables A.5.4.1.2.1-2 and A.5.4.1.2.1-2A define the parameters to be configured and strength of the transmitted signals. The NR PSCell is configured with two TRPs in the test. Each TRP is associated with a CORESET, with coresetPoolIndex-r16 is set to 0 for the first TRP and set to 1 for the second TRP. UE is also configured with tag2 in ServingCellConfig. Two SRS resource sets are configured and associated to different TAGs via TCI state configuration. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.5.4.1.2.1-3.

For UE not support the capability of “rxTimingDiff-r18”, the UE is only required to be tested in Test1 and Test3.

For UE supports the capability of “rxTimingDiff-r18”, the UE is only required to be tested in Test2 and Test4.

Table A.5.4.1.2.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1		Test2		Test3		Test4		Band Group
			TRP #1	TRP #2	TRP #1	TRP #2	TRP #1	TRP #2	TRP #1	TRP #2	
SSB ARFCN		1,2	Freq1								
Duplex Mode		1,2	TDD								
TDD configuration		1,2	TDDConf.3.1								
$BW_{channel}$	MHz	1,2	100: $N_{PRB,c}$ = 66								
Data PRBs allocated		1,2	66								
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1								
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1								
TRS Configuration		1,2	TRS.2.1 TDD TRS.2.2 TDD								
DRX Cycle	ms	1,2	N/A				DRX.8[Note5]				
PDSCH Reference measurement channel		1,2	SR.3. 3 TDD								
RMSI CORESET Reference Channel		1,2	CR.3.1 TDD								
coresetPoolIndex for dedicated CORESET Reference Channel		1,2	0	1	0	1	0	1	0	1	
Dedicated CORESET Reference Channel		1,2	CCR.3.4 TDD	CCR.3.6 TDD	CCR.3.4 TDD	CCR.3.6 TDD	CCR.3.4 TDD	CCR.3.6 TDD	CCR.3.4 TDD	CCR.3.6 TDD	
TCI configuration		1,2	DLorJoint TCI.State.0 with tag-Id-ptr-r18 = n0	DLorJoint TCI.State.1 with tag-Id-ptr-r18 = n1	DLorJoint TCI.State.0 with tag-Id-ptr-r18 = n0	DLorJoint TCI.State.1 with tag-Id-ptr-r18 = n1	DLorJoint TCI.State.0 with tag-Id-ptr-r18 = n0	DLorJoint TCI.State.1 with tag-Id-ptr-r18 = n1	DLorJoint TCI.State.0 with tag-Id-ptr-r18 = n0	DLorJoint TCI.State.1 with tag-Id-ptr-r18 = n1	
Timing difference compared to TRP#1	us	1,2	0	0.1	0	7	0	0.1	0	7	
OCNG Patterns		1,2	O P. 1								
SSB Configuration		1,2	SSB.1 FR2								
SMTC Configuration		1,2	SMTC.1								
PDSCH/PDCCH subcarrier spacing	kHz	1,2	120								
EPRE ratio of PSS to SSS	dB	1,2	0				0				

Parameter	Unit	Config	Test1		Test2		Test3		Test4		Band Group
			TRP #1	TRP #2	TRP #1	TRP #2	TRP #1	TRP #2	TRP #1	TRP #2	
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of PDCCH DMRS to SSS											
EPRE ratio of PDCCH to PDCCH DMRS											
EPRE ratio of PDSCH DMRS to SSS											
EPRE ratio of PDSCH to PDSCH											
EPRE ratio of OCNG DMRS to SSS(Note 1)											
EPRE ratio of OCNG to OCNG DMRS (Note 1)											
Propagation condition		1,2	AWGN								
SRS Config		1,2	SRSConf.1[Note6]				SRSConf.2[Note6]				

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.5.4.1.2.1-3

Table A.5.4.1.2.1-2A: OTA related test parameters

Parameter	Unit	Test 1	Test 2	Test 3	Test 4
Angle of arrival configuration		Setup 3 as specified in clause A.3.15 Note 7			
Assumption for UE beams Note 6		Fine			
N_{oc} Note1	dBm/15 kHz Note4	-112			
N_{oc} Note1	dBm/SCS Note3	-100			
$\hat{E}_s / N_{oc}$	dB	4			
SSB_RP Note2	dBm/SCS Note4	-99			
$\hat{E}_s / I_{ot}$	dB	4			
Io Note2	dBm/95.04 MHz Note4	-68.5			

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 7: AoA1 for TRP1 and AoA2 for TRP2

Table A.5.4.1.2.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1		SRSConf.2		Comments
SRS-ResourceSet	srs-ResourceSetId	0	1	0	1	
	srs-ResourceIdList	0	1	0	1	
	resourceType	Periodic	Periodic	Periodic	Periodic	
	Usage	Codebook	Codebook	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	1	0	0	
	nrofSRS-Ports	Port1	Port1	Port1	Port1	
	transmissionComb	n2	n2	n2	n2	
	combOffset-n2	0	0	0	0	
	cyclicShift-n2	0	0	0	0	
	resourceMapping startPosition	0	0	0	0	
	resourceMapping nrofSymbols	n1	n1	n1	n1	
	resourceMapping repetitionFactor	n1	n1	n1	n1	
	freqDomainPosition	0	0	0	0	
	freqDomainShift	0	0	0	0	
	freqHopping c-SRS	17	17	17	17	Matches $N_{PRB,C}$
	freqHopping b-SRS	0	0	0	0	
	freqHopping b-hop	0	0	0	0	
	groupOrSequenceHopping	Neither	Neither	Neither	Neither	
	resourceType	Periodic	Periodic	Periodic	Periodic	
	periodicityAndOffset-p	sl2, 0	sl2, 1	sl2560, 4	sl2560, 9	Offset to align with DRX periodicity
	sequenceId	0	0	0	0	Any 10 bit number
	TCI state	DLorJoint TCI.State.0	DLorJoint TCI.State.1	DLorJoint TCI.State.0	DLorJoint TCI.State.1	

Table A.5.4.1.2.1-4: Void

A.5.4.1.2.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up E-UTRA PCell according to parameters given in table A.3.7.2.2-1 and setup NR PSCell according to parameters given in table A.5.4.1.2.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB for each TAG.

   a. The N_{TA} offset value (in T_c units) is 13792

   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in table A.5.4.1.2.2-1 for only TRP#1. The timing of the DL path of TRP#2 is not changed.

Table A.5.4.1.2.2-1 Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1&Test2	Test3&Test4
240	$+8*64T_c$	$+4*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first path (in time) of DL SSB of each TAG used by the UE to determine downlink timing is received from the reference cell at the UE antenna. For TRP#2, the test system shall verify there is no adjustment. Skip this step for Test 3 and Test 4 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first path (in time) of DL SSB of each TAG used by the UE to determine downlink timing is received from the reference cell at the UE antenna. For Test 3 and Test 4 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment

A.5.4.2 UE timer accuracy

A.5.4.3 Timing advance

A.5.4.3.1 EN-DC FR2 timing advance adjustment accuracy

A.5.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.5.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.5.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in tables A.5.4.3.1.2-2, A.5.4.3.1.2-3, A.5.4.3.1.2-3A and A.5.4.3.1.2-4. The configuration of Cell 1 (LTE PCell) is specified in clause A.3.7.2.1.

In all test cases, two cells are used. Cell 1 is the PCell in the primary Timing Advance Group (pTAG) and Cell 2 is the PSCell is in the secondary Timing Advance Group (sTAG). Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands for sTAG are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.5.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured for PSCell in sTAG.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element for sTAG, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance for sTAG used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value specified in table A.5.4.3.1.2-2. This value shall result in changes of the timing advance for sTAG used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.

Table A.5.4.3.1.2-1: Timing advance supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.4.3.1.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		Cell 1: 1 Cell 2: 2	1 for E-UTRAN PCell 2 for NR PSCell
Initial DL BWP		DLBWP.0.1	As specified in table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	*For 120 kHz SCS* $N_{TA_new} = N_{TA_old} + 1024*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.5.4.3.1.2-3: Cell specific test parameters for timing advance

Parameter	Unit	Test1	
		T1	T2
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66	
BWP BW	MHz	100: $N_{PRB,c}$ = 66	
DRX Cycle	ms	Not Applicable	
PDSCH Reference measurement channel		SR.3.1 TDD	
RMSI CORESET Reference Channel		CR.3.1 TDD	
Dedicated CORESET Reference Channel		CCR.3.1 TDD	
TRS configuration		TRS.2.1 TDD	
PDSCH/PDCCH TCI state		TCI.State.2	
OCNG Patterns		OCNG pattern 1	
SMTC configuration		SMTC.1	
SSB configuration		SSB.3 FR2	
PDSCH/PDCCH subcarrier spacing	kHz	120 kHz	
PUCCH/PUSCH subcarrier spacing	kHz	120 kHz	
EPRE ratio of PSS to SSS	dB	0	

Parameter	Unit	Test1	
		T1	T2
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation condition	-	AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.4.3.1.2-3A: OTA related test parameters

Parameter	Unit	Test 1	
		T1	T2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 6		Fine	
N_{oc} Note1	dBm/15 kHz Note4	-112	
N_{oc} Note1	dBm/SCS Note3	-103	
$\hat{E}_s / N_{oc}$	dB	4	
SS-RSRP Note2	dBm/SCS Note4	-99	
$\hat{E}_s / I_{ot}$	dB	4	
Io Note2	dBm/95.04 MHz Note4	-68.5	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance

Field	Value	Comment
c-SRS	16	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=4	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission

Field	Value	Comment
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.5.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value for PSCell in sTAG to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where *k* = 11.

The Timing Advance adjustment accuracy for PSCell in sTAG shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.5.5 Signaling characteristics

A.5.5.1 Radio link Monitoring

In the following clause, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

Editor NOTE: The metric for the detection of the UE UL transmitted signal by the TE is FFS.

A.5.5.1.1 Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with SSB-based RLM RS in non-DRX mode

A.5.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.5.5.1.1.1-1. The test parameters are given in tables A.5.5.1.1.1-2, A.5.5.1.1.1-3, and A. 5.5.1.1.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-2. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.5.5.1.1.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

Table A.5.5.1.1.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.1.1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 2		TDD

Parameter			Unit	Value
				Test 1
$BW_{channel}$		Config 1, 2		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1, 2		24
DL initial BWP configuration		Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2		DLBWP.1.1
UL initial BWP configuration		Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2		ULBWP.1.1
TDD Configuration		Config 1, 2		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1, 2		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1, 2		CCR.3.4 TDD
SSB Configuration		Config 1, 2		SSB.1 FR2
SMTC Configuration		Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1, 2		120 KHz
PRACH Configuration		Config 1, 2		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1, 2		0,1
OCNG parameters				OP.5
CP length				Normal
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				*gp0*
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1, 2		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1, 2		TRS.2.1 TDD
T1			s	0.2
T2			s	9.68
T3			s	9.68
D1			s	9.64
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.				

Table A.5.5.1.1.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter	Unit	Test 1					
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 3 defined in A.3.15					
		AoA1			AoA2		
Assumption for UE beams[Note 5]		Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS	dB	4					
EPRE ratio of PDCCH to PDCCH DMRS	dB						
EPRE ratio of PBCH DMRS to SSS	dB						
EPRE ratio of PBCH to PBCH DMRS	dB						

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
EPRE ratio of PSS to SSS		dB	0			Not sent		
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
ssb-Index 0 SNR	Config 1, 2	dB	2 Note 6	-6 Note 6	-15			
ssb-Index 1 SNR	Config 1, 2		Not sent			2 Note 6	-15	-15
N_{oc}	Config 1, 2	dBm/ 15 kHz	-92.1			-92.1		
Time multiplexing of the downlink transmissions from each AoA			Defined in figure A.5.5.1.1.1-2					
Propagation condition			TDL-A 30ns 75 Hz			TDL-A 30ns 75 Hz		
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband								

Table A.5.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap).	

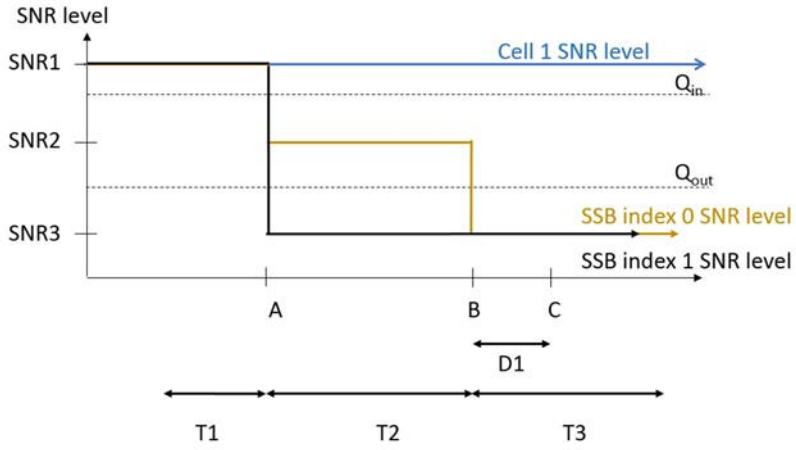


Figure A.5.5.1.1.1-1: SNR variation for out-of-sync testing

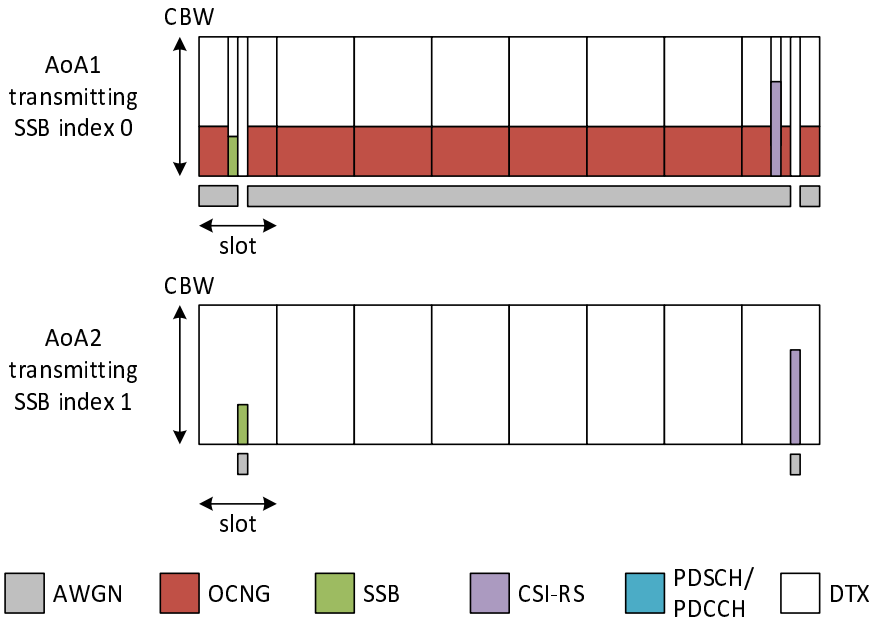


Figure A.5.5.1.1.1-2: Time multiplexed downlink transmissions

A.5.5.1.1.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.1.2 Radio Link Monitoring In-sync Test for FR2 PSCell configured with SSB-based RLM RS in non-DRX mode

A.5.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.5.5.1.2.1-1. The test parameters are given in tables A.5.5.1.2.1-2, and A.5.5.1.2.1-3 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-2. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.5.5.1.2.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Table A.5.5.1.2.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.2.1-2: General test parameters for FR2 in-sync testing in non-DRX mode

Parameter			Unit	Value
				Test 1
Active E-UTRA PCell				Cell 1
E-UTRA RF Channel Number				1
Active PSCell				Cell 2
RF Channel Number				2
Duplex mode		Config 1, 2		TDD
$BW_{channel}$		Config 1, 2		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1, 2		24
DL initial BWP configuration		Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2		DLBWP.1.1
UL initial BWP configuration		Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2		ULBWP.1.1
TDD Configuration		Config 1, 2		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1, 2		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1, 2		CCR.3.1 TDD
SSB Configuration		Config 1, 2		SSB.1 FR2
SMTC Configuration		Config 1, 2		SMTC.3
PDSCH/PDCCH subcarrier spacing		Config 1, 2		120 KHz
PRACH Configuration		Config 1, 2		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1, 2		0,1
OCNG parameters				OP.5
CP length				Normal
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	0
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				N.A.
Layer 3 filtering				*Enabled*
T310 timer			ms	4000
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1, 2		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1, 2		TRS.2.1 TDD
T1			s	0.2
T2			s	0.2
T3			s	1.88
T4			s	0.2
T5			s	3.84
D1			s	3.8
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.				

Parameter	Unit	Value
		Test 1
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.		

Table A.5.5.1.2.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1									
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
AoA setup			Setup 3 defined in A.3.15									
			AoA1					AoA2				
Assumption for UE beams[Note 5]			Rough					Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0					Not sent				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0									
EPRE ratio of PBCH DMRS to SSS		dB										
EPRE ratio of PBCH to PBCH DMRS		dB										
EPRE ratio of PSS to SSS		dB										
EPRE ratio of PDSCH DMRS to SSS		dB										
EPRE ratio of PDSCH to PDSCH DMRS		dB										
EPRE ratio of OCNG DMRS to SSS		dB										
EPRE ratio of OCNG to OCNG DMRS		dB										
ssb-Index 0 SNR	Config 1, 2	dB	2[Note 6]	-6[Note 6]	-15	-15	-15					
ssb-Index 1 SNR	Config 1, 2		Not sent					2[Note 6]	-15	-15	-4.5	2[Note 6]
N_{oc}	Config 1, 2	dBm/ 15KHz	-92.1					-92.1				
Time multiplexing of the downlink transmissions from each AoA			Defined in figure A.5.5.1.2.1-2									
Propagation condition			TDL-A 30ns 75 Hz					TDL-A 30ns 75 Hz				
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband												

Table A.5.5.1.2.1-4: Void

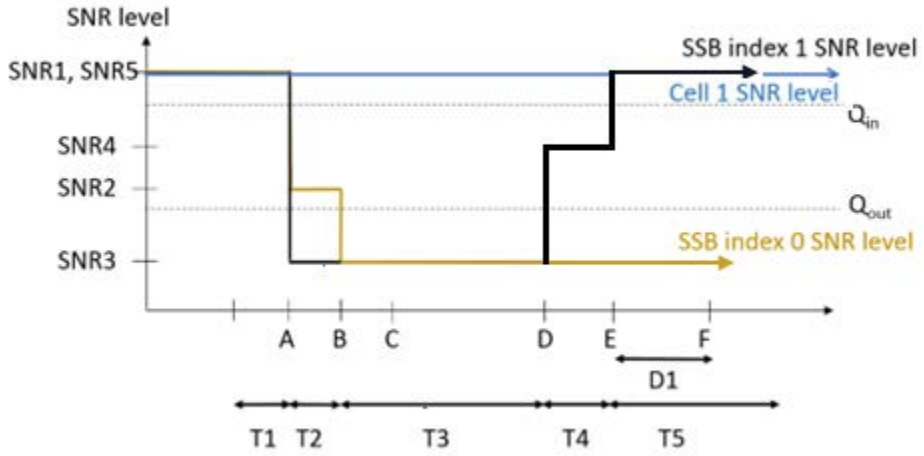


Figure A.5.5.1.2.1-1: SNR variation for in-sync testing

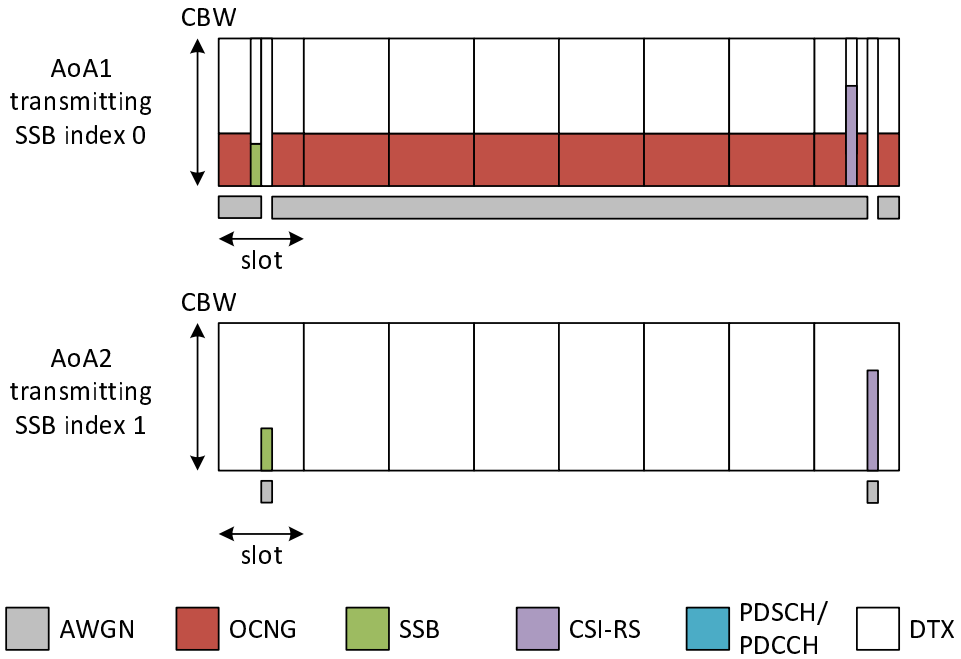


Figure A.5.5.1.2.1-2: Time multiplexed downlink transmissions

A.5.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.1.3 Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with SSB-based RLM RS in DRX mode

A.5.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.5.5.1.3.1-1. The test parameters are given in tables A.5.5.1.3.1-2, and A.5.5.1.3.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-2. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.5.5.1.3.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.3.1-2: General test parameters for FR2 out-of-sync testing in DRX mode

Parameter			Unit	Value
				Test 1
Active E-UTRA PCell				Cell 1
E-UTRA RF Channel Number				1
Active PSCell				Cell 2
RF Channel Number				2
Duplex mode		Config 1, 2		TDD
$BW_{channel}$		Config 1, 2		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1, 2		66
DL initial BWP configuration		Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2		DLBWP.1.1
UL initial BWP configuration		Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2		ULBWP.1.1
TDD Configuration		Config 1, 2		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1, 2		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1, 2		CCR.3.4 TDD
SSB Configuration		Config 1, 2		SSB.1 FR2
SMTC Configuration		Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1, 2		120 KHz
PRACH Configuration		Config 1, 2		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1, 2		0,1
OCNG parameters				OP.1
CP length				Normal
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX Configuration				DRX.3

Parameter		Unit	Value
			Test 1
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD
T1		s	0.2
T2		s	14.48
T3		s	14.48
D1		s	14.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.			

Table A.5.5.1.3.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
AoA setup			Setup 1 defined in A.3.15		
Assumption for UE beams[Note 5]			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
ssb-Index 0 SNR	Config 1, 2	dB	2[Note 6]	-6[Note 6]	-15
ssb-Index 1 SNR	Config 1, 2		2[Note 6]	-15	-15
N_{oc}	Config 1, 2	dBm/15KHz	-104.7 dBm		
Propagation condition			TDL-A 30ns 75 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband					

Table A.5.5.1.3.1-4: Void

Table A.5.5.1.3.1-5: Void

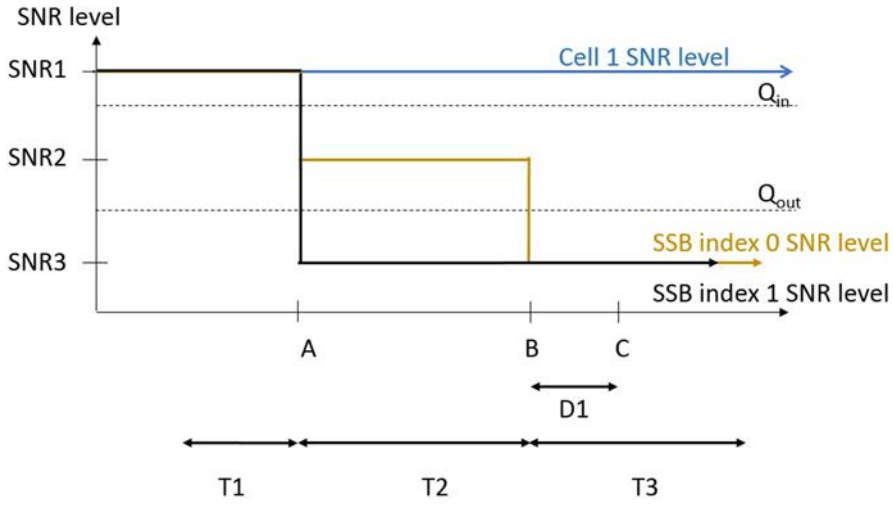


Figure A.5.5.1.3.1-1: SNR variation for out-of-sync testing

A.5.5.1.3.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.1.4 Radio Link Monitoring In-sync Test for FR2 PSCell configured with SSB-based RLM RS in DRX mode

A.5.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.5.5.1.4.1-1. The test parameters are given in tables A.5.5.1.4.1-2, and A.5.5.1.4.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-2. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.5.5.1.4.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.4.1-2: General test parameters for FR2 in-sync testing in DRX mode

Parameter			Unit	Value
				Test 1
Active E-UTRA PCell				Cell 1
E-UTRA RF Channel Number				1
Active PSCell				Cell 2
RF Channel Number				2
Duplex mode		Config 1, 2		TDD
$BW_{channel}$		Config 1, 2		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1, 2		66
DL initial BWP configuration		Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2		DLBWP.1.1
UL initial BWP configuration		Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2		ULBWP.1.1
TDD Configuration		Config 1, 2		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1, 2		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1, 2		CCR.3.1 TDD
SSB Configuration		Config 1, 2		SSB.1 FR2
SMTC Configuration		Config 1, 2		SMTC.3
PDSCH/PDCCH subcarrier spacing		Config 1, 2		120 KHz
PRACH Configuration		Config 1, 2		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1, 2		0,1
OCNG parameters				OP.1
CP length				Normal
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	0
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX Configuration				DRX.11
Gap pattern ID				N.A.
Layer 3 filtering				*Enabled*
T310 timer			ms	4000
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1, 2		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1, 2		TRS.2.1 TDD
T1			s	0.2
T2			s	0.2
T3			s	2.8
T4			s	0.2
T5			s	3.88
D1			s	3.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Parameter	Unit	Value
		Test 1
NOTE 3: E-UTRAN is in non-DRX mode under test.		

Table A.5.5.1.4.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for in-sync radio link monitoring test in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams[Note 5]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
ssb-Index 0 SNR	Config 1, 2	dB	2[Note 6]	-6[Note 6]	-15	-4.5	2[Note 6]
ssb-Index 1 SNR	Config 1, 2		2[Note 6]	-15	-15	-15	-15
N_{oc}	Config 1, 2	dBm/15KHz	-104.7 dBm				
Propagation condition			TDL-A 30ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.3
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.5.5.1.4.1-4: Void

Table A.5.5.1.4.1-5: Void

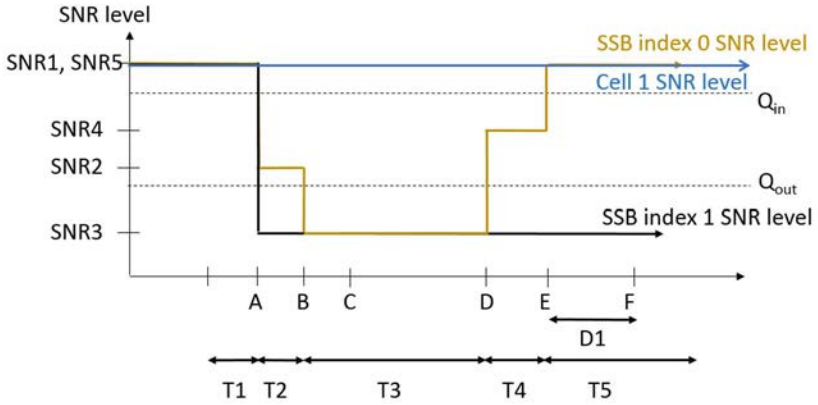


Figure A.5.5.1.4.1-1: SNR variation for in-sync testing.

A.5.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.1.5 EN-DC Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with CSI-RS-based RLM in non-DRX mode

A.5.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.5.5.1.5.1-1, A.5.5.1.5.1-2, A.5.5.1.5.1-3 and A.5.5.1.5.1-3A below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.5.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms). In the test, SSB0 and SSB1 are configured as BFD-RS and are not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.5.5.1.5.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.5.1-2: General test parameters for FR2 PSCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex Mode			TDD
$BW_{channel}$	Config 1, 2		100: $N_{RB,c}$ = 66
Data RBs allocated	Config 1, 2		24
$BW_{occupied}$	Config 1, 2		24
TDD Configuration	Config 1		TDDConf.3.1
	Config 2		TDDConf.3.1
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.4
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.4
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
	Config 2		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.4 TDD CCR.3.6 TDD
	Config 2		CCR.3.4 TDD CCR.3.6 TDD

SSB Configuration	Config 1		SSB.1 FR2
	Config 2		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
	Config 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
	Config 2		120 KHz
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
SSB index for BFD-RS	Config 1, 2		0, 1
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.5
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	0.35
T3		s	0.35
D1		s	0.31
Note 1: UE-specific PDCCH is not transmitted after T1 starts. Note 2: E-UTRAN is in non-DRX mode under test.			

Table A.5.5.1.5.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter	Unit	Test 1					
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 3 defined in A.3.15					
		AoA1			AoA2		
Assumption for UE beams[Note 10]		Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS	dB	4					
EPRE ratio of PDCCH to PDCCH DMRS	dB						
EPRE ratio of PBCH DMRS to SSS	dB						

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
EPRE ratio of PBCH to PBCH DMRS		dB	0			Not sent		
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR on RLM-RS1	Config 1, 2	dB	2 Note 11	-6 Note 11	-15			
SNR on RLM-RS2	Config 1, 2	dB	Not sent			2 Note 11	-15	-15
N_{oc}	Config 1, 2	dBm/ 15 kHz	-92.1			-92.1		
Propagation condition			TDL-A 30ns 75 Hz			TDL-A 30ns 75 Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.1.5.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.5.5.1.5.1-3A: Measurement gap configuration for FR2 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap)	

Table A.5.5.1.5.1-4: Void

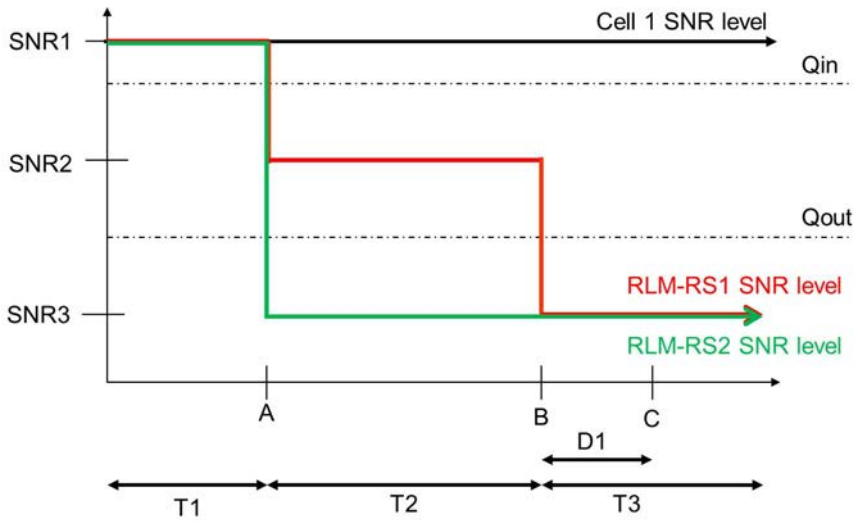


Figure A.5.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing

A.5.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C (D_1 after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.1.6 EN-DC Radio Link Monitoring In-sync Test for FR2 PSCell configured with CSI-RS-based RLM in non-DRX mode

A.5.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.5.5.1.6.1-1, A.5.5.1.6.1-2, and A.5.5.1.6.1-3 below. There are two cells, cell 1which is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.6.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5ms. In the test, DRX configuration is not enabled. In the test, SSB0 and SSB1 are configured as BFD-RS and are not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.5.5.1.6.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.6.1-2: General test parameters for FR2 PSCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex Mode			TDD
$BW_{channel}$	Config 1, 2		100: $N_{RB,c}$ = 66
Data RBs allocated	Config 1, 2		24
$BW_{occupied}$	Config 1, 2		24
TDD Configuration	Config 1		TDDConf.3.1
	Config 2		TDDConf.3.1
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.4
UL initial BWP configuration	Config 1, 2		ULBWP.0.1

UL dedicated BWP configuration	Config 1, 2		ULBWP.1.4
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
	Config 2		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
	Config 2		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
	Config 2		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
	Config 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
	Config 2		120 KHz
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
SSB index for BFD-RS	Config 1, 2		0, 1
OCNG parameters			OP.5
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1

CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
Note 1: UE-specific PDCCH is not transmitted after T1 starts. Note 2: E-UTRAN is in non-DRX mode under test.			

Table A.5.5.1.6.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1									
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
AoA setup			Setup 3 defined in A.3.15									
			AoA1					AoA2				
Assumption for UE beams[Note 10]			Rough					Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0					Not sent				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0									
EPRE ratio of PBCH DMRS to SSS		dB										
EPRE ratio of PBCH to PBCH DMRS		dB										
EPRE ratio of PSS to SSS		dB										
EPRE ratio of PDSCH DMRS to SSS		dB										
EPRE ratio of PDSCH to PDSCH DMRS		dB										
EPRE ratio of OCNG DMRS to SSS		dB										
EPRE ratio of OCNG to OCNG DMRS		dB										
SNR on RLM-RS1	Config 1, 2	dB	2[Note 11]	-6[Note 11]	-15	-15	-15					
SNR on RLM-RS2	Config 1, 2	dB	Not sent					2[Note 11]	-15	-15	-4.5	2[Note 6]
N_{oc}	Config 1, 2	dBm/ 15KHz	-92.1					-92.1				
Propagation condition			TDL-A 30ns 75 Hz					TDL-A 30ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.5.5.1.6.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.5.5.1.6.1-3A: Void

Table A.5.5.1.6.1-4: Void

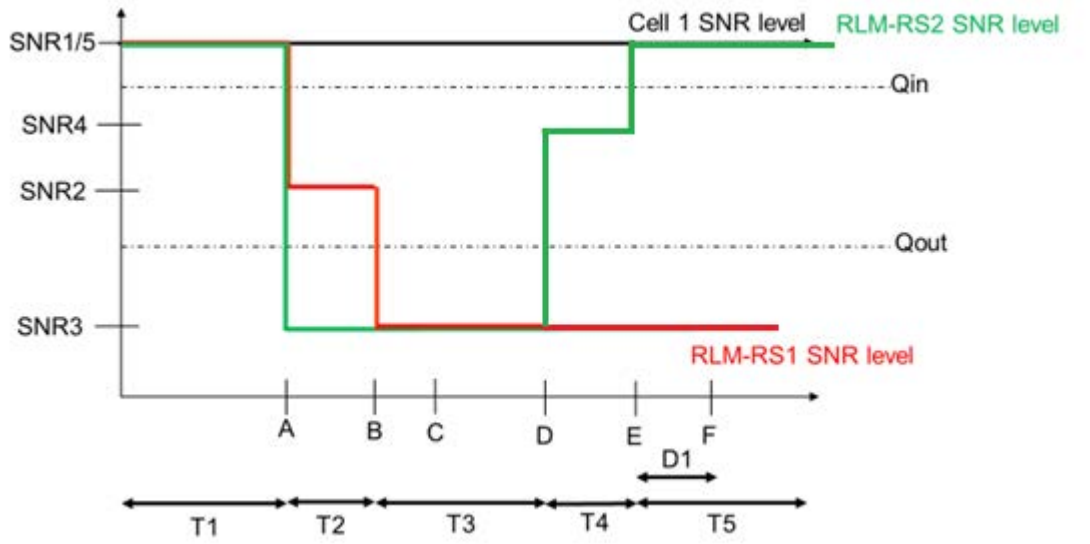


Figure A.5.5.1.6.1-1: SNR variation for CSI-RS in-sync testing

A.5.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.1.7 EN-DC Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with CSI-RS-based RLM in DRX mode

A.5.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in tables A.5.5.1.7.1-1, A.5.5.1.7.1-2, and A.5.5.1.7.1-3 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.7.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. In the test, SSB0 and SSB1 are configured as BFD-RS and are not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.5.5.1.7.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to pass in one of the supported test configurations in FR2

Table A.5.5.1.7.1-2: General test parameters for FR2 PSCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex Mode			TDD
TDD Configuration	Config 1		TDDConf.3.1
	Config 2		TDDConf.3.1
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR. 3.1 TDD
	Config 2		CR. 3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR. 3.4 TDD CCR.3.6 TDD
	Config 2		CCR. 3.4 TDD CCR.3.6 TDD
SSB Configuration	Config 1		SSB.1 FR2
	Config 2		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
	Config 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
	Config 2		120 KHz
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
SSB index for BFD-RS	Config 1, 2		0, 1
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1

Parameter		Unit	Value
			Test 1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts. NOTE 2: E-UTRAN is in non-DRX mode under test.			

Table A.5.5.1.7.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
AoA setup			Setup 1 defined in A.3.15		
Assumption for UE beams[Note 10]			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB			
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS1	Config 1, 2	dB	2[Note 11]	-6[Note 11]	-15
SNR on RLM-RS2	Config 1, 2		2[Note 11]	-15	-15
N_{oc}	Config 1	dBm/15KHz	-104.7		
	Config 2		-104.7		
Propagation condition			TDL-A 30ns 75 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1. NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1. NOTE 4: Void NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.1.7.1-1. NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation. NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband.					

Table A.5.5.1.7.1-3A: Void

Table A.5.5.1.7.1-4: Void

Table A.5.5.1.7.1-5: Void

Table A.5.5.1.7.1-6: Void

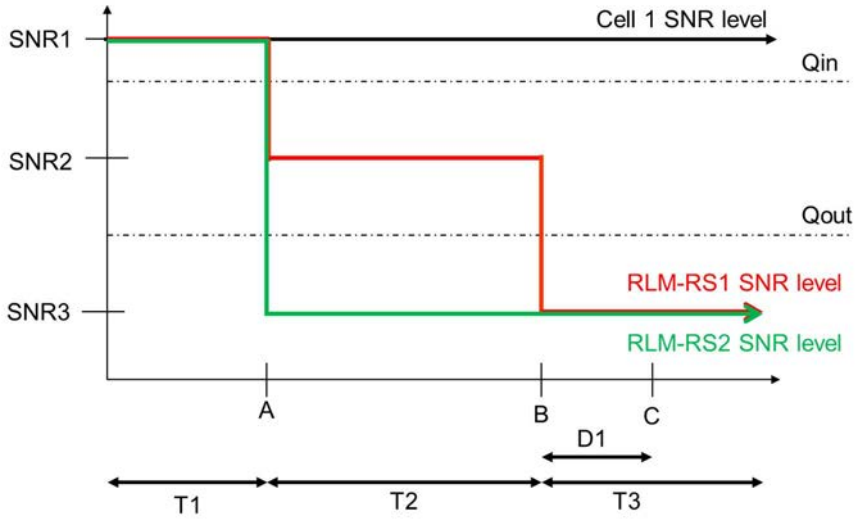


Figure A.5.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing

A.5.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C (D_1 after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.1.8 EN-DC Radio Link Monitoring In-sync Test for FR2 PSCell configured with CSI-RS-based RLM in DRX mode

A.5.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in tables A.5.5.1.8.1-1, A.5.5.1.8.1-2, A.5.5.1.8.1-3 and A.5.5.1.8.1-3A below. There are two cells, Cell 1which is the E-UTRAN PCell, and Cell 2 is the NR PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.8.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms). In the test, SSB0 and SSB1 are configured as BFD-RS and are not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.5.5.1.8.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.8.1-2: General test parameters for FR2 PSCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex Mode			TDD
TDD Configuration	Config 1		TDDConf.3.1
	Config 2		TDDConf.3.1
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
	Config 2		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
	Config 2		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
	Config 2		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
	Config 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
	Config 2		120 KHz
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
SSB index for BFD-RS	Config 1, 2		0, 1
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4

Parameter		Unit	Value
			Test 1
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	0.2
T3		s	1.64
T4		s	0.2
T5		s	1.88
D1		s	1.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts. NOTE 2: E-UTRAN is in non-DRX mode under test.			

Table A.5.5.1.8.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams[Note 10]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB	0				
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS1	Config 1, 2	dB	2[Note 11]	-6[Note 11]	-15	-4.5	2[Note 11]
SNR on RLM-RS2	Config 1, 2	dB	2[Note 11]	-15	-15	-15	-15
N_{oc}	Config 1, 2	dBm/15KHz	-104.7				
Propagation condition			TDL-A 30ns 75 Hz				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.5.5.1.8.1-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.						
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.						
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband						

Table A.5.5.1.8.1-3A: Measurement gap configuration for FR2 CSI-RS in-sync radio link monitoring in DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap)	

Table A.5.5.1.8.1-4: Void

Table A.5.5.1.8.1-5: Void

Table A.5.5.1.8.1-6: Void

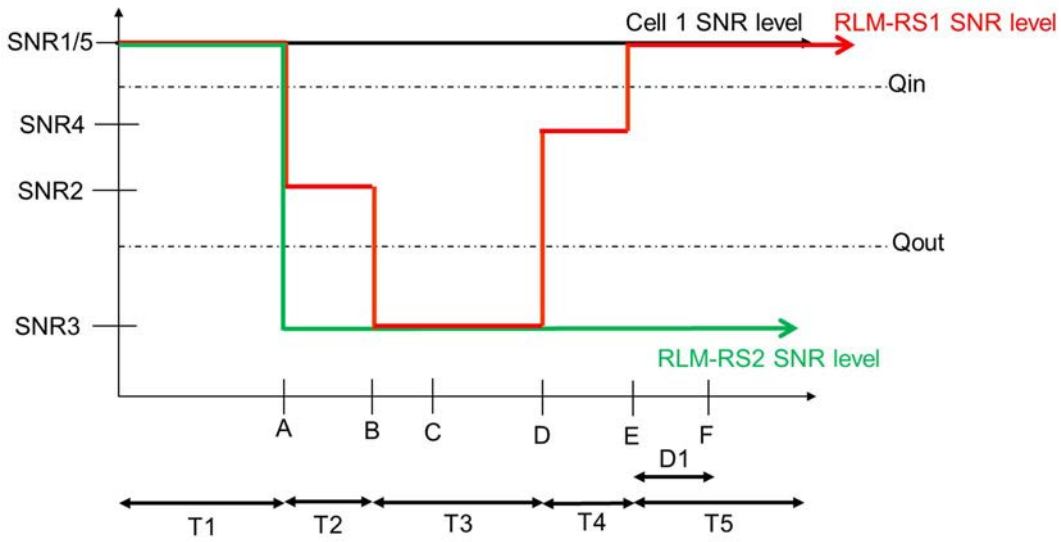


Figure A.5.5.1.8.1-1: SNR variation for CSI-RS in-sync testing

A.5.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.1.9 EN-DC Radio Link Monitoring UE Scheduling Restrictions on FR2

A.5.5.1.9.1 Test Purpose and Environment

The purpose is to verify that the NR UE correctly follows the RLM scheduling restrictions requirements defined in clause 8.1.7. This test verifies that the UE correctly receive the PDCCH scheduled on the symbols right before the RLM SSB symbols without overlap so that it sends ACK/NACK correctly. The test case is only applicable to UE which supports pdcch-MonitoringAnyOccasions or pdcch-MonitoringAnyOccasionsWithSpanGap.

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and NR FR2 PSCell (Cell 2). The test parameters for NR PSCell are given in table A.5.5.1.9.1-1, table A.5.5.1.9.1-2 and table A.5.5.1.9.1-3 below and the parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. The UE is required during time period T1 to transmit ACK/NACK correctly upon scheduling of PDSCH.

Table A.5.5.1.9.1-1: Supported test configurations

Configuration	Description
1	FDD LTE, 120 kHz SSB SCS, 120 kHz RMC SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE, 120 kHz SSB SCS, 120 kHz RMC SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.5.5.1.9.1-2: General test parameters for RLM scheduling restriction test case in FR2

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		1, 2	1 and 2	1 for NR PSCell and 2 for LTE PCell
SSB configuration		1, 2	SSB.1 FR2	
SMTC configuration		1, 2	SMTC.3	
DRX cycle length	s	1, 2	OFF	
T1	s	1, 2	5	During T1 the UE is required to correctly transmit ACK/NACK

Table A.5.5.1.9.1-3: Cell specific test parameters for RLM scheduling restriction test case in FR2

Parameter	Unit	Test configuration	Cell 2	
AoA setup		1, 2	Setup 3 defined in A.3.15.3	
			AoA1	AoA2
Assumption for UE beams[Note 1]			Rough	Rough
TDD configuration		1, 2	TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1, 2	24	
PDSCH Reference measurement channel		1, 2	SR.3.2 TDD	Not sent
RMSI CORESET RMC configuration		1, 2	CR.3.1 TDD	Not sent
Dedicated CORESET RMC configuration		1, 2	CCR.3.2 TDD	Not sent
TRS configuration		1, 2	TRS.2.1 TDD	TRS.2.2 TDD
PDCCH/PDSCH TCI state		1, 2	TCI.State.2	Not sent

Parameter	Unit	Test configuration	Cell 2	
OCNG Pattern		1, 2	OP.5 defined in A.3.2.1	Not sent
Initial DL BWP configuration		1, 2	DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1	
RLM-RS		1, 2	SSB with index 0	SSB with index 1
N_{oc}	dBm/15 kHz	1, 2	-92.1	-92.1
N_{oc} Note2	dBm/SCS	1, 2	-84.9	Not sent
$\hat{E}_s/N_{oc}$	dB	1, 2	3	N/A
$\hat{E}_s/I_{ot}$ BB Note 4	dB	1, 2	1	1
SSB_RP Note3	dBm/SCS	1, 2	-81.1	-81.1
Io	dBm/95.04 MHz	1, 2	-54.35	-54.35
Time multiplexing of the downlink transmissions from each AoA		1, 2	Defined in figure A.5.5.1.9.1-1	
Propagation Condition		1, 2	AWGN	AWGN

NOTE 1: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

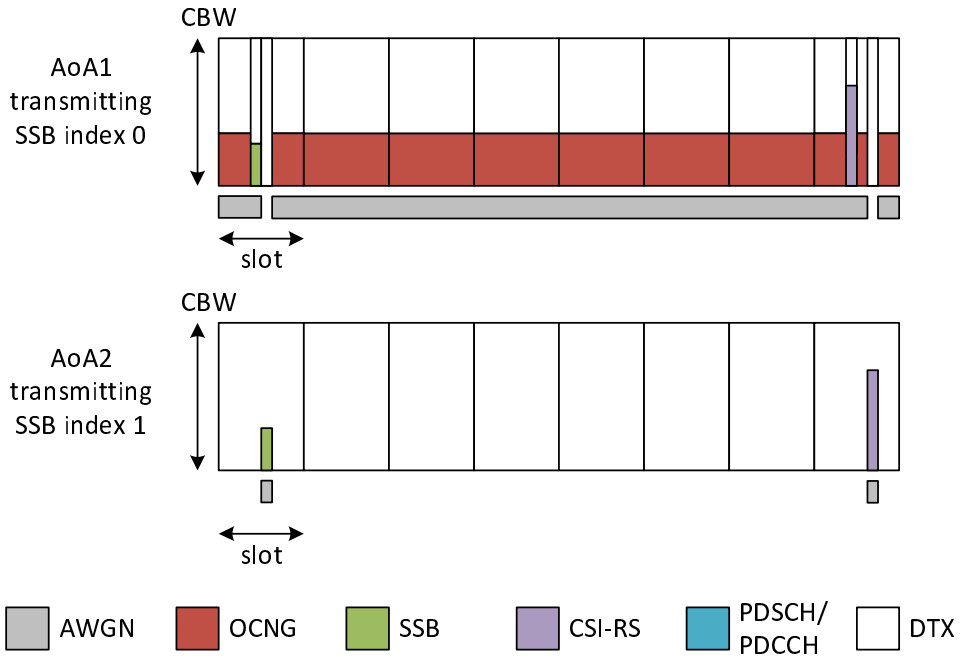


Figure A.5.5.1.9.1-1: Time multiplexed downlink transmissions

A.5.5.1.9.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.1.7.3.

The UE shall be continuously scheduled by PDCCH on the symbols right before each SSB which is not covered by SMTC during the entire length of T1. The UE shall transmit ACK/NACK for every scheduled PDCCH during the time duration T1.

A.5.5.1.10 Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with SSB-based RLM RS for UE fulfilling relaxed measurement criterion

A.5.5.1.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.2.4 for UE fulfilling good serving cell quality criterion.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.5.5.1.10.1-1. The test parameters are given in tables A.5.5.1.10.1-2, and A.5.5.1.10.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-2. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.10.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.5.5.1.10.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.10.1-2: General test parameters for FR2 out-of-sync testing for UE fulfilling relaxed measurement criterion

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 2		TDD
$BW_{channel}$	Config 1, 2		100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1, 2		66
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
TDD Configuration	Config 1, 2		TDDConf.3.1
RMSI CORESET Reference Channel	Config 1, 2		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1, 2		CCR.3.4 TDD
SSB Configuration	Config 1, 2		SSB.1 FR2
SMTC Configuration	Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 KHz
PRACH Configuration	Config 1, 2		Table A.3.8.3.4
SSB index assigned as RLM RS	Config 1, 2		0
OCNG parameters			OP.1
CP length			Normal

Parameter			Unit	Value
				Test 1
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX Configuration				DRX.3
Gap pattern ID				N.A.
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1, 2		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1, 2		TRS.2.1 TDD
T1			s	0.2
T2			s	14.48
T3			s	28.88
D1			s	28.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.				

Table A.5.5.1.10.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests for UE fulfilling relaxed measurement criterion

Parameter		Unit	Test 1		
			T1	T2	T3
AoA setup			Setup 1 defined in A.3.15		
Assumption for UE beams[Note 5]			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
ssb-Index 0 SNR	Config 1, 2	dB	2[Note 6]	2[Note 6]	-15
N_{oc}	Config 1, 2	dBm/15KHz	-104.7 dBm		
goodServingCellEvaluationRLM			configured		
offset in goodServingCellEvaluationRLM		dB	Not configured		
Propagation condition			TDL-A 30ns 75 Hz		

Parameter	Unit	Test 1		
		T1	T2	T3
NOTE 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.				
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.				
NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.				
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				
NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband				

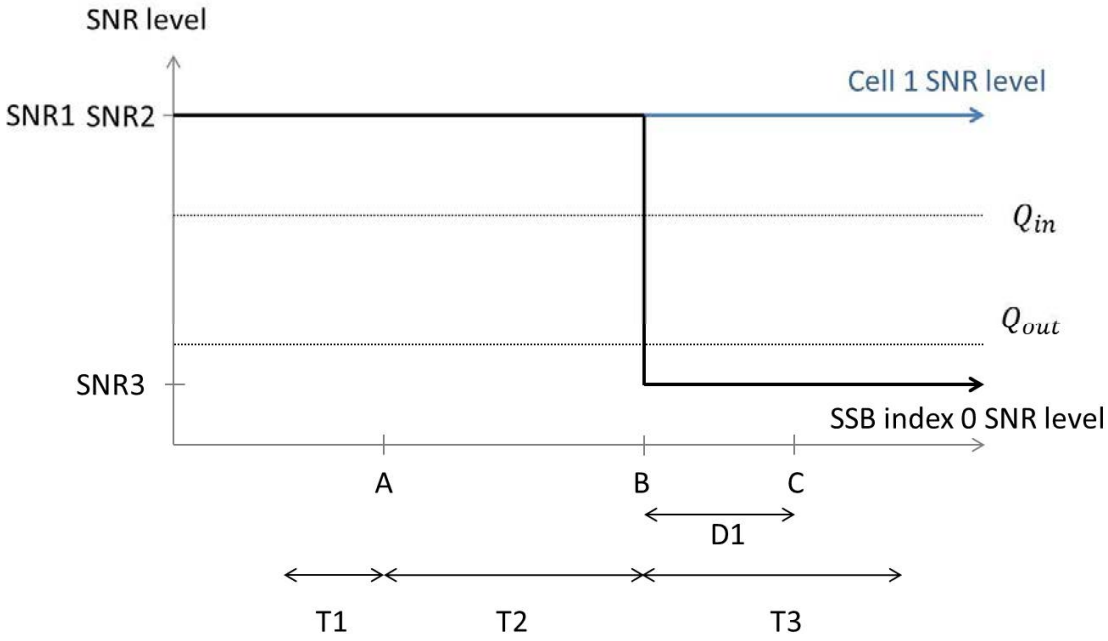


Figure A.5.5.1.10.1-1: SNR variation for out-of-sync testing

A.5.5.1.10.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.1.11 Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with SSB-based RLM RS in non-DRX mode for UE supporting fast beam sweeping in multi-Rx

A.5.5.1.11.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.5.5.1.11.1-1. The test

parameters are given in tables A.5.5.1.11.1-2, and A.5.5.1.11.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-2. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.11.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.5.5.1.11.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2 and configured with *groupBasedBeamReporting-r17*. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Table A.5.5.1.11.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.5.5.1.11.1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode

Parameter			Unit	Value
				Test 1
Active E-UTRA PCell				Cell 1
E-UTRA RF Channel Number				1
Active PSCell				Cell 2
RF Channel Number				2
Duplex mode		Config 1, 2		TDD
$BW_{channel}$		Config 1, 2		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1, 2		24
DL initial BWP configuration		Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2		DLBWP.1.1
UL initial BWP configuration		Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2		ULBWP.1.1
TDD Configuration		Config 1, 2		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1, 2		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1, 2		CCR.3.4 TDD
SSB Configuration		Config 1, 2		SSB.1 FR2
SMTC Configuration		Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1, 2		120 KHz
PRACH Configuration		Config 1, 2		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1, 2		0,1
OCNG parameters				OP.5
CP length				Normal
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				*NA*
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1, 2		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2

Parameter		Unit	Value
			Test 1
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD
T1		s	0.2
T2		s	1.2*N +0.08 Note 4
T3		s	1.2*N +0.08 Note 4
D1		s	1.2*N +0.04 Note 4
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test. NOTE 4: N is the value indicated by UE for *fastBeamSweepingMultiRx-r18*.			

Table A.5.5.1.11.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
AoA setup			Setup 5 defined in A.3.15					
			AoA1			AoA2		
Assumption for UE beams Note 5			Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4			Not sent		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0					
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
ssb-Index 0 SNR	Config 1, 2	dB	2 Note 6	-6 Note 6	-15			
ssb-Index 1 SNR	Config 1, 2		Not sent			2 Note 6	-15	-15
N_{oc}	Config 1, 2	dBm/ 15 kHz	-92.1			-92.1		
Time multiplexing of the downlink transmissions from each AoA			Defined in figure A.5.5.1.11.1-2					
Propagation condition			TDL-A 30ns 75 Hz			TDL-A 30ns 75 Hz		
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband								

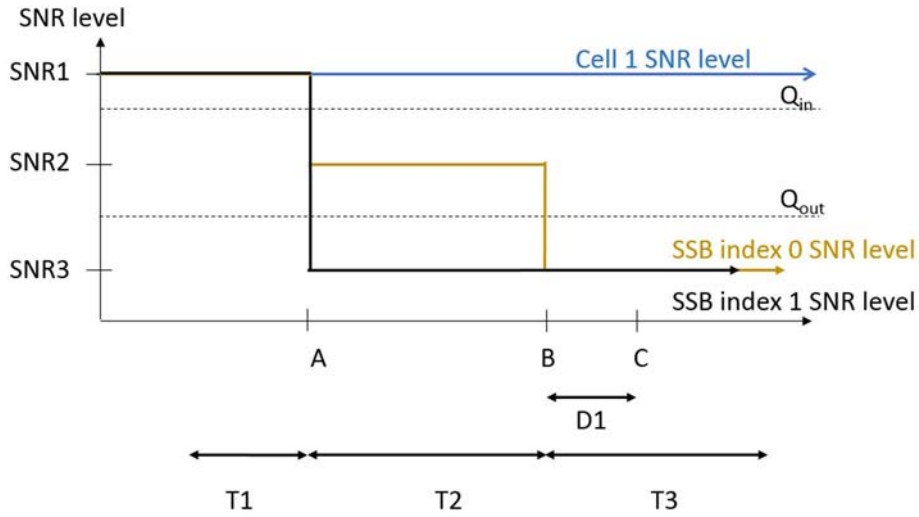


Figure A.5.5.1.11.1-1: SNR variation for out-of-sync testing

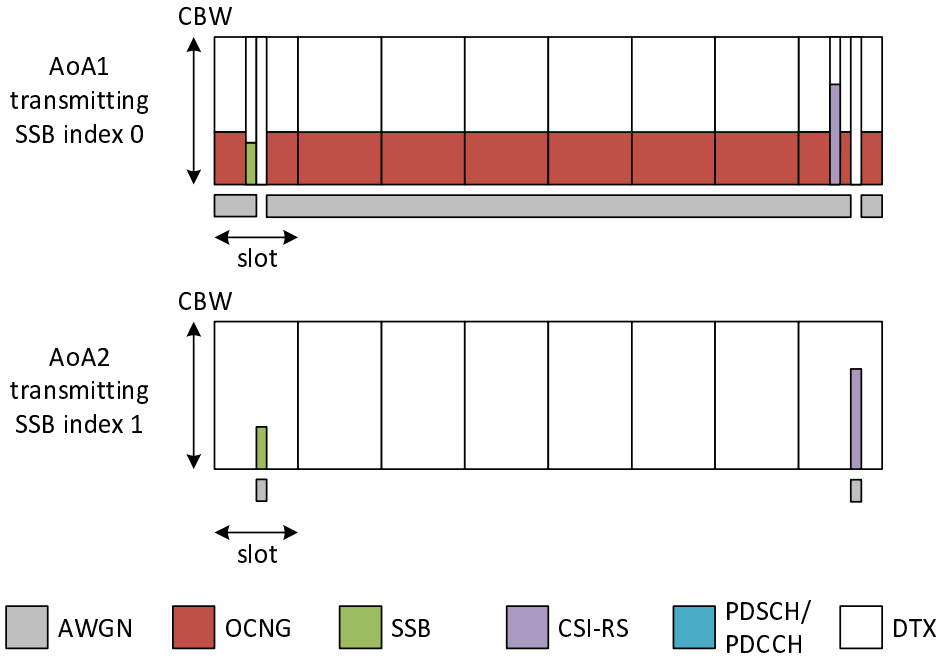


Figure A.5.5.1.11.1-2: Time multiplexed downlink transmissions

A.5.5.1.11.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.1.12 EN-DC Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with CSI-RS-based RLM in non-DRX mode when CD-SSB is outside active BWP

A.5.5.1.12.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used and when CD-SSB is outside active BWP. This test will partly verify the FR2 TDD PSCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test is for UE supporting *rlm-BM-BFD-CSI-RS-OutsideActiveBWP-r18* and the UE is not required past legacy test in A.5.5.1.5.

The test environment is the same as in A.5.5.1.5.

NOTE: The starting PRB index of the SSB can be any possible PRB index of the RF channel BW occurring after the last PRB of the DL active BWP.

The test requirements are the same as in A.5.5.1.5.2.

A.5.5.1.13 Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with SSB-based RLM RS in non-DRX mode when CD-SSB is outside active BWP

A.5.5.1.13.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when CD-SSB is outside active BWP. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

The test environment is the same as in A.5.5.1.1 with following exceptions in table A.5.5.1.1.1-2.

Parameter		Unit	Value
			Test 1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.5
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.5

A.5.5.1.13.2 Test Requirements

The test requirements are the same as in A.5.5.1.1.2.

A.5.5.1.14 EN-DC Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with SSB-based RLM RS in non-DRX mode for UE supporting NCD-SSB based measurement outside active BWP

A.5.5.1.14.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell for UE supporting FG 53-3. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.5.5.1.14.1-1. The test parameters are given in tables A.5.5.1.14.1-2, A.5.5.1.14.1-3, and A. 5.5.1.x.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to table A.3.7.2.1-2. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.14.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.5.5.1.14.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

Table A.5.5.1.14.1-1: Supported test configurations for FR2 PSCell for UE supporting NCD-SSB based measurement outside active BWP

Configuration	Description
1	FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.14.1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode

Parameter			Unit	Value
				Test 1
Active E-UTRA PCell				Cell 1
E-UTRA RF Channel Number				1
Active PSCell				Cell 2
RF Channel Number				2
Duplex mode		Config 1, 2		TDD
$BW_{channel}$		Config 1, 2		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1, 2		24
DL initial BWP configuration		Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2		DLBWP.1.1
UL initial BWP configuration		Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2		ULBWP.1.1
TDD Configuration		Config 1, 2		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1, 2		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1, 2		CCR.3.4 TDD
SSB Configuration		Config 1, 2		SSB.1 FR2
NCD-SSB Configuration		Config 1		SSB.19 FR2
SMTC Configuration		Config 1, 2		SMTC pattern 1 for RedCap
PDSCH/PDCCH subcarrier spacing		Config 1, 2		120 KHz
PRACH Configuration		Config 1, 2		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1, 2		0,1
OCNG parameters				OP.5
CP length				Normal
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				*gp0*
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1

Parameter		Unit	Value
			Test 1
N311			1
CSI-RS for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD
T1		s	0.2
T2		s	9.68
T3		s	9.68
D1		s	9.64
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.			

Table A.5.5.1.14.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
AoA setup			Setup 3 defined in A.3.15					
			AoA1			AoA2		
Assumption for UE beams[Note 5]			Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4			Not sent		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0					
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
ssb-Index 0 SNR	Config 1, 2	dB	2[Note 6]	-6[Note 6]	-15			
ssb-Index 1 SNR	Config 1, 2		Not sent			2[Note 6]	-15	-15
N_{oc}	Config 1, 2	dBm/ 15 kHz	-92.1			-92.1		
Time multiplexing of the downlink transmissions from each AoA			Defined in figure A.5.5.1.1.1-2					
Propagation condition			TDL-A 30ns 75 Hz			TDL-A 30ns 75 Hz		
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband								

Table A.5.5.1.14.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap).	

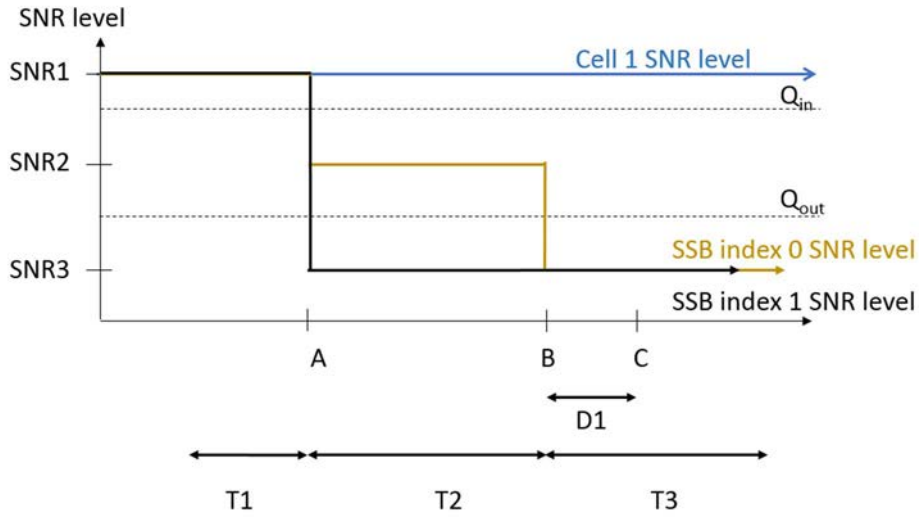


Figure A.5.5.1.14.1-1: SNR variation for out-of-sync testing

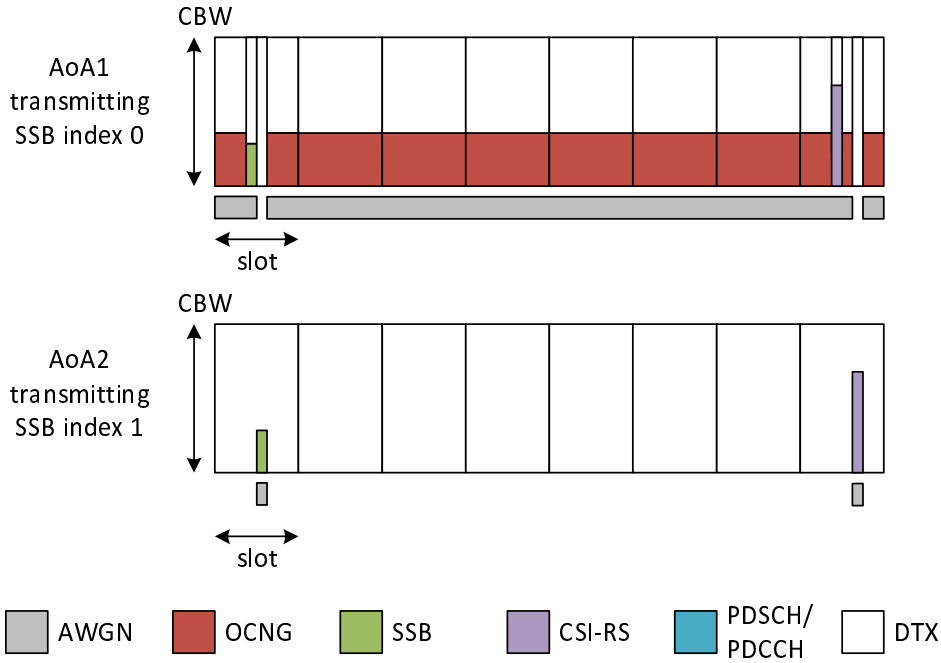


Figure A.5.5.1.14.1-2: Time multiplexed downlink transmissions

A.5.5.1.14.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.2 Interruption

A.5.5.2.1 E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

A.5.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that when E-UTRA PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.1.1-1.

The general test parameters are given in table A.5.5.2.1.1-2, and NR cell specific test parameters are given in table A.5.5.2.1.1-3 and A.5.5.2.1.1-4. The E-UTRAN PCell DRX configuration parameters are given in table A.5.5.2.1.1-5 below. And the E-UTRAN cell specific test parameters can refer to table A.3.7.2.2-1. In the test there are two cells: Cell 1 and Cell2. Cell 1 is LTE PCell on and Cell2 is NR FR2 PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, Cell 1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. PDCCH indicating a new transmission on PSCell shall be sent continuously during the entire time duration to ensure UE would not enter DRX state on PSCell.

Table A.5.5.2.1.1-1: Interruption at transitions between active and non-active during DRX supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.1.1-2: General test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other is NR RF channel
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell 1 and Cell 2
DRX		DRX.4	DRX related parameters are defined in table A.3.3.4-1
Measurement gap pattern Id		OFF	
T1	s	6.25	

Table A.5.5.2.1.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1,2		66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1

Parameter		Unit	Cell 2
TRS configuration	Config 1,2		TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD
RMC CORESET Reference Channel	Config 1,2		CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.3 FR2
SMTC Configuration	Config 1,2		SMTC.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
$\hat{E}_s/N_{oc}$		dB	17
Propagation Condition			AWGN
Time offset to Cell 1 Note 2		µs	3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells			

Table A.5.5.2.1.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter	Unit	Cell2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note1	dBm/15 kHz Note4	-112
N_{oc} Note1	dBm/SCS Note3	-102.97
$\hat{E}_s/N_{oc}$	dB	17
SSB_RP Note2	dBm/SCS Note4	-85.97
$\hat{E}_s/I_{ot}$	dB	17
Io Note2	dBm/95.04 MHz Note4	-56.90
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.		
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone		
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone		
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation		

Table A.5.5.2.1.1-5: Void

A.5.5.2.1.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99 % of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed 0.625 ms (5 slots) as defined in clause 8. 2.1.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.2.2 E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

A.5.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.2.1-1.

The general test parameters are given in table A.5.5.2.2.1-2, and NR cell specific test parameters are given in table A.5.5.2.2.1-3 and A.5.5.2.2.1-4. The E-UTRAN PCell DRX configuration parameters are given in table A.5.5.2.2.1-5 below. And the E-UTRAN cell specific test parameters can refer to table A.3.7.2.2-1. In the test there are two cells: Cell 1 and Cell2. Cell 1 is LTE PCell and Cell2 is NR PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, Cell 1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. PDCCH indicating a new transmission on PSCell shall be sent continuously during the entire time duration to ensure UE would not enter DRX state on PSCell.

Table A.5.5.2.2.1-1: Interruption at transitions between active and non-active during DRX supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.2.1-2: General test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other is NR RF channel
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell 1 and Cell 2
DRX		DRX.6	DRX related parameters are defined in table A.3.3.6-1
Measurement gap pattern Id		OFF	
T1	s	6.25	

Table A.5.5.2.2.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1,2		66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1

Parameter		Unit	Cell 2
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1
TRS configuration	Config 1,2		TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD
RMC CORESET Reference Channel	Config 1,2		CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.3 FR2
SMTC Configuration	Config 1,2		SMTC.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
$\hat{E}_s/N_{oc}$		dB	17
Propagation Condition			AWGN
Time offset to Cell 1 Note 2		µs	62.5

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells

Table A.5.5.2.2.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Unit	Cell2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note1	dBm/15 kHz Note4	-112
N_{oc} Note1	dBm/SCS Note3	-102.97
$\hat{E}_s/N_{oc}$	dB	17
SS B_RP Note2	dBm/SCS Note4	-85.97
$\hat{E}_s/I_{ot}$	dB	17
Io Note2	dBm/95.04 MHz Note4	-56.90

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.5.2.2.1-5: Void

A.5.5.2.2.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99 % of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed 0.625 ms (5 slots) as defined in clause 8. 2.1.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.2.3 E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

A.5.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that for NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for and NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.3.1-1.

The general test parameters are given in table A.5.5.2.3.1-2, and NR cell specific test parameters are given in table A.5.5.2.3.1-3 and A.5.5.2.3.1-4 below. The E-UTRAN cell specific test parameters can be found in table A.3.7.2.1-2. In the test there are three cells: Cell 1, Cell2 and Cell3. Cell 1 is LTE PCell, Cell2 and Cell 3 are NR FR2 PSCell and NR FR2 deactivated SCell, respectively. Cell 1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell 1 and Cell2. The point in time at which the RRC message including *measCycleSCell* for the deactivated NR SCells is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.5.5.2.3.1-1: Interruption during measurements on deactivated NR SCC supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.3.1-2: General test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on NR RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	Ms	640	
T1	S	10	

Table A.5.5.2.3.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Frequency Range			FR2	FR2
Duplex mode	Config 1,2		TDD	TDD
TDD configuration	Config 1,2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66

Parameter		Unit	Cell 2	Cell 3
Data PRBs allocated	Config 1,2		66	66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1	DLBWP.0.1
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1	DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1	ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1	ULBWP.1.1
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD	-
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD	CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		CCR 3.1 TDD	CCR 3.1 TDD
OCNG Patterns			OP.1	OP.1
SSB Configuration	Config 1,2		SSB.1 FR2	SSB.1 FR2
SMTC Configuration	Config 1,2		SMTC.1	SMTC.1
TRS configuration	Config 1,2		TRS.2.1 TDD	TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0	TCI.State.0
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation Condition			AWGN	AWGN
Time offset to Cell 1 Note 2		µs	3	3+ Time offset to Cell 2
Time offset to Cell 2 Note 3		µs	-	3

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells
NOTE 3: Receive time difference of signals received between slot timing boundary from two NR Cells including time alignment error between the two cells

Table A.5.5.2.3.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Angle of arrival configuration			Setup 1 defined in clause A.3.15.1	
Assumption for UE beams Note 6			Fine	Rough
N_{oc} Note1	NR_TDD_FR2_A	dBm/15 kHz	-111.7	-104.7
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS Note3	-102.7	-95.7
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
SSB_RP Note2	NR_TDD_FR2_A	dBm/SCS Note4	-90.7	-90.7
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			

Parameter		Unit	Cell 2	Cell 3
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
$\hat{E}_s/I_{ot}$	NR_TDD_FR2_A	dB	12	5
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
$\hat{E}_s/N_{oc}$	NR_TDD_FR2_A	dB	12	5
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-61.45	-60.52
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone				
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone				
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.5.5.2.3.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5 % of ACK/NACK on NR PSCell.

If the NR PSCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on NR PSCell immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in table A.5.5.2.3.2-1.

If the NR PSCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on PSCell no earlier than 4 slot before an SMTC and no later than 4 slot after the SMTC. the interruption on NR PSCell shall not exceed the value defined in table A.5.5.2.3.2-2.

Table A.5.5.2.3.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	4

Table A.5.5.2.3.2-2: Interruption duration if the NR PSCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	8 + SMTC duration

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.2.4 E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

A.5.5.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that for NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.4.1-1.

The general test parameters are given in table A.5.5.2.4.1-2, and NR cell specific test parameters are given in table A.5.5.2.4.1-3 and A.5.5.2.4.1-4 below. The E-UTRAN cell specific test parameters can be found in table A.3.7.2.1-2. In the test there are three cells: Cell 1, Cell2 and Cell3. Cell 1 is LTE PCell, Cell2 and Cell 3 are NR FR2 PSCell and NR FR2 deactivated SCell, respectively. Cell 1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell 1 and Cell2. The point in time at which the RRC message including *measCycleSCell* for the deactivated NR SCells is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.5.5.2.4.1-1: Interruption during measurements on deactivated NR SCC supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.4.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on NR RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3
AoA number		1	Applicable to Cell 2 and Cell 3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.5.5.2.4.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Frequency Range			FR2	FR2
Duplex mode	Config 1,2		TDD	TDD
TDD configuration	Config 1,2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1,2		66	66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1	
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1	
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1	
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1	
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD	-

Parameter		Unit	Cell 2	Cell 3
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD	CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		CCR.3.1 TDD	CCR.3.1 TDD
OCNG Patterns			OP.1	OP.1
SSB Configuration			SSB.1 FR2	SSB.1 FR2
SMTC Configuration	Config 1,2		SMTC.1	SMTC.1
TRS configuration	Config 1,2		TRS.2.1 TDD	TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0	TCI.State.0
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation Condition			AWGN	AWGN
Time offset to Cell 1 Note 2		µs	62.5	62.5+ Time offset to Cell 2
Time offset to Cell 2 Note 3		µs	-	3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells NOTE 3: Receive time difference of signals received between slot timing boundary from two NR Cells including time alignment error between the two cells				

Table A.5.5.2.4.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Angle of arrival configuration			Setup 1 defined in clause A.3.15.1	
Assumption for UE beams Note 6			Fine	Rough
N_{oc} Note1	NR_TDD_FR2_A	dBm/15 kHz	-111.7	-104.7
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS Note3	-102.7	-95.7
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
SSB_RP Note2	NR_TDD_FR2_A	dBm/SCS Note4	-90.7	-90.7
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
$\hat{E}_s/I_{ot}$		dB	12	5
$\hat{E}_s/N_{oc}$		dB	12	5
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-61.45	-60.52
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			

Parameter	Unit	Cell 2	Cell 3
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 2: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone			
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone			
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			

A.5.5.2.4.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5 % of ACK/NACK on NR PSCell.

If the NR PSCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on NR PSCell immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in table A.5.5.2.4.2-1.

If the NR PSCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on PSCell no earlier than 4 slot before an SMTC and no later than 4 slot after the SMTC. the interruption on NR PSCell shall not exceed the value defined in table A.5.5.2.4.2-2.

Table A.5.5.2.4.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	4

Table A.5.5.2.4.2-2: Interruption duration if the NR PSCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	8 + SMTC duration

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.2.5 E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

A.5.5.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that for NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.5.1-1.

The general test parameters are given in table A.5.5.2.5.1-2, and NR cell specific test parameters are given in table A.5.5.2.5.1-3 and A.5.5.2.5.1-4 below. The E-UTRAN cell specific test parameters can be found in table A.3.7.2.1-2. In the test there are three cells: Cell 1, Cell2 and Cell3. Cell 1 and Cell3 are LTE PCell and LTE deactivated SCell, respectively, and Cell2 is NR FR2 PSCell. Cell 1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell 1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated E-UTRA SCell is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.5.5.2.5.1-1: Interruption during measurements on deactivated E-UTRAN SCC supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.5.1-2: General test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is NR RF channel and two are E-UTRAN RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on E-UTRAN RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.5.5.2.5.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1,2		66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		CCR.3.1 TDD
OCNG Patterns			OP.1
SMTC Configuration	Config 1,2		SMTC.1
SSB Configuration	Config 1,2		SSB.1 FR2
TRS configuration	Config 1,2		TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation Condition			AWGN

Parameter	Unit	Cell 2
Time offset to Cell 1 Note 2	μs	3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells		

Table A.5.5.2.5.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in synchronous EN-DC

Parameter	Unit	Cell2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note1	dBm/15 kHz Note4	-112
N_{oc} Note1	dBm/SCS Note3	-102.97
$\hat{E}_s / N_{oc}$	dB	17
SSB_RP Note2	dBm/SCS Note4	-85.97
$\hat{E}_s / I_{ot}$	dB	17
Io Note2	dBm/95.04 MHz Note4	-56.90
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 2: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.		
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone		
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone		
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation		

A.5.5.2.5.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5 % of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in table A.5.5.2.5.2-1.

Table A.5.5.2.5.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	5

Table A.5.5.2.5.2-2: Void

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.2.6 E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

A.5.5.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that for NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.6.1-1.

The general test parameters are given in table A.5.5.2.6.1-2, and NR cell specific test parameters are given in table A.5.5.2.6.1-3 and A.5.5.2.6.1-4 below. The E-UTRAN cell specific test parameters can be found in table A.3.7.2.1-2. In the test there are three cells: Cell 1, Cell2 and Cell3. Cell 1 and Cell3 are LTE PCell and LTE deactivated SCell, respectively, and Cell2 is NR FR2 PSCell. Cell 1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell 1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated E-UTRA SCell is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.5.5.2.6.1-1: Interruption during measurements on deactivated E-UTRAN SCC supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.6.1-2: General test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is NR RF channel and two are E-UTRAN RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on E-UTRAN RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell 2 and Cell 3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.5.5.2.6.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in asynchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1,2		66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		CCR.3.1 TDD
OCNG Patterns			OP.1
SMTC Configuration	Config 1,2		SMTC.1

Parameter		Unit	Cell 2
SSB Configuration	Config 1,2		SSB.1 FR2
TRS configuration	Config 1,2		TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation Condition			AWGN
Time offset to Cell 1 Note 2		μs	62.5
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells			

Table A.5.5.2.6.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in asynchronous EN-DC

Parameter	Unit	Cell2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note1	dBm/15 kHz Note4	-112
N_{oc} Note1	dBm/SCS Note3	-102.97
$\hat{E}_s / N_{oc}$	dB	17
SSB_RP Note2	dBm/SCS Note4	-85.97
$\hat{E}_s / I_{ot}$	dB	17
Io Note2	dBm/95.04 MHz Note4	-56.90
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 2: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.		
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone		
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone		
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation		

A.5.5.2.6.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5 % of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in table A.5.5.2.6.2-1.

Table A.5.5.2.6.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	5

Table A.5.5.2.6.2-2: Void

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.2.7 E-UTRAN – NR FR2 interruptions at E-UTRA SRS carrier based switching

A.5.5.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that when a UE needs to transmit aperiodic SRS on a PUSCH-less carrier of SCell, the UE can perform carrier based switching to one PUSCH-less SCCs from a CC with PUSCH. The test will verify the interruption requirements on active serving cell in SCG in clause 8.2.1.2.13. Supported test configurations are shown in table A.5.5.2.7.1-1.

In the test there are three cells: Cell 1, Cell 2 and Cell 3. Cell 1 is E-UTRAN PCell on the primary component carrier. Cell3 is E-UTRAN SCell on the TDD secondary component carrier which operates in downlink without PUCCH/PUSCH. Cell2 is NR FR2 PSCell. The UE is configured with the SRS switching between E-UTRAN PCell and E-UTRAN SCell. The general test parameters and NR cell specific test parameters are given in table A.5.5.2.8.1-2, A.5.5.2.8.1-3. And the E-UTRAN cell specific test parameters (for Cell 1 and Cell 3) can refer to table A.3.7.2.1-1. The test consists of two successive time periods, with duration of T1 and T2, respectively. During T1 LTE PCell and NR PSCell are continuously scheduled in DL. Immediately at the beginning of T2, the UE is triggered for SRS switching by DCI 2_3 scheduling. After T2, the UE is expected to transmit aperiodic SRS on a special slot in the configured TDD UL/DL configuration, as scheduled by DCI 2_3.

Table A.5.5.2.7.1-1: E-UTRAN – NR FR2 interruptions at E-UTRA SRS carrier based switching supported test configurations

Config	Description
1	LTE FDD(Cell 1), LTE TDD (Cell 3), NR 120 kHz SSB SCS, 100 MHz bandwidth,TDD duplex mode
2	LTE TDD(Cell 1), LTE TDD (Cell 3), NR 120 kHz SSB SCS, 100 MHz bandwidth,TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.7.1-2: General test parameters for E-UTRAN – NR FR2 interruptions at E-UTRA SRS carrier based switching

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is NR RF channel and the other two are E-UTRAN RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Active PSCell		Cell2	PSCell on NR RF channel number 2.
Activated SCell		Cell3	SCell on E-UTRAN RF channel number 3.
CP length		Normal	Applicable to Cell 1, Cell2 and Cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
T1	s	0.2	
T2	s	0.2	UE shall perform SRS switching during T2

Table A.5.5.2.7.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions at E-UTRA SRS carrier based switching

Parameter		Unit	Cell 2
Frequency Range			**FR2**
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1

Parameter		Unit	Cell 2
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1
TRS configuration	Config 1,2		TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD
RMC CORESET Reference Channel	Config 1,2		CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.1 FR2
SMTC Configuration	Config 1,2		SMTC.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
$\hat{E}_s/N_{oc}$		dB	17
Propagation Condition			AWGN
Time offset to Cell 1 Note 2		ms	3

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells

Table A.5.5.2.7.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Unit	Cell2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note1	dBm/15 kHz Note4	-112
N_{oc} Note1	dBm/SCS Note3	-102.97
$\hat{E}_s/N_{oc}$	dB	17
SS-RSRP Note2	dBm/SCS Note4	-85.97
$\hat{E}_s/I_{ot}$	dB	17
Io Note2	dBm/95.04 MHz Note4	-56.90

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.5.2.7.1-5: Sounding Reference Symbol Configuration for E-UTRAN – NR FR2 interruptions at E-UTRA SRS carrier based switching

Field	Value	Comment
srsBandwidthConfiguration	bw5	
srsSubframeConfiguration	Sc8	Once every 5 subframes
ackNackSrsSimultaneousTransmission	FALSE	
srsMaxUpPTS	N/A	Not applicable
srsBandwidth	0	No hopping
srsHoppingBandwidth	hbw0	
frequencyDomainPosition	0	
Duration	TRUE	Indefinite duration
Srs-ConfigIndexAp	17	SRS periodicity of 10 ms. See Table 8.2-5 in TS 36.213 for aperiodic SRS transmission.
transmissionComb	0	
cyclicShift	cs0	No cyclic shift
SRS-AntennaPort	an1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 36.331.		

A.5.5.2.7.2 Test Requirements

The UE shall be continuously scheduled in NR FR2 PSCell throughout the test. During T2 two interruption time periods are allowed on Cell2 and Cell 1, each interruption due to SRS carrier based switching on Cell2 shall not exceed X defined in table A.5.5.2.7.2-1.

Table A.5.5.2.7.2-1: Interruption length X (slot) E-UTRAN – NR at E-UTRA SRS carrier based switching

μ	NR Slot length (ms)	Interruption length X (slots)
2	0.25	5
3	0.125	9

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.2.8 E-UTRAN – NR FR2 interruptions at NR SRS carrier based switching

A.5.5.2.8.1 Test Purpose and Environment

The purpose of the test is to verify interruptions at NR SRS carrier based switching requirements defined in TS 38.133 [2] clause 8.2.1.2.12 and TS 36.133 [15] clause 7.32.2.13. The general test parameters are given in table A.5.5.2.8.1-2, and NR cell specific test parameters are given in table A.5.5.2.8.1-3. And the E-UTRAN cell specific test parameters can refer to table A.3.7.2.2-1.

In the test there are three cells: Cell 1, Cell2 and Cell3. Cell 1 is LTE PCell, Cell2 is NR FR2 PSCell and Cell3 is NR FR2 SCell. Cell3 is not configured with PUCCH/PUSCH transmission. The test consists of two time periods, with duration of T1 and T2, respectively. During T1 and T2, Cell 1, Cell2 and Cell3 are continuously scheduled in DL. Prior to the start of the time duration T1, Cell 1 shall be configured as LTE PCell, Cell2 shall be configured as NR PSCell and Cell3 shall be configured as NR SCell.

At the beginning of T2, the UE is triggered for SRS switching by DCI 2_3 scheduling. After T2, the UE is expected to transmit aperiodic SRS on a special slot in the configured TDD UL/DL configuration, as scheduled by DCI 2_3. TE shall trigger aperiodic SRS transmission on Cell3.

Table A.5.5.2.8.1-1: Interruption at transitions between active and non-active during DRX supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.8.1-2: General test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other is NR RF channel
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured SCell		Cell3	SCell on NR RF channel number 3.
CP length		Normal	Applicable to Cell 1 and Cell 2
DRX		OFF	
Measurement gap pattern Id		OFF	
T1	s	5	
T2	s	0.1	

Table A.5.5.2.8.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Frequency Range			FR2	
Duplex mode	Config 1,2		TDD	
TDD configuration	Config 1,2		TDDConf.3.1	
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66	
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1	
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1	
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1	
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1	
TRS configuration	Config 1,2		TRS.2.1 TDD	
SRS configuration	Config 1,2		SRS.3 TDD	
TCI state	Config 1,2		TCI.State.0	
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD	
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD	
RMC CORESET Reference Channel	Config 1,2		CCR.3.1 TDD	
OCNG Patterns			OP.1	
SSB Configuration			SSB.1 FR2	
SMTC Configuration	Config 1,2		SMTC.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
$\hat{E}_s/N_{oc}$		dB	17	
Propagation Condition			AWGN	
Time offset to Cell 1 Note 2		µs	33	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells

Table A.5.5.2.8.1-3A: OTA related test parameters

Parameter	Unit	Test 1	
		T1	T2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams[Note 6]		Fine	
N_{oc} [Note1]	dBm/15 kHz[Note4]	-112	
N_{oc} [Note1]	dBm/SCS[Note3]	-103	
$\hat{E}_s / N_{oc}$	dB	4	
SS-RSRP[Note2]	dBm/SCS [Note4]	-99	
$\hat{E}_s / I_{ot}$	dB	4	
Io[Note2]	dBm/95.04 MHz [Note4]	-68.5	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.5.2.8.1-4: Void

A.5.5.2.8.3 Test Requirements

In T2 UE shall transmit SRS on Cell3 as requested. During T2 interruption on Cell2 due to SRS carrier based switching from Cell2 to Cell3 shall not exceed the requirements defined in TS 38.133 [2] clause 8.2.1.2.12.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.2.9 E-UTRAN – NR FR2 interruptions during measurements on deactivated NR PSCell

A.5.5.2.9.1 Test Purpose and Environment

The purpose of this test is to verify that for E-UTRAN PCell interruptions during the measurement on the deactivated NR PSCell, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for LTE PCell in EN-DC specified in TS 36.133 [15] clause 7.32.2.20. Supported test configurations are shown in table A.5.5.2.9.1-1.

The general test parameters are given in table A.5.5.2.9.1-2, and NR cell specific test parameters are given in table A.5.5.2.9.1-3 and A.5.5.2.9.1-4 below. The E-UTRAN cell specific test parameters can be found in table A.3.7.2.1-2. In the test there are two cells: Cell 1 and Cell2. Cell 1 is LTE PCell, Cell2 is NR FR2 deactivated PSCell, respectively. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell 1 and Cell2. The point in time at which the RRC message including *measCyclePSCell* for the deactivated NR PSCell and NR PSCell deactivation command is received by the UE, defines the start of time period T1. During T1, LTE PCell is continuously scheduled in DL. UE is configured with RRM and bfd-and-RLM measurements on the deactivated Cell2.

Table A.5.5.2.9.1-1: Interruption during measurements on deactivated NR PSCell supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.9.1-2: General test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR PSCell

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell 1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell 1 and Cell 2
DRX		OFF	
Measurement gap pattern Id		OFF	
PSCell measurement cycle (measCyclePSCell)	Ms	640	
T1	S	10	

Table A.5.5.2.9.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR PSCell

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1,2		66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		CCR 3.1 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2		SSB.1 FR2
SMTC Configuration	Config 1,2		SMTC.1
TRS configuration	Config 1,2		TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation Condition			AWGN
Time offset to Cell 1 Note 2		µs	3

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells

Table A.5.5.2.9.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR PSCell

Parameter		Unit	Cell 2
Angle of arrival configuration			Setup 1 defined in clause A.3.15.1
Assumption for UE beams[Note 6]			Fine
N_{oc} Note1	NR_TDD_FR2_A	dBm/15 kHz	-111.7
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS[Note3]	-102.7
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
SSB_RP[Note2]	NR_TDD_FR2_A	dBm/SCS [Note4]	-90.7
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
$\hat{E}_s/I_{ot}$	NR_TDD_FR2_A	dB	12
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
$\hat{E}_s/N_{oc}$	NR_TDD_FR2_A	dB	12
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
Io[Note2]	NR_TDD_FR2_A	dBm/95.04 MHz [Note4]	-61.45
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.2.9.2 Test Requirements

The UE shall be continuously scheduled in Cell 1 during the entire length of T1 and the UE is configured with RRM and RLM/BFD measurements on the deactivated Cell2. During the time duration T1 the UE shall transmit at least 99 % of ACK/NACK on E-UTRAN PCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed 1 subframe for synchronous inter-band EN-DC.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.3 SCell Activation and Deactivation Delay

A.5.5.3.1 SCell Activation and deactivation of SCell in FR2 intra-band

A.5.5.3.1.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.4.5.3.1.1 except the SCell is in FR2 intra-band.

The supported test configurations are shown in table A.5.5.3.1.1-1 below. The general and cell specific test parameters are the same except those described in the following clause. The listed parameter values in tables A.5.5.3.1.1-2 and A.5.5.3.1.1-3 will replace the values of corresponding parameters in tables A.4.5.3.1.1-2 and A.4.5.3.1.1-3. In this case, OTA related test parameters are shown in table A.5.5.3.1.1-4 below.

In this test it is assumed that the UE is receiving RRC messages pertaining to the SCell in SCG via signaling on SRB3.

Table A.5.5.3.1.1-1: Supported test configurations for FR2 SCell activation case with FR2 PSCell

Configuration	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.5.5.3.1.1-2: General test parameters for FR2 SCell activation case with FR2 PSCell

Parameter	Unit	Value	Comment
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2

Table A.5.5.3.1.1-3: Cell specific test parameters for FR2 SCell activation case with FR2 PSCell

Parameter[Note 5]	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
SSB ARFCN		freq1			freq2		
Duplex mode		TDD			TDD		
TDD configuration		TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		66			66		
PDSCH Reference measurement channel		SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET Reference Channel		CR.3.1 TDD			CR.3.1 TDD		
RMC CORESET Reference Channel		CCR.3.1 TDD			CCR.3.1 TDD		
DL initial BWP configuration		DLBWP.0.1					
DL dedicated BWP configuration		DLBWP.1.1					
UL initial BWP configuration		ULBWP.0.1					
UL dedicated BWP configuration		ULBWP.1.1					
OCNG Patterns		OP.1					
SMTC configuration		SMTC.1					
SSB configuration		SSB.1 FR2					
TCI state		TCI.State.0					
TRS configuration		TRS.2.1 TDD					
CSI-RS configuration for CSI reporting		CSI-RS.3.1 TDD					
reportConfigType		periodic			N/A		
reportQuantity		cri-RI-PMI-CQI			N/A		
CSI reporting periodicity	slot	40			N/A		
CSI reporting offset	slot	4			N/A		
PDSCH/PDCCH subcarrier spacing	kHz	120					
EPRE ratio of PSS to SSS	dB	0					
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							

Parameter[Note 5]	Unit	Cell 2	Cell 3
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS[Note 1]			
EPRE ratio of OCNG to OCNG DMRS [Note 1]			
Propagation conditions		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: All parameters apply for configuration 1 and 2.

Table A.5.5.3.1.1-4: OTA related test parameters for FR2 SCell activation case with FR2 PSCell

Parameter[Note 6]	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to A.3.15.1					
Assumption for UE beams[Note 7]		Rough			Rough		
N_{oc} [Note1]	dBm/15 kHz[Note4]	-104.7			-104.7		
N_{oc} [Note1]	dBm/SCS[Note3]	-95.7			-95.7		
$\hat{E}_s / N_{oc}$	dB	7			7		
SSB_RP[Note2]	dBm/SCS [Note4]	-88.7			-88.7		
$\hat{E}_s / I_{ot}$	dB	7			7		
Io[Note2]	dBm/95.04 MHz [Note4]	-58.92			-58.92		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: All parameters apply for configuration 1 and 2
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.3.1.2 Test Requirements

The test requirements defined in clause A.4.5.3.1.2 shall apply to this test case, with the following exceptions:

- Placement of interruptions is only verified in NR PSCell.

A.5.5.3.2 SCell Activation and deactivation of known SCell in FR1 for 160 ms SCell measurement cycle

A.5.5.3.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.4.5.3.1.1, except PSCell is in FR2.

The supported test configurations are shown in table A.5.5.3.2.1-1 below. The general test parameters are the same in tables A.4.5.3.1.1-2. The cell specific test parameters are given in tables A.5.5.3.2.1-2. In this case, OTA related test parameters are the same as in table A.5.5.3.2.1-3.

Table A.5.5.3.2.1-1: Supported test configurations for FR1 SCell activation case with PSCell is FR2

Configuration	Description
1	FDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

	Cell 3 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	FDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Cell 3 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	FDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Cell 3 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	TDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Cell 3 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	TDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Cell 3 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	TDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Cell 3 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.5.5.3.2.1-2: Cell specific test parameters for FR1 SCell activation case with FR2 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			freq2			freq1		
Duplex mode	Config 1,4		TDD			FDD		
	Config 2,3,5,6		TDD			TDD		
TDD configuration	Config 1,4		TDDConf.3.1			Not Applicable		
	Config 2,5					TDDConf.1.1		
	Config 3,6					TDDConf.2.1		
$BW_{channel}$	Config 1,4	MHz	100: $N_{PRB,c}$ = 66			10: $N_{PRB,c}$ = 52		
	Config 2,5					10: $N_{PRB,c}$ = 52		
	Config 3,6					40: $N_{PRB,c}$ = 106		
Data PRBs allocated	Config 1,4		66			52		
	Config 2,5					52		
	Config 3,6					106		
DL initial BWP configuration	Config 1,2,3,4,5,6		DLBWP.0.1					
DL dedicated BWP configuration	Config 1,2,3,4,5,6		DLBWP.1.1					
UL initial BWP configuration	Config 1,2,3,4,5,6		ULBWP.0.1					
UL dedicated BWP configuration	Config 1,2,3,4,5,6		ULBWP.1.1					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.3.1 TDD			SR.1.1 FDD		
	Config 2,5					SR.1.1 TDD		
	Config 3,6					SR.2.1 TDD		
RMSI CORESET Reference Channel	Config 1,4		CR.3.1 TDD			CR.1.1 FDD		
	Config 2,5					CR.1.1 TDD		
	Config 3,6					CR.2.1 TDD		
RMC CORESET Reference Channel	Config 1,4		CCR.3.1 TDD			CCR.1.1 FDD		
	Config 2,5					CCR.1.1 TDD		
	Config 3,6					CCR.2.1 TDD		
OCNG Patterns			OP.1					
SMTC configuration			SMTC.1					
TCI state			TCI.State.0			NA		
TRS configuration	Config 1,4		TRS.2.1 TDD			TRS.1.1 FDD		
	Config 2,5					TRS.1.1 TDD		
	Config 3,6					TRS.1.2 TDD		
SSB configuration	Config 1,2,4,5		SSB.1 FR2			SSB.1 FR1		
	Config 3,6					SSB.2 FR1		
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.3.1 TDD			CSI-RS.1.1 FDD		
	Config 2,5					CSI-RS.1.1 TDD		
	Config 3,6					CSI-RS.2.1 TDD		
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	120 kHz			15 kHz		
	Config 3,6					30 kHz		
reportConfigType	Config 1-6		periodic			N/A		
reportQuantity	Config 1-6		cri-RI-PMI-CQI			N/A		
CSI reporting periodicity	Config 1,2,3,4,5,6	slot	40			N/A		
CSI reporting offset	Config 1,2,3,4,5,6	slot	4			N/A		
EPRE ratio of PSS to SSS		dB	0					

Parameter	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
Propagation condition		AWGN			NA Link only, see clause A.3.7A		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Void NOTE 3: Void NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.							

Table A.5.5.3.2.1-3: OTA related test parameters for FR1 SCell activation case with FR2 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			Setup 1 according to clause A.3.15.1			NA Link only, see clause A.3.7A		
Assumption for UE beams[Note 7]			Rough					
N_{oc} [Note1]		dBm/15 kHz	-104.7					
N_{oc} [Note1]	Config 1,2,4,5	dBm/SCS	-95.7					
	Config 3,6							
SSB_RP[Note2]	Config 1,2,4,5	dBm/SCS Note3	-88.7					
	Config 3,6							
$\hat{E}_s/N_{oc}$	Config 1,2,3,4,5,6	dB	7					
$\hat{E}_s/I_{ot}$		dB	7					
Io[Note2]	Config 1,2,4,5	dBm/ChBw[Note4,Note6]	-58.92					
	Config 3,6							
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: Void NOTE 6: ChBW is 94.04 MHz for Cell2, 9.36 MHz for Cell 3 in configurations 1,2,4,5, 38.1 MHz in configurations 3,6 NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation								

A.5.5.3.2.2 Test Requirements

The test requirements defined in clause A.4.5.3.1.2 shall apply to this test case.

A.5.5.3.3 Void

A.5.5.3.4 Void

A.5.5.3.5 SCell Activation and deactivation of SCell in FR2

A.5.5.3.5.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell is in FR2.

The supported test configurations are shown in table A.5.5.3.5.1-1 below. The test parameters are the same as in clause A.4.5.3.3.1 except those described in the following clause. The listed parameter values in tables A.5.5.3.5.1-2 will replace the values of corresponding parameters in tables A.4.5.3.3.1-2. The listed parameter values in tables A.5.5.3.5.1-3 will replace the values of corresponding parameters in tables A.4.5.3.3.1-3. In this case, OTA related test parameters are shown in table A.5.5.3.5.1-4 below.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell (Cell 1), NR has two cells, PSCell (Cell 2) in FR1 and SCell (Cell 3) in FR2. Cell 1 and Cell 2 have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRAN and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment 100 ms after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2.

During T2, the test equipment monitors the L1-RSRP measurement reporting for the SCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot $m+T_{L1\text{-}RSRP}$. In the next DL slot after slot $m+T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during activation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell 1 deactivation command is sent until CSI reporting for SCell 1 is discontinued.

Table A.5.5.3.5.1-1: FR2 SCell activation in non-DRX test configurations with FR1 PSCell

Configuration	Description
1	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
6	LTE TDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.3.5.1-2: General test parameters for FR2 SCell activation case with FR1 PSCell

Parameter	Unit	Value	Comment
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2
T2	s	2	During this time the UE shall activate the SCell.

Table A.5.5.3.5.1-3: Cell specific test parameters for FR2 SCell activation case with FR1 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2		
Duplex mode	Config 1,4		FDD			TDD		
	Config 2,3,5,6		TDD			TDD		
TDD configuration	Config 1,4		Not Applicable			TDDConf.3.1		
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
Data PRBs allocated	Config 1,4		52			66		
	Config 2,5		52					
	Config 3,6		106					
BWP BW	Config 1,4		10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD			SR.3.1 TDD		
	Config 2,5		SR.1.1 TDD					
	Config 3,6		SR.2.1 TDD					
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD			CR.3.1 TDD		
	Config 2,5		CR.1.1 TDD					
	Config 3,6		CR.2.1 TDD					
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD			CCR.3.1 TDD		
	Config 2,5		CCR.1.1 TDD					
	Config 3,6		CCR.2.1 TDD					
OCNG Patterns			OP.1					
SMTC configuration			SMTC.1					
TCI state			NA			TCI.State.0		
TRS configuration	Config 1,4		TRS.2.1 TDD			TRS.2.1 TDD		
	Config 2,5		TRS.1.1 TDD					
	Config 3,6		TRS.1.2 TDD					
SSB configuration	Config 1,2,4,5		SSB.1 FR1			SSB.1 FR2		
	Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz			120 kHz		
	Config 3,6		30 kHz					
CSI-RS configuration	Config 1~6		NA			NA	CSI-RS.3.1 TDD Note 5	
reportConfigType	Config 1~6		periodic			NA		
reportQuantity	Config 1~6		cri-RI-PMI-CQI			NA		
CSI reporting periodicity Note 6	Config 1~6	slot	40			NA		
CSI reporting offset	Config 1~6	slot	4			NA		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
Propagation condition		-	N/A Link only, see clause A.3.7A			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot $m+T_{L1\text{-}RSRP}$ during T2.
NOTE 6: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.5.5.3.5.1-4: OTA related test parameters for FR2 SCell activation case with FR1 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			NA			Setup 1 according to clause A.3.15.1		
Assumption for UE beams Note 7			NA			Rough		
N_{oc} Note1		dBm/15 kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} Note1	Config 1,2,4,5	dBm/SCS				-95.7		
	Config 3,6							
SSB_RP Note2	Config 1,2,4,5	dBm/SCS Note3				-∞	-88.7	-88.7
	Config 3,6							
$\hat{E}_s/N_{oc}$	Config 1,2,3,4,5,6	dB				-∞	7	7
$\hat{E}_s/I_{ot}$		dB				-∞	7	7
Io Note2, Note 4	Config 1,2,4,5	dBm/95.04 MHz				-66.68	-58.92	-58.92
	Config 3,6							

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 3: Void

NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

NOTE 5: Void

NOTE 6: Void

NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.5.5.3.5.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PSCell in the slot.

During T2 the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than

3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$

as defined in clause 8.3.2. For this test case, $T_{FirstSSB_MAX}$=T_{SMTC_MAX}=T_{rs}=20 ms; $T_{L1\text{-}RSRP,\ measure}$=480 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ 1000 ms.

During T2 the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in table A.5.5.3.1.1-2

- $T_{activation_time}$ = 3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows 1030 ms

- $T_{CSI_Reporting}$ = 10 ms

- NR slot length is 0.125 ms for this test case.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}}$, and interruption of E-UTRA PCell during SCell activation shall not happen outside the subframe $m_1 + 1 + \frac{T_{\text{HARQ}}}{\text{EUTRA slot length}}$ to subframe $m_2 + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{EUTRA slot length}}$, as defined in clause 8.3, where T_X =20 ms, and m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m.

During T3 the starting point of interruption of PSCell during SCell deactivation shall not happen outside the slot n + $1 + \frac{T_{\text{HARQ}}}{NR\ slot\ length}$ to n + $1 + \frac{T_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3 and the starting point of interruption of E-UTRA PCell during SCell deactivation shall not happen outside the subframe $n_1 + 1 + \frac{T_{\text{HARQ}}}{EUTRA\ subframe\ length}$ to subframe $n_2 + 1 + \frac{T_{\text{HARQ}}+3\ ms}{EUTRA\ subframe\ length}$, where n_1 and n_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot n.

The interruption of PSCell due to activation of SCell 1 and SCell2 shall not be more than the values specified for EN-DC in clause 8.2.1.2.10.

The interruption of PCell due to activation of SCell 1 and SCell2 shall not be more than the values specified for EN-DC in clause 7.32.2.5 of TS 36.133 [15].

A.5.5.3.6 Multiple SCell Activation and deactivation of one unknown SCell and one known SCell in FR2

A.5.5.3.6.1 Test Purpose and Environment

The purpose of this test is to verify that the multiple SCell activation and deactivation delay and interruption are within the requirements stated in clause 8.3, when the two SCells to be activated are in FR2 and one SCell is known and the other SCell is unknown by the UE at the time of activation.

The supported test configurations are shown in table A.5.5.3.6.1-1 below. The general test parameters are given in table A.5.5.3.6.1-2 and cell-specific test parameters in table A.5.5.3.6.1-3 below. OTA related test parameters are shown in table A.5.5.3.6.1-4.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are four carriers, one E-UTRA cell, and three NR cells. Before the test starts the UE is connected to Cell 1 (PCell) on the E-UTRA carrier and Cell 2 (PSCell) on the NR carrier in FR1, but is not aware of Cell 3 (SCell 1) or Cell 4 (SCell2) on the NR carriers both in FR2. Cell 1, Cell 2 and Cell 3 have constant signal levels throughout the test. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the Cell 3 (SCell 1) and Cell 4 (SCell2) are configured on NR. The test equipment sends a single MAC message for activation of both SCells within 3 s for UE power class 2/3/4 or 4 s for UE power class 1 after RRM reports is sent for SCell 1.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2. In the same MAC PDU, the test equipment activates the TCI state of RMC CORESET. In slot #m, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell 1 and SCell2.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for SCell is discontinued.

Table A.5.5.3.6.1-1: Supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.3.6.1-2: General test parameters

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3,4	One E-UTRAN radio channel (1) and three NR radio channels (2,3,4) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2 in FR1.
Configured deactivated SCells		Cell 3, Cell 4	Configured deactivated secondary cell on NR RF channel number 3 and RF channel number 4, both in FR2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
SCell measurement cycle (measCycleSCell)	ms	160	For both Cell 3 and Cell 4
T1	s	7	During this time the PSCell shall be known and the SCells configured, SCell 1 detected but SCell2 not detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
k	slot	$k_1 + 3 \cdot N_{\text{slot}}^{\text{subframe},\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A. 5.5.3.6.1-3: Cell specific test parameters

Parameter		Unit	Cell 2			Cell 3			Cell 4		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
SSB ARFCN			**freq1**			**freq2**			**freq3**		
Duplex mode	Config 1,2		TDD								
TDD configuration	Config 1,2		TDDConf.3.1								
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66								
DL initial BWP configuration	Config 1,2		DLBWP.0.1								
DL dedicated BWP configuration	Config 1,2		DLBWP.1.1								
UL initial BWP configuration	Config 1,2		ULBWP.0.1								
UL dedicated BWP configuration	Config 1,2		ULBWP.1.1								
Timing offset to Cell 2		ms	Not Applicable			0			0		
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD			SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD			CR.3.1 TDD			CR.3.1 TDD		
RMC CORESET Reference Channel	Config 1,2		CCR.3.1 TDD			CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration	Config 1,2		TRS.2.1 TDD			TRS.2.1 TDD			TRS.2.1 TDD		

CSI-RS configuration	Config 1,2		CSI-RS.3.1 TDD	N/A	CSI-RS.3.1 TDD	N/A	CSI-RS.3.1 TDD
CSI reporting periodicity	Config 1,2	ms	5		5		5
OCNG Patterns			OP.1				
SMTC configuration			SMTC.1				
SSB configuration	Config 1,2		SSB.1 FR2		SSB.1 FR2	N/A	SSB.1 FR2
EPRE ratio of PSS to SSS		dB	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
Propagation condition		-	AWGN				
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							

Table A.5.5.3.6.1-4: OTA related test parameters

Parameter[Note 6]	Unit	Cell 3			Cell 4		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to A.3.15.1					
Assumption for UE beams[Note 7]		Rough			Rough		
N_{oc} [Note1]	dBm/15 kHz[Note4]	-112			-112		
N_{oc} [Note1]	dBm/SCS[Note3]	-102.97			-102.97		
$\hat{E}_s / N_{oc}$	dB	14			N/A	14	14
SS-RSRP[Note2]	dBm/SCS [Note4]	-88.97			N/A	-88.97	-88.97
$\hat{E}_s / I_{ot}$	dB	14			N/A	14	14
Io[Note2]	dBm/95.04 MHz [Note4]	-59.81			-73.98	-59.81	-59.81
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone							
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone							
NOTE 6: All parameters apply for configuration 1 and 2							
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation							

A.5.5.3.6.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PSCell in the slot.

During T2 the UE shall start sending CSI reports for SCell 1 and SCell2 with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in table A.5.5.3.Y.1-2

- $T_{activation_time}$ = 5 ms + $T_{FineTiming}$ = 25 ms,

- $T_{CSI_Reporting}$ = 10 ms

- NR slot length is 0.125 ms.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.5.5.3.7 Direct SCell activation at SCell addition of known SCell in FR2

A.5.5.3.7.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.4.5.3.5 except the SCell is in FR2 intra-band.

The supported test configurations are shown in table A.5.5.3.7.1-1 below. The general and cell specific test parameters are the same except those described in the following clause. The listed parameter values in tables A.5.5.3.7.1-2 and A.5.5.3.7.1-3 will replace the values of corresponding parameters in tables A.4.5.3.5.1-2 and A.4.5.3.5.1-3. In this case, OTA related test parameters are shown in table A.5.5.3.7.1-4 below.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, each with one cell. Cell 1 operates in either FDD or TDD duplex mode according to test configuration. Cell 2 and Cell 3 operate in TDD duplex mode. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and Cell 2 (PSCell) on radio channel 2 (PSCC), but is not aware of Cell 3 (SCell 1) on radio channel 3 (SCC). The UE is only monitoring the PCC/PSCC. The UE shall be continuously scheduled in the PCell/PSCell throughout the whole test.

At the beginning of T1, the UE is configured to measure radio channel 3 and starts detecting the Cell 3 (SCell) on radio channel 3 (SCC). During T1 Cell 3 is detected and measured and measurement report is sent by the UE to the test equipment.

Time period T2 starts when test equipment sends the RRCConnectionReconfiguration message for the activation of the SCell within time period specified in clause 8.3.2 for known cell definition to ensure the configured SCell is known.The NR shall be use an *RRCConnectionReconfigurationComplete* message with parameter *sCellState* set to *activated*for the SCell (Cell 3), which causes the SCell to become configured and activated on radio channel 3 (SCC). The message is sent from the test equipment to the UE and is received in a subframe # denoted m at the UE antenna connector. The UE shall accomplish the activation of the SCell no later than subframe (m+ N_{direct}).

Time period T3 starts at (m+ N_{direct}), at which point UE shall be reporting a valid CQI for PCell/PSCell and SCell.

During T3, the UE shall be continuously scheduled in the SCell.

The test equipment verifies the activation time by counting the subframes from the time when the direct SCell activation is sent and until a CSI report with other than CQI index 0 is received.

The test equipment verifies the CSI report from the direct activated SCell after the activation procedure is completed contains CQI index other than 0.

Table A.5.5.3.7.1-1: Supported test configurations for FR2 SCell activation case with FR2 PSCell

Configuration	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.5.5.3.7.1-2: General test parameters for FR2 SCell activation case with FR2 PSCell

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	Two radio channels are used for this test. One for E-UTRA cell and two for NR Cell
Active PCell		Cell 1	PCell on RF channel number 1. As specified in clause A.3.7.2.2
Active PSCell		Cell2	PSCell on RF channel number 2.
Deconfigured deactivated SCell		Cell3	Deconfigured deactivated secondary cell on RF channel number 3
DRX		OFF	Continuous monitoring of PCell/PSCell
PRACH configuration on Cell 2		FR2 configuration 2	Captured in A.3.8.3.2
PSCell CQI/PMI periodicity and offset configuration index		slot5	CQI reporting for PSCell every uplink slot
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on carrier frequency of Cell 1.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on carrier frequency of Cell 2.
Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for cells on carrier frequency of Cell 3.
T1	s	7	During this time the PCell/PSCell shall be known and Cell 3 is detected, and UE shall report a valid CQI for PCell/PSCell.
T2	s	N_{direct}	During this time the UE shall be configured with directly activated SCell 1.
T3	s	1	During this time the UE shall report a valid CQI for PCell/PSCell and SCell.

Table A.5.5.3.7.1-3: Cell specific test parameters for FR2 SCell activation case with FR2 PSCell

Parameter[Note 5]	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
SSB ARFCN		freq1			freq2		
Duplex mode		TDD			TDD		
TDD configuration		TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
PDSCH Reference measurement channel		SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET Reference Channel		CR.3.1 TDD			CR.3.1 TDD		
RMC CORESET Reference Channel		CCR.3.1 TDD			CCR.3.1 TDD		
DL initial BWP configuration		DLBWP.0.1					
DL dedicated BWP configuration		DLBWP.1.1					
UL initial BWP configuration		ULBWP.0.1					
UL dedicated BWP configuration		ULBWP.1.1					
OCNG Patterns		OP.1					
SMTC configuration		SMTC.1					
SSB configuration		SSB.1 FR2					
TCI state		TCI.State.0					
TRS configuration		TRS.2.1 TDD					
CSI-RS configuration for CSI reporting		CSI-RS.3.1 TDD					
reportConfigType		periodic			N/A		
reportQuantity		cri-RI-PMI-CQI			N/A		
CSI reporting periodicity	slot	40			N/A		
CSI reporting offset	slot	4			N/A		
PDSCH/PDCCH subcarrier spacing	kHz	120					
EPRE ratio of PSS to SSS	dB	0					
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS[Note 1]							
EPRE ratio of OCNG to OCNG DMRS [Note 1]							
Propagation conditions		AWGN					

Parameter[Note 5]	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 5: All parameters apply for configuration 1 and 2.							

Table A.5.5.3.7.1-4: OTA related test parameters for FR2 SCell activation case with FR2 PSCell

Parameter[Note 6]	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to A.3.15.1					
Assumption for UE beams[Note 7]		Rough			Rough		
N_{oc} [Note1]	dBm/15 kHz[Note4]	-104.7			-104.7		
N_{oc} [Note1]	dBm/SCS[Note3]	-95.7			-95.7		
$\hat{E}_s / N_{oc}$	dB	7			7		
SS-RSRP[Note2]	dBm/SCS [Note4]	-88.7			-88.7		
$\hat{E}_s / I_{ot}$	dB	7			7		
Io[Note2]	dBm/95.04 MHz [Note4]	-58.92			-58.92		
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone							
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone							
NOTE 6: All parameters apply for configuration 1 and 2							
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation							

A.5.5.3.7.2 Test Requirements

The UE shall accomplish the activation of the SCell no later than subframe m+N_{direct} as defined in clause 8.3.4.

Time period T3 starts at (m+ N_{direct}), at which point UE shall be reporting a valid CQI for both PSCell and SCell.

During T3 the UE shall send CSI reports for SCell with non-zero CQI index and continue to send CSI reports for SCell 1 with non-zero CQI index until the end of T3. All of the above test requirements shall be fulfilled in order for the observed SCell 1 direct activation delay to be counted as correct. The rate of correct observed SCell 1 direct activation delay during repeated tests shall be at least 90 %.

A.5.5.3.8 Fast SCell Activation of SCell in FR2 intra-band

A.5.5.3.8.1 Test Purpose and Environment

The purpose of this test is to verify that the fast SCell activation and deactivation times are within the requirements stated in clause 8.3.16, when the SCell in FR2 is known by the UE at the time of activation.

The supported test configurations are shown in table A.5.5.3.8-1 below. The test parameters are given in tables A.5.5.3.8-2 and cell-specific parameters in A.5.5.3.8-3 below. The test consists of two successive time periods, with duration of T1 and T2, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. All cells have

constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test. In this case, OTA related test parameters are shown in table A.5.5.3.8.1-4 below.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. The UE now starts monitoring the SCell. The test equipment sends a MAC message for activation of the SCell and triggering the aperiodic CSI-RS for fast SCell activation.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m (where m mode 20=1), defines the start of time period T2. The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot m + $\frac{T_{\text{HARQ}}+T_{\text{activation_time}}+T_{\text{CSI_Reporting}}}{\text{NR slot length}}$, as defined in clause 8.3.16. The UE shall start reporting CSI in PSCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption due to activation of SCell shall occur in the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to slot $m + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.5.5.3.8.1-1: Supported test configurations for FR2 SCell activation case with FR2 PSCell

Configuration	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.5.5.3.8.1-2: General test parameters for FR2 SCell activation case with FR2 PSCell

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on E-UTRA RF channel number	dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on secondary component carrier.
Cell3 timing offset to Cell 2	µs	0	
Time alignment error between Cell 3 and Cell 2	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PSCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
A3-offset	dB	-15	

Parameter	Unit	Value	Comment
T_{HARQ}	ms	k_1NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
k	slot	$k_1 + 3 \cdot N_{\text{slot}}^{\text{subframe},\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.5.5.3.8.1-3: Cell specific test parameters for FR2 SCell activation case with FR2 PSCell

Parameter[Note 5]	Unit	Cell 2		Cell 3	
		T1	T2	T1	T2
SSB ARFCN		freq1		freq2	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		66		66	
PDSCH Reference measurement channel		SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel		CR.3.1 TDD		CR.3.1 TDD	
RMC CORESET Reference Channel		CCR.3.1 TDD		CCR.3.1 TDD	
DL initial BWP configuration		DLBWP.0.1			
DL dedicated BWP configuration		DLBWP.1.1			
UL initial BWP configuration		ULBWP.0.1			
UL dedicated BWP configuration		ULBWP.1.1			
OCNG Patterns		OP.1			
SMTC configuration		SMTC.1			
SSB configuration		SSB.1 FR2			
Aperiodic CSI-RS for Scell activation		-		TRS.2.3	
gapBetweenBursts	slots	N/A			
TCI state		TCI.State.0			
TRS configuration		TRS.2.1 TDD			
CSI-RS configuration for CSI reporting		CSI-RS.3.1 TDD			
reportConfigType		periodic		N/A	
reportQuantity		cri-RI-PMI-CQI		N/A	
CSI reporting periodicity	slot	40		N/A	
CSI reporting offset	slot	4		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	120			
EPRE ratio of PSS to SSS	dB	0			
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS[Note 1]					
EPRE ratio of OCNG to OCNG DMRS [Note 1]					
Propagation conditions		AWGN			

Parameter[Note 5]	Unit	Cell 2		Cell 3	
		T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Void NOTE 3: Void NOTE 4: Void NOTE 5: All parameters apply for configuration 1 and 2.					

Table A.5.5.3.8.1-4: OTA related test parameters for FR2 SCell activation case with FR2 PSCell

Parameter[Note 6]	Unit	Cell 2		Cell 3	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 1 according to A.3.15.1			
Assumption for UE beams[Note 7]		Rough		Rough	
N_{oc} [Note1]	dBm/15 kHz[Note4]	-104.7		-104.7	
N_{oc} [Note1]	dBm/SCS[Note3]	-95.7		-95.7	
$\hat{E}_s / N_{oc}$	dB	7		7	
SS_RP[Note2]	dBm/SCS [Note4]	-88.7		N/A	
CSI-RS_RP[Note2]	dBm/SCS [Note4]	N/A		-88.7	
$\hat{E}_s / I_{ot}$	dB	7		7	
Io[Note2]	dBm/95.04 MHz [Note4]	-58.92		-58.92	
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: Es/Iot, SS_RP, CSI_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: Void NOTE 6: All parameters apply for configuration 1 and 2 NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation					

A.5.5.3.8.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available uplink resource if an available uplink resource is subject to interruption. Whether CSI report in slot (m+k) was interrupted is checked by monitoring ACK/NACK sent in PCell in slot (m+k).

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, $T_{activation_time} = T_{FirstATRS} + 5$ ms, as defined in clause 8.3.

During T2 interruption of PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{\text{interruption}}$.

The interruption of PSCell shall not be more than the values specified for EN-DC in clause 8.2.1.2.4.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.5.5.3.9 PUCCH SCell Activation and deactivation of known SCell in FR2

A.5.5.3.9.1 Test Purpose and Environment

The purpose of this test is to verify that the PUCCH SCell activation and deactivation times are within the requirements stated in clause 8.3, when the PUCCH SCell is in FR2.

The supported test configurations are shown in table A.5.5.3.9.1-1 below. The test parameters are the same as in clause A.4.5.3.3.1 except those described in the following clause. The listed parameter values in tables A.5.5.3.9.1-2 will replace the values of corresponding parameters in tables A.4.5.3.3.1-2. The listed parameter values in tables A.5.5.3.9.1-3 will replace the values of corresponding parameters in tables A.4.5.3.3.1-3. In this case, OTA related test parameters are shown in table A.5.5.3.9.1-4 below.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell (Cell 1), and NR has two cells, PSCell (Cell 2) in FR1 and PUCCH SCell (Cell 3) in FR2. Cell 1 and Cell 2 have constant signal levels throughout the test. Cell 1, Cell2 and Cell 3 are in primary Timing Advance Group (pTAG). UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment for sTAG.

Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRAN and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (PUCCH SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell (Cell 3) becomes configured on NR. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the PUCCH SCell.

The point in time at which the MAC message is received at the UE antenna connector provided that the HARQ ACK of the MAC message is received by TE, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI on for the activated PUCCH SCell on PUCCH SCell at latest in slot n + $\frac{T_{\mathrm{HARQ}}+T_{\mathrm{activation_time}}+[X]+T_{\mathrm{CSI_Reporting}}}{\text{NR slot length}}$, as defined in clause 8.3.

Time period T3 starts when a MAC message for deactivation of PUCCH SCell, sent from the test equipment to the UEin a slot # denoted m, is received at the UE antenna connector provided that the HARQ ACK of the MAC message is received by TE. The UE shall carry out deactivation of the PUCCH SCell in a slot m + $\frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during activation of PUCCH SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the PUCCH SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the PUCCH SCell deactivation command is sent until CSI reporting for PUCCH SCell is discontinued.

Table A.5.5.3.9.1-1: FR2 SCell activation in non-DRX test configurations with FR1 PSCell

Configuration	Description
1	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
6	LTE TDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.3.9.1-2: General test parameters for FR2 SCell activation case with FR1 PSCell

Parameter	Unit	Value	Comment
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2
T2	s	2	During this time the UE shall activate the SCell.

Table A.5.5.3.9.1-3: Cell specific test parameters for FR2 SCell activation case with FR1 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2		
Duplex mode	Config 1,4		FDD			TDD		
	Config 2,3,5,6		TDD			TDD		
TDD configuration	Config 1,4		Not Applicable			TDDConf.3.1		
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
Data PRBs allocated	Config 1,4		52			66		
	Config 2,5		52					
	Config 3,6		106					
BWP BW	Config 1,4		10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 2,5		10: NRB,c = 52					
	Config 3,6		40: NRB,c = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD			SR.3.1 TDD		
	Config 2,5		SR.1.1 TDD					
	Config 3,6		SR.2.1 TDD					
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD			CR.3.1 TDD		
	Config 2,5		CR.1.1 TDD					
	Config 3,6		CR.2.1 TDD					
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD			CCR.3.1 TDD		
	Config 2,5		CCR.1.1 TDD					
	Config 3,6		CCR.2.1 TDD					
OCNG Patterns			OP.1					
SMTC configuration			SMTC.1					
TCI state			NA			TCI.State.0		
TRS configuration	Config 1,4		TRS.2.1 TDD			TRS.2.1 TDD		
	Config 2,5		TRS.1.1 TDD					
	Config 3,6		TRS.1.2 TDD					
SSB configuration	Config 1,2,4,5		SSB.1 FR1			SSB.1 FR2		
	Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz			120 kHz		
	Config 3,6		30 kHz					
CSI-RS configuration	Config 1~6		NA			NA	CSI-RS.3.1 TDD Note 5	
reportConfigType	Config 1~6		NA			periodic		
reportQuantity	Config 1~6		NA			cri-RI-PMI-CQI		
CSI reporting periodicity Note 6	Config 1~6	slot	NA			40		
CSI reporting offset	Config 1~6	slot	NA			4		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
Propagation condition		-	N/A			AWGN		

Parameter	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
		Link only, see clause A.3.7A					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
NOTE 6: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.5.5.3.9.1-4: OTA related test parameters for FR2 SCell activation case with FR1 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			NA			Setup 1 according to clause A.3.15.1		
Assumption for UE beams[Note 7]			NA			Rough		
N_{oc} [Note1]		dBm/15 kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} [Note1]	Config 1,2,4,5	dBm/SCS				-95.7		
	Config 3,6							
SSB_RP[Note2]	Config 1,2,4,5	dBm/SCS [Note3]				-88.7	-88.7	-88.7
	Config 3,6							
$\hat{E}_s/N_{oc}$	Config 1,2,3,4,5,6	dB				7	7	7
$\hat{E}_s/I_{ot}$		dB				7	7	7
Io[Note2, Note 4]	Config 1,2,4,5	dBm/95.04 MHz				-58.92	-58.92	-58.92
	Config 3,6							

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.5.5.3.9.2 Test Requirements

During T2 the UE shall start sending CSI reports for PUCCH SCell with non-zero CQI index at latest in a slot n + $\frac{T_{\text{HARQ}}+T_{\text{activation_time}}+[X]+T_{\text{CSI_Reporting}}}{\text{NR slot length}}$, $T_{\text{activation_time}} = T_{\text{FirstSSB}} + 5$ ms, as defined in clause 8.3.

During T3 the UE shall stop sending CSI reports for PUCCH SCell at latest in a slot m + $\frac{T_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

All of the above test requirements shall be fulfilled in order for the observed PUCCH SCell activation delay and PUCCH SCell deactivation delay to be counted as correct. The rate of correct observed PUCCH SCell activation delay and PUCCH SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in slot n + $\frac{T_{\text{HARQ}}+T_{\text{activation_time}}+[X]+T_{\text{CSI_Reporting}}}{\text{NR slot length}}$ then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.5.5.3.10 PUCCH SCell Activation and deactivation of unknown SCell in FR2

A.5.5.3.10.1 Test Purpose and Environment

The purpose of this test is to verify that the PUCCH SCell activation and deactivation times are within the requirements stated in clause 8.3, when the PUCCH SCell is in FR2.

The supported test configurations are shown in table A.5.5.3.10.1-1 below. The test parameters are the same as in clause A.4.5.3.3.1 except those described in the following clause. The listed parameter values in tables A.5.5.3.10.1-2 will replace the values of corresponding parameters in tables A.4.5.3.3.1-2. The listed parameter values in tables A.5.5.3.10.1-3 will replace the values of corresponding parameters in tables A.4.5.3.3.1-3. In this case, OTA related test parameters are shown in table A.5.5.3.10.1-4 below.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell (Cell 1), and NR has two cells, PSCell (Cell 2) in FR1 and PUCCH SCell (Cell 3) in FR2. Cell 1 and Cell 2 have constant signal levels throughout the test.

Cell 1, Cell2 are in primary Timing Advance Group (pTAG), and Cell3 is in secondary Timing Advance Group (sTAG). The TimeAlignmentTimer of sTAG expires before receiving the activation command.

Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRAN and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (PUCCH SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell (Cell 3) becomes configured on NR.

The point in time at which the MAC message is received at the UE antenna connector provided that the HARQ ACK of the MAC message is received by TE, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI on for the activated PUCCH SCell on PUCCH SCell at latest in slot n + $\frac{T_{\text{HARQ}}+T_{delay_PUCCH_SCell}}{\text{NR slot length}}$, as defined in clause 8.3.

Time period T3 starts when a MAC message for deactivation of PUCCH SCell, sent from the test equipment to the UEin a slot # denoted m, is received at the UE antenna connector provided that the HARQ ACK of the MAC message is received by TE. The UE shall carry out deactivation of the PUCCH SCell in a slot m + $\frac{\text{T}_{\text{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during activation of PUCCH SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the PUCCH SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the PUCCH SCell deactivation command is sent until CSI reporting for PUCCH SCell is discontinued.

Table A.5.5.3.10.1-1: FR2 SCell activation in non-DRX test configurations with FR1 PSCell

Configuration	Description
1	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
6	LTE TDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.3.10.1-2: General test parameters for FR2 SCell activation case with FR1 PSCell

Parameter	Unit	Value	Comment
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2
T2	s	2	During this time the UE shall activate the SCell.

Table A.5.5.3.10.1-3: Cell specific test parameters for FR2 SCell activation case with FR1 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2		
Duplex mode	Config 1,4		FDD			TDD		
	Config 2,3,5,6		TDD			TDD		
TDD configuration	Config 1,4		Not Applicable			TDDConf.3.1		
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
Data PRBs allocated	Config 1,4		52			66		
	Config 2,5		52					
	Config 3,6		106					
BWP BW	Config 1,4		10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 2,5		10: NRB,c = 52					
	Config 3,6		40: NRB,c = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD			SR.3.1 TDD		
	Config 2,5		SR.1.1 TDD					
	Config 3,6		SR.2.1 TDD					
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD			CR.3.1 TDD		
	Config 2,5		CR.1.1 TDD					
	Config 3,6		CR.2.1 TDD					
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD			CCR.3.1 TDD		
	Config 2,5		CCR.1.1 TDD					
	Config 3,6		CCR.2.1 TDD					
OCNG Patterns			OP.1					
SMTC configuration			SMTC.1					
TCI state			NA			TCI.State.0		
TRS configuration	Config 1,4		TRS.2.1 TDD			TRS.2.1 TDD		
	Config 2,5		TRS.1.1 TDD					
	Config 3,6		TRS.1.2 TDD					
SSB configuration	Config 1,2,4,5		SSB.1 FR1			SSB.1 FR2		
	Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz			120 kHz		
	Config 3,6		30 kHz					
CSI-RS configuration	Config 1~6		NA			NA	CSI-RS.3.1 TDD Note 5	
reportConfigType	Config 1~6		NA			periodic		
reportQuantity	Config 1~6		NA			cri-RI-PMI-CQI		
CSI reporting periodicity Note 6	Config 1~6	slot	NA			40		
CSI reporting offset	Config 1~6	slot	NA			4		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
Propagation condition		-	N/A			AWGN		

Parameter	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
		Link only, see clause A.3.7A					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
NOTE 6: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.5.5.3.10.1-4: OTA related test parameters for FR2 SCell activation case with FR1 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			NA			Setup 1 according to clause A.3.15.1		
Assumption for UE beams[Note 7]			NA			Rough		
N_{oc} [Note1]		dBm/15 kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} [Note1]	Config 1,2,4,5	dBm/SCS				-95.7		
	Config 3,6							
SSB_RP[Note2]	Config 1,2,4,5	dBm/SCS [Note3]				-88.7	-88.7	-88.7
	Config 3,6							
$\hat{E}_s/N_{oc}$	Config 1,2,3,4,5,6	dB				7	7	7
$\hat{E}_s/I_{ot}$		dB				7	7	7
Io[Note2, Note 4]	Config 1,2,4,5	dBm/95.04 MHz				-58.92	-58.92	-58.92
	Config 3,6							

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.5.5.3.10.2 Test Requirements

During T2 the UE shall start sending CSI reports for PUCCH SCell with non-zero CQI index at latest in a slot n + $\frac{T_{\text{HARQ}}+T_{delay_PUCCH_SCell}}{\text{NR slot length}}$, as defined in clause 8.3.

During T3 the UE shall stop sending CSI reports for PUCCH SCell at latest in a slot m + $\frac{T_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

All of the above test requirements shall be fulfilled in order for the observed PUCCH SCell activation delay and PUCCH SCell deactivation delay to be counted as correct. The rate of correct observed PUCCH SCell activation delay and PUCCH SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in slot n + $\frac{T_{\text{HARQ}}+T_{delay_PUCCH_SCell}}{\text{NR slot length}}$ then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.5.5.3.11 Multiple SCell activation and deactivation of one known PUCCH SCell and one unknown SCell in FR2

A.5.5.3.11.1 Test Purpose and Environment

The purpose of this test is to verify that the PUCCH SCell with multiple SCell activation and deactivation delay requirement defined in clause 8.3, and interruption requirement defined in clause 8.2, when one known PUCCH SCell and one unknown SCell to be activated are in FR2.

The supported test configurations are shown in table A.5.5.3.11.1-1 below. The general test parameters are given in table A.5.5.3.11.1-2 and cell-specific test parameters in table A.5.5.3.11.1-3 below. OTA related test parameters are shown in table A.5.5.3.11.1-4.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are four carriers, one E-UTRA cell, and three NR cells. Before the test starts the UE is connected to Cell 1 (PCell) on the E-UTRA carrier and Cell 2 (PSCell) on the NR carrier in FR2, but is not aware of Cell 3 (PUCCH SCell) or Cell 4 (SCell) on the NR carriers both in FR2. Cell 2 and Cell 4 are in the primary PUCCH group, and Cell 3 is in the secondary PUCCH group. In addition, Cell 2 and Cell 4 are in primary Timing Advance Group (pTAG), and Cell 3 is in the secondary Timing Advance Group (sTAG). Cell 1, Cell 2 and Cell 3 have constant signal levels throughout the test. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

There are two sub tests in this section.

- For Test 1 (valid TA case), UE is provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment for sTAG.
- For Test 2 (invalid TA case), TimeAlignmentTimer of sTAG expires before UE receives the activation command

At the beginning of T1 the UE receives an RRC message by which the Cell 3 (PUCCH SCell) and Cell 4 (SCell) are configured on NR. The test equipment sends a single MAC message for activation of both Cell 3 and Cell 4 within 3 s for UE power class 2/3/4 or 4 s for UE power class 1 after RRM reports is sent for Cell 3.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2. In the same MAC PDU, the test equipment activates the TCI state of RMC CORESET. In slot #m, the test equipment also sends an RRC message to configure the CSI-RS resources for both Cell 3 and Cell 4.

During T2, the UE shall be able to report valid CSI on PUCCH SCell for the activated PUCCH SCell at latest in

- slot m+ $T_{activate_total_PUCCH_SCell}$ as defined in clause 8.3.13.

During T2, the UE shall be able to report valid CSI on PCell for the activated SCell at latest in

- slot m+ $T_{activate_total_other_SCell.}$ as defined in clause 8.3.13.

Any PCell and PSCell interruption due to activation of PUCCH SCell shall occur in the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $m + 1 + T_{\text{activate_total_PUCCH_SCell}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

Any PCell and PSCell interruption due to activation of SCell shall occur in the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $m + 1 + T_{\text{activate_total_other_SCell}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

Time period T3 starts when a MAC message for deactivation of both Cell 3 and Cell 4, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the PUCCH SCell in a slot m + $\frac{\text{T}_{\text{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3, and the starting point of any PCell interruption due to the deactivation shall occur in the slot m + 1 + $\frac{\text{T}_{\text{HARQ}}}{NR\ slot\ length}$ to m + 1 + $\frac{\text{T}_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of PUCCH SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for SCell is discontinued.

Table A.5.5.3.11.1-1: Supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.3.11.1-2: General test parameters

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3,4	One E-UTRAN radio channel (1) and three NR radio channels (2,3,4) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2 in FR1.
Configured deactivated PUCCH SCell		Cell 3	Configured deactivated secondary cell with PUCCH on NR RF channel number 3 in FR2
Configured deactivated SCells		Cell 4	Configured deactivated secondary cell on NR RF channel number 4 in FR2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
SCell measurement cycle (measCycleSCell)	ms	160	For both Cell 3 and Cell 4
T1	s	7	During this time the PSCell shall be known and the SCells configured, PUCCH SCell detected but SCell not detected.
T2	s	1	During this time the UE shall activate both the SCells.
T3	s	1	During this time the UE shall deactivate the SCells.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
k	slot	$k_1+3\cdot N_{\text{slot}}^{\text{subframe},\mu}+1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.5.5.3.11.1-3: Cell specific test parameters

Parameter		Unit	Cell 2			Cell 3			Cell 4		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2			freq3		
Duplex mode	Config 1,2		TDD								
TDD configuration	Config 1,2		TDDConf.3.1								
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66								
DL initial BWP configuration	Config 1,2		DLBWP.0.1								
DL dedicated BWP configuration	Config 1,2		DLBWP.1.1								
UL initial BWP configuration	Config 1,2		ULBWP.0.1								

Parameter		Unit	Cell 2			Cell 3			Cell 4		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
UL dedicated BWP configuration	Config 1,2		ULBWP.1.1								
Timing offset to Cell 2		ms	Not Applicable			0			0		
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD			SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD			CR.3.1 TDD			CR.3.1 TDD		
RMC CORESET Reference Channel	Config 1,2		CCR.3.1 TDD			CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration	Config 1,2		TRS.2.1 TDD			TRS.2.1 TDD			TRS.2.1 TDD		
CSI-RS configuration	Config 1,2		CSI-RS.3.1 TDD			N/A	CSI-RS.3.1 TDD		N/A	CSI-RS.3.1 TDD	
CSI reporting periodicity	Config 1,2	slot	40			40			-		
CSI reporting offset	Config 1,2	slot	4			4			-		
OCNG Patterns			OP.1								
SMTC configuration			SMTC.1								
SSB configuration	Config 1,2		SSB.1 FR2			SSB.1 FR2			N/A	SSB.1 FR2	
EPRE ratio of PSS to SSS		dB	0								
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of PDCCH DMRS to SSS											
EPRE ratio of PDCCH to PDCCH DMRS											
EPRE ratio of PDSCH DMRS to SSS											
EPRE ratio of PDSCH to PDSCH											
EPRE ratio of OCNG DMRS to SSS(Note 1)											
EPRE ratio of OCNG to OCNG DMRS (Note 1)											
Propagation condition		-	AWGN								

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.5.5.3.11.1-4: OTA related test parameters

Parameter[Note 6]	Unit	Cell 2 and 3			Cell 4		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to A.3.15.1					
Assumption for UE beams[Note 7]		Rough			Rough		
N_{oc} [Note1]	dBm/15 kHz[Note4]	-112			-112		
N_{oc} [Note1]	dBm/SCS[Note3]	-102.97			-102.97		
$\hat{E}_s / N_{oc}$	dB	14			N/A	14	14
SS-RSRP[Note2]	dBm/SCS [Note4]	-88.97			N/A	-88.97	-88.97
$\hat{E}_s / I_{ot}$	dB	14			N/A	14	14
Io[Note2]	dBm/95.04 MHz [Note4]	-59.81			-73.98	-59.81	-59.81

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: All parameters apply for configuration 1 and 2
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.3.11.2 Test Requirements

During T2 the UE shall start sending CSI reports for Cell 3 with non-zero CQI index in the configured slots for CSI reporting no later than slot m+ $T_{activate_total_PUCCH_SCell}$, as defined in clause 8.3.

During T2 the UE shall start sending CSI reports for Cell 4 with non-zero CQI index in the configured slots for CSI reporting no later than slot m+ $T_{activate_total_other_SCell}$, as defined in clause 8.3.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell and PSCell during PUCCH SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + T_{activate_total_PUCCH_SCell} + N_{interruption}$, as defined in clause 8.3.

During T2 interruption of PCell and PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + T_{activate_total_other_SCell} + N_{interruption}$, as defined in clause 8.3.

During T3 the starting point of interruption of PCell and PSCell during the deactivation of PUCCH SCell and SCell shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption on any activated serving cell shall not be more than the summation of interruption length due to PUCCH SCell activation/ deactivation and interruption length due to SCell activation/ deactivation, the values of interruption length are specified for EN-DC in clause 8.2.

All of the above test requirements shall be fulfilled in order for the observed SCells activation delay to be counted as correct. The rate of correct observed SCells activation delay and SCells deactivation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI for PUCCH SCell in a slot m+ $T_{activate_total_PUCCH_SCell}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI for SCell in a slot m+ $T_{activate_total_other_SCell}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.5.5.3.12 SCell Activation and deactivation of unknown PUCCH SCell and unknown DL SCell in FR2 in non-DRX

A.5.5.3.12.1 Test Purpose and Environment

The purpose of this test is to verify that the PUCCH SCell and DL SCell activation and deactivation times are within the requirements stated in clause 8.3.13, when the PUCCH SCell in FR2 and DL SCell in FR2 is unknown to the UE at the time of activation.

The supported test configurations are shown in table A.5.5.3.12.1-1 below. The test parameters are given in tables A.5.5.3.12.1-2 and cell-specific parameters in A.5.5.3.12.1-3 below. OTA related test parameters are shown in table A.5.5.3.12.1-4.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are four carriers, each with one cell. Before the test starts the UE is connected to Cell 1(PCell) on the E-UTRA carrier and Cell 2 (PSCell) on the NR carrier in FR2, but is not aware of Cell3 (PUCCH SCell) and Cell4(DL SCell2) on the NR carriers both in FR2. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test. SCC of Cell 3 and SCC of Cell 4 are on a same band.

At the beginning of T1 the UE receives an RRC message by which the Cell 3 and Cell 4 becomes configured on NR. The test equipment sends a single MAC message for activation of both SCells.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2. In the same MAC PDU, the test equipment activates the TCI state of RMC CORESET. In slot #m, the test equipment also sends an RRC message to configure the CSI-RS resources for Cell 3 and Cell 4.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for SCell is discontinued.

Table A.5.5.3.12.1-1: Supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.3.12.1-2: General test parameters

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3,4	One E-UTRAN radio channel (1) and three NR radio channels (2,3,4) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2 in FR1.
Configured deactivated SCells		Cell 3 (PUCCH SCell 1), Cell 4(DL SCell 2)	Configured deactivated secondary cell on NR RF channel number 3 and RF channel number 4, both in FR2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
SCell measurement cycle (measCycleSCell)	ms	160	For both Cell 3 and Cell 4
TimeAlignmentTimer	ms	1280	Cell 1 and Cell 2 in pTAG.
TimeAlignmentTimerSTAG	ms	1280	Cell 3 and Cell 4 in sTAG
T1	s	1	During this time Cell 3 and Cell 4 is configured and undetected.
T2	s	2	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
k	slot	$k_1+3\cdot N_{\text{slot}}^{\text{subframe},\mu}+1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.5.5.3.12.1-3: Cell specific test parameters

Parameter		Unit	Cell 2			Cell 3			Cell 4		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2			freq3		
Duplex mode	Config 1,2		TDD								

Parameter		Unit	Cell 2			Cell 3			Cell 4		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
TDD configuration	Config 1,2		TDDConf.3.1								
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66								
DL initial BWP configuration	Config 1,2		DLBWP.0.1								
DL dedicated BWP configuration	Config 1,2		DLBWP.1.1								
UL initial BWP configuration	Config 1,2		ULBWP.0.1								
UL dedicated BWP configuration	Config 1,2		ULBWP.1.1								
Timing offset to Cell 2		ms	Not Applicable			0			0		
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD			SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD			CR.3.1 TDD			CR.3.1 TDD		
RMC CORESET Reference Channel	Config 1,2		CCR.3.1 TDD			CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration	Config 1,2		TRS.2.1 TDD			TRS.2.1 TDD			TRS.2.1 TDD		
CSI-RS configuration	Config 1,2		CSI-RS.3.1 TDD			N/A	CSI-RS.3.1 TDD		N/A	CSI-RS.3.1 TDD	
CSI reporting periodicity	Config 1,2	slot	40			40			-		
CSI reporting offset	Config 1,2	slot	4			4			-		
OCNG Patterns			OP.1								
SMTC configuration			SMTC.1								
SSB configuration	Config 1,2		SSB.1 FR2			SSB.1 FR2			N/A	SSB.1 FR2	
EPRE ratio of PSS to SSS		dB	0								
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of PDCCH DMRS to SSS											
EPRE ratio of PDCCH to PDCCH DMRS											
EPRE ratio of PDSCH DMRS to SSS											
EPRE ratio of PDSCH to PDSCH											
EPRE ratio of OCNG DMRS to SSS(Note 1)											
EPRE ratio of OCNG to OCNG DMRS (Note 1)											
Propagation condition		-	AWGN								
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.											

Table A.5.5.3.12.1-4: OTA related test parameters

Parameter[Note 6]	Unit	Cell 2			Cell 3			Cell 4		
		T1	T2	T3	T1	T2	T3	T1	T2	T3
Angle of arrival configuration		NA			Setup 1 according to A.3.15.1					
Assumption for UE beams[Note 7]		NA			Rough			Rough		
N_{oc} [Note1]	dBm/15 kHz[Note4]	Link only, see clause A.3.7A			-112			-112		
N_{oc} [Note1]	dBm/SCS[Note3]				-102.97			-102.97		
$\hat{E}_s / N_{oc}$	dB				-∞	14	14	-∞	14	14
SS-RSRP[Note2]	dBm/SCS [Note4]				-∞	-88.97	-88.97	-∞	-88.97	-88.97
$\hat{E}_s / I_{ot}$	dB				-∞	14	14	-∞	14	14
Io[Note2]	dBm/95.04 MHz [Note4]				-73.98	-59.81	-59.81	-73.98	-59.81	-59.81

Parameter[Note 6]	Unit	Cell 2			Cell 3			Cell 4		
		T1	T2	T3	T1	T2	T3	T1	T2	T3
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.										
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.										
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.										
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone										
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone										
NOTE 6: All parameters apply for configuration 1 and 2										
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation										

A.5.5.3.12.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PSCell in the slot.

During T2 the UE shall start sending CSI reports for SCell 1 with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{delay_multiple_SCells_PUCCH_SCell}}{NR\ slot\ length}$, where

T_{HARQ} is defined in table A.5.5.3.12.1-2

$T_{delay_multiple_SCells_PUCCH_SCell}$ is defined in section 8.13.13.1. In this test case, both valid TA and invalid TA cases shall be tested.

Test for case when UE has valid TA: the *TimeAlignmentTimer* [2] associated with the TAG containing the PUCCH SCell is running, and $T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + \max((T_{First_available_CSI} + T_{CSI_processing}), 3*T_{target_PL\text{-}RS}) + T_{CSI_reporting_after}$.

Test for case when UE do not have valid TA: $T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + \max((T_{First_available_CSI} + T_{CSI_processing}), (T1+T2+T3), 3*T_{target_PL\text{-}RS}) + T_{CSI_reporting_after}$

$T_{activation_time_multiple_scells}$ is the target SCell activation delay in millisecond in multiple SCell activation scenario as specified in section 8.3.7

$T_{CSI_Reporting}$ = 10 ms

- NR slot length is 0.125 ms.

During T2 the UE shall start sending CSI reports for SCell2 with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{delay_multiple_SCells_other_SCell}}{NR\ slot\ length}$where

T_{HARQ} is defined in table A.5.5.3.12.1-2

$T_{delay_multiple_SCells_other_SCell} = T_{activation_time_multiple_scells} + T_{CSI_Reporting}$.

- $T_{activation_time_multiple_scells}$ is the target SCell activation delay in millisecond in multiple SCell activation scenario as specified in section 8.3.7

$T_{CSI_Reporting}$ = 10 ms

NR slot length is 0.125 ms.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.14.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot m + $\frac{T_{HARQ}+T_{delay_\text{multiple}_SCells_PUCCH_SCell}}{NR\ slot\ length}$, as defined in clause 8.3.13 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.5.5.3.13 SCell Activation and deactivation of unknown SCell in FR2 for UE in DRX, capable of small beam sweeping factors and/or short measurement interval

A.5.5.3.13.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell is unknown in FR2 by the UE at the time of activation. The test will also verify that the SSB-based L1-RSRP measurement accuracy is within the specified limits as stated in clause 10.1.20.1.

The supported test configurations are shown in table A.5.5.3.13.1-1 below. The test parameters are the same as in clause A.4.5.3.3.1 except those described in the following clause. The general test parameters are given in table A.5.5.3.13.1-2 and cell-specific test parameters in table A.5.5.3.13.1-3 below. In this case, OTA related test parameters are shown in table A.5.5.3.13.1-4 below.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell (Cell 1), NR has two cells, PSCell (Cell 2) in FR1 and SCell (Cell 3) in FR2. Cell 1 and Cell 2 have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRAN and Cell 2 (PSCell) on NR but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled within on-duration based on DRX configuration in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment 100 ms after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2.

During T2, the test equipment monitors the L1-RSRP measurement reporting for the SCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot $m+T_{L1\text{-}RSRP}$. In the next DL slot after slot $m+T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received. In this test the allowed time for SCell activation depends on the UE reported capabilities regarding small beam sweeping factors (i.e. X1/X2 as indicated in beamSweepingFactorReduction-r18) and short measurement intervals (shortMeasInterval-r18).

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for SCell is discontinued.

The test equipment verifies the absolute accuracy of SSB-based L1-RSRP measurements during T2 by using the parameters in table A.5.5.3.13.1-3 and table A.5.5.3.13.1-4.

Table A.5.5.3.13.1-1: Supported test configurations for FR2 SCell activation case with FR1 PSCell

Configuration	Description
1	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode

	Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
6	LTE TDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.3.13.1-2: General test parameters for FR2 SCell activation case with FR1 PSCell

Parameter	Unit	Value	Comment
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2
T1	ms	100	During this time the PSCell shall be known and the SCell configured, but not detected.
T2	s	2 or 12	During this time the UE shall activate the SCell. Depends on the UE capability, 2 s for the case where DRX is not applicable and 12 s for the case where DRX is applicable.
T3	s	1	During this time the UE shall deactivate the SCell.
X1		1,2,4,6 (Default 8)	Optionally signaled by the UE capabilities as part of beamSweepingFactorReduction-r18: reduceForCellDetection
X2		0,1,2,3,4,5,6,7 (Default 8)	Optionally signaled by the UE capabilities as part of beamSweepingFactorReduction-r18: reduceForSSB-L1-RSRP-Meas

Table A.5.5.3.13.1-3: Cell specific test parameters for FR2 SCell activation case with FR1 active PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2		
Duplex mode	Config 1,4		FDD			TDD		
	Config 2,3,5,6		TDD			TDD		
TDD configuration	Config 1,4		Not Applicable			TDDConf.3.1		
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
Data PRBs allocated	Config 1,4		52			66		
	Config 2,5		52					
	Config 3,6		106					
BWP BW	Config 1,4		10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 2,5		10: $N_{PRB,c}$ = 52					
	Config 3,6		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	DRX.8					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD			SR.3.1 TDD		
	Config 2,5		SR.1.1 TDD					
	Config 3,6		SR.2.1 TDD					
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD			CR.3.1 TDD		
	Config 2,5		CR.1.1 TDD					
	Config 3,6		CR.2.1 TDD					
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD			CCR.3.1 TDD		
	Config 2,5		CCR.1.1 TDD					
	Config 3,6		CCR.2.1 TDD					
OCNG Patterns			OP.1					
SMTC configuration			SMTC.3					
TCI state			NA			TCI.State.0		
TRS configuration	Config 1,4		TRS.2.1 TDD			TRS.2.1 TDD		
	Config 2,5		TRS.1.1 TDD					
	Config 3,6		TRS.1.2 TDD					
SSB configuration	Config 1,2,4,5		SSB.1 FR1			SSB.1 FR2		
	Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz			120 kHz		
	Config 3,6		30 kHz					

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
CSI-RS configuration	Config 1~6		NA			NA	CSI-RS.3.1 TDD Note 5	
reportConfigType	Config 1~6		periodic			NA		
reportQuantity	Config 1~6		cri-RI-PMI-CQI			NA		
CSI reporting periodicity Note 6	Config 1~6	slot	40			NA		
CSI reporting offset	Config 1~6	slot	4			NA		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
Propagation condition		-	N/A Link only, see clause A.3.7A			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
NOTE 6: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.5.5.3.13.1-4: OTA related test parameters for FR2 SCell activation case with FR1 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			NA			Setup 1 according to clause A.3.15.1		
Assumption for UE beams Note 7			NA			Rough		
N_{oc} Note1		dBm/15 kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} Note1	Config 1,2,4,5	dBm/SCS				-95.7		
	Config 3,6							
SSB_RP Note2	Config 1,2,4,5	dBm/SCS Note3				-∞	-88.7	-88.7
	Config 3,6							
$\hat{E}_s/N_{oc}$	Config 1,2,3,4,5,6	dB				-∞	7	7
$\hat{E}_s/I_{ot}$		dB				-∞	7	7
Io Note2, Note 4	Config 1,2,4,5	dBm/95.04 MHz				-66.68	-58.92	-58.92
	Config 3,6							

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.5.5.3.13.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PSCell in the slot.

For UE capable of *beamSweepingFactorReduction-r18* and *shortMeasInterval-r18* capabilities:

During T2 the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than

- 3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ as defined in clause 8.3.2.

- For this test case, $T_{FirstSSB_MAX,\ enhanced}$ =$T_{SMTC_MAX,\ enhanced}$ =$T_{rs,\ enhanced}$ = T_{SSB}=20 ms; $T_{L1\text{-}RSRP,\ enhanced_measure}$= (X2/8)*480 ms and $T_{L1\text{-}RSRP,reprt}$=5 ms, which allows $T_{L1\text{-}RSRP}$ = 968 ms if X1 and X2 use the default value. Value of $T_{L1\text{-}RSRP}$ for various X1/X2 capabilities is obtained from table A.5.5.3.13.1-5.

During T2 the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in table A.4.5.3.1.1-2

- $T_{activation_time}$ = 3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max{(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})} which allows 1000 ms in case of no X1/X2 capability and a minimum of 380 ms for the case with X1=1, X2=0 (for other values of X1/X2 capability corresponding value of $T_{L1\text{-}RSRP}$ shall be adopted from table A.5.5.3.13.1-5).

$T_{L1\text{-}RSRP,\ enhanced_measure}$ is

  - SSB based L1-RSRP measurement delay $T_{L1\text{-}RSRP_Measurement_Period_SSB}$ ms based on applicability as defined in clause 9.5 assuming M=1 and T_{Report}=0; N is equal to the value reported by the UE in *reduceForSSB-L1-RSRP-Meas i.e. X2*. Otherwise, if *reduceForSSB-L1-RSRP-Meas* is absent, N= 8.

  - CSI-RS based L1-RSRP measurement delay $T_{L1\text{-}RSRP_Measurement_Period_CSI\text{-}RS}$ ms based on applicability as defined in clause 9.5 assuming M=1 and T_{Report}=0.

In case UE has signalled X1/X2 to be lower than 8 the following values are allowed for $T_{L1\text{-}RSRP}$:

Table A.5.5.3.13.2-1: $T_{L1\text{-}RSRP}$ for different X1/X2 capabilities (ms)

	X1=1	X1=2	X1=4	X1=6
X2=0	348	368	408	448
X2=1	408	428	468	508
X2=2	468	488	528	568
X2=3	528	548	588	628
X2=4	588	608	648	688
X2=5	648	668	708	748
X2=6	708	728	768	808
X2=7	768	788	828	868

For UE capable of *beamSweepingFactorReduction-r18* but not *shortMeasInterval-r18* capabilities, and the cell specific test parameters are described in table A.5.5.3.13.1-3 except that SMTC value is SMTC.1:

During T2 the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than:

- 3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ as defined in clause 8.3.2.

- For this test case, considering DRX, $T_{FirstSSB_MAX,\ enhanced}$ =$T_{SMTC_MAX,\ enhanced}$ =$T_{rs,\ enhanced}$ =20 ms; from table 9.5.4.1-2 $T_{L1\text{-}RSRP,\ enhanced_measure}$= (X2/8)*11520 ms and $T_{L1\text{-}RSRP,report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ = 12008 ms if X1 and X2 are absent. Value of $T_{L1\text{-}RSRP}$ for various X1/X2 capabilities is obtained from table A.5.5.3.13.1-6 assuming DRX cycle = 320 ms.

During T2 the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in table A.4.5.3.1.1-2
- $T_{activation_time}$ = 3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max{(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})} which allows 12040 ms in case of no X1/X2 capability and a minimum of 380 ms for the case with X1=1, X2=0 (for other values of X1/X2 capability corresponding value of $T_{L1\text{-}RSRP}$ shall be adopted from table A.5.5.3.13.1-6).

Table A.5.5.3.13.1-6: $T_{L1\text{-}RSRP}$ for different X1/X2 capabilities with 320 ms DRX cycle (ms)

	X1=1	X1=2	X1=4	X1=6
X2=0	348	368	408	448
X2=1	1788	1808	1848	1888
X2=2	3228	3248	3288	3328
X2=3	4668	4688	4728	4768
X2=4	6108	6128	6168	6208
X2=5	7548	7568	7608	7648
X2=6	8988	9008	9048	9088
X2=7	10428	10448	10488	10528

For UE capable of *shortMeasInterval-r18* but not *beamSweepingFactorReduction-r18* capabilities, the general test parameters are described in table A.5.5.3.13.1-2 except that the default value for X1=X2=8 is chosen.

During T2 the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than:

- 3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + 8*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ as defined in clause 8.3.2.
- For this test case, even with DRX, the UE treats the case as non-DRX, thus $T_{FirstSSB_MAX,\ enhanced}$ =$T_{SMTC_MAX,\ enhanced}$ =$T_{rs,\ enhanced}$ = T_{SSB}=20 ms; $T_{L1\text{-}RSRP,\ measure}$= 480 ms and $T_{L1\text{-}RSRP,report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ = 968 ms.

During T2 the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in table A.4.5.3.1.1-2
- $T_{activation_time}$ = 3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + 8*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max{(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})} which allows 1000 ms.
- $T_{CSI_Reporting}$ = 10 ms
- NR slot length is 0.125 ms for this test case.

The L1-RSRP measurement accuracy for SSB resource reported by UE in L1-RSRP report (SSB#0 or SSB#1) of Cell 3 shall fulfil the accuracy requirements in clauses 10.1.20.1 provided the side condition is -2 dB as defined in clause 8.3.2.

During T3 the UE shall stop sending CSI reports for the SCell no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

A.5.5.3.14 PUCCH SCell activation and deactivation with FR1 PSCell based on L3 reporting after SCell activation command

A.5.5.3.14.1 Test Purpose and Environment

The purpose of this test is to verify that the PUCCH SCell activation and deactivation times are within the requirements stated in clause 8.3.12 for UE capable of l3-MeasUnknownSCellActivation-r18.

The supported test configurations are shown in table A.5.5.3.14.1-1 below. The test parameters are given in tables A.5.5.3.14.1-2 and cell-specific parameters in A.5.5.3.14.1-3 and A.5.5.3.14.1-4 below. The test consists of Three successive time periods, with duration of T1, T2 and T3 respectively. There are two NR carriers and one E-UTRA carrier, each with one cell. The E-UTRAN PCell setting refers to table A.3.7.2.1-1. Before the test starts the UE is connected to Cell 1 and Cell 2 but is not aware of Cell3, and UE is configured with MeasObjectNR on carriers of Cell2 and Cell3. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell (Cell 3) becomes configured on radio channel 3, and one measID is associated with *reportOnActivation*. The UE now starts monitoring the Cell3. The test equipment sends a MAC message for activation of the PUCCH SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI for the activated PUCCH SCell at latest in slot $n+\frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$, as defined in clause 8.3.12.

There are two sub-tests in the test. In sub-test 1, TE shall transmit DCI 0-1 to PSCell at slot $n+\frac{T_{\mathrm{HARQ}}+7\ ms}{\mathrm{NR\ slot\ length}}$, and the UE shall be able to send L3 measurements report of the SCell at slot $n+\frac{T_{\mathrm{HARQ}}+7\ ms+\mathrm{k2}}{\mathrm{NR\ slot\ length}}$, where k2 =1. In sub-test 2, TE shall transmit DCI 0-1 to PSCell at slot $n+\frac{T_{\mathrm{HARQ}}+7\ ms+\mathrm{M}-\mathrm{k2}}{\mathrm{NR\ slot\ length}}$, where k2=1 and M is defined in 8.3.12. The UE shall be able to send L3 measurements report of the SCell at$+\frac{T_{\mathrm{HARQ}}+7\ ms+\mathrm{M}}{\mathrm{NR\ slot\ length}}$.

Any PSCell interruption due to activation of PUCCH SCell shall occur in the slot $n+1+\frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n+1+\frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}}+N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2

Time period T3 starts when a MAC message for deactivation of PUCCH SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot $\mathrm{m}+\frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3.14and the starting point of any PCell interruption due to the deactivation shall occur in the slot $\mathrm{m}+1+\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to $\mathrm{m}+1+\frac{\mathrm{T_{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.14.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation and deactivation of PUCCH SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.5.5.3.14.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
6	LTE TDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which passes test case A.5.5.3.14 can skip the test case A.5.5.3.15	

Table A. A.5.5.3.14.1-2: General test parameters for FR2 SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	One E-UTRA radio channel (1) and Two NR radio channel (2, 3) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRA RF channel number 1.
Active PSCell		Cell 2	Active Secondary cell on NR RF channel number 2
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell2 timing offset to Cell 1	µs	0	
Time alignment error between Cell 3 and Cell 1	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	26	During this time the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell. PUSCH for L3 reporting is scheduled at the first UL slot after slot n + T_{HARQ} + 7 ms
T3	s	1	During this time the UE shall deactivate the SCell.
A4-offset	dB	-15	
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.5.5.3.14.1-3: Cell specific test parameters for FR2 SCell activation case: Cell2

Parameter		Unit	Cell 2		
			T1	T2	T3
SSB ARFCN			Freq1		
Duplex mode	Config 1,4		FDD		
	Config 2,3,5,6		TDD		
TDD configuration	Config 1,4		Not Applicable		
	Config 2,5		TDDConf.1.1		
	Config 3,6		TDDConf.2.1		
Downlink initial BWP Configuration	Config 1,2,3,4,5,6		DLBWP.0.1		
Downlink dedicated BWP Configuration	Config 1,2,3,4,5,6		DLBWP.1.1		
Uplink initial BWP configuration	Config 1,2,3,4,5,6		ULBWP.0.1		
Uplink dedicated BWP configuration	Config 1,2,3,4,5,6		ULBWP.1.1		
TRS configuration	Config 1,2,3,4,5,6		N/A		
TCI state	Config 1,2,3,4,5,6		TCI.State.0		
$BW_{channel}$	Config 1,2,4,5	MHz	10: $N_{PRB,c}$ = 52		

Parameter		Unit	Cell 2		
			T1	T2	T3
	Config 3,6		40: $N_{PRB,c}$ = 106		
Data PRBs allocated	Config 1,2,4,5		52	52	52
	Config 3,6		106	106	106
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD		
	Config 2,5		SR.1.1 TDD		
	Config 3,6		SR.2.1 TDD		
RMSI CORESET Parameters	Config 1,4		CR.1.1 FDD		
	Config 2,5		CR.1.1 TDD		
	Config 3,6		CR.2.1 TDD		
Dedicated CORESET Parameters	Config 1,4		CCR.1.1 FDD		
	Config 2,5		CCR.1.1 TDD		
	Config 3,6		CCR.2.1 TDD		
OCNG Patterns	Config 1,2,3,4,5,6		OP.1		
SSB configuration	Config 1,2,4,5		SSB.1 FR1		
	Config 3,6		SSB.2 FR1		
SMTC configuration			SMTC.1		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions			N/A Link only, see clause A.3.7A		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.5.5.3.14.1-4: Cell specific test parameters for FR2 SCell activation case: Cell3

Parameter Note 5		Unit	Cell 3		
			T1	T2	T3
SSB ARFCN			Freq3		
Duplex mode	Config 1,2,3,4,5,6		TDD		
TDD configuration	Config 1,2,3,4,5,6		TDDConf.3.1		
Downlink initial BWP Configuration	Config 1,2,3,4,5,6		DLBWP.0.1		
Downlink dedicated BWP Configuration	Config 1,2,3,4,5,6		DLBWP.1.1		
Uplink initial BWP configuration	Config 1,2,3,4,5,6		ULBWP.0.1		
Uplink dedicated BWP configuration	Config 1,2,3,4,5,6		ULBWP.1.1		
TRS configuration	Config 1,2,3,4,5,6		TRS.2.1 TDD		
TCI state	Config 1,2,3,4,5,6		TCI.State.0		
$BW_{channel}$	Config 1,2,3,4,5,6	MHz	100: NRB,c = 66		
Data PRBs allocated	Config 1,2,3,4,5,6		66		
PDSCH Reference measurement channel	Config 1,2,3,4,5,6		SR.3.1 TDD		
RMSI CORESET Parameters	Config 1,2,3,4,5,6		CR.3.1 TDD		
Dedicated CORESET Parameters	Config 1,2,3,4,5,6		CCR.3.1 TDD		
OCNG Patterns	Config 1,2,3,4,5,6		OP.1		
SSB configuration	Config 1,2,3,4,5,6		SSB.1 FR2		
CSI-RS configuration for CSI reporting	Config 1,2,3,4,5,6		CSI-RS.3.1 TDD		
reportConfigType for CSI reporting	Config 1,2,3,4,5,6		periodic		
reportQuantity for CSI reporting	Config 1,2,3,4,5,6		cri-RI-PMI-CQI		

Parameter Note 5		Unit	Cell 3		
			T1	T2	T3
CSI reporting periodicity	Config 1,2,3,4,5,6	slot	40		
CSI reporting offset	Config 1,2,3,4,5,6	slot	4		
SMTC configuration	Config 1,2,3,4,5,6		SMTC.1		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions			AWGN		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.5.5.3.14.1-4: OTA related test parameters for FR2 SCell with FR1 PCell

Parameter		Unit	Cell 1 and Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			N/A			According to clause A.3.15.1		
Assumption for UE beams Note 7			N/A			Rough		
N_{oc} Note 1	Config 1,2,3	dBm/15 kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} Note 1	Config 1,2,3	dBm/SCS				-95.7		
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB				-∞	7	7
$\hat{E}_s / I_{ot}$	Config 1,2,3	dB				-∞	7	7
SSB_RP Note 2, Note 4	Config 1,2,3	dBm/SCS				-∞	-88.7	-88.7
Io Note 2, Note 4	Config 1,2,3	dBm/95.04 MHz				-66.68	-58.92	-58.92
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 3: Void								
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone								
NOTE 5: Void								
NOTE 6: Void								
NOTE 7: Information about types of UE beam is given in B.2.1.3 and does not imit UE implementation or test system implementation.								

A.5.5.3.14.2 Test Requirements

By end of T2 the UE shall finish the DL activation for the PUCCH SCell. Assuming the periodic CSI reporting is used and assuming periodic CSI activation and TCI state is sent along with SCell activation MAC CE, UE shall finish the DL activation by slot n+ $\frac{T_{HARQ}+T_{activation_time}}{NR\ slot\ length}$ as defined in clause 8.3.12.

During T2 the UE shall start sending PRACH preamble to TE and shall obtain the TA command from TE and shall be ready to send valid CSI report to the TE. CSI report shall be transmitted within $T_{activation_time}$ + Max(($T_{First_available_CSI}$ + $T_{CSI_processing}$), (T1+T2+T3)) + $T_{CSI_reporting_after}$ from the transmission of HARQ feedback of SCell activation command as specified in the 8.3.12.

In sub-test 1, $T_{activation_time}$ = 7 ms + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.12.

In sub-test 2, $T_{activation_time}$ = 7 ms + M+ max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.12.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot m + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PSCell during SCell activation shall not happen outside the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, as defined in clause 8.3, where T_X =20 ms.

During T3 the starting point of interruption of PSCell during SCell deactivation shall not happen outside the slot m + $1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to m + $1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption of PSCell due to activation of SCell shall not be more than the values specified for SA in clause 8.2.2.2.7.

A.5.5.3.15 SCell Activation of unknown SCell in FR2 in non-DRX for 160 ms SCell measurement cycle with the L3 reporting during activation

A.5.5.3.15.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3.17, when the SCell in FR2 is unknown by the UE at the time of activation. In this test, UE shall perform two sub-tests where two different UL resource locations are configured.

The supported test configurations are shown in table A.5.5.3.15.1-1 below. The test parameters are given in tables A.5.5.3.15.1-2 and cell-specific parameters in A.5.5.3.15.1-3 and A.5.5.3.15.1-5 below. OTA related test parameters are shown in table A.5.5.3.15.1-4. The test consists of three successive time periods, with duration of T1, T2, and T3, respectively. There are three carriers and each with one cell. E-UTRA has one cell (Cell 1), NR has two cells, PSCell (Cell 2) in FR1 and SCell (Cell 3) in FR2. Cell 1 and Cell 2 have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRAN and Cell 2 (PSCell) on NR but is not aware of Cell 3 (SCell) on NR. The UE is only monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on radio channel 3. In the measurement control information for Cell 3, it is indicated to the UE that event-triggered reporting with Event A2 and reportOnActivation is used. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the SCell activation.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n (where n mode 20=1), defines the start of time period T2. The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot n + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{\text{NR slot length}}$, as defined in clause 8.3.

In sub-test1, TE shall transmit DCI 0-1 to PSCell at slot $n + \frac{T_{HARQ}+7\ ms}{\text{NR slot length}}$. The UE shall be able to send L3 measurements report of the SCell at slot $n + \frac{T_{HARQ}+7\ ms+0.125\ \text{ms}}{\text{NR slot length}}$ for sub-test 1.
In sub-test2, TE shall transmit DCI 0-1 to PSCell at slot $n + \frac{T_{HARQ}+3\ ms+\text{M}-0.125\ \text{ms}}{\text{NR slot length}}$, The UE shall be able to send L3 measurements report of the SCell at slot $n + \frac{T_{HARQ}+7\ ms+\text{M}}{\text{NR slot length}}$ for sub-test 2. TE will send TCI activation command after receiving L3 measurement report of the SCell.

The UE shall start reporting CSI in PSCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $n + \frac{T_{HARQ}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for SCell is discontinued.

Table A.5.5.3.15.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
6	LTE TDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.3.15.1-2: General test parameters for FR2 SCell activation case

Parameter	Unit	Value	Comment
LTE RF Channel Number		1	Cell 1 use LTE RF channel 1
NR RF Channel Number		2,3	Cell2 and Cell 3 use NR RF channel 2 and 3, respectively.
Active PCell		Cell 1	Primary cell on LTE RF channel number 1.
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell2 timing offset to Cell 1	μs	0	
Time alignment error between Cell 2 and Cell 1	μs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	16	During this time SCell is configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
Hysteresis	dB	0	
a2-Threshold	dBm	-100	
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability

Parameter	Unit	Value	Comment
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.5.5.3.15.1-3: Cell specific test parameters for FR2 SCell activation case: Cell 3

Parameter		Unit	Cell 3		
			T1	T2	T3
SSB ARFCN			Freq3		
Duplex mode	Config 1~6		TDD		
TDD configuration	Config 1~6		TDDConf.3.1		
Downlink initial BWP Configuration	Config 1~6		DLBWP.0.1		
Downlink dedicated BWP Configuration	Config 1~6		DLBWP.1.1		
Uplink initial BWP configuration	Config 1~6		ULBWP.0.1		
Uplink dedicated BWP configuration	Config 1~6		ULBWP.1.1		
TRS configuration	Config 1~6		TRS.2.1 TDD		
TCI state	Config 1~6		TCI.State.0		
$BW_{channel}$	Config 1~6	MHz	100: NRB,c = 66		
Data PRBs allocated	Config 1~6		66		
PDSCH Reference measurement channel	Config 1~6		SR.3.1 TDD		
RMSI CORESET Parameters	Config 1~6		CR.3.1 TDD		
Dedicated CORESET Parameters	Config 1~6		CCR.3.1 TDD		
OCNG Patterns	Config 1~6		OP.1		
SSB configuration	Config 1~6		SSB.1 FR2		
CSI-RS configuration for CSI reporting	Config 1~6		CSI-RS.3.1 TDD		
reportConfigType for CSI reporting	Config 1~6		periodic		
reportQuantity for CSI reporting	Config 1~6		cri-RI-PMI-CQI		
CSI reporting periodicity	Config 1~6	slot	40		
CSI reporting offset	Config 1~6	slot	4		
SMTC configuration	Config 1~6		SMTC.1		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.5.5.3.15.1-4: OTA related test parameters for FR2 SCell activation case

Parameter	Unit	Cell 1 and Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		N/A			Setup 1 according to table A.3.15.1		

Parameter	Unit	Cell 1 and Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 7		N/A			Rough		
N_{oc} Note1	dBm/15 kHz Note4	Link only, see clause A.3.7A			-104.7		
N_{oc} Note1	dBm/SCS Note3				-95.7		
$\hat{E}_s / N_{oc}$	dB				7		
SSB_RP Note2	dBm/SCS Note4				-88.7		
$\hat{E}_s / I_{ot}$	dB				7		
Io Note2	dBm/95.04 MHz Note4				-58.92		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

Table A.5.5.3.15.1-5: Cell specific test parameters for FR2 SCell activation case: Cell 2

Parameter		Unit	Cell 2		
			T1	T2	T3
SSB ARFCN			Freq1		
Duplex mode	Config 1,4		FDD		
	Config 2,3,5,6		TDD		
TDD configuration	Config 1,4		Not Applicable		
	Config 2,5		TDDConf.1.1		
	Config 3,6		TDDConf.2.1		
Downlink initial BWP Configuration	Config 1,2,3,4,5,6		DLBWP.0.1		
Downlink dedicated BWP Configuration	Config 1,2,3,4,5,6		DLBWP.1.1		
Uplink initial BWP configuration	Config 1,2,3,4,5,6		ULBWP.0.1		
Uplink dedicated BWP configuration	Config 1,2,3,4,5,6		ULBWP.1.1		
TRS configuration	Config 1,2,3,4,5,6		N/A		
TCI state	Config 1,2,3,4,5,6		TCI.State.0		
$BW_{channel}$	Config 1,2,4,5	MHz	10: $N_{PRB,c}$ = 52		
	Config 3,6		40: $N_{PRB,c}$ = 106		
Data PRBs allocated	Config 1,2,4,5		52	52	52
	Config 3,6		106	106	106
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD		
	Config 2,5		SR.1.1 TDD		
	Config 3,6		SR.2.1 TDD		
RMSI CORESET Parameters	Config 1,4		CR.1.1 FDD		
	Config 2,5		CR.1.1 TDD		
	Config 3,6		CR.2.1 TDD		
Dedicated CORESET Parameters	Config 1,4		CCR.1.1 FDD		
	Config 2,5		CCR.1.1 TDD		
	Config 3,6		CCR.2.1 TDD		
OCNG Patterns	Config 1,2,3,4,5,6		OP.1		
SSB configuration	Config 1,2,4,5		SSB.1 FR1		
	Config 3,6		SSB.2 FR1		
SMTC configuration			SMTC.1		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH_DMRS to SSS					

Parameter	Unit	Cell 2		
		T1	T2	T3
EPRE ratio of PBCH to PBCH_DMRS				
EPRE ratio of PDCCH_DMRS to SSS				
EPRE ratio of PDCCH to PDCCH_DMRS				
EPRE ratio of PDSCH_DMRS to SSS				
EPRE ratio of PDSCH to PDSCH_DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation conditions		N/A Link only, see clause A.3.7A		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				

A.5.5.3.15.2 Test Requirements

During T2, the UE shall be able to send a valid L3-RSRP report for the SCell in the configured slots for CSI reporting at slot n + $\frac{T_{HARQ}+7ms+0.125ms}{NR\ slot\ length}$ for sub-test 1. For sub-test2, the UE shall be able to send a valid L3-RSRP for the SCell at slot n + $\frac{T_{HARQ}+7ms+M}{NR\ slot\ length}$. The UE is not required to send L3-RSRP report after slot n + $\frac{T_{HARQ}+3ms+M}{NR\ slot\ length}$, where M is defined in 8.3.17.

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot n + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} and $T_{CSI_Reporting}$ are defined in table A.7.5.3.16.1-2.
- In this case, $T_{SSB}=T_{SMTC}$ = 20 ms and $T_{L1\text{-}RSRP,report}$ = 5 ms.
- For sub-test1, $T_{activation_time}$ = 7 ms + 0.125 ms + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}).
- For sub-test2, $T_{activation_time}$ = 3 ms + M + max (T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay})
- NR slot length is 0.125 ms for this test case.

During T3 the UE shall stop sending CSI reports for SCell no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell / PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, as defined in clause 8.3, where T_X =20 ms.

During T3 interruption of PCell / PSCell during SCell activation shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.5.5.4 Void

A.5.5.5 Beam Failure Detection and Link recovery procedures

A.5.5.5.1 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with SSB-based BFD and LR in non-DRX mode

A.5.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in tables A.5.5.5.1.1-1, A.5.5.5.1.1-2, A.5.5.5.1.1-3 and A.5.5.5.1.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.1.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PSCell to emulate SSB based beam failure. Figure A.5.5.5.1.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test 1.

Table A.5.5.5.1.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
3	LTE FDD, TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
4	LTE TDD, TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.5.1.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active E-UTRA PCell	1-4		Cell 1	
E-UTRA RF Channel Number	1-4		1	
Active PCell	1-4		Cell 2	
RF Channel Number	1-4		2	
Duplex mode	1-4		TDD	
TDD Configuration	1-4		TDDConf.3.1	
$BW_{channel}$	1-4	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1-4		66	
PDSCH/PDCCH subcarrier spacing	1-4	kHz	120	
DL initial BWP configuration	1-4		DLBWP.0.1	
DL dedicated BWP configuration	1-4		DLBWP.1.1	
UL initial BWP configuration	1-4		ULBWP.0.1	
UL dedicated BWP configuration	1-4		ULBWP.1.1	
PDSCH Reference Channel	1-2		SR.3.2 TDD	
	3-4		SR.3.3 TDD	
RMSI CORESET Reference Channel	1-2		CR.3.1 TDD	
	3-4		CR.3.2 TDD	
Dedicated CORESET Reference Channel	1-2		CCR.3.1 TDD	
	3-4		CCR.3.7 TDD	
OCNG parameters	1-4		OP.1	
CP length	1-4		Normal	
PDSCH/PDCCH TCI state	1-4		TCI.State.0	
CSI-RS for tracking	1-4		TRS.2.1 TDD	
SSB Configuration	1-2		SSB.1 FR2	
	3-4		SSB.2 FR2	
SMTC Configuration	1-4		SMTC.3	

Parameter		Test Config.	Unit	Value	Comment
PRACH Configuration		1-4		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration		1-4		OFF	
SSB index assigned as BFD RS (q_0)		1-4		0	
SSB index assigned as CBD RS (q_1)		1-4		1	
SSB index assigned as RLM RS		1-4		0,1	
Beam failure detection transmission parameters	DCI format	1-4		1-0	
	Number of Control OFDM symbols	1-4		2	
	Aggregation level	1-4	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-4	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-4	dB	0	
	DMRS precoder granularity	1-4		REG bundle size	
	REG bundle size	1-4		6	
Gap pattern ID		1-4		gp0	
gapOffset		1-4	ms	0	
rlmInSyncOutOfSyncThreshold		1-4		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1-2	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
		3-4		-92	
powerControlOffsetSS		1-4		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1-4		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1-4		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1-4		CSI-RS.3.1 TDD	
reportConfigType		1-4		periodic	
reportQuantity		1-4		cri-RI-PMI-CQI	
CSI reporting periodicity		1-4	slot	40	
CSI reporting offset		1-4	slot	4	
T310		1-4	ms	1000	
N310		1-4		2	
T1		1-4	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2		1-4	s	2.61	
T3		1-4	s	1.64	
T4		1-4	s	0	
T5		1-4	s	1.01	
D1		1-4	s	0.97	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.5.5.5.1.1-3: Cell specific test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
AoA setup		Setup 1 defined in A.3.15				
Assumption for UE beams[Note 10]		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1-4	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_SSB of set q_1	Config 1-4	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	Config 1-2	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 3-4		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1-4	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.5.5.5.1.1-4: Void

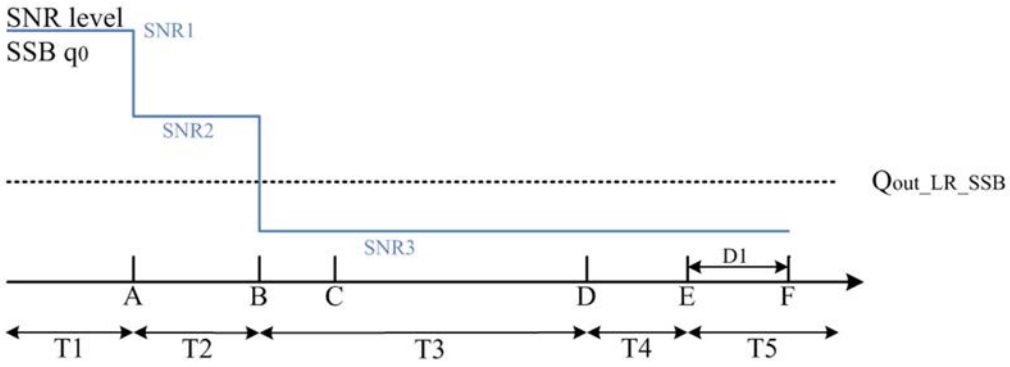


Figure A.5.5.5.1.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

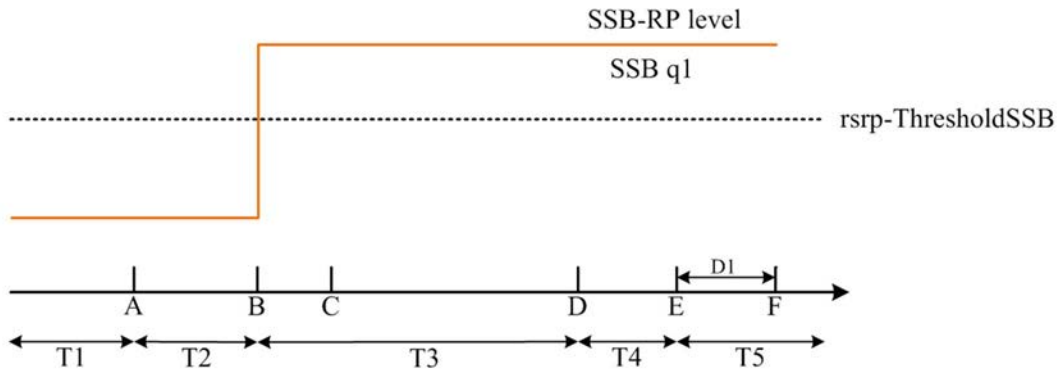


Figure A.5.5.5.1.1-2: SSB_RP level variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.5.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 960+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.5.2 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with SSB-based BFD and LR in DRX mode

A.5.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in tables A.5.5.5.2.1-1, A.5.5.5.2.1-2, A.5.5.5.2.1-3, A.5.5.5.2.1-4 and A.5.5.5.2.1-5 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.2.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PSCell to emulate SSB based beam failure. Figure A.5.5.5.2.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCSell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.5.5.5.2.1-1: Supported test configurations for FR2 PSCell

Configuration	Description

1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
3	LTE FDD, TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
4	LTE TDD, TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.5.2.1-2: General test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Active E-UTRA PCell		1-4		Cell 1	
E-UTRA RF Channel Number		1-4		1	
Active PCell		1-4		Cell 2	
RF Channel Number		1-4		2	
Duplex mode		1-4		TDD	
TDD Configuration		1-4		TDDConf.3.1	
$BW_{channel}$		1-4	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1-4		66	
PDSCH/PDCCH subcarrier spacing		1-4	kHz	120	
DL initial BWP configuration		1-4		DLBWP.0.1	
DL dedicated BWP configuration		1-4		DLBWP.1.1	
UL initial BWP configuration		1-4		ULBWP.0.1	
UL dedicated BWP configuration		1-4		ULBWP.1.1	
PDSCH Reference Channel		1-2		SR.3.2 TDD	
		3-4		SR.3.3 TDD	
RMSI CORESET Reference Channel		1-2		CR.3.1 TDD	
		3-4		CR.3.2 TDD	
Dedicated CORESET Reference Channel		1-2		CCR.3.1 TDD	
		3-4		CCR.3.7 TDD	
OCNG parameters		1-4		OP.1	
CP length		1-4		Normal	
PDSCH/PDCCH TCI state		1-4		TCI.State.0	
CSI-RS for tracking		1-4		TRS.2.1 TDD	
SSB Configuration		1-2		SSB.1 FR2	
		3-4		SSB.2 FR2	
SMTC Configuration		1-4		SMTC.3	
PRACH Configuration		1-4		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration		1-4		DRX.3	A.3.3.3
SSB index assigned as BFD RS (q_0)		1-4		0	
SSB index assigned as CBD RS (q_1)		1-4		1	
SSB index assigned as RLM RS		1-4		0,1	
Beam failure detection transmission parameters	DCI format	1-4		1-0	
	Number of Control OFDM symbols	1-4		2	
	Aggregation level	1-4	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-4	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-4	dB	0	
	DMRS precoder granularity	1-4		REG bundle size	
	REG bundle size	1-4		6	
Gap pattern ID		1-4		N/A	
rlmInSyncOutOfSyncThreshold		1-4		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1-2	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
		3-4		-92	
powerControlOffsetSS		1-4		db0	Used for deriving rsrp-ThresholdCSI-RS

Parameter	Test Config.	Unit	Value	Comment
beamFailureInstanceMaxCount	1-4		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer	1-4		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	1-4		CSI-RS.3.1 TDD	
reportConfigType	1-4		periodic	
reportQuantity	1-4		cri-RI-PMI-CQI	
CSI reporting periodicity	1-4	slot	40	
CSI reporting offset	1-4	slot	4	
T310	1-4	ms	1000	
N310	1-4		2	
T1	1-4	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2	1-4	s	3.37	
T3	1-4	s	2.8	
T4	1-4	s	0	
T5	1-4	s	0.61	
D1	1-4	s	0.57	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.5.5.5.2.1-3: Cell specific test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams[Note 10]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1-4	dB	5[Note 11]	-3[Note 11]	-12	-12	-12
SNR_SSB of set q_1	Config 1-4	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	Config 1-2	dBm/ SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 3-4		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1-4	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.2.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.5.5.5.2.1-4: Void

Table A.5.5.5.2.1-5: Void

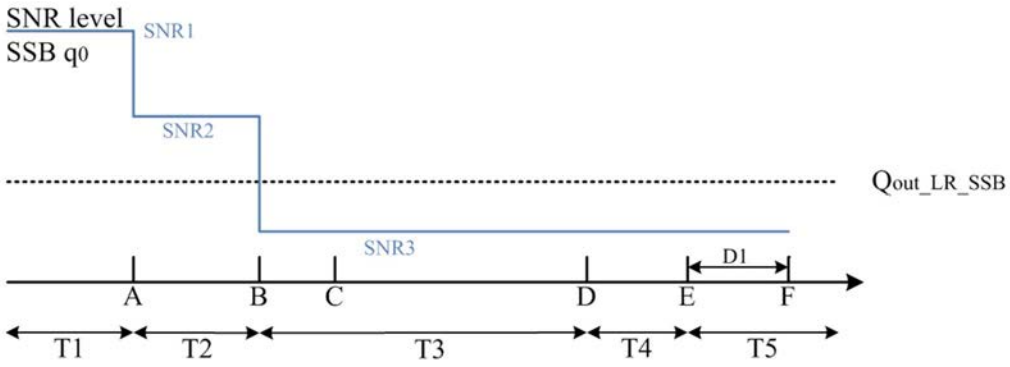


Figure A.5.5.5.2.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in DRX mode

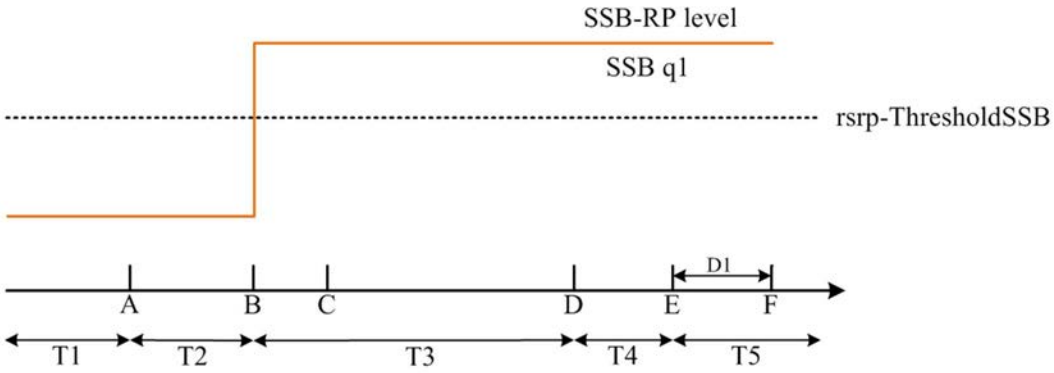


Figure A.5.5.5.2.1-2: SSB_RP level variation for SSB-based beam failure detection and link recovery testing in DRX mode

A.5.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 560+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.5.3 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.5.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in tables A.5.5.5.3.1-1, A.5.5.5.3.1-2, and A.5.5.5.3.1-3 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.3.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the CSI-RS in set q_0 in the active PSCell to emulate CSI-RS based beam failure. Figure A.5.5.5.3.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.5.5.5.3.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.5.5.5.3.1-2: General test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Active E-UTRA PCell		1-2		Cell 1	
E-UTRA RF Channel Number		1-2		1	
Active PCell		1-2		Cell 2	
RF Channel Number		1-2		2	
Duplex mode		1-2		TDD	
TDD Configuration		1-2		TDDConf.3.1	
$BW_{channel}$		1-2		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1-2		66	
PDSCH/PDCCH subcarrier spacing		1-2	kHz	120	
DL initial BWP configuration		1-2		DLBWP.0.1	
DL dedicated BWP configuration		1-2		DLBWP.1.1	
UL initial BWP configuration		1-2		ULBWP.0.1	
UL dedicated BWP configuration		1-2		ULBWP.1.1	
PDSCH Reference Channel		1-2		SR.3.2 TDD	
RMSI CORESET Reference Channel		1-2		CR.3.1 TDD	
Dedicated CORESET Reference Channel		1-2		CCR.3.1 TDD	
OCNG parameters		1-2		OP.1	
CP length		1-2		Normal	
PDSCH/PDCCH TCI state		1-2		TCI.State.0	
CSI-RS for tracking		1-2		TRS.2.1 TDD	
SSB Configuration		1-2		SSB.1 FR2	
SMTC Configuration		1-2		SMTC.3	
PRACH Configuration		1-2		FR2 PRACH configuration 4	A.3.8.3.4
DRX configuration		1-2		OFF	
CSI-RS configuration for BFD/CBD/RLM		1-2		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0)		1-2		0	
CSI-RS index assigned as CBD RS (q_1)		1-2		1	
CSI-RS index assigned as RLM RS		1-2		0,1	
Beam failure detection transmission parameters	DCI format	1-2		1-0	
	Number of Control OFDM symbols	1-2		2	
	Aggregation level	1-2	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0	

Parameter		Test Config.	Unit	Value	Comment
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0	
	DMRS precoder granularity	1-2		REG bundle size	
	REG bundle size	1-2		6	
Gap pattern ID		1-2		N/A	
rlmInSyncOutOfSyncThreshold		1-2		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1-2	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1-2		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1-2		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1-2		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType		1-2		periodic	
reportQuantity		1-2		cri-RI-PMI-CQI	
CSI reporting periodicity		1-2	slot	40	
CSI reporting offset		1-2	slot	4	
T310		1-2	ms	1000	
N310		1-2		2	
T1		1-2	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2		1-2	s	1.17	
T3		1-2	s	0.9	
T4		1-2	s	0	
T5		1-2	s	0.31	
D1		1-2	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.5.5.5.3.1-3: Cell specific test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams[Note 10]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1-2	dB	5 [Note 11]	-3 [Note 11]	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1-2	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1-2	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1-2	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30ns 75 Hz				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Void						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.3.1-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.						
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband						

Table A.5.5.5.3.1-4: Void

Table A.5.5.5.3.1-5: Void

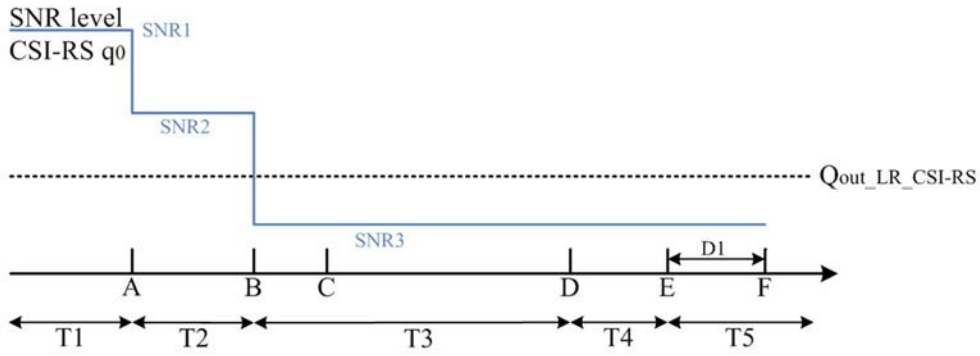


Figure A.5.5.5.3.1-1: SNR variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

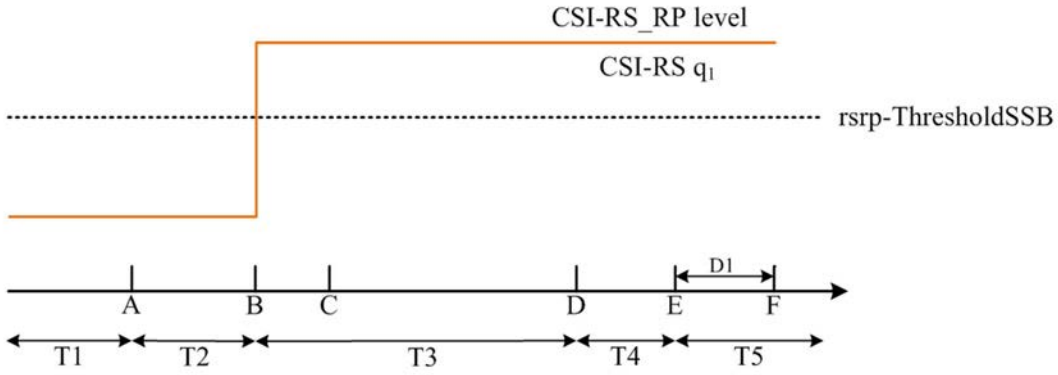


Figure A.5.5.5.3.1-2: CSI-RS_RP level variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

A.5.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.5.4 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with CSI-RS-based BFD and LR in DRX mode

A.5.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in tables A.5.5.5.4.1-1, A.5.5.5.4.1-2, A.5.5.5.4.1-3, and A.5.5.5.4.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.4.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the CSI-RS in set q_0 in the active PSCell to emulate CSI-RS based beam failure. Figure A.5.5.5.4.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.5.5.5.4.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	LTE TDD, FDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.5.5.5.4.1-2: General test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active E-UTRA PCell	1-2		Cell 1	
E-UTRA RF Channel Number	1-2		1	
Active PCell	1-2		Cell 2	
RF Channel Number	1-2		2	
Duplex mode	1-2		TDD	
TDD Configuration	1-2		TDDConf.3.1	
$BW_{channel}$	1-2		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1-2		66	
PDSCH/PDCCH subcarrier spacing	1-2	kHz	120	
DL initial BWP configuration	1-2		DLBWP.0.1	
DL dedicated BWP configuration	1-2		DLBWP.1.1	
UL initial BWP configuration	1-2		ULBWP.0.1	
UL dedicated BWP configuration	1-2		ULBWP.1.1	
PDSCH Reference Channel	1-2		SR.3.2 TDD	
RMSI CORESET Reference Channel	1-2		CR.3.1 TDD	

Parameter		Test Config.	Unit	Value	Comment
Dedicated CORESET Reference Channel		1-2		CCR.3.1 TDD	
OCNG parameters		1-2		OP.1	
CP length		1-2		Normal	
PDSCH/PDCCH TCI state		1-2		TCI.State.0	
CSI-RS for tracking		1-2		TRS.2.1 TDD	
SSB Configuration		1-2		SSB.1 FR2	
SMTC Configuration		1-2		SMTC.3	
PRACH Configuration		1-2		FR2 PRACH configuration 4	A.3.8.3.4
DRX configuration		1-2		DRX.3	A.3.3.3
CSI-RS configuration for BFD/CBD/RLM		1-2		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0)		1-2		0	
CSI-RS index assigned as CBD RS (q_1)		1-2		1	
CSI-RS index assigned as RLM RS		1-2		0,1	
Beam failure detection transmission parameters	DCI format	1-2		1-0	
	Number of Control OFDM symbols	1-2		2	
	Aggregation level	1-2	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0	
	DMRS precoder granularity	1-2		REG bundle size	
	REG bundle size	1-2		6	
Gap pattern ID		1-2		N/A	
rlmInSyncOutOfSyncThreshold		1-2		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1-2	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1-2		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1-2		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1-2		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType		1-2		periodic	
reportQuantity		1-2		cri-RI-PMI-CQI	
CSI reporting periodicity		1-2	slot	40	
CSI reporting offset		1-2	slot	4	
T310		1-2	ms	1000	
N310		1-2		2	
T1		1-2	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2		1-2	s	5.43	
T3		1-2	s	5.16	
T4		1-2	s	0	
T5		1-2	s	0.31	
D1		1-2	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.5.5.5.4.1-3: Cell specific test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
AoA setup		Setup 1 defined in A.3.155				
Assumption for UE beams[Note 10]		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB			0		
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1-2	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1-2	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1-2	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1-2	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.4.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.5.5.5.4.1-4: Void

Table A.5.5.5.4.1-5: Void

Table A.5.5.5.4.1-6: Void

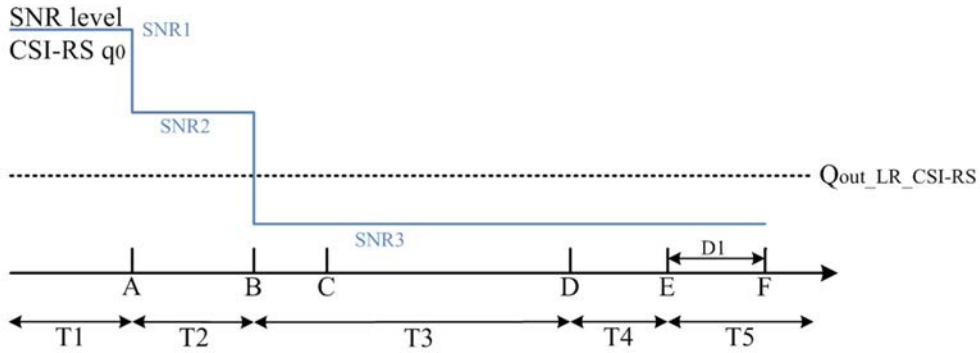


Figure A.5.5.5.4.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

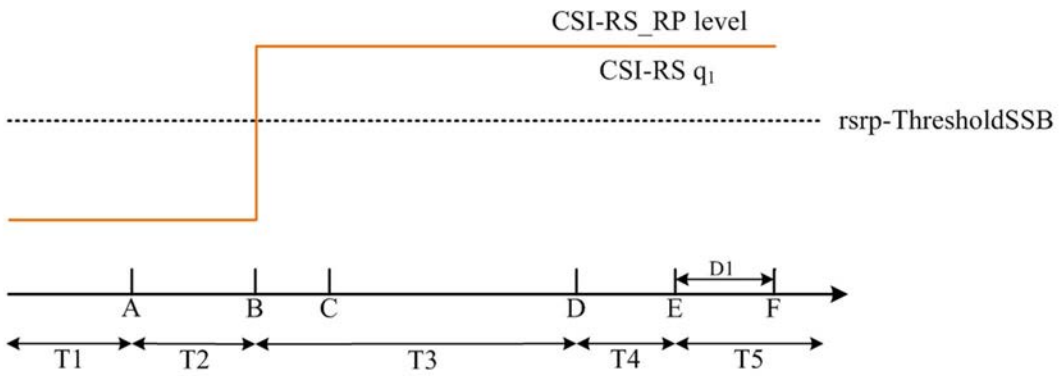


Figure A.5.5.5.4.1-2: CSI-RS_RP level variation for CSI-RS based beam failure detection and link recovery testing in DRX mode

A.5.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.5.5 EN-DC scheduling availability restriction during Beam Failure Detection and Link Recovery for FR2 PSCell configured with SSB-based BFD and LR in non-DRX mode

A.5.5.5.5.1 Test Purpose and Environment

The purpose is to test scheduling availability restrictions when the UE is performing beam failure detection or when the UE is performing L1-RSRP measurement for candidate beam detection, when no DRX is used. This test will verify the scheduling availability restriction requirements for SSB based beam failure detection and link recovery for an FR2 serving cell in clause 8.5.7 and 8.5.8.

The test parameters are given in tables A.5.5.5.5.1-1, A.5.5.5.5.1-2 and A.5.5.5.5.1-3 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.5.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB index 0 in the active PSCell to emulate SSB based beam failure. Figure A.5.5.5.5.1-2 shows the variation of the downlink L1-RSRP of the SSB index 1 used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. This test will focus on the scheduling availability during beam failure detection and candidate beam detection. In the test, DRX configuration is not enabled. Test is to test the scheduling availability restriction of UE performing beam failure detection and candidate beam detection when SSB RS configured for Beam failure detection and candidate beam detection. During the test the UE is scheduled to transmit continuously in UL.

Table A.5.5.5.5.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.5.5.1-2: General test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Active E-UTRA PCell		1-4		Cell 1	
E-UTRA RF Channel Number		1-4		1	
Active PCell		1-4		Cell 2	
RF Channel Number		1-4		2	
Duplex mode		1-4		TDD	
TDD Configuration		1-4		TDDConf.3.1	
$BW_{channel}$		1-4		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1-4		66	
PDSCH/PDCCH subcarrier spacing		1-4	kHz	120	
DL initial BWP configuration		1-4		DLBWP.0.1	
DL dedicated BWP configuration		1-4		DLBWP.1.1	
UL initial BWP configuration		1-4		ULBWP.0.1	
UL dedicated BWP configuration		1-4		ULBWP.1.1	
PDSCH Reference Channel		1-2		SR.3.2 TDD	
		3-4		SR.3.3 TDD	
RMSI CORESET Reference Channel		1-2		CR.3.1 TDD	
		3-4		CR.3.2 TDD	
Dedicated CORESET Reference Channel		1-2		CCR.3.1 TDD	
		3-4		CCR.3.7 TDD	
OCNG parameters		1-4		OP.1	
CP length		1-4		Normal	
PDSCH/PDCCH TCI state		1-4		TCI.State.0	
CSI-RS for tracking		1-4		TRS.2.1 TDD	
SSB Configuration		1-2		SSB.1 FR2	
		3-4		SSB.2 FR2	
SMTC Configuration		1-4		SMTC.1	
PRACH Configuration		1-4		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration		1-4		OFF	
Beam failure detection transmission parameters	DCI format	1-4		1-0	
	Number of Control OFDM symbols	1-4		2	
	Aggregation level	1-4	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-4	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-4	dB	0	
	DMRS precoder granularity	1-4		REG bundle size	
	REG bundle size	1-4		6	
Gap pattern ID		1-4		N/A	No measurement gap is configured
rlmInSyncOutOfSyncThreshold		1-4		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1-2	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
		3-4		-92	
powerControlOffsetSS		1-4		db0	Used for deriving rsrp-ThresholdCSI-RS

Parameter	Test Config.	Unit	Value	Comment
beamFailureInstanceMaxCount	1-4		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer	1-4		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	1-4		CSI-RS.3.1 TDD	
reportConfigType	1-4		periodic	
reportQuantity	1-4		cri-RI-PMI-CQI	
CSI reporting periodicity	1-4	slot	40	
CSI reporting offset	1-4	slot	4	
T310	1-4	ms	1000	
N310	1-4		2	
T1	1-4	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2	1-4	s	2.6	
T3	1-4	s	1.64	
T4	1-4	s	0	
T5	1-4	s	1.01	
D1	1-4	s	0.97	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.5.5.5.5.1-3: Cell specific test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams[Note 10]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SSB index assigned as BFD RS (q_0)	Config 1-4		0	0	Note 12		
SSB index assigned as CBD RS (q_1)	Config 1-4		1	1	1	1	1
SNR of SSB index 0	Config 1-4	dB	5[Note 11]	-3[Note 11]	-12	-12	-12
SNR of SSB index 1	Config 1-4	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of SSB index 1	Config 1-2	dBm/ SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 3-4		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1-4	dBm/120 kHz	-104.7				
Propagation condition			TDL-A 30ns 75 Hz				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.5.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband
NOTE 12: BFD RS (q_0) is configured as SSB index 0 at the start of T3, and it is reconfigured by RRC as SSB index 1 after the UE transmits the preamble on a beam associated with the candidate beam set q_1.

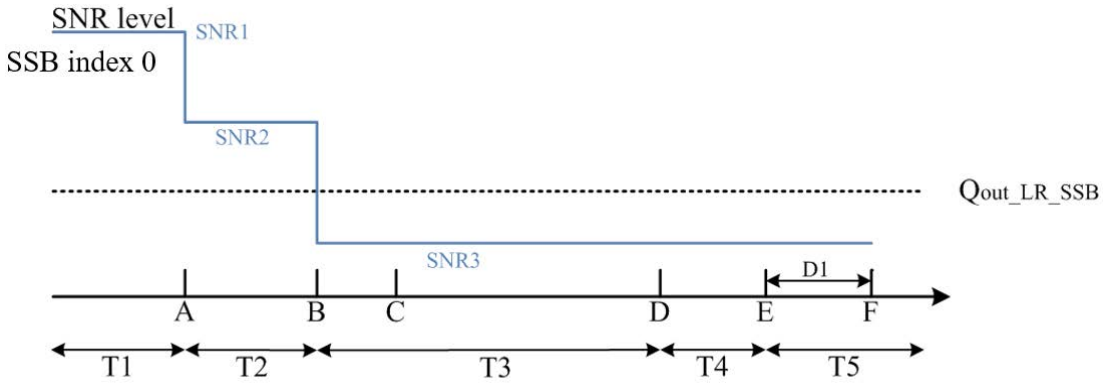


Figure A.5.5.5.5.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

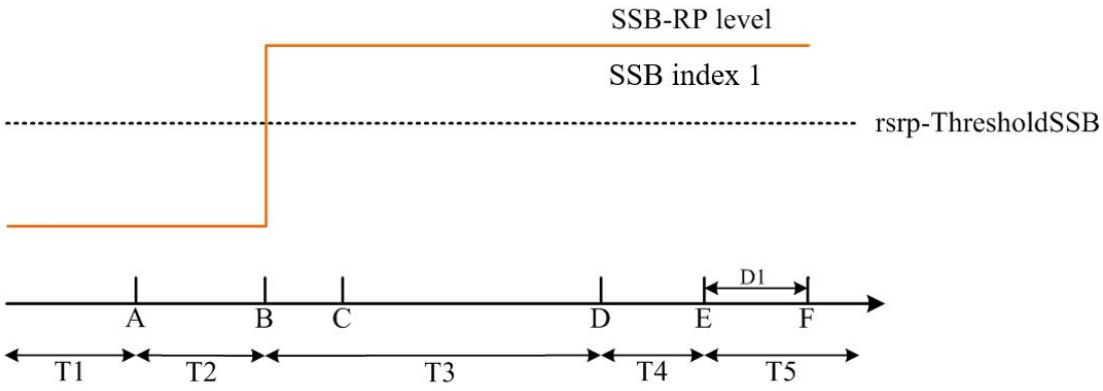


Figure A.5.5.5.5.1-2: SSB_RP level variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.5.5.5.5.2 Test Requirements

The UE behaviour during time duration T3 follows the requirements defined in clause 8.5.7.3:

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on BFD-RS symbols to be measured for beam failure detection.

The UE behaviour during time durations T4 and T5 follows the requirements defined in clause 8.5.8.3:

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on reference symbols to be measured for candidate beam detection.

A.5.5.5.6 EN-DC Beam Failure Detection and Link Recovery Test for FR2 SCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.5.5.5.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for an active SCell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the SCell with *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 SCell requirements in clause 8.5.

The test parameters are given in tables A.5.5.5.6.1-1, A.5.5.5.6.1-2 and A.5.5.5.6.1-3. There are three cells, Cell 1 is the E-UTRAN PCell, Cell 2 is the PSCell, and Cell 3 is the SCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.6.1-1 shows the variation of the downlink SNR of the active SCell and the SNR of the CSI-RS in set q_0 in the active SCell to emulate CSI-RS based beam failure. Figure A.5.5.5.6.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1, Cell 2, and Cell 3. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.5.5.5.6.1-1: Supported test configurations for FR2 PSCell and SCell

Configuration	Description
1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.5.5.5.6.1-2: General test parameters for FR2 SCell for beam failure detection and link recovery testing in non-DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active E-UTRA PCell	1-2		Cell 1	
E-UTRA RF Channel Number	1-2		1	
Active PCell	1-2		Cell 2	
RF Channel Number for PSCell	1-2		2	
Active SCell	1-2		Cell 3	
RF Channel Number for SCell	1-2		3	
Duplex mode	1-2		TDD	
TDD Configuration	1-2		TDDConf.3.1	
$BW_{channel}$	1-2	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1-2		66	
PDSCH/PDCCH subcarrier spacing	1-2	kHz	120	
DL initial BWP configuration	1-2		DLBWP.0.1	
DL dedicated BWP configuration	1-2		DLBWP.1.1	
UL initial BWP configuration	1-2		ULBWP.0.1	
UL dedicated BWP configuration	1-2		ULBWP.1.1	
PDSCH Reference Channel	1-2		SR.3.2 TDD	
RMSI CORESET Reference Channel	1-2		CR.3.1 TDD	A.3.1.2
Dedicated CORESET Reference Channel	1-2		CCR.3.1 TDD	
OCNG parameters	1-2		OP.1	A.3.2.1
CP length	1-2		Normal	
PDSCH/PDCCH TCI state	1-2		TCI.State.0	
CSI-RS for tracking	1-2		TRS.2.1 TDD	
SSB Configuration	1-2		SSB.3 FR2	A.3.10

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
SMTC Configuration		1-2		SMTC.3	A.3.11
PRACH Configuration		1-2		FR2 PRACH configuration 4	Table A.3.8.3.4-1
DRX configuration		1-2		OFF	
CSI-RS configuration for BFD/CBD in activated SCell		1-2		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0) in activated SCell		1-2		0	
CSI-RS index assigned as CBD RS (q_1) in activated SCell		1-2		1	
CSI-RS configuration for RLM in PSCell		1-2		CSI-RS.3.2 TDD	A.3.14.2
Beam failure detection transmission parameters	DCI format	1-2		1-0	
	Number of Control OFDM symbols	1-2		2	
	Aggregation level	1-2	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0	
	DMRS precoder granularity	1-2		REG bundle size	
	REG bundle size	1-2		6	
Gap pattern ID		1-2		N/A	
schedulingRequestID-BFR-SCell-r16		1-2		Configured	
Periodicity of PUCCH for SR configuration for BFR on SCell		1-2	slot	40	5 ms
Offset of PUCCH for SR configuration for BFR on SCell		1-2	slot	4	
PUCCH parameters for SR configuration for BFR on SCell		1-2		Table 8.3.3.1.2-1 in [13]	
rlmInSyncOutOfSyncThreshold		1-2		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1-2	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1-2		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1-2		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1-2		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType		1-2		periodic	
reportQuantity		1-2		cri-RI-PMI-CQI	
CSI reporting periodicity		1-2	slot	40	
CSI reporting offset		1-2	slot	4	
T310		1-2	ms	1000	
N310		1-2		2	
T1		1-2	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2		1-2	s	1.17	
T3		1-2	s	0.9	
T4		1-2	s	0	
T5		1-2	s	0.31	
D1		1-2	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.5.5.5.6.1-3: Cell specific test parameters for FR2 SCell for beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Cell2	Cell3 Test 1				
			T1 to T5	T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15	Setup 1 defined in A.3.15				
Assumption for UE beams[Note 10]			Rough	Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR_CSI-RS of set q_0	Config 1,2	dB	5	5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1,2	dB	0.2	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1,2	dBm/SCS kHz	-104.5	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1,2	Config 1	dBm/120 kHz	-104.7				
Propagation condition			TDL-A 30ns 75 Hz	TDL-A 30ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.6.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

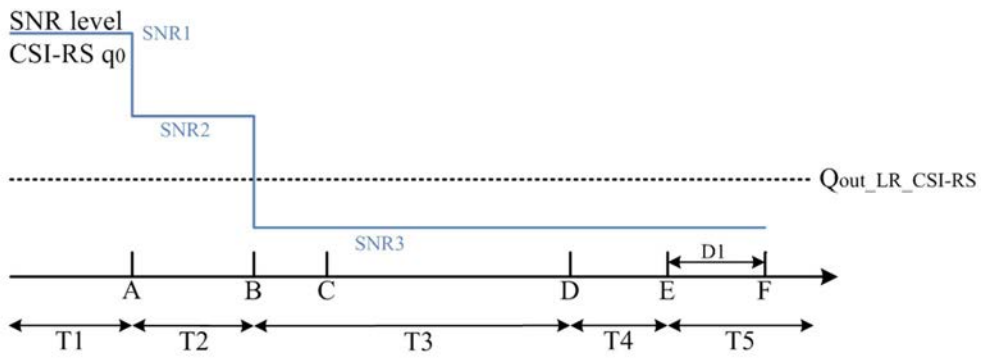


Figure A.5.5.5.6.1-1: SNR variation for CSI-RS based beam failure detection and link recovery testing for SCell in non-DRX mode

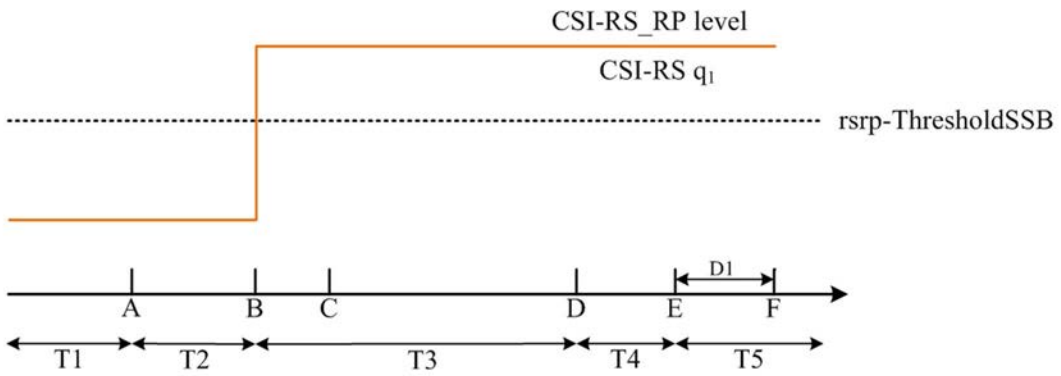


Figure A.5.5.5.6.1-2: CSI-RS_RP level variation for CSI-RS based beam failure detection and link recovery testing for SCell in non-DRX mode

A.5.5.5.6.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 in A.5.5.5.6.1 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initial link recovery. During T4 and T5 the UE measures and evaluates beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q_1. The UE shall not transmit PUCCH with an LRR with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.5.7 EN-DC Beam Failure Detection and Link Recovery Test for FR2 SCell configured with CSI-RS-based BFD and LR in DRX mode

A.5.5.5.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for an active SCell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the SCell with *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 SCell requirements in clause 8.5.

The test parameters are given in tables A.5.5.5.7.1-1, A.5.5.5.7.1-2 and A.5.5.5.7.1-3. There are three cells, Cell 1 is the E-UTRAN PCell, Cell 2 is the PSCell, and Cell 3 is the SCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.7.1-1 shows the variation of the downlink SNR of the active SCell and the SNR of the CSI-RS in set q_0 in the active SCell to emulate CSI-RS based beam failure. Figure A.5.5.5.7.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1, Cell 2, and Cell 3. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.5.5.5.7.1-1: Supported test configurations for FR2 PSCell and SCell

Configuration	Description
1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.5.5.5.7.1-2: General test parameters for FR2 SCell for beam failure detection and link recovery testing in DRX mode

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Active E-UTRA PCell		1-2		Cell 1	
E-UTRA RF Channel Number		1-2		1	
Active PCell		1-2		Cell 2	
RF Channel Number for PSCell		1-2		2	
Active SCell		1-2		Cell 3	
RF Channel Number for SCell		1-2		3	
Duplex mode		1-2		TDD	
TDD Configuration		1-2		TDDConf.3.1	
$BW_{channel}$		1-2	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1-2		66	
PDSCH/PDCCH subcarrier spacing		1-2	kHz	120	
DL initial BWP configuration		1-2		DLBWP.0.1	
DL dedicated BWP configuration		1-2		DLBWP.1.1	
UL initial BWP configuration		1-2		ULBWP.0.1	
UL dedicated BWP configuration		1-2		ULBWP.1.1	
PDSCH Reference Channel		1-2		SR.3.2 TDD	
RMSI CORESET Reference Channel		1-2		CR.3.1 TDD	A.3.1.2
Dedicated CORESET Reference Channel		1-2		CCR.3.1 TDD	
OCNG parameters		1-2		OP.1	A.3.2.1
CP length		1-2		Normal	
PDSCH/PDCCH TCI state		1-2		TCI.State.0	
CSI-RS for tracking		1-2		TRS.2.1 TDD	
SSB Configuration		1-2		SSB.3 FR2	A.3.10
SMTC Configuration		1-2		SMTC.3	A.3.11
PRACH Configuration		1-2		FR2 PRACH configuration 4	Table A.3.8.3.4-1
DRX configuration		1-2		DRX.3	A.3.3.3
CSI-RS configuration for BFD/CBD in activated SCell		1-2		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0) in activated SCell		1-2		0	
CSI-RS index assigned as CBD RS (q_1) in activated SCell		1-2		1	
CSI-RS configuration for RLM in PSCell		1-2		CSI-RS.3.2 TDD	A.3.14.2
Beam failure detection transmission parameters	DCI format	1-2		1-0	
	Number of Control OFDM symbols	1-2		2	
	Aggregation level	1-2	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0	
	DMRS precoder granularity	1-2		REG bundle size	
	REG bundle size	1-2		6	
Gap pattern ID		1-2		N/A	
schedulingRequestID-BFR-SCell-r16		1-2		Configured	
Periodicity of PUCCH for SR configuration for BFR on SCell		1-2	slot	40	5 ms
Offset of PUCCH for SR configuration for BFR on SCell		1-2	slot	4	

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
PUCCH parameters for SR configuration for BFR on SCell	1-2		Table 8.3.3.1.2-1 in [13]	
rlmInSyncOutOfSyncThreshold	1-2		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB	1-2	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS	1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount	1-2		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer	1-2		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	1-2		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType	1-2		periodic	
reportQuantity	1-2		cri-RI-PMI-CQI	
CSI reporting periodicity	1-2	slot	40	
CSI reporting offset	1-2	slot	4	
T310	1-2	ms	1000	
N310	1-2		2	
T1	1-2	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2	1-2	s	5.43	
T3	1-2	s	5.16	
T4	1-2	s	0	
T5	1-2	s	0.31	
D1	1-2	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.5.5.5.7.1-3: Cell specific test parameters for FR2 SCell for beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Cell2	Cell3 Test 1				
				T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.155	Setup 1 defined in A.3.155				
Assumption for UE beams[Note 10]			Rough	Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR_CSI-RS of set q_0	Config 1,2	dB	5	5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1,2	dB	0.2	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1,2	dBm/ SCS kHz	-104.5	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1,2	dBm/120 kHz	-104.7	-104.7				
Propagation condition			TDL-A 30ns 75 Hz	TDL-A 30ns 75 Hz				

Parameter	Unit	Cell2	Cell3 Test 1				
			T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 4: Void							
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.							
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.							
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.7.1-1.							
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.							
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation							

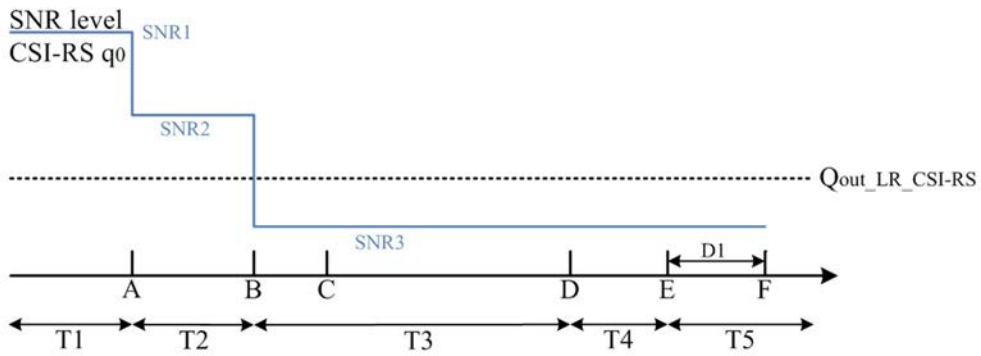


Figure A.5.5.5.7.1-1: SNR variation for CSI-RS-based beam failure detection and link recovery testing for SCell in DRX mode

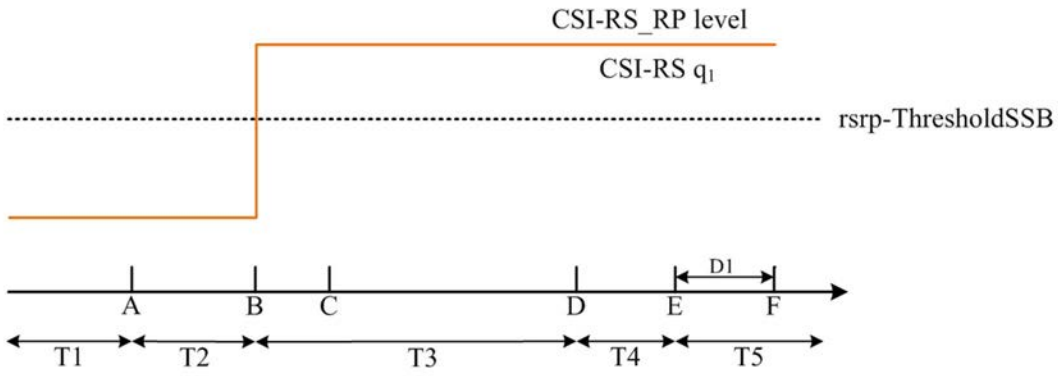


Figure A.5.5.5.7.1-2: CSI-RS_RP level variation for CSI-RS based beam failure detection and link recovery testing for SCell in DRX mode

A.5.5.5.7.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 in A.5.5.5.7.1 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 2.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

During T3 the UE shall detect beam failure and initial link recovery. During T4 and T5 the UE measures and evaluates beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q_1. The UE shall not transmit PUCCH with an LRR with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.5.8 EN-DC TRP specific Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with CSI-RS-based BFD and LR in DRX mode

A.5.5.5.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the TRP specific CSI-RS-based beam failure in the set (q0,0), (q0,1) configured for a serving PSCell and a cell with PCID different from the serving cell, and that the UE performs correct CSI-RS-based link recovery based on beam candidate set (q1,0) and (q1,1). The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell with *schedulingRequestID-BFR-r17* configured, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in tables A.5.5.5.8.1-1, A.5.5.5.8.1-2, A.5.5.5.8.1-3, and A.5.5.5.8.1-4 below. There are three cells, Cell 1 is the E-UTRAN PCell, Cell 2 is the PSCell and Cell 3 is the cell with different PCID in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.8.1-1 shows the variation of the downlink SNR of the PSCell and the SNR of the CSI-RS in set q_0 in the active PSCell to emulate CSI-RS based beam failure. Figure A.5.5.5.8.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.5.5.5.8.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode

Table A.5.5.5.8.1-2: General test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active E-UTRA PCell	1-2		Cell 1	
E-UTRA RF Channel Number	1-2		1	
Active PSCell	1-2		Cell 2	
RF Channel Number	1-2		2	
Duplex mode	1-2		TDD	
TDD Configuration	1-2		TDDConf.3.1	
$BW_{channel}$	1-2		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1-2		66	
PDSCH/PDCCH subcarrier spacing	1-2	kHz	120	
DL initial BWP configuration	1-2		DLBWP.0.1	
DL dedicated BWP configuration	1-2		DLBWP.1.1	
UL initial BWP configuration	1-2		ULBWP.0.1	
UL dedicated BWP configuration	1-2		ULBWP.1.1	
PDSCH Reference Channel	1-2		SR.3.2 TDD	
RMSI CORESET Reference Channel	1-2		CR.3.1 TDD	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Dedicated CORESET Reference Channel		1-2		CCR.3.1 TDD	
OCNG parameters		1-2		OP.1	
CP length		1-2		Normal	
PDSCH/PDCCH TCI state		1-2		TCI.State.0	
CSI-RS for tracking		1-2		TRS.2.1 TDD	
SSB Configuration		1-2		SSB.1 FR2	
SMTC Configuration		1-2		SMTC.3	
PRACH Configuration		1-2		FR2 PRACH configuration 4	A.3.8.3.4
DRX configuration		1-2		DRX.3	A.3.3.3
CSI-RS configuration for TRP0		1-2		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS configuration for TRP1				CSI-RS.3.6 TDD	A.3.14.2
CSI-RS index assigned as BFD RS ($q_{0,0}$)		1-2		CSI-RS#0	
CSI-RS index assigned as CBD RS ($q_{1,0}$)		1-2		CSI-RS#1	
CSI-RS index assigned as BFD RS ($q_{0,1}$)		1-2		CSI-RS#2	
CSI-RS index assigned as CBD RS ($q_{1,1}$)		1-2		CSI-RS#3	
CSI-RS index assigned as RLM RS		1-2		0,1,2,3	
Beam failure detection transmission parameters	DCI format	1-2		1-0	
	Number of Control OFDM symbols	1-2		2	
	Aggregation level	1-2	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0	
	DMRS precoder granularity	1-2		REG bundle size	
	REG bundle size	1-2		6	
Gap pattern ID		1-2		N/A	
schedulingRequestID-BFR- r17		1-2		Configured	
Periodicity of PUCCH for SR configuration for BFR on PSCell		1-2	slot	40	5 ms
rlmInSyncOutOfSyncThreshold		1-2		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdCSI-RS		1-2	dBm/SCS	-95	Threshold used for $Q_{in_LR_CSI-RS}$
powerControlOffsetSS		1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1-2		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1-2		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1-2		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType		1-2		periodic	
reportQuantity		1-2		cri-RI-PMI-CQI	
CSI reporting periodicity		1-2	slot	40	
CSI reporting offset		1-2	slot	4	
T310		1-2	ms	1000	
N310		1-2		2	
T1		1-2	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2		1-2	s	10.81	

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
T3	1-2	s	10.28	
T4	1-2	s	0	
T5	1-2	s	0.57	
D1	1-2	s	0.53	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.5.5.5.8.1-3: Cell specific test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 3 defined in A.3.15				
Assumption for UE beams[Note 10]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set $q_{0,0}$	Config 1-2	dB	5	-3	-12	-12	-12
SNR_CSI-RS of set $q_{0,1}$	Config 1-2	dB	5	5	5	5	5
SNR_CSI-RS of set $q_{1,0}$	Config 1-2	dB	0.2	0.2	20.2	20.2	20.2
SNR_CSI-RS of set $q_{1,1}$	Config 1-2	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set $q_{1,0}$	Config 1-2	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
CSI-RS_RP of set $q_{1,1}$	Config 1-2	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1-2	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.4.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

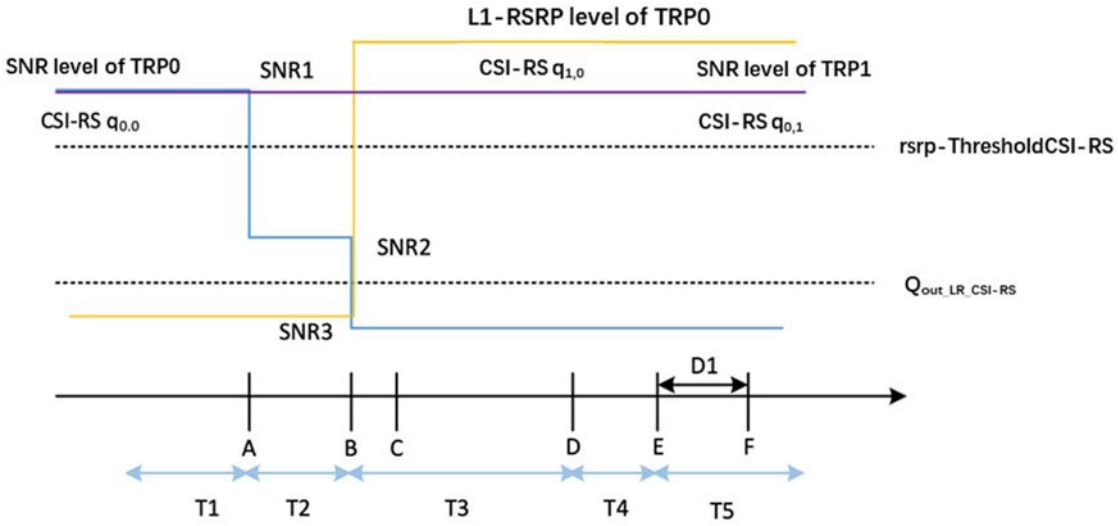


Figure A.5.5.5.8.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

A.5.5.5.8.2 Test Requirements

Test requirements are applied to TRP specific report respectively on (q0,0), (q0,1) for cell-2 and (q1,0), (q1,1) for cell-3 repectively as Figure A.5.5.5.8.1-1.

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set $q_{1,0}$. The UE shall not transmit PUCCH with an LRR with the candidate beam set $q_{1,0}$ earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.5.9 Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with SSB-based BFD and LR in DRX mode for UE fulfilling relaxed measurement criterion

A.5.5.5.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.2.4 for UE fulfilling good serving cell quality criterion, if configured. *goodServingCellEvaluationBFD* [2] criterion is configured according to the parameters listed in table A.5.5.5.9.1-2.

The test parameters are given in tables A.5.5.5.9.1-1, A.5.5.5.9.1-2 and A.5.5.5.9.1-3 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.9.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSBs in set q_0 in the active PSCell to emulate SSB based beam failure. Figure A.5.5.5.9.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.5.5.5.9.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
3	LTE FDD, TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
4	LTE TDD, TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.5.9.1-2: General test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Active E-UTRA PCell		1-4		Cell 1	
E-UTRA RF Channel Number		1-4		1	
Active PCell		1-4		Cell 2	
RF Channel Number		1-4		2	
Duplex mode		1-4		TDD	
TDD Configuration		1-4		TDDConf.3.1	
$BW_{channel}$		1-4	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1-4		66	
PDSCH/PDCCH subcarrier spacing		1-4	kHz	120	
DL initial BWP configuration		1-4		DLBWP.0.1	
DL dedicated BWP configuration		1-4		DLBWP.1.1	
UL initial BWP configuration		1-4		ULBWP.0.1	
UL dedicated BWP configuration		1-4		ULBWP.1.1	
PDSCH Reference Channel		1-2		SR.3.2 TDD	
		3-4		SR.3.3 TDD	
RMSI CORESET Reference Channel		1-2		CR.3.1 TDD	
		3-4		CR.3.2 TDD	
Dedicated CORESET Reference Channel		1-2		CCR.3.1 TDD	
		3-4		CCR.3.7 TDD	
OCNG parameters		1-4		OP.1	
CP length		1-4		Normal	
PDSCH/PDCCH TCI state		1-4		TCI.State.0	
CSI-RS for tracking		1-4		TRS.2.1 TDD	
SSB Configuration		1-2		SSB.1 FR2	
		3-4		SSB.2 FR2	
SMTC Configuration		1-4		SMTC.3	
PRACH Configuration		1-4		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration		1-4		DRX.3	A.3.3.3
SSB index assigned as BFD RS (q_0)		1-4		0,1	
SSB index assigned as CBD RS (q_1)		1-4		2	
SSB index assigned as RLM RS		1-4		0,2	
Beam failure detection transmission parameters	DCI format	1-4		1-0	
	Number of Control OFDM symbols	1-4		2	
	Aggregation level	1-4	CCE	8	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-4	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-4	dB	0	
	DMRS precoder granularity	1-4		REG bundle size	
	REG bundle size	1-4		6	
Gap pattern ID		1-4		N/A	
rlmInSyncOutOfSyncThreshold		1-4		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1-2	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
		3-4		-92	
powerControlOffsetSS		1-4		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1-4		n1	See TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1-4		pbfd4	See TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1-4		CSI-RS.3.1 TDD	
reportConfigType		1-4		periodic	
reportQuantity		1-4		cri-RI-PMI-CQI	
CSI reporting periodicity		1-4	slot	40	
CSI reporting offset		1-4	slot	4	
T310		1-4	ms	1000	
N310		1-4		1	
T1		1-4	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2		1-4	s	3.37	
T3		1-4	s	5.56	
T4		1-4	s	0	
T5		1-4	s	0.61	
D1		1-4	s	0.57	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.5.5.5.9.1-3: Cell specific test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams[Note 10]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB0 of set q_0	Config 1-4	dB	6[Note 11]	6[Note 11]	-12	-12	-12
SNR_SSB1 of set q_0	Config 1-4	dB	-12	-12	-12	-12	-12
SNR_SSB of set q_1	Config 1-4	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	Config 1-2	dBm/ SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 3-4		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1-4	dBm/120 KHz	-104.7				
goodServingCellEvaluation		dB	4				
Propagation condition			TDL-A 30ns 75 Hz				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Void						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.						
NOTE 8: The SNR for SSB0 in time periods T1, T2, T3, T4 and T5 is denoted as SNR0_1, SNR0_2 and SNR0_3 respectively in figure A.5.5.5.9.1-1. The SNR for SSB1 in time periods T1, T2, T3, T4 and T5 is denoted as SNR1_1, SNR1_2 and SNR1_3 respectively in figure A.5.5.5.9.1-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.						
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband						

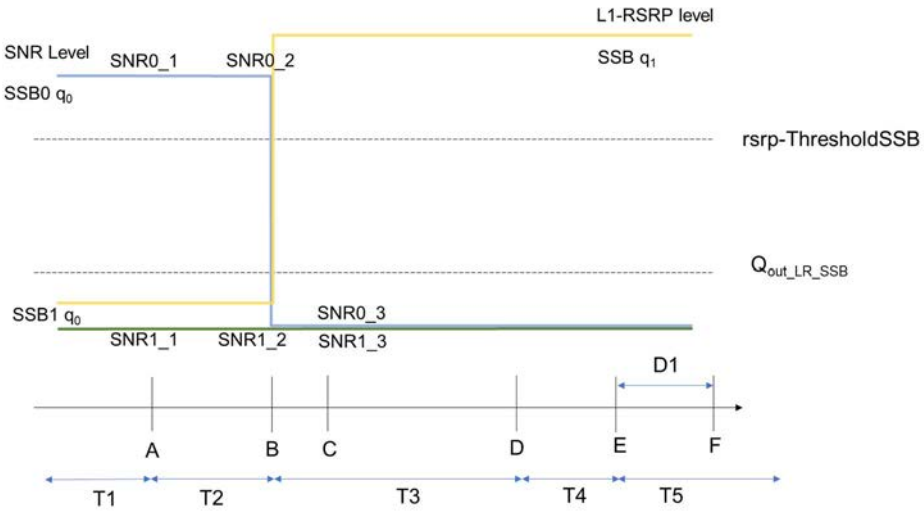


Figure A.5.5.5.9.1-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in DRX mode for UE fulfilling relaxed measurement criterion

A.5.5.5.9.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 560+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.6 Active BWP switch

A.5.5.6.1 DCI-based and Timer-based Active BWP Switch

A.5.5.6.1.1 E-UTRAN – NR PSCell FR2 DL active BWP switch with non-DRX in synchronous EN-DC

A.5.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6. Supported test configurations are shown in table A.5.5.6.1.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in table A.5.5.6.1.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in table A.5.5.6.1.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.5.5.6.1.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE should switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}$).

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

> The time period T3 starts from the slot #*j*, where j is the beginning slot of the DL subframe immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.
>
> The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell at latest at the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}$).

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

Table A.5.5.6.1.1.1-1: DL BWP switch supported test configurations

Config	Description

1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which fulfils the requirements in test case A.5.5.2.2 can skip the test cases in A.5.5.2.1.	

Table A.5.5.6.1.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
bwp-InactivityTimer	ms	200	
PDCCH and PDSCH maximum number of HARQ transmission		1	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to Cell 1	μs	3	Synchronous EN-DC
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.5.5.6.1.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Active BWP ID		1, 2
Initial DL BWP Configuration		DLBWP.0.2 Note 2
Active DL BWP-1 Configuration		DLBWP.1.1 Note 2
Active DL BWP-2 Configuration		DLBWP.1.3 Note 2
Initial UL BWP Configuration		ULBWP.0.2 Note 2
Active UL BWP-1 Configuration		ULBWP.1.1 Note 2
Active UL BWP-2 Configuration		ULBWP.1.3 Note 2
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State		TCI.State.0
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN

Parameter	Unit	Cell 2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].		

Table A.5.5.6.1.1.1-4: OTA related test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note 1	dBm/15 kHz	-112
N_{oc} Note 1	dBm/SCS	-103
SS-RSRP Note 2	dBm/120 kHz Note3	-85
$\hat{E}_s/I_{ot}$	dB	18
Io Note2	dBm/95.04 MHz Note4	-56
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.		
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone		
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.		
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation		

A.5.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after DL slot ($i+Y1$), ($j+Y2$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.5.5.6.1.2 E-UTRAN – NR PSCell FR2 with FR2 SCell DL active BWP switch in non-DRX in synchronous EN-DC

A.5.5.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6.2, and interruption requirements for NR victim cell defined in clause 8.2.1.2.7. Supported test configurations are shown in table A.5.5.6.1.2.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and one NR SCell (Cell 3) as given in table A.5.5.6.1.2.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and SCell are specified in table A.5.5.6.1.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) and SCell (Cell 3) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 3 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC) and Cell 3 (SCell) on radio channel 3 (SCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2, in Cell 3 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for PSCell, BWP-0 in Cell 2 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in SCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in PSCell.
- UE is configured with a *bwp-InactivityTimer* timer value for SCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for SCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in SCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}$).
>
> PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.
>
> PSCell(Cell 2) interruption due to BWP switch on SCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

> The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.
>
> The UE shall be able to receive PDSCH at the beginning of the DL slot right after SCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell on PSCell at latest at the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-1 starting from the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}$).
>
> PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.
>
> PSCell(Cell 2) interruption due to BWP switch of SCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in SCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to NR PSCell is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during BWP switch of SCell.

Table A.5.5.6.1.2.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which fulfils the requirements in test case A.5.5.6.1.2 can skip the test cases in A.5.5.6.1.1. NOTE 3: NR configuration is the same for PSCell and SCells.	

Table A.5.5.6.1.2.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2, 3	Two NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
Active SCell		Cell 3	SCell on RF channel number 3.
CP length		Normal	
DRX		OFF	
bwp-InactivityTimer	ms	200	
PDCCH and PDSCH maximum number of HARQ transmission		1	For PCell, PSCell and SCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for cells on SCC.
Cell2 timing offset to Cell 1	µs	3	Synchronous EN-DC
Cell3 timing offset to Cell 2	µs	3	Synchronous cells
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.5.5.6.1.2.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Cell 2	Cell 3
Frequency Range		FR2	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66	
Active BWP ID		0	1,2
Initial DL BWP Configuration		DLBWP.0.2	DLBWP.0.2
Active DL BWP-0 Configuration		DLBWP.0.2	N.A.
Active DL BWP-1 Configuration		N.A.	DLBWP.1.3
Active DL BWP-2 Configuration		N.A.	DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2	N.A.
Active UL BWP-0 Configuration		ULBWP.0.2	N.A.
Active UL BWP-1 Configuration		N.A.	N.A.
Active UL BWP-2 Configuration		N.A.	N.A.
PDSCH Reference measurement channel		SR.3.1 TDD	
RMSI CORESET parameters		CR.3.1 TDD	
Dedicated CORESET parameters		CCR.3.1 TDD	
OCNG Patterns		OP.1	
SSB Configuration		SSB.1 FR2	
SMTC Configuration		SMTC.1	
TCI State		TRS.2.1 TDD	
TRS Configuration		TCI.State.0	
Antenna Configuration		1x2	
Propagation Condition		AWGN	
EPRE ratio of PSS to SSS	dB	0	0

Parameter	Unit	Cell 2	Cell 3
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3.			

Table A.5.5.6.1.2.1-4: OTA related test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15	
Assumption for UE beams[Note 6]		Fine	Fine
N_{oc}[Note 1]	dBm/15 kHz	-112	-112
SS-RSRP [Note 2]	dBm/120 kHz [Note3]	-85	-85
$\hat{E}_s/I_{ot}$	dB	18	18
Io[Note2]	dBm/95.04 MHz [Note4]	-56	-56
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone			
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.			
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			

A.5.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK for SCell from the first UL slot that occurs after the beginning of DL slot $(i+T_{BWPswitchDelay}+k1)$.

During T3, the UE shall start to send the ACK for SCell from the first UL slot that occurs after the beginning of DL slot $(j+T_{BWPswitchDelay}+k1)$.

All of the above test requirements shall be fulfilled in order for the observed SCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T1, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS 36.133 [15] clause 7.32.2.7.

During T1, the start of the interruption of PSCell during SCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PSCell during SCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PSCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.6.2.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after slot $(i+T_{BWPswitchDelay}+k1)$, $(j+T_{BWPswitchDelay}+k1)$, then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.5.5.6.2 RRC-based Active BWP Switch

A.5.5.6.2.1 E-UTRAN – NR PSCell FR2 DL active BWP switch with non-DRX in synchronous EN-DC

A.5.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6.3. Supported test configurations are shown in table A.5.5.6.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1) and one PSCell (Cell 2) as given in table A.5.5.6.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of PSCell are specified in table A.5.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on E-UTRA PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2.

Before the test starts,

- UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 2 (PSCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PSCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

If the *RRCReconfiguration* is embedded in E-UTRA RRC message, time period T1 starts when a E-UTRA RRC message *RRCConnectionReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side from PCell in PSCell's slot # denoted *i*. Otherwise, i.e., if the *RRCReconfiguration* is not embedded in E-UTRA RRC message, time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side in from PSCell in PSCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to completely receive PDSCH on PSCell from the first DL slot occurs right after the beginningof PSCell's DL slot i + $\frac{T_{\mathrm{RRCprocessingDelay}}+T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}}$ as defined in clause 8.6.3 and starts to report valid ACK/NACK for the PSCell from the first UL slot that occurs after the beginning of DL slot i +

$\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1. The UE shall be continuously scheduled on PSCell's BWP-1 starting the first DL slot that occurs right after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$.

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in PSCell by counting the time from the time when the RRC Reconfiguration message including updated BWP configurationis sent till the time when a vaild ACK/NACK is received.

Table A.5.5.6.2.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.6.2.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	
PDCCH and PDSCH maximum number of HARQ transmission		1	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to Cell 1	μs	3	Synchronous EN-DC
T1	s	0.2	

Table A.5.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode			TDD
TDD configuration			TDDConf.3.1
$BW_{channel}$			100 MHz: $N_{PRB,c}$ = 66
Active BWP ID			1
Initial DL BWP Configuration			DLBWP.0.2
Initial UL BWP Configuration			ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration		DLBWP.1.3
	Active UL BWP-1 Configuration		ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration		DLBWP.1.1
	Active UL BWP-1 Configuration		ULBWP.1.1
PDSCH Reference measurement channel			SR.3.1 TDD
RMSI CORESET parameters			CR.3.1 TDD
Dedicated CORESET parameters			CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.1 FR2
SMTC Configuration			SMTC.1
TCI State			TCI.State.0
TRS Configuration			TRS.2.1 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			

Parameter	Unit	Cell 2
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.5.5.6.2.1.1-4: OTA related test parameters for BWP switching test case

Parameter		Unit	Cell 2
Angle of arrival configuration			Setup 1 according to table A.3.15
Assumption for UE beams Note 5			Fine
N_{oc} Note1	NR_TDD_FR2_A	dBm/15 kHz	-112
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS	-103
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
SS-RSRP Note2	NR_TDD_FR2_A	dBm/SCS Note3	-85
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
$\hat{E}_s/I_{ot}$		dB	18
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-56
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.6.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PSCell from the first DL slot that occurs right after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for the PSCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.6.3 Simultaneous DCI-based and Timer-based Active BWP Switch on multiple CCs

A.5.5.6.3.1 E-UTRAN – NR PSCell FR2 and NR SCell FR2 DL active BWP switch on multiple CCs in synchronous EN-DC

A.5.5.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch on multiple CCs delay requirement defined in clause 8.6. Supported test configurations are shown in table A.5.5.6.3.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) and one NR SCell (Cell 3) as given in table A.5.5.6.3.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and NR SCell is specified in table A.5.5.6.3.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.5.5.6.3.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) and SCell (Cell 3) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and Cell 3 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC) and Cell 3 (SCell) on radio channel 3 (SCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for PSCell and SCell, BWP-1 and BWP-2, in Cell 2 and Cell 3 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell and SCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell and SCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch and a DCI format 1_1 command for SCell DL BWP switch, sent from the test equipment to the UE simultaneously, are received at the UE side in PSCell and SCell slot # denoted *i*. The UE should switch its bandwidth part from BWP-1 to BWP-2 in PSCell and SCell.
>
> The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{MultipleBWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{MultipleBWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from the beginning of the DL slot right after slot ($i+T_{MultipleBWPswitchDelay}$).

The UE shall be able to receive PDSCH at the beginning of the DL slot right after SCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{MultipleBWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from the beginning of the DL slot right after slot ($i+T_{MultipleBWPswitchDelay}$).

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell (Cell 2) and SCell (Cell 3).

During T3,

The time period T3 starts from the slot #*j*, where j is the beginning slot of the DL subframe immediately after the slot wherein *bwp-InactivityTimer* timer expires in PSCell and SCell. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1 in both PSCell and SCell.

The UE shall be able to receive PDSCH on PSCell at the beginning of the DL slot right after PSCell's DL slot ($j+ T_{MultipleBWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell at latest at the beginning of the DL slot right after slot ($j+ T_{MultipleBWPswitchDelay} +k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after slot ($j+ T_{MultipleBWPswitchDelay}$).

The UE shall be able to receive PDSCH on SCell at the beginning of the DL slot right after SCell's DL slot ($j+ T_{MultipleBWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell at latest at the beginning of the DL slot right after slot ($j+ T_{MultipleBWPswitchDelay} +k1$). The UE shall be continuously scheduled on SCell's BWP-1 starting from the beginning of the DL slot right after slot ($j+ T_{MultipleBWPswitchDelay}$).

The test equipment verifies the DL BWP switch time in PSCell and SCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

Table A.5.5.6.3.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.6.3.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2, 3	Two NR radio channel is used for this test for PSCell and SCell
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
Active SCell		Cell 3	SCell on RF channel number 3.
CP length		Normal	
DRX		OFF	For both PCell, PSCell and SCell
bwp-InactivityTimer	ms	200	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for cells on SCC.
Cell2 timing offset to Cell 1	µs	3	Synchronous EN-DC
Cell3 timing offset to Cell 2	µs	0	Synchronous Cells
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.5.5.6.3.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Cell 2	Cell 3
Frequency Range		FR2	FR2

Parameter	Unit	Cell 2	Cell 3
Duplex mode		TDD	TDD
TDD configuration		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66	100 MHz: $N_{PRB,c}$ = 66
Active BWP ID		1, 2	1, 2
Initial DL BWP Configuration		DLBWP.0.2 Note 2	DLBWP.0.2 Note 2
Active DL BWP-1 Configuration		DLBWP.1.1 Note 2	DLBWP.1.1 Note 2
Active DL BWP-2 Configuration		DLBWP.1.3 Note 2	DLBWP.1.3 Note 2
Initial UL BWP Configuration		ULBWP.0.2 Note 2	ULBWP.0.2 Note 2
Active UL BWP-1 Configuration		ULBWP.1.1 Note 2	ULBWP.1.1 Note 2
Active UL BWP-2 Configuration		ULBWP.1.3 Note 2	ULBWP.1.3 Note 2
PDSCH Reference measurement channel		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD	CCR.3.1 TDD
OCNG Patterns		OP.1	OP.1
SSB Configuration		SSB.1 FR2	SSB.1 FR2
SMTC Configuration		SMTC.1	SMTC.1
TCI State		TCI.State.0	TCI.State.0
TRS Configuration		TRS.2.1 TDD	TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation Condition		AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.5.5.6.3.1.1-4: OTA related test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine	Fine
N_{oc} Note 1	dBm/15 kHz	-112	-112
N_{oc} Note 1	dBm/SCS	-103	-103
SS-RSRP Note 2	dBm/120 kHz Note3	-85	-85
$\hat{E}_s/I_{ot}$	dB	18	18
Io Note2	dBm/95.04 MHz Note4	-56	-56

NOTE 1:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3:	SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4:	Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5:	As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 6:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.6.3.1.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell and SCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{MultipleBWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell and SCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{MultipleBWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* and *bwp-SwitchingMultiCCs-r16* [2], UE shall finish BWP switch within the time duration $T_{MultipleBWPswitchDelay}$ defined in TS 38.133 caluse 8.6.2A and 8.6.2B

All of the above test requirements shall be fulfilled in order for the observed PSCell and SCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after DL slot ($i+Y1$), ($j+Y2$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.5.5.6.4 SCell dormancy switch

A.5.5.6.4.1 E-UTRAN – NR FR2 PSCell SCell dormancy switch of single FR2 SCell inside active time

A.5.5.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify

1) the interruption due to RRM and CSI measurement during SCell dormancy on spCell is within the limits 1) the interruption due to RRM and CSI measurement during SCell dormancy on spCell is within the limits specified in clause 8.2.1.2.15.2 and 8.2.1.2.15.3 for NR victim cell, and

2) the SCell dormancy switch delay is within the requirement defined in clause 8.6.2, and the SCell dormancy switch interruption is within the limits defined in clause 8.2.1.2.15.1 for NR victim cell.

Supported test configurations are shown in table A.5.5.6.4.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and one NR SCell (Cell 3) as given in table A.5.5.6.4.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and SCell are specified in table A.5.5.6.4.1.1-3 below.

The tests consist of three consecutive time periods T1, T2, and T3, respectively. All cells have constant signal levels throughout the test. The UE is continuously scheduled in PCell and PSCell throughout the test

Before the test starts,

- UE is connected to Cell 1 (PCell), Cell 2 (PSCell) and Cell 3 (SCell).
- UE is configured with a single UE-specific downlink bandwidth part, BWP-0, for Cell 2. BWP-0 includes the bandwidth of the initial DL BWP and SSB.

- UE is configured with one non-dormant and one dormant UE-specific downlink bandwidth part, BWP-0 and BWP-1, respectively, for Cell 3. BWP-0 includes the bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP in Cell 3 is BWP-0.
- UE is indicated that firstOutsideActiveTimeBWP-Id that the active DL BWP after when switching from dormant BWP in Cell 3 is BWP-0

T1 starts at the point in time at which the UE receives a DCI with dormancy indication on PDCCH in PSCell at the antenna connector, in a slot # denoted *m*, pertaining to dormancy indication for switching SCell from non-dormancy to dormancy. The UE shall complete switching of the SCells to dormancy by the end of slot *m* + ceil($T_{BWPswitchDelay}$/NR slot length) + 1 in Test1, and slot *m* + ceil($T_{BWPswitchDelay}$/NR slot length) + 2 in Test2, as specified in clause 8.6.2. Any PSCell interruptions due to the switching between non-dormant and dormant BWPs shall fulfill requirements in clause 8.2.1.2.15.1 for NR victim cell. The test equipment verifies that interruptions due to switching from non-dormancy to dormancy are within the requirements by analysing HARQ feedback transmitted in PSCell for PSCell.

During T2, the UE is carrying out CSI and RRM measurements on dormant SCell. Any interruptions due to CSI and RRM measurements shall fulfill requirements in clause 8.2.1.2.15.2 and 8.2.1.2.15.3 for NR victim cell. The test equipment verifies that the interruptions are within the allowed percentages by counting ACK/NACKs in PSCell. At the end of T2, the test equipment transmits a DCI with dormancy indication on PDCCH in PSCell carrying a dormany indication for switching SCell from dormancy to non-dormancy.

T3 starts at the point in time at which the UE receives a DCI with dormancy indication on PDCCH in PSCell at the antenna connector, in a slot # denoted *n*, pertaining to dormancy indication for switching SCell from dormancy to non-dormancy. The UE shall complete switching of the SCell to non-dormancy by the end of slot *n* + ceil($T_{BWPswitchDelay}$/NR slot length) + 1 in Test1, and slot *n* + ceil($T_{BWPswitchDelay}$/NR slot length) + 2 in Test2, as specified in clause 8.6.2. Any PSCell interruptions due to the switching between non-dormant and dormant BWPs shall fulfill requirements in clause 8.2.1.2.15.1 for NR victim cell. The test equipment verifies that interruptions due to switching from dormancy to non-dormancy are within the requirements by analysing HARQ feedback transmitted in PSCell for PSCell. PDCCHs indicating new transmissions shall be sent continuously on SCell from the slot right after *n* + ceil($T_{BWPswitchDelay}$/NR slot length) + 1 in Test1, and slot *n* + ceil($T_{BWPswitchDelay}$/NR slot length) + 2 in Test2. The test equipment verifies the SCell dormancy switch delay by counting the slots from slot n till an ACK/NACK for SCell is received.

There are two subtests in this test. In Subtest 1 the DCI format 1_1 command for SCell dormancy switch is transmitted within the first 3 OFDM symbols in a slot, and in Subtest 2 the DCI format 1_1 command for SCell dormancy switch is transmitted after the first 3 OFDM symbols in a slot. A UE that only supports triggering during within the first three OFDM symbols of a slot shall only undergo Test1, whereas a UE that supports triggering also in remaining OFDM symbols of a slot shall undergo Test1 and Test2.

Table A.5.5.6.4.1.1-1: Dormancy switch supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which fulfils the requirements in test case in clause A.5.5.6.4.2 can skip the test cases in current clause A.5.5.6.4.1. NOTE 3: NR configuration is the same for PSCell and SCells.	

Table A.5.5.6.4.1.1-2: General test parameters for Dormancy switch in synchronous EN-DC

Parameter	Unit	Value		Comment
		Subtest 1	Subtest 2	
E-UTRA RF Channel Number		1		One E-UTRA radio channel is used for this test
NR RF Channel Number		2, 3		Two NR radio channel is used for this test
Active PCell		Cell 1		PCell on RF channel number 1.
Active PSCell		Cell 2		PSCell on RF channel number 2.
Active SCell		Cell 3		SCell on RF channel number 3.
CP length		Normal		
DRX		OFF		
Measurement gap pattern Id		OFF		
bwp-InactivityTimer	ms	500		

Cell-individual offset for cells on RF channel number 1	dB	0		Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0		Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0		Individual offset for cells on SCC.
Cell2 timing offset to Cell 1	µs	3		Synchronous EN-DC
Cell3 timing offset to Cell 2	µs	0		Synchronous cells
Triggering DCI format		DCI 1_1		Triggering DCI format for triggering during active time
OFDM symbol range in slot for transmission of DCI with dormancy indication		0 – 2	3 – 11	Test1 is based on that triggering DCI is received within the first three OFDM symbols of a slot. Test2 is based on that the triggering DCI is received later than within the first three OFDM symbols of a slot.
T1	s	0.2		
T2	s	5		
T3	s	0.2		

Table A.5.5.6.4.1.1-3: NR Cell specific test parameters for Dormancy switch in synchronous EN-DC

Parameter	Unit	Subtest 1		Subtest 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Frequency Range		FR2		FR2	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66		100 MHz: $N_{PRB,c}$ = 66	
Active BWP ID		0	0	0	0
Initial DL BWP Configuration		DLBWP.0.2	DLBWP.0.2	DLBWP.0.2	DLBWP.0.2
Active DL BWP-0 Configuration		DLBWP.1.1	DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
Active DL BWP-1 Configuration		NA	DLBWP.1.2	NA	DLBWP.1.2
Initial UL BWP Configuration		ULBWP.0.2	ULBWP.0.2	ULBWP.0.2	ULBWP.0.2
Active UL BWP-0 Configuration		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
Active UL BWP-1 Configuration		NA	ULBWP.1.2	NA	ULBWP.1.2
PDSCH Reference measurement channel		SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET parameters		CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET parameters		CCR.3.1 TDD		CCR.3.2 TDD	CCR.3.1 TDD
OCNG Patterns		OP.1		OP.1	
SSB Configuration		SSB.1 FR2		SSB.1 FR2	
SMTC Configuration		SMTC.1		SMTC.1	
TCI State		TCI.State.0		TCI.State.0	
TRS Configuration		TRS.2.1 TDD		TRS.2.1 TDD	
CSI-RS for CSI reporting		CSI-RS.3.1 TDD		CSI-RS.3.1 TDD	
CSI reporting periodicity	slots	640		640	
SCell measurement cycle (measCycleSCell)	ms	640		640	
Antenna Configuration		1x2		1x2	
Propagation Condition		AWGN		AWGN	
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					

Parameter	Unit	Subtest 1		Subtest 2	
		Cell 2	Cell 3	Cell 2	Cell 3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3.					

Table A.5.5.6.4.1.1-4: OTA related test parameters for Dormancy switch in synchronous EN-DC

Parameter	Unit	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15	
N_{oc} Note 1	dBm/15 kHz	-112	-112
SS-RSRP Note 2	dBm/120 kHz Note3	-85	-85
$\hat{E}_s/I_{ot}$	dB	18	18
Io Note2	dBm/95.04 MHz Note4	-56	-56
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone			
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.			

A.5.5.6.4.1.2 Test Requirements

During T1, any interruption on PSCell due to dormancy switching of SCell shall be within the requirement specified in in clause 8.2.1.2.15.1 for NR victim cell.

During T2, interruptions on PSCell due to CSI and RRM measurements on dormant SCell shall be within the interruption rate requirements specified in 8.2.1.2.15.1 for NR victim cell.

During T3, any interruption on PSCell due to dormancy switching of SCell shall be within the requirement specified in in clause 8.2.1.2.15.1 for NR victim cell. Monitoring of PDCCH for SCell in PSCell shall be resumed within the dormancy switching time specified in clause 8.6.2A.

For an event to be considered to be correct, all requirements above have to be fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.6.4.2 E-UTRAN – NR FR1 PSCell SCell dormancy switch of two FR2 SCells outside active time

A.5.5.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify the NR SCell dormant BWP switch delay requirement defined in clause 8.6.2A.1, interruption requirements due to the NR SCell dormant BWP switch defined in clause 8.2.1.2.15.1 for NR victim cells and in clause 7.32.2.14.1 of TS 36.133 [15] for E-UTRA victim cell, respectively, and interruption requirements due to CSI and RRM measurements on the NR dormant SCells defined in clauses 8.2.1.2.15.2 and 8.2.1.2.15.3 for NR victim cells and in clause 7.32.2.14.2 of TS 36.133 [15] for E-UTRA victim cell, respectively. Supported test configurations are shown in table A.5.5.6.4.2.1-1.

The general test parameters are given in table A.5.5.6.4.2.1-2, and NR cell specific test parameters are given in table A.5.5.6.4.2.1-3 and table A.5.5.6.4.2.1-4 below. And the E-UTRAN cell specific test parameters can refer to table A.3.7.2.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR FR1 PSCell (Cell 2), and three NR FR2 SCells (Cell 3-5) as given in table A.5.5.6.4.2.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and SCell are specified in table A.5.5.6.4.2.1-3 and table A.5.5.6.4.2.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1), PSCell (Cell 2), and SCell (Cell 5) to ensure that the UE will have ACK/NACK sending except the time before T1 and during T3. PDCCHs indicating new transmissions shall be sent continuously on SCells (Cell 3,4) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on the cells and the time duration of when active BWP of the cell is dormant.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC), and Cell 3-5 (SCells) on radio channels 3-5 (SCCs), respectively.
- UE is configured with 2 different UE-specific downlink BWPs for Cell 3 and Cell 4, BWP-1 and BWP-2. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB. Here, BWP-2 on Cell 3 and Cell 4 is configured as dormant BWP.
- UE is configured with 1 UE-specific downlink BWP the same as initial BWP for Cell 3 and Cell 4.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in Cell 3 and Cell 4.
- UE is configured with DRX.
- UE is configured to monitor PDCCH for DCI format 2_6 from Cell 2 at *ps-Offset* before the start of *onDuration*. *ps-Offset* is selected to correspond to the dormancy switching time specified in clause 8.6.2A.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, T3, and T4, respectively.

During T1,

Time period T1 starts when a DCI format 2_6 command for Cell 3 and Cell 4 DL BWP switch to BWP-2, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot (i+ $T_{MultipleBWPswitchDelay}$+X) as defined in clause 8.6.2A.2. The UE shall be continuously scheduled on the cell starting from the beginning of the DL slot right after slot (i+ $T_{MultipleBWPswitchDelay}$+X).

The UE shall be able to receive PDSCH at the beginning of the DL slot right after SCell(Cell 5)'s DL slot (i+ $T_{MultipleBWPswitchDelay}$+X) as defined in clause 8.6.2A.2. The UE shall be continuously scheduled on the cell starting from the beginning of the DL slot right after slot (i+ $T_{MultipleBWPswitchDelay}$+X).

PCell(Cell 1) interruption due to dormant BWP switch on PSCell shall occur within the dormant BWP switch delay.

SCell(Cell 5) interruption due to dormant BWP switch on SCell(Cell 5) shall occur within the dormant BWP switch delay.

During T2,

Time period T2 starts when dormant BWP switch latency requirement test is completed. The test equipement shall schedule PDSCH every slot.

The UE shall be able to report ACK/NACK corresponding to the scheduled PDSCH to PSCell except for the allowed times as defined in clauses 8.2.1.2.15.2 and 8.2.1.2.15.3.

The UE shall be able to report ACK/NACK corresponding to the scheduled PDSCH to PCell except for the allowed times as defined in clause 7.32.2.14.2 of TS 36.133 [15].

During T3,

Time period T3 starts when interruption due to SSB based RRM measurement and CSI measurement requirements test is completed. Test equipment shall not transmit PDCCH, hence, the UE doesn't monitor PDCCH except DCI format 2_6 based PDCCH.

During T4,

Time period T4 starts when a DCI format 2_6 command for Cell 3 and Cell 4 DL BWP switch to BWP-1, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *j*. The UE shall switch its bandwidth part from BWP-2 to BWP-1.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($j+ T_{MultipleBWPswitchDelay}+X$) as defined in clause 8.6.2A.2. The UE shall be continuously scheduled on the cell starting from the beginning of the DL slot right after slot ($j+ T_{MultipleBWPswitchDelay}+X$).

The UE shall be able to receive PDSCH at the beginning of the DL slot right after all SCell's (Cell 3,4,5) DL slot ($j+ T_{MultipleBWPswitchDelay}+X$) as defined in clause 8.6.2A.2. The UE shall be continuously scheduled on the cells starting from the beginning of the DL slot right after slot ($j+ T_{MultipleBWPswitchDelay}+X$).

PCell(Cell 1) interruption due to dormant BWP switch on PSCell shall occur within the dormant BWP switch delay.

SCell(Cell 5) interruption due to dormant BWP switch on SCell(Cell 5) shall occur within the dormant BWP switch delay.

Table A.5.5.6.4.2.1-1: Supported test configurations for EN-DC DCI 2_6 based Domant BWP Switch on Multiple NR FR2 SCells

Config	Cell 1	Cell 2	Cell 3, Cell 4, Cell 5	DCI 2_6 of Cell 2
1	LTE FDD	15 kHz SSB SCS, FDD	120 kHz SSB SCS, TDD	within 3 OFDM symbols
2	LTE FDD	15 kHz SSB SCS, TDD	120 kHz SSB SCS, TDD	within 3 OFDM symbols
3	LTE FDD	30 kHz SSB SCS, TDD	120 kHz SSB SCS, TDD	within 3 OFDM symbols
4	LTE TDD	15 kHz SSB SCS, FDD	120 kHz SSB SCS, TDD	within 3 OFDM symbols
5	LTE TDD	15 kHz SSB SCS, TDD	120 kHz SSB SCS, TDD	within 3 OFDM symbols
6	LTE TDD	30 kHz SSB SCS, TDD	120 kHz SSB SCS, TDD	within 3 OFDM symbols
7	LTE FDD	15 kHz SSB SCS, FDD	120 kHz SSB SCS, TDD	after 3 OFDM symbols
8	LTE FDD	15 kHz SSB SCS, TDD	120 kHz SSB SCS, TDD	after 3 OFDM symbols
9	LTE FDD	30 kHz SSB SCS, TDD	120 kHz SSB SCS, TDD	after 3 OFDM symbols
10	LTE TDD	15 kHz SSB SCS, FDD	120 kHz SSB SCS, TDD	after 3 OFDM symbols
11	LTE TDD	15 kHz SSB SCS, TDD	120 kHz SSB SCS, TDD	after 3 OFDM symbols
12	LTE TDD	30 kHz SSB SCS, TDD	120 kHz SSB SCS, TDD	after 3 OFDM symbols
NOTE 1: 10 MHz bandwidth for Cell 2 with 15 kHz SSB SCS. NOTE 2: 40 MHz bandwidth for Cell 2 with 30 kHz SSB SCS. NOTE 3: 100 MHz bandwidth for Cell 3,4,5. NOTE 4: The UE is only required to be tested in one of the supported test configurations.				

Table A.5.5.6.4.2.1-2: General test parameters for EN-DC DCI 2_6 based Domant BWP Switch on Multiple NR FR2 SCells

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRAN carrier frequenciy is used.
NR RF Channel Number		2,3,4,5	Four NR radio channels are used for this test. RF channel number 2 is in FR 1 and RF channel numbers 3,4,5 are in a band where intra-band FR2 CA is allowed.
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Active PSCell		Cell 2	Primary SCG cell on NR RF channel number 2.
Configured activated SCell		Cell 3,4,5	Configured activated secondary cell on NR RF channel numbers 3,4,5.
CP length		Normal	
DRX		DRX.3	As specified in clause A.3.3

Parameter	Unit	Value	Comment
ps-Offset		Depending on UE capability	Monitoring of DCI 2_6 ahead of start of drx-onDurationTimer. Value of ps-Offset shall correspond to SCell dormancy switching time for switching of two SCells, as specified in clause 8.6.2A. Actual value depends on reported UE capabilities.
ps-WakeUp		true	Wake up for onDuration in case DCI format 2_6 is not detected.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell2 timing offset to Cell 1	µs	3	
Cell3,4,5 timing offset to Cell 1	µs	3	
Timing offset among Cell 3,4,5	µs	0	
T1	s	0.2	During this time Cell 3,4 switch to dormancy from non-dormancy.
T2	s	10	During this time Cell 3,4 are dormant.
T3	S	0.1	During this time PDCCH is not transmitted from all cells.
T4	s	0.2	During this time Cell 3,4 switch to non-dormancy from dormancy.

Table A.5.5.6.4.2.1-3: Cell specific test parameters for EN-DC DCI 2_6 based Domant BWP Switch on Multiple NR FR2 SCells

Parameter		Unit	Cell 2	Cell 3,4	Cell 5
Frequency range			FR1	FR2	FR2
Duplex mode			FDD	TDD	TDD
TDD configuration	Config 1,4,7,10		NA	TDDConf.3.1	TDDConf.3.1
	Config 2,5, 8,11		TDDConf.1.1	TDDConf.3.1	TDDConf.3.1
	Config 3,6,9,12		TDDConf.2.1	TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	Config 1,2,4,5,7,8,10,11	MHz	10: $N_{PRB,c}$ = 52	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
	Config 3,6,9,12	MHz	40: $N_{PRB,c}$ = 106	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
SSB Configuration	Config 1,2,4,5,7,8,10,11		SSB.1 FR1	SSB.1 FR2	SSB.1 FR2
	Config 3,6,9,12		SSB.2 FR1	SSB.1 FR2	SSB.1 FR2
Downlink initial BWP Configuration			DLBWP.0.2	DLBWP.0.2	DLBWP.0.2
Active (non-dormant) DL BWP-1 Configuration			NA	DLBWP.1.1	NA
Active (dormant) DL BWP-2 Configuration			NA	DLBWP.1.1	NS
Uplink initial BWP Configuration			ULBWP.0.2	ULBWP.0.2	ULBWP.0.2
Active Uplink BWP-1 Configuration			NA	ULBWP.1.1	NA
Active Uplink BWP-2 Configuration			NA	ULBWP.1.1	NA
SMTC Configuration			SMTC.1	SMTC.1	SMTC.1
TRS configuration	Config 1,4,7,10		TRS.1.1 FDD	TRS.2.1 TDD	TRS.2.1 TDD
	Config 2,5, 8,11		TRS.1.1 TDD	TRS.2.1 TDD	TRS.2.1 TDD
	Config 3,6,9,12		TRS.1.2 TDD	TRS.2.1 TDD	TRS.2.1 TDD
TCI state			TCI.State.0	TCI.State.0	TCI.State.0
PDSCH Reference measurement channel	Config 1,4,7,10		SR.1.1 FDD	SR.3.1 TDD	SR.3.1 TDD
	Config 2,5, 8,11		SR.1.1 TDD	SR.3.1 TDD	SR.3.1 TDD
	Config 3,6,9,12		SR.2.1 TDD	SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Parameters	Config 1,4,7,10		CR.1.1 FDD	CR.3.1 TDD	CR.3.1 TDD
	Config 2,5, 8,11		CR.1.1 TDD	CR.3.1 TDD	CR.3.1 TDD
	Config 3,6,9,12		CR.2.1 TDD	CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Parameters for scheduling PDCCH	Config 1,4		CCR.1.1 FDD	CCR.3.1 TDD	CCR.3.1 TDD
	Config 7,10		CCR.1.5 FDD	CCR.3.1 TDD	CCR.3.1 TDD CCR.3.1 TDD

Parameter		Unit	Cell 2	Cell 3,4	Cell 5
	Config 2,5		CCR.1.1 TDD	CCR.3.1 TDD	CCR.3.1 TDD
	Config 8,11		CCR.1.5 TDD	CCR.3.1 TDD	CCR.3.1 TDD
	Config 3,6		CCR.2.1 TDD	CCR.3.1 TDD	CCR.3.1 TDD
	Config 9,12		CCR.2.3 TDD	CCR.3.1 TDD	CCR.3.1 TDD
Dedicated CORESET Parameters for DCI 2_6	Config 1,4		CCR.1.1 FDD	NA	NA
	Config 7,10		CCR.1.5 FDD	NA	NA
	Config 2,5		CCR.1.1 TDD	NA	NA
	Config 8,11		CCR.1.5 TDD	NA	NA
	Config 3,6		CCR.2.1 TDD	NA	NA
	Config 9,12		CCR.2.3 TDD	NA	NA
CSI-RS configuration			NA	CSI-RS.3.1 TDD	NA
OCNG Patterns			OP.1		
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions			N/A Link only, see clause A.3.7A	AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.5.5.6.4.2.1-4: OTA related test parameters for EN-DC DCI 2_6 based Domant BWP Switch on Multiple NR FR2 SCells

Parameter Note 6	Unit	Cell 2	Cell 3,4	Cell 5
Angle of arrival configuration		N/A Link only, see clause A.3.7A	Setup 1 defined in clause A.3.15.1	
Assumption for UE beams Note 7			Fine	Fine
N_{oc} Note1	dBm/15 kHz Note4		-111.7	-111.7
N_{oc} Note1	dBm/SCS Note3		-102.7	-102.7
$\hat{E}_s / N_{oc}$	dB		7	7
SS-RSRP Note2	dBm/SCS Note4		-95.7	-95.7
$\hat{E}_s / I_{ot}$	dB		7	7
Io Note2	dBm/95.04 MHz Note4		-65.9	-65.9
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone				
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone				
NOTE 6: All parameters apply for configuration 1 and 2				
NOTE 7: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.				

A.5.5.6.4.2.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell from the first UL slot that occurs after the beginning of PSCell's DL slot (i+ $T_{MultipleBWPswitchDelay}$+X) as defined in clause 8.6.2A.2.

During T2, the UE shall transmit at least 98.5 % of ACK/NACK on NR PCell.

During T4, the UE shall start to send the ACK for PSCell from the first UL slot that occurs after the beginning of PSCell's DL slot (j+ $T_{MultipleBWPswitchDelay}$+X) as defined in clause 8.6.2A.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T1, the start of the interruption of PCell and SCell (Cell 5) during dormant BWP switch on SCells (Cell 3,4) shall not happen outside the dormant BWP switch delay.

During T1, the start of the interruption of PCell and SCells (Cell 3,4,5) during dormant BWP switch on SCells (Cell 3,4) shall not happen outside the dormant BWP switch delay.

A.5.5.6.5 Simultaneous RRC-based Active BWP Switch on multiple CCs

A.5.5.6.5.1 E-UTRAN – NR PSCell FR2 and NR SCell FR2 DL active BWP switch on multiple CCs with non-DRX in synchronous EN-DC

A.5.5.6.5.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for simultaneous RRC-based BWP switch on multiple CCs defined in clause 8.6.3A. Supported test configurations are shown in table A.5.5.6.5.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1) and one NR PSCell (Cell 2) and one NR SCell (Cell 3) as given in table A.5.5.6.5.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and NR SCell are specified in table A.5.5.6.5.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), to Cell 2 (PSCell) on radio channel 2 (PSCC) and to Cell 3 (SCell) on radio channel 3.
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 2 (PSCell) and Cell 3 (SCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in Cell 2 (PSCell) and Cell 3 (SCell).

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration in Cell 2 and Cell3, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition in Cell 2 and Cell 3.

The UE shall be able to completely receive PDSCH on Cell 2 and Cell 3 at the beginning of the DL slot right after PSCell's DL slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$) as defined in clause 8.6.3A and be ready for the reception of uplink grant for the PSCell no later than at the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$). The UE shall be continuously scheduled on Cell 2's BWP-1and Cell 3's BWP-1 starting from the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$).

$T_{RRCprocessingDelay}$, $T_{BWPswitchDelayRRC}$ and D_{RRC} are defined in clause 8.6.3A.

The test equipment verifies the DL BWP switch time in Cell 2 and Cell 3 by counting the time from the time when the RRC Reconfiguration message including updated BWP configuration is sent till the time when RRC Reconfiguration Complete message is received.

Table A.5.5.6.5.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.6.5.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2, 3	Two NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1
Active PSCell		Cell 2	PSCell on RF channel number 2
Active SCell		Cell 3	SCell on RF channel number 3
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for cells on SCC.
Cell2 timing offset to Cell 1	µs	3	Synchronous EN-DC
Cell3 timing offset to Cell 2	µs	0	Synchronous Cells
T1	s	0.2	

Table A.5.5.6.5.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Frequency Range			FR2	FR2
Duplex mode			TDD	TDD
TDD configuration			TDDConf.3.1	TDDConf.3.1
$BW_{channel}$			100 MHz: $N_{PRB,c}$ = 66	100 MHz: $N_{PRB,c}$ = 66
Active BWP ID			1	1
Initial DL BWP Configuration			DLBWP.0.2	DLBWP.0.2
Initial UL BWP Configuration			ULBWP.0.2	ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration		DLBWP.1.3	DLBWP.1.3
	Active UL BWP-1 Configuration		ULBWP.1.3	ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration		DLBWP.1.1	DLBWP.1.1
	Active UL BWP-1 Configuration		ULBWP.1.1	ULBWP.1.1
PDSCH Reference measurement channel			SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET parameters			CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET parameters			CCR.3.1 TDD	CCR.3.1 TDD
OCNG Patterns			OP.1	OP.1
SSB Configuration			SSB.1 FR2	SSB.1 FR2
SMTC Configuration			SMTC.1	SMTC.1
TCI State			TCI.State.0	TCI.State.0
TRS Configuration			TRS.2.1 TDD	TRS.2.1 TDD
Antenna Configuration			1x2	1x2
Propagation Condition			AWGN	AWGN
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				

EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.5.5.6.5.1.1-4: OTA related test parameters for BWP switching test case

Parameter	Unit	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to table A.3.15	Setup 1 according to table A.3.15
Assumption for UE beams Note 5		Fine	Fine
N_{oc} Note1	dBm/15 kHz	-112	-112
N_{oc} Note1	dBm/SCS	-103	-103
SS-RSRP Note2	dBm/SCS Note3	-85	-85
$\hat{E}_s/I_{ot}$	dB	18	18
Io Note2	dBm/95.04 MHz Note4	-56	-56

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.6.5.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PSCell and SCell in the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$).

All of the above test requirements shall be fulfilled in order for the observed PSCell and SCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.7 PSCell addition and release delay

A.5.5.7.1 Addition and Release Delay of NR PSCell

A.5.5.7.1.1 Test purpose and environment

The purpose of this test is to verify that the NR PSCell addition and release delays under EN-DC are within the requirements stated in clause 7.31.2 of TS 36.133 [15] for the case when the PSCell is unknown by the UE at the time of addition.

Supported test configurations are shown in A.5.5.7.1.1-1. The test parameters for the E-UTRA cell are given in table A.3.7.2.2-1. The E-UTRA cell once set up is not changed across time.

The test parameters for NR cell are given in tables A.5.5.7.1.1-2, cell-specific parameters in A.5.5.7.1.1-3 and OTA parameters in A.5.5.7.1.1-4 below. The test consists of four successive time periods with duration of T1, T2, T3 and T4. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell 1 is known to the UE.

The test system shall send a RRC message to the UE to add PSCell (Cell 2) on radio channel 2. The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added. The RRC message to add PSCell shall be sent to the UE during period T1. The point in time at which the RRC message to add PSCell (Cell2) is received at the UE antenna connector defines the start of period T2.

The test system shall observe the periodic reporting of CSI for PSCell during T3. The point in time at which the UE has sent PRACH to the PSCell (Cell 2) defines the start of period T3.

The test system shall send a RRC message to the UE to release PSCell (Cell 2) on radio channel 2. The RRC message to release PSCell (Cell2) shall be sent to the UE during period T3, after the UE has sent at least one CQI report with non-zero CQI index for PSCell (Cell 2). The point in time at which the RRC message to release PSCell (Cell2) is received at the UE antenna connector defines the start of period T4.

Table A.5.5.7.1.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
2	LTE TDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.7.1.1-2: General Test Parameters for PSCell Addition and Release

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell
Initial Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell2	Neighbour cell on RF channel number 2.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour Cell		Cell2	PSCell released on RF channel number 2.
B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	Threshold RSRP	dBm	-118	Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin.
	Time to Trigger	s	0	

DRX		OFF	Continuous monitoring of primary cell
PRACH configuration on Cell 2		FR2 configuration 2	Captured in A.3.8.3.2
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on carrier frequency of Cell 2.
T1	s	1	During this time the PCell shall be known and Cell 2 shall be unknown.
T2	s	1	During this time the UE adds the PSCell.
T3	s	1	During this time the UE sends CSI reports for PSCell.
T4	s	1	During this time the UE releases the PSCell.

Table A.5.5.7.1.1-3: Cell Specific Parameters for PSCell Addition and Release

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
E-UTRA Channel Number		1,2	1			
NR Channel Number		1,2	2			
Duplex Mode		1,2	TDD			
TDD configuration		1,2	TDDConf.3.1			
$BW_{channel}$	MHz	1,2	100: NRB,c = 66			
Data PRBs allocated		1,2	48			
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1			
TRS Configuration		1	TRS.2.1 TDD			
PDSCH/PDCCH TCI state		1	TCI.State.2			
PDSCH Reference measurement channel		1,2	SR.3.3 TDD			
RMSI CORESET Reference Channel		1,2	CR.3.2 TDD			
Dedicated CORESET Reference Channel		1,2	CCR.3.7 TDD			
OCNG Patterns		1,2	OP.3			
SSB configuration		1,2	SSB.2 FR2			
SMTC configuration		1,2	SMTC.2			
PDSCH/PDCCH subcarrier spacing	kHz	1,2	120			
TRS Configuration		1,2	TRS.2.1 TDD			
CSI-RS configuration for CSI reporting		1,2	CSI-RS.3.1 TDD			
reportConfigType		1,2	periodic			
reportQuantity		1,2	cri-RI-PMI-CQI			
CSI reporting periodicity	slot	1,2	40			
CSI reporting offset	slot	1,2	4			
EPRE ratio of PSS to SSS	dB	1,2	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
Propagation condition		1,2	No external noise (Note 1)			
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40]						

Table A.5.5.7.1.1-4: OTA related test parameters

Parameter	Unit	Cell 2			
		T1	T2	T3	T4
Angle of arrival configuration		Setup 2a according to clause A.3.15.2.1			
Assumption for UE beams[Note 6]		Rough			
$\hat{E}_s / N_{oc}$ Ês [Note2]	dBm/SCS	-∞	-81		

Parameter	Unit	Cell 2			
		T1	T2	T3	T4
SSB_RP Note2, Note 4	dBm/SCS	-∞	-81		
$\hat{E}_s/I_{ot}$ BB Note 2, Note 7	dB	-∞	4.88		
Io Note 2, Note 4	dBm/95.04 MHz	N/A	-56.41		

NOTE 1: Void
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.5.5.7.1.2 Test Requirements

The UE shall transmit the PRACH to PSCell at latest 582 ms Note1 into T2.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T3.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T3

The UE shall stop sending CSI reports for PSCell in at latest 20 ms into T4.

All the above test requirements shall be fulfilled for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90 %.

NOTE 1: The PSCell addition delay can be expressed as follows as specified in clause 7.31.2 of TS 36.133 [15]:

$$T_{config_PSCell} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell_DU} + 2 \text{ ms}$$

Where:

T_{RRC_delay} = 20 ms

$T_{processing}$ = 40 ms

T_{search} = 8*3*20 = 480 ms

T_{Δ} = 20 ms

T_{PSCell_DU} = 1*10+10 = 20 ms

A.5.5.8 Active TCI state switch delay

A.5.5.8.1 MAC-CE based active TCI state switch

A.5.5.8.1.1 E-UTRAN – NR PSCell FR2 active TCI state switch for a known TCI state

A.5.5.8.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10.3. Supported test configurations are shown in table A.5.5.8.1.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in table A.5.5.8.1.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in table A.5.5.8.1.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.5.5.8.1.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 2 different TCI states for PSCell, PDCCH TCI state 0 (QCL'd to SSB0) and TCIstate 1 (QCL'd to SSB1), in Cell 2 before starting the test.
- UE is indicated in TCI state 0 as the active PDCCH TCI state

The test consists of two time periods, T1 and T2. Figure A.5.5.8.1.1.1-1 and Figure A.5.5.8.1.1.1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which PDCCH-TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies that UE can be scheduled on PSCell on TCI state 0 till slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$. The test equipment also verifies the TCI state switch time in PSCell by scheduling the UE on TCI state 1 after slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$ + ($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$)/*NR slot length* .

Table A.5.5.8.1.1.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.8.1.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to Cell 1	µs	3	Synchronous EN-DC
T1	s	0.2	
T2	s	0.2	

Table A.5.5.8.1.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD

Parameter	Unit	Cell 2
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TCI.State.2
TCI State 1		TCI.State.3
TRS Configuration		TRS.2.1 TDD TRS.2.2 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		No external noise (Note 2)
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].		

Table A.5.5.8.1.1.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 2			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
$\hat{E}_S$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	- Infinity	-80.6
$\hat{E}_s/I_{oc}$ BB Note 7	dB	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-55.41	-55.41	- Infinity	-55.41
NOTE 1: Void NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone. NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					

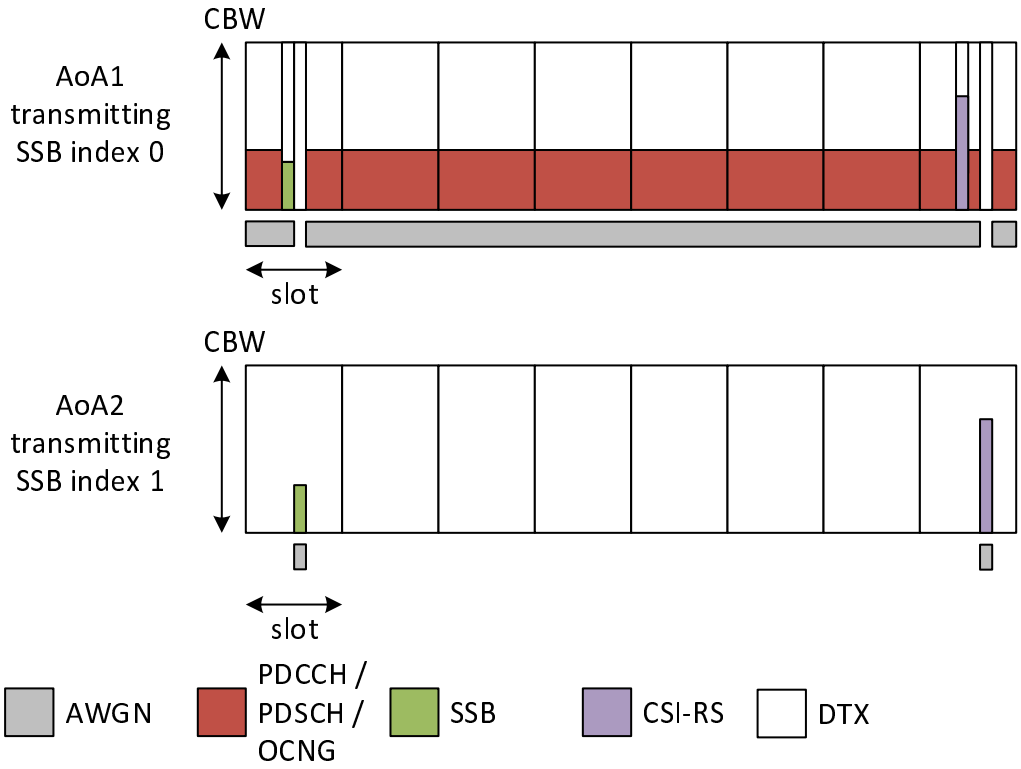


Figure A.5.5.8.1.1.1-1: Time multiplexed downlink transmissions during T1

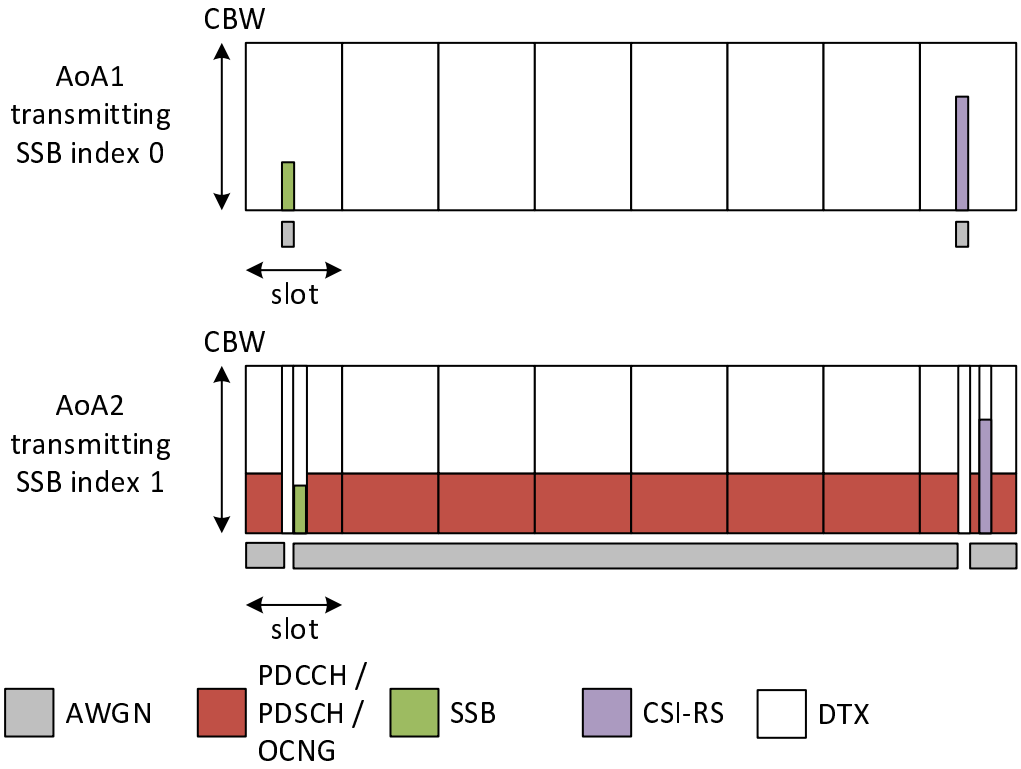


Figure A.5.5.8.1.1.1-2: Time multiplexed downlink transmissions during T2

A.5.5.8.1.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on TCI state 0 till slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$
- be able to start receiving on TCI state 1 after slot n+ T_{HARQ} +5$N_{slot}^{subframe,\mu}$ + $T_{first\text{-}SSB}$/*NR slot length*

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.8.2 RRC based active TCI state switch

A.5.5.8.2.1 E-UTRAN – NR PSCell FR2 active TCI state switch for a known TCI state

A.5.5.8.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10.3Supported test configurations are shown in table A.5.5.8.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in table A.5.5.8.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in table A.5.5.8.2.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.5.5.8.2.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 1 TCI state for PSCell, PDCCH-TCI-state0 (QCL'd to SSB0)
- UE is indicated in TCI state0 as the active TCI state

The test consists of two time periods, T1 and T2. Figure A.5.5.8.2.1.1-1 and Figure A.5.5.8.2.1.1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI-state1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a RRC command indicating a switch to TCI-state1.

The test equipment verifies the TCI state switch time in PSCell by scheduling the UE on TCI state 1 after slot n+ ($T_{RRC_processing}$ + $T_{first\text{-}SSB}$)/*NR slot length* + 2$N_{slot}^{subframe,\mu}$.

Table A.5.5.8.2.1.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.8.2.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.

Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to Cell 1	µs	3	Synchronous EN-DC
T1	s	0.2	
T2	s	0.2	

Table A.5.5.8.2.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TC. State.2
TCI State 1		TCI.State.3
TRS Configuration		TRS.2.1 TDD TRS.2.2 TDD
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
Number of reported RS		2
L1-RSRP reporting period	slot	640
timeRestrictionForChannelMeasurements		configured
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		No external noise (Note 2)
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].		

Table A.5.5.8.2.1.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 2			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams[Note 6]		Rough		Rough	
$\hat{E}_s$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SSB_RP [Note 2]	dBm/ SCS	-80.6	-80.6	- Infinity	-80.6
Io[Note2]	dBm/95.04 MHz [Note4]	-55.41	-55.41	- Infinity	-55.41

NOTE 1: Void
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

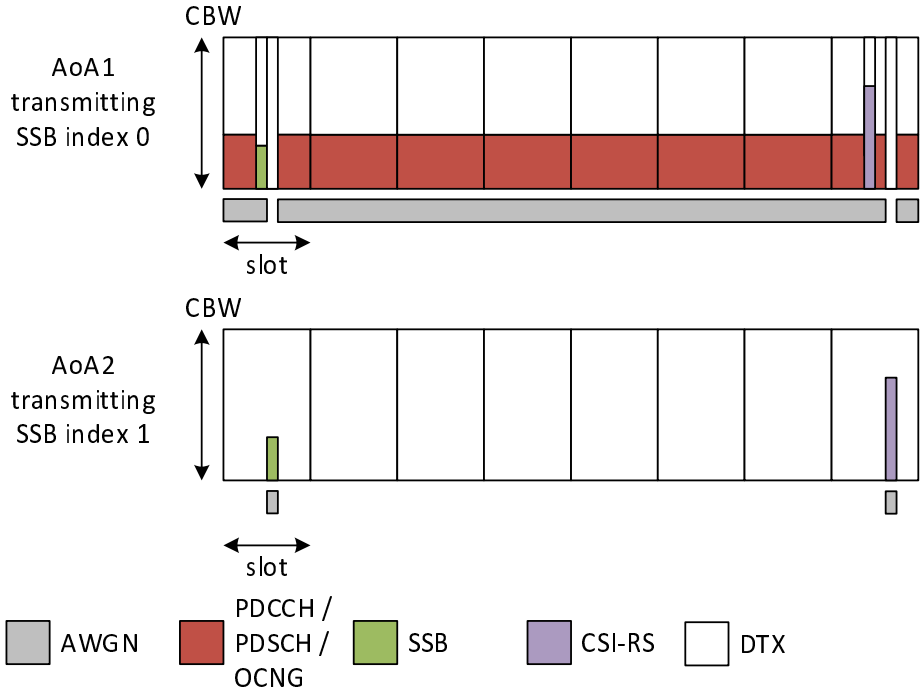


Figure A.5.5.8.2.1.1-1: Time multiplexed downlink transmissions during T1

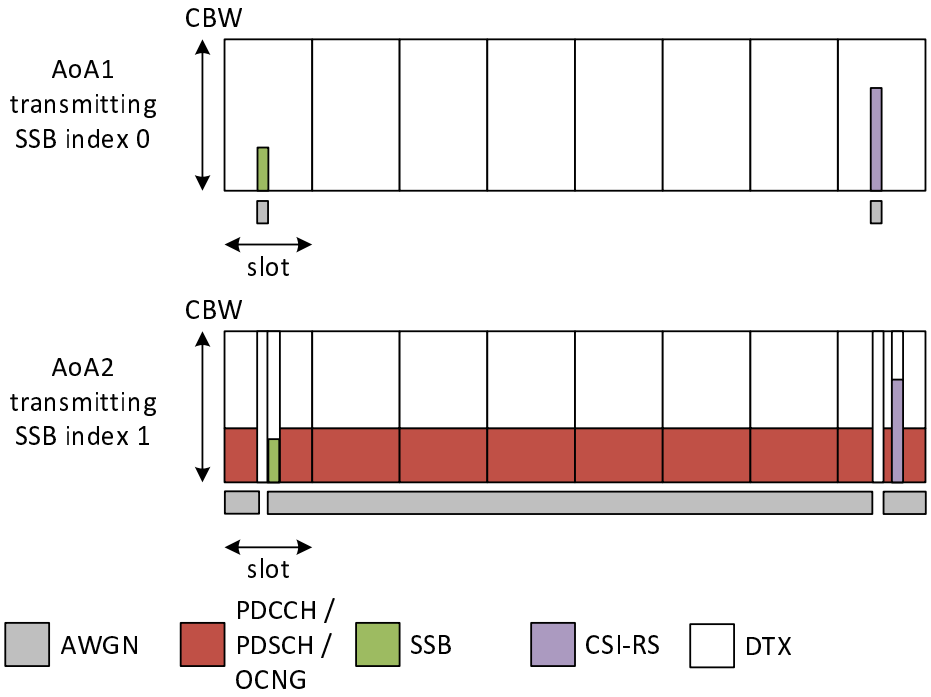


Figure A.5.5.8.2.1.1-2: Time multiplexed downlink transmissions during T2

A.5.5.8.2.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with both SSB0 and SSB1.

After receiving RRC command in slot n, UE shall be able to start receiving on TCI state 1 after slot n+ ($T_{RRC_processing}$ + $T_{first\text{-}SSB}$)/*NR slot length* + $2N_{slot}^{subframe,\mu}$.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.9 Uplink spatial relation switch delay

A.5.5.9.1 MAC-CE based uplink spatial relation switch

A.5.5.9.1.1 E-UTRAN – NR PSCell FR2 uplink spatial relation switch for a known spatial relation

A.5.5.9.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the uplink spatial relation switch delay requirement defined in clause 8.12.3 by a UE capable of beam correspondence without the need for UL beam sweeping. Supported test configurations are shown in table A.5.5.9.1.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in table A.5.5.9.1.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in table A.5.5.9.1.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.5.5.9.1.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have continuous ACK/NACK sending by PUCCH.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).

- UE is configured with 2 different spatial relations for PSCell, PUCCH spatial relation 0 (QCL'd to SSB0) and spatial relation 1 (QCL'd to SSB1), in Cell 2 before starting the test.

- UE is indicated in spatial relation 0 as the active PUCCH spatial relation

The test consists of two time periods, T1 and T2. During T1 only SSB to which PUCCH spatial relation 0 QCLed is transmitted. At the beginning of T2, the SSB corresponding to spatial relation 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a MAC-CE command indicating a switch to transmit PUCCH with spatial relation 1.

The test equipment verifies that UE can be scheduled on PSCell on spatial relation 0 till n + T_{HARQ}/NR slot length + $3N_{slot}^{subframe,\mu}$. The test equipment also verifies the spatial relation switch time in PSCell by scheduling the UE on spatial relation 1 from slot n + T_{HARQ}/NR slot length + $3N_{slot}^{subframe,\mu}$ + 1 and onwards.

Table A.5.5.9.1.1.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.9.1.1.1-2: General test parameters for spatial relation switch

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to Cell 1	μs	3	Synchronous EN-DC
L1-RSRP reporting period	slot	160	Periodic L1-RSRP reporting configured
L1-RSRP measured RS		SSB0, SSB1	L1-RSRP measurements of SSB0 and SSB1.
Number of reported RS		2	L1-RSRP reporting of measurements on SSB0 and SSB1.
T1	s	0.2	
T2	s	2	

Table A.5.5.9.1.1.1-3: NR Cell specific test parameters for spatial relation switch

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1

Spatial Relation 0		PUCCH. SRI.0
Spatial Relation 1		PUCCH. SRI.1
TRS Configuration		TRS.2.1 TDD
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
timeRestrictionForChannelMeasurements		configured
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS (Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.5.5.9.1.1.1-4: OTA related test parameters for uplink spatial relation switch

Parameter	Unit	Cell 2			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
Noc Note 1	dBm/15 kHz	-92.1			
Noc Note 1	dBm/SCS	-83.1			
Ês/Noc	dB	1	1	-Infinity	1
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1	-82.1	-Infinity	-82.1
Io Note2,Note6	dBm/95.04 MHz Note4	-50.6	-50.6	-54.1	-50.6
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone. NOTE 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.					

A.5.5.9.1.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with results for SSB1.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to transmit PUCCH on spatial relation 0 till $n + T_{HARQ}$/NR slot length + $3N_{slot}^{subframe,\mu}$;
- be able to start transmitting PUCCH on spatial relation 1 from slot $n + T_{HARQ}$/NR slot length + $3N_{slot}^{subframe,\mu} + 1$.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.9.2 RRC based spatial relation switch

A.5.5.9.2.1 E-UTRAN – NR PSCell FR2 spatial relation switch associated with a known DL-RS

A.5.5.9.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the RRC based spatial relation switch delay requirement defined in clause 8.12.5 by a UE capable of beam correspondence without the need for UL beam sweeping. Supported test configurations are shown in table A.5.5.9.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in table A.5.5.9.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in table A.5.5.9.2.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.5.5.9.2.1.1-4.

Periodic SRS is transmitted on NR PSCell (Cell2), and the SRS configuration is SRSConf.1 given in table A.5.4.1.1.1-3.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 1 SRS-SpatialRelation0 associated with SSB0.
- UE is indicated SRS-SpatialRelation0 as the active SRS spatial relation.

The test consists of two time periods, T1 and T2. During T1 only SSB0 to which SRS-SpatialRelation0 associated is transmitted. UE shall transmit periodic SRS with SRS-SpatialRelation0 of PSCell. At the beginning of T2, the SSB1 corresponding to SRS-SpatialRelation1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a RRC command indicating a switch to transmit periodic SRS with target SRS-SpatialRelation1. The test equipment verifies that UE shall be able to transmit periodic SRS with target spatial relation (SRS-SpatialRelation1) on PSCell in the slot n + $T_{RRC_processing}$/NR slot length + 1.

Table A.5.5.9.2.1.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.5.5.9.2.1.1-2: General test parameters for spatial relation switch associated with a known DL-RS

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
T1	s	0.2	
T2	s	2	

Table A.5.5.9.2.1.1-3: NR Cell specific test parameters for spatial relation switch associated with a known DL-RS

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1

Parameter	Unit	Cell 2
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
SRS-SpatialRelation0		SRS.SRI0
SRS-SpatialRelation1		SRS.SRI1
TRS Configuration		TRS.2.1 TDD
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
Number of reported RS		2
L1-RSRP reporting period	slot	160
timeRestrictionForChannelMeasurements		configured
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS (Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.5.5.9.2.1.1-4: OTA related test parameters for spatial relation switch associated with a known DL-RS

Parameter	Unit	Cell 2			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough		Rough	
N_{oc} Note 1	dBm/15 kHz	-92.1			
N_{oc} Note 1	dBm/SCS	-83.1			
$\hat{E}_s/N_{oc}$	dB	1	1	-Infinity	1
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1	-82.1	-Infinity	-82.1
Io Note2,Note6	dBm/95.04 MHz Note4	-50.6	-50.6	-54.1	-50.6

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.9.2.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with SSB1 to which SRS-SpatialRelation1 is associated.

After receiving RRC command in slot n, UE shall be able to transmit target periodic SRS with SRS-SpatialRelation1 on PSCell in the slot $n + T_{RRC_processing}/NR\ slot\ length + 1$.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.10 UE specific CBW change

A.5.5.10.1 UE specific CBW change on FR2 NR PSCell

A.5.5.10.1.1 Test Purpose and Environment

The purpose of this test is to verify the UE specific CBW change delay requirement defined in clause 8.13. Supported test configurations are shown in table A.5.5.10.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1) and one NR PSCell (Cell 2) as given in table A.5.5.10.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell are specified in table A.5.5.10.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 2 (PSCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PSCell.
- UE is indicated in *SCS-SpecificCarrier* that the active CBW is CBW-1 of initial condition in PSCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* which reconfigure the UE specific CBW parameter, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall reconfigure its UE specific CBW with the updated UE specific CBW of final condition.

The UE shall be able to completely receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$) as defined in clause 8.13 and be ready for the reception of uplink grant for the PSCell no later than at the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$). The UE shall be continuously scheduled on PSCell's BWP-1 on CBW-2 starting from the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$).

$T_{RRCprocessingDelay}$ and $T_{CBWchangeDelayRRC}$ are defined in clause 8.13.

The test equipment verifies the UE specific CBW change switch time in PSCell by counting the time from the time when the RRC Reconfiguration message including updated UE specific CBW configuration is sent till the time when RRC Reconfiguration Complete message is received.

Table A.5.5.10.1.1-1: UE specific CBW change supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.10.1.1-2: General test parameters for UE specific CBW change in synchronous EN-DC

Parameter	Unit	Value	Comment

E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to Cell 1	μs	3	Synchronous EN-DC
T1	s	0.2	

Table A.5.5.10.1.1-3: NR Cell specific test parameters for UE specific CBW change in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode			TDD
TDD configuration			TDDConf.3.1
$BW_{channel}$			100 MHz: $N_{PRB,c}$ = 66
Active BWP ID			1
Initial DL BWP Configuration			DLBWP.0.2
Initial UL BWP Configuration			ULBWP.0.2
Active DL BWP Configuration			DLBWP.1.3
Active UL BWP Configuration			DLBWP.1.3
Initial Condition	Active DL CBW-1 Configuration		DLCBW.1.1
	Active UL CBW-1 Configuration		ULCBW.1.1
Final Condition	Active DL CBW-1 Configuration		DLCBW.1.2
	Active UL CBW-1 Configuration		ULCBW.1.2
PDSCH Reference measurement channel			SR.3.1 TDD
RMSI CORESET parameters			CR.3.1 TDD
Dedicated CORESET parameters			CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.1 FR2
SMTC Configuration			SMTC.1
TCI State			TCI.State.0
TRS Configuration			TRS.2.1 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.5.5.10.1.1-4: OTA related test parameters for UE specific CBW change test case

Parameter		Unit	Cell 2
Angle of arrival configuration			Setup 1 according to table A.3.15
Assumption for UE beams Note 5			Fine
N_{oc} Note1	NR_TDD_FR2_A	dBm/15 kHz	-112
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS	-103
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
SS-RSRP Note2	NR_TDD_FR2_A	dBm/SCS Note3	-85
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
$\hat{E}_s/I_{ot}$		dB	18
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-56
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.10.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PSCell in the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$).

All of the above test requirements shall be fulfilled in order for the observed PSCell UE specific CBW change switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.11 Unified TCI state switch delay

A.5.5.11.1 MAC-CE based active joint TCI state switch

A.5.5.11.1.1 E-UTRAN – NR PSCell FR2 active joint TCI state switch for a known TCI state

A.5.5.11.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the MAC-CE based joint TCI state switch delay requirement defined in clause 8.15.3 and 8.16.3 by a UE capable of beam correspondence without the need for UL beam sweeping. Supported test configuration is shown in table A.5.5.11.1.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in table A.5.5.11.1.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.2-1 and cell-specific parameters of NR PSCell is specified in table A.5.5.11.1.1.2-1 below. The OTA related test parameters for FR2 are shown in table A.5.5.11.1.1.2-2.

PDCCHs indicating new transmissions shall be sent continuously on PSCell to ensure that the UE would have ACK/NACK sending.

Table A.5.5.11.1.1.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.11.1.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
E-UTRA RF Channel No.		Channel 1	One E-UTRA radio channel is used for this test
NR RF Channel No.		Channel 2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to Cell 1	μs	3	Synchronous EN-DC
L1-RSRP reporting period		160	Periodic L1-RSRP reporting configured
L1-RSRP measured RS		SSB0, SSB1	L1-RSRP measurements of SSB0 and SSB1.
Number of RS for L1-RSRP reporting		2	L1-RSRP reporting of measurements on SSB0 and SSB1.
T1	s	0.2	
T2	s	2	

A.5.5.11.1.1.2 Test parameters

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is provided with *dl-OrJoint-TCIStateList-r17* and UE's higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *joint.*
- UE is configured with 2 different DLorJoint States for PSCell, Joint TCI state 0 (QCL'd to SSB0) and Joint TCI state 1 (QCL'd to SSB1) before starting the test,

- UE is indicated in Joint TCI state 0 as the active joint TCI state.

The test consists of two time periods, T1 and T2. Figure A.5.5.11.3.1.1-1 and Figure A.5.5.11.3.1.1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB0 to which Joint TCI state 0 is QCL'd is transmitted. At the beginning of T2, the SSB1 corresponding to Joint TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a MAC-CE command indicating a switch to Joint TCI state 1.The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The test equipment verifies that UE shall be able to receive and transmit with Joint TCI state 0 until slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$, and shall be able to receive and transmit with Joint TCI state 1 from slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$ + ($T_{first_target\text{-}PL\text{-}RS}$ + 4*$T_{target_PL\text{-}RS}$ + 2 ms) / *NR slot length*.

Table A.5.5.11.1.1.2-1: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
Joint TCI State 0		DLorJoint TCI.State.2
Joint TCI State 1		DLorJoint TCI.State.3
TRS Configuration		TRS.2.1 TDD for DLorJoint TCI.State.2 TRS 2.2 TDD for DLorJoint TCI.State.3
Pathloss RS Configuration		Resource #4 in TRS.2.1 TDD for DLorJoint TCI.State.2 and for DLorJoint TCI.State.3
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.5.5.11.1.1.2-2: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 2			
		SSB#0		SSB#1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough for SSB reception			
N_{oc} Note 1	dBm/15 kHz	-92.1			
N_{oc} Note 1	dBm/SCS	-83.1			
Ês/Noc	dB	1	1	-Infinity	1

Parameter	Unit	Cell 2			
		SSB#0		SSB#1	
		T1	T2	T1	T2
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1	-82.1	-Infinity	-82.1
Io Note2,Note6	dBm/95.04 MHz Note4	-55.0	-55.0	-58.5	-55.0
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone. NOTE 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.					

A.5.5.11.1.1.3 Test Requirements

The test verifies that UE can be scheduled by PSCell on Joint TCI state 0 and Joint TCI state 1.

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall:

- be able to receive and transmit with Joint TCI state 0 until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$
- be able to start receiving and transmitting with Joint TCI state 1 after slot n+ T_{HARQ} +$3N_{slot}^{subframe,\mu}$ + ($T_{first_target\text{-}PL\text{-}RS}$ + 4*$T_{target_PL\text{-}RS}$ + 2 ms) / *NR slot length*

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.11.2 MAC-CE based active uplink TCI state switch

A.5.5.11.2.1 E-UTRAN – NR PSCell FR2 active uplink TCI state switch for a known TCI state

A.5.5.11.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the MAC-CE based uplink TCI state switch delay requirement defined in clause 8.16.3 by a UE capable of beam correspondence without the need for UL beam sweeping. Supported test configurations are shown in table A.5.5.11.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in table A.5.5.11.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.2-1 and cell-specific parameters of NR PSCell is specified in table A.5.5.11.2.1.2-1 below. The OTA related test parameters for FR2 is shown in table A.5.5.11.2.1.2-2.

Table A.5.5.11.2.1.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.11.2.1.1-2: General test parameters for spatial relation switch

Parameter	Unit	Value	Comment
E-UTRA RF Channel No.		Channel 1	One E-UTRA radio channel is used for this test
NR RF Channel No.		Channel 2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	

DRX		OFF	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to Cell 1	µs	3	Synchronous EN-DC
L1-RSRP reporting period	slot	160	Periodic L1-RSRP reporting configured
L1-RSRP measured RS		SSB0, SSB1	L1-RSRP measurements of SSB0 and SSB1.
Number of reported RS		2	L1-RSRP reporting of measurements on SSB0 and SSB1.
T1	s	0.2	
T2	s	2	

A.5.5.11.2.1.2 Test parameters

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC);
- PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have continuous ACK/NACK sending by PUCCH;
- UE is provided with *TCI-UL-State-r17* and UE's higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *separate*;
- UE is configured with 2 different uplink TCI states for PSCell, uplink TCI state 0 (associated with SSB0) and uplink TCI state 1 (associated with SSB1), by using RRC signalling *ul-TCI-StateList-r17* in IE *BWP-UplinkDedicated*, in Cell 2 before starting the test;
- UE is indicated uplink TCI state 0 as the active uplink TCI state.

The test consists of two time periods, T1 and T2. During T1 only SSB#0 with which uplink TCI state 0 is associated is transmitted. At the beginning of T2, the SSB#1 corresponding to uplink TCI state 1 starts transmitting. After the beginning of T2, in slot *n* which is within 1280 ms of UE providing L1-RSRP report with results for both SSB#0 and SSB#1, UE receives a MAC-CE command indicating a switch to transmit PUCCH with uplink TCI state 1. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

Index of CSI-RS#1 is configured for UE as *PUSCH-PathlossReferenceRS-Id-r17* which is indicated in *TCI-UL-State-r17* of uplink TCI state 1. CSI-RS#1 is QCLed typeD with SSB#1. UE does not maintain CSI-RS#1 as pathloss RS before the uplink TCI state switching.

Table A.5.5.11.2.1.2-1: NR Cell specific test parameters for uplink TCI state switch

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
DL TCI State		DLorJoint TCI.State.0
PL-RS Configuration (CSI-RS#1)		Resource #4 in TRS.2.1 TDD for UL TCI.State.2 Resource #4 in TRS.2.2 TDD for UL TCI.State.3
Uplink TCI State 0		UL TCI.State.2

Parameter	Unit	Cell 2
Uplink TCI State 1		UL TCI.State.3
TRS Configuration		TRS.2.1 TDD
reportQuantity for SSB		ssb-Index-RSRP-Index-r17
reportConfigType for SSB		periodic
reportQuantity for CSI-RS		cri-RSRP-Index-r17
reportConfigType for CSI-RS		periodic
timeRestrictionForChannelMeasurements		configured
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS (Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.5.5.11.2.1.2-2: OTA related test parameters for uplink spatial relation switch

Parameter	Unit	Cell 2			
		SSB#0		SSB#1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough for SSB reception			
Noc Note 1	dBm/15 kHz	-92.1			
Noc Note 1	dBm/SCS	-83.1			
Ês/Noc	dB	1	1	-Infinity	1
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1	-82.1	-Infinity	-82.1
Io Note2,Note6	dBm/95.04 MHz Note4	-55.0	-55.0	-58.5	-55.0
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone. NOTE 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.					

A.5.5.11.2.1.3 Test Requirements

The test verifies that UE can be scheduled by PSCell on uplink TCI state 0 and uplink TCI state 1. The test also verifies the active uplink TCI state switch time in PSCell meeting the requirement defined in 8.16.3. Specifically,

During T2, UE shall send L1-RSRP report with results for SSB#0 and SSB#1 before sending MAC-CE command.

After receiving MAC-CE command in slot *n* in T2, UE shall:

- be able to continue to transmit PUCCH on uplink TCI state 0 till slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu}$;
- be able to start transmitting PUCCH on uplink TCI state 1 from slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{first_target\text{-}PL\text{-}RS} + 4*T_{target_PL\text{-}RS} + 2$ ms) / *NR slot length* and onwards.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.11.3 MAC-CE based active downlink TCI state switch

A.5.5.11.3.1 E-UTRAN – NR PSCell FR2 downlink TCI state switch to cell with additional PCI for a known TCI state

A.5.5.11.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the active DL TCI state switch delay requirement for unified TCI defined in clause 8.15.3. Supported test configurations are shown in table A.5.5.X.3.1.1-1.

Table A.5.5.11.3.1.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

A.5.5.11.3.1.2 Test Parameters

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2), and one NR cell with additional PCI different from from serving cell (Cell 3) configured for intercell L1-RSRP measurement and report as given in table A.5.5.11.3.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and cell with additional PCI are specified in table A.5.5.11.3.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.5.5.11.3.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) and cell with additional PCI (Cell 3) to ensure that the UE would have ACK/NACK transmission.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC), Cell 3 (Cell with additional PCI) in radio channel 3.
- UE is provided with *dl-OrJoint-TCIStateList-r17* and UE's higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *seperate*;
- UE is configured with L1-RSRP measurements on cell with additional PCI (Cell 3)
- UE is configured with 2 different TCI states for PSCell, PDCCH TCI state 0 (QCL'd to TRS resource set 1, TCI state of which is QCLed to SSB0 of Cell2) and TCI state 1 (QCL'd to TRS resource set 3, TCI state of which is QCLed to SSB1 of Cell3), in Cell 2 before starting the test.
- UE is indicated in TCI state 0 as the active PDCCH TCI state

The test consists of two time periods, T1 and T2. Figure A.5.5.11.3.1.1-1 and Figure A.5.5.11.3.1.1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which PDCCH-TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 of Cell 2 and SSB1 of Cell 3, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies that UE can be scheduled on PSCell on TCI state 0 till slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$. The test equipment also verifies the TCI state switch time in to cell with additional PCI by scheduling the UE on TCI state 1 after slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$ + ($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) /*NR slot length* .

Table A.5.5.11.3.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test

NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
Cell with addiitonal PCI		Cell 3	Cell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to Cell 1	μs	3	Synchronous EN-DC
Cell3 timing offset to Cell 2	μs	0	
T1	s	0.2	
T2	s	2	

Table A.5.5.11.3.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
DL TCI State 0		DLorJoint TCI.State.0
DL TCI State 1		DLorJoint TCI.State.1
UL TCI State 0		UL TCI.State.0
UL TCI State 1		UL TCI.State.1
Pathloss RS Configuration		Resource #4 in TRS.2.1 TDD
TRS Configuration		TRS.2.1 TDD for DLorJoint TCI.State.0 TRS.2.2 TDD for DLorJoint TCI.State.1
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		No external noise (Note 2)
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38]		

Table A.5.5.11.3.1.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 2		Cell 3	
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival		Setup 3 according to clause A.3.15.3			

Parameter	Unit	Cell 2		Cell 3	
		SSB0		SSB1	
		T1	T2	T1	T2
configuration		AoA1		AoA2	
$\hat{E}_s$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	- Infinity	-80.6
$\hat{E}_s / I_{ot}$ BB Note 7	dB	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-56.0	-56.0	- Infinity	-56.0

NOTE 1: Void
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

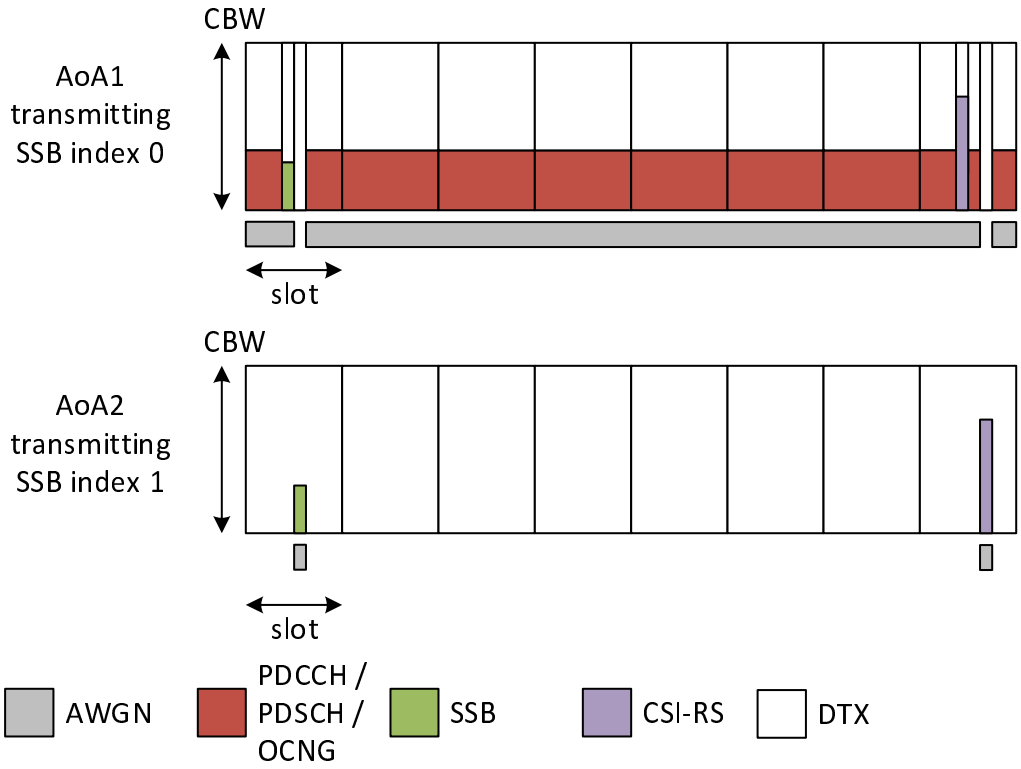


Figure A.5.5.11.3.1.1-1: Time multiplexed downlink transmissions during T1

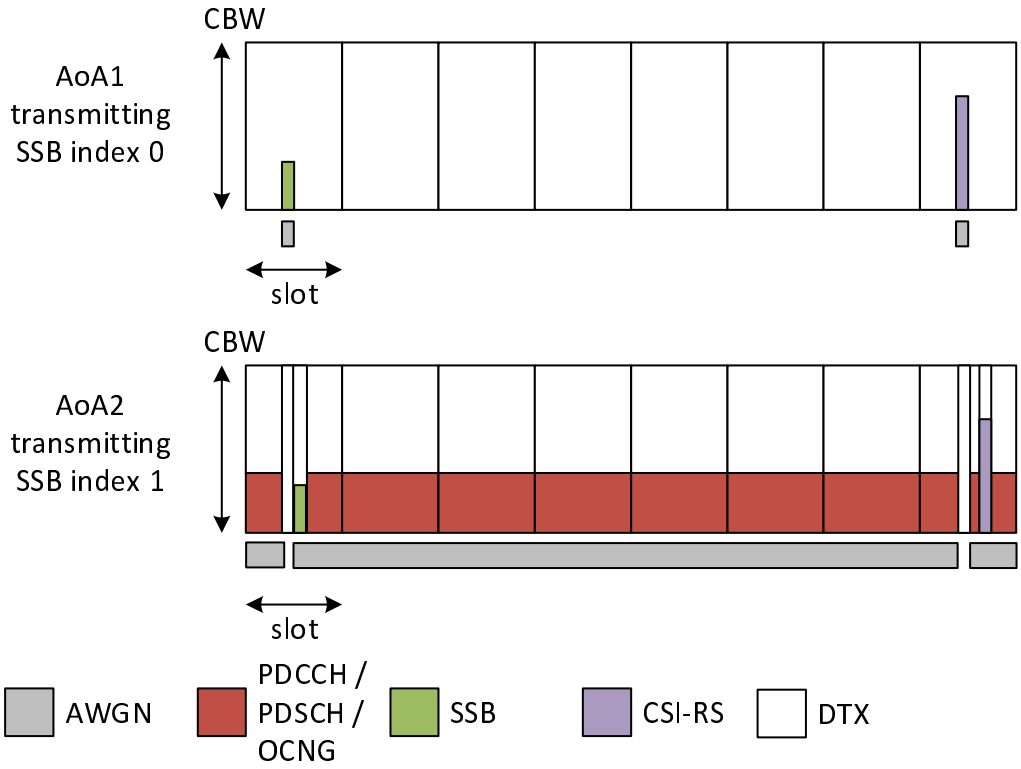


Figure A.5.5.11.3.1.1-2: Time multiplexed downlink transmissions during T2

A.5.5.11.3.1.3 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on DL TCI state 0 till slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$
- be able to start receiving on DL TCI state 1 after slot n+ T_{HARQ} +(5 ms + $T_{first\text{-}SSB}$) / *NR slot length*

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.5.12 PSCell activation and deactivation delay

A.5.5.12.1 PSCell activation and deactivation delay

A.5.5.12.1.1 Test purpose and environment

The purpose of this test is to verify that the NR PSCell activation and deactivation delay under EN-DC are within the requirements stated in clause 7.38 in TS 36.133 [15] for the case when UE configured with one deactivated SCG and when PScell in one SCG is being activated where the PSCell is known by the UE at the time of activation.

Supported test configurations are shown in A.5.5.12.1.1-1. The test parameters for the E-UTRA cell are given in table A.3.7.2.2-1. The E-UTRA cell once set up is not changed across time.

The test parameters for NR cell are given in tables A.5.5.12.1.1-2, cell-specific parameters in A.5.5.12.1.1-3 and OTA parameters in A.5.5.12.1.1-4 below. The test consists of four successive time periods with duration of T1, T2, T3 and T4. There are two carriers each with one cell. The UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) and PSCell (Cell2) is in deactivated state. During T1, both Cell 1 and Cell2 are known to UE and UE performs measurement on deactivated PCell. Before the test starts the UE is configured RLM and BFD on deactivated PSCell. During T1, UE performs RLM and BFD on the deactivated PSCell and TCI state is known.

The test system shall send a RRC message to the UE to activate PSCell (Cell 2) on radio channel 2, where no any PSCell parameter is modified in the RRC message. The RRC message (to activate PSCell) also includes a request for the UE to transmit scheduling request on PUCCH for the PSCell after the PSCell has been successfully activated. The RRC message to activate PSCell shall be sent to the UE during period T1. The point in time at which the RRC message to activate PSCell (Cell2) is received at the UE antenna connector defines the start of period T2.

The test system shall observe the periodic reporting of CSI for PSCell during T3. The point in time at which the UE has sent scheduling request on PUCCH for PSCell (Cell 2) defines the start of period T3.

The test system shall send a RRC message to the UE to deactivate PSCell (Cell 2) on radio channel 2. The RRC message to deactivate PSCell (Cell2) shall be sent to the UE during period T3, after the UE has sent at least one CQI report with non-zero CQI index for PSCell (Cell 2). The point in time at which the RRC message to deativate PSCell (Cell2) is received at the UE antenna connector defines the start of period T4.

Table A.5.5.12.1.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
2	LTE TDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.12.1.1-2: General Test Parameters for PSCell activation and deactivation

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell
Initial Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Deactivated cell		Cell2	SCell on RF channel number 2.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Deactivated cell		Cell2	PSCell deactivated on RF channel number 2.
DRX			OFF	Continuous monitoring of primary cell
Scheduling request resource priodicity			20 ms	At the starting of period T3, UE sends a SR on PUCCH for PSCell
T1		s	1	During this time the PCell shall be known and Cell 2 shall be unknown.
T2		s	1	During this time the UE adds the PSCell.
T3		s	1	During this time the UE sends CSI reports for PSCell.
T4		s	1	During this time the UE releases the PSCell.

Table A.5.5.12.1.1-3: Cell Specific Parameters for PSCell activation and deactivation

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
E-UTRA Channel Number		1,2	1			
NR Channel Number		1,2	2			
Duplex Mode		1,2	TDD			
TDD configuration		1,2	TDDConf.3.1			
$BW_{channel}$	MHz	1,2	100: NRB,c = 66			
Data PRBs allocated		1,2	48			
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1			
TRS Configuration		1	TRS.2.1 TDD			
PDSCH/PDCCH TCI state		1	TCI.State.2			
PDSCH Reference measurement channel		1,2	SR.3.3 TDD			
RMSI CORESET Reference Channel		1,2	CR.3.2 TDD			
Dedicated CORESET Reference Channel		1,2	CCR.3.7 TDD			
OCNG Patterns		1,2	OP.3			
SSB configuration		1,2	SSB.2 FR2			
SMTC configuration		1,2	SMTC.2			
PDSCH/PDCCH subcarrier spacing	kHz	1,2	120			
TRS Configuration		1,2	TRS.2.1 TDD			

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
CSI-RS configuration for CSI reporting		1,2	CSI-RS.3.1 TDD			
reportConfigType		1,2	periodic			
reportQuantity		1,2	cri-RI-PMI-CQI			
CSI reporting periodicity	slot	1,2	40			
CSI reporting offset	slot	1,2	4			
EPRE ratio of PSS to SSS	dB	1,2	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
Propagation condition		1,2	No external noise (Note 1)			
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].						

Table A.5.5.12.1.1-4: OTA related test parameters

Parameter	Unit	Cell 2			
		T1	T2	T3	T4
Angle of arrival configuration		Setup 2a according to clause A.3.15.2.1			
Assumption for UE beams[Note 6]		Rough			
$\hat{E}s$	dBm/SCS	-81			
SSB_RP[Note2, Note 4]	dBm/SCS	-81			
$\hat{E}_s / I_{ot}$ [BB Note 2, Note 7]	dB	4.88			
Io[Note 2, Note 4]	dBm/95.04 MHz	-56.41			
NOTE 1: Void NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: Void NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.					

A.5.5.12.1.2 Test Requirements

The UE performs RACH-less based PSCell activation. UE shall transmit the SR on PUCCH for PSCell at latest 65 ms[Note1] into T2.

The UE shall send at least one PUSCH on PSCell during T3.

The UE shall stop transmit PUSCH for PSCell in at latest 20 ms into T4.

All the above test requirements shall be fulfilled for the observed PSCell activation delay and PSCell deactivation delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90 %.

Note1: The PSCell addition delay can be expressed as follows as specified in clause 7.38 in TS 36.133 [15]:

$T_{activation_time} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{IU} + 2$ ms

Where:

$T_{RRC_delay} = 20$ ms

$T_{processing}$ = 5 ms

T_{search} = 0 ms

T_{Δ} = 20 ms

T_{IU}= max 20 ms

A.5.5.13 Conditional PSCell addition and release delay

A.5.5.13.1 Addition and Release Delay of NR PSCell

A.5.5.13.1.1 Test purpose and environment

The purpose of this test is to verify that the conditional NR PSCell addition and release delays under EN-DC are within the requirements stated in clause 8.9A.2.

Supported test configurations are shown in A.5.5.13.1.1-1. The test parameters for the E-UTRA cell are given in table A.3.7.2.2-1. The E-UTRA cell once set up is not changed across time.

The test parameters for NR cell are given in tables A.5.5.13.1.1-2, cell-specific parameters in A.5.5.13.1.1-3 and OTA parameters in A.5.5.13.1.1-4 below. The test consists of four successive time periods with duration of T1, T2, T3 and T4. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC.

During T1 only Cell 1 is known to the UE. NR shall configure a condition implying PSCell addition (Cell 2) during T1, at a time earlier than T_{RRC_delay} before the beginning of T2.

Starting T2, Cell 2 becomes detectable. The point in time at which the UE has sent PRACH to the PSCell (Cell 2) defines the start of period T3. The test system shall observe the periodic reporting of CSI for PSCell during T3.

The test system shall send a RRC message to the UE to release PSCell (Cell 2) on radio channel 2. The RRC message to release PSCell (Cell2) shall be sent to the UE during period T3, after the UE has sent at least one CQI report with non-zero CQI index for PSCell (Cell 2). The point in time at which the RRC message to release PSCell (Cell2) is received at the UE antenna connector defines the start of period T4.

Table A.5.5.13.1.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
2	LTE TDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.13.1.1-2: General Test Parameters for Conditional PSCell Addition and Release

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell
Initial Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell2	Neighbour cell on RF channel number 2.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour Cell		Cell2	PSCell released on RF channel number 2.
B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	Threshold RSRP	dBm	-118	Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin.
	Time to Trigger	s	0	
DRX			OFF	Continuous monitoring of primary cell
Gap pattern ID			gp0	
PRACH configuration on Cell 2			FR2 configuration 2	Captured in A.3.8.3.2
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.

Parameter	Unit	Value	Comment
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on carrier frequency of Cell 2.
T1	s	1	During this time the PCell shall be known and Cell 2 shall be unknown.
T2	s	<7	During this time the UE adds the PSCell.
T3	s	1	During this time the UE sends CSI reports for PSCell.
T4	s	1	During this time the UE releases the PSCell.

Table A.5.5.13.1.1-3: Cell Specific Parameters for Conditional PSCell Addition and Release

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
E-UTRA Channel Number		1,2	1			
NR Channel Number		1,2	2			
Duplex Mode		1,2	TDD			
TDD configuration		1,2	TDDConf.3.1			
$BW_{channel}$	MHz	1,2	100: $N_{PRB,c}$ = 66			
Data PRBs allocated		1,2	48			
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1			
TRS Configuration		1	TRS.2.1 TDD			
PDSCH/PDCCH TCI state		1	TCI.State.2			
PDSCH Reference measurement channel		1,2	SR.3.3 TDD			
RMSI CORESET Reference Channel		1,2	CR.3.2 TDD			
Dedicated CORESET Reference Channel		1,2	CCR.3.7 TDD			
OCNG Patterns		1,2	OP.3			
SSB configuration		1,2	SSB.2 FR2			
SMTC configuration		1,2	SMTC.2			
PDSCH/PDCCH subcarrier spacing	kHz	1,2	120			
TRS Configuration		1,2	TRS.2.1 TDD			
CSI-RS configuration for CSI reporting		1,2	CSI-RS.3.1 TDD			
reportConfigType		1,2	periodic			
reportQuantity		1,2	cri-RI-PMI-CQI			
CSI reporting periodicity	slot	1,2	40			
CSI reporting offset	slot	1,2	4			
EPRE ratio of PSS to SSS	dB	1,2	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
Propagation condition		1,2	No external noise (Note 1)			

NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].

Table A.5.5.13.1.1-4: OTA related test parameters

Parameter	Unit	Cell 2			
		T1	T2	T3	T4
Angle of arrival configuration		Setup 2a according to clause A.3.15.2.1			

Parameter	Unit	Cell 2			
		T1	T2	T3	T4
Assumption for UE beams Note 6		Rough			
$\hat{E}s$	dBm/SCS	-∞	-81		
SSB_RP Note2, Note 4	dBm/SCS	-∞	-81		
$\hat{E}_s/I_{ot}$ BB Note 2, Note 7	dB	-∞	4.88		
Io Note 2, Note 4	dBm/95.04 MHz	N/A	-56.41		

NOTE 1: Void
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.5.5.13.1.2 Test Requirements

$T_{RRC_delay} + T_{Event_DU}$ occurs during T1 as the PSCell addition condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall transmit the PRACH to PSCell (Cell 2) less than $T_{config_PSCell_Addition_Conditional}$ Note1 into T2.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T3.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T3

The UE shall stop sending CSI reports for PSCell in at latest 20 ms into T4.

All the above test requirements shall be fulfilled for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90 %.

Note1: The PSCell addition delay during T2 can be expressed as follows:

$$T_{config_PSCell_Addition_Conditional} = T_{measure} + T_{UE_preparation} + T_{processing} + T_{\Delta} + T_{PSCell_DU} + 2 \text{ ms}$$

Where:

$T_{measure}$ = 6720 ms for power class 1 or 4160 for power class 2/3/4

$T_{UE_preparation}$ = 10 ms

$T_{processing}$ = 40 ms

T_{Δ} = 20 ms

T_{PSCell_DU} = 1*10+10 = 20 ms

A.5.6 Measurement procedure

A.5.6.1 Intra-frequency Measurements

A.5.6.1.1 EN-DC event triggered reporting test without gap under non-DRX

A.5.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.1.1-1.

Table A.5.6.1.1.1-1: supported test configurations

Configuration	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.5.6.1.1.1-2, A.5.6.1.1.1-3 and A.5.6.1.1.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

Table A.5.6.1.1.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)	
Neighbour cell		1~4	Cell 3	Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3	One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
SMTC configuration		1~4	SMTC.1	
A3-Offset	dB	1~4	-11	
CP length		1~4	Normal	
Hysteresis	dB	1~4	0	
Time To Trigger	s	1~4	0	
Filter coefficient		1~4	0	L3 filtering is not used
DRX		1~4	OFF	
Time offset between Cell 1 and Cell 2		1~4	3 μs	Synchronous EN-DC
Time offset between Cell 2 and Cell 3		1~4	3 μs	Synchronous cells
T1	s	1~4	5	
T2	s	1~4	5	

Table A.5.6.1.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1~4	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1,2	24		24	
		3,4	48		48	
Intial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1~4	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1~4	ULBWP.1.1		ULBWP.1.1	

RLM-RS		1~4	SSB	SSB
PDSCH RMC configuration		1,2	SR.3.2 TDD	N/A
		3,4	SR.3.3 TDD	
RMSI CORESET RMC configuration		1,2	CR.3.1 TDD	N/A
		3,4	CR.3.2 TDD	N/A
Dedicated CORESET RMC configuration		1,2	CCR.3.1 TDD	N/A
		3,4	CCR.3.7 TDD	N/A
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120	120
OCNG Patterns		1~4	OP.5	N/A
TRS configuration		1~4	TRS.2.1 TDD	N/A
PDSCH/PDCCH TCI state		1~4	TCI.State.2	N/A
cellIndividualOffset	dB	1~4	N/A	16
SSB configuration		1, 2	SSB.3 FR2	SSB.7 FR2
		3, 4	SSB.4 FR2	SSB.8 FR2
Propagation Condition		1~4	No external noise (Note 1)	No external noise (Note 1)
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].				

Table A.5.6.1.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Assumption for UE beams[Note 4]		1~4	Rough		Rough	
	dBm/SCS	1, 2	-89	-89	-Infinity	-89
		3, 4	-86	-86	-Infinity	-86
$\hat{E}_s/I_{ot}$ BB [Note 5]	dB	1~4	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1, 2	-89	-89	-Infinity	-89
		3, 4	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1,2	-64.41	-64.41	-Infinity	-64.41
		3,4	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1~4	Defined in figure A.5.6.1.1.1-1			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Void
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

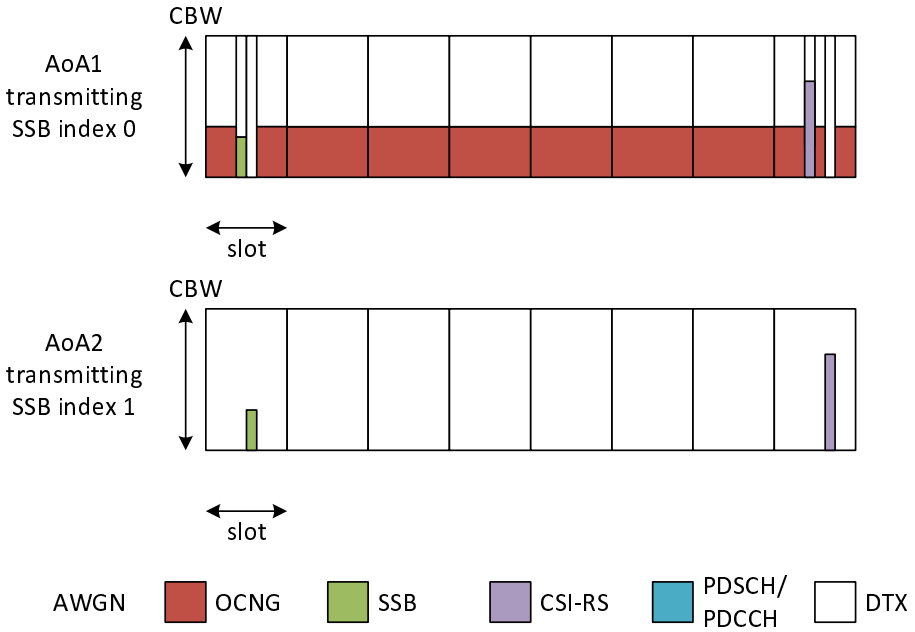


Figure A.5.6.1.1.1-1: Time multiplexed downlink transmissions (Config 1,2 example)

A.5.6.1.1.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 2.4 s for a UE supporting power class 1,
- 1.44 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.1.2 EN-DC event triggered reporting test without gap under DRX

A.5.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.2.1-1.

Table A.5.6.1.2.1-1: supported test configurations

Configuration	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.5.6.1.2.1-2 ~ table A.5.6.1.2.1-6 below.

In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.1.2.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)		
Neighbour cell		1~4	Cell 3		Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3		One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
SMTC configuration		1~4	SMTC.1		
A3-Offset	dB	1~4	-6		
CP length		1~4	Normal		
Hysteresis	dB	1~4	0		
Time To Trigger	s	1~4	0		
Filter coefficient		1~4	0		L3 filtering is not used
DRX		1~4	DRX.1	DRX.7	DRX related parameters are defined in table A.5.6.1.2.1-4
Time offset between Cell 1 and Cell 2		1~4	3 μs		Synchronous EN-DC
Time offset between Cell 2 and Cell 3		1~4	3 μs		Synchronous cells
T1	s	1~4	5		
T2	s	1~4	10	52	

Table A.5.6.1.2.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1~4	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1~4	66		66	
Intial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1~4	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1~4	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1~4	SSB		SSB	
PDSCH RMC configuration		1,2	SR.3. 2 TDD		N/A	
		3,4	SR.3.3 TDD			
RMSI CORESET RMC configuration		1,2	CR.3.1 TDD		N/A	
		3,4	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1,2	CCR.3.1 TDD		N/A	
		3,4	CCR.3.7 TDD		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120		120	
OCNG Patterns		1~4	OP.1		OP.1	
PDSCH/PDCCH TCI state		1~4	TCI.State.2		N/A	
CSI-RS for tracking			TRS.2.1 TDD		N/A	

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
			TRS.2.1 TDD		N/A	
SSB configuration		1, 2	SSB.3 FR2		SSB.3 FR2	
		3, 4	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1~4	AWGN		AWGN	

Table A.5.6.1.2.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 1 defined in A.3.15.1			
Assumption for UE beams Note 4		1~4	Rough		Rough	
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1~4	3.77	-1.52	-Infinity	-1.52
N_{oc} Note 2	dBm/15 KHz	1~4	-98			
N_{oc} Note 2	dBm/SCS	1, 2	-89			
		3, 4	-86			
SSB_RP	dBm/SCS	1, 2	-85	-85	-Infinity	-85
		3, 4	-82	-82	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1~4	4	4	-Infinity	4
Io	dBm/95.04 MHz	1~4	-54.53	-52.18	See Cell 2 columns	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.5.6.1.2.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2 s for a UE supporting power class 1,
- 4.32 s for a UE supporting power class 2, 3 and 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2 s for a UE supporting power class 1,
- 30.72 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.1.3 EN-DC event triggered reporting test with per-UE gaps under non-DRX

A.5.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.3.1-1.

Table A.5.6.1.3.1-1: supported test configurations

Configuration	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.5.6.1.3.1-2 ~ 4 below.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

Table A.5.6.1.3.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)	
Neighbour cell		1~4	Cell 3	Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3	One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
Gap type		1~4	Per-UE gaps	
Measurement gap repitition periodicity	ms	1~4	40	
Measurement gap length	ms	1~4	6	
Measurement gap offset	ms	1~4	39	
SMTC configuration		1~4	SMTC.1	
CSI-RS parameters		1~4	CSI-RS.3.2 TDD resource #0	Resource #1 is not used
A3-Offset	dB	1~4	-11	
CP length		1~4	Normal	
Hysteresis	dB	1~4	0	
Time To Trigger	s	1~4	0	
Filter coefficient		1~4	0	L3 filtering is not used
DRX		1~4	OFF	
Time offset between Cell 1 and Cell 2		1~4	3 μs	Synchronous EN-DC
Time offset between Cell 2 and Cell 3		1~4	3 μs	Synchronous cells
T1	s	1~4	5	
T2	s	1~4	5	

Table A.5.6.1.3.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1~4	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1,2	24		24	
		3,4	48		48	
Intial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1,2	DLBWP.1.2		DLBWP.1.1	
		3,4	DLBWP.1.7		DLBWP.1.1	
Active UL BWP configuration		1,2	ULBWP.1.2		ULBWP.1.1	
		3,4	ULBWP.1.7		ULBWP.1.1	
RLM-RS		1~4	CSI-RS		SSB	
PDSCH RMC configuration		1,2	SR.3.2 TDD		N/A	
		3,4	SR.3.3 TDD			
RMSI CORESET RMC configuration		1,2	CR.3.1 TDD		N/A	
		3,4	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1,2	CCR.3.1 TDD		N/A	
		3,4	CCR.3.7 TDD		N/A	
TRS configuration		1~4	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		1~4	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120		120	
OCNG Patterns		1~4	OP.5		N/A	
cellIndividualOffset	dB	1~4	N/A		16	
SSB		1, 2	SSB.3 FR2		SSB.7 FR2	
		3, 4	SSB.4 FR2		SSB.8 FR2	
Propagation Condition		1~4	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

Table A.5.6.1.3.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Assumption for UE beams[Note 4]		1~4	Rough		Rough	
E_s	dBm/SCS	1, 2	-89	-89	-Infinity	-89
		3, 4	-86	-86	-Infinity	-86
$\hat{E}_s / I_{ot\ BB}$ [Note 5]	dB	1~4	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1, 2	-89	-89	-Infinity	-89
		3, 4	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1,2	-64.41	-64.41	-Infinity	-64.41
		3,4	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1~4	Defined in figure A.5.6.1.3.1-1			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Void NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation. NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.							

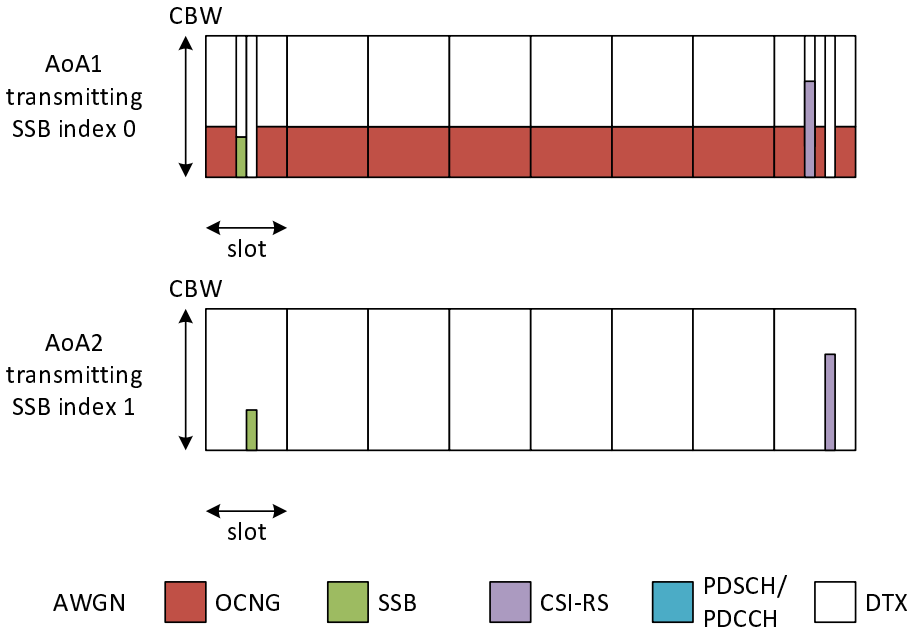


Figure A.5.6.1.3.1-1: Time multiplexed downlink transmissions (Config 1,2 example)

A.5.6.1.3.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 3.2 s for a UE supporting power class 1,
- 1.92 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.1.4 EN-DC event triggered reporting test with per-UE gaps under DRX

A.5.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.4.1-1.

Table A.5.6.1.4.1-1: supported test configurations

Configuration	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.5.6.1.4.1-2 ~ 6.

During the test, Cell 2 and Cell 3 are transmitted from the direction determined according to A3.8.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.1.4.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)		
Neighbour cell		1~4	Cell 3		Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3		One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
Gap type		1~4	Per-UE gaps		
Measurement gap repitition periodicity	ms	1~4	40		
Measurement gap length	ms	1~4	6		
Measurement gap offset	ms	1~4	39		
SMTC configuration		1~4	SMTC.1		
CSI-RS parameters		1~4	CSI-RS.3.2 TDD resource #0		Resource #1 is not used
A3-Offset	dB	1~4	-6		
CP length		1~4	Normal		
Hysteresis	dB	1~4	0		
Time To Trigger	s	1~4	0		
Filter coefficient		1~4	0		L3 filtering is not used
DRX		1~4	DRX.1	DRX.7	DRX related parameters are defined in table A.5.6.1.4.1-5
Time offset between Cell 1 and Cell 2		1~4	3 μs		Synchronous EN-DC
Time offset between Cell 2 and Cell 3		1~4	3 μs		Synchronous cells
T1	s	1~4	5		
T2	s	1~4	10	52	

Table A.5.6.1.4.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1~4	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1~4	66		66	
Intial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	

Active DL BWP configuration		1,2	DLBWP.1.2	DLBWP.1.1
		3,4	DLBWP.1.7	DLBWP.1.1
Active UL BWP configuration		1,2	ULBWP.1.2	ULBWP.1.1
		3,4	ULBWP.1.7	ULBWP.1.1
RLM-RS		1~4	CSI-RS	SSB
PDSCH RMC configuration		1,2	SR.3.2 TDD	N/A
		3,4	SR.3.3 TDD	
RMSI CORESET RMC configuration		1,2	CR.3.1 TDD	N/A
		3,4	CR.3.2 TDD	N/A
Dedicated CORESET RMC configuration		1,2	CCR.3.1 TDD	N/A
		3,4	CCR.3.7 TDD	N/A
TRS configuration		1~4	TRS.2.1 TDD	N/A
PDSCH/PDCCH TCI state		1~4	TCI.State.2	N/A
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120	120
OCNG Patterns		1~4	OP.1	OP.1
SSB		1, 2	SSB.3 FR2	SSB.3 FR2
		3, 4	SSB.4 FR2	SSB.4 FR2
Propagation Condition		1~4	AWGN	AWGN

Table A.5.6.1.4.1-4: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 1 defined in A.3.15.1			
Assumption for UE beams Note 4		1~4	Rough		Rough	
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1~4	3.77	-1.52	-Infinity	-1.52
N_{oc} Note 2	dBm/15 KHz	1~4	-98			
N_{oc} Note 2	dBm/SCS	1, 2	-89			
		3, 4	-86			
SSB_RP	dBm/SCS	1, 2	-85	-85	-Infinity	-85
		3, 4	-82	-82	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1~4	4	4	-Infinity	4
Io	dBm/95.04 MHz	1~4	-54.53	-52.18	See Cell 2 columns	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

Table A.5.6.1.4.1-5: Void

Table A.5.6.1.4.1-6: Void

A.5.6.1.4.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2 s for a UE supporting power class 1,
- 4.32 s for a UE supporting power class 2, 3 and 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.20 s for a UE supporting power class 1,
- 30.72 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.1.5 EN-DC event triggered reporting test without gap under non-DRX when CD-SSB is outside active BWP

A.5.6.1.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* makes correct reporting of an event when CD-SSB is outside active BWP. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.1.1-1.

The test environment is the same as in A.5.6.1.1 with following exceptions in table A.5.6.1.1.1-3.

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
Intial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		-	
Active DL BWP configuration		1~4	DLBWP.1.5		-	
Active UL BWP configuration		1~4	ULBWP.1.5		-	

A.5.6.1.5.2 Test Requirements

The test requirements are the same as in A.5.6.1.1.2.

A.5.6.1.6 EN-DC event triggered reporting test without gap under non-DRX

A.5.6.1.6.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.6.1-1.

Table A.5.6.1. X.1-1: supported test configurations

Configuration	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.5.6.1.6.1-2, A.5.6.1.6.1-3 and A.5.6.1.6.1-4 below.

The CD-SSB is configured outside active DL BWP and NCD-SSB is configured fully within active DL BWP of FR2 PSCell. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

Table A.5.6.1.6.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)	
Neighbour cell		1~4	Cell 3	Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3	One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
SMTC configuration		1~4	SMTC.10	
A3-Offset	dB	1~4	-11	
CP length		1~4	Normal	
Hysteresis	dB	1~4	0	
Time To Trigger	s	1~4	0	
Filter coefficient		1~4	0	L3 filtering is not used
DRX		1~4	OFF	
Time offset between Cell 1 and Cell 2		1~4	3 μs	Synchronous EN-DC
Time offset between Cell 2 and Cell 3		1~4	3 μs	Synchronous cells
T1	s	1~4	5	
T2	s	1~4	5	

Table A.5.6.1.6.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1~4	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1,2	24		24	
		3,4	48		48	
Intial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1~4	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1~4	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1~4	SSB		SSB	
PDSCH RMC configuration		1,2	SR.3.2 TDD		N/A	
		3,4	SR.3.3 TDD			
RMSI CORESET RMC configuration		1,2	CR.3.1 TDD		N/A	
		3,4	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1,2	CCR.3.1 TDD		N/A	
		3,4	CCR.3.7 TDD		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120		120	
OCNG Patterns		1~4	OP.5		N/A	
TRS configuration		1~4	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		1~4	TCI.State.2		N/A	

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
cellIndividualOffset	dB	1~4	N/A		16	
CD-SSB configuration		1, 2	SSB.3 FR2		SSB.7 FR2	
		3, 4	SSB.4 FR2		SSB.8 FR2	
NCD-SSB configuration		1, 2	SSB.26 FR2		SSB.26 FR2	
		3, 4	SSB.27 FR2		SSB.27 FR2	
Propagation Condition		1~4	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

Table A.5.6.1.6.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Assumption for UE beams Note 4		1~4	Rough		Rough	
	dBm/SCS	1, 2	-89	-89	-Infinity	-89
		3, 4	-86	-86	-Infinity	-86
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1~4	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1, 2	-89	-89	-Infinity	-89
		3, 4	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1,2	-64.41	-64.41	-Infinity	-64.41
		3,4	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1~4	Defined in figure A.5.6.1.1.1-1			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Void NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation. NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.							

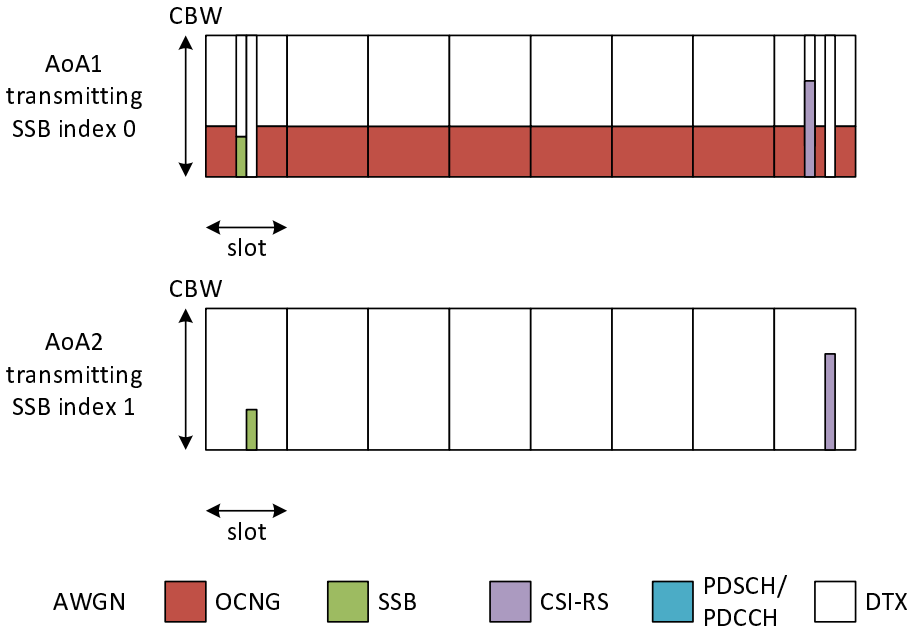


Figure A.5.6.1.1.1-1: Time multiplexed downlink transmissions (Config 1,2 example)

A.5.6.1.6.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 9.6s for a UE supporting power class 1,
- 5.76s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2 Inter-frequency Measurements

A.5.6.2.1 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is not used

A.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE Cell 1 as PCell on E-UTRA RF channel 1, NR Cell 2 as PSCell in FR2 on NR RF channel 1 and NR Cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.5.6.2.1.1-1, A.5.6.2.1.1-2, and A.5.6.2.1.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in table A.5.6.2.1.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in table A.5.6.2.1.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

The configuration of LTE Cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.1.1-1.

Table A.5.6.2.1.1-1 EN-DC event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.5.6.2.1.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2	1		One E-UTRAN TDD carrier frequency is used.

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2	1, 2		Two FR2 NR carrier frequencies are used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR Cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 3		NR Cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	39	39	
SMTC-SSB parameters		Config 1,2	SSB.3 FR2		As specified in clause A.3.10.2
offsetMO	dB	Config 1,2	16		Applied to NR Cell 3 measurement object
A3-Offset	dB	Config 1,2	-11		
Hysteresis	dB	Config 1,2	0		
CP length		Config 1,2	Normal		
TimeToTrigger	s	Config 1,2	0		
Filter coefficient		Config 1,2	0		L3 filtering is not used
DRX		Config 1,2	OFF		DRX is not used
Time offset between PCell and PSCell		Config 1,2	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3μs		Synchronous cells.
T1	s	Config 1,2	5		
T2	s	Config 1,2	5.2 for PC1; 3.5 for other PC	5.2 for PC1; 3.5 for other PC	

Table A.5.6.2.1.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 3 as specified in clause A.3.15			
			AoA1		AoA2	
Assumption for UE beams[Note 7]		Config 1,2	Rough		Rough	
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		Config 1,2	66		66	
BWP BW	MHz	Config 1,2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1		Config 1,2	OP.1		OP.1	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
PDSCH/PDCCH TCI state		Config 1,2	TCI.State.2		NA	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
RMSI CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
Dedicated CORESET Reference Channel		Config 1,2	CCR.3.1 TDD		-	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
$\hat{E}_S$	dBm/SCS	Config 1,2	-87	-87	-Infinity	-87
SSBRP Note 3	dBm/SCS Note5	Config 1,2	-87	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ BB Note 8	dB	Config 1,2	1.89	1.89	-Infinity	1.89
Io Note3	dBm/95.04 MHz Note5	Config 1,2	-58.01	-58.01	-Infinity	-58.01
Propagation Condition		Config 1,2	No external noise (Note 9)		No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SSBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.5.6.2.1.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.2 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is used

A.5.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE Cell 1 as PCell on E-UTRA RF channel 1, NR Cell 2 as PSCell in FR2 on NR RF channel 1 and NR Cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.5.6.2.2.1-1, A.5.6.2.2.1-2, and A.5.6.2.2.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.5.6.2.2.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in table A.5.6.2.2.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

The configuration of LTE Cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.2.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.2.2.1-1 EN-DC event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.5.6.2.2.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2	1				One E-UTRAN TDD carrier frequenciy is used.
NR RF Channel Number		Config 1,2	1, 2				Two FR2 NR carrier frequencies are used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR Cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 3				NR Cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0		13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	39		39		
SMTC-SSB parameters		Config 1,2	SSB.3 FR2				As specified in clause A.3.10.2
A3-Offset	dB	Config 1,2	-6				
Hysteresis	dB	Config 1,2	0				
CP length		Config 1,2	Normal				
TimeToTrigger	s	Config 1,2	0				
Filter coefficient		Config 1,2	0				L3 filtering is not used
DRX		Config 1,2	DRX.1	DRX.7	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2	3 μs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3μs				Synchronous cells.
T1	s	Config 1,2	5				

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
T2	s	Config 1,2	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.5.6.2.2.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 1 as specified in clause A.3.15			
Assumption for UE beams Note 7		Config 1,2	Rough		Rough	
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		Config 1,2	66		66	
BWP BW	MHz	Config 1,2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	ULBWP.0.1			
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1		Config 1,2	OP.1		OP.1	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
PDSCH/PDCCH TCI state		Config 1,2	TCI.State.2		NA	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
RMSI CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
Dedicated CORESET Reference Channel		Config 1,2	CCR.3.1 TDD		-	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		-104.7		-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1,2	-95.7		-95.7	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s / I_{ot}$	dB	Config 1,2	6	6	-Infinity	9
$\hat{E}_s / N_{oc}$	dB	Config 1,2	6	6	-Infinity	9

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
Io[Note3]	dBm/95.04 MHz Note5	Config 1,2	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1,2	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.2.2.2 Test Requirements

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.3 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is not used

A.5.6.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE Cell 1 as PCell on E-UTRA RF channel 1, NR Cell 2 as PSCell in FR2 on NR RF channel 1 and NR Cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.5.6.2.3.1-1, A.5.6.2.3.1-2, and A.5.6.2.3.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in table A.5.6.2.3.1-1 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in table A.5.6.2.3.1-1 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

The configuration of LTE Cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.3.1-1.

Table A.5.6.2.3.1-1 EN-DC event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.5.6.2.3.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2	1		One E-UTRAN TDD carrier frequency is used.
NR RF Channel Number		Config 1,2	1, 2		Two FR2 NR carrier frequencies are used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR Cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 3		NR Cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	39	39	
SMTC-SSB parameters		Config 1,2	SSB.3 FR2		As specified in clause A.3.10.2
offsetMO	dB	Config 1,2	16		Applied to NR Cell 3 measurement object
A3-Offset	dB	Config 1,2	-11		
Hysteresis	dB	Config 1,2	0		
CP length		Config 1,2	Normal		
TimeToTrigger	s	Config 1,2	0		
Filter coefficient		Config 1,2	0		L3 filtering is not used
DRX		Config 1,2	OFF		DRX is not used
Time offset between PCell and PSCell		Config 1,2	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3μs		Synchronous cells.
T1	s	Config 1,2	5		
T2	s	Config 1,2	7 for PC1; 4.5 for other PC	7 for PC1; 4.5 for other PC	

Table A.5.6.2.3.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 3 as specified in clause A.3.15			
			AoA1		AoA2	
Assumption for UE beams[Note 7]		Config 1,2	Rough		Rough	
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		Config 1,2	66		66	
BWP BW	MHz	Config 1,2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	DLBWP.0.1		N/A	
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1		Config 1,2	OP.1		OP.1	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
RMSI CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
Dedicated CORESET Reference Channel		Config 1,2	CCR.3.1 TDD		-	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
PDSCH/PDCCH TCI state		Config 1,2	TCI.State.2		NA	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
$\hat{E}_S$	dBm/SCS	Config 1	-87	-87	-Infinity	-87
SSBRP Note 3	dBm/SCS Note5	Config 1,2	-87	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ BB Note 8	dB	Config 1,2	1.89	1.89	-Infinity	1.89
Io Note3	dBm/95.04 MHz Note5	Config 1,2	-58.01	-58.01	-Infinity	-58.01
Propagation Condition		Config 1,2	No external noise (Note 9)		No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SSBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40]

A.5.6.2.3.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.4 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is used

A.5.6.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE Cell 1 as PCell on E-UTRA RF channel 1, NR Cell 2 as PSCell in FR2 on NR RF channel 1 and NR Cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.5.6.2.4.1-1, A.5.6.2.4.1-2, and A.5.6.2.4.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.5.6.2.4.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in table A.5.6.2.4.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

The configuration of LTE Cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.4.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.2.4.1-1: EN-DC event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.5.6.2.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2	1				One E-UTRAN TDD carrier frequency is used.
NR RF Channel Number		Config 1,2	1, 2				Two FR2 NR carrier frequencies are used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR Cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 3				NR Cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0		13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	39		39		
SMTC-SSB parameters		Config 1,2	SSB.3 FR2				As specified in clause A.3.10.2
A3-Offset	dB	Config 1,2	-6				
Hysteresis	dB	Config 1,2	0				

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
CP length		Config 1,2	Normal				
TimeToTrigger	s	Config 1,2	0				
Filter coefficient		Config 1,2	0				L3 filtering is not used
DRX		Config 1,2	DRX.1	DRX.7	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2	3 μs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3μs				Synchronous cells.
T1	s	Config 1,2	5				
T2	s	Config 1,2	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	

Table A.5.6.2.4.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 1 as specified in clause A.3.15			
Assumption for UE beams[Note 7]		Config 1,2	Rough		Rough	
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		Config 1,2	66		66	
BWP BW	MHz	Config 1,2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	ULBWP.0.1			
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1		Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
RMSI CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
Dedicated CORESET Reference Channel		Config 1,2	CCR.3.1 TDD		-	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
PDSCH/PDCCH TCI state		Config 1,2	TCI.State.2		NA	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		-104.7		-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1,2	-95.7		-95.7	
SSB_RP Note 3	dBm/SCS Note5	Config 1,2	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1,2	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2	6	6	-Infinity	9
Io Note3	dBm/95.04 MHz Note5	Config 1,2	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1,2	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.2.4.2 Test Requirements

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.5 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is not used

A.5.6.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE Cell 1 as PCell on E-UTRA RF channel 1, NR Cell 2 as PSCell in FR1 on NR RF channel 1 and NR Cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.5.6.2.5.1-1, A.5.6.2.5.1-2, and A.5.6.2.5.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in table A.5.6.2.5.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in table A.5.6.2.5.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

The configuration of LTE Cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.5.6.2.5.1-1.

Table A.5.6.2.5.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.5.6.2.5.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN TDD carrier frequency is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		One FR1 and one FR2 NR carrier frequency is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR Cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR Cell 3		NR Cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39	39	
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2,5	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1		As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2		As specified in clause A.3.10.2
CSI-RS for tracking		Config 1,4	TRS.1.1 FDD		
		Config 2,5	TRS.1.1 TDD		
		Config 3,6	TRS.1.2 TDD		
offsetMO	dB	Config 1,2,3,4,5,6	6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
a4-Threshold	dBm	Config 1,2,3,4,5,6	-105		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF		DRX is not used

Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3 ms		Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	5.2 for PC1; 3.5 for other PC	5.2 for PC1; 3.5 for other PC	

Table A.5.6.2.5.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6	NA		Setup 1 as specified in clause A.3.15	
Assumption for UE beams[Note 7]		Config 1,2,3,4,5,6	N/A		Rough	
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD		TDD	
		Config 2,3,5,6	TDD		TDD	
$BW_{channel}$	MHz	Config 1,4	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 2,5	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 3,6	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
BWP BW	MHz	Config 1,4	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 2,5	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 3,6	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		Config 1,4	52		66	
		Config 2,5	52		66	
		Config 3,6	106		66	
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.3.1	
		Config 3,6	TDDConf.2.1		TDDConf.3.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR.2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR.2.1 TDD			
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD		-	
		Config 2,5	CCR.1.1 TDD			
		Config 3,6	CCR.2.1 TDD			
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2		SMTC.2	
		Config 2,3,5,6	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15		120	
		Config 3,6	30		120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
$\hat{E}_s$	dBm/SCS	Config 1,2,3,4,5,6	Link only, see clause A.3.7A		-Infinity	-87
SSB_RP Note 3	dBm/SCS Note5	Config 1,2,3,4,5,6			-Infinity	-87
$\hat{E}_s/I_{ot\ BB}$ Note 8	dB	Config 1,2,3,4,5,6			-Infinity	14.69
Io Note3	dBm/95.04 MHz Note5	Config 1,2,3,4,5,6			-Infinity	-58.01
Propagation Condition		Config 1,2,3,4,5,6			No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.5.6.2.5.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.6 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is used

A.5.6.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE Cell 1 as PCell on E-UTRA RF channel 1, NR Cell 2 as PSCell in FR1 on NR RF channel 1 and NR Cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.5.6.2.6.1-1, A.5.6.2.6.1-2, and A.5.6.2.6.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.5.6.2.6.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in table A.5.6.2.6.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

The configuration of LTE Cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.5.6.2.6.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.2.6.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.5.6.2.6.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1				One E-UTRAN TDD carrier frequency is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2				One FR1 and one Fr2 NR carrier frequency is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR Cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR Cell 3				NR Cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0		13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39		39		
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1				As specified in clause A.3.10.1
		Config 2,5	SSB.1 FR1				As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1				As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2				As specified in clause A.3.10.2
CSI-RS for tracking		Config 1,4	TRS.1.1 FDD				
		Config 2,5	TRS.1.1 TDD				
		Config 3,6	TRS.1.2 TDD				
offsetMO	dB	Config 1,2,3,4,5,6	6				
Hysteresis	dB	Config 1,2,3,4,5,6	0				
a4-Threshold	dBm	Config 1,2,3,4,5,6	-105				

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
CP length		Config 1,2,3,4,5,6	Normal				
TimeToTrigger	s	Config 1,2,3,4,5,6	0				
Filter coefficient		Config 1,2,3,4,5,6	0				L3 filtering is not used
DRX		Config 1,2,3,4,5,6	DRX.1	DRX.7	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3 ms				Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs				Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5				
T2	s	Config 1,2,3,4,5,6	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.5.6.2.6.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6	NA		Setup 1 as specified in clause A.3.15	
Assumption for UE beams[Note 7]		Config 1,2,3,4,5,6	N/A		Rough	
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD		TDD	
		Config 2,3,5,6	TDD		TDD	
$BW_{channel}$	MHz	Config 1,4	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 2,5	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 3,6	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
BWP BW	MHz	Config 1,4	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 2,5	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 3,6	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		Config 1,4	52		66	
		Config 2,5	52		66	
		Config 3,6	106		66	
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.3.1	
		Config 3,6	TDDConf.2.1		TDDConf.3.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR.2.1 TDD			

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD		-	
		Config 2,5	CCR.1.1 TDD			
		Config 3,6	CCR.2.1 TDD			
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2		SMTC.2	
		Config 2,3,5,6	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15		120	
		Config 3,6	30		120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		NA Link only, see clause A.3.7A		-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1,2,4,5			-95.7	
		Config 3,6			-95.7	
SSB_RP Note 3	dBm/SCS Note5	Config 1,2,4,5			-Infinity	-86.7
		Config 3,6			-Infinity	-86.7
$\hat{E}_s / I_{ot}$	dB	Config 1,2,3,4,5,6			-Infinity	9
$\hat{E}_s / N_{oc}$	dB	Config 1,2,3,4,5,6			-Infinity	9
Io Note3	dBm/9.36 MHz	Config 1,2,4,5			-	-
	dBm/38.16 MHz	Config 3,6			-	-
	dBm/95.04 MHz Note5	Config 1,2,3,4,5,6			-66.7	-57.2
Propagation Condition		Config 1,2,3,4,5,6			AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.2.6.2 Test Requirements

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.7 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is not used

A.5.6.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE Cell 1 as PCell on E-UTRA RF channel 1, NR Cell 2 as PSCell in FR1 on NR RF channel 1 and NR Cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.5.6.2.7.1-1, A.5.6.2.7.1-2, and A.5.6.2.7.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in table A.5.6.2.7.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in table A.5.6.2.7.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

The configuration of LTE Cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.5.6.2.7.1-1.

Table A.5.6.2.7.1-1: EN-DC event triggered reporting tests with SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.5.6.2.7.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN TDD carrier frequency is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		One FR1 and one FR2 NR carrier frequency is used.

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR Cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR Cell 3		NR Cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39	39	
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2,5	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1		As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2		As specified in clause A.3.10.2
CSI-RS for tracking		Config 1,4	TRS.1.1 FDD		
		Config 2,5	TRS.1.1 TDD		
		Config 3,6	TRS.1.2 TDD		
offsetMO	dB	Config 1,2,3,4,5,6	6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
a4-Threshold	dBm	Config 1,2,3,4,5,6	-105		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF		DRX is not used
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3 ms		Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	7 for PC1; 4.5 for other PC	7 for PC1; 4.5 for other PC	

Table A.5.6.2.7.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6	NA		Setup 1 as specified in clause A.3.15	
Assumption for UE beams[Note 7]		Config 1,2,3,4,5,6	N/A		Rough	
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD		TDD	
		Config 2,3,5,6	TDD		TDD	
$BW_{channel}$	MHz	Config 1,4	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 2,5	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 3,6	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
BWP BW	MHz	Config 1,4	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 2,5	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 3,6	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
Data PRBs allocated		Config 1,4	52		66	
		Config 2,5	52		66	
		Config 3,6	106		66	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR.2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR.2.1 TDD			
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD		-	
		Config 2,5	CCR.1.1 TDD			
		Config 3,6	CCR.2.1 TDD			
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.3.1	
		Config 3,6	TDDConf.2.1		TDDConf.3.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2		SMTC.2	
		Config 2,3,5,6	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15		120	
		Config 3,6	30		120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
$\hat{E}_s$	dBm/SCS	Config 1,2,3,4,5,6	Link only, see clause A.3.7A		-Infinity	-87
SSB_RP Note 3	dBm/SCS Note5	Config 1,2,3,4,5,6			-Infinity	-87
$\hat{E}_s / I_{ot\ BB}$ Note 8	dB	Config 1,2,3,4,5,6			-Infinity	14.69
Io Note3	dBm/95.04 MHz Note5	Config 1,2,3,4,5,6			-Infinity	-58.01
Propagation Condition		Config 1,2,3,4,5,6			No external noise (Note 9)	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Void						
NOTE 3: SS-B_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Void						
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.						
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

A.5.6.2.7.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.8 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is used

A.5.6.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE Cell 1 as PCell on E-UTRA RF channel 1, NR Cell 2 as PSCell in FR1 on NR RF channel 1 and NR Cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.5.6.2.8.1-1, A.5.6.2.8.1-2, and A.5.6.2.8.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.5.6.2.8.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in table A.5.6.2.8.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

The configuration of LTE Cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.5.6.2.8.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.2.8.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.5.6.2.8.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1				One E-UTRAN TDD carrier frequenciy is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2				One FR1 and one FR2 NR carrier frequency is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR Cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR Cell 3				NR Cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0		13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39		39		
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1				As specified in clause A.3.10.1
		Config 2,5	SSB.1 FR1				As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1				As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2				As specified in clause A.3.10.2
CSI-RS for tracking		Config 1,4	TRS.1.1 FDD				
		Config 2,5	TRS.1.1 TDD				
		Config 3,6	TRS.1.2 TDD				
offsetMO	dB	Config 1,2,3,4,5,6	6				
Hysteresis	dB	Config 1,2,3,4,5,6	0				
a4-Threshold	dBm	Config 1,2,3,4,5,6	-105				
CP length		Config 1,2,3,4,5,6	Normal				
TimeToTrigger	s	Config 1,2,3,4,5,6	0				
Filter coefficient		Config 1,2,3,4,5,6	0				L3 filtering is not used
DRX		Config 1,2,3,4,5,6	DRX.1	DRX.7	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 µs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3 ms				Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 2,3,5,6	3µs				Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5				

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
T2	s	Config 1,2,3,4,5,6	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	

Table A.5.6.2.8.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6	NA		Setup 1 as specified in clause A.3.15	
Assumption for UE beams[Note 7]		Config 1,2,3,4,5,6	N/A		Rough	
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD		TDD	
		Config 2,3,5,6	TDD		TDD	
$BW_{channel}$	MHz	Config 1,4	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 2,5	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 3,6	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
BWP BW	MHz	Config 1,4	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 2,5	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 3,6	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		Config 1,4	52		66	
		Config 2,5	52		66	
		Config 3,6	106		66	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR.2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR.2.1 TDD			
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD		-	
		Config 2,5	CCR.1.1 TDD			
		Config 3,6	CCR.2.1 TDD			
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.3.1	
		Config 3,6	TDDConf.2.1		TDDConf.3.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2		SMTC.2	
		Config 2,3,5,6	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15		120	
		Config 3,6	30		120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		NA Link only, see clause A.3.7A		-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1,2,4,5			-95.7	
		Config 3,6			-95.7	
SSB_RP Note 3	dBm/SCS Note5	Config 1,2,4,5			-Infinity	-86.7
		Config 3,6			-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6			-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6			-Infinity	9
Io Note3	dBm/9.36 MHz	Config 1,2,4,5			-	-
	dBm/38.16 MHz	Config 3,6			-	-
	dBm/95.04 MHz Note5	Config 1,2,3,4,5,6			-66.7	-57.2
Propagation Condition		Config 1,2,3,4,5,6			AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.2.8.2 Test Requirements

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.3 L1-RSRP measurement for beam reporting

A.5.6.3.1 SSB based L1-RSRP measurement when DRX is not used

A.5.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.5.6.3.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.5.6.3.1.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.5.6.3.1.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.6.3.1.2-1 and table A.5.6.3.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.5.6.3.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1~4		TDD
TDD Configuration	1~4		TDDConf.3.1
$BW_{channel}$	1~4	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~4		66
PDSCH Reference measurement channel	1,2		SR.3.2 TDD
	3,4		SR.3.3 TDD
RMSI CORESET Reference Channel	1,2		CR.3.1 TDD
	3,4		CR.3.2 TDD
Dedicated CORESET Reference Channel	1,2		CCR.3.1 TDD
	3,4		CCR.3.7 TDD
SSB configuration	1,2		SSB.1 FR2
	3,4		SSB.2 FR2
OCNG Patterns	1~4		OP.1

Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~4		SMTC.1
TRS Configuration	1~4		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2
DRX configuration	1~4		Off
reportConfigType	1~4		periodic
reportQuantity	1~4		ssb-Index-RSRP
Number of reported RS	1~4		2
L1-RSRP reporting period	1~4	slot	320
T1	1~4	s	5
T2	1~4	s	2
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.3.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Assumption for UE beams Note 4	1~4		Rough			
N_{oc} Note2	1~4	dBm/15 kHz	-105			
N_{oc} Note2	1,2	dBm/SSB SCS	-96			
	3,4		-93			
$\hat{E}_s / I_{ot}$	1~4	dB	0	0	-Infinity	9
SSB_RP Note3	1,2	dBm/SSB SCS	-96	-96	-Infinity	-87
	3,4		-93	-93	-Infinity	-84
Io Note3	1,2	dBm/95.04 MHz	-63.97	-63.97	-66.98	-57.47
	3,4		-63.97	-63.97	-66.98	-57.47
$\hat{E}_s / N_{oc}$	1~4	dB	0	0	-Infinity	9

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.3.1.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 1680 for UE supporting power class 1
- 1200 for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.6.3.2 SSB based L1-RSRP measurement when DRX is used

A.5.6.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.5.6.3.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.5.6.3.2.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.5.6.3.2.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.6.3.2.2-1 and table A.5.6.3.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.5.6.3.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1~4		TDD
TDD Configuration	1~4		TDDConf.3.1
$BW_{channel}$	1~4	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~4		66
PDSCH Reference measurement channel	1,2		SR.3.2 TDD
	3,4		SR.3.3 TDD
RMSI CORESET Reference Channel	1,2		CR.3.1 TDD
	3,4		CR.3.2 TDD
Dedicated CORESET Reference Channel	1,2		CCR.3.1 TDD
	3,4		CCR.3.7 TDD
SSB configuration	1,2		SSB.1 FR2
	3,4		SSB.2 FR2
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~4		SMTC.1
TRS Configuration	1~4		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2
DRX configuration	1~4		DRX.3
reportConfigType	1~4		periodic
reportQuantity	1~4		ssb-Index-RSRP

Parameter	Config	Unit	Value
Number of reported RS	1~4		2
L1-RSRP reporting period	1~4	slot	320
T1	1~4	s	5
T2	1~4	s	3
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.3.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Assumption for UE beams Note 4	1~4		Rough			
N_{oc} Note2	1~4	dBm/15 kHz	-105			
N_{oc} Note2	1,2	dBm/SSB SCS	-96			
	3,4		-93			
$\hat{E}_s/I_{ot}$	1~4	dB	0	0	-Infinity	9
SSB_RP Note3	1,2	dBm/SSB SCS	-96	-96	-Infinity	-87
	3,4		-93	-93	-Infinity	-84
Io Note3	1,2	dBm/95.04 MHz	-63.97	-63.97	-66.98	-57.47
	3,4		-63.97	-63.97	-66.98	-57.47
$\hat{E}_s/N_{oc}$	1~4	dB	0	0	-Infinity	9
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.						

A.5.6.3.2.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 2880 for UE supporting power class 1
- 1920 for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.6.3.3 CSI-RS based L1-RSRP measurement when DRX is not used

A.5.6.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.5.6.3.3.1-1.

Table A.5.6.3.3.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.5.6.3.3.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.6.3.3.2-1 and table A.5.6.3.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 480 ms from the beginning of the test, the DCI trigger comes in slot 1 of a frame and UE provides the report back based on the reporting configuration as defined in table A.5.6.3.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.5.6.3.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~2		66
PDSCH Reference measurement channel	1~2		SR.3.3 TDD
RMSI CORESET Reference Channel	1~2		CR.3.2 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.7 TDD
SSB configuration	1~2		SSB.1 FR2
CSI-RS configuration	1~2		CSI-RS.3.3 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		Off
reportConfigType	1~2		aperiodic
reportQuantity	1~2		cri-RSRP
Number of reported RS	1~2		2
qcl-Info	1~2		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1~2		8
Propagation condition	1~2		AWGN
T1	1~2	s	5
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.3.3.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1~2		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 3	1~2		Rough	
N_{oc} Note1	1~2	dBm/15 kHz	-105	
N_{oc} Note1	1~2	dBm/SSB SCS	-95.97	
$\hat{E}_s / I_{ot}$	1~2	dB	0	9
CSI-RS RSRP Note2	1~2	dBm/SSB SCS	-95.97	-86.97
Io Note2	1~2	dBm/95.04 MHz	-63.97	-57.47
$\hat{E}_s / N_{oc}$	1~2	dB	0	9

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.3.3.3 Test Requirements

After 480 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.20.1. The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

For absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1, the UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.5.6.3.3.3-1.

For relative accuracy of CSI-RS0 compared with CSI-RS1, the UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

Table A.5.6.3.3.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}

NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class

A.5.6.3.4 CSI-RS based L1-RSRP measurement when DRX is used

A.5.6.3.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.5.6.3.4.1-1.

Table A.5.6.3.4.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.5.6.3.4.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.6.3.4.2-1 and table A.5.6.3.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 1440 ms from the beginning of the test, the DCI trigger comes in slot 1 of a frame and UE provides the report back based on the reporting configuration as defined in table A.5.6.3.4.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.5.6.3.4.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~2		66
PDSCH Reference measurement channel	1~2		SR.3.3 TDD
RMSI CORESET Reference Channel	1~2		CR.3.2 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.7 TDD
SSB configuration	1~2		SSB.1 FR2
CSI-RS configuration	1~2		CSI-RS.3.3 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		DRX.3
reportConfigType	1~2		aperiodic
reportQuantity	1~2		cri-RSRP
Number of reported RS	1~2		2
qcl-Info	1~2		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~2		8
Propagation condition	1~2		AWGN
T1	1~2	s	5
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.3.4.2-1: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1~2		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4	1~2		Rough	
N_{oc} Note1	1~2	dBm/15 kHz	-105	

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~2	dBm/SSB SCS	-95.97	
$\hat{E}_s/I_{ot}$	1~2	dB	0	9
CSI-RS RSRP Note2	1~2	dBm/SSB SCS	-95.97	-86.97
Io Note2	1~2	dBm/95.04 MHz	-63.97	-57.47
$\hat{E}_s/N_{oc}$	1~2	dB	0	9

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.3.4.3 Test Requirements

After 1440 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.20.1. The reported L1-RSRP value shall include the Rx antenna gain in the range from -10 to +20 dB which is referred to Table B.2.1.5.1-1 when calculated.

For absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1, the UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.5.6.3.4.3-1.

For relative accuracy of CSI-RS0 compared with CSI-RS1, the UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

Table A.5.6.3.4.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}

NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class

A.5.6.3.5 CSI-RS based L1-RSRP measurement when DRX is not used and when CD-SSB is outside active BWP

A.5.6.3.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement when CD-SSB is outside active BWP. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.5.6.3.3.1-1.

The test is for UE supporting *rlm-BM-BFD-CSI-RS-OutsideActiveBWP-r18* and the UE is not required past legacy test in A.5.6.3.3.

The test environment is the same as in A.5.6.3.3 with following exceptions in table A.5.6.3.3.2-1.

The value of parameter "Dedicated BWP configuration" is DLBWP.1.2 and ULBWP.1.2.

NOTE: The starting PRB index of the SSB can be any possible PRB index of the RF channel BW occurring after the last PRB of the DL active BWP.

The test requirements are the same as in A.5.6.3.3.3.

A.5.6.3.6 SSB based L1-RSRP measurement when DRX is not used when CD-SSB is outside active BWP

A.5.6.3.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* makes correct reporting of L1-RSRP measurement when CD-SSB is outside active BWP. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.5.6.3.1.1-1.

The test environment is the same as in A.5.6.3.1 with following exceptions in table A.5.6.3.1.2-1.

Parameter	Config	Unit	Value
Dedicated BWP configuration	1~4		DLBWP.1.5 ULBWP.1.5

A.5.6.3.6.2 Test Requirements

The test requirements are the same as in A.5.6.3.1.3.

A.5.6.3.7 SSB based L1-RSRP measurement for UE supporting NCD-SSB based L1 measurement outside active BWP when DRX is not used

A.5.6.3.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.5.6.3.7.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.5.6.3.7.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.5.6.3.7.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.6.3.7.2-1 and table A.5.6.3.7.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured. During time duration T1, the UE shall not have any timing information of NR Cell 2.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.5.6.3.7.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1~4		TDD

Parameter	Config	Unit	Value
TDD Configuration	1~4		TDDConf.3.1
$BW_{channel}$	1~4	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~4		66
PDSCH Reference measurement channel	1,2		SR.3.2 TDD
	3,4		SR.3.3 TDD
RMSI CORESET Reference Channel	1,2		CR.3.1 TDD
	3,4		CR.3.2 TDD
Dedicated CORESET Reference Channel	1,2		CCR.3.1 TDD
	3,4		CCR.3.7 TDD
CD-SSB configuration	1,2		SSB.1 FR2
	3,4		SSB.2 FR2
NCD-SSB configuration	1,2		SSB.x FR2
	3,4		SSB.y FR2
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		[DLBWP.1.1 RedCap] [ULBWP.1.1 RedCap]
SMTC configuration	1~4		[SMTC.2 RedCap]
TRS Configuration	1~4		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2
DRX configuration	1~4		Off
reportConfigType	1~4		periodic
reportQuantity	1~4		ssb-Index-RSRP
Number of reported RS	1~4		2
L1-RSRP reporting period	1~4	slot	320
T1	1~4	s	5
T2	1~4	s	2
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.3.7.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Assumption for UE beams Note 4	1~4		Rough			
N_{oc} Note2	1~4	dBm/15 kHz	-105			
N_{oc} Note2	1,2	dBm/SSB SCS	-96			
	3,4		-93			
$\hat{E}_s / I_{ot}$	1~4	dB	0	0	-Infinity	9
SSB_RP Note3	1,2	dBm/SSB SCS	-96	-96	-Infinity	-87
	3,4		-93	-93	-Infinity	-84
Io Note3	1,2	dBm/95.04 MHz	-63.97	-63.97	-66.98	-57.47
	3,4		-63.97	-63.97	-66.98	-57.47
$\hat{E}_s / N_{oc}$	1~4	dB	0	0	-Infinity	9
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.5.6.3.7.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- [3360] for UE supporting power class 1
- [2080] for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.5.6.4 CLI measurements

A.5.6.4.1 SRS-RSRP measurement with DRX

A.5.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of SRS-RSRP measurement. This test will verify the SRS-RSRP measurement requirements in clause 9.7.2.5 with the testing configurations for NR cells in table A.5.6.4.1.1-1.

Table A.5.6.4.1.1-1: Applicable NR configurations for FR2 SRS-RSRP test

Configuration	Description
1	NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode

A.5.6.4.1.2 Test Parameters

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2). The test parameters for PSCell is given in table A.5.6.4.1.2-1 ~ A.5.6.4.1.2-3 below and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system transmits SRS resource for measurement in the DL slot according to the SRS configuration in table A.5.6.4.1.2-4 and the test parameters for the (virtual) neighbour cell UE in table A.5.6.4.1.2-3. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

Table A.5.6.4.1.2-1: General test parameters for SRS-RSRP event triggered reporting for PSCell in FR2

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	E-UTRAN Cell 1 and NR Cell 2	
RF Channel Number		1	1: Cell 1 2: Cell 2	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC.1	
SRS configuration		1	SRSConf.1	Table A.5.6.4.1.2-4

CP length		1	Normal	
i1-Threshold	dBm	1	-103	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX	ms	1	DRX.11	
Time offset between DL from serving cell and SRS from test system	µs	1,2	10.67	
T1	s	1	5	
T2	s	1	1	

Table A.5.6.4.1.2-2: NR Cell specific test parameters for SRS-RSRP event triggered reporting for PSCell in FR2

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
TDD configuration		1	TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	
OCNG Patterns		1	OP.1	
TRS configuration			TRS.2.1. TDD	
PDSCH/PDCCH TCI state		1	TCI.State.2	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1	
Propagation Condition		1	AWGN	

Table A.5.6.4.1.2-3: NR OTA Cell specific test parameters for SRS-RSRP event triggered reporting for PSCell and Neighbour cell UE in FR2

Parameter	Unit	Test configuration	Cell 2		Neighbour cell UE	
			T1	T2	T1	T2
AoA setup		1	Setup 1 defined A.3.15.1			
Beam assumption Note 4		1	Fine			
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
N_{oc} Note 2	dBm/SCS	1	-89		-89	
$\hat{E}_s/I_{ot}$	dB	1	-	-	-infinity	4
$\hat{E}_s/N_{oc}$	dB	1	4	4	-infinity	4
SRS-RSRP Note 3	dBm/SCS kHz	1	-	-	-infinity	-94
Io	dBm/95.04 MHz	1	-61.36	-55.91	-70.01	-68.82

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Cell 2 doesn't transmit during the SRS and the 2 previous symbols. Es/NoC is not applied to those symbols.

Table A.5.6.4.1.2-4: SRS configuration for measurement reporting

	Field	SRSConf.1	Comments
SRS-ResourceSet	srs-ResourceSetId	0	
	srs-ResourceIdList	0	
	resourceType	Periodic	
	Usage	Codebook	

	Field	SRSConf.1	Comments
SRS-Resource	SRS-ResourceId	0	
	nrofSRS-Ports	Port1	
	transmissionComb	n2	
	combOffset-n2	0	
	cyclicShift-n2	0	
	resourceMapping startPosition	0	
	resourceMapping nrofSymbols	n1	
	resourceMapping repetitionFactor	n1	
	freqDomainPosition	0	
	freqDomainShift	0	
	freqHopping c-SRS	12	
	freqHopping b-SRS	0	
	freqHopping b-hop	0	
	groupOrSequenceHopping	Neither	
	resourceType	Periodic	
	periodicityAndOffset	sl160, 25	
	sequenceId	0	Any 10 bit number

A.5.6.4.1.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 60 ms from the beginning of time period T2.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.4.2 CLI-RSSI measurement with DRX

A.5.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of CLI-RSSI measurement. This test will verify the CLI-RSSI measurement requirements in clause 9.7.3.5 with the testing configurations for NR cells in table A.5.6.4.2.1-1.

Table A.5.6.4.2.1-1: Applicable NR configurations for FR2 CLI-RSSI test

Configuration	Description
1	NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode

A.5.6.4.2.2 Test Parameters

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2). The test parameters for PSCell is given in table A.5.6.4.2.2-1 ~ A.5.6.4.2.2-3 below and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI measurement resource and on 2 data symbols before. The CLI-RSSI measurement resource configuration is in table A.5.6.4.2.2-4.

Table A.5.6.4.2.2-1: General test parameters for CLI-RSSI event triggered reporting for PSCell in FR2

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	E-UTRAN Cell 1 and NR Cell 2	
RF Channel Number		1	1: Cell 1 2: Cell 2	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC.1	
CLI-RSSI configuration		1	CLI-RSSIConf.1	Table A.5.6.4.2.2-4
CP length		1	Normal	
i1-Threshold	dBm	1	-94.5	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX		1	DRX.11	
Time offset between DL from serving cell and OCNG from test system	μs	1	10.67	
T1	s	1	5	
T2	s	1	1	

Table A.5.6.4.2.2-2: NR Cell specific test parameters for CLI-RSSI event triggered reporting for PSCell in FR2

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
TDD configuration		1	TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD	
PUSCH parameters		1	N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	
OCNG Patterns Note 1		1	OP.1	
TRS configuration			TRS.2.1. TDD	
PDSCH/PDCCH TCI state		1	TCI.State.2	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1	
Propagation Condition		1	AWGN	
NOTE 1: OCNG is not transmitted in the CLI-RSSI measurement resources.				

Table A.5.6.4.2.2-3: NR OTA Cell specific test parameters for CLI-RSSI event triggered reporting for PSCell in FR2

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
AoA setup		1	Setup 1 defined in A.3.15.1	
Beam assumption Note 3		1	Fine	
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/15 kHz	1	-119	-108
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/SCS	1	-110	-99
Io on CLI-RSSI measurement resource	dBm/95.04 MHz	1	-81.01	-70.01
Io on CLI-RSSI measurement resource	dBm/1.08 MHz	1	-100.46	-89.46
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.				

Table A.5.6.4.2.2-4: CLI-RSSI measurement resource configuration for measurement reporting

	Field	CLI-RSSIConf.1
RSSI-Resource	rssi-ResourceId	0
	rssi-SCS	120
	startPRB	0
	nrofPRBs	66
	startPosition	3
	nrofSymbols	11
	rssi-PeriodicityAndOffset	sl160, 25

A.5.6.4.2.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 20 ms from the beginning of time period T2. The nominal RSSI used to evaluate the requirement shall be based on Io.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.5 Measurements with autonomous gaps

A.5.6.5.1 EN-DC inter-frequency CGI identification of NR neighbor cell in FR2

A.5.6.5.1.1 Test Purpose and Environment

This test is to verify the requirement for identification of a new CGI of NR cell with autonomous gaps in clause 9.11.

In this test, there are three cells: LTE Cell 1 as PCell on E-UTRA RF channel 1, NR Cell 2 as PSCell in FR2 on NR RF channel 1 and NR Cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.5.6.5.1.1-1, A.5.6.5.1.1-2, and A.5.6.5.1.1-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 3 Starting T2, Cell 3 becomes detectable and the UE is expected to detect and send a measurement report with SSB index. In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. Gap pattern configuration with id #0 is configured before T2 begins to enable inter-frequency monitoring.

A RRC message implying SI reading with autonomous gap shall be sent to the UE during period T2, within 3 s after the UE has reported Event A3. The RRC message shall create a measurement report configuration with *reportCGI* and *useAutonomousGaps-r16* setup. The start of T3 is the instant when the last TTI containing the RRC message implying SI reading is sent to the UE. Measurement gaps shall be deconfigured before the start of T3.

PDCCHs indicating new transmissions shall be sent continuously to ensure that the UE would have ACK/NACK sending during identifying a new CGI of NR cell.

The configuration of LTE Cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.5.1.1-1.

Table A.5.6.5.1.1-1 Supported test configurations for EN-DC inter-frequency CGI identification of NR neighbor cell in FR2

Config	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.5.6.5.1.1-2: General test parameters for EN-DC inter-frequency CGI identification of NR neighbor cell in FR2

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		Config 1,2	1	One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR Cell 2 (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 3	NR Cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	39	
SMTC-SSB parameters		Config 1,2	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1,2	-15	
Hysteresis	dB	Config 1,2	0	
CP length		Config 1,2	Normal	
TimeToTrigger	s	Config 1,2	0	
Filter coefficient		Config 1,2	0	L3 filtering is not used
DRX		Config 1,2	OFF	DRX is not used
Time offset between PCell and PSCell		Config 1,2	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3μs	Synchronous cells.
T1	s	Config 1,2	5	
T2	s	Config 1,2	7 for PC1; 4.5 for other PC	
T3	s	Config 1,2	5	

Table A.5.6.5.1.1-3: Cell specific test parameters for EN-DC inter-frequency CGI identification of NR neighbor cell in FR2

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2, T3	T1	T2, T3
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP BW	MHz	Config 1,2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	DLBWP.0.1			
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
RMSI scheduling periodicity	ms	Config 1,2	NA		20	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
TCI configuration		Config 1,2	CSI-RS.Config.0		NA	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						

Parameter	Unit	Test	Cell 2	Cell 3
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation Condition		Config 1,2	AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Table A.5.6.5.1.1-4: OTA cell specific test parameters for EN-DC inter-frequency CGI identification of NR neighbor cell in FR2

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2, T3	T1	T2, T3
AoA setup		Config 1,2	Setup 1 defined in A.3.15.1			
Assumption for UE beams[Note 4]		Config 1,2	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	Config 1,2	4	4	-Infinity	-3
N_{oc} [Note 2]	dBm/15 KHz	Config 1,2	-102			
N_{oc} [Note 2]	dBm/SCS	Config 1, 2	-93			
SS-RSRP	dBm/SCS	Config 1, 2	-89	-89	-Infinity	-96
$\hat{E}_s/N_{oc}$	dB	Config 1,2	4	4	-Infinity	-3
Io	dBm/95.04 MHz	Config 1,2	-58.56		-62.25	
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation. NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone						

A.5.6.5.1.2 Test Requirements

The UE shall transmit a measurement report containing the cell global identifier of Cell 3 within 660 milliseconds from the start of T3.

Test requirement = RRC Procedure delay + $T_{identify_CGI}$ + additional margin for FR2 + TTI insertion uncertainty

= 15 + (25*20 + 6*20) + 20 + 2 ms from the start of T3

= 657 ms, allow 660 ms.

The UE shall be scheduled continuously throughout the test, and from the start of T3 until 660 ms the number of interrupted slots shall not exceed the allowed number as defined in clause 8.2.1.2.16.

The maximum number of interrupted slots allowed is 25*48 + 6*49 = 1494.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.6 L1-SINR measurement for beam reporting

A.5.6.6.1 L1-SINR measurement with CSI-RS based CMR and no dedicated IMR configured when DRX is used

A.5.6.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements in clause 9.8.4.1, with the testing configurations for NR cells in table A.5.6.6.1.1-1.

Table A.5.6.6.1.1-1: Applicable NR configurations for FR2 CSI-RS based L1-SINR test

Config	Description
1	LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.5.6.6.1.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.6.6.1.2-1 and table A.5.6.6.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1- SINR on aperiodic CSI-RS resources. After 480 ms from the beginning of the test, the DCI trigger comes in slot 8 of a frame and UE provides the report back based on the reporting configuration as defined in table A.5.6.6.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.5.6.6.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2
CSI-RS configuration	1~2		CSI-RS.3.3 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		DRX.3
reportConfigType	1~2		aperiodic
reportQuantity-r16	1~2		*cri-SINR-r16*
Number of reported RS	1~2		2
qcl-Info	1~2		SSB#0 for resource#0
			SSB#1 for resource#1

Parameter	Config	Unit	Value
reportSlotOffsetList	1~2		26
Propagation condition	1~2		AWGN
T1	1~2	s	5
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.6.1.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1~2		Setup 1 according to A.3.15.1	
Beam assumption Note 4	1~2		Rough	
N_{oc} Note1	1~2	dBm/15 kHz	-105	
N_{oc} Note1	1~2	dBm/SSB SCS	-95.97	
$\hat{E}_s / I_{ot}$	1~2	dB	0	9
CSI-RS RSRP Note2	1~2	dBm/SSB SCS	-95.97	-86.97
Io Note2	1~2	dBm/95.04 MHz	-63.97	-57.47
$\hat{E}_s / N_{oc}$	1~2	dB	0	9
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.5.6.6.1.3 Test Requirements

After 480 ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.28.1.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.6.2 L1-SINR measurement with SSB based CMR and dedicated IMR when DRX is not used

A.5.6.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements in clause 9.8.4.2, with the testing configurations for NR cells in table A.5.6.6.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.5.6.6.2.1-1: Applicable NR configurations for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.5.6.6.2.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.6.6.2.2-1 and table A.5.6.6.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the SSBs and the associated CSI-RS resources, and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD measurements based on the SSBs, and UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-RS resources as IMR.

Table A.5.6.6.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1~4		TDD
TDD Configuration	1~4		TDDConf.3.1
$BW_{channel}$	1~4	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1~4		SR.3.1 TDD
RMSI CORESET Reference Channel	1~4		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~4		CCR.3.1 TDD
SSB configuration	1,2		SSB.1 FR2
	3,4		SSB.2 FR2
CSI-RS configuration	1~4		CSI-RS.3.1A TDD
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~4		SMTC.1
TRS Configuration	1~4		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2
DRX configuration	1~4		off
reportConfigType	1~4		periodic
reportQuantity-r16	1~4		ssb-Index-SINR-r16
Number of reported RS	1~4		2
L1-SINR reporting period	1~4	slot	640
T1	1~4	s	5
T2	1~4	s	3
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.6.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam assumption Note 4			Rough			
N_{oc} Note2	1~4	dBm/15 kHz	-105			
N_{oc} Note2	1,2	dBm/SSB SCS	-96			
	3,4		-93			
$\hat{E}_s/I_{ot}$	1~4	dB	0	0	-Infinity	9
SSB RSRP Note3	1,2	dBm/SSB SCS	-96	-96	-Infinity	-87
	3,4		-93	-93	-Infinity	-84
Io Note3	1,2	dBm/95.04 MHz	-63.97	-63.97	-67	-57.5
	3,4		-63.97	-63.97	-67	-57.5
$\hat{E}_s/N_{oc}$	1~4	dB	0	0	-Infinity	9

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.6.6.2.2-3: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0		CSI-RS#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam assumption Note 4			Rough			
N_{oc} Note2	1~4	dBm/15 kHz	-105			
N_{oc} Note2	1~4	dBm/CSI-RS SCS	-96			
$\hat{E}_s/I_{ot}$	1~4	dB	0	0	-Infinity	9
$\hat{E}_s/N_{oc}$	1~4	dB	0	0	-Infinity	9
CSI-RS RSRP Note3	1~4	dBm/ CSI-RS SCS	-96	-96	-Infinity	-87
Io Note3	1~4	dBm/95.04 MHz	-63.97	-63.97	-67	-57.5

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.6.2.3 Test Requirements

The UE shall send L1-SINR report every 640 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-SINR report including the results for both SSB#0+CSI-RS#0 and SSB#1+CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.28.2, where X is

- 2880 for UE supporting power class 1
- 1920 for UE supporting power class 2, 3 or 4.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.6.3 L1-SINR measurement with CSI-RS based CMR and dedicated IMR configured when DRX is not used

A.5.6.6.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements with CSI-RS based CMR and dedicated IMR cofigured in clause 9.8.4.3, with the testing configurations for NR cells in table A.5.6.6.3.1-1.

Table A.5.6.6.3.1-1: Applicable NR configurations for FR2 L1-SINR test with CMR and dedicated IMR

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.5.6.6.3.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.6.6.3.2-1 and table A.5.6.6.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the configured CSI-RS as CMR and an associated CSI-IM as IMR, and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources and the associated IMR. UE is also configured to measure L1-SINR based on SSB. After 480 ms from the beginning of the test, the DCI trigger comes in slot 8 of a frame and UE provides the report back based on the reporting configuration as defined in table A.5.6.6.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs, and UE is configured to perform L1-SINR measurement based on the CSI-RS as CMR and the CSI-IM as IMR.

Table A.5.6.6.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2
CSI-RS configuration	1~2		CSI-RS.3.3 TDD
CSI-IM configuration	1~2		CSI-IM.3.2 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		Off
reportConfigType	1~2		aperiodic
reportQuantity-r16	1~2		cri-SINR-r16

Parameter	Config	Unit	Value
Number of reported RS	1~2		2
qcl-Info	1~2		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~2		26
T1	1~2	s	5
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.6.3.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1~2		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 3	1~2		Rough	
N_{oc} Note1	1~2	dBm/15 kHz	-105	
N_{oc} Note1	1~2	dBm/SSB SCS	-95.97	
$\hat{E}_s / I_{ot}$	1~2	dB	0	9
CSI-RS RSRP Note2	1~2	dBm/SSB SCS	-95.97	-86.97
Io Note2	1~2	dBm/95.04 MHz	-63.97	-57.47
$\hat{E}_s / N_{oc}$	1~2	dB	0	9
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.5.6.6.3.3 Test Requirements

After 480 ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 as CMR + CSI-IM#0 as IMR and CSI-RS#1 as CMR + CSI-IM#1 as IMR while meeting the accuracy requirements defined in clause 10.1.28.3. The reported L1-SINR value shall consider the Rx antenna gain in the range from -10 to +20 dB which is referred to Table B.2.1.5.1-1 when calculated.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.7 CSI-RS based Intra-frequency Measurements

A.5.6.7.1 EN-DC event triggered reporting test without gap under non-DRX

A.5.6.7.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell identification requirements in clause 9.10.2. Supported test configurations are shown in table A.5.6.7.1.1-1.

Table A.5.6.7.1.1-1: supported test configurations

Configuration	Description
1	LTE FDD, 120 kHz SSB SCS, 120Khz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 120Khz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.5.6.7.1.1-2, A.5.6.7.1.1-3 and A.5.6.7.1.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

Table A.5.6.7.1.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1,2	E-UTRAN PCell (Cell 1) PSCell (Cell 2)	
Neighbour cell		1,2	Cell 3	Cell to be identified.
RF Channel Number		1,2	1: Cell 1 2: Cell 2 and Cell 3	One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
SMTC configuration		1,2	SMTC.1	
A3-Offset	dB	1,2	-6	
CP length		1,2	Normal	
Hysteresis	dB	1,2	0	
Time To Trigger	s	1,2	0	
Filter coefficient		1,2	0	L3 filtering is not used
DRX		1,2	OFF	
Time offset between Cell 1 and Cell 2	μs	1,2	3	Synchronous EN-DC
Time offset between Cell 2 and Cell 3	μs	1,2	0.58	The timing of Cell 3 is CP later than the timing of Cell 2.
T1	s	1,2	5	
T2	s	1,2	5	

Table A.5.6.7.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1,2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1,2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Intial BWP configuration		1,2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1,2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1,2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1,2	SSB		SSB	
PDSCH RMC configuration		1,2	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1,2	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1,2	CCR.3.1 TDD		CCR.3.1 TDD	
OCNG Patterns		1,2	OP.1		OP.1	
TRS configuration		1,2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		1,2	TCI.State.2		N/A	
SMTC configuration		1, 2	SMTC.1		SMTC.1	
SSB configuration		1,2	SSB.3 FR2		SSB.7 FR2	

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
CSI-RS RRM configuration		1,2	CSI-RS.RRM.FR2.1 TDD		CSI-RS.RRM.FR2.1 TDD except Associated SSB index = 1; slotConfig = ms20 (slot 2)	
Propagation Condition		1,2	AWGN			

Table A.5.6.7.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1,2	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Assumption for UE beams[Note 4]		1,2	Rough		Rough	
$\hat{E}_s/I_{ot}$ for SSB	dB	1,2	4	4	-Infinity	8
$\hat{E}_s/I_{ot}$ for CSI-RS	dB	1,2	4	4	-Infinity	8
N_{oc} [Note 2]	dBm/15 KHz	1,2	-102			
N_{oc} [Note 2]	dBm/SCS	1,2	-93			
SS-RSRP	dBm/SCS	1,2	-89	-89	-Infinity	-85
CSI-RSRP	dBm/SCS	1,2	-89	-89	-Infinity	-85
$\hat{E}_s/N_{oc}$ for SSB	dB	1,2	4	4	-Infinity	8
$\hat{E}_s/N_{oc}$ for CSI-RS	dB	1,2	4	4	-Infinity	8
Io	dBm/95.04 MHz	1,2	-58.56		-55.38	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.5.6.7.1.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 3.2 s for a UE supporting power class 1,
- 2.4 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test in order to detect associated SSB for the CSI-RS resource of Cell 3.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.8 CSI-RS based Inter-frequency Measurements

A.5.6.8.1 EN-DC event triggered reporting tests for NR FR2 cell when DRX is used

A.5.6.8.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.10.3.

In this test, there are three cells: LTE Cell 1 as PCell on E-UTRA RF channel 1, NR Cell 2 as PSCell in FR2 on NR RF channel 1 and NR Cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.5.6.8.1.1-1, A.5.6.8.1.1-2, and A.5.6.8.1.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in table A.5.6.8.1.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in table A. 5.6.5.1.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #13, it is only required to pass test2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

The configuration of LTE Cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.8.1.1-1.

Table A.5.6.8.1.1-1 EN-DC event triggered reporting tests for FR2-FR2

Config	Description
1	LTE FDD, 120 kHz SSB SCS, 120 kHz CSI-RS SCS,100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.8.1.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2	1		One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2	1, 2		Two FR2 NR carrier frequencies is used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR Cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 3		NR Cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	39	39	
SMTC-SSB parameters		Config 1,2	SSB.3 FR2		As specified in clause A.3.10.2
A3-Offset	dB	Config 1,2	-6		
Hysteresis	dB	Config 1,2	0		
CP length		Config 1,2	Normal		
TimeToTrigger	s	Config 1,2	0		
Filter coefficient		Config 1,2	0		L3 filtering is not used
DRX		Config 1,2	DRX.1		As specified in clause A.3.3.3
Time offset between PCell and PSCell	μs	Config 1,2	3		Synchronous EN-DC

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Time offset between serving and neighbour cells	μs	Config 1,2	0.58		The timing of Cell 3 is CP later than the timing of Cell 2.
T1	s	Config 1,2	5		
T2	s	Config 1,2	21 for PC1; 13 for other PC	21 for PC1; 13 for other PC	

Table A.5.6.8.1.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 1 as specified in clause A.3.15			
Assumption for UE beams Note 7		Config 1,2	Rough		Rough	
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2	10: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP BW	MHz	Config 1,2	10: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	ULBWP.0.1			
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
TCI configuration		Config 1,2	CSI-RS.Config.0		NA	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.1		SMTC.1	
CSI-RS RRM configuration		Config 1,2	CSI-RS.RRM.FR2.1 TDD		CSI-RS.RRM.FR2.1 TDD	
firstOFDMSymbolInTimeDomain		Config 1,2	7		12	
N_{oc} Note2	dBm/15 kHz Note5		-104.7		-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1,2	-95.7		-95.7	
CSI-RSRP Note 3	dBm/SCS Note5	Config 1,2	-89.7	-89.7	-Infinity	-86.7
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s/I_{ot}$ for SSB	dB	Config 1,2	6	6	-Infinity	9
$\hat{E}_s/I_{ot}$ for CSI-RS	dB	Config 1,2	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$ for SSB	dB	Config 1,2	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$ for CSI-RS	dB	Config 1,2	6	6	-Infinity	9
Io Note3	dBm/95.04 MHz Note5	Config 1,2	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1,2,3,4,5,6	AWGN			

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP, CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.5.6.8.1.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

20160 ms for UE supporting power class 1, or

12480 ms for UE supporting other power class.

The UE is required to read the neighbour cell SSB index in this test in order to detect associated SSB for the CSI-RS resource of Cell 3.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.7 Measurement Performance requirements

Unless explicitly stated otherwise:

- Reported measurements shall be within defined range of accuracy limits defined in clause 10 for at least 90 % of the reported cases. If multiple measurement performance requirements are verified in the same test, the reported measurements for each requirement shall be within defined range of accuracy limits of the corresponding requirement defined in clause 10 for at least 90 % of the reported cases.
- Measurements are performed in RRC_CONNECTED state.
- The reference channels assume transmission of PDSCH with a maximum number of 5 HARQ transmissions unless otherwise specified.

A.5.7.1 SS-RSRP

A.5.7.1.1 EN-DC intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.5.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.3.1.1 and 10.1.3.1.2 for intra-frequency measurements.

A.5.7.1.1.2 Test parameters

In this set of test cases, all NR cells are on the same carrier frequency. Supported test configurations are shown in table A.5.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in table A.5.7.1.1.2-2 and A.5.7.1.1.2-3. The E-UTRA PCell is configured as specified in clause A.3.7.2.2. In all test cases, Cell 1 is the PCell, Cell 2 is the PSCell and Cell 3 is the target cell. The test consists of two time phases T1 and T2.

Table A.5.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Configuration	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.5.7.1.1.2-2: SS-RSRP Intra frequency general test parameters

Parameter[Note 5]		Unit	T1		T2	
			Cell 2	Cell 3	Cell 2	Cell 3
Physical cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode			TDD		TDD	
TDD configuration			TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			24		24	
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
TRS configuration			TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state			TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel			SR.3. 2 TDD	-	SR.3. 2 TDD	-
RMSI CORESET Reference Channel			CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Reference Channel			CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns			OP.3	OP.3	OP.3	OP.3
SSB configuration			SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration			SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 2		µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing		kHz	120	120	120	120
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS[Note 1]						
EPRE ratio of OCNG to OCNG DMRS [Note 1]						
Propagation conditions			AWGN		AWGN	
Antenna configuration			1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: All parameters apply for configuration 1 and 2
NOTE 6: Void

Table A.5.7.1.1.2-3: SS-RSRP Intra frequency OTA related test parameters

Parameter	Unit	T1		T2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 8		Rough			
N_{oc} Note1	dBm/15 kHz Note4	-91.6		N/A	
N_{oc} Note1	dBm/SCS Note4	-82.6		N/A	
$\hat{E}_s / N_{oc}$	dB	6.0	1.0	N/A	N/A
E_s	dBm/SCS Note4			(Table B.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2-2 Rx Beam Peak +2.1 dB)
SSB_RP Note2	dBm/SCS	-76.6	-81.6	(Table B.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2-2 Rx Beam Peak +2.1 dB)
$\hat{E}_s / I_{ot\ BB}$ Note6	dB	2.44	-5.98	-5.98	-5.98
Io Note2	dBm/95.04 MHz Note4	-50.05		(Table B.2.2-2 Rx Beam Peak +29.70 dB)	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, Es/Iot, Es in test 1 and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: All parameters apply for configurations 1 and 2
NOTE 8: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.3.1.1 and relative accuracy requirements in clause 10.1.3.1.2. The following requirements are to be verified:

During T1:

Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.5.7.1.1.3-1.

Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3.1.2-1.

During T2:

Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.5.7.1.1.3-1.

Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3.1.2-1.

During T1 and T2:

Relative accuracy of Cell 2 during T2 compared with Cell 2 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3.1.2-1

Relative accuracy of Cell 3 during T2 compared with Cell 3 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3.1.2-1.

Table A.5.7.1.1.3-1: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 2	$SSB_RP2 - \delta + G_{min} \leq$ Reported RSRP(dBm) $\leq SSB_RP2 + \delta + G_{max}$
Cell 3	$SSB_RP3 - \delta + G_{min} \leq$ Reported RSRP(dBm) $\leq SSB_RP3 + \delta + G_{max}$
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.3.1.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.5.7.1.2 EN-DC inter-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.5.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.5.1.1 and 10.1.5.1.2 for inter-frequency measurements with the testing configurations for NR cells in table A.5.7.1.2.1-1.

Table A.5.7.1.2.1-1: Applicable NR configurations for FR2 inter-frequency SS-RSRP accuracy test

Configuration	Description
1	FDD LTE PCell, cells 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, cells 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	FDD LTE PCell, cells 2&3 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	TDD LTE PCell, cells 2&3 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

A.5.7.1.2.2 Test parameters

In this set of test cases, there are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.5.7.1.2.2-1 and table A.5.7.1.2.2-2 below. Both absolute and relative accuracy of RSRP intrer-frequency measurements are tested by using the parameters in table A.5.7.1.2.2-1 and table A.5.7.1.2.2-2. The inter-frequency measurements are supported by a measurement gap.

Table A.5.7.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN	1~4		freq1	freq2	freq1	freq2
$BW_{channel}$	1~4		100: $N_{PRB,c} = 66$		100: $N_{PRB,c} = 66$	
Data PRBs allocated	1,2		24		24	
	3,4		48		48	
Duplex mode	1~4		TDD		TDD	
TDD configuration	1~4		TDDConf.3.1		TDDConf.3.1	
PDSCH Reference measurement channel	1,2		SR.3. 2 TDD	-	SR.3. 2 TDD	-
	3,4		SR.3.3 TDD		SR.3.3 TDD	
RMSI CORESET Reference Channel	1,2		CR.3.1 TDD	-	CR.3.1 TDD	-
	3,4		CR.3.2 TDD		CR.3.2 TDD	
Dedicated CORESET Reference Channel	1,2		CCR.3.1 TDD	-	CCR.3.1 TDD	-
	3,4		CCR.3.7 TDD		CCR.3.7 TDD	

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB configuration	1,2		SSB.3 FR2		SSB.3 FR2	
	3,4		SSB.4 FR2		SSB.4 FR2	
PDSCH/PDCCH subcarrier spacing	1~4	kHz	120		120	
OCNG Patterns	1~4		OP.3		OP.3	
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1~4		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2		TCI.State.2	
SMTC configuration	1~4		SMTC.1		SMTC.1	
Time offset between Cell 2 and Cell 3	1~4	µs	3		3	
EPRE ratio of PSS to SSS	1~4	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition	1~4	-	AWGN	AWGN	AWGN	AWGN
Antenna configuration	1~4	-	1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Void						

Table A.5.7.1.2.2-2: SS-RSRP inter frequency OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration	1~4		Setup 4b according to clause A.3.15.4.2		Setup 4b according to clause A.3.15.4.2	
			AoA1 Spherical coverage	AoA2 Rx Beam Peak	AoA1 Spherical coverage	AoA2 Rx Beam Peak
Assumption for UE beams Note 7	1~4		Rough		Rough	
N_{oc} Note1	1, 2	dBm/15 kHz Note4	-90.6	-90.6	(Table B.2.3-2 Rx Beam Peak Note 8 +1.97 dB)	(Table B.2.3-2 Rx Beam Peak Note 8 -3.03 dB)
	3, 4		-93.7	-93.7		
N_{oc} Note1	1, 2	dBm/SCS Note4	-81.6	-81.6	(Table B.2.3-2 Rx Beam Peak Note 8 +11.0 dB)	(Table B.2.3-2 Rx Beam Peak Note 8 +6.0 dB)
	3, 4		-81.7	-81.7	(Table B.2.3-2 Rx Beam Peak Note 8 +14.0 dB)	(Table B.2.3-2 Rx Beam Peak Note 8 +9.0 dB)
$\hat{E}_s / N_{oc}$	1~4	dB	6.0	6.0	17.0	-1.0
SSB_RP Note2	1, 2	dBm/SCS	-75.6	-75.6	(Table B.2.3-2 Rx Beam Peak Note 8 +28.0 dB)	(Table B.2.3-2 Rx Beam Peak Note 8 +5.0 dB)
	3, 4		-75.7	-75.7	(Table B.2.3-2 Rx Beam	(Table B.2.3-2 Rx Beam

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
					Peak[Note 8] +31.0 dB)	Peak[Note 8] +8.0 dB)
($SSB_RP_{Cell\ 2}$ – $SSB_RP_{Cell\ 3}$)	1~4	dB	0		23.00	
$\hat{E}_s / I_{ot\ BB}$[Note6]	1, 2	dB	5.26	5.96	9.53	-3.46
	3, 4		4. 61	5.91		
Io[Note2]	1, 2	dBm/95.04 MHz [Note4]	-50.00	-50.00	(Table B.2.3-2 Rx Beam Peak[Note 8] +52.68 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +33.13 dB)
	3, 4		-50.09	-50.09	(Table B.2.3-2 Rx Beam Peak[Note 8] +55.69 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +36.14 dB)
($Io_{freq\ 1}$ – $Io_{freq\ 2}$)	1~4	dB	0		19.55	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, Es/Iot, Io, ($SSB_RP_{Cell\ 3}$ – $SSB_RP_{Cell\ 2}$) and ($Io_{freq\ 2}$ – $Io_{freq\ 1}$) levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P or ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: The value in table B.2.3-2 is the Minimum SSB_RP for SCS_{SSB} = 120 kHz, selected according to the operating band of Cell 3 and UE power class, without $\Delta MB_{P,n}$ adjustment.

A.5.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil the absolute requirements in clause 10.1.5.1.1 and the relative requirements in clause 10.1.5.1.2.

Test 1:

Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.5.7.1.2.3-1.

Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in A.5.7.1.2.3-2.

Test 2:

Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.5.7.1.2.3-1.

Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in A.5.7.1.2.3-2.

Table A.5.7.1.2.3-1: SS-RSRP absolute accuracy test requirement

	Test requirement [Notes1,2,3,4]
Cell 2	$SSB_RP2 - \delta + G_{min} + X \le$ Reported RSRP(dBm) $\le SSB_RP2 + \delta + G_{max}$
Cell 3	$SSB_RP3 - \delta + G_{min} \le$ Reported RSRP(dBm) $\le SSB_RP3 + \delta + G_{max}$

NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.5.1.1-1, selected according to the Io used in the test
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class

NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.

Table A.5.7.1.2.3-2: SS-RSRP relative accuracy test requirement

	Test requirement Notes1,2,3,4, 5, 6, 7
Cell 3 – Cell 2	SSB_RP3 - SSB_RP2 -δ - D - G_{inter} ≤ Reported RSRP(dB) ≤ SSB_RP3 - SSB_RP2 +δ + G_{inter} –(X) + E

NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration
NOTE 2: δ is the RSRP relative accuracy requirement from Table 10.1.5.1.2-1
NOTE 3: Void
NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.
NOTE 5: D is the margin due to mis-alignment between fine beam and rough beam. D is the Rough Beam gain reduction in Rx beam peak direction from Table B.2.1.5.3-1, selected according to the UE power class. D is always a positive value.
NOTE 6: G_{inter} is the margin due to different antenna gain caused by frequency separation. G_{inter} is from Table B.2.1.5.2-1, selected according to the UE power class, and is always a positive value.
NOTE 7: E = 3 (dB) is an additional margin to account for the actual gain difference between peak direction and spherical coverage using rough beams.

A.5.7.1.3 EN-DC inter-frequency measurement accuracy with FR1 serving cell and FR2 target cell

A.5.7.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.5.1.1 for inter-frequency measurements with the testing configurations in table A.5.7.1.3.1-1.

Table A.5.7.1.3.1-1: Applicable NR configurations for FR2 inter-frequency SS-RSRP accuracy test

Config	Description of serving cell	Description of target cell
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

A.5.7.1.3.2 Test parameters

In this set of test cases there are three cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.5.7.1.3.2-1 and table A.5.7.1.3.2-2 below. Absolute accuracy of RSRP inter-frequency measurements are tested by using the parameters in table A.5.7.1.3.2-1 and table A.5.7.1.3.2-2. The inter-frequency measurements are supported by a measurement gap.

Table A.5.7.1.3.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN	1~6		freq1	freq2	freq1	freq2
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52	100: $N_{PRB,c}$ = 66	10: $N_{PRB,c}$ = 52	100: $N_{PRB,c}$ = 66
	2,5		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	3,6		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
Data PRBs allocated	1,2,4,5		52	24	52	66
	3,6		106		106	
Gap pattern ID			0		0	
Duplex mode	1,4		FDD	TDD	FDD	TDD
	2,5		TDD		TDD	
	3,6		TDD		TDD	
TDD configuration	1,4		N/A	TDDConf.3.1	N/A	TDDConf.3.1
	2,5		TDDConf.1.1		TDDConf.1.1	
	3,6		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	2,5		SR.1.1 TDD		SR.1.1 TDD	
	3,6		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
	2,5		CR.1.1 TDD	-	CR.1.1 TDD	-
	3,6		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2,5		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3,6		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1,4		SSB.1 FR1	SSB.3 FR2	SSB.1 FR1	SSB.3 FR2
	2,5		SSB.1 FR1		SSB.1 FR1	
	3,6		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~6		OP.1	OP.3	OP.1	OP.1
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~6		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1~6		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1~6		TCI.State.2		TCI.State.2	
SMTC configuration	1~6		SMTC.1		SMTC.1	
Time offset between Cell 2 and Cell 3	1~6	µs	3		3	
EPRE ratio of PSS to SSS	1~6	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition	1~6	-	NA	AWGN	NA	AWGN
Antenna configuration	1~6	-	Link only, see clause A.3.7A	1x2	Link only, see clause A.3.7A	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void

Table A.5.7.1.3.2-2: SS-RSRP inter-frequency OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration according to clause A.3.15			NA	Setup 2b	NA	Setup 2b
Assumption for UE beams Note 4			N/A	Rough	N/A	Rough
N_{oc}	1~6	dBm/15 kHz	Link only, see clause A.3.7A	-90	Link only, see clause A.3.7A	NA
N_{oc}	1~6	dBm/SSB SCS		-80.97		NA
$\hat{E}_s / N_{oc}$	1~6	dB		5		NA
E_S	1~6	dBm/SCS				(Table B.2.3-2 Spherical coverage +1 dB)
SSB_RP Note1	1~6	dBm/SCS		-76.0		(Table B.2.3-2 Spherical coverage +1 dB)
$\hat{E}_s / I_{ot\ BB}$ Note6	1~6	dB		4.35		-3.81
Io Note1	1~6	dBm/ 95.04 MHz		-50.18		SSB_RP+28.98

NOTE 1: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 2: Void
NOTE 3: No additional noise is added by the test system in Test 2.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.5.7.1.3.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 3 shall fulfil the Absolute requirement in clause 10.1.5.1.1.

Test 1:

Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.5.7.1.3.3.

Test 2:

Absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.5.7.1.3.3.

Table A.5.7.1.3.3: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 3	SSB_RP2 -δ +Gmin +X ≤ Reported RSRP(dBm) ≤ SSB_RP2 +δ +Gmax

NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.5.1.1-1, selected according to the Io used in the test
NOTE 3: Gmin and Gmax are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class

NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.

A.5.7.2 SS-RSRQ

A.5.7.2.1 EN-DC Intra-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.5.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.8.1.1.

A.5.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A.5.7.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in table A.5.7.2.1.2-2 and table A.5.7.2.1.2-3. The configuration of Cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.5.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Configuration	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.5.7.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
Cell ID			489	0	489	0
SSB ARFCN			Freq1		Freq1	
Duplex mode			TDD		TDD	
TDD configuration			TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			66		66	
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
TRS configuration			TRS.2.1 TDD		TRS.2.1 TDD	
TCI state			TCI.State.0		TCI.State.0	
PDSCH Reference measurement channel			SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel			CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC			CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns			OP.1	OP.1	OP.1	OP.1
SMTC configuration			SMTC.1			
SSB configuration			SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing		kHz	120	120	120	120
SS-RSSI-Measurement			Not Applicable			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation condition		AWGN		AWGN	
Antenna Configuration		1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void

Table A.5.7.2.1.2-3: SS-RSRQ Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 9		Rough			
N_{oc} Note1	dBm/15 kHz Note4	-95		-95	
N_{oc} Note1	dBm/SCS Note3	-86		-86	
$\hat{E}_s / N_{oc}$	dB	3		3	
SSB_RP Note2	dBm/SCS Note4	-83	-83	-89	-89
SS-RSRQ Note2	dB	-14.77	-14.77	-16.81	-16.81
$\hat{E}_s / I_{ot}$	dB	-1.76	-1.76	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-50		-54	Io Note2

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRQ, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Void
NOTE 7: Void
NOTE 8: Void
NOTE 9: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.2.1.3 Test Requirements

The SS-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal SS-RSRQ+2.5 dB to Nominal SS-RSRQ -2.5 dB and the SS-RSRQ measurement accuracy in test 2 shall be within the range Nominal SS-RSRQ +3.5 dB to Nominal SS-RSRQ -3.5 dB according to the requirements in clause 10.1.8.1.1. Nominal SS-RSRQ is the value shown in table A.5.7.2.1.2-3.

A.5.7.2.2 EN-DC Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.5.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.9.1.1 and 10.1.9.1.2 for inter-frequency measurement.

A.5.7.2.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.5.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test setup in table A.5.7.2.2.2-2 and table A.5.7.2.2.2-3. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1.

Table A.5.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.5.7.2.2.2-2: SS-RSRQ Inter frequency general test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN			Freq1	Freq2	Freq1	Freq2
Duplex mode			TDD		TDD	
TDD configuration			TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
TRS configuration			TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state			TCI.State.0	-	TCI.State.0	-
Data PRBs allocated			66		66	
PDSCH Reference measurement channel			SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel			CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns			OP.1	OP.1	OP.1	OP.1
SSB configuration			SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration			SMTC.1	SMTC.1	SMTC.1	SMTC.1
PDSCH/PDCCH subcarrier spacing		kHz	120	120	120	120
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation conditions			AWGN	AWGN	AWGN	AWGN
Antenna configuration			1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void

Table A.5.7.2.2.2-3: SS-RSRQ Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
AoA setup		Setup 1 in clause A.3.15		Setup 1 in clause A.3.15	
Assumption for UE beams Note 8		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-94.03		-94.03	
N_{oc} Note1	dBm/SCS Note3	-85.0		-85.0	
$\hat{E}_s / N_{oc}$	dB	-1.75		-1.75	
SSB_RP Note2	dBm/SCS Note4	-86.75	-86.75	-88	-88
SS-RSRQ Note2	dB	-14.75	-14.75	-15.56	-15.56
$\hat{E}_s / I_{ot}$	dB	-1.75	-1.75	-3	-3
Io Note2	dBm/95.04 MHz Note4	-53.8	-53.8	-54.25	-54.25

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRQ, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Void
NOTE 7: Void
NOTE 8: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.2.2.3 Test Requirements

The SS-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal SS-RSRQ+2.5 dB to Nominal SSRQ-2.5 dB and the SS-RSRQ measurement accuracy in test 2 shall be within the range Nominal SS-RSRQ+3.5 dB to Nominal SS-RSRQ-3.5 dB according to the requirements in clause 10.1.10.1.1.

The SS-RSRQ relative measurement accuracy shall fulfil the requirements in clause 10.1.10.1.2.

A.5.7.3 SS-SINR

A.5.7.3.1 EN-DC Intra-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.5.7.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.13.1.1.

A.5.7.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A.5.7.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is test by using the parameters in table A.5.7.3.1.2-2 and table A.5.7.3.1.2-3. The configuration of Cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.5.7.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Configuration	Description

1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.5.7.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Cell ID		489	0	489	0
SSB ARFCN		Freq2		Freq2	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		66		66	
Downlink initial BWP configuration		DLBWP.0.1			
Downlink dedicated BWP configuration		DLBWP.1.1			
Uplink initial BWP configuration		ULBWP.0.1			
Uplink dedicated BWP configuration		ULBWP.1.1			
DRX cycle configuration	ms	Not applicable			
TRS configuration		TRS.2.1 TDD			
TCI state		TCI.State.0			
PDSCH Reference measurement channel		SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated RMSI CORESET Reference Channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1			
SSB configuration		SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
SS-RSSI-Measurement		Not Applicable			
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN		AWGN	
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Void NOTE 3: Void NOTE 4: Void					

Table A.5.7.3.1.2-3: SS-SINR Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 9		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-105		-105	
N_{oc} Note1	dBm/SCS Note3	-96		-96	
$\hat{E}_s / N_{oc}$	dB	4.54		2.66	
SS-RSRP Note2	dBm/SCS Note4	-91.46	-93.34	-99	-99

SS-SINR Note2	dB	0	-3.2	-4.76	-4.76
$\hat{E}_s / I_{ot}$	dB	0	-3.2	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-59.43		-64	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-SINR, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Void
NOTE 7: Void
NOTE 8: Void
NOTE 9: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.3.1.3 Test Requirements

The SS-SINR absolute measurement accuracy in test 1 shall be within the range Nominal SS-SINR+3B to Nominal SS-SINR -3 dB and the SS-SINR measurement accuracy in test 2 shall be within the range Nominal SS-SINR +3.5 dB to Nominal SS-SINR -3.5 dB according to the requirements in clause 10.1.10.13.1. Nominal SS-SINR is the value shown in table A.5.7.3.1.2-3.

A.5.7.3.2 EN-DC Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.5.7.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.15.1.1 and 10.1.15.1.2 for inter-frequency measurement.

A.5.7.3.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.5.7.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test setup in table A.5.7.3.2.2-2 and table A.5.7.3.2.2-3. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.5.7.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.5.7.3.2.2-2: SS-SINR Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		Freq1	Freq2	Freq1	Freq2	Freq1	Freq2
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		66		66		66	
Downlink initial BWP configuration		DLBWP.0.1					
Downlink dedicated BWP configuration		DLBWP.1.1					
Uplink initial BWP configuration		ULBWP.0.1					

Uplink dedicated BWP configuration		ULBWP.1.1					
DRX cycle configuration	ms	Not applicable					
TRS configuration		TRS.2.1 TDD					
TCI state		TCI.State.0					
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1	SMTC.1	SMTC.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
Propagation conditions		AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Void NOTE 3: Void NOTE 4: Void							

Table A.5.7.3.2.2-3: SS-SINR Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration	degrees	Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 10		Rough		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-105	-105	-105	-105	-105	-105
N_{oc} Note1	dBm/SCS Note3	-96	-96	-96	-96	-96	-96
$\hat{E}_s / N_{oc}$	dB	-0.5		-0.5		11	
SS-RSRP Note2	dBm/SCS Note4	-96.5	-96.5	-85	-85	-99	-99
SS-SINR Note2	dB	-0.5	-0.5	11	11	-3.0	-3.0
$\hat{E}_s / I_{ot}$	dB	-0.5	-0.5	11	11	-3.0	-3.0
Io Note2	dBm/95.04 MHz Note4	-69.3		-55.4		-65.24	

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 2: SS-SINR, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 3: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone							
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone							
NOTE 6: Void							
NOTE 7: Void							
NOTE 8: Void							
NOTE 9: Void							
NOTE 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation							

A.5.7.3.2.3 Test Requirements

The SS-SINR absolute measurement accuracy in test 1 shall be within the range Nominal SS-SINR+3 dB to Nominal SS-SINR -3 dB and the SS-SINR measurement accuracy in test 2 shall be within the range Nominal SS-SINR+3.5 dB to Nominal SS-SINR -3.5 dB according to the requirements in clause 10.1.15.1.1. Nominal SS-SINR is the value shown in table A.5.7.2.2.2-3

The SS-SINR relative measurement accuracy shall fulfil the requirements in clause 10.1.15.1.2.

A.5.7.4 L1-RSRP measurement for beam reporting

A.5.7.4.1 SSB based L1-RSRP measurement

A.5.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.5.2 and clause 10.1.20.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.5.7.4.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.5.7.4.1.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.5.7.4.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.7.4.1.2-1 and table A.5.7.4.1.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.5.7.4.1.2-1 and table A.5.7.4.1.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.5.7.4.1.2-1: FR2 SSB based L1-RSRP general test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~4		freq1	freq1
Duplex mode	1~4		TDD	TDD
TDD Configuration	1~4		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1~4	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~4		66	66
PDSCH Reference measurement channel	1.2		SR.3.2 TDD	SR.3.2 TDD
	3,4		SR.3.3 TDD	SR.3.3 TDD
RMSI CORESET Reference Channel	1,2		CR.3.1 TDD	CR.3.1 TDD
	3,4		CR.3.2 TDD	CR.3.2 TDD
Dedicated CORESET Reference Channel	1,2		CCR.3.1 TDD	CCR.3.1 TDD
	3,4		CCR.3.7 TDD	CCR.3.7 TDD
SSB configuration	1,2		SSB.1 FR2	SSB.1 FR2
	3,4		SSB.2 FR2	SSB.2 FR2
OCNG Patterns	1~4		OP.1	OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
TRS Configuration	1~4		TRS.2.1 TDD	TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2	TCI.State.2
SMTC configuration	1~4		SMTC.1	SMTC.1
reportConfigType	1~4		periodic	periodic
reportQuantity	1~4		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1~4		2	2
L1-RSRP reporting period	1~4		slot320	slot320
Propagation condition	1~4		AWGN	AWGN
Antenna configuration			1x2	1x2
EPRE ratio of PSS to SSS	1~4	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS[Note 1]				
EPRE ratio of OCNG to OCNG DMRS [Note 1]				

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Table A.5.7.4.1.2-2: FR2 SSB based L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 [NOTE 3]	
			SSB0	SSB1	SSB0	SSB1
Angle of arrival configuration			Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams[Note 4]			Rough		Rough	
N_{oc}	1~4	dBm/15 kHz	-100		n.a.	
N_{oc}	1,2	dBm/SSB SCS	-91		n.a.	
	3,4		-88		n.a.	
$\hat{E}_s / I_{ot}$	1~4	dB	10	-2	n.a.	
SSB_RP[Note1]	1,2	dBm/SCS	-81	-93	As in table B.2.4-2	
	3,4		-78	-90	As in table B.2.4-2	
Io[Note1]	1~4	dBm/ 95.04 MHz	-51.57		SSB_RP+28.98	

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			SSB0	SSB1	SSB0	SSB1
$\hat{E}_s / N_{oc}$	1~4	dB	10	-2	n.a.	
NOTE 1: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 2: Void NOTE 3: No additional noise is added by the test system in Test 2. NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.5.7.4.1.3 Test Requirements

After 320 ms from the beginning of the test, the L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 2 shall fulfil the requirements in clauses 10.1.20.1. The following requirements are to be verified:

For Test 1:

Absolute accuracy of SSB0. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.5.7.4.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.1.2-1.

For Test 2:

Absolute accuracy of SSB resource reported by UE in L1-RSRP report (SSB0 or SSB1). The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.5.7.4.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.1.2-1.

Table A.5.7.4.1.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
SSB0	$SSB_RP0 - \delta + G_{min} \le$ Reported RSRP(dBm) $\le SSB_RP0 + \delta + G_{max}$
SSB1	$SSB_RP1 - \delta + G_{min} \le$ Reported RSRP(dBm) $\le SSB_RP1 + \delta + G_{max}$
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the SSB n under consideration NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.1.1-1, selected according to the Io used in the test NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.5.7.4.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.5.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.5.3 and clause 10.1.20.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in table A.5.7.4.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.5.7.4.2.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.5.7.4.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.7.4.2.2-1 and table A.5.7.4.2.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.5.7.4.2.2-1 and table A.5.7.4.2.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.5.7.4.2.2-1: FR2 CSI-RS based L1-RSRP general test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~2		freq1	freq1
Duplex mode	1~2		TDD	TDD
TDD Configuration	1~2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2	SSB.1 FR2
OCNG Patterns	1~2		OP.1	OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
TRS Configuration	1~2		TRS.2.1 TDD	TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2	TCI.State.2
SMTC configuration	1~2		SMTC.1	SMTC.1
CSI-RS	1~2		CSI-RS.3.2 TDD	CSI-RS.3.2 TDD
reportConfigType	1~2		periodic	periodic
reportQuantity	1~2		cri-RSRP	cri-RSRP
Number of reported RS	1~2		2	2
L1-RSRP reporting period	1~2		slot320	slot320
Propagation condition	1~2		AWGN	AWGN
Antenna configutaion	1~2		1x2	1x2
EPRE ratio of PSS to SSS	1~2	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Table A.5.7.4.2.2-2: FR2 CSI-RS based L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			CSI-RS0	CSI-RS1	CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough		Rough	

N_{oc}	1~2	dBm/15 kHz	-100		n.a.
N_{oc}	1~2	dBm/SSB SCS	-91		n.a. n.a.
$\hat{E}_s / I_{ot}$	1~2	dB	10	-2	n.a.
CSI-RS-RSRP[Note1]	1~2	dBm/SCS	-81	-93	As in table B.2.4-2
Io[Note1]	1~2	dBm/ 95.04 MHz	-59.86		SS-RSRP+28.98
$\hat{E}_s / N_{oc}$	1~2	dB	-51.57	-2	n.a.

NOTE 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 3: No additional noise is added by the test system in Test 2.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.4.2.3 Test Requirements

After 320 ms from the beginning of the test, the L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 2 shall fulfil the requirements in clauses 10.1.20.2. The following requirements are to be verified:

For Test 1:

Absolute accuracy of CSI-RS0. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.5.7.4.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

For Test 2:

Absolute accuracy of CSI-RS resource reported by UE in L1-RSRP report (CSI-RS0 or CSI-RS1). The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.5.7.4.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

Table A.5.7.4.2.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement [Notes1,2,3]
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}

NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class

A.5.7.5 CLI measurements

A.5.7.5.1 EN-DC SRS-RSRP measurement accuracy with FR2 serving cell

A.5.7.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SRS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.22.1.1 with the testing configurations for NR cells in table A.5.7.5.1.1-1.

Table A.5.7.5.1.1-1: Applicable NR configurations for FR2 SRS-RSRP accuracy test

Config	Description
1	LTE FDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.5.7.5.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.7.5.1.2-1 and A.5.7.5.1.2-2 below. The test parameter for the (virtual) neighbor cell UE transmitting SRS are given in table A.5.7.5.1.2-2.

Before the test UE is configured to perform SRS-RSRP measurement. During the test, the test system transmits SRS resources for measurement in the DL slots according to the SRS configuration in table A.5.7.5.1.2-3. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

Table A.5.7.5.1.2-1: FR2 test parameters for SRS-RSRP accuracy

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~2		freq1	freq1
Duplex mode	1~2		TDD	TDD
TDD configuration	1~2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1~2		SSB.3 FR2	SSB.3 FR2
OCNG Patterns	1~2		OP.1	OP.1
TRS configuration	1~2		TRS.2.1 TDD	TRS.2.1 TDD
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1	SMTC.1
Time offset between DL from serving cell and SRS from test system	1~2	µs	10.76	10.67
EPRE ratio of PSS to SSS	1~2	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation condition	1~2		AWGN	AWGN
Antenna configuration	1~2		1x2	1x2
SRS configuration	1~2		SRSConf.1	SRSConf.1
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Table A.5.7.5.1.2-2: SRS-RSRP accuracy OTA related test parameters for PSCell and Neighbour cell UE in FR2

Parameter	Unit	Test 1	Test 2
Angle of arrival configuration		Setup 1 defined A.3.15.1	Setup 1 defined A.3.15.1
Beam assumption Note 5		Fine	Fine
N_{oc} Note1	dBm/15 kHz Note3	-100	N/A
N_{oc} Note1	dBm/SCS Note3	-91	N/A

Parameter	Unit	Test 1	Test 2
$\hat{E}_s / N_{oc}$	dB	2	N/A
E_S	dBm/SCS Note3		(Table B.2.7-2 Rx Beam Peak)
SRS_RP Note2	dBm/SCS	-89	(Table B.2.7-2 Rx Beam Peak)
$\hat{E}_s / I_{ot\ BB}$ Note4	dB	>1	1
Io Note2	dBm/95.04 MHz Note3	-57.89	(Table B.2.7-2 Rx Beam Peak +50.79 dB)

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 2 dB for UE multi-band relaxation factor $\sum MB_P$ from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

Table A.5.7.5.1.2-3: SRS configuration parameters for FR2 SRS-RSRP accuracy

	Field	SRSConf.1
SRS-ResourceSet	srs-ResourceSetId	0
	srs-ResourceIdList	0
	resourceType	Periodic
	Usage	Codebook
SRS-Resource	SRS-ResourceId	0
	nrofSRS-Ports	Port1
	transmissionComb	n2
	combOffset-n2	0
	cyclicShift-n2	0
	resourceMapping startPosition	0
	resourceMapping nrofSymbols	n1
	resourceMapping repetitionFactor	n1
	freqDomainPosition	0
	freqDomainShift	0
	freqHopping c-SRS	12
	freqHopping b-SRS	0
	freqHopping b-hop	0
	groupOrSequenceHopping	Neither
	resourceType	Periodic
	periodicityAndOffset-p	sl160,25
	sequenceId	0

A.5.7.5.1.3 Test Requirements

The SRS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.22.1.1. The following requirements are to be verified:

During Test 1:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table A.5.7.5.1.3-1.

During Test 2:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table A.5.7.5.1.3-1.

Table A.5.7.5.1.3-1: SRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
SRS	SRS_RP -δ +G_{min} ≤ Reported SRS-RSRP(dBm) ≤SRS_RP +δ +G_{max}
NOTE 1: SRS_RP is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.22.1.1-2, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.5.7.5.2 EN-DC CLI-RSSI measurement accuracy with FR2 serving cell

A.5.7.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CLI-RSSI measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.22.2.1 with the testing configurations for NR cells in table A.5.7.5.2.1-1.

Table A.5.7.5.2.1-1: Applicable NR configurations for FR2 CLI-RSSI accuracy test

Config	Description
1	LTE FDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.5.7.5.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.7.5.2.2-1 and A.5.7.5.2.2-2 below.

Before the test UE is configured to perform CLI-RSSI measurement. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI resource and on 2 data symbol before. The CLI-RSSI measurement resource configuration is in table A.5.7.5.2.2-3.

Table A.5.7.5.2.2-1: FR2 test parameters for CLI-RSSI accuracy

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~2		freq1	freq1
Duplex mode	1~2		TDD	TDD
TDD configuration	1~2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1~2		SSB.3 FR2	SSB.3 FR2
OCNG Patterns Note2	1~2		OP.1	OP.1
TRS configuration	1~2		TRS.2.1 TDD	TRS.2.1 TDD
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1	SMTC.1
Time offset between DL from serving cell and OCNG from test system	1~2	μs	10.67	10.67
EPRE ratio of PSS to SSS	1~2	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				

Parameter	Config	Unit	Test 1	Test 2
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation condition	1~2		AWGN	AWGN
Antenna configuration	1~2		1x2	1x2
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: OCNG is not transmitted in the CLI-RSSI measurement resources.				

Table A.5.7.5.2.2-2: CLI-RSSI accuracy OTA related test parameters

Parameter	Unit	Test 1	Test 2
Angle of arrival configuration		Setup 1 defined A.3.15.1	
Beam assumption Note 5		Fine	
N_{oc} on CLI-RSSI measurement resource Note1	dBm/15 kHz Note3	-100	
N_{oc} on CLI-RSSI measurement resource Note1	dBm/SCS Note3	-91	
$\hat{E}_s / N_{oc}$ on CLI-RSSI measurement resource	dB	-Infinity	
RSRP on CLI-RSSI measurement resource Note2	dBm/SCS	-Infinity	
$\hat{E}_s / I_{ot\ BB}$ on CLI-RSSI measurement resource Note4	dB	-Infinity	
Io on CLI-RSSI measurement resource Note2	dBm/95.04 MHz Note3	-62.01	
Io on CLI-RSSI measurement resource Note2	dBm/1.08 MHz	-81.46	
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 2 dB for UE multi-band relaxation factor $\sum MB_P$ from TS 38.101-2 [19] Table 6.2.1.3-4. NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.			

Table A.5.7.5.2.2-3: CLI-RSSI measurement resource configuration for FR2 CLI-RSSI accuracy

	Field	SRSConf.1
CLI-RSSI measurement resource	rssi-ResourceId	0
	rssi-SCS	120 kHz
	startPRB	0
	nrofPRBs	66
	startPosition	3
	nrofSymbols	11
	rssi-PeriodicityAndOffset	sl160, 25

A.5.7.5.2.3 Test Requirements

The CLI-RSSI measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.22.2.1. The following requirements are to be verified:

During Test 1:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table A.5.7.5.2.3-1.

During Test 2:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table A.5.7.5.2.3-1.

Table A.5.7.5.2.3-1: CLI-RSSI absolute accuracy test requirement

	Test requirement Notes1,2,3
	Io -δ +G_{min} ≤ Reported CLI-RSSI(dBm) ≤Io +δ +G_{max}
NOTE 1: Io is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for 1.08 MHz	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.22.1.1-2, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.5.7.6 L1-SINR measurement for beam reporting

A.5.7.6.1 L1-SINR measurement with CSI-RS based CMR and no dedicated IMR configured and CSI-RS resource set with repetition off

A.5.7.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.8.4.1 and clause 10.1.28.1 for FR2 L1-SINR measurements based on CSI-RS with the testing configurations for NR cells in table A.5.7.6.1.1-1, which configures the measurement resources for the CSI-RS based CMR and no dedicated IMR.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.5.7.6.1.1-1: Applicable NR configurations for FR2 L1-SINR test with CSI-RS based CMR and no dedicated IMR configured

Config	**Description**
1	LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.5.7.6.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.7.6.1.2-1 and table A.5.7.6.1.2-2 below. The absolute and relative accuracy of L1-SINR measurements are tested by using the parameters in table A.5.7.6.1.2-1 and table A.5.7.6.1.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.5.7.6.1.2-1: FR2 CSI-RS based L1-SINR general test parameters

Parameter	**Config**	**Unit**	**Test 1**
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1

Parameter	Config	Unit	Test 1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
SMTC configuration	1~2		SMTC.1
CSI-RS	1~2		CSI-RS.3.2 TDD
reportConfigType	1~2		periodic
reportQuantity-r16	1~2		cri-SINR-r16
nrofReportedRS	1~2		2
L1-SINR reporting period	1~2		slot640
Propagation condition	1~2		AWGN
Antenna configuration	1~2		1x2
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			

Table A.5.7.6.1.2-2: FR2 CSI-RS based L1-SINR OTA related test parameters

Parameter	Config	Unit	Test 1	
			CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough	
N_{oc}	1~2	dBm/15 kHz	-100	
N_{oc}	1~2	dBm/SSB SCS	-91	
$\hat{E}_s / I_{ot}$	1~2	dB	10	-2
CSI-RS-RSRP Note1	1~2	dBm/SCS	-81	-93
Io Note1	1~2	dBm/ 95.04 MHz	-51.57	-59.86
$\hat{E}_s / N_{oc}$	1~2	dB	10	-2
NOTE 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 3: Void. NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.5.7.6.1.3 Test Requirements

After 640 ms from the beginning of the test, the L1-SINR measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 2 shall fulfil the requirements in clauses 10.1.28.1. The following requirements are to be verified:

For Test 1:

Absolute accuracy of CSI-RS0. The UE is deemed to meet the requirement if the reported L1-SINR is in the range shown in table A.5.7.6.1.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the reported differential L1-SINR meets is in the range shown in table A.5.7.6.1.3-2.

Table A.5.7.6.1.3-1: L1-SINR absolute accuracy test requirement

	Test requirement Notes1,2
CSI-RS0	L1-SINR0-δ≤ Reported SINR(dB) ≤L1-SINR0+δ
NOTE 1: L1-SINR0 is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS 0 under consideration	
NOTE 2: δ is the SINR absolute accuracy requirement from Table 10.1.28.1.1-1, selected according to the Io used in the test	

Table A.5.7.6.1.3-2: L1-SINR relative accuracy test requirement

	Test requirement Notes1,2
CSI-RS0 - CSI-RS1	L1-SINR0 - L1-SINR1 - σ ≤ Reported DIFFSINR (dB) ≤ L1-SINR0 - L1-SINR1 + σ
NOTE 1: L1-SINRn is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration	
NOTE 2: σ is the SINR relative requirement from Table 10.1.28.1.2-1, selected according to the Io used in the test	

A.5.7.6.2 L1-SINR measurement with SSB based CMR and dedicated IMR

A.5.7.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.8.4.2 and clause 10.1.28.2 for L1-SINR measurements with SSB based CMR and dedicated CSI-RS based IMR, with the testing configurations for NR cells in table A.5.7.6.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.5.7.6.2.1-1: Applicable NR configurations for FR2 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.5.7.6.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.7.6.2.2-1 and table A.5.7.6.2.2-2 below. The absolute accuracy of L1-SINR measurements are tested by using the parameters in table A.5.7.6.2.2-1 and table A.5.7.6.2.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources and one CSI-RS resource set with two CSI-RS resource. UE is configured to perform RLM and BFD measurement based on the SSB resources 0 and 1. UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-RS resources as IMR.

Table A.5.7.6.2.2-1: FR2 L1-SINR measurement test parameters with SSB based CMR and CSI-RS based IMR

Parameter	Config	Unit	Test 1
SSB ARFCN	1~4		freq1

Parameter	Config	Unit	Test 1
Duplex mode	1~4		TDD
TDD Configuration	1~4		TDDConf.3.1
$BW_{channel}$	1~4	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1~4		SR.3.1 TDD
RMSI CORESET Reference Channel	1~4		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~4		CCR.3.1 TDD
SSB configuration	1,2		SSB.1 FR2
	3,4		SSB.2 FR2
CSI-RS configuration	1~4		CSI-RS 3.1A TDD
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3
TRS Configuration	1~4		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2
SMTC configuration	1~4		SMTC.1
reportConfigType	1~4		periodic
reportQuantity-r16	1~4		ssb-Index-SINR-r16
Number of reported RS	1~4		2
L1-SINR reporting period	1~4		slot640
Propagation condition	1~4		AWGN
Antenna configuration	1~4		1x2
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Table A.5.7.6.2.2-2: FR2 SSB specific test parameters

Parameter	Config	Unit	Test 1	
			SSB#0	SSB#1
Angle of arrival configuration			Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough	
N_{oc}	1~4	dBm/15 kHz	-100	
N_{oc}	1,2	dBm/SSB SCS	-91	
	3,4		-88	
$\hat{E}_s / I_{ot}$	1~4	dB	10	0
SSB RSRP Note1	1,2	dBm/SCS	-81	-91
	3,4		-78	-88
Io Note1	1~4	dBm/ 95.04 MHz	-51.57	-58.97
$\hat{E}_s / N_{oc}$	1~4	dB	10	0

NOTE 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.7.6.2.2-3: FR2 CSI-RS specific test parameters

Parameter	Config	Unit	Test 1	
			CSI-RS#0	CSI-RS#1
Angle of arrival configuration			Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough	
N_{oc}	1~4	dBm/15 kHz	-100	
N_{oc}	1~4	dBm/CSI-RS SCS	-91	
$\hat{E}_s / I_{ot}$	1~4	dB	10	0
CSI-RS RSRP Note1	1~4	dBm/SCS	-81	-91
Io Note1	1~4	dBm/ 95.04 MHz	-51.57	-58.97
$\hat{E}_s / N_{oc}$	1~4	dB	10	0
NOTE 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.5.7.6.2.3 Test Requirements

After 640 ms from the beginning of the test, the L1-SINR measurement accuracy for SSB#0+CSI-RS#0 and SSB#1+CSI-RS#1 of Cell 2 shall fulfil the requirements in clauses 10.1.28.2. The following requirements are to be verified:

For Test 1:

Absolute accuracy of SSB#0+CSI-RS#0. The UE is deemed to meet the requirement if the reported L1-SINR is in the range shown in table A.5.7.6.2.3-1.

Relative accuracy of SSB#0+CSI-RS#0 compared with SSB#1+CSI-RS#1. The UE is deemed to meet the requirement if the reported differential L1-SINR is in the range shown in table A.5.7.6.2.3-2.

Table A.5.7.6.2.3-1: L1-SINR absolute accuracy test requirement

	Test requirement Notes1,2
SSB#0+CSI-RS#0	L1_SINR0 -δ + ≤ Reported SINR (dB) ≤ L1_SINR 0 +δ
NOTE 1: L1_SINR0 is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the SSB#0+CSI-RS#0 under consideration	
NOTE 2: δ is the SINR absolute accuracy requirement from Table 10.1.28.2.1-1, selected according to the Io used in the test	

Table A.5.7.6.2.3-2: L1-SINR relative accuracy test requirement

	Test requirement Notes1,2
SSB#0+CSI-RS#0 - SSB#1+CSI-RS#1	L1-SINR0 - L1-SINR1 - σ ≤ Reported DIFFSINR (dB) ≤ L1-SINR0 - L1-SINR1 + σ
NOTE 1: L1-SINRn is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the SSB#n+CSI-RS#n under consideration	
NOTE 2: σ is the SINR relative requirement from Table 10.1.28.2.2-1, selected according to the Io used in the test	

A.5.7.6.3 L1-SINR measurement with CSI-RS based CMR and dedicated IMR

A.5.7.6.3.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will partly verify the requirements in clauses 9.8.4.3 and clause 10.1.28.3 for L1-SINR measurements based on CSI-RS as CMR and CSI-IM as IMR with the testing configurations for NR cells in table A.5.7.6.3.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.5.7.6.3.1-1: Applicable NR configurations for FR2 L1-SINR measurement test with CSI-RS based CMR and CSI-IM based IMR

Config	Description
1	LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.5.7.6.3.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in table A.5.7.6.3.2-1 and A.5.7.6.3.2-2 below. The absolute and relative accuracy of L1-SINR measurements are tested by using the parameters in table A.5.7.6.3.2-1 and A.5.7.6.3.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources and one CSI-IM resource set with two CSI-IM resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB. UE is configured to perform L1-SINR measurement based on the configured CSI-RS as CMR and CSI-IM as IMR.

Table A.5.7.6.3.2-1: FR2 L1-SINR measurement test with CSI-RS based CMR and CSI-IM based IMR

Parameter	Config	Unit	Test 1
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
SMTC configuration	1~2		SMTC.1
CSI-RS configuration as CMR	1~2		CSI-RS.3.2 TDD
CSI-IM configuration as IMR	1~2		CSI-IM.3.3 TDD
reportConfigType	1~2		periodic
reportQuantity-r16	1~2		cri-SINR-r16
nrofReportedRS	1~2		2
L1-SINR reporting period	1~2		slot640
Propagation condition	1~2		AWGN
Antenna configutaion	1~2		1x2
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			

Parameter	Config	Unit	Test 1
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			

Table A.5.7.6.3.2-2: FR2 CSI-RS based L1-SINR measurement OTA related test parameters

Parameter	Config	Unit	Test 1	
			CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough	
N_{oc}	1~2	dBm/15 kHz	-100	
N_{oc}	1~2	dBm/SSB SCS	-91	
$\hat{E}_s/I_{ot}$	1~2	dB	10	-2
CSI-RS-RSRP Note1	1~2	dBm/SCS	-81	-93
Io Note1	1~2	dBm/ 95.04 MHz	-51.57	-59.86
$\hat{E}_s/N_{oc}$	1~2	dB	10	-2
NOTE 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 3: No additional noise is added by the test system in Test 2. NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.5.7.6.3.3 Test Requirements

After 640 ms from the beginning of the test, the L1-SINR measurement accuracy for CSI-RS#0+CSI-IM#0 and CSI-RS#1+CSI-IM#1 of Cell 2 shall fulfil the requirements in clauses 10.1.28.3. The following requirements are to be verified:

Absolute accuracy of CSI-RS#0+CSI-IM#0. The UE is deemed to meet the requirement if the reported L1-SINR is in the range shown in table A.5.7.6.3.3-1.

Relative accuracy of CSI-RS#0+CSI-IM#0 compared with CSI-RS#1+CSI-IM#1. The UE is deemed to meet the requirement if the reported differential L1-SINR is in the range shown in table A.5.7.6.3.3-2.

Table A.5.7.6.3.3-1: L1-SINR absolute accuracy test requirement

	Test requirement Notes1,2
CSI-RS#0+CSI-IM#0	L1-SINR0 -δ≤ Reported SINR(dBm) ≤L1-SINR 0 +δ
NOTE 1: L1-SINR0 is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS#0 under consideration NOTE 2: δ is the SINR absolute accuracy requirement from Table 10.1.28.3.1-2.	

Table A.5.7.6.3.3-2: L1-SINR relative accuracy test requirement

	Test requirement Notes1,2
CSI-RS#0+CSI-IM#0 - CSI-RS#1+CSI-IM#1	L1-SINR0 - L1-SINR1 - σ≤ Reported DIFFSINR (dB) ≤ L1-SINR0 - L1-SINR1 + σ
NOTE 1: L1-SINRn is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS#n+CSI-IM#n under consideration NOTE 2: σ is the SINR relative requirement from Table 10.1.28.3.2-2, selected according to the Io used in the test	

A.5.7.7 CSI-RSRP

A.5.7.7.1 EN-DC intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.5.7.7.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RS based RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.3.1.1 and 10.1.3.1.2 for intra-frequency measurements.

A.5.7.7.1.2 Test parameters

In this set of test cases, all NR cells are on the same carrier frequency. Supported test configurations are shown in table A.5.7.7.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in table A.5.7.7.1.2-2 and A.5.7.7.1.2-3. The E-UTRA PCell is configured as specified in clause A.3.7.2.2. In all test cases, Cell 1 is the PCell, Cell 2 is the PSCell and Cell 3 is the target cell. The test consists of two time phases T1 and T2.

Table A.5.7.7.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Configuration	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 120KHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 120KHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.5.7.7.1.2-2: CSI-RSRP Intra frequency general test parameters

Parameter[Note 5]	Unit	T1		T2	
		Cell 2	Cell 3	Cell 2	Cell 3
Physical cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Reference Channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
CSI-RS configuration for RRM		CSI-RS.RRM.FR2.1 TDD	CSI-RS.RRM.FR2.1 TDD	CSI-RS.RRM.FR2.1 TDD	CSI-RS.RRM.FR2.1 TDD
Time offset with Cell 2	µs	-	0.58	-	0.58
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS[Note 1]					

EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: All parameters apply for configuration 1 and 2
NOTE 6: Void

Table A.5.7.7.1.2-3: CSI-RSRP Intra frequency OTA related test parameters

Parameter	Unit	T1		T2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 8		Rough			
N_{oc} Note1	dBm/15 kHz Note4	-91.6		N/A	
N_{oc} Note1	dBm/SCS Note4	-82.6		N/A	
$\hat{E}_s/N_{oc}$ for SSB	dB	6.0	1.0	N/A	N/A
$\hat{E}_s/N_{oc}$ for CSI-RS	dB	6.0	1.0	N/A	N/A
E_s for SSB	dBm/SCS Note4			(Table B.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2-2 Rx Beam Peak +2.1 dB)
E_s for CSI-RS	dBm/SCS Note4			(Table B.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2-2 Rx Beam Peak +2.1 dB)
SSB_RP Note2	dBm/SCS	-76.6	-81.6	(Table B.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2-2 Rx Beam Peak +2.1 dB)
$\hat{E}_s/I_{ot\ BB}$ Note6 for SSB	dB	2.44	-5.98	-5.98	-5.98
$\hat{E}_s/I_{ot\ BB}$ Note6 for CSI-RS	dB	2.44	-5.98	-5.98	-5.98
CSI_RP	dBm/SCS	-76.6	-81.6	(Table B.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2-2 Rx Beam Peak +2.1 dB)
Io Note2	dBm/95.04 MHz Note4	-50.05		(Table B.2.2-2 Rx Beam Peak +29.70 dB)	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: All parameters apply for configurations 1 and 2
NOTE 8: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.7.1.3 Test Requirements

The CSI-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.3.1.1 and relative accuracy requirements in clause 10.1.3.1.2. The following requirements are to be verified:

During T1:

- Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported CSI-RSRP is in the range shown in table A.5.7.6.1.3-1.

- Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported CSI-RSRP meets the requirements in table 10.1.3.1.2-1.

During T2:

- Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported CSI-RSRP is in the range shown in table A.5.7.6.1.3-1.

- Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported CSI-RSRP meets the requirements in table 10.1.3.1.2-1.

During T1 and T2:

- Relative accuracy of Cell 2 during T2 compared with Cell 2 during T1. The UE is deemed to meet the requirement if the difference in reported CSI-RSRP meets the requirements in table 10.1.3.1.2-1

- Relative accuracy of Cell 3 during T2 compared with Cell 3 during T1. The UE is deemed to meet the requirement if the difference in reported CSI -RSRP meets the requirements in table 10.1.3.1.2-1.

Table A.5.7.7.1.3-1: CSI-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 2	CSI_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ CSI_RP2 +δ +G_{max}
Cell 3	CSI_RP3 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ CSI_RP3 +δ +G_{max}
NOTE 1: CSI_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.3.1.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.5.7.7.2 EN-DC inter-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.5.7.7.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RS based RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.5.3.1 and 10.1.5.3.2 for inter-frequency measurements with the testing configurations for NR cells in table A.5.7.7.2.1-1.

Table A.5.7.7.2.1-1: Applicable NR configurations for FR2 inter-frequency CSI-RSRP accuracy test

Configuration	Description
1	FDD LTE PCell, cells 2&3 120 kHz SSB SCS, 120KHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, cells 2&3 120 kHz SSB SCS, 120KHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

A.5.7.7.2.2 Test parameters

In this set of test cases, there are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.5.7.7.2.2-1 and table A.5.7.7.2.2-2

below. Both absolute and relative accuracy of RSRP intrer-frequency measurements are tested by using the parameters in table A.5.7.7.2.2-1 and table A.5.7.7.2.2-2. The inter-frequency measurements are supported by a measurement gap.

Table A.5.7.7.2.2-1: CSI-RSRP inter-frequency general test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
Physical cell ID			489	0	489	0
SSB ARFCN	1,2		freq1	freq2	freq1	freq2
$BW_{channel}$	1,2		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Gap pattern ID			0		0	
Duplex mode	1,2		TDD	TDD	TDD	TDD
TDD configuration	1,2		TDDConf.3.1		TDDConf.3.1	
PDSCH Reference measurement channel	1,2		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel	1,2		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Reference Channel	1,2		CCR.3.1 TDD	-	CCR.3.1 TDD	-
SSB configuration	1,2		SSB.3 FR2		SSB.3 FR2	
OCNG Patterns	1,2		OP.3		OP.3	
Initial BWP Configuration	1,2		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1,2		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1,2		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1,2		TCI.State.2		TCI.State.2	
SMTC configuration	1,2		SMTC.1		SMTC.1	
CSI-RS configuration for RRM	1,2		CSI-RS.RRM.3.1 TDD	CSI-RS.RRM.3.2 TDD	CSI-RS.RRM.3.1 TDD	CSI-RS.RRM.3.2 TDD
Time offset between Cell 2 and Cell 3	1,2	µs	0.58		0.58	
EPRE ratio of PSS to SSS	1,2	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition	1,2	-	AWGN	AWGN	AWGN	AWGN
Antenna configuration	1,2	-	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void

Table A.5.7.7.2.2-2: CSI-RSRP inter-frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 4b according to clause A.3.15.4.2		Setup 4b according to clause A.3.15.4.2	
		AoA1 Spherical coverage	AoA2 Rx Beam Peak	AoA1 Spherical coverage	AoA2 Rx Beam Peak

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Assumption for UE beams Note 7		Rough	Rough	Assumption for UE beams Note 7	
N_{oc} Note1	dBm/15 kHz Note4	-90.6	-90.6	(Table B.2.3-2 Rx Beam Peak +1.97 dB)	(Table B.2.3-2 Rx Beam Peak -3.03 dB)
N_{oc} Note1	dBm/SCS Note4	-81.6	-81.6	(Table B.2.3-2 Rx Beam Peak +11.0 dB)	(Table B.2.3-2 Rx Beam Peak +6.0 dB)
$\hat{E}_s/N_{oc}$ for SSB	dB	6.0	6.0	17.0	-1.0
$\hat{E}_s/N_{oc}$ for CSI-RS	dB	6.0	6.0	17.0	-1.0
SSB_RP Note2	dBm/SCS	-75.60	-75.60	(Table B.2.3-2 Rx Beam Peak +28.0 dB)	(Table B.2. 3-2 Rx Beam Peak +5.0 dB)
($SSB_RP_{Cell\ 1}$ – $SSB_RP_{Cell\ 2}$)	dB	0		23.00	
$\hat{E}_s/I_{ot\ BB}$ Note6 for SSB	dB	5.29	5.96	8.86	-3.92
$\hat{E}_s/I_{ot\ BB}$ Note6 for CSI-RS	dB	5.29	5.96	8.86	-3.92
CSI_RP	dBm/SCS	-75.60	-75.60	(Table B.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2-2 Rx Beam Peak +2.1 dB)
Io Note2	dBm/95.04 MHz Note4	-50.03	-50.03	(Table B.2.3-2 Rx Beam Peak +52.68 dB)	(Table B.2.3-2 Rx Beam Peak +33.13 dB)
($Io_{freq\ 1}$ – $Io_{freq\ 2}$)	dB	0		19.55	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, Es/Iot, Io, ($SSB_RP_{Cell\ 2}$ – $SSB_RP_{Cell\ 1}$) and ($Io_{freq\ 2}$ – $Io_{freq\ 1}$) levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P or ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.7.2.3 Test Requirements

The CSI-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil the absolute requirements in clause 10.1.5.3.1 and the relative requirements in clause 10.1.5.3.2.

Test 1:

- Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported CSI-RSRP is in the range shown in table A.5.7.7.2.3-1.

- Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported CSI -RSRP meets the requirements in table A.5.7.7.2.3-2.

Test 2:

- Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported CSI -RSRP is in the range shown in table A.5.7.7.2.3-1.

- Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported CSI -RSRP meets the requirements in table A.5.7.7.2.3-2.

Table A.5.7.7.2.3-1: CSI-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 2	CSI _RP2 -δ +G_{min} +X ≤ Reported RSRP(dBm) ≤ CSI _RP2 +δ +G_{max}
Cell 3	CSI _RP3 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ CSI _RP3 +δ +G_{max}
NOTE 1: CSI_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.5.1.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	
NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.	

Table A.5.7.7.2.3-2: CSI-RSRP relative accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 3 – Cell 2	CSI _RP3 - CSI _RP2 – δ – D – G_{inter} ≤ Reported RSRP(dB) ≤ CSI_RP3 - CSI_RP2 + δ + G_{inter} – (X) + E
NOTE 1: CSI_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP relative accuracy requirement from Table 10.1.5.1.2-1	
NOTE 3: Void	
NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.	
NOTE 5: D is the margin due to mis-alignment between fine beam and rough beam. D is the Rough Beam gain reduction in Rx beam peak direction from Table B.2.1.5.3-1, selected according to the UE power class. D is always a positive value.	
NOTE 6: G_{inter} is the margin due to different antenna gain caused by frequency separation. G_{inter} is from Table B.2.1.5.2-1, selected according to the UE power class, and is always a positive value.	
NOTE 7: E = 3 (dB) is an additional margin to account for the actual gain difference between peak direction and spherical coverage using rough beams.	

A.5.7.8 CSI-RSRQ

A.5.7.8.1 EN-DC Intra-frequency measurement accuracy with FR2 serving cell and FR2 target cell

A.5.7.8.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.8 for inter-frequency measurement.

A.5.7.8.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.5.7.8.1.2-1. The absolute accuracy of CSI-RSRQ intra-frequency measurement is test by using the parameters in table A.5.7.8.1.2-2. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell. The configuration of Cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1.

Table A.5.7.8.1.2-1: CSI-RSRQ Intra frequency CSI-RSRQ supported test configurations

Config	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB&CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB&CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.5.7.8.1.2-2: CSI-RSRQ Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN			Freq1		Freq1	
Duplex mode			TDD		TDD	
TDD configuration			TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
TRS configuration			TRS.2.1 TDD		TRS.2.1 TDD	
CSI-RS configuration for RRM			CSI-RS.RRM.FR2.1 TDD			
TCI state			TCI.State.0		TCI.State.0	
PDSCH Reference measurement channel			SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel			CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC			CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns			OP.1	OP.1	OP.1	OP.1
SMTC configuration			SMTC.1			
SSB configuration			SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
Time offset with Cell 2		µs	-	0.58	-	0.58
PDSCH/PDCCH subcarrier spacing		kHz	120	120	120	120
SS-RSSI-Measurement			Not Applicable			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-RSRQ, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-RSRQ and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Void

Table A.5.7.8.1.2-3: CSI-RSRQ Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 9		Rough			
N_{oc} Note1	dBm/15 kHz Note4	-95		-95	
N_{oc} Note1	dBm/SCS Note3	-86		-86	
$\hat{E}_s / N_{oc}$ for SSB	dB	3	3	-3	-3
$\hat{E}_s / N_{oc}$ for CSI-RS	dB	3	3	-3	-3
CSI-RSRP Note2	dBm/SCS Note4	-83	-83	-89	-89

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
CSI-RSRQ Note2	dB	-14.77	-14.77	-16.81	-16.81
$\hat{E}_s/I_{ot}$ for SSB	dB	-1.76	-1.76	-4.76	-4.76
$\hat{E}_s/I_{ot}$ for CSI-RS	dB	-1.76	-1.76	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-50		-54	-54

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: CSI-RSRQ, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: CSI-RSRQ and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: NR operating band groups are as defined in clause 3.5.2.
NOTE 7: Void
NOTE 8: Void
NOTE 9: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.8.1.3 Test Requirements

The CSI-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal CSI-RSRQ +2.5 dB to Nominal CSI-RSRQ –3.5 dB and the CSI-RSRQ measurement accuracy in test 2 shall be within the range Nominal CSI-RSRQ +3.5 dB to Nominal CSI-RSRQ –4.5 dB according to the requirements in clause 10.1.8 with an additional -1 dB margin reflecting the possible impact of UE self-noise in the test. Nominal CSI-RSRQ is the value shown in table A.5.7.8.1.2-3.

A.5.7.8.2 EN-DC Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.5.7.8.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.10 for inter-frequency measurement.

A.5.7.8.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.5.7.8.2.2-1. Both absolute accuracy and relative accuracy requirements of CSI-RSRQ inter-frequency measurement are tested by using test setup in table A.5.7.8.2.2-2 and table A.5.7.8.2.2-3. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1.

Table A.5.7.8.2.2-1: CSI-RSRQ Inter frequency CSI-RSRQ supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB&CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB&CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

Table A.5.7.8.2.2-2: CSI-RSRQ Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		Freq1	freq2	freq1	Freq2
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	

PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
CSI-RS configuration for RRM		CSI-RS.RRM.FR2.1 TDD			
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
Time offset with Cell 2	µs	-	0.58	-	0.58
EPRE ratio of PSS to SSS EPRE ratio of PBCH_DMRS to SSS EPRE ratio of PBCH to PBCH_DMRS EPRE ratio of PDCCH_DMRS to SSS EPRE ratio of PDCCH to PDCCH_DMRS EPRE ratio of PDSCH_DMRS to SSS EPRE ratio of PDSCH to PDSCH_DMRS EPRE ratio of OCNG DMRS to SSS[Note 1] 	dB	0	0	0	0

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-RSRQ, CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-RSRQ and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.5.7.8.2.2-3: CSI-RSRQ Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
AoA setup		Setup 1 in clause A.3.15		Setup 1 in clause A.3.15	
Assumption for UE beams[Note 8]		Rough		Rough	
N_{oc} [Note1]	dBm/15 kHz[Note4]	-94.03		-94.03	
N_{oc} [Note1]	dBm/SCS[Note3]	-85.0		-85.0	
$\hat{E}_s / N_{oc}$ for SSB	dB	-1.75	-1.75	-3	-3
$\hat{E}_s / N_{oc}$ for CSI-RS	dB	-1.75	-1.75	-3	-3
CSI-RP[Note2]	dBm/SCS [Note4]	-86.75	-86.75	-88	-88
CSI-RSRQ[Note2]	dB	-14.75	-14.75	-15.56	-15.56
$\hat{E}_s / I_{ot}$ for SSB	dB	-1.75	-1.75	-3	-3
$\hat{E}_s / I_{ot}$ for CSI-RS	dB	-1.75	-1.75	-3	-3
Io[Note2]	dBm/95.04 MHz [Note4]	-53.8	-53.8	-54.25	-54.25

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: CSI-RSRQ, CSI-RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: CSI-RSRQ and CSI-RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Void
NOTE 7: Void
NOTE 8: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.8.2.3 Test Requirements

The CSI-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal CSI-RSRQ +2.5 dB to Nominal CSI-RSRQ -3.5 dB and the CSI-RSRQ measurement accuracy in test 2 shall be within the range Nominal CSI-RSRQ +3.5 dB to Nominal CSI-RSRQ -4.5 dB according to the requirements in clause 10.1.10 with an additional -1 dB margin reflecting the possible impact of UE self-noise in the test.

The CSI-RSRQ relative measurement accuracy shall fulfil the requirements in clause 10.1.10.

A.5.7.9 CSI-SINR

A.5.7.9.1 EN-DC Intra-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.5.7.9.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.13.2.1.

A.5.7.9.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A.5.7.9.1.2-1. The absolute accuracy of CSI-SINR intra-frequency measurement is test by using the parameters in table A.5.7.9.1.2-2 and table A.5.7.9.1.2-3. The configuration of Cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.5.7.9.1.2-1: CSI-SINR Intra frequency CSI-SINR supported test configurations

Configuration	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.5.7.9.1.2-2: CSI-SINR Intra frequency test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		Freq2		Freq2	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1			
Downlink dedicated BWP configuration		DLBWP.1.1			
Uplink initial BWP configuration		ULBWP.0.1			
Uplink dedicated BWP configuration		ULBWP.1.1			
DRX cycle configuration	ms	Not applicable			
TRS configuration		TRS.2.1 TDD			
TCI state		TCI.State.0			
PDSCH Reference measurement channel		SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated RMSI CORESET Reference Channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1			
SSB configuration		SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
CSI-RS for mobility		-	CSI-RS.RRM.FR2.1 TDD	-	CSI-RS.RRM.FR2.1 TDD
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
Time offset with Cell 2	μs	-	0.29	-	0.29
CSI-RSSI-Measurement		Not Applicable			
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.5.7.9.1.2-3: CSI-SINR Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 7		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-105		N/A	
N_{oc} Note1	dBm/SCS Note3	-96		N/A	
$\hat{E}_s / N_{oc}$ for SSB	dB	4.54	2.66	-3	-3
$\hat{E}_s / N_{oc}$ for CSI-RS	dB	4.54	2.66	-3	-3
CSI-RSRP Note2	dBm/SCS Note4	-91.46	-93.34	-99	-99
CSI-SINR Note2	dB	0	-3.2	-4.76	-4.76
$\hat{E}_s / I_{ot}$ for SSB	dB	0	-3.2	-4.76	-4.76
$\hat{E}_s / I_{ot}$ for CSI-RS	dB	0	-3.2	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-59.2		-64	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: NR operating band groups are as defined in clause 3.5.2.
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.9.1.3 Test Requirements

The CSI-SINR absolute measurement accuracy in test 1 shall be within the range Nominal CSI-SINR+3 dB to Nominal CSI-SINR -4 dB and the CSI-SINR measurement accuracy in test 2 shall be within the range Nominal CSI-SINR +3.5

dB to Nominal CSI-SINR -4.5 dB according to the requirements in clause 10.13.2 with an additional -1 dB margin reflecting the possible impact of UE self noise in the test. Nominal CSI-SINR is the value shown in table A.5.7.9.1.2-3.

A.5.7.9.2 EN-DC Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.5.7.9.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.15.2.1 and 10.1.15.2.2 for inter-frequency measurement.

A.5.7.9.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.5.7.9.2.2-1. Both absolute accuracy and relative accuracy requirements of CSI-SINR inter-frequency measurement are tested by using test setup in table A.5.7.9.2.2-2 and table A.5.7.9.2.2-3. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.5.7.9.2.2-1: CSI-SINR Inter frequency CSI-SINR supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

Table A.5.7.9.2.2-2: CSI-SINR Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		Freq1	freq2	freq1	Freq2	freq1	Freq2
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1					
Downlink dedicated BWP configuration		DLBWP.1.1					
Uplink initial BWP configuration		ULBWP.0.1					
Uplink dedicated BWP configuration		ULBWP.1.1					
DRX cycle configuration	ms	Not applicable					
TRS configuration		TRS.2.1 TDD					
TCI state		TCI.State.0					
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1	OP.1	OP.1
Time offset with Cell 2	µs	-	0.29	-	0.29	-	0.29
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1	SMTC.1	SMTC.1
CSI-RS for mobility		-	CSI-RS.RRM.FR2.1 TDD	-	CSI-RS.RRM.FR2.1 TDD	-	CSI-RS.RRM.FR2.1 TDD
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-SINR, CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.5.7.9.2.2-3: CSI-SINR Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration	degrees	Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 7		Rough		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-105		-105		-105	
N_{oc} Note1	dBm/SCS Note3	-96		-96		-96	
$\hat{E}_s / N_{oc}$ for SSB	dB	-0.5	-0.5	11.0	11.0	-3.0	-3.0
$\hat{E}_s / N_{oc}$ for CSI-RS	dB	-0.5	-0.5	11.0	11.0	-3.0	-3.0
CSI-RSRP Note2	dBm/SCS Note4	-96.5	-96.5	-85	-85	-99	-99
CSI-SINR Note2	dB	-0.5	-0.5	11	11	-3.0	-3.0
$\hat{E}_s / I_{ot}$ for SSB	dB	-0.5	-0.5	11	11	-3.0	-3.0
$\hat{E}_s / I_{ot}$ for CSI-RS	dB	-0.5	-0.5	11	11	-3.0	-3.0
Io Note2	dBm/95.04 MHz Note4	-69.3		-55.4		-65.24	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: NR operating band groups are as defined in clause 3.5.2.
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.9.2.3 Test Requirements

The CSI-SINR absolute measurement accuracy in test 1 shall be within the range Nominal CSI-SINR+3 dB to Nominal CSI-SINR -4 dB and the CSI-SINR measurement accuracy in test 2 shall be within the range Nominal CSI-SINR+3.5 dB to Nominal CSI-SINR -4.5 dB according to the requirements in clause 10.1.15.2.1 with an additional -1 dB margin reflecting the possible impact of UE self noise in the test. Nominal CSI-SINR is the value shown in table A.5.7.2.2.2-3

The CSI-SINR relative measurement accuracy shall fulfil the requirements in clause 10.1.15.2.2.

A.5.8 Void

A.6 NR standalone tests with all NR cells in FR1

A.6.1 SA: RRC_IDLE state mobility

A.6.1.1 Cell re-selection to NR

A.6.1.1.1 Cell reselection to FR1 intra-frequency NR case

A.6.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell reselection requirements specified in clause 4.2.2.3.

A.6.1.1.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.6.1.1.1.2-1, A.6.1.1.1.2-2 and A.6.1.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.6.1.1.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.1.1.1.2-2: General test parameters for intra-frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	
T2 end condition	Active cell		1, 2, 3	Cell 2	
	Neighbour cells		1, 2, 3	Cell 1	
Final condition	Active cell		1, 2, 3	Cell 1	
	Neighbour cells		1, 2, 3	Cell 2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC.2	Configured in SIB2 of Cell 1
				SMTC.6	Configured in SIB2 of Cell 2
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	

Parameter	Unit	Test configuration	Value	Comment
T1	s	1, 2, 3	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2	s	1, 2, 3	40	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3	s	1, 2, 3	15	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.1.2-3: Cell specific test parameters for intra-frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in clause A.3.2.1			OP.1 defined in clause A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-130			-130		
		3	-127			-127		
Pcompensation	dB	1, 2, 3	0			0		
$Qhyst_s$	dB	1, 2, 3	0			0		
$Qoffset_{s,n}$	dB	1, 2, 3	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1	16	-3.11	2.79	-infinity	2.79	-3.11
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s / N_{oc}$	dB	1	16	13	16	-infinity	16	13
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-82	-85	-82	-infinity	-82	-85
		2	-82	-85	-82	-infinity	-82	-85

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
		3	-79	-82	-79	-infinity	-79	-82
Io	dBm/9.36 MHz	1	-53.94	-52.21	-52.21	Same as parameters specified in Cell 1 columns-		
	dBm/9.36 MHz	2	-53.94	-52.21	-52.21			
	dBm/38.16 MHz	3	-47.85	-46.12	-46.12			
Treselection	s	1, 2, 3	0	0	0	0	0	0
SintrasearchP	dB	1, 2, 3	60			60		
Propagation Condition		1, 2, 3	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.1.1.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 34 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI\text{-}NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR_ intra} + T_{SI\text{-}NR}$,

Where:

T_{detect, NR_Intra} See table 4.2.2.3-1 in clause 4.2.2.3

$T_{evaluate, NR_ intra}$ See table 4.2.2.3-1 in clause 4.2.2.3

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 33.28 s, allow 34 s for the cell re-selection delay to a newly detectable cell and 7.68 s for the cell re-selection delay to an already detected cell in the test case, which we allow 8 s.

A.6.1.1.2 Cell reselection to FR1 inter-frequency NR case

A.6.1.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the inter-frequency NR cell reselection requirements specified in clause 4.2.2.4.

A.6.1.1.2.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.6.1.1.2.2-1, A.6.1.1.2.2-2 and A.6.1.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3

respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

Table A.6.1.1.2.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.1.2.2-2: General test parameters for FR1 inter-frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 2	The UE camps on Cell 2 in the initial phase and during T1 period the UE reselects to Cell 1
	Neighbour cell		1, 2, 3	Cell 1	
T1 end condition	Active cell		1, 2, 3	Cell 1	The UE shall perform reselection to Cell 1 during T1
	Neighbour cells		1, 2, 3	Cell 2	
T3 end condition	Active cell		1, 2, 3	Cell 2	The UE shall perform reselection to Cell 2 with higher priority during T3
	Neighbour cell		1, 2, 3	Cell 1	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC.2	Configured in SIB4 of Cell 1
				SMTC.6	Configured in SIB4 of Cell 2
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3		s	1, 2, 3	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.2.2-3: Cell specific test parameters for FR1 inter-frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in clause A.3.2.1			OP.1 defined in clause A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-140			-140		
		3	-137			-137		
Pcompensation	dB	1, 2, 3	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
$\hat{E}_s/I_{ot}$	dB	1	14	14	14	-4	-infinity	12
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	14	14	14	-4	-infinity	12
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-84	-84	-84	-102	-infinity	-86
		2	-84	-84	-84	-102	-infinity	-86
		3	-81	-81	-81	-99	-infinity	-83
Io	dBm/9.36 MHz	1	-55.88	-55.88	-55.88	-68.60	-70.05	-57.78
	dBm/9.36 MHz	2	-55.88	-55.88	-55.88	-68.60	-70.05	-57.78
	dBm/38.16 MHz	3	-49.79	-49.79	-49.79	-62.50	-63.96	-51.69
Treselection	s	1, 2, 3	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2, 3	50			50		
$Thresh_{x, highP}$	dB	1, 2, 3	48			48		
$Thresh_{serving, lowP}$	dB	1, 2, 3	44			44		
$Thresh_{x, lowP}$	dB	1, 2, 3	50			50		
Propagation Condition		1, 2, 3	AWGN					

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

A.6.1.1.2.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps again on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search}$ + $T_{evaluate,\ NR_\ inter}$ + $T_{SI\text{-}NR}$, and to a lower priority cell can be expressed as: $T_{evaluate,\ NR_\ inter}$ + $T_{SI\text{-}NR}$,

Where:

$T_{higher_priority_search}$ See clause 4.2.2.7

$T_{evaluate,\ NR_\ inter}$ See table 4.2.2.4-1 in clause 4.2.2.4

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority cell and 7.68 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 8 s.

A.6.1.1.3 Cell reselection to FR1 intra-frequency NR case for UE fulfilling low mobility relaxed measurement criterion

A.6.1.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell reselection requirements for UE fulfilling low mobility criterion specified in clause 4.2.2.9.2

A.6.1.1.3.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.6.1.1.3.2-1, A.6.1.1.3.2-2 and A.6.1.1.3.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.6.1.1.3.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.1.1.3.2-2: General test parameters for FR1 intra-frequency NR cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	The UE camps on Cell 1 in the initial phase
	Neighbour cells		1, 2, 3	Cell 2	
T1 end condition	Active cell		1, 2, 3	Cell 2	The UE reselects to Cell 2 during T1 period
	Neighbour cells		1, 2, 3	Cell 1	
Final condition	Active cell		1, 2, 3	Cell 1	The UE reselects to Cell 1 during T2 period
	Neighbour cells		1, 2, 3	Cell 2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	Configured in SIB2 of Cell 1
				SMTC pattern 6	Configured in SIB2 of Cell 2
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	25	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3	25	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.3.2-3: Cell specific test parameters for FR1 intra-frequency NR cell re-selection test case in AWGN for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3	OP.1 defined in clause A.3.2.1		OP.1 defined in clause A.3.2.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
$S_{SearchDeltaP}$	dB	1, 2, 3	3		3	
$T_{SearchDeltaP}$	s	1, 2, 3	5		5	
Cell_selection_and_reselection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1, 2, 3	-3.11	2.79	2.79	-3.11
N_{oc} Note2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1, 2, 3	-98			
$\hat{E}_s / N_{oc}$	dB	1, 2, 3	13	16	16	13
SS-RSRP Note3	dBm/SCS	1	-85	-82	-82	-85
		2	-85	-82	-82	-85
		3	-82	-79	-79	-82
Io	dBm/9.36 MHz	1	-52.21	-52.21	specified in Cell 1 columns-	
	dBm/9.36 MHz	2	-52.21	-52.21		
	dBm/38.16 MHz	3	-46.12	-46.12		
Treselection	s	1, 2, 3	0	0	0	0
SintrasearchP	dB	1, 2, 3	60		60	
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.1.1.3.3 Test Requirements

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected cell shall be less than 17 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to an already detected cell can be expressed as: $T_{evaluate,NR_Intra} + T_{SI-NR}$,

Where:

$T_{evaluate,NR_Intra}$ See table 4.2.2.9.2-1 in clause 4.2.2.9.2 for reselection to Cell 2 during T1 with UE fulfilling low mobility criterion. 15.36 s.

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 16.64 s, allow 17 s for the cell re-selection delay to an already detected cell for UE fulfilling low mobility criterion in the test case.

A.6.1.1.4 Cell reselection to FR1 intra-frequency NR case for UE fulfilling not-at-cell edge relaxed measurement criterion

A.6.1.1.4.1 Test Purpose and Environment

This test is to verify the relaxed cell re-selection requirement for UEs configured with not-at-cell edge criterion specified in clause 4.2.2.9.3.

A.6.1.1.4.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.6.1.1.4.2-1, A.6.1.1.4.2-2 and A.6.1.1.4.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas.

Table A.6.1.1.4.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.1.1.4.2-2: General test parameters for FR1 intra-frequency NR cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active Cell		1, 2, 3	Cell 1	The UE camps on Cell 1 in the initial phase
	Neighbour Cells		1, 2, 3	Cell 2	
T1 end condition	Active Cell		1, 2, 3	Cell 2	The UE shall fulfil the not-at-cell edge criterion and reselect to Cell 2 during T1 period during T1.
	Neighbour Cells		1, 2, 3	Cell 1	
T2 end condition	Active Cell		1, 2, 3	Cell 1	The UE shall perform reselection to Cell 1 during T2
	Neighbour Cells		1, 2, 3	Cell 2	
RF Channel Number			1, 2, 3	1	
Time offset between Cells			1	3 ms	Asynchronous Cells
			2	3 µs	Synchronous Cells
			3	3 µs	Synchronous Cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	Configured in SIB2 of Cell 1
				SMTC pattern 6	Configured in SIB2 of Cell 2
			2	SMTC pattern 1	

Parameter	Unit	Test configuration	Value	Comment
		3	SMTC pattern 1	
DRX cycle length	s	1, 2, 3	0.64	The value shall be used for all Cells in the test.
PRACH configuration index		1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell		1, 2, 3	Not configured	
T1	s	1, 2, 3	20	T1 needs to be defined so that Cell re-selection reaction time is taken into account.
T2	s	1, 2, 3	20	T2 needs to be defined so that Cell re-selection reaction time is taken into account.

Table A.6.1.1.4.2-3: Cell specific test parameters for FR1 intra-frequency NR cell re-selection test case in AWGN for UE fulfilling not-at-cell edge criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3	OP.1 defined in clause A.3.2.1		OP.1 defined in clause A.3.2.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
Cell_selection_and_reselection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1	-3.11	2.79	2.79	-3.11
		2				
		3				
N_{oc} Note2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1	-98			
		2				
		3				

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$\hat{E}_s / N_{oc}$	dB	1	13	16	16	13
		2				
		3				
SS-RSRP Note3	dBm/SCS	1	-85	-82	-82	-85
		2	-85	-82	-82	-85
		3	-82	-79	-79	-82
Io	dBm/9.36 MHz	1	-52.21	-52.21	-52.21	-52.21
	dBm/9.36 MHz	2	-52.21	-52.21	-52.21	-52.21
	dBm/38.16 MHz	3	-46.12	-46.12	-46.12	-46.12
Treselection	s	1, 2, 3	0	0	0	0
SintrasearchP	dB	1, 2, 3	60		60	
$S_{searchThresholdP}$	dB	1, 2, 3	50		50	
Propagation Condition		1, 2, 3	AWGN			
NOTE 1: OCNG shall be used such that both Cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other Cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.1.1.4.3 Test Requirements

The cell re-selection delay to an already detected cell for UE configured with *cellEdgeEvaluation* criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected cell for UE configured with *cellEdgeEvaluation* criterion shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to an already detected cell for UE configured with relaxed measurement criterion can be expressed as: $T_{evaluate,NR_Intra} + T_{SI\text{-}NR}$,

Where:

$T_{evaluate,NR_Intra}$ See table 4.2.2.9.3-1 for UE fulfilling not-at-cell edge criterion in clause 4.2.2.9.3.

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a Cell; 1280 ms is assumed in this test case.

This gives a total of 16.64 s, allow 17 s for the cell re-selection delay to an already detected cell for UE fulfilling not-at-cell edge criterion in the test case.

A.6.1.1.5 Cell reselection to FR1 inter-frequency NR case for UE fulfilling low mobility relaxed measurement criterion

A.6.1.1.5.1 Test Purpose and Environment

This test is to verify the requirement for the inter-frequency NR cell reselection requirements specified in clause 4.2.2.10.2, for UE fulfilling low mobility relaxed measurement criterion.

A.6.1.1.5.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.6.1.1.5.2-1, A.6.1.1.5.2-2 and A.6.1.1.5.2-3. The test consists of two successive time periods, with time duration of T1 and T2

respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

As specified in the Test Purpose, the UE is configured with the relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1]. So, Cell 2 and Cell 1 configure the UE as follows:

lowMobilityEvalutation [2] criterion is configured according to the parameters listed in table A.6.1.1.5.2-3;

cellEdgeEvaluation [2] criterion is not configured;

combineRelaxedMeasCondition [2] is not configured;

Table A.6.1.1.5.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.1.5.2-2: General test parameters for FR1 inter-frequency NR cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 2	The UE camps on Cell 2 in the initial phase, it fulfills Low Mobility relaxation measurements criterion, and during T1 period the UE reselects to Cell 1
	Neighbour cells		1, 2, 3	Cell 1	
T1 end condition	Active cell		1, 2, 3	Cell 1	The UE shall perform reselection to Cell 1 during T1
	Neighbour cells		1, 2, 3	Cell 2	
T2 end condition	Active cell		1, 2, 3	Cell 2	The UE shall perform reselection to Cell 2 with higher priority during T2
	Neighbour cells		1, 2, 3	Cell 1	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB Configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	Configured in SIB4 of Cell 1
				SMTC pattern 6	Configured in SIB4 of Cell 2
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	25 s	T1 is defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3	25 s	T2 is defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.5.2-3: Cell specific test parameters for FR1 inter-frequency NR cell re-selection test case in AWGN for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		SR.1.1 FDD	
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3	OP.1 defined in clause A.3.2.1		OP.1 defined in clause A.3.2.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1	14	14	-4	12
		2				
		3				
N_{oc} Note2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s / N_{oc}$	dB	1	14	14	-4	12
		2				
		3				
SS-RSRP Note3	dBm/SCS	1	-84	-84	-102	-86
		2	-84	-84	-102	-86
		3	-81	-81	-99	-83
Io	dBm/9.36 MHz	1	-55.88	-55.88	-68.60	-57.78
	dBm/9.36 MHz	2	-55.88	-55.88	-68.60	-57.78
	dBm/38.16 MHz	3	-49.79	-49.79	-62.50	-51.69
Treselection	s	1, 2, 3	0	0	0	0
SnonintrasearchP	dB	1, 2, 3	Not sent		Not sent	
$Thresh_{x, highP}$	dB	1, 2, 3	48		48	
$Thresh_{serving, lowP}$	dB	1, 2, 3	44		44	
$Thresh_{x, lowP}$	dB	1, 2, 3	50		50	
$S_{SearchDeltaP}$	dB	1, 2, 3	3		3	
$T_{SearchDeltaP}$	s	1, 2, 3	5		5	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1, 2, 3	AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.1.1.5.3 Test Requirements

The cell reselection delay to an already detected lower priority cell for UE fulfilling low mobility relaxed measurements is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to a lower priority cell for UE fulfilling low mobility relaxed measurements shall be less than 17 s.

The cell reselection delay to an already detected higher priority cell for UE fulfilling low mobility relaxed measurements is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the RRCSetupRequest message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected higher priority cell for UE fulfilling low mobility relaxed measurements shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a known lower priority cell can be expressed as: $T_{evaluate,\ NR_\ inter} + T_{SI\text{-}NR}$,

Where:

$T_{evaluate,\ NR_\ inter}$ See table 4.2.2.10.2-1 in clause 4.2.2.10.2

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 16.64 s, allow 17 s for the cell re-selection delay to an already detected lower priority cell and 16.64 s for the cell re-selection delay to an already detected higher priority cell, which we allow 17 s for UE fulfilling low mobility relaxed measurements in the test case.

A.6.1.1.6 Cell reselection to FR1 inter-frequency NR case for UE fulfilling not-at-cell edge relaxed measurement criterion

A.6.1.1.6.1 Test Purpose and Environment

This test is to verify the requirement for the inter-frequency NR cell reselection requirements specified in clause 4.2.2.10.3, for UE fulfilling not-at-cell edge relaxed measurement criterion.

A.6.1.1.6.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.6.1.1.6.2-1, A.6.1.1.6.2-2 and A.6.1.1.6.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

As specified in the Test Purpose, the UE is configured with the relaxed measurement criterion for UE not-at-cell edge as defined in clause 5.2.4.9.2 in TS 38.304 [1]. So, Cell 2 and Cell 1configures the UE as follows:

cellEdgeEvaluation [2] criterion is configured according to the parameters listed in table A.6.1.1.5.2-3;

lowMobilityEvalutation [2] criterion is not configured;

combineRelaxedMeasCondition [2] is not configured;

Table A.6.1.1.6.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.1.6.2-2: General test parameters for FR1 inter-frequency NR cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 2	The UE camps on Cell 2 in the initial phase, it fulfills Not-at-cell edge relaxation measurements criterion, and during T1 period the UE reselects to Cell 1
	Neighbour cells		1, 2, 3	Cell 1	
T1 end condition	Active cell		1, 2, 3	Cell 1	The UE shall perform reselection to Cell 1 during T1
	Neighbour cells		1, 2, 3	Cell 2	
T2 end condition	Active cell		1, 2, 3	Cell 2	The UE shall perform reselection to Cell 2 with higher priority during T2
	Neighbour cells		1, 2, 3	Cell 1	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB Configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	Configured in SIB4 of Cell 1
				SMTC pattern 6	Configured in SIB4 of Cell 2
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	20 s	T1 is defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3	20 s	T2 is defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.6.2-3: Cell specific test parameters for FR1 inter-frequency NR cell re-selection test case in AWGN for UE fulfilling not-at-cell edge criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		SR.1.1 FDD	
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3	OP.1 defined in clause A.3.2.1		OP.1 defined in clause A.3.2.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1	14	14	-4	12
		2				
		3				
N_{oc} Note2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s / N_{oc}$	dB	1	14	14	-4	12
		2				
		3				
SS-RSRP Note3	dBm/SCS	1	-84	-84	-102	-86
		2	-84	-84	-102	-86
		3	-81	-81	-99	-83
Io	dBm/9.36 MHz	1	-55.88	-55.88	-68.60	-57.78
	dBm/9.36 MHz	2	-55.88	-55.88	-68.60	-57.78
	dBm/38.16 MHz	3	-49.79	-49.79	-62.50	-51.69
Treselection	s	1, 2, 3	0	0	0	0
SnonintrasearchP	dB	1, 2, 3	Not sent		Not sent	
$Thresh_{x, highP}$	dB	1, 2, 3	48		48	
$Thresh_{serving, lowP}$	dB	1, 2, 3	44		44	
$Thresh_{x, lowP}$	dB	1, 2, 3	50		50	
$S_{SearchThresholdP}$	dB	1, 2, 3	50		50	
$S_{SearchThresholdQ}$	s	1, 2, 3	Not Configured			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1, 2, 3	AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.1.1.6.3 Test Requirements

The cell reselection delay to an already detected lower priority cell for UE fulfilling not-at-cell edge relaxed measurements is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected lower priority cell for UE fulfilling not-at-cell edge relaxed measurements shall be less than 17 s.

The cell reselection delay to an already detected higher priority cell for UE fulfilling not-at-cell-edge relaxed measurements is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the RRCSetupRequest message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected higher priority cell for UE fulfilling not-at-cell-edge relaxed measurements shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate,\ NR_\ inter} + T_{SI\text{-}NR}$,

Where:

$T_{evaluate,\ NR_\ inter}$ See table 4.2.2.10.3-1 in clause 4.2.2.10

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 16.64 s , allow 17 s for the cell re-selection delay to an already detected lower priority cell and 16.64 s for the cell re-selection delay to an already higher priority cell, which we allow 17 s for UE fulfilling not-at-cell edge relaxed measurements in the test case.

A.6.1.1.7 Cell reselection to FR1 intra-frequency NR case for UE configured with *highSpeedMeasFlag-r16*

A.6.1.1.7.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell reselection requirements for UE configured with *highSpeedMeasFlag-r16* specified in clause 4.2.2.3.

A.6.1.1.7.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.6.1.1.7.2-1, A.6.1.1.7.2-2 and A.6.1.1.7.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. *highSpeedMeasFlag-r16* is broadcasted to UE.

Table A.6.1.1.7.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.1.1.7.2-2: General test parameters for intra-frequency NR cell re-selection test case for UE *configured with highSpeedMeasFlag-r16*

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	
	Neighbour cells		1, 2, 3	Cell 2	
T2 end condition	Active cell		1, 2, 3	Cell 2	
	Neighbour cells		1, 2, 3	Cell 1	
Final condition	Active cell		1, 2, 3	Cell 1	
	Neighbour cells		1, 2, 3	Cell 2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	Configured in SIB2 of Cell 1
				SMTC pattern 6	Configured in SIB2 of Cell 2
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.32	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	1, 2, 3	10	T2 needs to be defined so that cell re-selection reaction time is taken into account. NOTE: This value includes 6 sec to allow Tracking Area Update procedure to be completed.
T3		s	1, 2, 3	9	T3 needs to be defined so that cell re-selection reaction time is taken into account. NOTE:This value includes 6 sec to allow Tracking Area Update procedure to be completed.

Table A.6.1.1.7.2-3: Cell specific test parameters for intra-frequency NR cell re-selection test case for UE *configured with highSpeedMeasFlag-r16*

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in clause A.3.2.1			OP.1 defined in clause A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-140			-140		
		3	-137			-137		
Pcompensation	dB	1, 2, 3	0			0		
$Qhyst_s$	dB	1, 2, 3	0			0		
$Qoffset_{s,n}$	dB	1, 2, 3	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1	16	-3.11	2.79	-infinity	2.79	-3.11
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s / N_{oc}$	dB	1	16	13	16	-infinity	16	13
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-82	-85	-82	-infinity	-82	-85
		2	-82	-85	-82	-infinity	-82	-85
		3	-79	-82	-79	-infinity	-79	-82
Io	dBm/9.36 MHz	1	-53.94	-52.21	-52.21	Same as parameters specified in Cell 1 columns-		
	dBm/9.36 MHz	2	-53.94	-52.21	-52.21			
	dBm/38.16 MHz	3	-47.85	-46.12	-46.12			
Treselection	s	1, 2, 3	0	0	0	0	0	0
SintrasearchP	dB	1, 2, 3	60			60		
Propagation Condition		1, 2	AWGN			AWGN 1944 Hz Note4		
Propagation Condition		3	AWGN			AWGN 3334 Hz Note5		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.								
NOTE 5: The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334 Hz.								

A.6.1.1.7.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 4 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 3 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI-NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR_ intra} + T_{SI-NR}$,

Where:

T_{detect, NR_Intra} See table 4.2.2.3-2 in clause 4.2.2.3

$T_{evaluate, NR_ intra}$ See table 4.2.2.3-2 in clause 4.2.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 3.84 s, allow 4 s for the cell re-selection delay to a newly detectable cell and 2.24 s for the cell re-selection delay to an already detected cell in the test case, which we allow 3 s.

A.6.1.1.8 Cell reselection to FR1 inter-frequency NR case for UE configured with *highSpeedMeasInterFreq-r17*

A.6.1.1.8.1 Test Purpose and Environment

This test is to verify the requirement for the inter-frequency NR cell reselection requirements for UE configured with *highSpeedMeasInterFreq-r17* specified in clause 4.2.2.4.

A.6.1.1.8.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.6.1.1.8.2-1, A.6.1.1.8.2-2 and A.6.1.1.8.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

Table A.6.1.1.8.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.1.8.2-2: General test parameters for FR1 inter-frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 2	The UE camps on Cell 2 in the initial phase and during T1 period the UE reselects to Cell 1
	Neighbour cell		1, 2, 3	Cell 1	
T1 end condition	Active cell		1, 2, 3	Cell 1	The UE shall perform reselection to Cell 1 during T1
	Neighbour cells		1, 2, 3	Cell 2	
T3 end condition	Active cell		1, 2, 3	Cell 2	The UE shall perform reselection to Cell 2 during T3
	Neighbour cell		1, 2, 3	Cell 1	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC.2	
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3	0.32	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	10	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3		s	1, 2, 3	12	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.8.2-3: Cell specific test parameters for FR1 inter-frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in clause A.3.2.1			OP.1 defined in clause A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-140			-140		
		3	-137			-137		
Pcompensation	dB	1, 2, 3	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1	14	14	14	-4	-infinity	12
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s / N_{oc}$	dB	1	14	14	14	-4	-infinity	12
		2						
		3						
SSB_RP Note3	dBm/SCS	1	-84	-84	-84	-102	-infinity	-86
		2	-84	-84	-84	-102	-infinity	-86
		3	-81	-81	-81	-99	-infinity	-83
Io	dBm/9.36 MHz	1	-55.88	-55.88	-55.88	-68.60	-70.05	-57.78
	dBm/9.36 MHz	2	-55.88	-55.88	-55.88	-68.60	-70.05	-57.78
	dBm/38.16 MHz	3	-49.79	-49.79	-49.79	-62.50	-63.96	-51.69
Treselection	s	1, 2, 3	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2, 3	50			50		
$Thresh_{x, highP}$	dB	1, 2, 3	48			48		
$Thresh_{serving, lowP}$	dB	1, 2, 3	44			44		
$Thresh_{x, lowP}$	dB	1, 2, 3	50			50		
Propagation Condition		1, 2	AWGN			AWGN 1944Hz Note4		
Propagation Condition		3	AWGN			AWGN 3334Hz Note5		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.								
NOTE 5: The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334 Hz.								

A.6.1.1.8.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 5 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 3 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect,NR_Inter_HST} + T_{SI\text{-}NR}$, and to an already detected cell can be expressed as: $T_{evaluate,NR_Inter_HST} + T_{SI\text{-}NR}$,

Where:

T_{detect,NR_Inter_HST} See table 4.2.2.4-2 in clause 4.2.2.4

$T_{evaluate,NR_Inter_HST}$ See table 4.2.2.4-2 in clause 4.2.2.4

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 4.48 s, allow 5 s for the cell re-selection delay to a newly detectable cell and 2.24 s for the cell re-selection delay to an already detected cell in the test case, which we allow 3 s.

A.6.1.1.9 Cell reselection to FR1 intra-frequency NR case for UE operating on a cell with less than 5 MHz BW

A.6.1.1.9.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell reselection requirements specified in clause 4.2.2.3. for UE capable of operating on a cell with less than 5 MHz BW.

Supported test configurations are specified in table A.6.1.1.9.2-1. General test parameters as specified in table A.6.1.1.1.2-2 with config 1 apply except those specified in table A.6.1.1.9.2-2. Cell specific test parameters as specified in table A.6.1.1.1.2-3 with config 1 apply except those specified in table A.6.1.1.9.2-3. The test procedure specified in clause A.6.1.1.1.2 applies to this test.

Table A.6.1.1.9.2-1: Supported test configurations

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 3 MHz bandwidth

Table A.6.1.1.9.2-2: General test parameters for intra-frequency NR cell re-selection test case

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
BWchannel	MHz	Config 1	3: $N_{PRB,c}$ = 12	
SSB Configuration		Config 1	SSB.13	

Table A.6.1.1.1.9-3: Cell specific test parameters for intra-frequency NR cell re-selection test case

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
PDSCH RMC		1	SR.1.3 FDD			SR.1.3 FDD		
RMSI CORESET		1	CR.1.2 FDD			CR.1.2 FDD		
Dedicated CORESET		1	CCR.1.6 FDD			CCR.1.6 FDD		
Io	dBm/2.7 MHz	1	-60.31	-58.58	-58.58	Same as parameters specified in Cell 1 columns-		

A.6.1.1.9.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 34 s for UE operating on a cell with less than 5 MHz BW.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 8 s for UE operating on a cell with less than 5 MHz BW.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI-NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR_ intra} + T_{SI-NR}$,

Where:

T_{detect, NR_Intra} + 40 ms See table 4.2.2.3-1 in clause 4.2.2.3

$T_{evaluate, NR_ intra}$ See table 4.2.2.3-1 in clause 4.2.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1320 ms is assumed in this test case.

This gives a total of 33.36 s, allow 34 s for the cell re-selection delay to a newly detectable cell and 7.76 s for the cell re-selection delay to an already detected cell in the test case, which we allow 8 s.

A.6.1.2 Inter-RAT E-UTRAN cell re-selection

A.6.1.2.1 Cell reselection to higher priority E-UTRAN

A.6.1.2.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection requirements specified in clause 4.2.2.5 when the E-UTRAN cell is of higher priority.

A.6.1.2.1.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.1.2-1, A.6.1.2.1.2-2, A.6.1.2.1.2-3 and A.6.1.2.1.2-4. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. NR Cell 1 is already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of higher priority than Cell 1.

Table A.6.1.2.1.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.2.1.2-2: General test parameters for NR to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE camps on Cell 1 in the initial phase and during T2 period the UE reselects to Cell 2.
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 2	The UE shall perform reselection to cell 2 during T2.
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell 1	
T3 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE shall perform reselection to cell 1 during T3 for iteration of the tests.
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell 2	
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6	4	
E-UTRAN PRACH			1, 2, 3	53	As specified in table 5.7.1-2 in TS 36.211 [23]
configuration index			4, 5, 6	4	
T1		s	1, 2, 3, 4, 5, 6	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2.
T2		s	1, 2, 3, 4, 5, 6	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3		s	1, 2, 3, 4, 5, 6	15	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.2.1.2-3: Cell specific test parameters for NR Cell 1

Parameter	Unit	Test configuration	Cell 1		
			T1	T2	T3
TDD configuration		1, 4	N/A		

Parameter	Unit	Test configuration	Cell 1		
			T1	T2	T3
		2, 5	TDDConf.1.1		
		3, 6	TDDConf.2.1		
PDSCH parameters		1, 4	SR.1.1 FDD		
		2, 5	SR.1.1 TDD		
		3, 6	SR.2.1 TDD		
RMSI CORESET parameters		1, 4	CR.1.1 FDD		
		2, 5	CR.1.1 TDD		
		3, 6	CR.2.1 TDD		
Dedicated CORESET parameters		1, 4	CCR.1.1 FDD		
		2, 5	CCR.1.1 TDD		
		3, 6	CCR.2.1 TDD		
SSB parameters		1, 4	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.2 FR1		
NR SMTC parameters		1, 4	SMTC.2		
		2, 5	SMTC.1		
		3, 6	SMTC.1		
OCNG Pattern		1, 2, 3, 4, 5, 6	OP.1 defined in clause A.3.2.1		
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1		
RLM-RS		1, 2, 3, 4, 5, 6	SSB		
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140		
		3, 6	-137		
N_{oc}	dBm/SCS	1, 4	-98		
		2, 5	-98		
		3, 6	-95		
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98		
SS-RSRP	dBm/SCS	1, 4	-84	-84	-84
		2, 5	-84	-84	-84
		3, 6	-81	-81	-81
$\hat{E}_s/I_{ot}$	dB	1, 4	14	14	14
		2, 5			
		3, 6			
$\hat{E}_s/N_{oc}$	dB	1, 4	14	14	14
		2, 5			
		3, 6			
Io	dBm/9.36 MHz	1, 4	-55.88	-55.88	-55.88
	dBm/9.36 MHz	2, 5	-55.88	-55.88	-55.88
	dBm/38.16 MHz	3, 6	-49.79	-49.79	-49.79
Treselection	s	1, 2, 3, 4, 5, 6	0		
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6	50		
$Thresh_{x, highP}$ (Note 2)	dB	1, 2, 3, 4, 5, 6	48		
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6	44		
$Thresh_{x, lowP}$	dB	1, 2, 3, 4, 5, 6	50		
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell

Table A.6.1.2.1.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2		
		T1	T2	T3
E-UTRA RF Channel number		1		
$BW_{channel}$	MHz	10		
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6		
PBCH_RA	dB	0		

PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			
PHICH_RA	dB			
PHICH_RB	dB			
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA Note 1	dB			
OCNG_RB Note 1	dB			
Qrxlevmin	dBm	-140		
N_{oc}	dBm/15 kHz	-98		
RSRP	dBm/15 kHz	-infinity	-86	-102
$\hat{E}_s / I_{ot}$	dB	-infinity	12	-4
$\hat{E}_s / N_{oc}$	dB	-infinity	12	-4
$Treselection_{EUTRAN}$	s	0		
SnonintrasearchP	dB	Not sent		
$Thresh_{x, highP}$	dB	48		
$Thresh_{serving, lowP}$	dB	44		
$Thresh_{x, lowP}$ (Note 2)	dB	50		
Propagation Condition		AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: This refers to the value of $Thresh_{x, Low}$ which is included in E-UTRA system information, and is a threshold for the NR target cell

A.6.1.2.1.3 Test Requirements

The cell reselection delay to a higher priority E-UTRAN cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

$T_{higher_priority_search}$ See clause 4.2.2.7

$T_{evaluate, E-UTRAN}$ See table 4.2.2.5-1 in clause 4.2.2.5

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority E-UTRAN cell.

A.6.1.2.2 Cell reselection to lower priority E-UTRAN

A.6.1.2.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection requirements specified in clause 4.2.2.5 when the E-UTRAN cell is of lower priority.

A.6.1.2.2.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.2.2-1, A.6.1.2.2.2-2, A.6.1.2.2.2-3 and A.6.1.2.2.2-4. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both NR Cell 1 and E-UTRAN Cell 2 are already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of lower priority than Cell 1.

Table A.6.1.2.2.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.2.2.2-2: General test parameters for NR to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE camps on Cell 1 in the initial phase.
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell 2	
T1 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 2	The UE shall perform reselection to Cell 2 during T1.
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell 1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE shall perform reselection to Cell 1 during T2 for iteration of the tests.
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell 2	
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3	534	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6		
T1		s	1, 2, 3, 4, 5, 6	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.2.2.2-3: Cell specific test parameters for NR Cell 1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 4	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC.2	
		2, 5	SMTC.1	
		3, 6	SMTC.1	
OCNG Pattern		1, 2, 3, 4, 5, 6	OP.1 defined in clause A.3.2.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98	
SS-RSRP	dBm/SCS	1, 4	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s/I_{ot}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
$\hat{E}_s/N_{oc}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
Io	dBm/9.36 MHz	1, 4	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/38.16 MHz	3, 6	-62.50	-51.69
Treselection	s	1, 2, 3, 4, 5, 6	0	
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6	Not sent	
$Thresh_{x, highP}$	dB	1, 2, 3, 4, 5, 6	48	
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6	44	
$Thresh_{x, lowP}$ (Note 2)	dB	1, 2, 3, 4, 5, 6	50	
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell				

Table A.6.1.2.2.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		

Parameter	Unit	Cell 2	
		T1	T2
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 kHz	-84	-84
$\hat{E}_s / I_{ot}$	dB	14	14
$\hat{E}_s / N_{oc}$	dB	14	14
$Treselection_{EUTRAN}$	s	0	
SnonintrasearchP	dB	Not sent	
$Thresh_{x, highP}$ (Note 2)	dB	48	
$Thresh_{serving, lowP}$	dB	44	
$Thresh_{x, lowP}$	dB	50	
Propagation Condition		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell			

A.6.1.2.2.3 Test Requirements

The cell reselection delay to a lower priority E-UTRAN cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

$T_{evaluate, E-UTRAN}$ See table 4.2.2.5-1 in clause 4.2.2.5

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 7.68 s, allow 8 s for the cell re-selection delay to a lower priority E-UTRAN cell.

A.6.1.2.3 Cell reselection to lower priority E-UTRAN for UE fulfilling low mobility relaxed measurement criterion

A.6.1.2.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection when UE fulfills the low mobility criterion specified in clause 4.2.2.11.2 and the E-UTRAN cell is of lower priority.

A.6.1.2.3.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.3.2-1, A.6.1.2.3.2-2, A.6.1.2.3.2-3 and A.6.1.2.3.2-4. The test consists of two successive time periods, with time duration of T1 and T2, respectively. Both NR Cell 1 and E-UTRAN Cell 2 are already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of lower priority than Cell 1.

As specified in the test purpose, the UE is configured with the relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in TS 38.304 [1]. So, Cell 1 configures the UE as follows:

- *lowMobilityEvalutation* [2] criterion is configured according to the parameters listed in table A.6.1.2.3.2-3;
- *cellEdgeEvaluation* [2] criterion is not configured;
- *combineRelaxedMeasCondition* [2] is not configured

Table A.6.1.2.3.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.2.3.2-2: General test parameters for NR to E-UTRAN cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE camps on Cell 1 in the initial phase, it fulfills Low Mobility relaxation measurements criterion, and during T1 period the UE reselects to Cell 2
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell 2	
T1 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 2	The UE shall perform reselection to Cell 2 during T1
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell 1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE shall perform reselection to Cell 1 with higher priority during T2 for iteration of the tests.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell 2	
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	0.64	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6	4	
T1		s	1, 2, 3, 4, 5, 6	24	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6	24	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.2.3.2-3: Cell specific test parameters for NR Cell 1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 4	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC pattern 2	
		2, 5	SMTC pattern 1	
		3, 6	SMTC pattern 1	
OCNG Pattern		1, 2, 3, 4, 5, 6	OP.1 defined in clause A.3.2.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98	
SS-RSRP	dBm/SCS	1, 4	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s / I_{ot}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
$\hat{E}_s / N_{oc}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
Io	dBm/9.36 MHz	1, 4	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/38.16 MHz	3, 6	-62.50	-51.69
TreselectionP	s	1, 2, 3, 4, 5, 6	0	
Snonintrasearch	dB	1, 2, 3, 4, 5, 6	50	
$Thresh_{x, highP}$	dB	1, 2, 3, 4, 5, 6	48	
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6	44	
$Thresh_{x, lowP (Note 2)}$	dB	1, 2, 3, 4, 5, 6	50	
$S_{SearchDeltaP}$	dB	1, 2, 3, 4, 5, 6	3	
$T_{SearchDeltaP}$	s	1, 2, 3, 4, 5, 6	5	
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: This refers to the value of $Thresh_{x, low}$ which is included in NR system information, and is a threshold for the E-UTRA target cell

Table A.6.1.2.3.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	

Parameter	Unit	Cell 2	
		T1	T2
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 kHz	-84	-84
$\hat{E}_s / I_{ot}$	dB	14	14
$\hat{E}_s / N_{oc}$	dB	14	14
$Treselection_{EUTRAN}$	s	0	
Snonintrasearch	dB	Not sent	
$Thresh_{x, high (Note 2)}$	dB	48	
$Thresh_{serving, low}$	dB	44	
$Thresh_{x, low}$	dB	50	
Propagation Condition		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell.			

A.6.1.2.3.3 Test Requirements

The cell reselection delay to a lower priority E-UTRAN cell with UE fulfilling low mobility criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCConnectionRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a lower priority cell shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

$T_{evaluate, E-UTRAN}$ See table 4.2.2.11.2-1 in clause 4.2.2.11.2

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 15.36 ($T_{evaluate, E-UTRAN}$) + 1.28 ($T_{SI-E-UTRA}$) = 16.64 s, allow 17 s for the cell re-selection delay to a lower priority E-UTRAN cell for UE fulfilling low mobility criterion.

A.6.1.2.4 Cell reselection to lower priority E-UTRAN for UE fulfilling not-at-cell edge relaxed measurement criterion

A.6.1.2.4.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection requirements when UE fulfills not-at-cell edge criterion specified in clause 4.2.2.11.3 when the E-UTRAN cell is of lower priority.

A.6.1.2.4.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.4.2-1, A.6.1.2.4.2-2, A.6.1.2.4.2-3 and A.6.1.2.4.2-4. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both NR Cell 1 and E-UTRAN Cell 2 are already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of lower priority than Cell 1.

As specified in the Test Purpose, the UE is configured with the relaxed measurement criterion for UE with not-at-cell edge defined in clause 5.2.4.9.2 in [1]. So, Cell 1 configures the UE as follows:

- *lowMobilityEvalutation* [2] criterion is not configured;
- *cellEdgeEvaluation* [2] criterion is configured according to the parameters listed in table A.6.1.2.4.2-3;
- *combineRelaxedMeasCondition* [2] is not configured

Table A.6.1.2.4.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.2.4.2-2: General test parameters for NR to E-UTRAN cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE camps on Cell 1 in the initial phase and fulfill the not at the cell edge criteria.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell 2	
T1 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 2	The UE shall perform reselection to Cell 2 during T1.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell 1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE shall perform reselection to Cell 1 during T2 for iteration of the tests.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell 2	
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	0.64	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6	4	
T1		s	1, 2, 3, 4, 5, 6	24	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6	24	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.2.4.2-3: Cell specific test parameters for NR Cell 1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 4	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC pattern 2	
		2, 5	SMTC pattern 1	
		3, 6	SMTC pattern 1	
OCNG Pattern		1, 2, 3, 4, 5, 6	OP.1 defined in clause A.3.2.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98	
SS-RSRP	dBm/SCS	1, 4	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s / I_{ot}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
$\hat{E}_s / N_{oc}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
$S_{SearchThresholdP}$	dB	1, 2, 3, 4, 5, 6	32	32
Io	dBm/9.36 MHz	1, 4	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/38.16 MHz	3, 6	-62.50	-51.69
Treselection	s	1, 2, 3, 4, 5, 6	0	
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6	60	
$Thresh_{x, highP}$	dB	1, 2, 3, 4, 5, 6	48	
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6	44	
$Thresh_{x, lowP (Note 2)}$	dB	1, 2, 3, 4, 5, 6	50	
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: This refers to the value of $Thresh_{x, low}$ which is included in NR system information, and is a threshold for the E-UTRA target cell

Table A.6.1.2.4.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	

Parameter	Unit	Cell 2	
		T1	T2
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 kHz	-84	-84
$\hat{E}_s / I_{ot}$	dB	14	14
$\hat{E}_s / N_{oc}$	dB	14	14
$Treselection_{EUTRAN}$	s	0	
Snonintrasearch	dB	Not sent	
$Thresh_{x, high (Note 2)}$	dB	48	
$Thresh_{serving, low}$	dB	44	
$Thresh_{x, low}$	dB	50	
Propagation Condition		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell

A.6.1.2.4.3 Test Requirements

The cell reselection delay to a lower priority E-UTRAN cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCConnectionRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a lower priority cell shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

$T_{evaluate, E-UTRAN}$ See table 4.2.2.11.3-1 in clause 4.2.2.11.3

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 16.64 s, allow 17 s for the cell re-selection delay to a lower priority E-UTRAN cell for UE fulfilling not-at-cell edge criterion.

A.6.1.2.5 Cell reselection to lower priority E-UTRAN cell for UE configured with highSpeedMeasFlag-r16

A.6.1.2.5.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection requirements for UE configured with *highSpeedMeasFlag-r16* specified in clause 4.2.2.5 when the E-UTRAN cell is of lower priority.

A.6.1.2.5.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.5.2-1, A.6.1.2.5.2-2, A.6.1.2.5.2-3 and A.6.1.2.5.2-4. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both NR Cell 1 and E-UTRAN Cell 2 are already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of lower priority than Cell 1. The E-UTRAN Cell 2 is indicated by NR Cell 1 as an HST cell.

Table A.6.1.2.5.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.2.5.2-2: General test parameters for NR to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE camps on Cell 1 in the initial phase.
T1 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 2	The UE shall perform reselection to Cell 2 during T1.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell 1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE shall perform reselection to Cell 1 during T2 for iteration of the tests.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell 2	
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	0.32	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6	4	
T1		s	1, 2, 3, 4, 5, 6	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.2.5.2-3: Cell specific test parameters for NR Cell 1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 4	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC pattern 2	
		2, 5	SMTC pattern 1	
		3, 6	SMTC pattern 1	
OCNG Pattern		1, 2, 3, 4, 5, 6	OP.1 defined in clause A.3.2.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98	
SS-RSRP	dBm/SCS	1, 4	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s/I_{ot}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
$\hat{E}_s/N_{oc}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
Io	dBm/9.36 MHz	1, 4	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/38.16 MHz	3, 6	-62.50	-51.69
Treselection	s	1, 2, 3, 4, 5, 6	0	
$S_{nonintrasearchP}$	dB	1, 2, 3, 4, 5, 6	50	
$Thresh_{x, highP}$ (Note 2)	dB	1, 2, 3, 4, 5, 6	48	
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6	44	
$Thresh_{x, lowP}$	dB	1, 2, 3, 4, 5, 6	50	
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: This refers to the value of $Thresh_{x, highP}$ which is included in NR system information, and is a threshold for the E-UTRA target cell.
NOTE 3: Void.

Table A.6.1.2.5.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	

Parameter	Unit	Cell 2	
		T1	T2
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 kHz	-84	-84
$\hat{E}_s / I_{ot}$	dB	14	14
$\hat{E}_s / N_{oc}$	dB	14	14
$Treselection_{EUTRAN}$	s	0	
$S_{nonintrasearchP}$	dB	Not sent	
$Thresh_{x, highP}$ (Note 2)	dB	48	
$Thresh_{serving, lowP}$	dB	44	
$Thresh_{x, lowP}$	dB	50	
Propagation Condition		AWGN 1944 Hz Note3	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: This refers to the value of $Thresh_{x, highP}$ which is included in E-UTRA system information, and is a threshold for the NR target cell
NOTE 3: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.

A.6.1.2.5.3 Test Requirements

The cell reselection delay to a lower priority E-UTRAN cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a lower priority cell shall be less than 3 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, E\text{-}UTRAN_HST} + T_{SI\text{-}E\text{-}UTRA}$,

Where:

$T_{evaluate, E\text{-}UTRAN_HST}$ See table 4.2.2.5-2 in clause 4.2.2.5

$T_{SI\text{-}E\text{-}UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 2.24 s, allow 3 s for the cell re-selection delay to a lower priority E-UTRAN cell.

A.6.1.1.7 Void

A.6.2 SA: RRC_INACTIVE state mobility

A.6.2.1 Configured Grant based Small Data Transmissions (CG-SDT)

A.6.2.1.1 Test purpose and Environment

The purpose of this test is to partly verify that the UE properly perform TA validation for CG-SDT transmission in clause 5.5.3. The test includes two sub-tests, Sub-test#1 for testing valid TA where UE can initiat CG-SDT transmission, and Sub-test#2 for testing invalid TA where UE does not initiate CG-SDT transmission. Subtest#2 is only tested if Sub-test#1 is passed. For each sub-test, UE is configured with CG-SDT configurations when entering RRC Inactive state. Sub-test#1 consists of four successive time periods, with time duration of T1, T2, T3 and T4 repectively. Sub-test#2 consists of two successive time periods, with time duration of T5 and T6 repectively. There is one cell, which is the active NR cell in FR1. Figure A.6.2.1.1-1 shows the variation of the RSRP over the duration of Sub-test#1, and figure A.6.2.1.1-2 shows the variation of the RSRP over the duration of Sub-test#2.

In Sub-test#1:

- Prior to the time point TA, the UE shall be fully synchronized to PCell (Cell 1), be registered to the cell and have entered RRC connected mode.
- At time point TB, RSRP is changed from P0 to P1.
- At time point TC, which is W1 after time point TB, UE expect to receive RRC release with CG SDT configuration and RRC status is changed to INACTIVE status.
- At time point TD, RSRP is changed from P1 to P0.
- At time point TE, RSRP is changed from P0 to P2. TE must be W2 before TF.
- Test equipment triggers UL data arrival at UE lower layer at time point TF. After time point TF, test equipment observes whether UE transmits with CG-SDT no later than TG which is W3 after TF.
- After time point TG, RRC status is changed from RRC INACTIVE to RRC CONNECTED.

In Sub-test#2:

- Prior to the time point TA, the UE shall pass Sub-test#1 and have entered RRC connected mode. Otherwise, Sub-test#2 shall not be executed.
- From time point TA to time point TD, RSRP is set to P2.
- At time point TC, which is W1 after time point TB, UE expect to receive RRC release with CG SDT configuration and RRC status is changed to INACTIVE status.
- At time point TD, RSRP is changed from P2 to P0.
- Test equipment triggers UL data arrival at UE lower layer at time point TF. TF is 3360 ms after TD. After time point TF, test equipment observes whether UE transmits with CG-SDT no later than TG which is W3 after TF.

W1 equals to 640 ms and W2 equals to 640 ms based on requirements in clause 5.5.3. W3 is 860 ms.

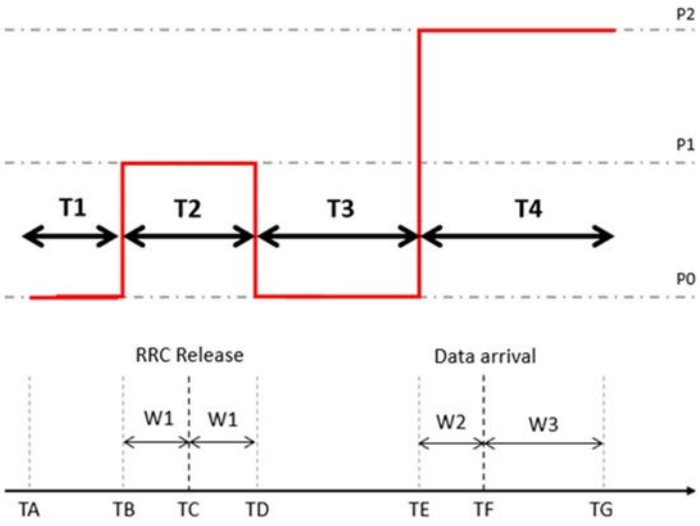


Figure A.6.2.1.1-1: RSRP variation model for CG-SDT Sub-test#1.

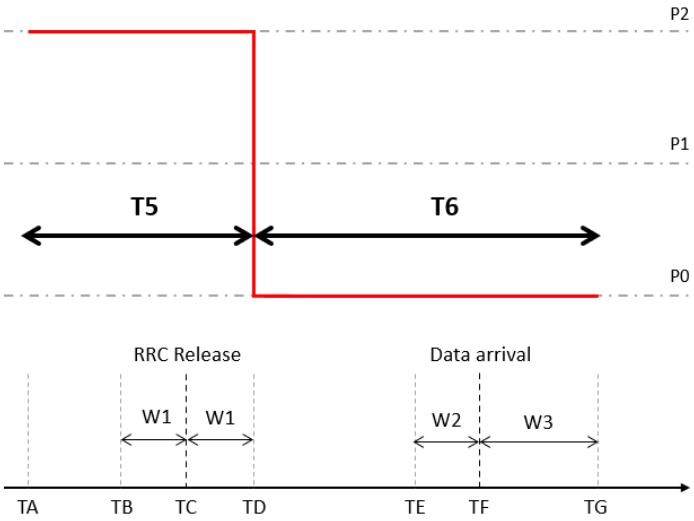


Figure A.6.2.1.1-2: RSRP variation model for CG-SDT Sub-test#2.

A.6.2.1.2 Test Parameters

There is one cells in the test, the FR1 PCell. The test parameters for the PCell are given in table A.6.2.1.2-1, table A.6.2.1.2-2, and table A.6.2.1.2-3.

Table A.6.2.1.2-1: NR configuration for FR1 SSB

Config	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.2.1.2-2 : General test parameters

Parameter	Unit	Test configuration	Value	Comment
TDD Configuration		1	N/A	
		2	TDDConf.1.1	
		3	TDDConf.2.1	

Parameter	Unit	Test configuration	Value	Comment
$BW_{channel}$	MHz	1,2	10: $N_{PRB,c}$ = 52	
		3	40: $N_{PRB,c}$ = 106	
PDSCH Reference measurement channel		1	SR.1.1 FDD	
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET Reference Channel		1	CR.1.1 FDD	
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
Dedicated CORESET Reference Channel		1	CCR.1.1 FDD	
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
SSB configuration		1,2	SSB.1 FR1	
		3	SSB.2 FR1	
OCNG Patterns		1,2,3	OP.1	
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration		1,2,3	DLBWP.1.1 ULBWP.1.1	
SMTC configuration		1,2,3	SMTC.1	
DRX configuration	ms	1,2,3	640	
T1	s	1,2,3	0.4	
T2	s	1,2,3	1.28	
T3	s	1,2,3	2.72	
T4	s	1,2,3	1.5	
T5	s	1,2,3	1.68	
T6	s	1,2,3	4.22	
cg-SDT-RSRP-ChangeThreshold	dB	1,2,3	8	
cg-SDT-RSRP-ThresholdSSB	dBm	1,2,3	-110 dB	
cg-SDT-TimeAlignmentTime		1,2,3	infinity	
CG-SDT resource period	ms		320	configuredGrantConfig Peridocity at 38.331 Config 1,2 : sym320x14, config 3 : sym640x14
Propagation condition		1,2,3	AWGN	

Table A.6.2.1.2-3: SSB specific test parameters

Parameter	Config	Unit	SSB#0					
			T1	T2	T3	T4	T5	T6
N_{oc}	1,2,3	dBm/15kHz	-100					
N_{oc}	1,2	dBm/SSB SCS	-100					
	3	dBm/SSB SCS	-97					
$\hat{E}_s/I_{ot}$	1,2,3	dB	0	12	0	14	14	0
SS RSRP	1,2	dBm/SSB SCS	-100	-88	-100	-86	-86	-100
	3		-97	-85	-97	-83	-83	-97
Io	1,2	dBm/9.36 MHz	-69.04	-59.78	-69.04	-57.88	-57.88	-69.04
	3	dBm/38.16 MHz	-62.93	-53.68	-62.93	-51.78	-51.78	-62.93
$\hat{E}_s/N_{oc}$	1,2,3	dB	0	12	0	14	14	0

A.6.2.1.3 Test requirements

The UE behaviour in each test during time durations shall be as follows:

During Sub-test#1, UE shall transmit PUSCH at CG-SDT resource within 860 ms after time point TF.

During Sub-test#2, after passing Sub-test#1, UE shall not transmit PUSCH at CG-SDT resources after TF until the end of the test at time point TG.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.2.2 Cell reselection for positioning

A.6.2.2.1 Cell reselection to FR1 intra-frequency NR case with RRC_ INACTIVE eDRX and positioning SRS

A.6.2.2.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell reselection requirements specified in clause 5.6.1A.2, when UE is in RRC_INACTIVE and configured with eDRX and to transmit SRS for positioning.

A.6.2.2.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.6.2.2.1.2-1, A.6.2.2.1.2-2 and A.6.2.2.1.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. UE is configured with transmit SRS for positioning in Cell 1.

Table A.6.2.2.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.2.2.1.2-2: General test parameters for intra frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell1	
T2 end condition	Active cell		1, 2, 3	Cell2	
	Neighbour cells		1, 2, 3	Cell1	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC.2	Configured in SIB2 of Cell 1
				SMTC.6	Configured in SIB2 of Cell 2
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3	1.28	The value shall be used for all cells in the test.
CN and RAN eDRX configuration			Config 1	eDRX cycle = 40.96s PTW length = 1.28s	

PRACH configuration index		1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell		1, 2, 3	Not configured	
T1	s	1, 2, 3	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2	s	1, 2, 3	120	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.2.2.1.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		SR.1.1 FDD	
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Periodicity of SRS for positioning	s	1, 2, 3	5.12		N/A	
Qrxlevmin	dBm/SCS	1, 2	-130		-130	
		3	-127		-127	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1	16	-3.11	-infinity	2.79
		2				
		3				
N_{oc} Note2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s / N_{oc}$	dB	1	16	13	-infinity	16
		2				
		3				
SS-RSRP Note3	dBm/SCS	1	-82	-85	-infinity	-82
		2	-82	-85	-infinity	-82
		3	-79	-82	-infinity	-79
Io	dBm/9.36 MHz	1	-53.94	-52.21	Same as parameters specified in Cell 1 columns-	

	dBm/9.36 MHz	2	-53.94	-52.21		
	dBm/38.16 MHz	3	-47.85	-46.12		
Treselection	s	1, 2, 3	0	0	0	0
SintrasearchP	dB	1, 2, 3	60		60	
Propagation Condition		1, 2, 3	AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.2.2.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 119 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI-NR}$,

Where:

T_{detect, NR_Intra} See table 5.6.1A.2-1 in clause 5.6.1A.2

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280ms is assumed in this test case.

This gives a total of 119.04 s, allow 120 s for the cell re-selection delay to a newly detectable cell.

A.6.3 RRC_CONNECTED state mobility

A.6.3.1 Handover

A.6.3.1.1 Intra-frequency handover from FR1 to FR1; known target cell

A.6.3.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency handover requirements specified in clause 6.1.1.2.

A.6.3.1.1.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.1.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.1.2-2, and A.6.3.1.1.2-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2.

NR shall send a RRC message implying handover to Cell 2. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3. T3 is defined as the end of the last TTI containing the RRC message implying handover.

Table A.6.3.1.1.2-1: Intra-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.1.2-2: General test parameters Intra-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.6.3.1.1.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency handover test case

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			1		
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD					
	Config 2		SR.1.1 TDD					
	Config 3		SR2.1 TDD					
CORESET Reference Channel	Config 1		CR.1.1 FDD					
	Config 2		CR.1.1 TDD					
	Config 3		CR2.1 TDD					
TRS configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz					

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
	Config 3		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15kHz	-98					
N_{oc} Note2	Config 1,2	dBm/SCS	-98					
	Config 3		-95					
$\hat{E}_s / I_{ot}$		dB	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s / N_{oc}$		dB	8	8	8	-Infinity	11	11
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-Infinity	-87	-87
	Config 3	dBm/SCS	-87	-87	-87	-Infinity	-84	-84
Io Note3	Config 1,2	dBm/ 9.36 MHz	-61.41	-57.06	-57.06	-61.41	-57.06	-57.06
	Config 3	dBm/ 38.16 MHz	-55.31	-50.96	-50.96	-55.31	-50.96	-50.96
Propagation condition		-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 62 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2.

This gives a total of 72 ms.

A.6.3.1.2 Intra-frequency handover from FR1 to FR1; unknown target cell

A.6.3.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency handover requirements specified in clause 6.1.1.2.

A.6.3.1.2.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.2.2-2, and A.6.3.1.2.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2, respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.6.3.1.2.2-1: Intra-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.2.2-2: General test parameters Intra-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	

Table A.6.3.1.2.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf. 2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	8	-0.64	-Infinity	-0.64
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	8
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-Infinity	-90
	Config 3	dBm/SCS	-87	-87	-Infinity	-87
Io Note3	Config 1,2	dBm/ 9.36 MHz	-61.41	-58.71	-61.41	-58.71
	Config 3	dBm/ 38.16 MHz	-55.31	-52.60	-55.31	-52.60
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 92 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 82 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2.

This gives a total of 92 ms.

A.6.3.1.3 Inter-frequency handover from FR1 to FR1; unknown target cell

A.6.3.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 inter-frequency handover requirements specified in clause 6.1.1.2.

A.6.3.1.3.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.3.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.3.2-2, and A.6.3.1.3.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.6.3.1.3.2-1: Inter-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.3.2-2: General test parameters Inter-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤5	

Table A.6.3.1.3.2-3: Cell specific test parameters for NR FR1-FR1 Inter-frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Config 3		CR2.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s/I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s/N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.3.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 132 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 122 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2.

This gives a total of 132 ms.

A.6.3.1.4 SA NR - E-UTRAN handover

A.6.3.1.4.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to E-UTRAN handover requirements as specified in clause 6.1.2.1.

The test comprises of one NR carrier and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in table 9.1.2-1 is configured before T2 begins to enable inter-RAT frequency monitoring.

A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the next instant after the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.6.3.1.4-1. General test parameters are provided in table A.6.3.1.4-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.6.3.1.4-3 and A.6.3.1.4-4 respectively.

Table A.6.3.1.4-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.4-2: General test parameters for SA inter-RAT E-UTRAN handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2	E-UTRAN cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
b2-Threshold1		dBm	As specified in Table A.6.3.1.4-3	Absolute E-UTRAN RSRP threshold for event B2 (*b2-Threshold2EUTRA*)
b2-Threshold2EUTRAN		dBm	-98	Absolute E-UTRAN RSRP threshold for event B2
Hysteresis		dB	0	
TimeToTrigger		s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
Gap pattern configuration Id			0	As specified in Table 9.1.2-1 started before T2 starts
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.6.3.1.4-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3, 4, 5, 6	1		
Duplex mode			1, 4	FDD		
			2, 3, 5, 6	TDD		
TDD Configuration			2, 5	TDDConf.1.1		
			3, 6	TDDConf.2.1		
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)		
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)		
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)		
PDSCH reference measurement channel			1, 4	SR.1.1 FDD		
			2, 5	SR.1.1 TDD		
			3, 6	SR.2.1 TDD		
CORSET reference channel			1, 4	CR.1.1 FDD		
			2, 5	CR.1.1 TDD		
			3, 6	CR.2.1 TDD		
TRS configuration			1, 4	TRS.1.1 FDD		
			2, 5	TRS.1.1 TDD		
			3, 6	TRS.1.2 TDD		
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1		
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration			1, 2, 4, 5	SSB.1 FR1		
			3, 6	SSB.2 FR1		
b2-Threshold1		dBm	1, 2, 4, 5	-96		
			3, 6	-93		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0		
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}[Note2]		dBm/15 kHz	1, 2, 3, 4, 5, 6	-100	-104	-100
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-100	-104	-100
			3, 6	-97	-101	-97
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	12	0	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	12	0	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104	-104
			3, 6	-85	-101	-101
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-59.78	-73.04	-69.04
		dBm/38.16 MHz	3, 6	-53.68	-66.9448	-64.19
Propagation condition			1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6	1x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					

Table A.6.3.1.4-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6	2		
Duplex mode		1, 2, 3	FDD		
		4, 5, 6	TDD		
TDD special subframe configuration[Note1]		4, 5, 6	6		
TDD uplink-downlink configuration[Note1]		4, 5, 6	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PRACH Configuration[Note2]		1, 2, 3	4		
		4, 5, 6	53		
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD		
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note3]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD		
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note4]					
OCNG_RB[Note4]					
N_{oc}[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	8	78
$\hat{E}_s/I_{ot}$[Note6]	dB	1, 2, 3, 4, 5, 6	-Infinity	78	78
RSRP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-90	-90
SCH_RP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-90	-90
Io[Note6]	dBm/9 MHz	1, 2, 3, 4, 5, 6	-67.21 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
Antenna Configuration and Correlation Matrix Note7		1, 2, 3, 4, 5, 6	1x2 Low		
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].					
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].					
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.					
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].					

A.6.3.1.4.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 85 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in clause 6.1.2.1.

$T_{interrupt}$ = 35 ms in the test; $T_{interrupt}$ is defined in clause 6.1.2.1.

This gives a total of 85 ms.

A.6.3.1.5 SA NR - E-UTRAN handover with unknown target cell

A.6.3.1.5.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to E-UTRAN handover requirements for the case when the target E-UTRAN cell is unknown as specified in clause 6.1.2.1.

The test comprises of one NR carrier and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable. No gap pattern shall be configured.

A RRC message implying handover shall be sent to the UE during period T1. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.6.3.1.5-1. General test parameters are provided in table A.6.3.1.5-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.6.3.1.5-3 and A.6.3.1.5-4 respectively.

Table A.6.3.1.5-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.5-2: General test parameters for SA inter-RAT E-UTRAN handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2	E-UTRAN cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
T1		s	≤5	
T2		s	1	

Table A.6.3.1.5-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 4	FDD	
			2, 3, 5, 6	TDD	
TDD Configuration			2, 5	TDDConf.1.1	
			3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)	
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
TRS configuration			1, 4	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1	
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP			DLBWP.1.1	
	Initial UL BWP			ULBWP.0.1	
	Dedicated UL BWP			ULBWP.1.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					

Parameter	Unit	Configuration	Cell 1	
			T1	T2
N_{oc}[Note2]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98	
N_{oc}[Note2]	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	0	0
$\hat{E}_s/I_{ot}$[Note3]	dB	1, 2, 3, 4, 5, 6	0	0
SS-RSRP[Note3]	dBm/SCS	1, 2, 4, 5	-98	-98
		3, 6	-95	-95
Io[Note3]	dBm/9.36 MHz	1, 2, 4, 5	-67.04	-67.04
	dBm/38.16 MHz	3, 6	-60.94	-60.94
Propagation condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

Table A.6.3.1.5-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	2	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PRACH Configuration[Note2]		1, 2, 3	4	
		4, 5, 6	53	
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note3]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				

PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note4				
OCNG_RB Note4				
N_{oc} Note5	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/I_{ot}$ Note6	dB	1, 2, 3, 4, 5, 6	-Infinity	7
RSRP Note6	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-91
SCH_RP Note6	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-91
Io Note6	dBm/9 MHz	1, 2, 3, 4, 5, 6	-70.22	-62.43
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix Note7		1, 2, 3, 4, 5, 6	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.6.3.1.5.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 165 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in clause 6.1.2.1.

$T_{interrupt}$ = 115 ms in the test; $T_{interrupt}$ is defined in clause 6.1.2.1.

This gives a total of 165 ms.

A.6.3.1.6 SA NR - UTRAN FDD handover

A.6.3.1.6.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT UTRAN FDD handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to UTRAN FDD handover requirements as specified in clause 6.1.2.2.1.

The test comprises of one NR carrier and one UTRA FDD carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT UTRAN FDD neighbour cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in table 9.1.2-1 is configured before T2 begins to enable inter-RAT frequency monitoring.

A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.6.3.1.6-1. General test parameters are provided in table A.6.3.1.6-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.6.3.1.6-3 and A.6.3.1.6-4 respectively.

Table A.6.3.1.6-1: Supported test configurations for SA inter-RAT UTRAN FDD handover tests

Configuration	Description

1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, UTRAN FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, UTRAN FDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.6-2: General test parameters for SA inter-RAT UTRAN FDD handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
UTRA RF Channel Number			2	1 UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2	UTRAN cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
Inter-RAT (UTRAN FDD) measurement quantity			CPICH Ec/N0	
b2-Threshold1		dBm	As specified in Table A.6.3.1.6-3	Absolute NR SS-RSRP threshold for event B2
b2-Threshold2UTRA-FDD		dB	-18	Absolute UTRAN CPICH Ec/Io threshold for event B2
Hysteresis		dB	0	
TimeToTrigger		s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
Gap pattern configuration Id			0	As specified in Table 9.1.2-1 started before T2 starts
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.6.3.1.6-3: Cell specific test parameters for SA inter-RAT UTRAN FDD handover (Cell 1)

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3	1		
Duplex mode			1	FDD		
			2, 3	TDD		
TDD Configuration			2	TDDConf.1.1		
			3	TDDConf.2.1		
$BW_{channel}$		MHz	1	10: $N_{PRB,c}$ = 52 (FDD)		
			2	10: $N_{PRB,c}$ = 52 (TDD)		
			3	40: $N_{PRB,c}$ = 106 (TDD)		
PDSCH reference measurement channel			1	SR.1.1 FDD		
			2	SR.1.1 TDD		
			3	SR.2.1 TDD		
CORSET reference channel			1	CR.1.1 FDD		
			2	CR.1.1 TDD		
			3	CR.2.1 TDD		
TRS configuration			1	TRS.1.1 FDD		
			2	TRS.1.1 TDD		
			3	TRS.1.2 TDD		
OCNG pattern[Note1]			1, 2, 3	OP.1		
BWP	Initial DL BWP		1, 2, 3	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
SMTC configuration		1, 2, 3	SMTC.1		
SSB configuration		1, 2	SSB.1 FR1		
		3	SSB.2 FR1		
b2-Threshold1	dBm	1, 2	-96		
		3	-93		
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}Note2	dBm/15 kHz	1, 2, 3	-100		
N_{oc}Note2	dBm/SCS	1, 2,	-100		
		3	-97		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3	12	-4	-4
$\hat{E}_s/I_{ot}$Note3	dB	1, 2, 3	12	-4	-4
SS-RSRPNote3	dBm/SCS	1, 2	-88	-104	-104
		3	-85	-101	-101
IoNote3	dBm/9.36 MHz	1, 2	-59.78	-70.59	-70.59
	dBm/38.16 MHz	3	-53.68	-64.49	-64.49
Propagation condition		1, 2, 3	AWGN		
Antenna Configuration and Correlation Matrix		1, 2, 3	1x2 Low		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					

Table A.6.3.1.6-4: Cell specific test parameters for SA inter-RAT UTRAN FDD handover (Cell 2)

Parameter	Unit	Cell 2 (UTRA)		
		T1	T2	T3
UTRA RF Channel Number		2		
CPICH_Ec/Ior	dB	-10		
PCCPCH_Ec/Ior	dB	-12		
SCH_Ec/Ior	dB	-12		
PICH_Ec/Ior	dB	-15		
DCH_Ec/Ior	dB	N/A	N/A	Note 1
OCNS_Ec/Ior	dB	-0.941	0.941	Note 2
$\hat{I}_{or}/I_{oc}$	dB	-infinity	-1.8	-1.8
I_{oc}	dBm/3,84 MHz	-70	-70	-70
CPICH_Ec/Io	dB	-infinity	-14	-14
Propagation Condition		AWGN		
NOTE 1: The DPCH level is controlled by the power control loop NOTE 2: The power of the OCNS channel that is added shall make the total power from the cell to be equal to I_{or}.				

A.6.3.1.6.2 Test Requirements

The UE shall start to transmit the UL DPCCH to Cell 2 less than 190 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms, which is specified in clause 5.3.1.1.1.

$T_{interrupt}$ = 140 ms in the test; $T_{interrupt}$ is defined in clause 5.3.1.1.2. This gives a total of 190 ms.

A.6.3.1.7 Intra-frequency synchronous DAPS handover in FR1

A.6.3.1.7.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency DAPS handover requirements in synchronous scenario specified in clause 6.1.3.2.

A.6.3.1.7.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.7.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.7.2-2, and A.6.3.1.7.2-3.The test consists of five successive time periods, with time durations of T1, T2, T3, T4, and T5 respectively.

Before the start of T1, the UE is connected to the cell1 and not aware of the cell2. The UE shall be configured with periodic CSI reporting for cell1. During T1, the UE does not have any timing information of the cell2.

Starting T2, the cell2 becomes detectable. During T2, the UE performs cell detection and measurements on the cell2 and shall send event report to the network. After receiving the event report A3, the network sends a RRC message implying DAPS handover to the UE.

The start of T3 is the instant when the last TTI containing DAPS handover command is sent to the UE. During T3, UE shall be able to perform random access, DL reception or UL transmission in the cell2 while the DL scheduling and UL feedback in the cell1 shall be avoided. After successful RACH procedure of the cell2, UE is scheduled with PDSCH from cell1 and cell2 in alternative TTIs where both cell1 and cell2 belong to the same TAG. In the end the network sends a RRC message implying cell1 release to the UE. During T3, the handover delay $D_{handover1}$ for target cell addition need to be verified.

The start of T4 is the instant when the last TTI containing cell1 release command is sent to the UE. During T4, the UE shall accomplish the release actions within $D_{handover2}$.

Starting T5, the UE stops sending the periodical CSI report to the cell1.

Table A.6.3.1.7.2-1: Intra-frequency DAPS handover in FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.7.2-2: General test parameters synchronous Intra-frequency DAPS handover in FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used

Access Barring Information	-	Not Sent	No additional delays in random access procedure.
Time offset between cells		3 μs	Synchronous cells
T1	s	5	
T2	s	≤5	
T3	s	1	
T4	ms	$D_{handover2}$	$D_{Handover2}$ is defined in clause 6.1.3.2.1
T5	ms	100	

Table A.6.3.1.7.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency DAPS handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2 - T5	T1	T2 - T5
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR.2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR.2.1 TDD			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD			
	Config 2		CSI-RS.1.1 TDD			
	Config 3		CSI-RS.2.1 TDD			
reportConfigType			periodic		N/A	
reportQuantity			cri-RI-PMI-CQI		N/A	
CSI reporting periodicity	Config 1,2	slot	5		N/A	
	Config 3		10		N/A	
CSI reporting offset	Config 1,2	slot	3		N/A	
	Config 3		5		N/A	
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						

Parameter		Unit	Cell 1		Cell 2	
			T1	T2 - T5	T1	T2 - T5
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	8	-1.5	-Infinity	0.36
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	9
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-Infinity	-89
	Config 3	dBm/SCS	-87	-87	-Infinity	-86
Io Note3	Config 1,2	dBm/ 9.36 MHz	-61.41	-58.21	-61.41	-58.21
	Config 3	dBm/ 38.16 MHz	-55.31	-52.11	-55.31	-52.11
Propagation condition			AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.7.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The target cell add delay $D_{handover1}$ can be expressed as: $T_{RRC_procedure} + T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{search}, T_{IU}, $T_{processing}$, T_{Δ} and T_{margin} are defined in clause 6.1.1.2.2.

If the target cell is known, then T_{search} = 0 ms

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 20 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 72 ms.

After successful RACH to Cell 2 and until the start of time period T4, UE shall be able to receive PDSCH alternatively from Cell 1 and Cell 2. UE is not expected to transmit UL to both Cell 1 and Cell 2 in the same TTI.

The UE shall release Cell 1 less than $D_{handover2} = (T_{RRC_procedure} + T_{interrupt2})$ from the beginning of time period T4.

NOTE: $D_{handover2}$ is defined in clause 6.1.3.2.1.

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt2}$ is defined in clause 6.1.3.2.2.

UE shall not report CSI to Cell 1 during T5.

A.6.3.1.8 Intra-frequency asynchronous DAPS handover in FR1

A.6.3.1.8.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency DAPS handover requirements in asynchronous scenario specified in clause 6.1.3.2.

A.6.3.1.8.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.8.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.8.2-2, and A.6.3.1.8.2-3.

The test consists of five successive time periods, with time durations of T1, T2, T3, T4, and T5 respectively.

Before the start of T1, the UE is connected to the cell1 and not aware of the cell2. The UE shall be configured with periodic CSI reporting for cell1. During T1, the UE does not have any timing information of the cell2.

Starting T2, the cell2 becomes detectable. During T2, the UE performs cell detection and measurements on the cell2 and shall send event report to the network. After receiving the event report A3, the network sends a RRC message implying DAPS handover to the UE.

The start of T3 is the instant when the last TTI containing DAPS handover command is sent to the UE. During T3, UE shall be able to perform random access, DL reception or UL transmission in the cell2 while the DL scheduling and UL feedback in the cell1 shall be avoided. After successful RACH procedure of the cell2, UE is scheduled with PDSCH from cell1 and cell2 in alternative TTIs where both cell1 and cell2 belong to the same TAG. In the end the network sends a RRC message implying cell1 release to the UE. During T3, the handover delay $D_{handover1}$ for target cell addition needs to be verified.

The start of T4 is the instant when the last TTI containing cell1 release command is sent to the UE by cell2. During T4, the UE shall accomplish the release actions within $D_{handover2}$.

Starting T5, the UE stops sending the periodical CSI report to the cell1.

Table A.6.3.1.8.2-1: Intra-frequency DAPS handover in FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.8.2-2: General test parameters Intra-frequency asynchronous DAPS handover in FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			7 μs	Asynchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	
T4		ms	$D_{handover2}$	$D_{Handover2}$ is defined in clause 6.1.3.2.1
T5		ms	100	

Table A.6.3.1.8.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency DAPS handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2 - T5	T1	T2 - T5
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR.2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR.2.1 FDD			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD			
	Config 2		CSI-RS.1.1 TDD			
	Config 3		CSI-RS.2.1 TDD			
reportConfigType			periodic		N/A	
reportQuantity			cri-RI-PMI-CQI		N/A	
CSI reporting periodicity	Config 1,2	slot	5		N/A	
	Config 3		10		N/A	
CSI reporting offset	Config 1,2	slot	3		N/A	
	Config 3		5		N/A	
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	8	-1.5	-Infinity	0.36
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	9

Parameter		Unit	Cell 1		Cell 2	
			T1	T2 - T5	T1	T2 - T5
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-Infinity	-89
	Config 3		-87	-87	-Infinity	-86
Io[Note3]	Config 1,2	dBm/ 9.36 MHz	-61.41	-58.21	-61.41	-58.21
	Config 3	dBm/ 38.16 MHz	-55.31	-52.11	-55.31	-52.11
Propagation condition			AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.8.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The target cell add delay $D_{handover1}$ can be expressed as: $T_{RRC_procedure} + T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{search}, T_{IU}, $T_{processing}$, T_{Δ} and T_{margin} are defined in clause 6.1.1.2.2.

If the target cell is known, then T_{search} = 0 ms

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 20 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 72 ms.

After successful RACH to Cell 2 and until the start of time period T4, UE shall be able to receive PDSCH alternatively from Cell 1 and Cell 2. UE is not expected to transmit UL to both Cell 1 and Cell 2 in the same TTI.

The UE shall release Cell 1 less than $D_{handover2} = (T_{RRC_procedure} + T_{interrupt2})$ from the beginning of time period T4.

NOTE: $D_{handover2}$ is defined in clause 6.1.3.2.1.

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt2}$ is defined in clause 6.1.3.2.2.

UE shall not report CSI to Cell 1 during T5.

A.6.3.1.9 Intra-band inter-frequency synchronous DAPS handover test in SA for FR1

A.6.3.1.9.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-band inter-frequency synchronous DAPS handover requirements specified in clause 6.1.3.2.

A.6.3.1.9.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.9.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.9.2-2, and A.6.3.1.9.2-3.

The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. The UE shall be configured with periodic CSI reporting for cell1. The test scenario comprises of two carriers and one cell on each carrier. Gap pattern with ID 0 as specified in table 9.1.2-1 is configured before T2 in the test case.

Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A3. After receiving the Event A3, the test system shall send a RRC message implying DAPS handover to the UE.

T3 is defined as the end of the last TTI containing the RRC message implying DAPS handover. During T3 UE shall be able to perform random access to Cell 2. Cell 1 is continuously scheduled in DL during T3. DL schedule and UL feedback to Cell 1 shall be avoided when UE is required to perform DL reception or UL transmission in PRACH procedure in Cell 2, except preamble transmission. At the end of T3 Cell 2 shall send an RRC message implying Cell 1 release command.

T4 is defined as the end of the last TTI containing the RRC message implying DAPS handover. Cell 2 is continuously scheduled in DL during T4. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stop sending CSI report to the source cell. And the test system shall observe the periodic reporting of CSI for Cell 1 during T5.

Table A.6.3.1.9.2-1: Intra-band inter-frequency synchronous DAPS handover in SA for FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.9.2-2: General test parameters for intra-band inter-frequency synchronous DAPS handover test in SA for FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			0 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	
T4		ms	10 + $T_{interrupt2}$	$T_{interrupt2}$ is defined in clause 6.1.3.2.2 Table 6.1.3.2.2-6
T5		ms	100	

Table A.6.3.1.9.2-3: Cell specific test parameters for intra-band inter-frequency synchronous DAPS handover test in SA for FR1

Parameter		Unit	Cell 1		Cell 2	
			T1	T2 - T5	T1	T2 - T5
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR.2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR.2.1 TDD			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD			
	Config 2		CSI-RS.1.1 TDD			
	Config 3		CSI-RS.2.1 TDD			
reportConfigType			periodic		N/A	
reportQuantity			cri-RI-PMI-CQI		N/A	
CSI reporting periodicity	Config 1,2	slot	5		N/A	
	Config 3		10		N/A	
CSI reporting offset	Config 1,2	slot	3		N/A	
	Config 3		5		N/A	
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	8	8	-Infinity	8
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	8

Parameter		Unit	Cell 1		Cell 2	
			T1	T2 - T5	T1	T2 - T5
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-Infinity	-90
	Config 3	dBm/SCS	-87	-87	-Infinity	-87
Io[Note3]	Config 1,2	dBm/ 9.36 MHz	-61.41	-61.41	-70.05	-61.41
	Config 3	dBm/ 38.16 MHz	-55.31	-55.31	-63.94	-55.31
Propagation condition			AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.9.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3.

During T3 UE is allowed to cause $T_{interrupt1}$ interruption to Cell 1. $T_{interrupt1}$ is defined in clause 6.1.3.2.2 table 6.1.3.2.2-2. When UE is transmitting PRACH preamble to Cell 2, interruption to Cell 1 is allowed.

During T4 UE is allowed to cause $T_{interrupt2}$ interruption to Cell 1. $T_{interrupt2}$ is defined in clause 6.1.3.2.2 table 6.1.3.2.2-5.

UE shall finish Cell 1 release in T4 and shall not send any CSI reports to Cell 1 during T5.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

A.6.3.1.10 Intra-band inter-frequency asynchronous DAPS handover test in SA for FR1

A.6.3.1.10.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-band inter-frequency asynchronous DAPS handover requirements specified in clause 6.1.3.2.

A.6.3.1.10.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.10.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.10.2-2, and A.6.3.1.10.2-3.

The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. The UE shall be configured with periodic CSI reporting for cell1. The test scenario comprises of two carriers and one cell on each carrier. Gap pattern ID gp0 as specified in table 9.1.2-1 is configured before T2 in the test case.

Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A3. After receiving the Event A3, the test system shall send a RRC message implying DAPS handover to the UE.

T3 is defined as the end of the last TTI containing the RRC message implying DAPS handover.During T3 UE shall be able to perform random access to Cell 2. Cell 1 is continuously scheduled in DL during T3. DL schedule and UL feedback to Cell 1 shall be avoided when UE is required to perfrom DL reception or UL transmission in PRACH procedure in Cell 2, except preamble transmission. At the end of T3 Cell 2 shall send an RRC message implying Cell 1 release command.

T4 is defined as the end of the last TTI containing the RRC message implying DAPS handover. Cell 2 is continuously scheduled in DL during T4. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stop sending CSI report to the source cell. And the test system shall observe the periodic reporting of CSI for Cell 1 during T5.

Table A.6.3.1.10.2-1: Intra-band inter-frequency asynchronous DAPS handover in SA for FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.10.2-2: General test parameters for intra-band inter-frequency asynchronous DAPS handover test in SA for FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			10 μs	Asynchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	
T4		ms	10 + $T_{interrupt2}$	$T_{interrupt2}$ is defined in clause 6.1.3.2.2 Table 6.1.3.2.2-5
T5		ms	100	

Table A.6.3.1.10.2-3: Cell specific test parameters for intra-band inter-frequency asynchronous DAPS handover test in SA for FR1

Parameter		Unit	Cell 1		Cell 2	
			T1	T2 - T5	T1	T2 - T5
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
TDD configuration	Config 1		Not Applicable			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
TRS configuration	Config 1		TRS.1.1 FDD			
OCNG Patterns			OP.1			
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD			
reportConfigType			periodic		N/A	
reportQuantity			cri-RI-PMI-CQI		N/A	
CSI reporting periodicity	Config 1	slot	5		N/A	
CSI reporting offset	Config 1	slot	3		N/A	
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1		SSB.1 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	15 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1	kHz	15 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2 - T5	T1	T2 - T5
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1	dBm/SCS	-98			
$\hat{E}_s / I_{ot}$		dB	8	8	-Infinity	8
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	8
SSB_RP	Config 1	dBm/SCS	-90	-90	-Infinity	-90
Io Note3	Config 1	dBm/ 9.36 MHz	-61.41	-61.41	-70.05	-61.41
Propagation condition			AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.10.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3.

During T3 UE is allowed to cause $T_{interrupt1}$ interruption to Cell 1. $T_{interrupt1}$ is defined in clause 6.1.3.2.2 table 6.1.3.2.2-2. When UE is transmitting PRACH preamble to Cell 2, interruption to Cell 1 is allowed.

During T4 UE is allowed to cause $T_{interrupt2}$ interruption to Cell 1. $T_{interrupt2}$ is defined in clause 6.1.3.2.2 table 6.1.3.2.2-6.

UE shall finish Cell 1 release in T4 and shall not send any CSI reports to Cell 1 during T5.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

A.6.3.1.11 Inter-band inter-frequency synchronous DAPS handover from FR1 to FR1

A.6.3.1.11.1 Test Purpose and Environment

This test is to verify the requirement for the FR1-to-FR1 inter-band inter-frequency synchronous DAPS handover requirements specified in clause 6.1.3.2.

A.6.3.1.11.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.11.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.11.2-2, A.6.3.1.11.2-3 and A.6.3.1.11.2-4.

The test scenario comprises of two bands each with one cell. The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively.

Before the start of T1, the UE is connected to Cell 1 (source PCell) on radio channel 1 but is not aware of Cell 2 (neighbour cell) on radio channel 2. The UE shall be configured with periodic CSI reporting for cell1. During T1, the UE shall not have any timing information of Cell 2.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event A3 is configured for neighbour cell (Cell 2), and the UE is configured with the measurement gaps (gap pattern ID # 0). Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A3. After receiving the Event A3, the test system shall send a RRC m`essage implying DAPS handover to the UE.

The start of T3 is the instant when the last TTI containing the RRC message implying DAPS handover to Cell 2 (target PCell) is sent to the UE. During T3, the UE shall be able to perform random access to Cell 2. DL schedule and UL feedback to Cell 1 shall be avoided when UE is required to perform DL reception or UL transmission in PRACH procedure in Cell 2, except preamble transmission. After the RACH procedure is completed, the test system shall send a RRC message to the UE to release Cell 1 (source cell) on radio channel 1.

The start of T4 is the instant when the last TTI containing the RRC message implying source cell release is sent to the UE. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stop sending CSI report to the source cell.

Table A.6.3.1.11.2-1: Inter-band inter-frequency synchronous DAPS handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
5	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
7	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
8	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
9	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.11.2-2: General test parameters for inter-band inter-frequency synchronous DAPS handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	PCell on RF channel number 1
	Neighbouring cell		Cell 2	Neighbour cell on RF channel number 2
Final condition	Active cell		Cell 2	PCell on RF channel number 2
	Neighbouring cell		Cell 1	Neighbour cell on RF channel number 1
A3-Offset		dB	-6	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells		µs	33	Synchronous cells
DRX			OFF	
Measurement gap pattern Id			#0	Gaps are configured before T2.
T1		s	5	
T2		s	<5	
T3		s	<0.5	
T4		ms	$10+T_{interrupt2}$	$T_{interrupt2}$ as defined in Table 6.1.3.2.2-7 for synchronous DAPS HO

Parameter	Unit	Value	Comment
T5	ms	100	

Table A.6.3.1.11.2-3: Cell specific test parameters for inter-band inter-frequency synchronous DAPS handover from FR1 to FR1 (Cell 1)

Parameter		Unit	Cell 1	
			T1	T2 – T5
NR RF Channel Number			1	
Duplex mode	Config 1,4,7		FDD	
	Config 2,3,5,6,8,9		TDD	
TDD configuration	Config 1,4,7		Not Applicable	
	Config 2,5,8		TDDConf.1.1	
	Config 3,6,9		TDDConf.2.1	
$BW_{channel}$	Config 1,4,7	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5,8		10: $N_{PRB,c}$ = 52	
	Config 3,6,9		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1,4,7	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5,8		10: $N_{PRB,c}$ = 52	
	Config 3,6,9		40: $N_{PRB,c}$ = 106	
TRS configuration	Config 1,4,7		TRS.1.1 FDD	
	Config 2,5,8		TRS.1.1 TDD	
	Config 3,6,9		TRS.1.2 TDD	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4,7		SR.1.1 FDD	
	Config 2,5,8		SR.1.1 TDD	
	Config 3,6,9		SR.2.1 TDD	
CORESET Reference Channel	Config 1,4,7		CR.1.1 FDD	
	Config 2,5,8		CR.1.1 TDD	
	Config 3,6,9		CR.2.1 TDD	
OCNG Patterns			OP.1	
CSI-RS configuration for CSI reporting	Config 1,4,7		CSI-RS.1.1 FDD	
	Config 2,5,8		CSI-RS.1.1 TDD	
	Config 3,6,9		CSI-RS.2.1 TDD	
reportConfigType			periodic	
reportQuantity			cri-RI-PMI-CQI	
CSI reporting periodicity	Config 1,2,4,5,7,8	slot	5	
	Config 3,6,9		10	
CSI reporting offset	Config 1,2,4,5,7,8	slot	3	
	Config 3,6,9		5	
SMTC Configuration			SMTC.1	
SSB Configuration	Config 1,2,4,5,7,8		SSB.1 FR1	
	Config 3,6,9		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz	
	Config 3,6,9		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz	
	Config 3,6,9		30 kHz	
PRACH configuration			FR1 PRACH configuration 2	
BWP	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.3	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.3	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	-98
N_{oc} Note2	Config 1,2,4,5,7,8	dBm/SCS	-98	-98
	Config 3,6,9		-95	-95

Parameter		Unit	Cell 1	
			T1	T2 – T5
$\hat{E}_s / I_{ot}$		dB	4	4
$\hat{E}_s / N_{oc}$		dB	4	4
SSB_RP	Config 1,2,4,5,7,8	dBm/SCS	-94	-94
	Config 3,6,9	dBm/SCS	-91	-91
Io[Note3]	Config 1,2,4,5,7,8	dBm/ 9.36 MHz	-64.59	-64.59
	Config 3,6,9	dBm/ 38.16 MHz	-58.49	-58.49
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.3.1.11.2-4: Cell specific test parameters for inter-band inter-frequency synchronous DAPS handover from FR1 to FR1 (Cell 2)

Parameter		Unit	Cell 2	
			T1	T2-T5
NR RF Channel Number			2	
Duplex mode	Config 1,2,3		FDD	
	Config 4,5,6,7,8,9		TDD	
TDD configuration	Config 1,2,3		Not Applicable	
	Config 4,5,6		TDDConf.1.1	
	Config 7,8,9		TDDConf.2.1	
$BW_{channel}$	Config 1,2,3	MHz	10: $N_{PRB,c}$ = 52	
	Config 4,5,6		10: $N_{PRB,c}$ = 52	
	Config 7,8,9		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1,2,3	MHz	10: $N_{PRB,c}$ = 52	
	Config 4,5,6		10: $N_{PRB,c}$ = 52	
	Config 7,8,9		40: $N_{PRB,c}$ = 106	
TRS configuration	Config 1,2,3		TRS.1.1 FDD	
	Config 4,5,6		TRS.1.1 TDD	
	Config 7,8,9		TRS.1.2 TDD	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,2,3		SR.1.1 FDD	
	Config 4,5,6		SR.1.1 TDD	
	Config 7,8,9		SR2.1 TDD	
CORESET Reference Channel	Config 1,2,3		CR.1.1 FDD	
	Config 4,5,6		CR.1.1 TDD	
	Config 7,8,9		CR2.1 TDD	
OCNG Patterns			OCNG pattern OP.1	
CSI-RS configuration for CSI reporting	Config 1,2,3		CSI-RS.1.1 FDD	
	Config 4,5,6		CSI-RS.1.1 TDD	
	Config 7,8,9		CSI-RS.2.1 TDD	
SMTC Configuration			SMTC pattern 1	
SSB Configuration	Config 1,2,3,4,5,6		SSB.1 FR1	
	Config 7,8,9		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,3,4,5,6	kHz	15 kHz	
	Config 7,8,9		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,3,4,5,6	kHz	15 kHz	
	Config 7,8,9		30 kHz	
PRACH configuration			FR1 PRACH configuration 2	
BWP	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.3	

Parameter		Unit	Cell 2	
			T1	T2-T5
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.3	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	-98
N_{oc} Note2	Config 1,2,3,4,5,6	dBm/SCS	-98	-98
	Config 7,8,9		-95	-95
$\hat{E}_s / I_{ot}$		dB	-Infinity	4
$\hat{E}_s / N_{oc}$		dB	-Infinity	4
SSB_RP	Config 1,2,3,4,5,6	dBm/SCS	-Infinity	-94
	Config 7,8,9	dBm/SCS	-Infinity	-91
Io Note3	Config 1,2,3,4,5,6	dBm/ 9.36 MHz	-70.05	-64.59
	Config 7,8,9	dBm/ 38.16 MHz	-63.94	-58.49
Propagation condition		-	AWGN	
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.3.1.11.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3. During $D_{handover1}$, the interruption on Cell 1 shall not exceed $T_{interrupt1}$ as defined in table 6.1.3.2.2-3 for synchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay $D_{handover1}$ can be expressed as: $T_{RRC_procedure} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 20 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 72 ms.

The UE shall complete to release Cell 1 less than (10 ms + $T_{interrupt2}$) from the beginning of time period T4. During $D_{handover2}$, the interruption on Cell 2 shall not exceed $T_{interrupt2}$ as defined in table 6.1.3.2.2-7 for synchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay $D_{handover2}$ can be expressed as: $T_{RRC_procedure} + T_{interrupt2}$, where:

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

A.6.3.1.12 Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR1

A.6.3.1.12.1 Test Purpose and Environment

This test is to verify the requirement for the FR1-to-FR1 inter-band inter-frequency asynchronous DAPS handover requirements specified in clause 6.1.3.2.

A.6.3.1.12.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.12.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.12.2-2, A.6.3.1.12.2-3 and A.6.3.1.12.2-4.

The test scenario comprises of two bands each with one cell. The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively.

Before the start of T1, the UE is connected to Cell 1 (source PCell) on radio channel 1 but is not aware of Cell 2 (neighbour cell) on radio channel 2. The UE shall be configured with periodic CSI reporting for cell1. During T1, the UE shall not have any timing information of Cell 2.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event A3 is configured for neighbour cell (Cell 2), and the UE is configured with the measurement gaps (gap pattern ID # 0). Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A3. After receiving the Event A3, the test system shall send a RRC message implying DAPS handover to the UE.

The start of T3 is the instant when the last TTI containing the RRC message implying DAPS handover to Cell 2 (target PCell) is sent to the UE. During T3, the UE shall be able to perform random access to Cell 2. DL schedule and UL feedback to Cell 1 shall be avoided when UE is required to perform DL reception or UL transmission in PRACH procedure in Cell 2, except preamble transmission. After the RACH procedure is completed, the test system shall send a RRC message to the UE to release Cell 1 (source cell) on radio channel 1.

The start of T4 is the instant when the last TTI containing the RRC message implying source cell release is sent to the UE. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stop sending CSI report to the source cell.

Table A.6.3.1.12.2-1: Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
5	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
7	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
8	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
9	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.12.2-2: General test parameters for inter-band inter-frequency asynchronous DAPS handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	

A3-Offset		dB	-4	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells	Config 1,2,4,5	ms	0.5	Asynchronous cells
	Config3,6,7,8,9	ms	0.25	
DRX			OFF	
Measurement gap pattern Id			#0	Gaps are configured before T2.
T1		s	5	
T2		s	<5	
T3		s	<0.5	
T4		ms	$10+T_{interrupt2}$	$T_{interrupt2}$ as defined in Table 6.1.3.2.2-7 for asynchronous DAPS HO.
T5		ms	100	

Table A.6.3.1.12.2-3: Cell specific test parameters for inter-band inter-frequency asynchronous DAPS handover from FR1 to FR1 (Cell 1)

Parameter		Unit	Cell 1	
			T1	T2 – T5
NR RF Channel Number			1	
Duplex mode	Config 1,4,7		FDD	
	Config 2,3,5,6,8,9		TDD	
TDD configuration	Config 1,4,7		Not Applicable	
	Config 2,5,8		TDDConf.1.1	
	Config 3,6,9		TDDConf.2.1	
$BW_{channel}$	Config 1,4,7	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5,8		10: $N_{PRB,c}$ = 52	
	Config 3,6,9		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1,4,7	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5,8		10: $N_{PRB,c}$ = 52	
	Config 3,6,9		40: $N_{PRB,c}$ = 106	
TRS configuration	Config 1,4,7		TRS.1.1 FDD	
	Config 2,5,8		TRS.1.1 TDD	
	Config 3,6,9		TRS.1.2 TDD	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4,7		SR.1.1 FDD	
	Config 2,5,8		SR.1.1 TDD	
	Config 3,6,9		SR.2.1 TDD	
CORESET Reference Channel	Config 1,4,7		CR.1.1 FDD	
	Config 2,5,8		CR.1.1 TDD	
	Config 3,6,9		CR.2.1 TDD	
OCNG Patterns			OP.1	
CSI-RS configuration for CSI reporting	Config 1,4,7		CSI-RS.1.1 FDD	
	Config 2,5,8		CSI-RS.1.1 TDD	
	Config 3,6,9		CSI-RS.2.1 TDD	
reportConfigType			periodic	
reportQuantity			cri-RI-PMI-CQI	
CSI reporting periodicity	Config 1,2,4,5,7,8	slot	5	
	Config 3,6,9		10	
CSI reporting offset	Config 1,2,4,5,7,8	slot	3	
	Config 3,6,9		5	
SMTC Configuration			SMTC.1	
SSB Configuration	Config 1,2,4,5,7,8		SSB.1 FR1	
	Config 3,6,9		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz	
	Config 3,6,9		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz	
	Config 3,6,9		30 kHz	
PRACH configuration			FR1 PRACH configuration 2	
BWP	Initial DL BWP		DLBWP.0.1	

Parameter		Unit	Cell 1	
			T1	T2 – T5
	Dedicated DL BWP		DLBWP.1.3	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.3	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	-98
N_{oc} Note2	Config 1,2,4,5,7,8	dBm/SCS	-98	-98
	Config 3,6,9		-95	-95
$\hat{E}_s / I_{ot}$		dB	4	4
$\hat{E}_s / N_{oc}$		dB	4	4
SSB_RP	Config 1,2,4,5,7,8	dBm/SCS	-94	-94
	Config 3,6,9	dBm/SCS	-91	-91
Io Note3	Config 1,2,4,5,7,8	dBm/ 9.36 MHz	-64.59	-64.59
	Config 3,6,9	dBm/ 38.16 MHz	-58.49	-58.49
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.3.1.12.2-4: Cell specific test parameters for inter-band inter-frequency asynchronous DAPS handover from FR1 to FR1 (Cell 2)

Parameter		Unit	Cell 2	
			T1	T2-T5
NR RF Channel Number			2	
Duplex mode	Config 1,2,3		FDD	
	Config 4,5,6,7,8,9		TDD	
TDD configuration	Config 1,2,3		Not Applicable	
	Config 4,5,6		TDDConf.1.1	
	Config 7,8,9		TDDConf.2.1	
$BW_{channel}$	Config 1,2,3	MHz	10: $N_{PRB,c}$ = 52	
	Config 4,5,6		10: $N_{PRB,c}$ = 52	
	Config 7,8,9		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1,2,3	MHz	10: $N_{PRB,c}$ = 52	
	Config 4,5,6		10: $N_{PRB,c}$ = 52	
	Config 7,8,9		40: $N_{PRB,c}$ = 106	
TRS configuration	Config 1,2,3		TRS.1.1 FDD	
	Config 4,5,6		TRS.1.1 TDD	
	Config 7,8,9		TRS.1.2 TDD	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,2,3		SR.1.1 FDD	
	Config 4,5,6		SR.1.1 TDD	
	Config 7,8,9		SR2.1 TDD	
CORESET Reference Channel	Config 1,2,3		CR.1.1 FDD	
	Config 4,5,6		CR.1.1 TDD	

Parameter		Unit	Cell 2	
			T1	T2-T5
	Config 7,8,9		CR2.1 TDD	
OCNG Patterns			OCNG pattern OP.1	
CSI-RS configuration for CSI reporting	Config 1,2,3		CSI-RS.1.1 FDD	
	Config 4,5,6		CSI-RS.1.1 TDD	
	Config 7,8,9		CSI-RS.2.1 TDD	
SMTC Configuration			SMTC pattern 1	
SSB Configuration	Config 1,2,3,4,5,6		SSB.1 FR1	
	Config 7,8,9		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,3,4,5,6	kHz	15 kHz	
	Config 7,8,9		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,3,4,5,6	kHz	15 kHz	
	Config 7,8,9		30 kHz	
PRACH configuration			FR1 PRACH configuration 2	
BWP	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.3	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.3	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	-98
N_{oc} Note2	Config 1,2,3,4,5,6	dBm/SCS	-98	-98
	Config 7,8,9		-95	-95
$\hat{E}_s / I_{ot}$		dB	-Infinity	4
$\hat{E}_s / N_{oc}$		dB	-Infinity	4
SSB_RP	Config 1,2,3,4,5,6	dBm/SCS	-Infinity	-94
	Config 7,8,9	dBm/SCS	-Infinity	-91
Io Note3	Config 1,2,3,4,5,6	dBm/ 9.36 MHz	-70.05	-64.59
	Config 7,8,9	dBm/ 38.16 MHz	-63.94	-58.49
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.12.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3. During $D_{handover1}$, the interruption on Cell 1 shall not exceed $T_{interrupt1}$ as defined in table 6.1.3.2.2-3 for asynchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay $D_{handover1}$ can be expressed as: $T_{RRC_procedure} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 20 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 72 ms.

The UE shall complete to release Cell 1 less than (10 ms + $T_{interrupt2}$) from the beginning of time period T4. During $D_{handover2}$, the interruption on Cell 2 shall not exceed $T_{interrupt2}$ as defined in table 6.1.3.2.2-7 for asynchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay $D_{handover2}$ can be expressed as: $T_{RRC_procedure}$ + $T_{interrupt2}$, where:

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

A.6.3.1.13 SA NR - E-UTRAN with NR PSCell addition in FR1

A.6.3.1.13.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover with PSCell addition when operating in standalone (SA) operation with PCell in FR1 where target PCell and target PSCell are unknown. This test shall verify the Handover with PSCell from NR SA to EN-DC requirements as specified in clause 6.1.5.2.

The test comprises of two NR carrier and one E-UTRA carrier. There are three cells and one cell on each carrier. Cell 1 is the NR PCell, Cell 2 is an inter-RAT E-UTRAN neighbour cell and Cell 3 is an NR neighbour cell. The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2 and Cell 3. Starting T2, Cell 2 and Cell 3 becomes detectable

A RRC message implying handover with PSCell shall be sent to the UE during period T1. The start of T2 is the instant when the last TTI containing the RRC message implying handover with PSCell is sent to the UE.Before T2, the UE does not have any information of Cell 3. The handover with PSCell message shall contain Cell 2 and Cell 3 as the target cells and the SMTC for Cell 3 is configured in *RRCConnectionReconfiguration.*

Supported test configurations are shown in table A.6.3.1.13.1-1. General test parameters are provided in table A.6.3.1.13.1-2. Cell specific test parameters for Cell 1, Cell 2 and Cell 3 are provided in tables A.6.3.1.13.1-3, A.6.3.1.13.1-4 and A.6.3.1.13.1-5 respectively.

Table A.6.3.1.13.1-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.13.1-2: General test parameters for Handover with PSCell from NR SA to EN-DC

Parameter		Unit	Value	Comment
NR RF Channel Number			1, 2	2 NR carrier frequency is used in the test
LTE RF Channel Number			3	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2, Cell 3	E-UTRAN cell and NR Cell
Final condition	Active cell		Cell 2 and Cell 3	
DRX			OFF	Non-DRX test

Access Barring Information	-	Not sent	No additional delays in random access procedure
Time offset between Cell 1 and Cell 2		3 ms	Asynchronous cells
T1	s	5	
T2	s	≤5	

Table A.6.3.1.13.1-3: Cell specific test parameters for Handover with PSCell from NR SA to EN-DC (Cell 1)

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 4	FDD	
			2, 3, 5, 6	TDD	
TDD Configuration			2, 5	TDDConf.1.1	
			3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)	
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
TRS configuration			1, 4	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1	
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP			DLBWP.1.1	
	Initial UL BWP			ULBWP.0.1	
	Dedicated UL BWP			ULBWP.1.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 kHz	1, 2, 3, 4, 5, 6	-100	-100
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-100	-100
			3, 6	-97	-97
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	12	-4
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	12	-4
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104
			3, 6	-85	-101
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-59.78	-70.59

Parameter	Unit	Configuration	Cell 1	
			T1	T2
	dBm/38.16 MHz	3, 6	-53.68	-64.49
Propagation condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

Table A.6.3.1.13.1-4: Cell specific test parameters for Handover with PSCell from NR SA to EN-DC (Cell 2)

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	3	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PRACH Configuration[Note2]		1, 2, 3	4	
		4, 5, 6	53	
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note3]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				

Parameter	Unit	Configuration	Cell 2	
			T1	T2
PDSCH_RB				
OCNG_RA Note4				
OCNG_RB Note4				
N_{oc} Note5	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	78
$\hat{E}_s/I_{ot}$ Note6	dB	1, 2, 3, 4, 5, 6	-Infinity	78
RSRP Note6	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-90
SCH_RP Note6	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-90
Io Note6	dBm/9 MHz	1, 2, 3, 4, 5, 6	-67.21 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix Note7		1, 2, 3, 4, 5, 6	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.6.3.1.13.1-5: Cell specific test parameters for Handover with PSCell from NR SA to EN-DC (Cell 3)

Parameter		Unit	Configuration	Cell 3	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	2	
Duplex mode			1, 4	FDD	
			2, 3, 5, 6	TDD	
TDD Configuration			2, 5	TDDConf.1.1	
			3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)	
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
TRS configuration			1, 4	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
PRACH configuration			1, 2, 3, 4, 5, 6	FR1 PRACH configuration 1	
OCNG pattern Note1			1, 2, 3, 4, 5, 6	OP.1	
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP			DLBWP.1.1	
	Initial UL BWP			ULBWP.0.1	
	Dedicated UL BWP			ULBWP.1.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	

Parameter	Unit	Configuration	Cell 3	
			T1	T2
EPRE ratio of PSS to SSS	dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS				
EPRE ratio of OCNG to OCNG DMRS				
N_{oc} Note2	dBm/15 kHz	1, 2, 3, 4, 5, 6	-100	-85
N_{oc} Note2	dBm/SCS	1, 2, 4, 5	-100	-85
		3, 6	-100	-82
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	0
$\hat{E}_s/I_{ot}$ Note3	dB	1, 2, 3, 4, 5, 6	-Infinity	0
SS-RSRP Note3	dBm/SCS	1, 2, 4, 5	-Infinity	-85
		3, 6	-Infinity	-82
Io Note3	dBm/9.36 MHz	1, 2, 4, 5	-72.05	-57
	dBm/38.16 MHz	3, 6	-68.96	-51
Propagation condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.13.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 175 ms from the beginning of time period T2.

The UE shall start to transmit the PRACH to Cell 3 less than 270 ms from the beginning of time period T2.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in clause 6.1.5.2.

$T_{interrupt}$ = 125 ms in the test; $T_{interrupt}$ is defined in clause 6.1.5.2.

The PSCell addition time can be expressed as: $T_{RRC_delay} + T_{processing} + T_{search_HO} + T_{search_PSCell} + T_{\Delta} + T_{PSCell_DU}$ + 2 ms which is defined in clause 6.1.5.2.

The rate of correct handovers observed during repeated tests shall be at least 90%.

A.6.3.1.14 SA NR - E-UTRAN handover with NR FR1 PSCell addition

A.6.3.1.14.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct SA inter-RAT handover from NR to E-UTRAN with FR1 PSCell addition when operating in standalone (SA) operation with PCell in FR1, for the case where the PSCell is known to the UE at the time of addition and SMTC of target known PSCell is not present in

RRCConnectionReconfiguration. This test shall verify delay requirements of inter-RAT handover from NR to E-UTRAN and FR1 PSCell addition as specified in clause 6.1.5.

The test comprises of two NR cells and one E-UTRA cell. Cell 1 is the NR PCell, Cell 2 is an inter-RAT E-UTRAN neighbour cell and Cell 3 is the target NR PSCell, on radio channel 1 in FR1, radio channel 2 in E-UTRAN and radio channel 3 in FR1, respectively.

In this test, inter-RAT handover from NR to E-UTRAN and FR1 PSCell addition are performed in parallel processing. The test consists of successive time periods for inter-RAT handover and FR1 PSCell addition with time durations of T1, T2 and T3 respectively.

At the start of time duration T1, the UE does not have any timing information of Cell 2 and Cell 3, and the UE is only monitoring Cell 1. During T1, only Cell 1 is known to the UE.

Before the start of T2, the test system shall send measurement control information including measurement gap configuration and event-triggered reporting configuration with event B2 for neighbour Cell 2 and event B1 for Cell 3. Gap pattern configuration with id #0 as specified in table 9.1.2-1 is configured before T2 begins.

Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report, and the Cell 3 (PSCell-to-be) on radio channel 3 becomes known to the UE at the time of addition. The RRC message implying handover with PSCell shall be sent to the UE during period T2 after the UE has reported Event B2 and Event B1. After receiving both Event B2 and Event B1the test system shall send a RRC message to the UE to release the measurement gaps.

The point in time at which the RRC message implying handover with PSCell is received at the UE antenna connector defines the start of period T3 and T3'. The handover with PSCell message shall contain Cell 2 as the target cell and Cell 3 as PSCell-to-be added. The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added.

During T3, the UE shall carry out random access (i.e., transmit the PRACH) towards the Cell 2. Reception by the test system of the PRACH preamble defines the end of T3.

During T3', the UE shall carry out random access (i.e., transmit the PRACH) towards the Cell 3. Reception by the test system of the PRACH preamble defines the start of period T4'.

During T4', the UE shall send periodic CSI reports in PSCell and the test system shall observe the periodic reporting of CSI for PSCell.

Supported test configurations are shown in table A.6.3.1.14.1-1. General test parameters are provided in table A.6.3.1.14.1-2. Cell specific test parameters for NR Cell 1, E-UTRAN PCell Cell 2 and NR PSCell Cell 3 are provided in tables A.6.3.1.14.1-3, A.6.3.1.14.1-4 and A.6.3.1.14.1-5 respectively.

Table A.6.3.1.14.1-1: Supported test configurations for SA inter-RAT E-UTRAN handover with FR1 PSCell addition tests

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.14.1-2: General test parameters for SA inter-RAT E-UTRAN handover with FR1 PSCell addition

Parameter		Unit	Value	Comment
NR RF Channel Number			1, 3	2 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2, 3	E-UTRAN cell and NR cell in FR1

Parameter		Unit	Value	Comment
Final condition	Active PCell		Cell 2	E-UTRAN cell
	Active PSCell		Cell 3	NR cell in FR1
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
Event B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	Threshold RSRP	dBm	-93	Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin.
	Time to Trigger	s	0	
Event B2	Threshold1	dBm	As specified in Table A.6.3.1.4-3	Absolute NR SS-RSRP threshold for event B2
	Threshold2EUTRAN	dBm	-98	Absolute E-UTRAN RSRP threshold for event B2
	Hysteresis	dB	0	
	TimeToTrigger	s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between Cell 1 and Cell 2			3 ms	Asynchronous cells
Measurement Gap pattern ID			0	As specified in Table 9.1.2-1
T1		s	1	During this time only Cell 1 is known to UE.
T2		s	≤5	During this time the UE shall identify Cell 2 and report event B2, and identify Cell 3 and report event B1.
T3		s	1	During this time the UE handovers to Cell 2.
T3'		s	0.5	During this time the UE adds the PSCell (Cell 3).
T4'		s	0.5	During this time the UE sends CSI reports for PSCell (Cell 3).

Table A.6.3.1.14.1-3: Cell specific test parameters for SA inter-RAT E-UTRA handover with FR1 PSCell addition (NR Cell 1)

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3, 4, 5, 6	1		
Duplex mode			1, 4	FDD		
			2, 3, 5, 6	TDD		
TDD Configuration			2, 5	TDDConf.1.1		
			3, 6	TDDConf.2.1		
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)		
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)		
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)		
PDSCH reference measurement channel			1, 4	SR.1.1 FDD		
			2, 5	SR.1.1 TDD		
			3, 6	SR.2.1 TDD		
CORSET reference channel			1, 4	CR.1.1 FDD		
			2, 5	CR.1.1 TDD		
			3, 6	CR.2.1 TDD		
TRS configuration			1, 4	TRS.1.1 FDD		
			2, 5	TRS.1.1 TDD		
			3, 6	TRS.1.2 TDD		
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1		
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration			1, 2, 4, 5	SSB.1 FR1		
			3, 6	SSB.2 FR1		
b2-Threshold1		dBm	1, 2, 4, 5	-96		
			3, 6	-93		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0		
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}[Note2]		dBm/15 kHz	1, 2, 3, 4, 5, 6	-100	-104	-100
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-100	-104	-100
			3, 6	-97	-101	-97
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	12	0	-4
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	12	0	-4
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104	-104
			3, 6	-85	-101	-101
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-59.78	-73.04	-70.59
		dBm/38.16 MHz	3, 6	-53.68	-66.9448	-64.49
Propagation condition			1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6	1x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.3.1.14.1-4: Cell specific test parameters for SA inter-RAT E-UTRA handover with FR1 PSCell addition (E-UTRA Cell 2)

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6	2		
Duplex mode		1, 2, 3	FDD		
		4, 5, 6	TDD		
TDD special subframe configuration[Note1]		4, 5, 6	6		
TDD uplink-downlink configuration[Note1]		4, 5, 6	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PRACH Configuration[Note2]		1, 2, 3	4		
		4, 5, 6	53		
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD		

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note3]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD		
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note4]					
OCNG_RB[Note4]					
N_{oc}[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	8	78
$\hat{E}_s/I_{ot}$[Note6]	dB	1, 2, 3, 4, 5, 6	-Infinity	78	78
RSRP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-90	-90
SCH_RP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-90	-90
Io[Note6]	dBm/9 MHz	1, 2, 3, 4, 5, 6	-67.21 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix [Note7]		1, 2, 3, 4, 5, 6	1x2 Low		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.6.3.1.14.1-5: Cell specific test parameters for SA inter-RAT E-UTRA handover with FR1 PSCell addition (NR Cell 3)

Parameter	Unit	Config	Test			
			T1	T2	T3'	T4'
E-UTRA RF Channel Number		1,2,3,4,5,6	1			
NR RF Channel Number		1,2,3,4,5,6	2			
TDD configuration		1,4	Not Applicable			
		2,5	TDDConf.1.1			
		3,6	TDDConf.2.1			
$BW_{channel}$	MHz	1,4	10: $N_{PRB,c}$ = 52			

Parameter	Unit	Config	Test			
			T1	T2	T3'	T4'
		2,5	10: $N_{PRB,c}$ = 52			
		3,6	40: $N_{PRB,c}$ = 106			
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1			
PDSCH Reference measurement channel		1,4	SR.1.1 FDD			
		2,5	SR.1.1 TDD			
		3,6	SR.2.1 TDD			
RMSI CORESET Reference Channel		1,4	CR.1.1 FDD			
		2,5	CR.1.1 TDD			
		3,6	CR.2.1 TDD			
Dedicated CORESET Reference Channel		1,4	CCR.1.1 FDD			
		2,5	CCR.1.1 TDD			
		3,6	CCR.2.1 TDD			
OCNG Patterns		1,2,3,4,5,6	OP.1			
SSB configuration		1,2,4,5	SSB.1 FR1			
		3,6	SSB.2 FR1			
SMTC configuration		1,2,4,5	SMTC.1			
		3,6	SMTC.1			
TRS Configuration		1,4	TRS.1.1 FDD			
		2,5	TRS.1.1 TDD			
		3,6	TRS.1.2 TDD			
PRACH configuration on cell2		FR1 PRACH configuration 1	Captured in clause A.3.8.2.1			
CSI-RS configuration for CSI reporting		1,4	CSI-RS.1.1 FDD			
		2,5	CSI-RS.1.1 TDD			
		3,6	CSI-RS.2.1 TDD			
reportConfigType		1,2,3,4,5,6	periodic			
reportQuantity		1,2,3,4,5,6	cri-RI-PMI-CQI			
CSI reporting periodicity	slot	1,2,4,5	5			
		3,6	10			
CSI reporting offset	slot	1,2,4,5	2			
		3,6	4			
EPRE ratio of PSS to SSS	dB	1,2,3,4,5,6	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	N/A	-85		
N_{oc} Note2	dBm/SCS	1,2,4,5	N/A	-85		
		3,6	N/A	-82		
$\hat{E}_s / I_{ot}$		1,2,3,4,5,6	-infinity	0		
$\hat{E}_s / N_{oc}$		1,2,3,4,5,6	-infinity	0		
SS-RSRP Note3	dBm/SCS	1,2,4,5	-infinity	-85		
		3,6	-infinity	-82		
Io Note3	dBm/9.36 MHz	1,2,4,5	N/A	-57		

Parameter	Unit	Config	Test			
			T1	T2	T3'	T4'
	dBm/38.1 MHz	3,6	N/A	-51		
Propagation condition		1,2,3,4,5,6	AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.6.3.1.14.2 Test Requirements

In this test, the UE shall start to transmit the PRACH to E-UTRA Cell 2 less than 85 ms [Note1] from the beginning of time period T3.

The UE shall transmit the PRACH to PSCell no later than 117 ms [Note2] from the start of T3'. The UE shall send at least one CSI report for PSCell with non-zero CQI index during T4'. The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T4'.

The above test requirements shall be fulfilled in order of T1, T2, T3 for the observed inter-RAT handover delay from NR to E-UTRAN to be counted as correct, and in order of T1, T2, T3', T4' for the observed PSCell addition delay to be counted as correct.

The rate of correct handovers and correct PSCell addition delay during repeated tests shall be at least 90 %.

NOTE1: The handover delay can be expressed as specified in clause 6.1.5.2:

$D_{HOwithPSCell_PCell}$ = RRC procedure delay + $T_{interrupt}$,

Where RRC procedure delay = 50 ms, $T_{interrupt} = T_{search_HO} + T_{IU} + T_{processing}$ is defined in clause 6.1.5.2.1, where

T_{search} = 0 ms

T_{IU} = 10 ms,

$T_{processing}$ = 25 ms

Note2: The PSCell addition delay can be expressed as follows as specified in clause 6.1.5.2.2:

$D_{HOwithPSCell_PSCell} = T_{RRC_delay} + T_{processing} + T_{search_HO} + T_{search_PSCell} + T_{\Delta} + T_{PSCell_DU} + 2$ ms

Where:

T_{RRC_delay} = 50 ms

$T_{processing}$ = 25 ms

T_{search_HO} = 0

T_{search_PSCell} = 0

T_{Δ} = 20 ms

T_{PSCell_DU} = 1*10+10 = 20 ms

A.6.3.1.15 Intra-frequency handover from FR1 to FR1; known target cell configured with NCD-SSB

A.6.3.1.15.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency handover requirements specified in clause 6.1.1.2, when the target cell is configured with NCD-SSB.

A.6.3.1.15.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.15.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.15.2-2, and A.6.3.1.15.2-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2.

Before the test starts,

- UE is connected to Cell 1 with active DL BWP and active UL BWP;
- UE is configured with *nonCellDefiningSSB-r17* under *BWP-DownlinkDedicated*, and NCD-SSB serves as the reference SSB for the serving cell, and is contained in the active DL BWP.

During T2, Cell 2 is switched ON, and transmits two SSBs, i.e. CD-SSB at SSB frequency 1 and NCD-SSB at SSB frequency 2. Before the test, UE is configured to measure SSB frequency 2. The test equipment shall send an RRC message implying handover to Cell 2. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3.

The start of T3 is defined as the end of the last TTI containing the RRC message implying handover. The handover command indicates the UE to handover to Cell 2 with *firstActiveDownlinkBWP-Id* configured to BWP-1. The UE then performs handover from Cell 1's active DL-BWP associated with the NCD-SSB of Cell 1 to Cell 2's BWP-1 which is associated with NCD-SSB of Cell 2.

Table A.6.3.1.15.2-1: Intra-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.15.2-2: General test parameters Intra-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
SMTC configuration			SMTC.11	For SSB frequency 2.
Measurement gap configuration			MG pattern #0, offset = 39	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.6.3.1.15.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency handover test case

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
NR RF Channel Number		1			1		

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD					
	Config 2		SR.1.1 TDD					
	Config 3		SR2.1 TDD					
CORESET Reference Channel	Config 1		CR.1.1 FDD					
	Config 2		CR.1.1 TDD					
	Config 3		CR2.1 TDD					
TRS configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
OCNG Patterns			OP.1					
CD-SSB Configuration	Config 1		SSB.1 FR1			SSB.1 FR1		
	Config 2		SSB.1 FR1			SSB.1 FR1		
	Config 3		SSB.2 FR1			SSB.2 FR1		
NCD-SSB Configuration	Config 1		SSB.9 FR1			SSB.9 FR1		
	Config 2		SSB.9 FR1			SSB.9 FR1		
	Config 3		SSB.10 FR1			SSB.10 FR1		
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.2 Note 4			DLBWP.1.2 Note 4		
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.2			ULBWP.1.2		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15kHz	-98					
N_{oc} Note2	Config 1,2	dBm/SCS	-98					
	Config 3		-95					
$\hat{E}_s / I_{ot}$		dB	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s / N_{oc}$		dB	8	8	8	-Infinity	11	11
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-Infinity	-87	-87
	Config 3	dBm/SCS	-87	-87	-87	-Infinity	-84	-84

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Io[Note 3]	Config 1,2	dBm/ 9.36 MHz	-61.41	-57.06	-57.06	-61.41	-57.06	-57.06
	Config 3	dBm/ 38.16 MHz	-55.31	-50.96	-50.96	-55.31	-50.96	-50.96
Propagation condition		-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The starting PRB index for dedicated DL BWP is selected such that NCD-SSB is within the BWP BW.

A.6.3.1.15.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 132 ms from the beginning of time period T3.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 122 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2.

This gives a total of 132 ms.

A.6.3.1.16 Inter-frequency handover from FR1 to FR1; known target cell configured with NCD-SSB

A.6.3.1.16.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 inter-frequency handover requirements specified in clause 6.1.1.2, when the target cell is configured with NCD-SSB.

A.6.3.1.16.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.16.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.16.2-2 and A.6.3.1.16.2-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2.

Before the test starts,

- UE is connected to Cell 1 with active DL BWP and active UL BWP;
- UE is not configured with *nonCellDefiningSSB-r17* under *BWP-DownlinkDedicated*, and CD-SSB serves as the reference SSB for the serving cell, and is contained in the active DL BWP.

During T2, Cell 2 is switched ON, and transmits two SSBs, i.e. CD-SSB at SSB frequency 1 and NCD-SSB at SSB frequency 2. Before the test, UE is configured to measure SSB frequency 1. The test equipment shall send an RRC message implying handover to Cell 2. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3.

The start of T3 is defined as the end of the last TTI containing the RRC message implying handover. The handover command indicates the UE to handover to Cell 2 with *firstActiveDownlinkBWP-Id* configured to BWP-1. The UE then performs handover from Cell 1's active DL-BWP associated with the CD-SSB of Cell 1 to Cell 2's BWP-1 which is associated with NCD-SSB of Cell 2.

Table A.6.3.1.16.2-1: Inter-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.16.2-2: General test parameters Inter-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
SMTC configuration			SMTC.1	For SSB frequency 1.
			SMTC.11	For SSB frequency 2.
Measurement gap configuration			MG pattern #0, offset = 39	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.6.3.1.16.2-3: Cell specific test parameters for NR FR1-FR1 Inter-frequency handover test case

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			2		
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD					
	Config 2		SR.1.1 TDD					
	Config 3		SR2.1 TDD					
CORESET Reference Channel	Config 1		CR.1.1 FDD					
	Config 2		CR.1.1 TDD					
	Config 3		CR2.1 TDD					
TRS configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
OCNG Patterns			OP.1					
CD-SSB Configuration	Config 1		SSB.1 FR1			SSB.1 FR1		
	Config 2		SSB.1 FR1			SSB.1 FR1		
	Config 3		SSB.2 FR2			SSB.2 FR1		
NCD-SSB Configuration	Config 1		N/A			SSB.9 FR1		
	Config 2		N/A			SSB.9 FR1		

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
	Config 3		N/A			SSB.10 FR2		
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.3			DLBWP.1.2 Note 4		
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.3			ULBWP.1.2		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15kHz	-98					
N_{oc} Note2	Config 1,2	dBm/SCS	-98					
	Config 3		-95					
$\hat{E}_s / I_{ot}$		dB	4	4	4	-Infinity	5	5
$\hat{E}_s / N_{oc}$		dB	4	4	4	-Infinity	5	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-94	-Infinity	-93	-93
	Config 3	dBm/SCS	-91	-91	-91	-Infinity	-90	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-64.59	-70.05	-63.85	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-58.49	-63.94	-57.75	-57.75
Propagation condition		-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The starting PRB index for dedicated DL BWP is selected such that NCD-SSB is within the BWP BW.

A.6.3.1.16.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 212 ms from the beginning of time period T3.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 202 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2.

This gives a total of 212 ms.

A.6.3.1.17 Handover with PSCell change delay from NR-DC (FR1-FR1) to NR-DC (FR1-FR1)

A.6.3.1.17.1 Test Purpose and Environment

The purpose of this test is to verify the handover delay requirements and PSCell change delay requirements in HO with PSCell from NR-DC (FR1-FR1) to NR-DC (FR1-FR1) defined in clauses 6.1.5.4. The requirements are applicable to NR FR1-FR1 intra-frequency PCell handover and NR FR1-FR1 intra-frequency PSCell change.

The supported test configurations are given in table A.6.3.1.17.1-1. The test scenario comprises four NR cells, source PCell(Cell 1) and source PSCell(Cell 2), target PCell(Cell 3), target PSCell(Cell 4).

Cell 1 and Cell 3 are on radio channel 1 in FR1. Cell 2 and Cell 4 are on radio channel 2 in FR1. Test parameters are given in Tables A.6.3.1.17.1-2, A.6.3.1.17.1-3, A.6.3.1.17.1-4 and A.6.3.1.17.1-5 below. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of T1, the UE shall be connected to Cell 1 on radio channel 1 and Cell 2 on radio channel 2. UE is not aware of Cell 3 and Cell 4. Starting T2, Cell 3 and Cell 4 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.6.3.1.17.1-1: Supported test configurations for HO with PSCell from NR-DC to NR-DC

Config	Description
1	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Source PSCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PSCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Source PSCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PSCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Source PSCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PSCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.17.1-2: General test parameters for PCell FR1-FR1 Intra-frequency handover

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 3	
Final condition	Active cell		Cell 3	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤5	

Table A.6.3.1.17.1-3: Cell specific test parameters for PCell FR1-FR1 Inter-frequency handover

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	8	8	-Infinity	12
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	12
SSB_RP	Config 1,2	dBm/SCS	-90	-90	- Infinity	-93
	Config 3	dBm/SCS	-87	-87	- Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-61.41	-61.41	- Infinity	-57.78
	Config 3	dBm/ 38.16 MHz	-55.31	-55.31	- Infinity	-51.68
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.3.1.17.1-4: General test parameters Intra-frequency FR1-FR1 PSCell change

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 2	
	Neighbouring cell		Cell 4	
Final condition	Active cell		Cell 4	

Access Barring Information	-	Not Sent	No additional delays in random access procedure.
T1	s	5	
T2	s	≤5	

Table A.6.3.1.17.1-5: Cell specific test parameters for Intra-frequency FR1-FR1 PSCell change

Parameter		Unit	Cell 2		Cell 4	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	8	8	-Infinity	12

Parameter		Unit	Cell 2		Cell 4	
			T1	T2	T1	T2
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	12
SSB_RP	Config 1,2	dBm/SCS	-90	-90	- Infinity	-93
	Config 3	dBm/SCS	-87	-87	- Infinity	-90
Io[Note3]	Config 1,2	dBm/ 9.36 MHz	-61.41	-61.41	- Infinity	-57.78
	Config 3	dBm/ 38.16 MHz	-55.31	-55.31	- Infinity	-51.68
Propagation condition		-	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.3.1.17.2 Test Requirements

In this test, the UE shall start to transmit the PRACH to target PCell (Cell 3) less than 93 ms from the beginning of time period T2.

The UE shall transmit the PRACH to target PSCell (Cell 4) no later than 103 ms from the beginning of time period T2.

The rate of correct handovers and correct PSCell change delay during repeated tests shall be at least 90 %.

NOTE: The handover with PSCell change delay is defined in clause 6.1.5.4.1 as

$D_{HOwithPSCell_PCell}$ = RRC procedure delay + $T_{interrupt}$, where

$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$

PSCell change delay during handover is defined in clause 6.1.5.4.2 as

$D_{HOwithPSCell_PSCell} = T_{RRC_delay} + T_{processing} + T_{search_HO} + T_{search_PSCell} + T_{\Delta} + T_{PSCell_DU}$ + 2 ms.

In this test the definition of each components are specified as followings :

T_{RRC_delay} = 16 ms and is specified in clause 12 in TS 38.331 [2],

$T_{processing}$ = 25 ms,

T_{search} = 20 ms,

T_{search_HO} = 0,

T_{search_PSCell} = 20 ms,

T_{IU} = 10 ms,

T_{Δ} = 20 ms,

T_{margin} = 2 ms,

T_{PSCell_DU} = 1*10+10 = 20 ms

A.6.3.1.18 Intra-frequency handover from FR1 to FR1; unknown target cell operating with 12 PRB SSB bandwidth

A.6.3.1.18.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency handover requirements for unknown target cell operating with 12 PRB SSB bandwidth specified in clause 6.1.1.2.

A.6.3.1.18.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.18.2-1. General test parameters as specified in table A.6.3.1.2.2-2 with config 1 apply except those specified in table A.6.3.1.18.2-2. Cell specific test parameters as specified in table A.6.3.1.2.2-3 with config 1 apply except those specified in table A.6.3.1.18.2-3.

The test procedure specified in clause A.6.3.1.2.2 applies to this test. The Cell 2 is the unknown target cell operating with 12 PRB SSB bandwidth.

Table A.6.3.1.18.2-1: Intra-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 3 MHz bandwidth with 15PRB CBW, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 3 MHz bandwidth with 15PRB CBW, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 3 MHz bandwidth with 12PRB CBW, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 3 MHz bandwidth with 12PRB CBW, FDD duplex mode
Note1: The UE is only required to be tested in one of the supported test configurations Note2: Configuration 2 is only applied for the testing on band n100	

Table A.6.3.1.18.2-2: General test parameters Intra-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	unknown target cell operating with 12 PRB SSB bandwidth
Final condition	Active cell		Cell 2	unknown target cell operating with 12 PRB SSB bandwidth

Table A.6.3.1.18.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
$BW_{channel}$	Config 1	MHz	3: $N_{PRB,c}$ = 15			
	Config 2		3: $N_{PRB,c}$ = 12			
BWP BW	Config 1	MHz	3: $N_{PRB,c}$ = 15			
	Config 2		3: $N_{PRB,c}$ = 12			
PDSCH Reference measurement channel	Config 1		SR.1.2 FDD			
	Config 2		SR.1.3 FDD			
CORESET Reference Channel	Config 1		CR.1.3 FDD			
	Config 2		CR.1.2 FDD			
SSB Configuration	Config 1,2		SSB.13 FR1			
Io^{Note1}	Config 1	dBm/ 2.7 MHz	-66.81	-64.11	-66.81	-64.11
	Config 2	dBm/ 2.16 MHz	-67.78	-65.07	-67.78	-65.07
Propagation condition		-	AWGN		AWGN	
NOTE 1: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.3.1.18.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 132 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 122 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2.

This gives a total of 132 ms.

A.6.3.1.19 Handover with PSCell change delay where target PSCell is with 12PRB SSB bandwidth

A.6.3.1.19.1 Test Purpose and Environment

The purpose of this test is to verify the handover delay requirements and PSCell change/addition delay requirements in HO with PSCell from NR-DC (FR1-FR1) to NR-DC (FR1-FR1) defined in clauses 6.1.5.4. The requirements are applicable to NR FR1-FR1 intra-frequency PCell handover and NR FR1-FR1 intra-frequency PSCell change/addition. The requirements are only applicable when the target PSCell is configured with 12PRB SSB bandwidth.

A.6.3.1.19.2 Test Parameters

The supported test configurations are given in table A.6.3.1.19.2-1. Only 15kHz FDD cases are considered. The test scenario comprises 3 NR cells, source PCell(Cell 1), target PCell(Cell 2), target PSCell(Cell 3).

Cell 1 and Cell 2 are on radio channel 1 in FR1. Cell 3 is on radio channel 2 in FR1. Test parameters are given in Tables A.6.3.1.19.2-2, A.6.3.1.19.2-3, and A.6.3.1.19.2-4 below. Note that for Cell 3 the SSB configuration refers to SSB pattern 13 in FR1: SSB allocation for SSB SCS=15kHz in 3 MHz. In the test, the SSB is configured with 12PRB bandwidth.

The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of T1, the UE shall be connected to Cell 1 on radio channel 1. UE is not aware of Cell 2 and Cell 3. Starting T2, Cell 2 and Cell 3 becomes detectable to the UE and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

The UE is required to successfully handover from Cell 1 to Cell 2 and at the same time in time period T2 add Cell 3 as PSCell attached to Cell 2. This test case verifies the delay starting from the start of T2 to time points where the UE finishes handover to Cell 2 and where the UE finishes addition of Cell 3. Test cases delay requirements are specified.

Table A.6.3.1.19.2-1: Supported test configurations for HO with PSCell with 12PRB SSB bandwidth

Config	Description
1	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PSCell: FR1 NR 15 kHz SSB SCS, 3 MHz bandwidth, FDD duplex mode

Table A.6.3.1.19.2-2: General test parameters for HO with PSCell with 12PRB SSB bandwidth

Parameter		Unit	Value	Comment
Initial conditions	Active PCell		Cell 1	
	Neighbouring cell		Cell 2, Cell 3	
Final condition	Active PCell		Cell 2	
	Active PSCell		Cell 3	
	Neighbouring cell		Cell 1	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤5	

Table A.6.3.1.19.2-3: Cell specific test parameters for Intra-frequency handover

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1			
Duplex mode	Config 1		FDD			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration	Config 1		Not Applicable			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
TRS configuration	Config 1		TRS.1.1 FDD			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1		SSB.1 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	15 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1	kHz	15 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1	dBm/SCS	-98			
$\hat{E}_s / I_{ot}$		dB	8	8	-Infinity	12
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	12
SSB_RP	Config 1	dBm/SCS	-90	-90	- Infinity	-93
Io Note3	Config 1	dBm/ 9.36 MHz	-61.41	-61.41	- Infinity	-57.78
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.3.1.19.2-4: Cell specific test parameters for Intra-frequency FR1-FR1 PSCell change/addition

Parameter		Unit	Cell 3	
			T1	T2
NR RF Channel Number			2	
Duplex mode	Config 1		FDD	
TDD configuration	Config 1		Not Applicable	
$BW_{channel}$	Config 1	MHz	3: $N_{PRB,c}$ = 15	
BWP BW	Config 1	MHz	3: $N_{PRB,c}$ = 15	
TRS configuration	Config 1		TRS.1.1 FDD	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1		SR.1.2 FDD	

Parameter		Unit	Cell 3	
			T1	T2
CORESET Reference Channel	Config 1		CR.1.2 FDD	
OCNG Patterns			OP.1	
SMTC Configuration			SMTC.1	
SSB Configuration	Config 1		SSB.13 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	15 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1	kHz	15 kHz	
PRACH configuration			FR1 PRACH configuration 1	
BWP	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	
N_{oc} Note2	Config 1	dBm/SCS	-98	
$\hat{E}_s / I_{ot}$		dB	-Infinity	12
$\hat{E}_s / N_{oc}$		dB	-Infinity	12
SSB_RP	Config 1	dBm/SCS	-Infinity	-86
Io Note3	Config 1	dBm/ SCS MHz	-Infinity	-85.7
Propagation condition		-	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.19.3 Test Requirements

Handover to PCell delay requirements

In this test, the UE shall start to transmit the PRACH to target PCell (Cell 2) less than [98] ms from the beginning of time period T2.

The handover delay is defined as

$$D_{HOwithPSCell_PCell} = \text{RRC procedure delay} + T_{interrupt}, \text{ where}$$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$$

The UE is required to follow the below parameters according to derivation from the test setup specified:

- RRC procedure delay = 16 ms,
- T_{search} = 20 ms,
- T_{IU} = 20 ms where PRACH association period should be configured as 1,

- $T_{processing}$ = 20 ms,
- $T\Delta$ = 20 ms,
- T_{margin} = 2ms.

That sums up to 98ms exactly.

PSCell change/addition delay requirements

The UE shall transmit the PRACH to target PSCell (Cell 3) no later than [178] ms from the beginning of time period T2.

PSCell change delay during handover is defined as

$$D_{HOwithPSCell_PSCell} = T_{RRC_delay} + T_{processing} + T_{search_PCell} + T_{search_PSCell} + T_{\Delta} + T_{PSCell_DU} + 2 \text{ ms}.$$

In this test the UE is required to follow the below parameters according to derivation from the test setup specified:

- T_{RRC_delay} = 16ms,
- $T_{processing}$ = 20 ms,
- T_{search_PCell} = 0,
- T_{search_PSCell} = 60 ms,
- T_{Δ} = 60 ms,
- T_{PSCell_DU} = 1*10+10 = 20 ms where PRACH association period should be configured as 1.

That sums up to 178ms exactly.

The test is considered successful only when both requirements are correctly verified, and the success rate during repeated tests shall be at least 90 %.

A.6.3.2 RRC Connection Mobility Control

A.6.3.2.1 SA: RRC Re-establishment

A.6.3.2.1.1 Intra-frequency RRC Re-establishment in FR1

A.6.3.2.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the NR intra-frequency RRC re-establishment delay in FR1 with known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.6.3.2.1.1.1-1, table A.6.3.2.1.1.1-2 and table A.6.3.2.1.1.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.6.3.2.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.3.2.1.1.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	
	Neighbour cells		1, 2, 3	Cell 2	
Final condition	Active cell		1, 2, 3	Cell 2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
N310		-	1, 2, 3	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3	0	Radio link failure timer;
T311		ms	1, 2, 3	3000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC.2	
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3	OFF	
PRACH configuration			1, 2, 3	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2, 3	5	
T2		ms	1, 2, 3	240	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133)
T3		s	1, 2, 3	2	

Table A.6.3.2.1.1.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in clause A.3.2.1			OP.1 defined in clause A.3.2.1		
TRS configuration		1	TRS.1.1 FDD			TRS.1.1 FDD		
		2	TRS.1.1 TDD			TRS.1.1 TDD		
		3	TRS.1.2 TDD			TRS.1.2 TDD		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
Active DL BWP configuration		1, 2, 3	DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		1, 2, 3	ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
RLM-RS		1, 2, 3	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	1.54	-infinity	-infinity	-3.79	4	4
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	7	-infinity	-infinity	4	4	4
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-91	-infinity	-infinity	-94	-94	-94
		2	-91	-infinity	-infinity	-94	-94	-94
		3	-88	-infinity	-infinity	-91	-91	-91
Io	dBm/9.36 MHz	1	-60.74	-64.59	-64.59	-60.74	-64.59	-64.59
	dBm/9.36 MHz	2	-60.74	-64.59	-64.59	-60.74	-64.59	-64.59
	dBm/38.16 MHz	3	-54.65	-58.50	-58.50	-54.65	-58.50	-58.50
Propagation Condition		1, 2, 3	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.2.1.1.2 Test Requirements

The RRC re-establishment delay is defined as the time from the moment UE declares RLF, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to a known NR intra-frequency cell shall be less than 1.6 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 1$

$T_{identify_intra_NR} = 200$ ms

$T_{SI} = 1280$ ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 [2] for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 1545 ms for RRC re-establishment delay, allow 1840 ms (240 ms + 1.6 s) from the beginning of T2 in the test case.

A.6.3.2.1.2 Inter-frequency RRC Re-establishment in FR1

A.6.3.2.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the NR inter-frequency RRC re-establishment delay in FR1 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.6.3.2.1.2.1-1, table A.6.3.2.1.2.1-2 and table A.6.3.2.1.2.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of Cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of Cell 2 by the end of T1.

Table A.6.3.2.1.2.1-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.3.2.1.2.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	
	Neighbour cells		1, 2, 3	Cell 2	
Final condition	Active cell		1, 2, 3	Cell 2	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
N310		-	1, 2, 3	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3	0	Radio link failure timer;
T311		ms	1, 2, 3	5000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC.2	
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3	OFF	
PRACH configuration			1, 2, 3	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2, 3	5	

T2	ms	1, 2, 3	240	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133)
T3	s	1, 2, 3	5	

Table A.6.3.2.1.2.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
RF Channel Number		1, 2, 3	1			2		
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in clause A.3.2.1			OP.1 defined in clause A.3.2.1		
TRS configuration		1	TRS.1.1 FDD			TRS.1.1 FDD		
		2	TRS.1.1 TDD			TRS.1.1 TDD		
		3	TRS.1.2 TDD			TRS.1.2 TDD		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
Active DL BWP configuration		1, 2, 3	DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		1, 2, 3	ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
RLM-RS		1, 2, 3	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	7
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	7
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-94	-infinity	-infinity	-infinity	-infinity	-91
		2	-94	-infinity	-infinity	-infinity	-infinity	-91
		3	-91	-infinity	-infinity	-infinity	-infinity	-88

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Io	dBm/9.36 MHz	1	-64.59	-70. 05	-70. 05	-70. 05	-70. 05	-62.26
	dBm/9.36 MHz	2	-64.59	-70. 05	-70. 05	-70. 05	-70.05	-62.26
	dBm/38.16 MHz	3	-58.50	-63.94	-63.94	-63.94	-63.94	-56.15
Propagation Condition		1, 2, 3	AWGN					
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.								
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

A.6.3.2.1.2.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR inter-frequency cell shall be less than 3 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50\ ms + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 2$.

$T_{identify_intra_NR} = 800$ ms.

$T_{identify_inter_NR} = 800$ ms.

$T_{SI} = 1280$ ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 [2] for the target inter-frequency NR cell.

$T_{PRACH} = 15$ ms; it is the additional delay caused by the random access procedure.

This gives a total of 2945 ms, allow 3 s in the test case.

A.6.3.2.1.3 Intra-frequency RRC Re-establishment in FR1 without serving cell timing

A.6.3.2.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the NR intra-frequency RRC re-establishment delay in FR1 without serving cell timing is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.6.3.2.1.3.1-1, table A.6.3.2.1.3.1-2 and table A.6.3.2.1.3.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.6.3.2.1.3.1-1: Supported test configurations

Configuration	Description

1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.3.2.1.3.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	
	Neighbour cells		1, 2, 3	Cell 2	
Final condition	Active cell		1, 2, 3	Cell 2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
N310		-	1, 2, 3	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3	6000	Radio link failure timer configured by *RLF-TimersAndConstants*
T311		ms	1, 2, 3	3000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC.2	
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3	OFF	
PRACH configuration			1, 2, 3	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2, 3	5	
T2		s	1, 2, 3	6.24	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133)
T3		s	1, 2, 3	3	

Table A.6.3.2.1.3.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in clause A.3.2.1			OP.1 defined in clause A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
TRS Configuration		1	TRS.1.1 FDD			TRS.1.1 FDD		
		2	TRS.1.1 TDD			TRS.1.1 TDD		
		3	TRS.1.2 TDD			TRS.1.2 TDD		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	4
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	4
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-94	-infinity	-infinity	-infinity	-infinity	-94
		2	-94	-infinity	-infinity	-infinity	-infinity	-94
		3	-91	-infinity	-infinity	-infinity	-infinity	-91
Io	dBm/9.36 MHz	1	-64.59	-infinity	-infinity	-infinity	-infinity	-64.59
	dBm/9.36 MHz	2	-64.59	-infinity	-infinity	-infinity	-infinity	-64.59
	dBm/38.16 MHz	3	-58.50	-infinity	-infinity	-infinity	-infinity	-58.50
Propagation Condition		1, 2, 3	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.2.1.3.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR intra-frequency cell without serving cell timing shall be less than 2.2 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$T_{UE_re-establish_delay} = 50\text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$.

$N_{freq} = 1$.

$T_{identify_intra_NR} = 800$ ms.

$T_{SI} = 1280$ ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 [2] for the target intra-frequency NR cell.

$T_{PRACH} = 15$ ms; it is the additional delay caused by the random access procedure.

This gives a total of 2145 ms, allow 2.2 s in the test case.

A.6.3.2.2 Random Access

A.6.3.2.2.1 4-step RA type contention based random access test in FR1 for NR standalone

A.6.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.6.3.2.2.1.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.6.3.2.2.1.1-2.

Table A.6.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.6.3.2.2.1.1-2: General test parameters for contention based random access test in FR1 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB pattern 1 in FR1	As defined in clause A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 2		SSB pattern 2 in FR1	
Number of SSBs per SS-burst			2	Different from the definition in clause A.3.10
SS/PBCH block index			0,1	Different from the definition in clause A.3.10
Duplex Mode for Cell 1	Config 1		FDD	
	Config 2		TDD	
TDD Configuration	Config 2		TDDConf.2.1	
CSI-RS for tracking	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.2 TDD	
OCNG Pattern Note 1			OP.1	As defined in clause A.3.2.1.
PDSCH parameters Note 4	Config 1		SR.1.1 FDD	As defined in clause A.3.1.1.
	Config 2		SR.2.1 TDD	

Parameter			Unit	Test-1	Comments
RMSI CORESET Reference Channel		Config 1		CR.1.1 FDD	
		Config 2		CR.2.1 TDD	
Dedicated CORESET Reference Channel		Config 1		CCR.1.1 FDD	
		Config 2		CCR.2.1 TDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH DMRS			dB		
EPRE ratio of PDCCH DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH DMRS			dB		
EPRE ratio of PDSCH DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-98	
		Config 2		-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP Note 3		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-98	
		Config 2		-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	
Io Note 2		Config 1	dBm	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 2		-62.2/38.16 MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\text{CMAX, f,c}}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1 [18].
PRACH Configuration				FR1 PRACH configuration 1	As defined in clause A.3.8.
Propagation Condition			-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: Void
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.6.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.6.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in clause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2.2.1.4 the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.6.3.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

A. 6.3.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

A.6.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in clause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.6.3.2.2.2 4-step RA type non-contention based random access test in FR1 for NR standalone

A.6.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.6.3.2.2.2.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.6.3.2.2.2.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports csi-RSRP-AndRSRQ-MeasWithSSB or csi-RSRP-AndRSRQ-MeasWithoutSSB.

Table A.6.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.6.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone

Parameter		Unit	Test-1	Test-2	Comments
SSB Configuration	Config 1		SSB pattern 1 in FR1	SSB pattern 1 in FR1	As defined in clause A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 2		SSB pattern 2 in FR1	SSB pattern 2 in FR1	
Number of SSBs per SS-burst			2	2	Different from the definition in clause A.3.10
SS/PBCH block index			0,1	0,1	Different from the definition in clause A.3.10
CSI-RS Configuration	Config 1		N/A	CSI-RS.1.1 FDD	As defined in clause A.3.1.4
	Config 2			CSI-RS.2.1 TDD	
Duplex Mode for Cell 1	Config 1		FDD	FDD	
	Config 2		TDD	TDD	
TDD Configuration	Config 2		TDDConf.2.1	TDDConf.2.1	
CSI-RS for tracking	Config 1		TRS.1.1 FDD	TRS.1.1 FDD	
	Config 2		TRS.1.2 TDD	TRS.1.2 TDD	
OCNG Pattern Note 1			OP.1	OP.1	As defined in clause A.3.2.1.

Parameter			Unit	Test-1	Test-2	Comments
PDSCH parameters Note 4		Config 1		SR.1.1 FDD	SR.1.1 FDD	As defined in clause A.3.1.1.
		Config 2		SR.2.1 TDD	SR.2.1 TDD	
RMSI CORESET Reference Channel		Config 1		CR.1.1 TDD	CR.1.1 TDD	
		Config 2		CR.2.1 TDD	CR.2.1 TDD	
Dedicated CORESET Reference Channel		Config 1		CCR.1.1 TDD	CCR.1.1 TDD	
		Config 2		CCR.2.1 TDD	CCR.2.1 TDD	
NR RF Channel Number				1	1	
EPRE ratio of PSS to SSS			dB	0	0	
EPRE ratio of PBCH DMRS to SSS			dB			
EPRE ratio of PBCH to PBCH DMRS			dB			
EPRE ratio of PDCCH DMRS to SSS			dB			
EPRE ratio of PDCCH to PDCCH DMRS			dB			
EPRE ratio of PDSCH DMRS to SSS			dB			
EPRE ratio of PDSCH to PDSCH DMRS			dB			
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-98	-98	
		Config 2		-101	-101	
	$\hat{E}_s / N_{oc}$		dB	3	3	
	SS-RSRP Note 3		dBm/ SCS	-95	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-98	-98	
		Config 2		-101	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	-115	
Io Note 2		Config 1	dBm	-65.3/9.36 MHz	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 2		-62.2/38.16 MHz	-62.2/38.16 MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 2	FR1 PRACH configuration 3	As defined in clause A.3.8.2.
Propagation Condition			-	AWGN	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: Void
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.6.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.6.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in clause 6.2.2.2.2.1 for SSB-based Random Access Preamble transmsission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in clause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.3 2-step RA type contention based random access test in FR1 for NR standalone

A.6.3.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the 2-step RA type random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.6.3.2.2.3.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.6.3.2.2.3.1-2.

Table A.6.3.2.2.3.1-1: Supported test configurations for 2-step RA type contention based random access with successRAR test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.6.3.2.2.3.1-2: General test parameters for 2-step RA type contention based random access with successRAR test in FR1 for NR standalone

Parameter			Unit	Test-1	Comments
SSB Configuration		Config 1		SSB pattern 1 in FR1	As defined in clause A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
		Config 2		SSB pattern 2 in FR1	
Number of SSBs per SS-burst				2	Different from the definition in clause A.3.10
SS/PBCH block index				0,1	Different from the definition in clause A.3.10
Duplex Mode for Cell 2		Config 1		FDD	
		Config 2		TDD	
TDD Configuration		Config 2		TDDConf.2.1	
OCNG Pattern Note 1				OP.1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1		SR.1.1 FDD	As defined in A.3.1.1.
		Config 2		SR.2.1 TDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH DMRS			dB		
EPRE ratio of PDCCH DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH DMRS			dB		
EPRE ratio of PDSCH DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-98	
		Config 2		-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below

Parameter			Unit	Test-1	Comments
	N_{oc}	Config 1	dBm/15kHz	-98	configured *msgA-RSRP-ThresholdSSB*
		Config 2		-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP		dBm/ SCS	-115	
Io Note 2		Config 1	dBm	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 2		-62.2/38.16 MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1 [18].
MsgA Configuration				FR1 MsgA configuration 1	As defined in clause A.3.20.2.1.
msgA-RSRP-ThresholdSSB			dBm	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
Propagation Condition			-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.6.3.2.2.3.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.6.3.2.2.3.2.1 MsgA Transmission

To test the UE behavior specified in clause 6.2.2.3.1.1 the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB.*

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first MsgA preamble transmission shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 3dB lower than the first MsgA PRACH power for test configuration 1 and equal to the first MsgA PRACH power for test configuration 2 & 3 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.3.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.2 the System Simulator shall transmit a MsgB containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit an ACK if the MsgB with a successRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble and if the Contention Resolution is successful.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the

backoff time expires if all received MsgB(s) contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 3dB lower than the first MsgA PRACH power for test configuration 1 and equal to the first MsgA PRACH power for test configuration 2 & 3 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.3.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be 3dB lower than the first MsgA PRACH power for test configuration 1 and equal to the first MsgA PRACH power for test configuration 2 & 3 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.4 2-step RA type non-contention based test in FR1 for NR standalone

A.6.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.6.3.2.2.4.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.6.3.2.2.4.1-2.

Table A.6.3.2.2.4.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone

Config	Description
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.6.3.2.2.4.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB pattern 2 in FR1	As defined in clause A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below

Parameter			Unit	Test-1	Comments
Number of SSBs per SS-burst				2	Different from the definition in clause A.3.10
SS/PBCH block index				0,1	Different from the definition in clause A.3.10
Duplex Mode for Cell 1		Config 1		TDD	
TDD Configuration		Config 1		TDDConf.2.1	
OCNG Pattern Note 1				OP.1	As defined in clause A.3.2.1.
PDSCH parameters Note 4		Config 1		SR.2.1 TDD	As defined in clause A.3.1.1.
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
msgA-*RSRP-ThresholdSSB*			dBm	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured msgA-*RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP Note 3		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured msgA-*RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	
Io Note 2		Config 1	dBm	-62.2/38.16 MHz	For symbols without SSB index 1
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\text{CMAX, f,c}}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1 [18].
MsgA Configuration				FR1 MsgA configuration 2	As defined in clause A.3.20.2.2.
Propagation Condition			-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.6.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.6.3.2.2.4.2.1 MsgA Transmission

To test the UE behavior specified in clause 6.2.2.3.2.1, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA PRACH on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.4.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a fallbackRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 containing the payload of MsgA PUSCH if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble. The UE shall monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB's contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA and msg3 transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.2.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.6.3.2.3 SA: RRC Connection Release with Redirection

A.6.3.2.3.1 Redirection from NR in FR1 to NR in FR1

A.6.3.2.3.1.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to NR requirements specified in clause 6.2.3.2.1.

A.6.3.2.3.1.2 Test Parameters

Supported test configurations are shown in table A.6.3.2.3.1.2-1. The time delay is tested by using the parameters in table A.6.3.2.3.1.2-2, and A.6.3.2.3.1.2-3.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2. Cell 1 and Cell 2 belong to different tracking areas.

Table A.6.3.2.3.1.2-1: Redirection from NR to NR test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.2.3.1.2-2: General test parameters for Redirection from NR to NR test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 µs	Synchronous cells
T1		s	5	
T2		s	2.3	

Table A.6.3.2.3.1.2-3: Cell specific test parameters for Redirection from NR to NR test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
SSB Configuration	Config 1		SSB.1 FR1			
	Config 2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
CSI-RS for tracking	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OCNG pattern OP.1			
SMTC configuration	Config 1,2		SMTC.1 FR1			
	Config 3		SMTC.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s/I_{ot}$		dB	4	4	-infinity	4
$\hat{E}_s/N_{oc}$		dB	4	4	-infinity	4
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-64.59
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-58.49
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.2.3.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 2240 ms from the beginning of time period T2.
The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_NR} = T_{RRC_procedure_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH},$$

where:

$T_{RRC_procedure_delay}$ = 110 msin the test.

$T_{identify-NR}$ = 680 ms in the test.

T_{SI-NR} = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331[2] for the target NR cell.

T_{RACH} = 170 ms in the test.

This gives a total of 2240 ms.

A.6.3.2.3.2 Redirection from NR in FR1 to E-UTRAN

A.6.3.2.3.2.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to E-UTRAN requirements specified in clause 6.2.3.2.2.

A.6.3.2.3.2.2 Test Parameters

Supported test configurations are shown in table A.6.3.2.3.2.2-1. The time delay is tested by using the parameters in table A.6.3.2.3.2.2-2, A.6.3.2.3.2.2-3 and A.6.3.2.3.2.2-4.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2.

Table A.6.3.2.3.2.2-1: Redirection from NR to E-UTRAN test configurations

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.2.3.2.2-2: General test parameters for Redirection from NR to E-UTRAN test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	2.3	

Table A.6.3.2.3.2.2-3: Cell specific test parameters for Redirection from NR to E-UTRAN (Cell 1)

Parameter		Unit	Cell 1	
			T1	T2
RF Channel Number			1	
Duplex mode	Config 1,4		FDD	
	Config 2,3,5,6		TDD	
SSB Configuration	Config 1,4		SSB.1 FR1	
	Config 2,5		SSB.1 FR1	
	Config 3,6		SSB.2 FR1	
CSI-RS for tracking	Config 1,4		TRS.1.1 FDD	
	Config 2,5		TRS.1.1 TDD	

Parameter		Unit	Cell 1	
			T1	T2
	Config 3,6		TRS.1.2 TDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2,5		TDDConf.1.1	
	Config 3,6		TDDConf.2.1	
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5		10: $N_{PRB,c}$ = 52	
	Config 3,6		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5		10: $N_{PRB,c}$ = 52	
	Config 3,6		40: $N_{PRB,c}$ = 106	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD	
	Config 3,6		SR2.1 TDD	
CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD	
	Config 3,6		CR2.1 TDD	
OCNG Patterns			OCNG pattern OP.1	
SMTC configuration	Config 1,2,4,5		SMTC.1 FR1	
	Config 3,6		SMTC.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz	
	Config 3,6		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz	
	Config 3,6		30 kHz	
PRACH configuration			FR1 PRACH configuration 1	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-98	
	Config 3,6		-95	
$\hat{E}_s / I_{ot}$		dB	4	4
$\hat{E}_s / N_{oc}$		dB	4	4
Io Note3	Config 1,2,4,5	dBm/ 9.36 MHz	-64.59	-64.59
	Config 3,6	dBm/ 38.16 MHz	-58.49	-58.49
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.3.2.3.2.2-4: Cell specific test parameters for Redirection from NR to E-UTRAN (Cell 2)

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	2	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PRACH Configuration[Note2]		1, 2, 3	4	
		4, 5, 6	53	
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note3]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note4]				
OCNG_RB[Note4]				
N_{oc}[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	4
$\hat{E}_s/I_{ot}$[Note6]	dB	1, 2, 3, 4, 5, 6	-Infinity	4
RSRP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-94
SCH_RP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-94
Io[Note6]	dBm/9 MHz	1, 2, 3, 4, 5, 6	-70.22	-64.76
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.6.3.2.3.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 2205 ms from the beginning of time period T2.
The rate of correct RRC connection release redirection to E-UTRAN observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_E\text{-}UTRA} = T_{RRC_procedure_delay} + T_{identify\text{-}E\text{-}UTRA} + T_{SI\text{-}E\text{-}UTRA} + T_{RACH},$$

where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}E\text{-}UTRA}$ = 800 ms in the test.

$T_{SI\text{-}E\text{-}UTRA}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 36.331 [2] for the target E-UTRA cell.

T_{RACH} = 15 ms in the test.

This gives a total of 2205 ms.

A.6.3.2.4 LTM PDCCH-order Random Access

A.6.3.2.4.1 PDCCH-order RACH on neighbor cell in FR1 when RACH BW is within active UL BWP

A.6.3.2.4.1.1 Test Purpose and Environment

This test is to verify the requirement for PDCCH-order RACH on neighbour cell in FR1 when RACH BW is within active UL BWP specified in clause 8.1 in TS 38.213 [3] and UE transmit timing in clause 7.1 for UE supporting *rach-EarlyTA-Measurement-r18*.

A.6.3.2.4.1.2 Test Parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. Test configurations are given in table A.6.3.2.4.1.2-1. Both PDCCH order RACH delay, transmit timing requirement and the interruption requirements are tested by using the parameters in table A.6.3.2.4.1.2-2 and A.6.3.2.4.1.2-3.

This test contains 2 tests (test 1, and 2) and UE may have to pass one of the tests based on the conditions defined in this clause.

In test 1, joint TCI state configuration as defined in table A.6.3.2.4.1.2-2 is provided.

In test 2, no candidate TCI state configurations are configured as in table A.6.3.2.4.1.2-2.

If a UE supports *ltm-MAC-CE-JointTCI-r18*, it is only required to pass test 1. If a UE does not support *ltm-MAC-CE-JointTCI-r18*, it is only required to pass test 2.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. No gap patterns are configured in the test case.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- A measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.

- For tests 1, 2, the UE has reported L3 measurement results and performed SSB based L1-RSRP measurement on Cell 2.

In test 1 and 2, T1 starts from UE transmitting a valid L1 report on Cell 2.

In test 1, after receiving the first L1 report on Cell 2 during T1, the test equipment sends TCI state activation MAC CE to active TCI state of Cell 2 no later than 100 ms after receiving the L1 report.

- In test 1, CandidateTCI-State#1 is activated.

- In test 2, test equipment shall not send TCI state activation MAC CE to active TCI state of Cell 2.

The start of T2 is the instant when PDCCH order to trigger PRACH transmission on Cell 2 is sent to the UE.

Table A.6.3.2.4.1.2-1: PDCCH order RACH on neighbor cell in FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Candidate cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Candidate cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Candidate: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.2.4.1.2-2: General test parameters for PDCCH order RACH in FR1

Parameter		Unit	Value			Comment
			Test 1	Void	Test 2	
Initial conditions	Active cell		Cell 1			
	Neighbouring cell		Cell 2			Cell 2 is the candidate cell
Final condition	Active cell		Cell 1			After transmitting PRACH on Cell 2, UE shall be back to Cell 1.
A3-Offset		dB	-6			
Hysteresis		dB	0			
Time To Trigger		ms	0			
Filter coefficient			0			L3 filtering is not used
DRX			OFF			DRX is not used
Time offset between cells			2 μs			RTD between cells is less than CP
deriveSSB-IndexFromCell			Enabled			
EarlyUL-SyncConfig	frequencyInfoUL		NR RF Channel Number 1			Same as Cell 1
	PRACH configuration		FR1 PRACH configuration 5			RACH bandwidth is within active UL BWP of Cell 1
	bwp-GenericParameters		ULBWP.0.1			
	n-TimingAdvanceOffset	Tc	25600			
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	80			Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1			Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1			
	spCellInclusion		N/A			
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State #1		DlorJoint TCI.State.0		N/A	As specified in clause A.3.16B. Configured for early TCI state activation for test 1.
Ltm-ConfigComplete			True			Candidate cell's configuration is complete configuration
T1		s	0.3			
T2		s	≤0.5			

Table A.6.3.2.4.1.2-3: Cell specific test parameters for PDCCH order RACH test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD		N/A	
	Config 2		SR.1.1 TDD		N/A	
	Config 3		SR.2.1 TDD		N/A	
CORESET Reference Channel	Config 1		CR.1.1 FDD		N/A	
	Config 2		CR.1.1 TDD		N/A	
	Config 3		CR.2.1 TDD		N/A	
CP length			Normal			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	-0.64	-0.64	-0.64	-0.64
$\hat{E}_s / N_{oc}$		dB	8	8	8	8
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-90
	Config 3	dBm/SCS	-87	-87	-87	-87
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.7	-58.7	-58.7	-58.7
	Config 3	dBm/ 38.16 MHz	-52.6	-52.6	-52.6	-52.6

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
Propagation condition	-	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					

A.6.3.2.4.1.3 Test Requirements

The UE shall transmit the PRACH preamble to Cell 2 in the first available PRACH occasion after $N_{T,2}$ + 0.5 ms + T_{SSB} from the beginning of time period T2. After transmitting PRACH on Cell 2, UE shall retune back to Cell 1.

NOTE: The PDCCH order RACH delay can be expressed as: $N_{T,2} + T_{\text{BWPswitchDelay}} + \Delta_{\text{Delay}} + T_{\text{switch}} + T_{\text{SSB}} + \Delta_{\text{RF/BB preparation}}$, where:

- $N_{T,2}$ is a time duration of N_2 symbols corresponding to a PUSCH preparation time for UE processing capability 1 assuming μ corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH order and the SCS configuration of the corresponding PRACH transmission and is specified in table 6.4-1 in TS 38.214 [26].
- $T_{\text{BWPswitchDelay}} = 0$, $T_{\text{switch}} = 0$, $\Delta_{\text{RF/BB preparation}} = 0$
- $\Delta_{\text{Delay}} = 0.5$ ms
- $T_{\text{SSB}} = 0$ for UE supporting *ltm-MAC-CE-JointTCI-r18* and/or *ltm-MAC-CE-SeparateTCI-r18*, otherwise $T_{\text{SSB}} = T_{\text{first-SSB_RACH}} + T_{\text{SSB-proc}}$, where $T_{\text{first-SSB_RACH}}$ is the time to first SSB after 1 slot from the end of the slot that UE receives PDCCH-order, and $T_{\text{SSB-proc}}$ = 2 ms, which is the time for SSB processing.

During T2, interruption on Cell 1 UL shall not happen outside the overlapped slot to transmit PRACH and *N* symbols before and after the PRACH occasion as defined in clause 8.1 in 38.213 [3], where N=2. During T2, interruption on Cell 1 DL shall not occur outside the overlapped slot to transmit PRACH.

The test equipment will verify that the timing of PRACH transmission on Cell 2 is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB of Cell 2.

- The N_{TA_offset} value (in T_c units) is 25600
- The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.3.2.4.2 PDCCH-ordered RACH to an inter-frequency candidate cell in FR1 for LTM

A.6.3.2.4.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 PDCCH-ordered RACH to an inter-frequency candidate cell in FR1 for LTM. The Te requirements are specified in 7.1. The interruption requirements specified in clause 8.2.2.2.20. This test is for UE supporting PDCCH-ordered RACH to an inter-frequency candidate cell, whose SSB is outside active BWPs of the UE.

A.6.3.2.4.2.2 Test Parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on a different frequency from the PCell. Test configurations are given in table A.6.3.2.4.2.2-1. Both interruption length and Te requirements for the first uplink transmission are tested by using the parameters in table A.6.3.2.4.2.2-2 and A.6.3.2.4.2.2-3.

The test consists of 2 tests, and UE is required to pass one among Test 1, Test 2.

- Test 1: for a UE supporting *ltm-MAC-CE-JointTCI-r18*
- Test 2: for a UE not supporting *ltm-MAC-CE-JointTCI-r18*

The test consists of two successive time periods, with time durations of T1 and T2, respectively. Measurement gap patterns are configured in the test case and the SSB of Cell 2 is outside the active BWP of Cell 1. The PCell is continuously scheduled during the whole test.

Before T1, for Test 1, 2:

- Cell 1 and Cell 2 on radio channel 1 are powered on.
- UE establishes a connection with the Cell 1.
- A measurement object is configured for the frequency of the Cell 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used. UE has reported an L3 measurement result of Cell 2 to Cell 1.
- UE is provided with *LTM-Candidate-r18* for Cell 2
  - Joint TCI state configuration as defined in table A.6.3.2.4.2.2-2 for Test 1 is provided.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2, and UE has already reported a valid L1-RSRP result of Cell 2.

During T1, for Test 1:

- At the start of T1, UE receives candidate cell TCI state activation MAC CE for Cell 2.
  - In Test 1, *CandidateTCI-State#1* is activated.
- T1 ends 100 ms after the candidate cell TCI state activation MAC CE transmission.
- In Test 2, T1 is skipped.

During T2, for Test 1, 2:

- At the start of T2, UE receives PDCCH order to trigger PRACH transmission on Cell 2.

  Note: PDCCH order is not expected on the frame with SFN mod 8 =3.
- T2 ends with UE back to Cell 1 after transmitting PRACH to Cell 2.
- The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during the transmission of PDCCH ordered RACH.
- The test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.
- The N_{TA} offset value (in T_c units) is 25600
- The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1

Table A.6.3.2.4.2.2-1: Inter-frequency PDCCH-ordered RACH from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.2.4.2.2-2: General test parameters for Inter-frequency PDCCH-ordered RACH test from FR1 to FR1 from FR1 to FR1

Parameter		Unit	Value		Comment
			Test 1	Test 2	
Initial conditions	Active cell		Cell 1		
	Neighbouring cell		Cell 2		Cell 2 is the candidate cell
Final condition	Active cell		Cell 1		
A3-Offset		dB	-6		
Hysteresis		dB	0		
Time To Trigger		s	0		
Filter coefficient			0		L3 filtering is not used
Measurement gap periodicity		ms	80		
DRX			OFF		DRX is not used
Access Barring Information		-	Not Sent		No additional delays in random access procedure.
Time offset between cells			2 μs		RTD between cells is less than CP
reportQuantityRS-Indexes			Rsrp		
maxNrofRS-IndexesToReport			1		
includeBeamMeasurements			True		
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	80		Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1		Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1		
	spCellInclusion		N/A		
EarlyUL-SyncConfig	frequencyInfoUL		NR RF Channel Number 2		Cell 2
	PRACH configuration		FR1 PRACH configuration 6		
	bwp-GenericParameters		ULBWP.0.1		
	n-TimingAdvanceOffset	Tc	25600		
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DLorJoint TCI.State.0	N/A	As specified in clause A.3.16B. In test 1, CandidateTCI-State#1 is configured for early TCI state activation. In test 2, CandidateTCI-State#1 is configured for TCI state indication in cell switch command.
ltm-ConfigComplete			True		Candidate cell's configuration is complete configuration
T1		s	≤0.1		
T2		s	≤0.2		

Table A.6.3.2.4.2.2-3: Cell specific test parameters for NR FR1-FR1 Inter-frequency PDCCH-ordered RACH test

Parameter		Unit	Cell 1	Cell 2
			T1-T2	T1-T2
NR RF Channel Number			1	2
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	

Parameter		Unit	Cell 1	Cell 2
			T1-T2	T1-T2
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR2.1 TDD	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR2.1 TDD	
TRS configuration for serving cell	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
OCNG Patterns			OP.1	
SMTC Configuration			SMTC.1	
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15	
	Config 3		30	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15	
	Config 3		30	
PRACH configuration			FR1 PRACH configuration 6	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98	
	Config 3		-95	
$\hat{E}_s / I_{ot}$		dB	8	4
$\hat{E}_s / N_{oc}$		dB	8	4
SSB_RP	Config 1,2	dBm/SCS	-90	-94
	Config 3	dBm/SCS	-87	-91
Io Note3	Config 1,2	dBm/ 9.36MHz	-61.41	-64.59
	Config 3	dBm/ 38.16 MHz	-55.31	-58.49
Propagation condition		-	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Unit	Cell 1	Cell 2
		T1-T2	T1-T2
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

A.6.3.2.4.2.3 Test Requirements

The UE shall transmit the PRACH preamble to Cell 2 in the first available PRACH occasion after $N_{T,2}$ + 0.5 ms + T_{SSB} from the beginning of time period T2. After transmitting PRACH on Cell 2, UE shall retune back to Cell 1.

NOTE: The PDCCH order RACH delay can be expressed as: $N_{T,2} + T_{\mathrm{BWPswitchDelay}} + \Delta_{\mathrm{Delay}} + T_{\mathrm{switch}} + T_{\mathrm{SSB}} + \Delta_{\mathrm{RF/BB\ preparation}}$, where:

- $N_{T,2}$ is a time duration of N_2 symbols corresponding to a PUSCH preparation time for UE processing capability 1 assuming μ corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH order and the SCS configuration of the corresponding PRACH transmission and is specified in table 6.4-1 in TS 38.214 [26].
- $T_{\mathrm{BWPswitchDelay}}$ = 0, T_{switch} = 0
- Δ_{Delay} = 0.5 ms
- $\Delta_{\mathrm{RF/BB\ preparation}}$ is defined in clause 6.2.2C
- T_{SSB} = 0 for UE supporting *ltm-MAC-CE-JointTCI-r18* and/or *ltm-MAC-CE-SeparateTCI-r18*, otherwise $T_{\mathrm{SSB}} = T_{\mathrm{first-SSB_RACH}} + T_{\mathrm{SSB-proc}}$, where $T_{\mathrm{first-SSB_RACH}}$ is the time to first SSB occasion overlapped with MGL after 2ms and 1 slot from the end of the slot that UE receives PDCCH-order, and $T_{\mathrm{SSB-proc}}$ = 2 ms, which is the time for SSB processing.

During T2, interruption on Cell 1 UL shall not happen outside ceil (Y/NR Slot length) +1 slots before and after PRACH transmission and the same slot of PRACH, where Y as reported in *pdcch-RACH-SwitchingTimeList-r18*.

The test equipment will verify that the timing of PRACH transmission on Cell 2 is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB of Cell 2.

- The N_{TA_offset} value (in T_c units) is 25600
- The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.3.2.4.3 PDCCH-order RACH on neighbor cell without L1-RSRP measurement in FR1 when RACH BW is within active UL BWP

A.6.3.2.4.3.1 Test Purpose and Environment

This test is to verify the requirement for PDCCH-order RACH on neighbour cell without L1-RSRP measurement in FR1 when RACH BW is within active UL BWP specified in clause 8.1 in 38.213 [3] and UE transmit timing in clause 7.1 for UE supporting *rach-EarlyTA-Measurement-r18.*

A.6.3.2.4.3.2 Test Parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. Test configurations are given in table A.6.3.2.4.3.2-1. Both PDCCH order RACH delay, transmit timing requirement and the interruption requirements are tested by using the parameters in table A.6.3.2.4.3.2-2 and A.6.3.2.4.3.2-3.

This test contains 2 tests (test 1 and 2) and UE may have to pass one of the tests based on the conditions defined in this clause.

- In test 1, joint TCI state configuration as defined in table A.6.3.2.4.3.2-2 is provided.
- In test 2, no candidate TCI state configurations are configured as in table A.6.3.2.4.3.2-2.

If a UE supports *ltm-MAC-CE-JointTCI-r18*, it is only required to pass test 1. If a UE does not support *ltm-MAC-CE-JointTCI-r18*, it is only required to pass test 2. The test consists of two successive time periods, with time durations of T1 and T2 respectively. No gap patterns are configured in the test case.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- A measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

In test 1 and 2, T1 starts from UE transmitting a L3 report on Cell 2. In test 1, after receiving the L3 report on Cell 2 during T1, the test equipment sends TCI state activation MAC CE to active TCI state of Cell 2 no later than 100 ms after receiving the L3 report.

- In test 1, CandidateTCI-State#1 is activated.
- In test 2, test equipment shall not send TCI state activation MAC CE to active TCI state of Cell 2.

The start of T2 is the instant when PDCCH order to trigger PRACH transmission on Cell 2 is sent to the UE.

Table A.6.3.2.4.3.2-1: PDCCH order RACH on neighbor cell in FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Candidate cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Candidate cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Candidate: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.2.4.3.2-2: General test parameters for PDCCH order RACH in FR1

Parameter		Unit	Value			Comment
			Test 1	Void	Test 2	
Initial conditions	Active cell		Cell 1			
	Neighbouring cell		Cell 2			Cell 2 is the candidate cell
Final condition	Active cell		Cell 1			After transmitting PRACH on Cell 2, UE shall be back to Cell 1.
A3-Offset		dB	-6			
Hysteresis		dB	0			
Time To Trigger		ms	0			
Filter coefficient			0			L3 filtering is not used
DRX			OFF			DRX is not used
Time offset between cells			2 μs			RTD between cells is less than CP
deriveSSB-IndexFromCell			Enabled			
EarlyUL-SyncConfig	frequencyInfoUL		NR RF Channel Number 1			Same as Cell 1
	PRACH configuration		FR1 PRACH configuration 5			RACH bandwidth is within active UL BWP of Cell 1
	bwp-GenericParameters		ULBWP.0.1			
	n-TimingAdvanceOffset	Tc	25600			
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DlorJoint TCI.State.0		N/A	As specified in clause A.3.16B. Configured for early TCI state activation for test 1.

Ltm-ConfigComplete		True	Candidate cell's configuration is complete configuration
T1	s	0.3	
T2	s	≤0.5	

Table A.6.3.2.4.3.2-3: Cell specific test parameters for PDCCH order RACH test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD		N/A	
	Config 2		SR.1.1 TDD		N/A	
	Config 3		SR.2.1 TDD		N/A	
CORESET Reference Channel	Config 1		CR.1.1 FDD		N/A	
	Config 2		CR.1.1 TDD		N/A	
	Config 3		CR.2.1 TDD		N/A	
CP length			Normal			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	-0.64	-0.64	-0.64	-0.64
$\hat{E}_s / N_{oc}$		dB	8	8	8	8
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-90

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Config 3	dBm/SCS	-87	-87	-87	-87
Io[Note3]	Config 1,2	dBm/ 9.36 MHz	-58.7	-58.7	-58.7	-58.7
	Config 3	dBm/ 38.16 MHz	-52.6	-52.6	-52.6	-52.6
Propagation condition		-	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.3.2.4.3.3 Test Requirements

The UE shall transmit the PRACH preamble to Cell 2 in the first available PRACH occasion after $N_{T,2}$ + 0.5 ms + T_{SSB} from the beginning of time period T2. After transmitting PRACH on Cell 2, UE shall retune back to Cell 1.

NOTE: The PDCCH order RACH delay can be expressed as: $N_{T,2} + T_{\text{BWPswitchDelay}} + \Delta_{\text{Delay}} + T_{\text{switch}} + T_{\text{SSB}} + \Delta_{\text{RF/BB preparation}}$, where:

- $N_{T,2}$ is a time duration of N_2 symbols corresponding to a PUSCH preparation time for UE processing capability 1 assuming μ corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH order and the SCS configuration of the corresponding PRACH transmission and is specified in table 6.4-1 in TS 38.214 [26].
- $T_{\text{BWPswitchDelay}} = 0$, $T_{\text{switch}} = 0$, $\Delta_{\text{RF/BB preparation}} = 0$
- $\Delta_{\text{Delay}} = 0.5$ ms
- T_{SSB} is the time to first SSB occasion, after 1 slot from the end of the slot of the PDCCH plus 2 ms (SSB processing time) .

During T2, interruption on Cell 1 UL shall not happen outside the overlapped slot to transmit PRACH and N symbols before and after the PRACH occasion as defined in clause 8.1 in TS 38.213 [3], where N=2. During T2, interruption on Cell 1 DL shall not occur outside the overlapped slot to transmit PRACH.

The test equipment will verify that the timing of PRACH transmission on Cell 2 is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB of Cell 2.

- The N_{TA_offset} value (in T_c units) is 25600
- The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.3.3 Conditional handover

A.6.3.3.1 Intra-frequency conditional handover from FR1 to FR1

A.6.3.3.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency conditional handover requirements specified in clause 6.1.4.2.

A.6.3.3.1.2 Test Parameters

Supported test configurations are shown in table A.6.3.3.1.2-1. Both conditional handover delay and interruption length are tested by using the parameters in table A.6.3.3.1.2-2 and A.6.3.3.1.2-3.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2.

NR shall configure a condition implying handover to Cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2.

Table A.6.3.3.1.2-1: Intra-frequency conditional handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.3.1.2-2: General test parameters Intra-frequency conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset in condition		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
PRACH configuration index			FR1 PRACH configuration 1	As specified in table 6.3.3.2-3 in TS 38.211 [6]
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤2	

Table A.6.3.3.1.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency conditional handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OCNG pattern OP.1			
SMTC Configuration			SMTC pattern SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	8	-3.3	-Infinity	2.36
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	11
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-Infinity	-87
	Config 3	dBm/SCS	-87	-87	-Infinity	-84
Io Note3	Config 1,2	dBm/ 9.36 MHz	-61.41	-57.06	-61.41	-57.06
	Config 3	dBm/ 38.16 MHz	-55.31	-50.96	-55.31	-50.96
Propagation condition		-	AWGN			AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.3.1.3 Test Requirements

$T_{RRC} + T_{Event_DU}$ occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure} + T_{interrupt} + T_{CHO_execution}$ = 800 +62 +10=872 ms from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}=T_{processing} + T_{IU} + T_{\Delta} + T_{margin}$ =40+20+2 = 62 ms

A.6.3.3.2 Inter-frequency conditional handover from FR1 to FR1

A.6.3.3.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR conditional FR1-NR FR1 inter-frequency conditional handover requirements specified in clause 6.1.4.2.

A.6.3.3.2.2 Test Parameters

Supported test configurations are shown in table A.6.3.3.2.2-1. Both conditional handover delay and interruption length are tested by using the parameters in table A.6.3.3.2.2-2 and A.6.3.3.2.2-3.

The test scenario comprises of two carriers and one cell on each carrier Gap pattern ID gp0 is configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. NR shall configure a condition implying handover to Cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2. At the start of T2, Cell 2 becomes detectable and meets the handover condition.

Table A.6.3.3.2.2-1: Inter-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.3.2.2-2: General test parameters Inter-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset in handover condition		dB	-4	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤2	

Table A.6.3.3.2.2-3: Cell specific test parameters for NR FR1-FR1 Inter-frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
Gap pattern ID			gp0			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.3.2.3 Test Requirements

$T_{RRC} + T_{Event_DU}$ occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure} + T_{interrupt} + T_{CHO_execution}$ =920 +62 +10=992 ms from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}=T_{processing} + T_{IU} + T_{\Delta} + T_{margin}$ =40+20+2 = 62 ms excluding any transmissions which do not occur due to measurement gaps.

A.6.3.3.3 NR conditional handover including target MCG and target SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC

A.6.3.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that UE can make correct NR-RC to NR-DC conditional handover including target MCG in FR1 and target SCG in FR1 as specified in clauses 6.1.6.1.

The supported test configurations are given in table A.6.3.3.3.1-1. The test scenario comprises four NR cells, source PCell (Cell 1) and source PSCell (Cell 2), target PCell (Cell 3), and target PSCell (Cell 4). Cell 1 and Cell 3 are on radio channel 1 in FR1. Cell 2 and Cell 4 are on radio channel 2 in FR1.

Test parameters are given in tables A.6.3.3.3.1-2, A.6.3.3.3.1-3, A.6.3.3.3.1-4 and A.6.3.3.3.1-5 below.

The test consists of two successive time periods, with time durations of T1, T2 respectively.

At the start of T1, the UE shall be connected to Cell 1 on radio channel 1 and Cell 2 on radio channel 2. UE is not aware of Cell 3 and Cell 4. NR shall configure a condition implying handover to Cell 3 and Cell 4 during T1, at a time earlier than T_{RRC} before the beginning of T2.

At the start of T2, Cell 3 and Cell 4 become detectable. The condition for conditional PCell handover is met during T2.

Table A.6.3.3.3.1-1: Supported test configurations for NR conditional handover including target MCG and target SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Config	Description
1	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Source PSCell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PSCell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Source PSCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PSCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Source PSCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PSCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.3.3.1-2: General test parameters for PCell handover at conditional handover including target MCG and target SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 3	
Final condition	Active cell		Cell 3	
A3-Offset in handover condition		dB	-4	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Cell 1 and Cell 3 are synchronous cells
T1		s	5	
T2		s	≤2	

Table A.6.3.3.3.1-3: Cell specific test parameters for PCell handover at conditional handover including target MCG and target SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/	-58.49	-58.49	-63.94	-57.75

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
		38.16 MHz				
Propagation condition		-	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

Table A.6.3.3.3.1-4: General test parameters for PSCell change at conditional handover including target MCG and target SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 2	
	Neighbouring cell		Cell 4	
Final condition	Active cell		Cell 4	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Cell 2 and Cell 4 are Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.6.3.3.3.1-5: Cell specific test parameters for PSCell change at conditional handover including target MCG and target SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Parameter		Unit	Cell 2		Cell 4	
			T1	T2	T1	T2
NR RF Channel Number			2		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			

Parameter		Unit	Cell 2		Cell 4	
			T1	T2	T1	T2
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.3.3.2 Test Requirements

$T_{RRC} + T_{Event_DU}$ occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 3 less than $T_{measure} + T_{interrupt} + T_{CHO_execution}$ =920 +57 +10=987 ms from the start of T2, and the interruption during T2 shall not exceeed $T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$=10+25+20+2=57 ms.

The UE shall start to transmit the PRACH to Cell 4 less than $T_{measure} + T_{CHO_execution} + T_{processing} + T_{search_PCell_Conditional} + T_{search_PSCell} + T_{\Delta_PSCell} + T_{PSCell_DU}$ + 2 ms =920+10+25+0+ (3*20)+ 20+2=1037 ms from the start of T2, excluding any transmissions which do not occur due to measurement gaps.

The rate of correct conditional handovers observed during repeated tests shall be at least 90 %.

Note1: The PCell conditional handover delay can be expressed as specified in clause 6.1.6.1:

$$D_{CHOwithPSCell_PCell} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{interrupt} + T_{CHO_execution}$$

The interruption time is the time between when the UE starts to execute the conditional handover to the target cell and the time the UE starts transmission of the new PRACH as specified in clause 6.1.6.1.1

$$T_{interrupt} = T_{IU} + T_{processing} + T_{\Delta} + T_{margin}\ \text{ms}$$

The PSCell conditional handover delay can be expressed as specified in clause 6.1.6.1.2:

$D_{CHOwithPSCell_PSCell} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{CHO_execution} + T_{processing} + T_{search_PCell_Conditional} + T_{search_PSCell} + T_{\Delta_PSCell} + T_{PSCell_DU} + 2$ ms

A.6.3.3.4 NR conditional handover including target MCG and candidate SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC

A.6.3.3.4.1 Test Purpose and Environment

This test is to verify the requirement for conditional handover including target MCG and candidate SCG for CPC in FR1 NR-DC specified in clause 6.1.7.1. This test verifies the requirements for PCell conditional handover delay in section 6.1.7.1.1 and PSCell conditional change delay in section 6.1.7.1.2 for FR1-FR1 NR-DC to FR1-FR1 NR-DC CHO with CPC.

A.6.3.3.4.2 Test Parameters

Supported test configurations are shown in table A.6.3.3.4.2-1. Conditional handover delay and interruption length are tested by using the parameters in table A.6.3.3.4.2-2 and A.6.3.3.4.2-3. Conditional PSCell change delay and interruption length are tested by using the parameters in tables A.6.3.3.4.2-2 and A.6.3.3.4.2-4.

The test consists of three successive time periods, with time durations of T1, T2, and T3, respectively.

At the start of time duration T1, the UE is connected to Cell 1 (source PCell) and Cell 2 (source PSCell). The UE may not have any timing information of Cell 3 (target PCell) and Cell 4 (target PSCell).

TE shall configure a condition implying conditional handover to Cell 3 with a condition implying conditional PSCell change to Cell 4 during T1, at a time earlier than T_{RRC} before the beginning of T2.

At the start of T2, Cell 3 becomes detectable. At the start of T3, Cell 4 becomes detectable. UE meets the handover condition and meets the PSCell change condition during T3.

Table A.6.3.3.4.2-1: Supported test configurations for NR conditional handover including target MCG and candidate SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Config	Description
1	Source cells (PCell and PSCell): NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cells (PCell and PSCell): NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cells (PCell and PSCell): NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cells (PCell and PSCell): NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cells (PCell and PSCell): NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cells (PCell and PSCell): NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.3.4.2-2: General test parameters for NR conditional handover including target MCG and candidate SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Parameter		Unit	Value	Comment
Initial conditions	Active cells		PCell: Cell 1 PSCell: Cell 2	
	Neighbouring cells		Cell 3, Cell 4	
Final condition	Active cells		PCell: Cell 3 PSCell: Cell 4	
A3-Offset in condition for PCell		dBm	0	
A4-Offset in condition for PSCell		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
PRACH configuration index			FR1 PRACH configuration 1	As specified in table 6.3.3.2-3 in TS 38.211 [6]
Time offset between cells			3 μs	Synchronous cells

Parameter	Unit	Value	Comment
T1	s	5	
T2	s	1	
T3	s	≤2	

Table A.6.3.3.4.2-3: Cell specific test parameters for NR conditional handover including target MCG and candidate SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC (Cell 1 and Cell 3)

Parameter		Unit	Cell 1			Cell 3		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			1		
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD					
	Config 2		SR.1.1 TDD					
	Config 3		SR2.1 TDD					
CORESET Reference Channel	Config 1		CR.1.1 FDD					
	Config 2		CR.1.1 TDD					
	Config 3		CR2.1 TDD					
TRS configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								

Parameter		Unit	Cell 1			Cell 3		
			T1	T2	T3	T1	T2	T3
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15kHz	-98					
N_{oc} Note2	Config 1,2	dBm/SCS	-98					
	Config 3		-95					
$\hat{E}_s / I_{ot}$		dB	4	4	4	-Infinity	5	5
$\hat{E}_s / N_{oc}$		dB	4	4	4	-Infinity	5	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-94	-Infinity	-93	-93
	Config 3	dBm/SCS	-91	-91	-91	-Infinity	-90	-90
Io Note3	Config 1,2	dBm/9.36 MHz	-64.59	-64.59	-64.59	-70.05	-63.85	-63.85
	Config 3	dBm/38.16 MHz	-58.49	-58.49	-58.49	-63.94	-57.75	-57.75
Propagation condition		-	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.3.3.4.2-4: Cell specific test parameters for NR conditional handover including target MCG and candidate SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC (Cell 2 and Cell 4)

Parameter		Unit	Cell 2			Cell 4		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			2			2		
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD					
	Config 2		SR.1.1 TDD					
	Config 3		SR2.1 TDD					

Parameter		Unit	Cell 2			Cell 4		
			T1	T2	T3	T1	T2	T3
CORESET Reference Channel	Config 1		CR.1.1 FDD					
	Config 2		CR.1.1 TDD					
	Config 3		CR2.1 TDD					
TRS configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15kHz	-98					
N_{oc} Note2	Config 1,2	dBm/SCS	-98					
	Config 3		-95					
$\hat{E}_s / I_{ot}$		dB	4	4	4	-Infinity	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	4	-Infinity	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-94	-Infinity	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-91	-Infinity	-Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-64.59	-70.05	-70.05	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-58.49	-63.94	-63.94	-57.75
Propagation condition		-	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Unit	Cell 2			Cell 4		
		T1	T2	T3	T1	T2	T3
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							

A.6.3.3.4.3 Test Requirements

T_{RRC} + T_{Event_DU} occurs during T1 and T2, as the conditional handover condition for Cell 3 becomes satisfied at the start of T2, and the conditional PSCell change condition for Cell 4 becomes satisfied at the start of T3. The test shall verify that there are no interruptions during T1 and T2. The UE shall not send PRACH to Cell 3 before the end of T3. The UE shall not send PRACH to Cell 4 before the end of T3.

The UE shall start to transmit PRACH to Cell 3 less than max ($T_{measure_PCell}$, $T_{measure_PSCell}$) + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ_PCell} + T_{PCell_DU} + 2 ms = (800 + 10 + 25 + 20 + 20 + 2) ms = 877 ms from the start of T3 and the interruption during T3 shall not exceeed $T_{processing}$ + T_{Δ_PCell} + T_{PCell_DU} + 2 ms = (25 + 20 + 20 + 2) ms = 67 ms.
The UE shall start to transmit PRACH to Cell 4 less than max ($T_{measure_PCell}$, $T_{measure_PSCell}$) + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ_PSCell} + T_{PSCell_DU} + 2 ms = (800 + 10 + 25 + 20 + 20 + 2) ms = 877 ms from the start of T3. The interruption during T3 shall not exceed $T_{processing}$ + T_{Δ_PSCell} + T_{PSCell_DU} + 2 ms = 25 ms + 20 + 20 ms + 2 ms = 67 ms.

A.6.3.3.5 NR conditional handover including target MCG and candidate SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC with complementary conditional handover configuration

A.6.3.3.5.1 Test Purpose and Environment

This test verifies the requirement for conditional handover when the UE is configured with target MCG and candidate SCG for CPC in FR1 NR-DC and additionally configured with a complementary CHO only configuration in FR1. The test verifies that the UE makes the correct decision to proceed with CHO without CPC in case CHO condition is met without CPC condition being met, meanwhile verifying the conditional handover delay requirement in section 6.1.4.2.

For UE which can pass test case defined in clause A.6.3.3.5, test case defined in clause A.6.3.3.1 can be skipped and corresponding test requirements are deemed to be fulfilled.

A.6.3.3.5.2 Test Parameters

Supported test configurations are shown in table A.6.3.3.5.2-1. Both conditional handover delay and interruption length are tested by using the parameters in table A.6.3.3.5.2-2 and A.6.3.3.5.2-3.

The test consists of two successive time periods, with time durations of T1 and T2 respectively.

At the start of time duration T1, the UE is connected to Cell 1 (source PCell) and Cell 2 (source PSCell). The UE may not have any timing information of Cell 3 (target PCell) and Cell 4 (target PSCell).

TE shall configure a condition implying conditional handover to Cell 3 with a condition implying conditional PSCell change to Cell 4 during T1, at a time earlier than T_{RRC} before the beginning of T2. Additionally, the TE shall configure a complementary condition only implying conditional handover to Cell 3.

At the start of T2, Cell 3 becomes detectable. UE meets the handover condition during T2.

Table A.6.3.3.5.2-1: Supported test configurations for NR conditional handover including target MCG and candidate SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC with complementary conditional handover configuration

Config	Description
1	Source cells (PCell and PSCell): NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cells (PCell and PSCell): NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cells (PCell and PSCell): NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cells (PCell and PSCell): NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cells (PCell and PSCell): NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cells (PCell and PSCell): NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.3.5.2-2: General test parameters NR conditional handover including target MCG and candidate SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC with complementary conditional handover configuration

Parameter		Unit	Value	Comment
Initial conditions	Active cells		PCell: Cell 1 PSCell: Cell 2	
	Neighbouring cells		Cell 3, Cell 4	
Final condition	Active cells		PCell: Cell 3 PSCell: Cell 4	
A3-Offset in condition for PCell		dB	-10	
A4-Offset in condition for PSCell		dB	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
PRACH configuration index			FR1 PRACH configuration 1	As specified in table 6.3.3.2-3 in TS 38.211 [6]
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤2	

Table A.6.3.3.5.2-3: Cell specific test parameters for NR conditional handover including target MCG and candidate SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC with complementary conditional handover configuration (Cell 1 and Cell 3)

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.3.3.5.2-4: Cell specific test parameters for NR conditional handover including target MCG and candidate SCG from FR1-FR1 NR-DC to FR1-FR1 NR-DC with complementary conditional handover configuration (Cell 2 and Cell 4)

Parameter		Unit	Cell 2		Cell 4	
			T1	T2	T1	T2
NR RF Channel Number			2		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			

Parameter		Unit	Cell 2		Cell 4	
			T1	T2	T1	T2
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.3.5.3 Test Requirements

$T_{RRC} + T_{Event_DU}$ occurs during T1 as the conditional handover condition for cell becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 3 less than $T_{measure} + T_{interrupt} + T_{CHO_execution}$ = 800 +62 +10=872 ms from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}=T_{processing} + T_{IU} + T_{\Delta} + T_{margin}$ =40+20+2 = 62 ms.

The UE shall not send PRACH to Cell 4.

A.6.3.3.6 NES triggering intra-frequency conditional handover from FR1 to FR1

A.6.3.3.6.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency NES-based conditional handover requirements specified in clause 6.1.4.2.

A.6.3.3.6.2 Test Parameters

Supported test configurations are shown in table A.6.3.3.6.2-1. Both NES-based conditional handover delay and interruption length are tested by using the parameters in table A.6.3.3.6.2-2 and A.6.3.3.6.2-3.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2.

NR shall configure the NES-based condition implying handover to Cell 2 firstly, and then configure DCI 2-9 with NES-mode indication during T1, at a time earlier than T_{RRC} before the beginning of T2. In the RRC signaling, one conditional execution condition with condEventA3 should be configured, that nesEvent set as true and A3-offset set as 0 dB.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1 and NES-based event is fulfilled.

Table A.6.3.3.6.2-1: NES triggering Intra-frequency conditional handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.3.6.2-2: General test parameters for NES triggering Intra-frequency conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset in condition		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
nesEvent			true	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
PRACH configuration index			FR1 PRACH configuration 1	As specified in table 6.3.3.2-3 in TS 38.211 [6]
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤2	

Table A.6.3.3.6.2-3: Cell specific test parameters for NR FR1-FR1 NES triggering Intra-frequency conditional handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR.2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR.2.1 TDD			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OCNG pattern OP.1			
SMTC Configuration			SMTC pattern SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	8	-3.3	-Infinity	2.36
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	11
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-Infinity	-87
	Config 3	dBm/SCS	-87	-87	-Infinity	-84
Io Note3	Config 1,2	dBm/ 9.36 MHz	-61.41	-57.06	-61.41	-57.06
	Config 3	dBm/ 38.16 MHz	-55.31	-50.96	-55.31	-50.96
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					

A.6.3.3.6.3 Test Requirements

T_{RRC} + T_{Event_DU} occurs during T1 as the NES-based handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure}$ + $T_{interrupt}$ + $T_{CHO_execution}$ = 800 +62 +10=872ms from the start of T2 and the interruption during T2 shall not exceed $T_{interrupt}$=$T_{processing}$ + T_{IU} + T_{Δ} + T_{margin} =40+20+2 = 62ms.

A.6.3.3.7 NES-based Inter-frequency conditional handover from FR1 to FR1

A.6.3.3.7.1 Test Purpose and Environment

This test is to verify the requirement for the NES-based NR FR1-NR FR1 inter-frequency conditional handover requirements specified in clause 6.1.4.2.

A.6.3.3.7.2 Test Parameters

Supported test configurations are shown in table A.6.3.3.7.2-1. Both conditional handover delay and interruption length are tested by using the parameters in table A.6.3.3.7.2-2 and A.6.3.3.7.2-3.

The test scenario comprises of two carriers and one cell on each carrier. Gap pattern ID gp0 is configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. NR shall configure a condition implying handover to Cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2. At the start of T2, Cell 2 becomes detectable and meets the NES-based handover condition. In this test, UE is not indicated to report SSB based RRM measurement result with the associated SSB index for carrier of Cell 2, and DCI 2-9 command of '1' value for indicating NES-specific CHO execution condition is transmitted to UE at 950 ms from the start of T2, i.e., UE receives DCI 2-9 command later than the time at the end of T_{Event_DU} + $T_{identify_inter_without_index}$.

Table A.6.3.3.7.2-1: NES-based inter-frequency conditional handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.3.7.2-2: General test parameters for NES-based inter-frequency conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset in handover condition without nesEvent-r18		dB	6	
A3-Offset in handover condition with nesEvent-r18 = true		dB	-4	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used

Access Barring Information	-	Not Sent	No additional delays in random access procedure.
T1	s	5	
T2	s	≤2	

Table A.6.3.3.7.2-3: Cell specific test parameters for NES-based NR FR1-FR1 inter-frequency conditional handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
Gap pattern ID			gp0			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OCNG pattern OP.1			
SMTC Configuration			SMTC pattern SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io[Note3]	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.3.3.7.3 Test Requirements

$T_{RRC} + T_{Event_DU}$ occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure} + T_{interrupt} + T_{CHO_execution}$ =950 +62 +10=1022 ms from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}=T_{processing} + T_{IU} + T_{\Delta} + T_{margin}$ =40+20+2 = 62 ms excluding any transmissions which do not occur due to measurement gaps.

A.6.3.4 LTM PCell Switch

A.6.3.4.1 RACH-based Intra-frequency PCell switch from FR1 to FR1

A.6.3.4.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 RACH-based intra-frequency PCell switch specified in clause 6.3.1 for both with and without early TCI state activation.

A.6.3.4.1.2 Test Parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. Test configurations are given in table A.6.3.4.1.2-1. Both cell switch delay and interruption length are tested by using the parameters in table A.6.3.4.1.2-2 and A.6.3.4.1.2-3.

The test consists of 2 tests, and UE is required to pass one among Test 1, Test 2.

- Test 1: for a UE supporting *ltm-MAC-CE-JointTCI-r18*
- Test 2: for a UE not supporting *ltm-MAC-CE-JointTCI-r18*

The test consists of four successive time periods, with time durations of T1 to T4 respectively. No gap patterns are configured in the test case.

During T1, for Test 1 and 2:

- A measurement object is configured for the frequency of the Cell 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used.
- T1 ends with UE reporting an L3 measurement result of Cell 2 to Cell 1.

During T2, for Test 1 and 2:

- At the start of T2, UE is provided with *LTM-Candidate-r18* for Cell 2

- In Test 1 and Test 2, joint TCI state configurations as defined in table A.6.3.4.1.2-2 are provided.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.
- T2 ends with UE reporting a valid L1-RSRP result of Cell 2.

During T3, for Test 1:

- At the start of T3, UE receives candidate cell TCI state activation MAC CE for Cell 2.
  - In Test 1, *CandidateTCI-State#1* is activated.
- T3 ends 50 ms after the candidate cell TCI state activation MAC CE transmission.
- In Test 2, T3 is skipped.

During T4, for Test 1 and 2:

- The start of T4 is the last TTI containing LTM cell switch command MAC CE is sent by Cell 1 to the UE.
- In the cell switch command, Cell 2 is the target cell. Contention-Free Random-Access Resources are indicated and the field of Timing Advance Command is set to FFF.
  - In test 1, CandidateTCI-State#2 is indicated.
  - In test 2, CandidateTCI-State#1 is indicated.
  - T4 ends upon the reception of PRACH at Cell 2.

Table A.6.3.4.1.2-1: Intra-frequency cell switch from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.4.1.2-2: General test parameters for Intra-frequency cell switch from FR1 to FR1

Parameter		Unit	Value				Comment
			Test 1	Void	Test 2	Void	
Initial conditions	Active cell		Cell 1				
	Neighbouring cell		Cell 2				Cell 2 is the candidate cell
Final condition	Active cell		Cell 2				
A3-Offset		dB	-6				
Hysteresis		dB	0				
Time To Trigger		s	0				
Filter coefficient			0				L3 filtering is not used
includeBeamMeasurements			TURE				
DRX			OFF				DRX is not used
Access Barring Information		-	Not Sent				No additional delays in random access procedure.
Time offset between cells			2 μs				RTD between cells is less than CP
deriveSSB-IndexFromCell			Enabled				
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	80				Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1				Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1				
	spCellInclusion		N/A				

Parameter		Unit	Value				Comment
			Test 1	Void	Test 2	Void	
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DLor Joint TCI.State.0		DLor Joint TCI.State.1		As specified in clause A.3.16B. In test 1, CandidateTCI-State#1is configured for early TCI state activation. CandidateTCI-State#2 is configured for TCI state indication in cell switch command. In test 2, CandidateTCI-State#1 is configured for TCI state indication in cell switch command.
	#2 CandidateTCI-State#2		DLor Joint TCI.State.1		N/A	DLor Joint TCI.State.0	
						DLor Joint TCI.State.1	
ltm-ConfigComplete			True				Candidate cell's configuration is complete configuration
T1		s	<3				
T2		s	≤0.2				
T3		s	≤0.1				
T4		s	≤0.1				

Table A.6.3.4.1.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency cell switch test case

Parameter		Unit	Cell 1	Cell 2
			T1~T4	T1~T4
NR RF Channel Number			1	1
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
CP length			Normal	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
OCNG Patterns			OP.1	
SMTC Configuration			SMTC.1	
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15	
	Config 3		30	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15	
	Config 3		30	
PRACH configuration			FR1 PRACH configuration 6	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	

Parameter		Unit	Cell 1		Cell 2	
			T1~T4		T1~T4	
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	-0.64	-0.64	-0.64	-0.64
$\hat{E}_s / N_{oc}$		dB	8	8	8	8
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-90
	Config 3	dBm/SCS	-87	-87	-87	-87
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.7	-58.7	-58.7	-58.7
	Config 3	dBm/ 38.16 MHz	-52.6	-52.6	-52.6	-52.6
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.4.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 in no later than D_{LTM} from the beginning of time period T4. The rate of correct cell switches observed during repeated tests shall be at least 90 %.

NOTE: The cell switch delay can be expressed as D_{LTM} (= T_{cmd} + $T_{LTM\text{-}interrupt}$), where:

T_{cmd} = T_{HARQ} + 3 ms and is specified in clause 6.3.1.2. $T_{LTM\text{-}interrupt}$ = $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$ + $T_{LTM\text{-}IU}$ ms and is specified in clause 6.3.1.2.1

- $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 0 ms for Test 1, $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 22 ms for Test 2
- $T_{LTM\text{-}IU_}$=20 ms
- $T_{LTM\text{-}RRC\text{-}processing}$ =10 ms if UE does not support *ltm-FastProcessingConfig-r18*, otherwise $T_{LTM\text{-}RRC\text{-}processing}$ =0 ms
- $T_{LTM\text{-}processing}$ =10 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 10 ms for FR1-to-FR1 cell switch in the capability
- $T_{LTM\text{-}processing}$ =15 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 15 ms for FR1-to-FR1 cell switch in the capability
- $T_{LTM\text{-}processing}$ =20 ms if the UE does not support *ltm-FastUE-Processing-r18* capability.

A.6.3.4.2 RACH based Inter-frequency LTM PCell switch from FR1 to FR1

A.6.3.4.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 inter-frequency LTM RACH based cell switch delay requirements specified in clause 6.3.1 for both with and without early TCI state activation.

A.6.3.4.2.2 Test Parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on a different frequency from the PCell. Test configurations are given in table A.6.3.4.2.2-1. Both cell switch delay and interruption length are tested by using the parameters in table A.6.3.4.2.2-2 and A.6.3.4.2.2-3.

The test consists of 2 tests, and UE is required to pass one among Test 1, Test 2.

- Test 1: for a UE supporting *ltm-MAC-CE-JointTCI-r18*
- Test 2: for a UE not supporting *ltm-MAC-CE-JointTCI-r18*

The test consists of four successive time periods, with time durations of T1, T2, T3 and T4, respectively.

During T1, for Test 1, 2:

- A measurement object is configured for the frequency of the Cell 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used.
- T1 ends with UE reporting an L3 measurement result of Cell 2 to Cell 1.

During T2, for Test 1, 2:

- At the start of T2, UE is provided with *LTM-Candidate-r18* for Cell 2
  - In Test 1 and Test 2 joint TCI state configurations as defined in table A.6.3.4.2.2-2 are provided.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.
- T2 ends with UE reporting a valid L1-RSRP result of Cell 2.

During T3, for Test 1:

- At the start of T3, UE receives candidate cell TCI state activation MAC CE for Cell 2.
  - In Test 1, *CandidateTCI-State#1* is activated.
- T3 ends 100 ms after the candidate cell TCI state activation MAC CE transmission.
- In Test 2, T3 is skipped.

During T4, for Test 1 and 2:

- The start of T4 is the instant when the last TTI containing LTM cell switch command MAC CE is sent by Cell 2 to the UE.
- In the cell switch command, Cell 2 is the target cell for PCell switch. Contention-Free Random-Access Resources are indicated and the field of Timing Advance Command is set to FFF.
  - In test 1, CandidateTCI-State#2 is indicated.
  - In test 2, CandidateTCI-State#1 is indicated.
- T4 ends upon the reception of PRACH at Cell 2.

Table A.6.3.4.2.2-1: Inter-frequency RACH based cell switch from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

	Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.4.2.2-2: General test parameters Inter-frequency RACH based cell switch from FR1 to FR1

Parameter		Unit	Value				Comment
			Test 1	Void	Test 2	Void	
Initial conditions	Active cell		Cell 1				
	Neighbouring cell		Cell 2				Cell 2 is the candidate cell
Final condition	Active cell		Cell 2				
A3-Offset		dB	-6				
Hysteresis		dB	0				
Time To Trigger		s	0				
Filter coefficient			0				L3 filtering is not used
maxNrofRS-IndexesToReport			1				
includeBeamMeasurements			True				
DRX			OFF				DRX is not used
Measurement gap pattern ID			gp0				As specified in Table 9.1.2-1
Measurement gap offset			39				
Access Barring Information		-	Not Sent				No additional delays in random access procedure.
Time offset between cells			2 μs				
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	80				Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1				Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1				
	spCellInclusion		N/A				
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DLorJoint TCI.State. 0		DLorJoint TCI.State. 1		As specified in clause A.3.16B. In test 1, CandidateTCI-State#1 is configured for early TCI state activation. CandidateTCI-State#2 is configured for TCI state indication in cell switch command. In test 2, CandidateTCI-State#1 is configured for TCI state indication in cell switch command.
	CandidateTCI-State#2		DLorJoint TCI.State. 1		N/A		

Parameter	Unit	Value				Comment
		Test 1	Void	Test 2	Void	
ltm-ConfigComplete		True				Candidate cell's configuration is complete configuration
T1	s	<3				
T2	s	≤0.2				
T3	s	≤0.2				
T4	s	≤0.1				

Table A.6.3.4.2.2-3: Cell specific test parameters for NR FR1-FR1 Inter-frequency RACH-based cell switch test case

Parameter		Unit	Cell 1	Cell 2
			T1-T4	T1-T4
NR RF Channel Number			1	2
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
TRS configuration for serving cell	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
OCNG Patterns			OP.1	
SMTC Configuration			SMTC.1	
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15	
	Config 3		30	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15	
	Config 3		30	
PRACH configuration			FR1 PRACH configuration 6	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				

Parameter		Unit	Cell 1	Cell 2
			T1-T4	T1-T4
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98	
	Config 3		-95	
$\hat{E}_s / I_{ot}$		dB	8	8
$\hat{E}_s / N_{oc}$		dB	8	8
SSB_RP	Config 1,2	dBm/SCS	-90	-90
	Config 3	dBm/SCS	-87	-87
Io Note3	Config 1,2	dBm/ 9.36 MHz	-61.41	-61.41
	Config 3	dBm/ 38.16 MHz	-55.31	-55.31
Propagation condition		-	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.4.2.3 Test Requirements

The UE shall start to transmit PRACH to Cell 2 in no later than D_{LTM} from the beginning of time period T4.
The rate of correct cell switches observed during repeated tests shall be at least 90 %.

NOTE: The cell switch delay can be expressed as D_{LTM} (= T_{cmd} + $T_{LTM\text{-}interrupt}$), where:

T_{cmd} = T_{HARQ} + 3 ms and is specified in clause 6.3.1.2, $T_{LTM\text{-}interrupt}$ is defined in clause 6.3.1.3 as $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$ + $T_{LTM\text{-}IU}$,

- $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 0 ms for Test 1, $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 22 ms for Test 2,
- $T_{LTM\text{-}IU_}$= 20 ms.
- $T_{LTM\text{-}RRC\text{-}processing}$ =10 ms if UE does not support *ltm-FastProcessingConfig-r18*, otherwise $T_{LTM\text{-}RRC\text{-}processing}$ = 0 ms
- $T_{LTM\text{-}processing}$ = 10 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 10 ms for FR1-to-FR1 cell switch in the capability
- $T_{LTM\text{-}processing}$ = 15 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 15 ms for FR1-to-FR1 cell switch in the capability
- $T_{LTM\text{-}processing}$ = 20 ms if the UE does not support *ltm-FastUE-Processing-r18* capability.

A.6.3.4.3 RACH-less Intra-frequency PCell switch from FR1 to FR1

A.6.3.4.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 RACH-less intra-frequency PCell switch specified in clause 6.3.1 for both with and without early TCI state activation.

A.6.3.4.3.2 Test Parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. Supported test configurations are shown in table A.6.3.4.3.2-1. Both cell switch delay and interruption length are tested by using the parameters in table A.6.3.4.3.2-2 and A.6.3.4.3.2-3.

The test consists of 2 tests, and UE is required to pass one among Test 1, Test 2.

- Test 1: for a UE supporting *ltm-MAC-CE-JointTCI-r18*
- Test 2: for a UE not supporting *ltm-MAC-CE-JointTCI-r18 8*

The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5, respectively. No gap patterns are configured in the test case.

During T1, for Test 1, 2:

- A measurement object is configured for the frequency of the Cell 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used.
- T1 ends with UE reporting an L3 measurement result of Cell 2 to Cell 1.

During T2, for Test 1, 2:

- At the start of T2, UE is provided with *LTM-Candidate-r18* for Cell 2
  - Joint TCI state configuration as defined in table A.6.3.4.3.2-2 for Test 1 are provided.
  - Separate TCI state configuration as defined in table A.6.3.4.3.2-2 for Test 1 are provided.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.
- T2 ends with UE reporting a valid L1-RSRP result of Cell 2.

During T3, for Test 1:

- At the start of T3, UE receives candidate cell TCI state activation MAC CE for Cell 2.
  - In Test 1, *CandidateTCI-State#1* is activated.
- T3 ends 50 ms after the candidate cell TCI state activation MAC CE transmission.
- In Test 2, T3 is skipped.

During T4, for Test 1, 2:

- At the start of T4, UE receives PDCCH order to trigger PRACH transmission on Cell 2.
- T4 ends 5 ms after the UE transmits the PRACH to Cell 2.
- For UE incapable of *rach-EarlyTA-Measurement-r18*, T4 is skipped.

During T5, for Test 1, 2:

- The start of T5 is the last TTI containing LTM cell switch command MAC CE is sent by Cell 1 to the UE.
- In the cell switch command, Cell 2 is the target cell and the field of Timing Advance Command is set to 0.
  - In test 1, CandidateTCI-State#2 is indicated.
  - In test 2, CandidateTCI-State#1 is indicated.
- Cell 2 continuously schedules PUSCH for the UE.
- T5 ends either at the UL slot of PUSCH scheduled by Cell 2 at the first DL slot not earlier than (T_{cmd} + $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$) after the beginning of T5 or upon the reception of PUSCH at Cell 2, whichever is earlier.
  - The values of T_{cmd}, $T_{LTM\text{-}RRC\text{-}processing}$ $T_{LTM\text{-}processing}$,$T_{first\text{-}RS}$ and $T_{RS\text{-}proc}$ are specified in clause A.6.3.4.3.3.

Table A.6.3.4.3.2-1: Intra-frequency cell switch from FR1 to FR1 test configurations

Config	Description

1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.4.3.2-2: General test parameters Intra-frequency cell switch from FR1 to FR1

Parameter		Unit	Value				Comment
			Test 1	Void	Test 2	Void	
Initial conditions	Active cell		Cell 1				
	Neighbouring cell		Cell 2				Cell 2 is the candidate cell
Final condition	Active cell		Cell 2				
A3-Offset		dB	-6				
Hysteresis		dB	0				
Time To Trigger		s	0				
Filter coefficient			0				L3 filtering is not used
includeBeamMeasurements			TURE				
DRX			OFF				DRX is not used
Access Barring Information		-	Not Sent				No additional delays in random access procedure.
Time offset between cells			2 µs				RTD between cells is less than CP
deriveSSB-IndexFromCell			Enabled				
EarlyUL-SyncConfig	frequencyInfoUL		NR RF Channel Number 1				Same as Cell 1
	PRACH configuration		FR1 PRACH configuration 5				RACH bandwidth is within active UL BWP of Cell 1
	bwp-GenericParameters		ULBWP.0.1				
	n-TimingAdvanceOffset	Tc	25600				
ltm-CSI-SSB-ResourceList			SSB 0 of Cell 2				
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	80				Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1				Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1				
	spCellInclusion		N/A				
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DLorJoint TCI.State.0		DLorJoint TCI.State.1		As specified in clause A.3.16B.

Parameter		Unit	Value				Comment
			Test 1	Void	Test 2	Void	
	CandidateTCI-State#2		DLorJoint TCI.State.1		N/A		In test 1, CandidateTCI-State#1 is configured for early TCI state activation. CandidateTCI-State#2 is configured for TCI state indication in cell switch command. In test 2, CandidateTCI-State#1 is configured for TCI state indication in cell switch command.
ltm-ConfigComplete			True				Candidate cell's configuration is complete configuration
T1		s	<3				
T2		s	≤0.2				
T3		s	≤0.1				
T4		s	≤0.2				
T5		s	≤0.1				

Table A.6.3.4.3.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency cell switch test case

Parameter		Unit	Cell 1	Cell 2
			T1~T5	T1~T5
NR RF Channel Number			1	1
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
DRX Cycle		Ms	Not Applicable	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR2.1 TDD	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
OCNG Patterns			OP.1	
SMTC Configuration			SMTC.1	

Parameter		Unit	Cell 1	Cell 2
			T1~T5	T1~T5
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15	
	Config 3		30	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15	
	Config 3		30	
PRACH configuration			FR1 PRACH configuration 6	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98	
	Config 3		-95	
$\hat{E}_s / I_{ot}$		dB	-0.64	-0.64
$\hat{E}_s / N_{oc}$		dB	8	8
SSB_RP	Config 1,2	dBm/SCS	-90	-90
	Config 3	dBm/SCS	-87	-87
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.7	-58.7
	Config 3	dBm/ 38.16 MHz	-52.6	-52.6
Propagation condition		-	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.4.3.3 Test Requirements

The UE shall start to transmit PUSCH to Cell 2 in no later than D_{LTM} from the beginning of time period T5.
The rate of correct cell switches observed during repeated tests shall be at least 90 %.

NOTE: The cell switch delay can be expressed as D_{LTM} (= T_{cmd} + $T_{LTM\text{-}interrupt}$), where:

T_{cmd} = T_{HARQ} + 3 ms and is specified in clause 6.3.1.2.

$T_{LTM\text{-}interrupt}$ is defined in clause 6.3.1.3 as $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$ + $T_{LTM\text{-}IU}$. $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$=0 for Test 1, $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$=22 ms for Test 2, and $T_{LTM\text{-}IU}$_is the uncertainty on transmitting the first uplink transmission on Cell 2.

- $T_{LTM\text{-}RRC\text{-}processing}$ = 10 ms if UE does not support *ltm-FastProcessingConfig-r18*, otherwise $T_{LTM\text{-}RRC\text{-}processing}$ =0 ms

- $T_{LTM-processing}$ = 10 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 10 ms for FR1-to-FR1 cell switch in the capability

- $T_{LTM-processing}$ = 15 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 15 ms for FR1-to-FR1 cell switch in the capability

- $T_{LTM-processing}$ = 20 ms if the UE does not support *ltm-FastUE-Processing-r18* capability.

A.6.3.4.4 RACH-less Intra-frequency PCell switch from FR1 to FR1 without L1-RSRP measurement

A.6.3.4.4.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 RACH-less intra-frequency PCell switch specified in clause 6.3.1 without L1-RSRP measurement and measurement reporting.

A.6.3.4.4.2 Test Parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. Supported test configurations are shown in table A.6.3.4.4.2-1. Both cell switch delay and interruption length are tested by using the parameters in table A.6.3.4.4.2-2 and A.6.3.4.4.2-3.

The test consists of 2 tests, and UE is required to pass one among Test 1, Test 2.

- Test 1: for a UE supporting *ltm-MAC-CE-JointTCI-r18*

- Test 2: for a UE not supporting ltm-MAC-CE-JointTCI-r18

The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5, respectively. No gap patterns are configured in the test case.

During T1, for Test 1, 2

- A measurement object is configured for the frequency of the Cell 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

- T1 ends with UE reporting an L3 measurement result of Cell 2 to Cell 1.

During T2, for Test 1, 2:

- At the start of T2, UE is provided with *LTM-Candidate-r18* for Cell 2

  - Joint TCI state configuration as defined in table A.6.3.4.4.2-2 for Test 1 are provided.

During T3, for Test 1:

- At the start of T3, UE receives candidate cell TCI state activation MAC CE for Cell 2.

  - In Test 1, *CandidateTCI-State#1* is activated.

- T3 ends 50 ms after the candidate cell TCI state activation MAC CE transmission.

- In Test 2, T3 is skipped.

During T4, for Test 1, 2:

- At the start of T4, UE receives PDCCH order to trigger PRACH transmission on Cell 2.

- T4 ends 5 ms after the UE transmits the PRACH to Cell 2.

- For UE incapable of *rach-EarlyTA-Measurement-r18*, T4 is skipped.

During T5, for Test 1, 2:

- The start of T5 is the last TTI containing LTM cell switch command MAC CE is sent by Cell 1 to the UE.

- In the cell switch command, Cell 2 is the target cell and the field of Timing Advance Command is set to 0.
  - In test 1, CandidateTCI-State#2 is indicated.
  - In test 2, CandidateTCI-State#1 is indicated.
- Cell 2 continuously schedules PUSCH for the UE.
- T5 ends either at the UL slot of PUSCH scheduled by Cell 2 at the first DL slot not earlier than (T_{cmd} + $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$) after the beginning of T5 or upon the reception of PUSCH at Cell 2, whichever is earlier.
  - The values of T_{cmd}, $T_{LTM\text{-}RRC\text{-}processing}$ $T_{LTM\text{-}processing}$,$T_{first\text{-}RS}$ and $T_{RS\text{-}proc}$ are specified in clause A.6.3.4.3.3.

Table A.6.3.4.4.2-1: Intra-frequency cell switch from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.4.4.2-2: General test parameters Intra-frequency cell switch from FR1 to FR1

Parameter		Unit	Value				Comment
			Test 1	Void	Test 2	Void	
Initial conditions	Active cell		Cell 1				
	Neighbouring cell		Cell 2				Cell 2 is the candidate cell
Final condition	Active cell		Cell 2				
A3-Offset		dB	-6				
Hysteresis		dB	0				
Time To Trigger		s	0				
Filter coefficient			0				L3 filtering is not used
includeBeamMeasurements			TURE				
DRX			OFF				DRX is not used
Access Barring Information		-	Not Sent				No additional delays in random access procedure.
Time offset between cells			2 μs				RTD between cells is less than CP
deriveSSB-IndexFromCell			Enabled				
EarlyUL-SyncConfig	frequencyInfoUL		NR RF Channel Number 1				Same as Cell 1
	PRACH configuration		FR1 PRACH configuration 5				RACH bandwidth is within active UL BWP of Cell 1
	bwp-GenericParameters		ULBWP.0.1				
	n-TimingAdvanceOffset	Tc	25600				
ltm-CSI-SSB-ResourceList			SSB 0 of Cell 2				

Parameter		Unit	Value				Comment
			Test 1	Void	Test 2	Void	
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DLorJoint TCI.State.0		DLorJoint TCI.State.1		As specified in clause A.3.16B. In test 1, CandidateTCI-State#1 is configured for early TCI state activation. CandidateTCI-State#2 is configured for TCI state indication in cell switch command. In test 2, CandidateTCI-State#1 configured for TCI state indication in cell switch command.
	CandidateTCI-State#2		DLorJoint TCI.State.1		N/A		
ltm-ConfigComplete			True				Candidate cell's configuration is complete configuration
T1		s	<3				
T2		s	≤0.2				
T3		s	≤0.1				
T4		s	≤0.2				
T5		s	≤0.1				

Table A.6.3.4.4.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency cell switch test case

Parameter		Unit	Cell 1	Cell 2
			T1~T5	T1~T5
NR RF Channel Number			1	1
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR2.1 TDD	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	

Parameter		Unit	Cell 1	Cell 2
			T1~T5	T1~T5
	Config 3		TRS.1.2 TDD	
OCNG Patterns			OP.1	
SMTC Configuration			SMTC.1	
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15	
	Config 3		30	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15	
	Config 3		30	
PRACH configuration			FR1 PRACH configuration 6	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98	
	Config 3		-95	
$\hat{E}_s / I_{ot}$		dB	-0.64	-0.64
$\hat{E}_s / N_{oc}$		dB	8	8
SSB_RP	Config 1,2	dBm/SCS	-90	-90
	Config 3	dBm/SCS	-87	-87
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.7	-58.7
	Config 3	dBm/ 38.16 MHz	-52.6	-52.6
Propagation condition		-	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.4.4.3 Test Requirements

The UE shall start to transmit PUSCH to Cell 2 in no later than D_{LTM} from the beginning of time period T5.
The rate of correct cell switches observed during repeated tests shall be at least 90 %.

NOTE: The cell switch delay can be expressed as D_{LTM} (= T_{cmd} + $T_{LTM\text{-}interrupt}$), where:

T_{cmd} = T_{HARQ} + 3 ms and is specified in clause 6.3.1.2.

$T_{LTM\text{-}interrupt}$ is defined in clause 6.3.1.3 as $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$ + $T_{LTM\text{-}IU}$. $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$=0 for Test 1, $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$=22 ms for Test 2, and $T_{LTM\text{-}IU}$ is the uncertainty on transmitting the first uplink transmission on Cell 2.

- $T_{LTM\text{-}RRC\text{-}processing}$ = 10 ms if UE does not support *ltm-FastProcessingConfig-r18*, otherwise $T_{LTM\text{-}RRC\text{-}processing}$ =0 ms

- $T_{LTM\text{-}processing}$ = 10 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 10 ms for FR1-to-FR1 cell switch in the capability

- $T_{LTM\text{-}processing}$ = 15 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 15 ms for FR1-to-FR1 cell switch in the capability

- $T_{LTM\text{-}processing}$ = 20 ms if the UE does not support *ltm-FastUE-Processing-r18* capability.

A.6.3.5 LTM PSCell Switch

A.6.3.5.1 RACH-based intra-frequency LTM PSCell switch from FR1 to FR1

A.6.3.5.1.1 Test Purpose and Environment

This test is to verify the intra-frequency RACH based LTM PSCell switch requirements from NR FR1 to NR FR1 specified in clause 8.20 for both with and without early TCI state activation.

A.6.3.5.1.2 Test Parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test configurations of PCell and PSCell are given in table A.6.3.5.1.2-1 and table A.6.3.5.1.2-1A. Both cell switch delay and interruption length are tested by using the parameters in table A.6.3.5.1.2-2 and table A.6.3.5.1.2-3.

The test consists of 2 tests, and UE is required to pass one among Test 1, Test 2.

- Test 1: for a UE supporting *ltm-MAC-CE-JointTCI-r18*

- Test 2: for a UE not supporting *ltm-MAC-CE-JointTCI-r18*

The test consists of four successive time periods, with time durations of T1, T2, T3 and T4, respectively.

During T1, for Test 1 and 2:

- A measurement object is configured for the frequency of the Cell 3, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

- T1 ends with UE reporting an L3 measurement result of Cell 3 to Cell 2.

During T2, for Test 1 and 2:

- At the start of T2, UE is provided with *LTM-Candidate-r18* for Cell 3

  - Joint TCI state configuration as defined in table A.6.3.5.1.2-2 for Test 1 are provided.

- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports for candidate cell (Cell 3) in PUCCH format 2.

- T2 ends with UE reporting a valid L1-RSRP result of Cell 3.

During T3, for Test 1:

- At the start of T3, UE receives candidate cell TCI state activation MAC CE for Cell 3.

  - In Test 1, *CandidateTCI-State#1* is activated.

- T3 ends 50 ms after the candidate cell TCI state activation MAC CE transmission.

- In Test 2, T3 is skipped.

During T4, for Test 1 and 2:

- The start of T4 is the instant when the last TTI containing LTM cell switch command MAC CE is sent by Cell 2 to the UE.
- In the cell switch command, Cell 3 is the target cell for PSCell switch. Contention-Free Random-Access Resources are indicated and the field of Timing Advance Command is set to FFF.
  - In test 1, CandidateTCI-State#2 is indicated.
  - In test 2, CandidateTCI-State#1 is indicated.
- T4 ends upon the reception of PRACH at Cell 3.

Table A.6.3.5.1.2-1: Supported PCell test configurations for intra-frequency PSCell cell switch from FR1 to FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.5.1.2-1A: Supported PSCell test configurations for intra-frequency PSCell cell switch from FR1 to FR1

Config	Description
1A	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2A	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3A	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.5.1.2-2: General test parameters for Intra-frequency cell switch from FR1 to FR1

Parameter		Unit	Value				Comment
			Test 1	Void	Test 2	Void	
Initial conditions	Active cells		Cell 1 (PCell), Cell 2 (PSCell)				
	Neighbouring cell		Cell 3				Cell 3 is the candidate cell
Final condition	Active cells		Cell 1 (PCell), Cell 3 (PSCell)				
A3-Offset		dB	-6				
Hysteresis		dB	0				
Time To Trigger		s	0				
Filter coefficient			0				L3 filtering is not used
DRX			OFF				DRX is not used
Access Barring Information		-	Not Sent				No additional delays in random access procedure.
Time offset between Cell 2 and Cell 3			2 μs				RTD between Cell 2 and Cell 3 is less than CP
deriveSSB-IndexFromCell			Enabled				
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	80				Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1				Report candidate cell's (Cell 3) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1				
	spCellInclusion		N/A				

Parameter		Unit	Value				Comment
			Test 1	Void	Test 2	Void	
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DLorJoint TCI.State. 0		DLorJoint TCI.State. 1		As specified in clause A.3.16B. In test 1, CandidateTCI-State#1 is configured for early TCI state activation. CandidateTCI-State#2 is configured for TCI state indication in cell switch command. In test 2, CandidateTCI-State#1 is configured for TCI state indication in cell switch command.
	CandidateTCI-State#2		DLorJoint TCI.State. 1		N/A		
ltm-ConfigComplete			True				Candidate cell's configuration is complete configuration
T1		s	<3				
T2		s	≤0.2				
T3		s	≤0.1				
T4		s	≤0.1				

Table A.6.3.5.1.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency cell switch test case

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T1 ~ T4	T1 ~ T4	T1 ~ T4
NR RF Channel Number			1	2	2
Duplex mode	Config 1, 1A		FDD		
	Config 2, 3, 2A, 3A		TDD		
TDD configuration	Config 1, 1A		Not Applicable		
	Config 2, 2A		TDDConf.1.1		
	Config 3, 3A		TDDConf.2.1		
$BW_{channel}$	Config 1, 1A	MHz	10: $N_{PRB,c}$ = 52		
	Config 2, 2A	MHz	10: $N_{PRB,c}$ = 52		
	Config 3, 3A	MHz	40: $N_{PRB,c}$ = 106		
BWP BW	Config 1, 1A	MHz	10: $N_{PRB,c}$ = 52		
	Config 2, 2A	MHz	10: $N_{PRB,c}$ = 52		
	Config 3, 3A	MHz	40: $N_{PRB,c}$ = 106		
PDSCH Reference	Config 1, 1A		SR.1.1 FDD		
	Config 2, 2A		SR.1.1 TDD		

Parameter			Unit	Cell 1	Cell 2	Cell 3
				T1 ~ T4	T1 ~ T4	T1 ~ T4
		Config 3, 3A		SR.2.1 TDD		
CORESET Reference Channel		Config 1, 1A		CR.1.1 FDD		
		Config 2, 2A		CR.1.1 TDD		
		Config 3, 3A		CR.2.1 TDD		
CP length		Config 1, 2, 3, 1A, 2A, 3A		Normal		
TRS configuration		Config 1, 1A		TRS.1.1 FDD		
		Config 2, 2A		TRS.1.1 TDD		
		Config 3, 3A		TRS.1.2 TDD		
OCNG Patterns		Config 1, 2, 3, 1A, 2A, 3A		OP.1		
SMTC Configuration		Config 1, 2, 3, 1A, 2A, 3A		SMTC.1		
SSB Configuration		Config 1,2, 1A, 2A		SSB.1 FR1		
		Config 3, 3A		SSB.2 FR1		
PDSCH/PDCCH subcarrier spacing		Config 1,2, 1A, 2A	kHz	15		
		Config 3, 3A	kHz	30		
PUCCH/PUSCH subcarrier spacing		Config 1,2, 1A, 2A	kHz	15		
		Config 3, 3A	kHz	30		
PRACH configuration		Config 1, 2, 3, 1A, 2A, 3A		FR1 PRACH configuration 6		
BWP configuration	Initial DL BWP	Config 1, 2, 3, 1A, 2A, 3A		DLBWP.0.1		
	Dedicated DL BWP	Config 1, 2, 3, 1A, 2A, 3A		DLBWP.1.1		
	Initial UL BWP	Config 1, 2, 3, 1A, 2A, 3A		ULBWP.0.1		
	Dedicated UL BWP	Config 1, 2, 3, 1A, 2A, 3A		ULBWP.1.1		
EPRE ratio of PSS to SSS		Config 1, 2, 3, 1A, 2A, 3A	dB	0		
EPRE ratio of PBCH DMRS to SSS		Config 1, 2, 3, 1A, 2A, 3A				
EPRE ratio of PBCH to PBCH DMRS		Config 1, 2, 3, 1A, 2A, 3A				
EPRE ratio of PDCCH DMRS to SSS		Config 1, 2, 3, 1A, 2A, 3A				
EPRE ratio of PDCCH to PDCCH DMRS		Config 1, 2, 3, 1A, 2A, 3A				

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T1 ~ T4	T1 ~ T4	T1 ~ T4
EPRE ratio of PDSCH DMRS to SSS	Config 1, 2, 3, 1A, 2A, 3A				
EPRE ratio of PDSCH to PDSCH DMRS	Config 1, 2, 3, 1A, 2A, 3A				
EPRE ratio of OCNG DMRS to SSS(Note 1)	Config 1, 2, 3, 1A, 2A, 3A				
EPRE ratio of OCNG to OCNG DMRS (Note 1)	Config 1, 2, 3, 1A, 2A, 3A				
N_{oc} Note2	Config 1, 2, 3, 1A, 2A, 3A	dBm/15kHz	-98		
N_{oc} Note2	Config 1,2, 1A, 2A	dBm/SCS	-98		
	Config 3, 3A		-95		
$\hat{E}_s / I_{ot}$	Config 1, 2, 3, 1A, 2A, 3A	dB	11	-0.64	-0.64
$\hat{E}_s / N_{oc}$	Config 1, 2, 3, 1A, 2A, 3A	dB	11	8	8
SSB_RP	Config 1,2, 1A, 2A	dBm/SCS	-87	-90	-90
	Config 3, 3A	dBm/SCS	-84	-87	-87
Io Note3	Config 1,2, 1A, 2A	dBm/ 9.36 MHz	-58.7	-58.7	-58.7
	Config 3, 3A	dBm/ 38.16 MHz	-52.62	-52.6	-52.6
Propagation condition	Config 1, 2, 3, 1A, 2A, 3A	-	AWGN	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.5.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 3 in no later than D_{LTM} from the beginning of time period T4.
The rate of correct cell switches observed during repeated tests shall be at least 90 %.

NOTE: The cell switch delay can be expressed as D_{LTM} (= T_{cmd} + $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$ + $T_{LTM\text{-}IU}$), where:

T_{cmd} = T_{HARQ} + 3 ms and is specified in clause 6.3.1.2

- $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 0 ms for Test 1, $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 22 ms for Test 2
- $T_{LTM\text{-}IU}$ = 20 ms
- $T_{LTM\text{-}RRC\text{-}processing}$ = 10 ms if UE does not support *ltm-FastProcessingConfig-r18*, otherwise $T_{LTM\text{-}RRC\text{-}processing}$ =0 ms
- $T_{LTM\text{-}processing}$ = 10 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 10 ms for FR1-to-FR1 cell switch in the capability

- $T_{LTM\text{-}processing}$ = 15 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 15 ms for FR1-to-FR1 cell switch in the capability

- $T_{LTM\text{-}processing}$ = 20 ms if the UE does not support *ltm-FastUE-Processing-r18* capability.

A.6.4 Timing

A.6.4.1 UE transmit timing

A.6.4.1.1 NR UE Transmit Timing Test for FR1

A.6.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNB and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in table A.6.4.1.1.1-1.

Table A.6.4.1.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

For this test a single NR cell is used. Table A.6.4.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.6.4.1.1.1-3.

Table A.6.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2
SSB ARFCN		1,2,3	1	1
TDD configuration		1	Not Applicable	
		2	TDDConf.1.1	
		3	TDDConf.2.1	
$BW_{channel}$	MHz	1	10: $N_{PRB,c}$ = 52	
		2	10: $N_{PRB,c}$ = 52	
		3	40: $N_{PRB,c}$ = 106	
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1	
DRX Cycle	ms	1,2,3	N/A	DRX.8[Note5]
PDSCH Reference measurement channel		1	SR.1.1 FDD	
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET Reference Channel		1	CR.1.1 FDD	
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
Dedicated CORESET Reference Channel		1	CCR.1.1 FDD	
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns		1,2,3	OP.1	
SSB configuration		1,2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC Configuration		1,2	SMTC.1	

Parameter	Unit	Config	Test1	Test2
		3	SMTC.2	
TRS configuration		1	TRS.1.1 FDD	
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
EPRE ratio of PSS to SSS	dB	1,2,3	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1,2,3	-98	-98
N_{oc} Note2	dBm/SCS	1,2	-98	-98
		3	-95	-95
$\hat{E}_s / I_{ot}$		1,2,3	3	3
$\hat{E}_s / N_{oc}$		1,2,3	3	3
SS-RSRP Note3	dBm/SCS	1,2	-95	-95
		3	-92	-92
Io Note3	dBm/9.36 MHz	1,2	-65.2	-65.2
	dBm/38.1 MHz	3	-59.2	-59.2
Propagation condition		1,2,3	AWGN	
SRS Config		1,2	SRSConf.1 Note6	SRSConf.3 Note6
		3	SRSConf.1 Note6	SRSConf.2 Note6

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.6.4.1.1.1-3

Table A.6.4.1.1.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	SRSConf.3	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	0	
	srs-ResourceIdList	0	0	0	
	resourceType	Periodic	Periodic	Periodic	
	Usage	Codebook	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	0	
	nrofSRS-Ports	Port1	Port1	Port1	
	transmissionComb	n2	n2	n2	
	combOffset-n2	0	0	0	
	cyclicShift-n2	0	0	0	
	resourceMapping startPosition	0	0	0	
	resourceMapping nrofSymbols	n1	n1	n1	
	resourceMapping repetitionFactor	n1	n1	n1	
	freqDomainPosition	0	0	0	
	freqDomainShift	0	0	0	
	freqHopping c-SRS	14 for test configuration 1,2 25 for test configuration 3	25	14	Matches $N_{PRB,c}$
	freqHopping	0	0	0	

	b-SRS				
	freqHopping b-hop	0	0	0	
	groupOrSequenceHopping	Neither	Neither	Neither	
	resourceType	Periodic	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl640, 0	sl320, 0	Offset to align with DRX periodicity
	sequenceId	0	0	0	Any 10 bit number

Table A.6.4.1.1.1-4: Void

A.6.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Setup NR PCell according to parameters given in table A.6.4.1.1.1-1.
2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.
   a. The N_{TA} offset value (in T_c units) is 25600
   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1
3) The test system shall adjust the timing of the DL path by values given in table A.6.4.1.1.2-1

Table A.6.4.1.1.2-1: Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
15	$+64*64T_c$	$+32*64T_c$
30	$+32*64T_c$	$+16*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 Table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna. Skip this step for test 2 with DRX configured.
5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment

A.6.4.1.2 NR UE Transmit Timing Test for two TRPs in FR1

A.6.4.1.2.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNB and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits for both TRPs. The test is configured with two TRPs in NR PCell. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in table A.6.4.1.1.1-1.

Table A.6.4.1.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz

2	NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

For this test a single NR cell is used. Table A.6.4.1.2.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.6.4.1.2.1-3.

For UE not supporting the capability of "rxTimingDiff-r18", the UE is only required to be tested in Test1 and Test3.

For UE supports the capability of "rxTimingDiff-r18", the UE is only required to be tested in Test2 and Test4.

Table A.6.4.1.2.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1		Test2		Test3		Test4	
			TRP# 1	TRP#2	TRP#1	TRP#2	TRP#1	TRP# 2	TRP# 1	TRP# 2
SSB ARFCN		1,2,3	1							
TDD configuration		1	Not Applicable							
		2	TDDConf.1.1							
		3	TDDConf.2.1							
$BW_{channel}$	MHz	1	10: $N_{PRB,c}$ = 52							
		2	10: $N_{PRB,c}$ = 52							
		3	40: $N_{PRB,c}$ = 106							
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1							
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1							
DRX Cycle	ms	1,2,3	N/A					DRX.8[Note5]		
PDSCH Reference measurement channel		1	SR.1.1 FDD							
		2	SR.1.1 TDD							
		3	SR.2.1 TDD							
RMSI CORESET Reference Channel		1	CR.1.1 FDD							
		2	CR.1.1 TDD							
		3	CR.2.1 TDD							
Dedicated CORESET Reference Channel		1	CCR.1.1 FDD							
		2	CCR.1.1 TDD							
		3	CCR.2.1 TDD							
coresetPoolIndex for dedicated CORESET Reference Channel		1,2,3	0	1	0	1	0	1	0	1
Timing difference compared to TRP#1	µs	1, 2	0	3	0	30	0	3	0	30
		3		1.5				1.5		
OCNG Patterns		1,2,3	OP.1							
SSB configuration		1,2	SSB.3 FR1							
		3	SSB.4 FR1							
SSB index		1,2,3	0	1	0	1	0	1	0	1
SMTC Configuration		1,2	SMTC.1							
		3	SMTC.2							

Parameter	Unit	Config	Test1		Test2		Test3		Test4	
			TRP#1	TRP#2	TRP#1	TRP#2	TRP#1	TRP#2	TRP#1	TRP#2
TRS configuration		1	TRS.1.1 FDD for DLorJoint TCI.State.1.3 & DLorJoint TCI.State.1.4							
		2	TRS.1.1 TDD for DLorJoint TCI.State.1.3 & DLorJoint TCI.State.1.4							
		3	TRS.1.2 TDD for DLorJoint TCI.State.1.3 & DLorJoint TCI.State.1.4							
EPRE ratio of PSS to SSS	dB	1,2,3	0					0		
EPRE ratio of PBCH DMRS to SSS										
EPRE ratio of PBCH to PBCH DMRS										
EPRE ratio of PDCCH DMRS to SSS										
EPRE ratio of PDCCH to PDCCH DMRS										
EPRE ratio of PDSCH DMRS to SSS										
EPRE ratio of PDSCH to PDSCH DMRS										
EPRE ratio of OCNG DMRS to SSS(Note 1)										
EPRE ratio of OCNG to OCNG DMRS (Note 1)										
N_{oc} Note2	dBm/15 kHz	1,2,3	-98					-98		
N_{oc} Note2	dBm/SCS	1,2	-98					-98		
		3	-95					-95		
$\hat{E}_s / I_{ot}$		1,2,3	3					3		
$\hat{E}_s / N_{oc}$		1,2,3	3					3		
SS-RSRP Note3	dBm/SCS	1,2	-95					-95		
		3	-92					-92		
Io Note3	dBm/9.36 MHz	1,2	-65.2					-65.2		
	dBm/38.1 MHz	3	-59.2					-59.2		
Propagation condition		1,2,3	AWGN							
SRS Config		1,2	SRSConf.1 Note6					SRSConf.3 Note6		
		3	SRSConf.1 Note6					SRSConf.2 Note6		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: DRX related parameters are given in Table A.3.3.8-1
NOTE 6: SRS configs are given in Table A.6.4.1.2.1-3

Table A.6.4.1.2.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	SRSConf.3	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	0	

	Field	SRSConf.1	SRSConf.2	SRSConf.3	Comments
	srs-ResourceIdList	0	0	0	
	resourceType	Periodic	Periodic	Periodic	
	Usage	Codebook	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	0	
	nrofSRS-Ports	Port1	Port1	Port1	
	transmissionComb	n2	n2	n2	
	combOffset-n2	0	0	0	
	cyclicShift-n2	0	0	0	
	resourceMapping startPosition	0	0	0	
	resourceMapping nrofSymbols	n1	n1	n1	
	resourceMapping repetitionFactor	n1	n1	n1	
	freqDomainPosition	0	0	0	
	freqDomainShift	0	0	0	
	freqHopping c-SRS	14 for test configuration 1,2 25 for test configuration 3	25	14	Matches $N_{PRB,c}$
	freqHopping b-SRS	0	0	0	
	freqHopping b-hop	0	0	0	
	groupOrSequenceHopping	Neither	Neither	Neither	
	resourceType	Periodic	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl640, 0	sl320, 0	Offset to align with DRX periodicity
	sequenceId	0	0	0	Any 10 bit number

A.6.4.1.2.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Setup NR PCell according to parameters given in table A.6.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB of TRP#1 and TRP#2.

   a. The N_{TA} offset value (in T_c units) is 25600

   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in table A.6.4.1.2.2-1 for only TRP#1. The timing of the DL path of TRP#2 is not changed.

Table A.6.4.1.2.2-1: Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1&Test2	Test3&Test4
15	$+64*64T_c$	$+32*64T_c$
30	$+32*64T_c$	$+16*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 Table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna for TRP#1. For TRP#2, the test system shall verify there is no adjustment. Skip this step for test 3&4 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna of TRP#1. For Test 3&4 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

A.6.4.2 UE timer accuracy

A.6.4.3 Timing advance

A.6.4.3.1 SA FR1 timing advance adjustment accuracy

A.6.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.6.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.6.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.6.4.3.1.2-2, A.6.4.3.1.2-3 and A.6.4.3.1.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.6.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to and clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.6.4.3.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k+1 for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.6.4.3.1.2-1: Timing advance supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.4.3.1.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment

RF channel number		1	
Initial DL BWP		DLBWP.0.1	As specified in Table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in Table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in Table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in Table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	For 15 kHz SCS $N_{TA_new} = N_{TA_old} + 8192*T_c$ For 30 kHz SCS $N_{TA_new} = N_{TA_old} + 4096*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.6.4.3.1.2-3: Cell specific test parameters for timing advance

Parameter		Unit	Test1	
			T1	T2
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
OCNG Patterns			OCNG pattern OP.1	
SMTC configuration	Config 1,2		SMTC.1 FR1	
	Config 3		SMTC.2 FR1	
SSB configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz	
	Config 3		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz	
	Config 3		30 kHz	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				

Parameter		Unit	Test1	
			T1	T2
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98	
	Config 3		-95	
$\hat{E}_s / I_{ot}$		dB	3	
$\hat{E}_s / N_{oc}$		dB	3	
Io Note3	Config 1,2	dBm/ 9.36 MHz	-67.57	
	Config 3	dBm/ 38.16 MHz	-62.58	
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance

Field		Value	Comment
c-SRS	Config 1,2	12	Frequency hopping is disabled
	Config 3	24	
b-SRS		0	
b-hop		0	
freqDomainPosition		0	Frequency domain position of SRS
freqDomainShift		0	
groupOrSequenceHopping		neither	No group or sequence hopping
SRS-PeriodicityAndOffset		sl5=2 for SCS 15kHz sl5=4 for SCS 30kHz	Once every 5 slots
pathlossReferenceRS		ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage		Codebook	Codebook based UL transmission
startPosition		0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols		n1	
repetitionFactor		n1	
combOffset-n2		0	transmissionComb setting
cyclicShift-n2		0	
nrofSRS-Ports		port1	Number of antenna ports used for SRS transmission

NOTE: For further information see clause 6.3.2 in TS 38.331 [2].

A.6.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.6.5 Signalling characteristics

A.6.5.1 Radio link Monitoring

In the following clause, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

For intra-band contiguous carrier aggregation, transmit OFF power is measured as the mean power per component carrier.

For UE with multiple transmit antennas, transmit OFF power is measured as the mean power at each transmit connector.

- UE output power higher than Transmit OFF power -50 dBm (as defined in TS 38.101-1 [18]) means uplink signal
- UE output power equal to or less than Transmit OFF power -50 dBm (as defined in TS 38.101-1 [18]) means no uplink signal.

A.6.5.1.1 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode

A.6.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.6.5.1.1.1-1. The test parameters are given in tables A.6.5.1.1.1-2, A.6.5.1.1.1-3, and A.6.5.1.1.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

Table A.6.5.1.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.1.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1

Parameter			Unit	Value
				Test 1
TDD Configuration		Config 1		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
RMSI CORESET Reference Channel		Config 1		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel		Config 1		CCR.1.3 FDD
		Config 2		CCR.1.3 TDD
		Config 3		CCR.2.2 TDD
SSB Configuration		Config 1		SSB.1 FR1
		Config 2		SSB.1 FR1
		Config 3		SSB.2 FR1
SMTC Configuration		Config 1, 2		SMTC.1
		Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1, 2		15 kHz
		Config 3		30 kHz
PRACH Configuration		Config 1, 2		Table A.3.8.2.1-1
		Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS				0
OCNG parameters				OP.1
CP length				Normal
Correlation Matrix and Antenna Configuration				2x2 Low
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				*gp0*
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS configuration for CSI reporting		Config 1		CSI-RS.1.1 FDD
		Config 2		CSI-RS.1.1 TDD
		Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking		Config 1		TRS.1.1 FDD
		Config 2		TRS.1.1 TDD
		Config 3		TRS.1.2 TDD
T1			s	0.2
T2			s	0.48
T3			s	0.48
D1			s	0.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.6.5.1.1.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter	Unit	Test 1		
		T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS	dB	4		

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1	dBm/15kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	Config 1	dBm/SCS	-98		
	Config 2		-98		
	Config 3		-95		
Propagation condition			TDL-C 300 ns 100 Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.6.5.1.1.1-1.
NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.

Table A.6.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE: Ensure that RLM RS is partially overlapped with measurement gap	

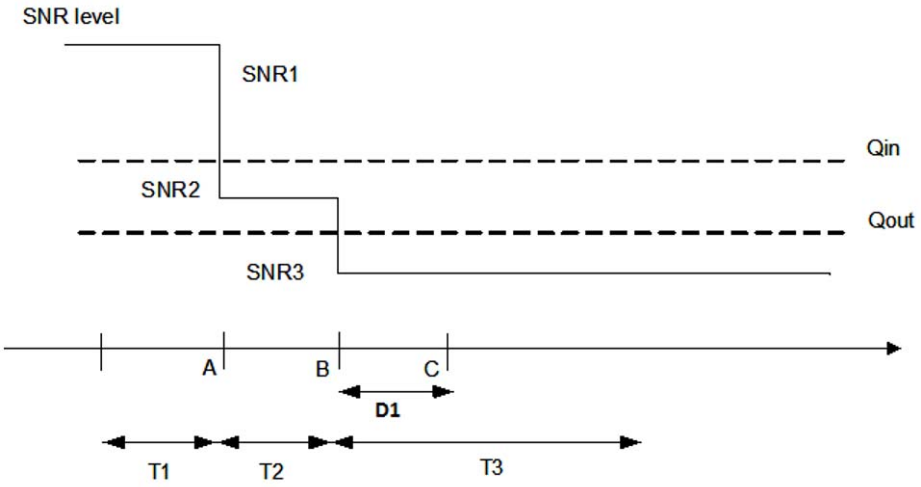


Figure A.6.5.1.1.1-1: SNR variation for out-of-sync testing

A.6.5.1.1.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.1.2 Radio Link Monitoring In-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode

A.6.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.6.5.1.2.1-1. The test parameters are given in tables A.6.5.1.2.1-2, and A.6.5.1.2.1-3 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Table A.6.5.1.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.2.1-2: General test parameters for FR1 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1

Parameter		Unit	Value
			Test 1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.2.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5

EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
N_{oc}	Config 1	dBm/SCS	-98				
	Config 2		-98				
	Config 3		-95				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.6.5.1.2.1-1.
NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in clause A.3.6.

Table A.6.5.1.2.1-4: Void

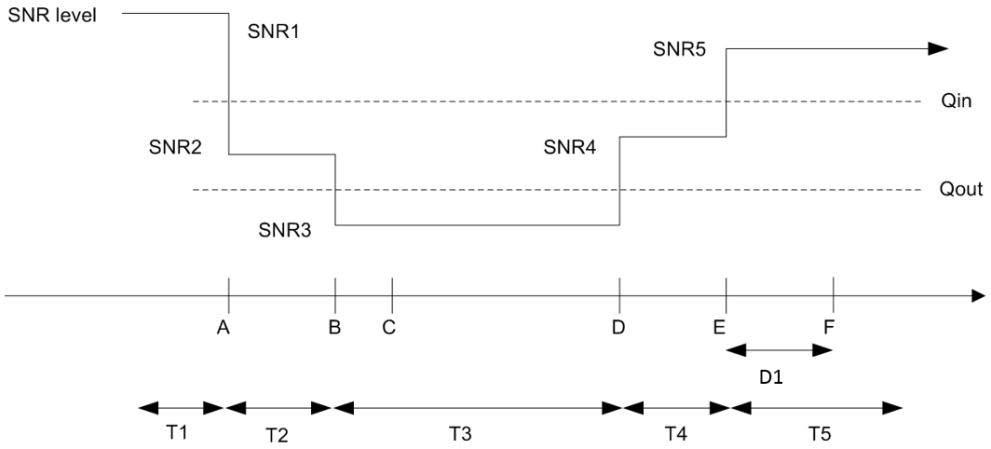


Figure A.6.5.1.2.1-1: SNR variation for in-sync testing

A.6.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.1.3 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in DRX mode

A.6.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.6.5.1.3.1-1. The test parameters are given in tables A.6.5.1.3.1-2, and A.6.5.1.3.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.6.5.1.3.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.3.1-2: General test parameters for FR1 out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.3 FDD
	Config 2		CCR.1.3 TDD
	Config 3		CCR.2.2 TDD
SSB Configuration	Config 1		SSB.1 FR1

Parameter		Unit	Value
			Test 1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	0.68
T3		s	0.68
D1		s	0.64
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.3.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in DRX mode

Parameter	Unit	Test 1		
		T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS	dB	4		
EPRE ratio of PDCCH to PDCCH DMRS	dB	0		
EPRE ratio of PBCH DMRS to SSS	dB	0		
EPRE ratio of PBCH to PBCH DMRS	dB			
EPRE ratio of PSS to SSS	dB			
EPRE ratio of PDSCH DMRS to SSS	dB			
EPRE ratio of PDSCH to PDSCH DMRS	dB			
EPRE ratio of OCNG DMRS to SSS	dB			
EPRE ratio of OCNG to OCNG DMRS	dB			

SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1	dBm/15kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	Config 1	dBm/SCS	-98		
	Config 2		-98		
	Config 3		-95		
Propagation condition			TDL-C 300 ns 100 Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.6.5.1.3.1-1.
NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.

Table A.6.5.1.3.1-4: Void

Table A.6.5.1.3.1-5: Void

Table A.6.5.1.3.1-6: Void

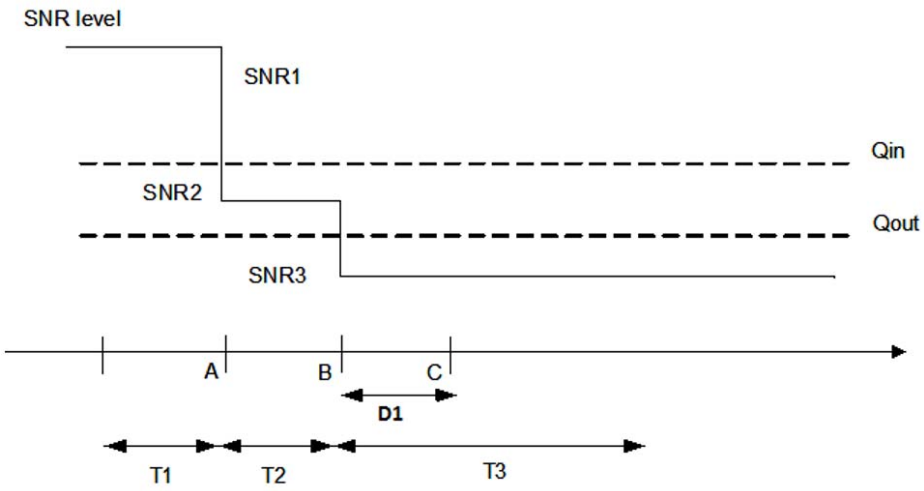


Figure A.6.5.1.3.1-1: SNR variation for out-of-sync testing

A.6.5.1.3.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.1.4 Radio Link Monitoring In-sync Test for FR1 PCell configured with SSB-based RLM RS in DRX mode

A.6.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.6.5.1.4.1-1. The test parameters are given in tables A.6.5.1.4.1-2, and A.6.5.1.4.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.6.5.1.4.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.4.1-2: General test parameters for FR1 in-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1

Parameter			Unit	Value
				Test 1
PDSCH/PDCCH subcarrier spacing		Config 1, 2		15 kHz
		Config 3		30 kHz
PRACH Configuration		Config 1, 2		Table A.3.8.2.1-1
		Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS				0
OCNG parameters				OP.1
CP length				Normal
Correlation Matrix and Antenna Configuration				2x2 Low
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	0
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX Configuration				DRX.3
Gap pattern ID				N.A.
Layer 3 filtering				*Enabled*
T310 timer			ms	2000
T311 timer			ms	1000
N310				1
N311				1
CSI-RS configuration for CSI reporting	Config 1			CSI-RS.1.1 FDD
	Config 2			CSI-RS.1.1 TDD
	Config 3			CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1			TRS.1.1 FDD
	Config 2			TRS.1.1 TDD
	Config 3			TRS.1.2 TDD
T1			s	0.2
T2			s	0.2
T3			s	0.64
T4			s	0.2
T5			s	0.88
D1			s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.6.5.1.4.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5

EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
N_{oc}	Config 1	dBm/SCS	-98				
	Config 2		-98				
	Config 3		-95				
Propagation condition			TDL-C 300 ns 100 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.							
NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.6.5.1.4.1-1.							
NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in clause A.3.6.							

Table A.6.5.1.4.1-4: Void

Table A.6.5.1.4.1-5: Void

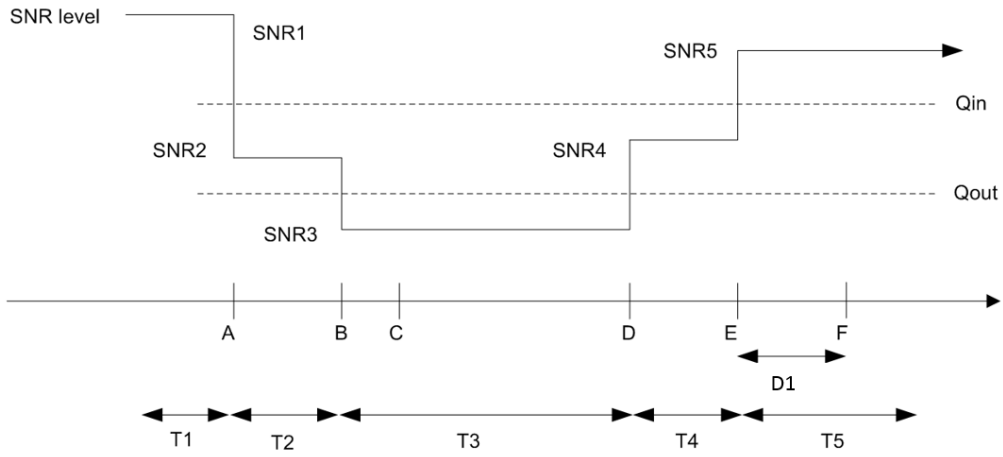


Figure A.6.5.1.4.1-1: SNR variation for in-sync testing.

A.6.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.1.5 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode

A.6.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in tables A.6.5.1.5.1-1, A.6.5.1.5.1-2, A.6.5.1.5.1-3, and A.6.5.1.5.1-3A below. There is one cell, Cell 1 which is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.5.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test. In the test, SSB0 is configured as the BFD-RS.

Table A.6.5.1.5.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.5.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.3 FDD
	Config 2		CCR.1.3 TDD
	Config 3		CCR.2.2 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz

Parameter		Unit	Value
			Test 1
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.5.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter	Unit	Test 1		
		T1	T2	T3
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta	dB	4		
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta	dB			
EPRE ratio of PBCH DMRS to SSSPBCH_beta	dB	0		
EPRE ratio of PBCH to PBCH DMRSPSS_beta	dB			
EPRE ratio of PSS to SSSSSS_beta	dB			
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta	dB			
EPRE ratio of PDSCH to PDSCH DMRS	dB			
EPRE ratio of OCNG DMRS to SSS	dB			
EPRE ratio of OCNG to OCNG DMRS	dB			

SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1	dBm/15kHz	-98		
	Config 2		-98		
	Config 3		-98		
Propagation condition			TDL-C 300 ns 100 Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1.5.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during defined in clause A.3.6.

Table A.6.5.1.5.1-3A: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: Void	

Table A.6.5.1.5.1-4: Void

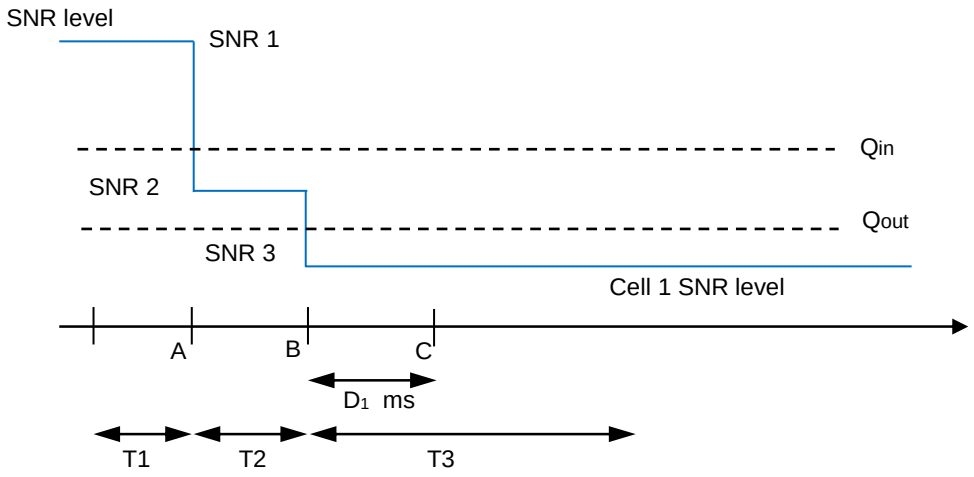


Figure A.6.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing

A.6.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.1.6 Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode

A.6.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in tables A.6.5.1.6.1-1, A.6.5.1.6.1-2, and A.6.5.1.6.1-3 below. There is one cells, Cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.6.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. In the test, SSB0 is configured as the BFD-RS.

Table A.6.5.1.6.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.6.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1		TRS.1.1 FDD

Parameter		Unit	Value
			Test 1
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.44
T4		s	0.2
T5		s	0.88
T6		s	0.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.6.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta	dB	4				
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB	0				
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB					
EPRE ratio of PSS to SSSSSS_beta		dB					
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1	dBm/15kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.6.5.1.6.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.

Table A.6.5.1.6.1-4: Void

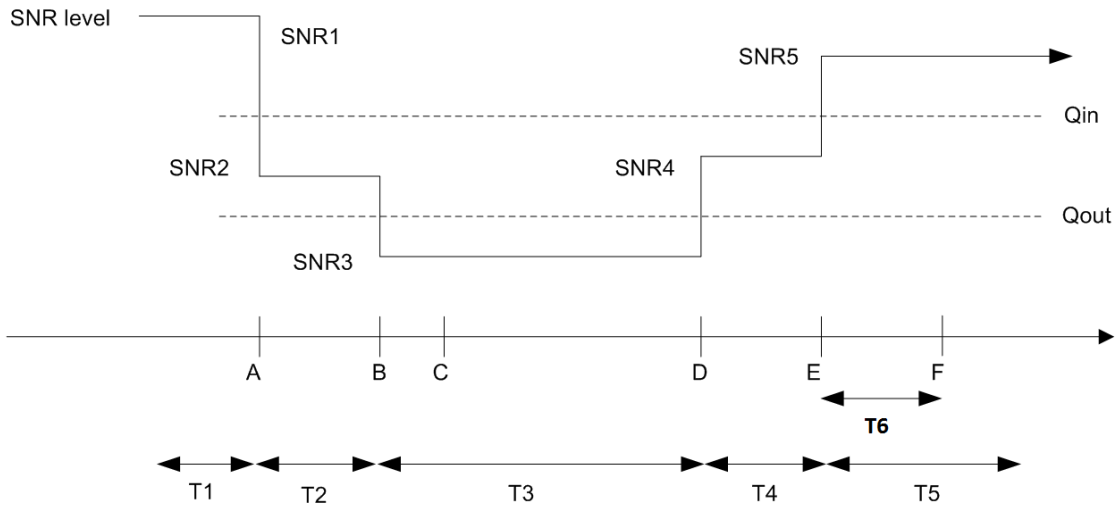


Figure A.6.5.1.6.1-1: SNR variation for CSI-RS in-sync testing

A.6.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.1.7 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode

A.6.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in tables A.6.5.1.7.1-1, A.6.5.1.7.1-2, and A.6.5.1.7.1-3 below. There is one cell, Cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.7.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. In the test, SSB0 is configured as the BFD-RS.

Table A.6.5.1.7.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.7.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.3 FDD
	Config 2		CCR.1.3 TDD
	Config 3		CCR.2.2 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1

Parameter		Unit	Value
			Test 1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.7.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter	Unit	Test 1		
		T1	T2	T3
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta	dB	4		
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta	dB	0		
EPRE ratio of PBCH DMRS to SSSPBCH_beta	dB			
EPRE ratio of PBCH to PBCH DMRSPSS_beta	dB			
EPRE ratio of PSS to SSSSSS_beta	dB			
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta	dB			
EPRE ratio of PDSCH to PDSCH DMRS	dB			

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1	dBm/15kHz	-98		
	Config 2		-98		
	Config 3		-98		
Propagation condition			TDL-C 300 ns 100 Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1.7.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.

Table A.6.5.1.7.1-4: Void

Table A.6.5.1.7.1-5: Void

Table A.6.5.1.7.1-6: Void

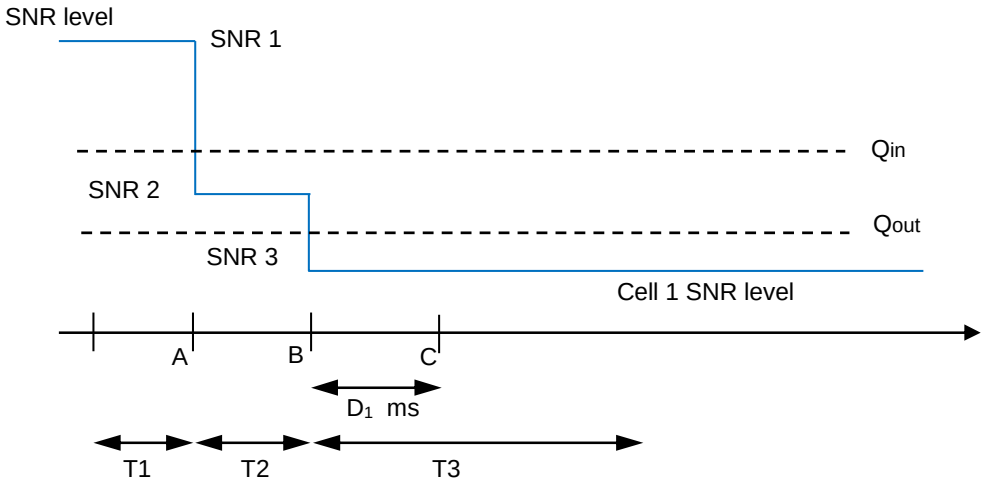


Figure A.6.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing

A.6.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.1.8 Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode

A.6.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in tables A.6.5.1.8.1-1, A.6.5.1.81-2, A.6.5.1.8.1-3 and A.6.5.1.8.1-3A below. There is one cells, Cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.8.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test. In the test, SSB0 is configured as the BFD-RS.

Table A.6.5.1.8.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.8.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1		Resource #4 in TRS.1.1 FDD

Parameter		Unit	Value
			Test 1
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	4000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	1.24
T4		s	0.2
T5		s	4
T6		s	3.88
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.8.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta	dB	0				
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta	dB					
EPRE ratio of PBCH DMRS to SSSPBCH_beta	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB					
EPRE ratio of PSS to SSSSSS_beta		dB					
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1	dBm/15kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.6.5.1.8.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.

Table A.6.5.1.8.1-3A: Measurement gap configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: Void	

Table A.6.5.1.8.1-4: Void

Table A.6.5.1.8.1-5: Void

Table A.6.5.1.8.1-6: Void

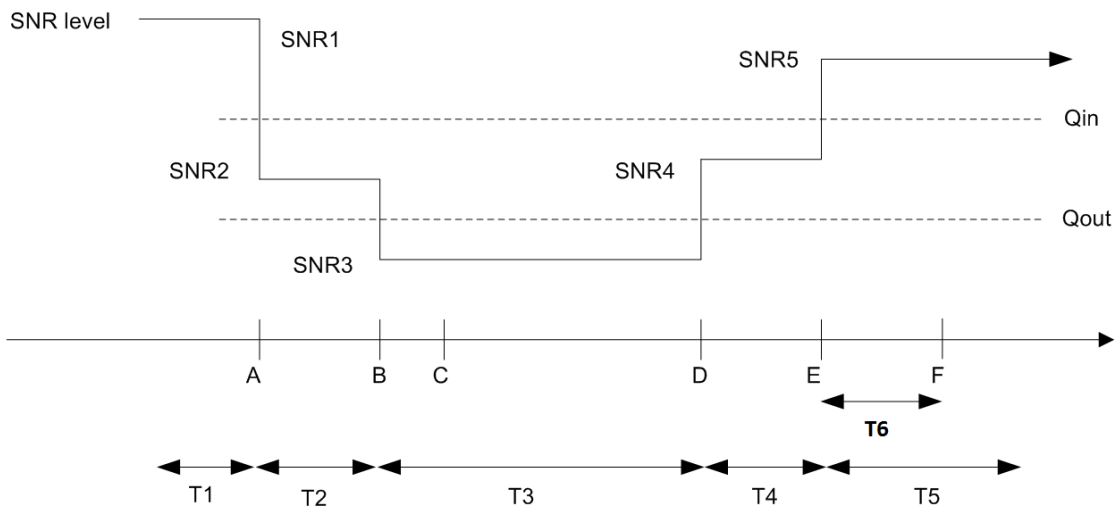


Figure A.6.5.1.8.1-1: SNR variation for CSI-RS in-sync testing

A.6.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.1.9 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM for UE fulfilling relaxed measurement criterion

A.6.5.1.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.3.4 for UE fulfilling good serving cell quality criterion.

The test parameters are given in tables A.6.5.1.9.1-1, A.6.5.1.9.1-2, and A.6.5.1.9.1-3 below. There is one cell, Cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.9.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. In the test, SSB0 is configured as the BFD-RS.

Table A.6.5.1.9.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.9.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.3 FDD
	Config 2		CCR.1.3 TDD
	Config 3		CCR.2.2 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.X1
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1

Parameter		Unit	Value
			Test 1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	2.48
T3		s	4.88
D1		s	4.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.9.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4		
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta		dB	0		
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB			
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB			
EPRE ratio of PSS to SSSSSS_beta		dB			
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1	dB	1	1	-15
	Config 2		1	1	-15
	Config 3		1	1	-15
N_{oc}	Config 1	dBm/15kHz	-98		
	Config 2		-98		
	Config 3		-98		
goodServingCellEvaluationRLM			configured		
offset in goodServingCellEvaluationRLM		dB	Not configured		
Propagation condition			TDL-C 300 ns 100 Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1.9.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.

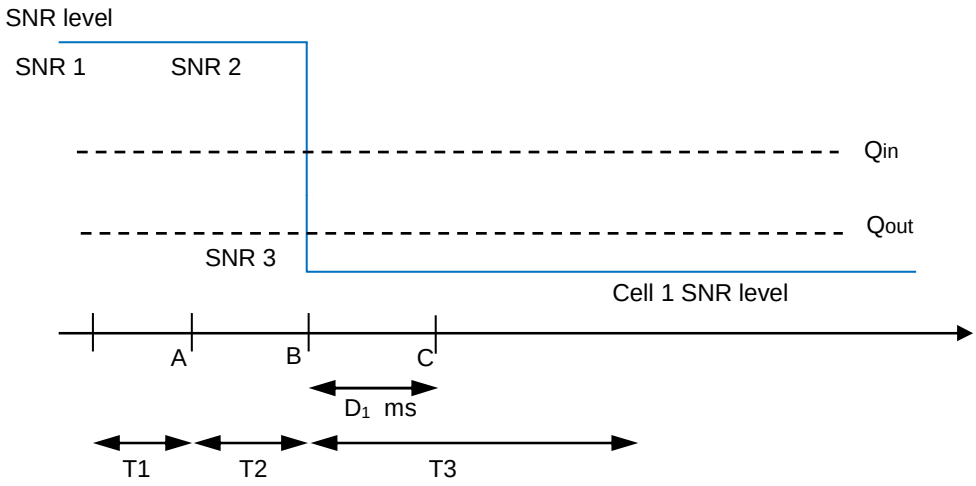


Figure A.6.5.1.9.1-1: SNR variation for CSI-RS out-of-sync testing

A.6.5.1.9.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.1.10 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode when CD-SSB is outside active BWP

A.6.5.1.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used and when CD-SSB is outside active BWP. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test is for UE supporting *rlm-BM-BFD-CSI-RS-OutsideActiveBWP-r18* and the UE is not required past legacy test in clause A.6.5.1.5.

The test environment is the same as in clause A.6.5.1.5 with following exceptions in Table A.6.5.1.5.1-2.

The value of parameter “DL dedicated BWP configuration” is DLBWP.1.2. The value of parameter “UL dedicated BWP configuration” is ULBWP.1.2.

NOTE: The starting PRB index of the SSB can be any possible PRB index of the RF channel BW occurring after the last PRB of the DL active BWP.

The test requirements are the same as for A.6.5.1.5.2.

A.6.5.1.11 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode when CD-SSB is outside active BWP

A.6.5.1.11.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when CD-SSB is outside active BWP. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

The test environment is the same as in clause A.6.5.1.1 with following exceptions in table A.6.5.1.1.1-2.

Parameter		Unit	Value
			Test 1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.2
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.2

A.6.5.1.11.2 Test Requirements

The test requirements are the same as in clause A.6.5.1.1.2.

A.6.5.1.12 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode for UE supporting NCD-SSB based measurement outside active BWP

A.6.5.1.12.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell for UE supporting FG 53-3. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.6.5.1.12.1-1. The test parameters are given in tables A.6.5.1.12.1-2, A.6.5.1.12.1-3, and A.6.5.1.12.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.12.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

Table A.6.5.1.12.1-1: Supported test configurations for FR1 PCell for UE supporting FG NCD-SSB based measurement outside active BWP

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.12.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode for UE supporting NCD-SSB based measurement outside active BWP

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52

Parameter		Unit	Value
			Test 1
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		20: $N_{PRB,c}$ = 51
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.3 FDD
	Config 2		CCR.1.3 TDD
	Config 3		CCR.2.2 TDD
CD-SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
NCD-SSB Configuration	Config 1		SSB.9 FR1
	Config 2		SSB.9 FR1
	Config 3		SSB.10 FR1
SMTC Configuration	Config 1, 2		SMTC.10
	Config 3		SMTC.10
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2

Parameter	Unit	Value
		Test 1
T2	s	0.48
T3	s	0.48
D1	s	0.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.		

Table A.6.5.1.12.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode for UE supporting NCD-SSB based measurement outside active BWP

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1	dBm/15kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	Config 1	dBm/SCS	-98		
	Config 2		-98		
	Config 3		-95		
Propagation condition			TDL-C 300 ns 100 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.6.5.1.12.1-1. NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band.					

Table A.6.5.1.12.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE: Ensure that RLM RS is partially overlapped with measurement gap	

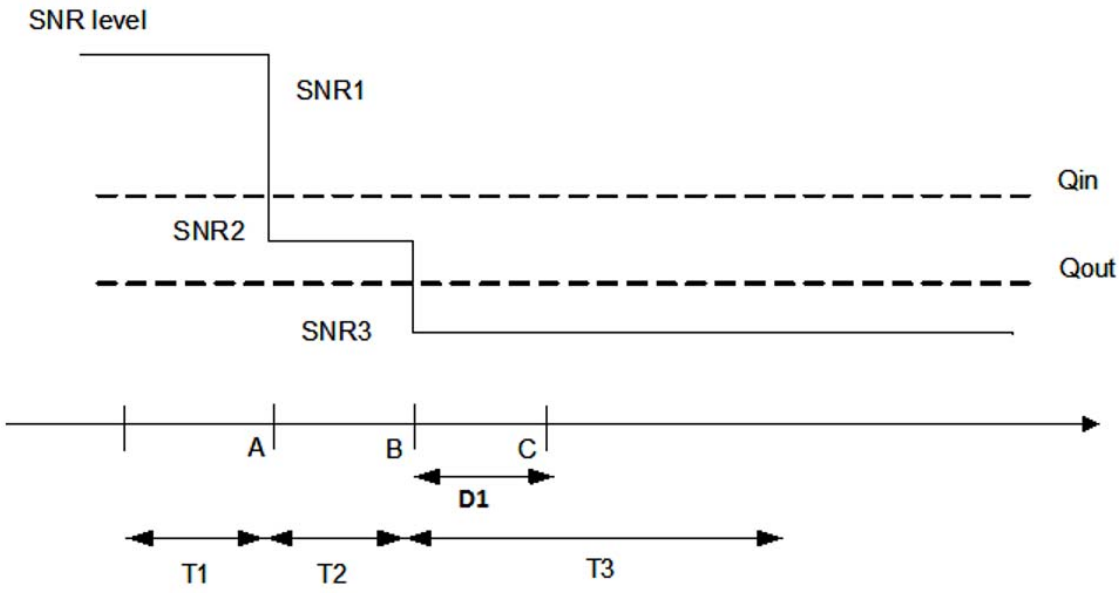


Figure A.6.5.1.12.1-1: SNR variation for out-of-sync testing

A.6.5.1.12.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.1.13 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in DRX mode for UE operating on a cell with less than 5 MHz BW

A.6.5.1.13.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *support-3MHz-ChannelBW-r18* properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell operating on a 3 MHz channel bandwidth. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

Supported test configurations are specified in table A.6.5.1.13.1-1. General test parameters as specified in table A.6.5.1.3.1-2 with config 1 apply except those specified in table A.6.5.1.13.1-2. Cell specific test parameters as specified in table A.6.5.1.3.1-3 apply except those specified in table A.6.5.1.13.1-3.

The test procedure specified in clause A.6.5.1.3.1 applies to this test.

Table A.6.5.1.13.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 3 MHz bandwidth

Table A.6.5.1.13.1-2: General test parameters for FR1 OOS 12 PRB in DRX mode

Parameter		Unit	Value
			Test 1
$BW_{channel}$	Config 1	MHz	3: $N_{PRB,c}$ = 12
RMSI CORESET Reference Channel	Config 1		CR.1.2 FDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.6 FDD
SSB Configuration	Config 1		SSB.13 FR1
	DCI format		1-0
In sync transmission parameters	Number of Control OFDM symbols		2
	Aggregation level	CCE	2
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
Out of sync transmission parameters	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	REG bundle size		6
	CP length		Normal
	Mapping from REG to CCE		Distributed

Table A.6.5.1.13.1-3: Cell specific test parameters for FR1 OOS 12 PRB in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
SNR on RLM-RS	Config 1	dB	4	-4	-12

A.6.5.1.13.2 Test Requirements

Test requirements specified in clause A.6.5.1.3.2 apply to this test.

A.6.5.1.14 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode for UE operating on a cell with less than 5 MHz BW

A.6.5.1.14.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *support-3MHz-ChannelBW-r18* properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell operating on a 3 MHz channel bandwidth. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

Supported test configurations are specified in table A.6.5.1.14.1-1. General test parameters as specified in table A.6.5.1.1.1-2 with config 1 apply except those specified in table A.6.5.1.14.1-2. Cell specific test parameters as specified in table A.6.5.1.1.1-3 apply except those specified in table A.6.5.1.14.1-3.

The test procedure specified in clause A.6.5.1.1.1 applies to this test.

Table A.6.5.1.14.1-1: Supported test configurations for FR1 PCell

Configuration	Description

1	FDD duplex mode, 15 kHz SSB SCS, 3 MHz bandwidth

Table A.6.5.1.14.1-2: General test parameters for FR1 OOS 15 PRB in DRX mode

Parameter		Unit	Value
			Test 1
$BW_{channel}$	Config 1	MHz	3: $N_{PRB,c}$ = 15
RMSI CORESET Reference Channel	Config 1		CR.1.3 FDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.7 FDD
SSB Configuration	Config 1		SSB.13 FR1
	DCI format		1-0
In sync transmission parameters	Number of Control OFDM symbols		3
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
Out of sync transmission parameters	Number of Control OFDM symbols		3
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	REG bundle size		6
	CP length		Normal
	Mapping from REG to CCE		Non-Distributed

Table A.6.5.1.14.1-3: Cell specific test parameters for FR1 PCell

Parameter		Unit	Test 1		
			T1	T2	T3
SNR_SSB of set q_0	Config 1	dB	2	-6	-14

A.6.5.1.14.2 Test Requirements

Test requirements specified in clause A.6.5.1.1.2 apply to this test.

A.6.5.1.15 Radio Link Monitoring In-sync Test for FR1 PCell with 3 MHz Channel Bandwidth configured with SSB-based RLM RS in non-DRX mode

A.6.5.1.15.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *support-3MHz-ChannelBW-r18* properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell operating on a 3 MHz channel bandwidth. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

Supported test configurations are specified in table A.6.5.1.15.1-1. General test parameters as specified in table A.6.5.1.2.1-2 with config 1 apply to this test for both config 1 and 2, except those specified in table A.6.5.1.15.1-2. Cell specific test parameters as specified in table A.6.5.1.2.1-3 apply except those specified in table A.6.5.1.15.1-3.

The test procedure specified in clause A.6.5.1.2.1 applies to this test.

Table A.6.5.1.15.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 3 MHz (15PRB)
NOTE: The UE is required to pass the test with configuration 1 for every supported 3 MHz band in FR1.	

Table A.6.5.1.15.1-2: General test parameters for FR1 in-sync testing in non-DRX mode

Parameter		Unit	Value
Parameter		Unit	Value
			Test 1
$BW_{channel}$	Config 1	MHz	3: $N_{RB,c}$ = 15
RMSI CORESET Reference Channel	Config 1		CR.1.3 FDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.7 FDD
SSB Configuration	Config 1		SSB.13 FR1
In sync transmission parameters	Number of Control OFDM symbols, Config 1		3
	Aggregation level, Config 1	CCE	4
	Mapping from REG to CCE, Config 1	Config 1	Non-Distributed
Out of sync transmission parameters	Number of Control OFDM symbols, Config 1		3
	Aggregation level, Config 1	CCE	8
	Mapping from REG to CCE, Config 1	Config 1	Non-Distributed

Table A.6.5.1.15.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
SNR on RLM-RS	Config 1	dB	2	-6	-14	-2.5	3

A.6.5.1.15.2 Test Requirements

Test requirements specified in clause A.6.5.1.2.2 apply to this test.

A.6.5.1.16 Radio Link Monitoring In-sync Test for FR1 PCell with 3MHz Channel Bandwidth configured with SSB-based RLM RS in DRX mode

A.6.5.1.16.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *support-3MHz-ChannelBW-r18* properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell operating on a 3MHz channel bandwidth. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

Supported test configurations are specified in Table A.6.5.1.16.1-1. General test parameters as specified in Table A.6.5.1.4.1- with config 1 apply to this test, except those specified in Table A.6.5.1.16.1-2. Cell specific test parameters as specified in Table A.6.5.1.4.1-3 apply except those specified in Table A.6.5.1.16.1-3.

The test procedure specified in A.6.5.1.4.1 applies to this test.

Table A.6.5.1.16.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 3 MHz (12 PRB)
Note: If the UE indicates the support for band n100, the UE is also required to pass the test with 12 PRB configuration.	

Table A.6.5.1.16.1-2: General test parameters for FR1 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
$BW_{channel}$	Config 1	MHz	3: $N_{RB,c}$ = 12
RMSI CORESET Reference Channel	Config 1		CR.1.2 FDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.6 FDD
SSB Configuration	Config 1		SSB.13 FR1
In sync transmission parameters	Number of Control OFDM symbols, Config 1		2
	Aggregation level, Config 1		2
	Mapping from REG to CCE, Config 1		Distributed
Out of sync transmission parameters	Number of Control OFDM symbols, Config 1		2
	Aggregation level, Config 1		4
	Mapping from REG to CCE, Config 1		Distributed

Table A.6.5.1.16.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
SNR on RLM-RS	Config 1	dB	4	-4	-12	0	5.5

A.6.5.1.16.2 Test Requirements

Test requirements specified in Clause A.6.5.1.4.2 apply to this test.

A.6.5.2 Interruption

A.6.5.2.1 Interruptions during measurements on deactivated NR SCC in FR1

A.6.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE missed ACK/NACK rate does not exceed the limits at NR PCell interruptions during the measurement on the deactivated NR SCC. This test will verify the missed ACK/NACK rate for PCell in standalone NR specified in clause 8.2.2.2.3. Supported test configurations for NR PCell are shown in table A.6.5.2.1.1-1. Supported test configurations for NR SCell are shown in table A.6.5.2.1.1-1A. Test configuration for NR PCell and test configuration for NR SCell are chosen independently.

The general test parameters and NR cell specific test parameters are given in Table A.6.5.2.1.1-2, A.6.5.2.1.1-3 and A.6.5.2.1.1-4 below. In the test there are two cells: Cell1 and Cell2. Cell1 is PCell, Cell2 is an NR deactivated SCell. Cell1 shall be configured as PCell and Cell2 shall be configured as SCell.

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2 and the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCell is received at the UE antenna connector. During T1, PCell is continuously scheduled in DL.

Table A.6.5.2.1.1-1: Interruptions during measurements on deactivated NR SCC supported test configurations for NR PCell

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.2.1.1-1A: Interruptions during measurements on deactivated NR SCC supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.2.1.1-2: General test parameters for interruptions during measurements on deactivated NR SCC in standalone NR

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two NR RF channels
Active PCell		Cell 1	PCell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Deactivated SCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell 1 and Cell 2
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.6.5.2.1.1-3: NR cell specific test parameters for NR PCell for interruptions during measurements on deactivated NR SCC in standalone NR

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
$BW_{channel}$	Config 1,2		Note 9
	Config 3		Note 9
$BW_{occupied}$	Config 1,2	RB	52 Note 7
	Config 3		106 Note 8
Initial DL BWP Configuration	Config 1,2,3		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,2,3		DLBWP.1.1
Initial UL BWP Configuration	Config 1,2,3		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,2,3		ULBWP.1.1
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.2 TDD
	Config 3		SR.2.1 TDD
CSI-RS for tracking	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
OCNG Patterns	Config 1,2		OP.1 Note 7
	Config 3		OP.1 Note 8
SMTC Configuration			SMTC.1
SSB Configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
N_{oc} Note 2	Config 1,2	dBm/SCS	-104
	Config 3		-101
Io Note3	Config 1,2	dBm/9.36 MHz	-58.96
	Config 3	dBm/38.16 MHz	-52.86
Time offset to Cell 1 Note 5		μs	-
Propagation Condition			AWGN

Parameter	Unit	Cell 1
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.		
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.		
NOTE 4: Void		
NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.		
NOTE 6: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in clause 12 of TS 38.213 [3].		
NOTE 7: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.		
NOTE 8: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.		
NOTE 9: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.		

Table A.6.5.2.1.1-4: NR cell specific test parameters for NR SCell for interruptions during measurements on deactivated NR SCC in standalone NR

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	$Config_{SCell}$ 1		FDD
	$Config_{SCell}$ 2,3		TDD
TDD configuration	$Config_{SCell}$ 1		Not Applicable
	$Config_{SCell}$ 2		TDDConf.1.1
	$Config_{SCell}$ 3		TDDConf.2.1
$BW_{channel}$	$Config_{SCell}$ 1,2		Note 9
	$Config_{SCell}$ 3		Note 9
$BW_{occupied}$	$Config_{SCell}$ 1,2	RB	52 Note 7
	$Config_{SCell}$ 3		106 Note 8
Initial DL BWP Configuration	$Config_{SCell}$ 1,2,3		DLBWP.0.1
Dedicated DL BWP Configuration	$Config_{SCell}$ 1,2,3		DLBWP.1.1
Initial UL BWP Configuration	$Config_{SCell}$ 1,2,3		N/A
Dedicated UL BWP Configuration	Config 1,2,3		N/A
PDSCH Reference measurement channel	$Config_{SCell}$ 1		SR.1.1 FDD
	$Config_{SCell}$ 2		SR.1.2 TDD
	$Config_{SCell}$ 3		SR.2.1 TDD
CSI-RS for tracking	$Config_{SCell}$ 1		TRS.1.1 FDD
	$Config_{SCell}$ 2		TRS.1.1 TDD
	$Config_{SCell}$ 3		TRS.1.2 TDD
RMSI CORESET parameters	$Config_{SCell}$ 1		CR.1.1 FDD
	$Config_{SCell}$ 2		CR.1.1 TDD
	$Config_{SCell}$ 3		CR.2.1 TDD
Dedicated CORESET parameters	$Config_{SCell}$ 1		CCR.1.1 FDD
	$Config_{SCell}$ 2		CCR.1.1 TDD
	$Config_{SCell}$ 3		CCR.2.1 TDD
OCNG Patterns	$Config_{SCell}$ 1,2		OP.1 Note 7
	$Config_{SCell}$ 3		OP.1 Note 8
SMTC Configuration			SMTC.4
SSB Configuration	$Config_{SCell}$ 1,2		SSB.5 FR1
	$Config_{SCell}$ 3		SSB.6 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			

Parameter		Unit	Cell 2
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
N_{oc} Note 2	$Config_{SCell}$ 1,2	dBm/SCS	-104
	$Config_{SCell}$ 3		-101
Io Note3	$Config_{SCell}$ 1,2	dBm/9.36 MHz	-58.96
	$Config_{SCell}$ 3	dBm/38.16 MHz	-52.86
Time offset to Cell 1 Note 5		μs	3
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.
NOTE 4: Void
NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.
NOTE 6: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in clause 12 of TS 38.213 [3].
NOTE 7: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 8: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 9: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.

A.6.5.2.1.2 Test Requirements

The UE shall be continuously scheduled on PCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5 % of ACK/NACK on PCell.

If the NR PCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on NR PCell immediately before and immediately after an SMTC. Each interruption on NR PCell shall not exceed the value defined in table A.6.5.2.1.2-1.

If the NR PCell is non-contiguous to the deactivated SCell in the same band and UE is capable of intraBandNRCA-NonCollocated-r18 on this FR1 bnad and nonCollocatedTypeNR-CA-r18 is not provided, the UE is only allowed to cause interruptions on NR PCell immediately before and immediately after an SMTC. Each interruption on NR PCell shall not exceed the value defined in table A.6.5.2.1.2-1.

If the NR PCell is non-contiguous to the deactivated SCell in the same band, when UE is not capable of intraBandNRCA-NonCollocated-r18 or when UE is capable of*intraBandNRCA-NonCollocated-r18* and provided with *nonCollocatedTypeNR-CA-r18*, the UE is only allowed to cause an interruption on PCell no earlier than 1 slot before an SMTC and no later than 1 slot after the SMTC. The interruption on NR PCell shall not exceed the value defined in table A.6.5.2.1.2-2.

If the NR PCell is contiguous to the deactivated SCell in the same band, the UE is only allowed to cause an interruption on PCell no earlier than 1 slot before an SMTC and no later than 1 slot after the SMTC. The interruption on NR PCell shall not exceed the value defined in table A.6.5.2.1.2-2.

Table A.6.5.2.1.2-1: Interruption duration if the PCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1
1	0.5	1

Table A.6.5.2.1.2-2: Interruption duration if the PCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slots)
0	1	2 + SMTC duration
1	0.5	2 + SMTC duration

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.2.2 SA interruptions at NR SRS carrier based switching

A.6.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that when a UE needs to transmit aperiodic SRS, the UE can perform carrier based switching to one carrier not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission. The test will partly verify the UE missed ACK/NACK does not exceed the interruption requirements on PCell in clause 8.2.2.2.9.

A.6.5.2.2.2 Test Parameters

which operates in downlink without PUCCH/PUSCH. The UE is configured with the SRS switching between PCell and SCell. The test parameters for PCell and SCell are given in table A.6.5.2.2.2-2 and A.6.5.2.2.2-3 below. The test consists of two successive time periods, with duration of T1 and T2, respectively. Immediately at the beginning of T2, the UE is triggered for SRS switching by DCI 2_3 scheduling. After T2, the UE is expected to transmit aperiodic SRS on a special slot in the configured TDD UL/DL configuration, as scheduled by DCI 2_3.

The test equipment verifies that potential interruption is carried out correctly by monitoring ACK/NACK sent in PCell.

Table A.6.5.2.2.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD – TDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD – TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD – TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.5.2.2.2-2: General test parameters for SA interruptions at NR SRS carrier based switching

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1
Configured SCell		Cell 2	Activated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell 2 timing offset to cell1	μs	0	
Time alignment error between cell2 and cell1	μs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	5	
T2	ms	40	UE shall perform SRS switching during T2

Table A.6.5.2.2.2-3: Cell specific test parameters for SA interruptions at NR SRS carrier based switching

Parameter		Unit	T1		T2	
			Cell 1	Cell 2	Cell 1	Cell 2
Duplex mode	Config 1		FDD	TDD	FDD	TDD
	Config 2,3		TDD			

Parameter		Unit	T1		T2	
			Cell 1	Cell 2	Cell 1	Cell 2
TDD configuration	Config 1		N/A	TDDConf.1.1	N/A	TDDConf.1.1
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
Downlink initial BWP Configuration			DLBWP.0.1			
Downlink dedicated BWP Configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
TCI state			TCI.State.0			
TRS Configuration			TRS.1.1 TDD			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.1.1 TDD	SR.1.1 FDD	SR.1.1 TDD
	Config 2		SR.1.1 TDD	SR.1.1 TDD	SR.1.1 TDD	SR.1.1 TDD
	Config 3		SR2.1 TDD	SR2.1 TDD	SR2.1 TDD	SR2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.1.1 TDD	CCR.1.1 FDD	CCR.1.1 TDD
	Config 2		CCR.1.1 TDD	CCR.1.1 TDD	CCR.1.1 TDD	CCR.1.1 TDD
	Config 3		CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.1.1 TDD	CR.1.1 FDD	CR.1.1 TDD
	Config 2		CR.1.1 TDD	CR.1.1 TDD	CR.1.1 TDD	CR.1.1 TDD
	Config 3		CR2.1 TDD	CR2.1 TDD	CR2.1 TDD	CR2.1 TDD
OCNG Patterns			OP.1			
SRS Configuration	Config 1,2		SRS.4 TDD			
	Config 3		SRS.5 TDD			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
SMTC configuration			SMTC.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	Config 1,2,4,5	dBm/15kHz	-104			
	Config 3,6		-101			
$\hat{E}_s / I_{ot}$		dB	17			
$\hat{E}_s / N_{oc}$		dB	17			
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87			
	Config 3,6		-84			
SCH_RP Note 3		dBm/15 kHz	-87			
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.

Table A.6.5.2.2.2-4: Void

A.6.5.2.2.3 Test Requirements

The UE shall be scheduled on PCell continuously throughout the test. During the time duration T2, the missed ACK/NACK interruption on PCell shall not be more than the values specified for SA in clause 8.2.2.2.9.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.2.3 SA interruptions at NR SRS antenna port switching with 1 SRS symbol in a slot in NR-CA

A.6.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that when a UE performs SRS antenna port switching, i.e. transmits SRS on the antenna port(s) not used for PUCCH/PUSCH transmission and on the antenna port(s) used for PUCCH/PUSCH transmission at different SRS transmission occasions. The test will partly verify the interruption requirements on PCell and SCell in clause 8.2.2.2.16. The interruption requirement is defined based on the band combination capability reported by UE, i.e., based on *txSwitchImpactToRx* or *txSwitchWithAnotherBand* as specified in requirement applicability in clause 8.2.2.2.16.

A.6.5.2.3.2 Test Parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the FR1 PCell and Cell 2 is activated SCell on the TDD PCC. Only PCC may be configured with more than 1 SRS resources in each SRS resource set with usage set to 'antennaSwitching'. The test parameters for PCell and SCell are given in table A.6.5.2.3.2-2 and A.6.5.2.3.2-3 below. The test consists of two successive time periods, with duration of T1 and T2, respectively. Immediately at the beginning of T2, the UE is configured with periodic SRS for antenna port switching via RRC reconfiguration. Note that the RRC reconfiguration message should be sent to UE at the time 50 ms before the beginning of T2.

The test equipment verifies that potential interruption is carried out correctly by monitoring ACK/NACK sent in SCell.

Table A.6.5.2.3.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode for NR PCell and FDD duplex mode for NR SCell
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode for NR PCell and TDD duplex mode for NR SCell
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode for NR PCell and TDD duplex mode for NR SCell
Note1: The UE is only required to be tested in one of the supported test configurations. Note2: Test configuration for NR PCell and NR SCell are chosen independently.	

Table A.6.5.2.3.2-2: General test parameters for SA interruptions at NR SRS antenna switching

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1
Configured SCell		Cell 2	Activated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell 2 timing offset to cell1	μs	0	
Time alignment error between cell2 and cell1	μs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	5	
T2	ms	40	UE shall perform SRS antenna switching during T2

Table A.6.5.2.3.2-3: Cell specific test parameters for SA interruptions at NR SRS antenna switching

Parameter		Unit	T1		T2	
			Cell 1	Cell 2	Cell 1	Cell 2
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		N/A			
	Config 2		TDDConf.1.2			
	Config 3		TDDConf.2.3			
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
Downlink initial BWP Configuration			DLBWP.0.1			
Downlink dedicated BWP Configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
TCI state			TCI.State.0			
TRS Configuration			TRS.1.1 TDD			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.1.1 FDD	SR.1.1 FDD	SR.1.1 FDD
	Config 2		SR.1.1 TDD	SR.1.1 TDD	SR.1.1 TDD	SR.1.1 TDD
	Config 3		SR2.1 TDD	SR2.1 TDD	SR2.1 TDD	SR2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.1.1 FDD	CCR.1.1 FDD	CCR.1.1 FDD
	Config 2		CCR.1.1 TDD	CCR.1.1 TDD	CCR.1.1 TDD	CCR.1.1 TDD
	Config 3		CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.1.1 FDD	CR.1.1 FDD	CR.1.1 FDD
	Config 2		CR.1.1 TDD	CR.1.1 TDD	CR.1.1 TDD	CR.1.1 TDD
	Config 3		CR2.1 TDD	CR2.1 TDD	CR2.1 TDD	CR2.1 TDD
OCNG Patterns			OP.1			
SRS Configuration	Config 1,2		SRS.1, with dedicated SRS configuation in Table A.6.5.2.3.2-4			
	Config 3		SRS.2, with dedicated SRS configuation in Table A.6.5.2.3.2-4			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
SMTC configuration			SMTC.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 2)						
N_{oc} Note3	Config 1,2,4,5	dBm/15kHz	-104			
	Config 3,6		-101			
$\hat{E}_s / I_{ot}$		dB	17			
$\hat{E}_s / N_{oc}$		dB	17			
SS-RSRP Note4	Config 1,2,4,5	dBm/SCS	-87			
	Config 3,6		-84			
SCH_RP Note 4		dBm/15 kHz	-87			
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.

NOTE 5: Test configuration for NR PCell and NR SCell are chosen independently.

Table A.6.5.2.3.2-4: Specific Sounding Reference Symbol Configuration for xTyR configuration

Parameter		xTyR configuration							
		1T2R		2T4R		1T4R			
srs-ResourceId		0	1	0	1	0	1	2	3
startPosition		3	3	3	3	3	3	3	3
nrofSRS-Ports		port1	port1	port2	port2	port1	port1	port1	port1
nrofSymbols		1	1	1	1	1	1	1	1
periodicityAndOffset-p	Config 1,2	sl40, 1	sl40, 6	sl40, 1	sl40, 6	sl40, 1	sl40, 6	sl40, 11	sl40, 16
	Config 3	sl80, 3	sl80, 13	sl80, 3	sl80, 13	sl80, 3	sl80, 13	sl80, 23	sl80, 33

A.6.5.2.3.3 Test Requirements

The UE shall be scheduled on SCell continuously throughout the test.

During the time duration T2, the DL interruption on NR SCell during the SRS antenna switching in each SRS transmission slot on NR PCell shall not exceed 1 slot if SCell is indicated in *txSwitchImpactToRx*.

During the time duration T2, the UL interruption on NR SCell during the SRS antenna switching in each SRS transmission slot on NR PCell shall not exceed 1 slot if SCell is indicated in *txSwitchWithAnotherBand*.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.2.4 SA interruptions at NR SRS antenna port switching

A.6.5.2.4.1 Test Purpose and Environment

The purpose of this test is to verify the interruption requirement on victim CC during SRS antenna port switching with more than 1 SRS symbols on aggressor CC defined in clause 8.2.2.2.16. The interruption requirement is defined based on the band combination capability reported by UE, i.e., based on *txSwitchImpactToRx* or *txSwitchWithAnotherBand* as specified in requirement applicability in clause 8.2.2.2.16.

A.6.5.2.4.2 Test Parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the FR1 PCell and Cell 2 is FR1 SCell. The UE is configured with the SRS antenna port in FR1 PCell. The test parameters for PCell and SCell are given in table A.6.5.2.4.2-2 and A.6.5.2.4.2-3 below. Common SRS configuration is given in clause A.3.24. Dedicated SRS configuration which is dependent on reported SRS capability *supportedSRS-TxPortSwitch*, is given in table A.6.5.2.4.2-4. The test consists of two successive time periods, with duration of T1 and T2, respectively. Immediately at the beginning of T2, the UE is triggered for SRS antenna port switching.

The test equipment verifies that potential interruption is carried out correctly by monitoring ACK/NACK sent in PCell.

Table A.6.5.2.4.2-1: Supported test configurations

Configuration	Description	
	NR PCell Note 2	NR SCell Note 2
1	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: Test configuration for NR PCell and NR SCell are chosen independently.		

Table A.6.5.2.4.2-2: General test parameters for SA interruptions at NR SRS antenna port switching

Parameter	Unit	Value	Comment

RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1
Configured SCell		Cell 2	Activated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell 2 timing offset to cell1	µs	0	
Time alignment error between cell2 and cell1	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	5	
T2	ms	40	UE shall perform SRS antenna port switching during T2

Table A.6.5.2.4.2-3: Cell specific test parameters for SA interruptions at NR SRS antenna port switching

Parameter		Unit	T1		T2	
			Cell 1	Cell 2	Cell 1	Cell 2
Duplex mode	Config 1		FDD	TDD	FDD	TDD
	Config 2,3		TDD			
TDD configuration	Config 1		N/A	TDDConf.1.2	N/A	TDDConf.1.2
	Config 2		TDDConf.1.2			
	Config 3		TDDConf.2.3			
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
Downlink initial BWP Configuration			DLBWP.0.1			
Downlink dedicated BWP Configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
TCI state			TCI.State.0			
TRS Configuration			TRS.1.1 TDD			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.1.1 TDD	SR.1.1 FDD	SR.1.1 TDD
	Config 2		SR.1.1 TDD	SR.1.1 TDD	SR.1.1 TDD	SR.1.1 TDD
	Config 3		SR2.1 TDD	SR2.1 TDD	SR2.1 TDD	SR2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.1.1 TDD	CCR.1.1 FDD	CCR.1.1 TDD
	Config 2		CCR.1.1 TDD	CCR.1.1 TDD	CCR.1.1 TDD	CCR.1.1 TDD
	Config 3		CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.1.1 TDD	CR.1.1 FDD	CR.1.1 TDD
	Config 2		CR.1.1 TDD	CR.1.1 TDD	CR.1.1 TDD	CR.1.1 TDD
	Config 3		CR2.1 TDD	CR2.1 TDD	CR2.1 TDD	CR2.1 TDD
ptrs-portindex			NA.	n0	NA.	n1
OCNG Patterns			OP.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
SRS configuration	Config 1,2		SRS.x1 Note 4	-	SRS.1 Note 4	-
	Config 3		SRS.x2 Note 4	-	SRS.2 Note 4	-
SMTC configuration			SMTC.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						

EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2	Config 1,2	dBm/15kHz	-104
	Config 3		-101
$\hat{E}_s / I_{ot}$		dB	17
$\hat{E}_s / N_{oc}$		dB	17
SS-RSRP Note3	Config 1,2	dBm/SCS	-87
	Config 3		-84
SCH_RP Note 3		dBm/15 kHz	-87
Propagation condition		-	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Dedicated SRS configuration in Table A.6.5.2.4.2-4

Table A.6.5.2.4.2-4: Dedicated Sounding Reference Symbol Configuration for xTyR configuration

Parameter		xTyR configuration							
		1T2R		2T4R		1T4R			
srs-ResourceId		0	1	0	1	0	1	2	3
nrofSymbols		1	1	1	1	1	1	1	1
startPosition		5	3	5	3	5	3	5	3
nrofSRS-Ports		port1	port1	port2	port2	port1	port1	port1	port1
periodicityAndOffset-p	Config 1,2	sl40, 1	sl40, 1	sl40, 1	sl40, 1	sl40, 1	sl40, 1	sl40, 6	sl40, 6
	Config 3	sl80, 3	sl80, 3	sl80, 3	sl80, 3	sl80, 3	sl80, 3	sl80, 13	sl80, 13

A.6.5.2.4.3 Test Requirements

The UE shall be scheduled on PCell continuously throughout the test. During the time duration T2, the interruption on SCell shall not be more than the values specified in table 8.2.1.2.18-3 in clause 8.2.1.2.18 for each SRS transmission slot.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.3 SCell Activation and Deactivation Delay

A.6.5.3.1 SCell Activation and deactivation of known SCell in FR1 in non-DRX for 160 ms SCell measurement cycle

A.6.5.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell in FR1 is known by the UE at the time of activation.

The supported test configurations for NR PCell are shown in table A.6.5.3.1.1-1 below. Supported test configurations for NR SCell are shown in table A.6.5.3.1.1-1A. Test configuration for NR PCell and test configuration for NR SCell are chosen independently. The test parameters are given in tables A.6.5.3.1.1-2 and cell-specific parameters in tables A.6.5.3.1.1-3 and A.6.5.3.1.1-4 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1, but is not aware of Cell 2. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot n + $\frac{T_{\text{HARQ}}+T_{\text{activation_time}}+T_{\text{CSI_Reporting}}}{\text{NR slot length}}$, as defined in clause 8.3. The UE shall start reporting CSI in PCell after at least one CSI-RS transmission occasion for channel measurement plus n_{CSI_ref} slots, as defined in 5.2.2.5 in [26], and reporting after slot $n + \frac{T_{\text{HARQ}}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot m + $\frac{\text{T}_{\text{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3, and The starting point of any PCell interruption due to the deactivation shall occur in the slot m + 1 + $\frac{\text{T}_{\text{HARQ}}}{NR\ slot\ length}$ to m + 1 + $\frac{\text{T}_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.6.5.3.1.1-1: known FR1 SCell activation in non-DRX for 160 ms SCell measurement cycle supported test configurations for NR PCell

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.1.1-1A: known FR1 SCell activation in non-DRX for 160 ms SCell measurement cycle supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.1.1-2: General test parameters for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	μs	0	
Time alignment error between cell2 and cell1	μs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
A3-offset	dB	-15	
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.6.5.3.1.1-3: Cell specific test parameters for NR PCell for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 1		
			T1	T2	T3
Duplex mode	Config 1		FDD		
	Config 2,3		TDD		
TDD configuration	Config 1		Not applicable		
	Config 2		TDDConf.1.1		
	Config 3		TDDConf.2.1		
$BW_{channel}$	Config 1,2	MHz	Note 7		
	Config 3		Note 7		
$BW_{occupied}$	Config 1,2	RB	52 Note 5		
	Config 3		106 Note 6		
Initial BWP configuration			DLBWP.0.1		
TCI state			TCI.State.0		
TRS Configuration	Config 1		TRS.1.1 FDD		
	Config 2		TRS.1.1 TDD		
	Config 3		TRS.1.2 TDD		
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD		
	Config 2		SR.1.1 TDD		
	Config 3		SR.2.1 TDD		

Parameter		Unit	Cell 1		
			T1	T2	T3
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD		
	Config 2		CCR.1.1 TDD		
	Config 3		CCR.2.1 TDD		
RMSI CORESET parameters	Config 1		CR.1.1 FDD		
	Config 2		CR.1.1 TDD		
	Config 3		CR.2.1 TDD		
OCNG Patterns	Config 1,2		OP.1 Note 5		
	Config 3,		OP.1 Note 6		
SSB Configuration	Config 1,2		SSB.1 FR1		
	Config 3		SSB.2 FR1		
CSI-RS configuration for CSI reporting (Note 8)	Config 1		CSI-RS.1.1 FDD		
	Config 2		CSI-RS.1.1 TDD		
	Config 3		CSI-RS.2.1 TDD		
SMTC configuration			SMTC.1		
reportConfigType			periodic		
reportQuantity			cri-RI-PMI-CQI		
CSI reporting periodicity	Config 1,2	slot	5		
	Config 3		10		
CSI reporting offset	Config 1,2	slot	3		
	Config 3		5		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	Config 1,2	dBm/SCS	-104		
	Config 3		-101		
$\hat{E}_s / I_{ot}$		dB	17		
$\hat{E}_s / N_{oc}$		dB	17		
SS-RSRP Note3	Config 1,2	dBm/SCS	-87		
	Config 3		-84		
SCH_RP Note 3		dBm/15 kHz	-87		
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96		
	Config 3	dBm/ 38.16 MHz	-52.87		
Propagation condition		-	AWGN		
Correlation Matrix and Antenna Configuration		-	2x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.

NOTE 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.

NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.

NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.

NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured $BW_{channel}$.

NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in TS 38.214 [26] clause 5.2.2.5.

Table A.6.5.3.1.1-4: Cell specific test parameters for NR SCell for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 2		
			T1	T2	T3
Duplex mode	Config$_{SCell}$ 1		FDD		
	Config$_{SCell}$ 2,3		TDD		
TDD configuration	Config$_{SCell}$ 1		Not applicable		
	Config$_{SCell}$ 2		TDDConf.1.1		
	Config$_{SCell}$ 3		TDDConf.2.1		
$BW_{channel}$	Config$_{SCell}$ 1,2	MHz	Note 7		
	Config$_{SCell}$ 3		Note 7		
$BW_{occupied}$	Config$_{SCell}$ 1,2	RB	52 Note 5		
	Config$_{SCell}$ 3		106 Note 6		
Initial BWP configuration			DLBWP.0.1		
TCI state			TCI.State.0		
TRS Configuration	Config$_{SCell}$ 1		TRS.1.1 FDD		
	Config$_{SCell}$ 2		TRS.1.1 TDD		
	Config$_{SCell}$ 3		TRS.1.2 TDD		
PDSCH Reference measurement channel	Config$_{SCell}$ 1		N/A		
	Config$_{SCell}$ 2		N/A		
	Config$_{SCell}$ 3		N/A		
Dedicated CORESET parameters	Config$_{SCell}$ 1		N/A		
	Config$_{SCell}$ 2		N/A		
	Config$_{SCell}$ 3		N/A		
RMSI CORESET parameters	Config$_{SCell}$ 1		N/A		
	Config$_{SCell}$ 2		N/A		
	Config$_{SCell}$ 3		N/A		
OCNG Patterns	Config$_{SCell}$ 1,2		OP.1 Note 5		
	Config$_{SCell}$ 3,		OP.1 Note 6		
SSB Configuration	Config$_{SCell}$ 1,2		SSB.1 FR1		
	Config$_{SCell}$ 3		SSB.2 FR1		
CSI-RS configuration for CSI reporting Note 8	Config$_{SCell}$ 1		CSI-RS.1.1 FDD		
	Config$_{SCell}$ 2		CSI-RS.1.1 TDD		
	Config$_{SCell}$ 3		CSI-RS.2.1 TDD		
SMTC configuration			SMTC.1		
reportConfigType			N/A		
reportQuantity			N/A		
CSI reporting periodicity	Config$_{SCell}$ 1,2	slot	N/A		
	Config$_{SCell}$ 3		N/A		
CSI reporting offset	Config$_{SCell}$ 1,2	slot	N/A		
	Config$_{SCell}$ 3		N/A		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	Config$_{SCell}$ 1,2	dBm/SCS	-104		
	Config$_{SCell}$ 3		-101		
$\hat{E}_s / I_{ot}$		dB	17		
$\hat{E}_s / N_{oc}$		dB	17		
SS-RSRP Note3	Config$_{SCell}$ 1,2	dBm/SCS	-87		
	Config$_{SCell}$ 3		-84		
SCH_RP Note 3		dBm/15 kHz	-87		
Io Note3	Config$_{SCell}$ 1,2	dBm/ 9.36 MHz	-58.96		
	Config$_{SCell}$ 3	dBm/ 38.16 MHz	-52.87		
Propagation condition		-	AWGN		
Correlation Matrix and Antenna Configuration			2x2 Low		

Parameter	Unit	Cell 2		
		T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.				
NOTE 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.				
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.				
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.				
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.				
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in clause 5.2.2.5 in TS 38.214 [26].				

A.6.5.3.1.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after at least one CSI-RS transmission occasion for channel measurement plus n_{CSI_ref} slots, as defined in clause 5.2.2.5 in TS 38.214 [26], and reporting after slot ($n + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption.

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot $n + \frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, $T_{activation_time} = T_{FirstSSB} + 5ms$, as defined in clause 8.3.

During T3 the UE shall stop sending CSI reports for SCell at latest in a slot $m + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell during SCell activation shall not happen outside the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{interruption}$, as defined in clause 8.3.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to $m + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.6.5.3.2 SCell Activation and deactivation of known SCell in FR1 in non-DRX for 640 ms SCell measurement cycle

A.6.5.3.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.6.5.3.1.1. The supported test configurations are the same as defined in clause A.6.5.3.1.1. The test parameters are the same except those described in the following clause. The listed parameter values in tables A.6.5.3.2.1-1 will replace the values of corresponding parameters in tables A.6.5.3.1.1-1.

Table A.6.5.3.2.1-1: General test parameters for known FR1 SCell activation case, 640 ms SCell measurement cycle

Parameter	Unit	Value	Comment
SCell measurement cycle (measCycleSCell)	ms	640	

A.6.5.3.2.2 Test Requirements

The test requirements defined in clause A.6.5.3.1.2 shall apply to this test case, except $T_{activation_time}$ will be replaced with the value $T_{FirstSSB_MAX} + T_{rs} + 5$ ms.

A.6.5.3.3 SCell Activation and deactivation of unknown SCell in FR1 in non-DRX

A.6.5.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell in FR1 is known by the UE at the time of activation.

The supported test configurations are shown in table A.6.5.3.1.1-1 and table A.6.5.3.1.1-1A. The test parameters are given in table A.6.5.3.1.1-2 and cell-specific parameters in table A.6.5.3.1.1-3. The listed parameter values in table A.6.5.3.3.1-1 will replace the values of corresponding parameters in table A.6.5.3.1.1-2. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1, but is not aware of Cell 2. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot n + $\frac{T_{\mathrm{HARQ}}+T_{\mathrm{activation_time}}+T_{\mathrm{CSI_Reporting}}}{\mathrm{NR\ slot\ length}}$, as defined in clause 8.3. The UE shall start reporting CSI in PCell after at least one CSI-RS transmission occasion for channel measurement plus n_{CSI_ref} slots, as defined in 5.2.2.5 in [26], and reporting after slot $n + \frac{T_{\mathrm{HARQ}}+3\ ms}{\mathrm{NR\ slot\ length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot $n + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot m + $\frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3, and The starting point of any PCell interruption due to the deactivation shall occur in the slot m + 1 + $\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to m + 1 + $\frac{\mathrm{T_{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.6.5.3.3.1-1: General test parameters for unknown FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment

T1	ms	100	During this time the PCell shall be known and the SCell configured, but not detected.

A.6.5.3.3.2 Test Requirements

The test requirements defined in clause A.6.5.3.1.2 shall apply to this test case, except $T_{activation_time}$ will be replaced with the value $T_{FirstSSB_MAX} + T_{SMTC_MAX} + 2*T_{rs} + 5$ ms as defined in clause 8.3.

A.6.5.3.4 Direct SCell activation at SCell addition of known SCell in FR1

A.6.5.3.4.1 Test Purpose and Environment

The purpose of this test is to verify fulfillment of direct SCell activation delay and interruption requirements at SCell addition as defined in clause 8.3.4 and 8.2.2, respectively. The supported test configurations for NR PCell are shown in table A.6.5.3.4.1-1. The supported test configurations for NR SCell are shown in table A.6.5.3.4.1-1A. Test configuration for NR PCell and test configuration for NR SCell are chosen independently.

The test scenario comprises one PCell (Cell 1) and one SCell (Cell 2) as outlined in table A.6.5.3.4.1-2. Cell-specific parameters are provided in table A.6.5.3.4.1-3 and table A.6.5.3.4.1-4.

The test consists of two successive time periods with duration T1 and T2, respectively. There are two carriers, each with one cell. Cell 1 (PCell) is on RF channel 1 (PCC), and Cell 2 (SCell) is on RF channel 2 (SCC). Cell 1 and Cell 2 both operate according to one of the configurations in table A.6.5.3.4.1-1 and table A.6.5.3.4.1-1A respectively.

Before the test starts the UE is connected to Cell 1 on RF channel 1. The UE is only monitoring RF channel 1 and is not aware of Cell 2 on RF channel 2.

The UE is continuously scheduled in PCell throughout the test.

At the beginning of T1 the UE is configured to measure RF channel 2 in measurement gaps. During T1, the UE detects and measures Cell 2 on RF channel 2, and sends a measurement report containing Cell 2 to the test equipment. After having received a measurement report containing Cell 2, the test equipment deconfigures the measurement gaps and thereafter sends a RRC connection reconfiguration message to the UE by which it configures the SCell (Cell 2) in activated state (*sCellState* is set to *activated*). The time between reception of the last measurement report carrying SCell and transmission of the RRC connection reconfiguration message directly activating SCell is kept short enough to allow the SCell to remain known to the UE.

Time period T2 starts when the UE receives the RRC connection reconfiguration message at the UE antenna connector. The corresponding slot at which the message is received at the UE antenna connector is denoted *n*. The UE shall complete activation of the SCell no later than in slot $n + \frac{N_{direct}}{\text{NR slot length}}$, as specified in clause 8.3.4. From slot $n + \frac{N_{direct}}{\text{NR slot length}}$ and onwards the UE shall report valid CSI both for PCell and SCell.

The test equipment verifies the activation time by counting the slots between the RRC connection reconfiguration message is sent and until CSI report with non-zero CQI for both PCell and SCell is received.

The test equipment verifies that interruptions on other serving cells are within the requirements by counting ACK/NACKs transmitted in PCell.

Table A.6.5.3.4.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.4.1-1A: Supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration.	

Table A.6.5.3.4.1-2: General test parameters

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2	Two NR radio channels are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Inter-frequency neighbor cell (SCell to-be)		Cell 2	Inter-frequency neighbor cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Measurement gap pattern		gp0	Measurement gap is used during parts of time period T1 for detection of Cell 2.
CSI reporting periodicity	ms	2	CSI reporting periodicity for periodic reporting of CQI for PCell and, when added, SCell.
SCell measurement cycle (measCycleSCell)	ms	160	Measurement cycle for SCell does not come into effect in direct activation at SCell addition.
Timing offset between Cell 1 and Cell 2	μs	≤ MRTD	The value of maximum timing offset depends upon the carrier aggregation scenario.
T1	s	7	During this time period the PCell shall be known and Cell 2 shall be detected as an inter-frequency neighbor cell.
T2	s	1	During this time period Cell 2 shall be configured and directly activated as SCell.
A3-offset	dB	-15	
THARQ	ms	k1×NR slot length	k1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by dl-DataToUL-ACK if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
TCSI_Reporting	ms	2	the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
k	ms	$k_1 + 3 \cdot N_{\text{slot}}^{\text{subframe},\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.6.5.3.4.1-3: NR Cell specific test parameters

Parameter		Unit	Cell 1	
			T1	T2
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL		DLBWP.0.1	
	Initial UL		ULBWP.0.1	
	Dedicated DL		DLBWP.1.1	
	Dedicated UL		ULBWP.1.1	
TCI state			TCI.State.0	
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	

Parameter		Unit	Cell 1	
			T1	T2
TRS Configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
RMSI CORESET parameters	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
OCNG Pattern			OP.1	
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration			SMTC.1	
reportConfigType			periodic	
reportQuantity			cri-RI-PMI-CQI	
CSI reporting periodicity	Config 1,2	slot	5	
	Config 3		10	
CSI reporting offset	Config 1,2	slot	3	
	Config 3		5	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note1				
EPRE ratio of OCNG to OCNG DMRS Note1				
N_{oc} Note2	Config 1,2	dBm/SCS	-104	
	Config 3		-101	
$\hat{E}_s/I_{ot}$		dB	17	
$\hat{E}_s/N_{oc}$		dB	17	
SS-RSRP Note3	Config 1,2	dBm/SCS	-87	
	Config 3		-84	
Io Note3	Config 1,2	dBm/9.36 MHz	-59.0	
	Config 3	dBm/38.16 MHz	-52.9	
Propagation condition			AWGN	
Correlation Matrix and Antenna Configuration			1x2 Low	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP, SCH_RP, and Io levels have been derived from other parameters for information purpose. They are not settable parameters themselves.

Table A.6.5.3.4.1-4: NR Cell specific test parameters for NR Scell

Parameter		Unit	Cell 2	
			T1	T2
Duplex mode	$Config_{SCell}$ 1		FDD	
	$Config_{SCell}$ 2,3		TDD	
TDD configuration	$Config_{SCell}$ 2		TDDConf.1.1	
	$Config_{SCell}$ 3		TDDConf.2.1	
$BW_{channel}$	$Config_{SCell}$ 1,2	MHz	10: $N_{PRB,c}$ = 52	
	$Config_{SCell}$ 3		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL		N/A	DLBWP.0.1
	Initial UL			N/A
	Dedicated DL			DLBWP.1.1
	Dedicated UL			N/A

Parameter		Unit	Cell 2	
			T1	T2
TCI state			N/A	TCI.State.0
CSI-RS configuration for CSI reporting	$Config_{SCell}$ 1		N/A	CSI-RS.1.1 FDD
	$Config_{SCell}$ 2			CSI-RS.1.1 TDD
	$Config_{SCell}$ 3			CSI-RS.2.1 TDD
TRS Configuration	$Config_{SCell}$ 1		N/A	TRS.1.1 FDD
	$Config_{SCell}$ 2			TRS.1.1 TDD
	$Config_{SCell}$ 3			TRS.1.2 TDD
PDSCH Reference measurement channel	$Config_{SCell}$ 1		N/A	SR.1.1 FDD
	$Config_{SCell}$ 2			SR.1.1 TDD
	$Config_{SCell}$ 3			SR.2.1 TDD
Dedicated CORESET parameters	$Config_{SCell}$ 1		N/A	CCR.1.1 FDD
	$Config_{SCell}$ 2			CCR.1.1 TDD
	$Config_{SCell}$ 3			CCR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell}$ 1		N/A	
	$Config_{SCell}$ 2			
	$Config_{SCell}$ 3			
OCNG Pattern			OP.1	
SSB Configuration	$Config_{SCell}$ 1,2		SSB.1 FR1	
	$Config_{SCell}$ 3		SSB.2 FR1	
SMTC configuration			SMTC.1	
reportConfigType			N/A	
reportQuantity			N/A	
CSI reporting periodicity	$Config_{SCell}$ 1,2	slot	N/A	
	$Config_{SCell}$ 3		N/A	
CSI reporting offset	$Config_{SCell}$ 1,2	slot	N/A	
	$Config_{SCell}$ 3		N/A	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note1				
EPRE ratio of OCNG to OCNG DMRS Note1				
N_{oc} Note2	$Config_{SCell}$ 1,2	dBm/SCS	-104	
	$Config_{SCell}$ 3		-101	
$\hat{E}_s/I_{ot}$		dB	17	
$\hat{E}_s/N_{oc}$		dB	17	
SS-RSRP Note3	$Config_{SCell}$ 1,2	dBm/SCS	-87	
	$Config_{SCell}$ 3		-84	
Io Note3	$Config_{SCell}$ 1,2	dBm/9.36 MHz	-59.0	
	$Config_{SCell}$ 3	dBm/38.16 MHz	-52.9	
Propagation condition			AWGN	
Correlation Matrix and Antenna Configuration			1x2 Low	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP, SCH_RP, and Io levels have been derived from other parameters for information purpose. They are not settable parameters themselves.

A.6.5.3.4.2 Test Requirements

The UE shall complete the direct activation of the SCell no later than at slot $n + \frac{N_{direct}}{NR\ slot\ length}$.

The UE shall report non-zero CQI for SCell from slot $n + \frac{N_{direct}}{NR\ slot\ length}$ and onwards throughout time period T2.

The interruption on PCell during direct activation of the SCell shall occur within the interruption window specified in clause 8.3.4 and shall not exceed the length specified in clause 8.2.2.2.11.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.3.5 Direct SCell activation at handover with known SCell in FR1

A.6.5.3.5.1 Test Purpose and Environment

This test is to verify the requirement for the FDD-FDD and TDD-TDD intra-frequency handover with direct SCell activation requirements specified in subclause 8.3.5.

Supported test configurations for NR PCell are shown in table A.6.5.3.5.1-1. Supported test configurations for NR SCell are shown in table A.6.5.3.5.1-1A. Test configuration for NR PCell and test configuration for NR SCell are chosen independently. Both handover with direct SCell activation requirements are tested by using the parameters in table A.6.5.3.5.1-2, A.6.5.3.5.1-3 and A.6.5.3.5.1-4.

The test scenario comprises of two NR carriers and 3 cells as given in tables A.6.5.3.5.1-1 and A.6.5.3.5.1-2. The test consists of three successive time periods, with time durations of T1, T2, and T3 respectively.

At the start of time duration T1, the UE is in connected mode with PCell and SCell 1 (Cell 2) is in activated state and UE is reporting CQI for both PCell and SCell 1.

Time period T2 starts when UE receives a handover command to Cell 3 that also activates SCell 1 (Cell 2). This is done using an *RRCReconfiguration* message with parameter *sCellState* set to *activated* for the SCell 1 (Cell 2). The message is sent from the test equipment to the UE and is received in a subframe # denoted n at the UE antenna connector. The UE shall accomplish the activation of the SCell no later than subframe ($n + N_{direct}$).

Time period T3 starts at ($n + N_{direct}$), at which point UE shall be reporting a valid CQI for both PCell and SCell 1.

Table A.6.5.3.5.1-1: Intra-frequency handover with direct SCell activation from FR1 to FR1 test configurations for NR PCell

Config	Description
1	Source PCell: NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode Target PCell: NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	Source PCell: NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode Target PCell: NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	Source PCell: NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode Target PCell: NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.5.1-1A: Intra-frequency handover with direct SCell activation from FR1 to FR1 test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration.	

Table A.6.5.3.5.1-2: General test parameters Intra-frequency handover with direct SCell activation from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	PCell		Cell 1	
	SCell		Cell 2	
	Target cell		Cell 3	
Final condition	PCell		Cell 3	
	SCell		Cell 2	
	neighbour cell		Cell 1	

Access Barring Information	-	Not Sent	No additional delays in random access procedure.
PRACH configuration index		FR1 PRACH configuration 1	As specified in table 6.3.3.2-3 in TS 38.211 [6]
Time offset between cells		3 μs	Synchronous cells
T1	s	5	UE is in connected mode with PCell and SCell 1 (Cell 2) is in activated state. UE receives a handover command
T2	s	N_{direct}	UE shall accomplish the activation of the SCell
T3	s	1	
A3-offset	dB	-15	
T_{HARQ}	slot	k	k is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
$T_{CSI_Reporting}$	ms	2	the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
k	ms	$k_1 + 3 \cdot N_{slot}^{subframe,\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.6.5.3.5.1-3: Cell specific test parameters for NR PCell for NR FR1-FR1 Intra-frequency handover with direct SCell activation test case

Parameter		Unit	Cell 1			Cell 3		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			1		
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD					
	Config 2		SR.1.1 TDD					
	Config 3		SR.2.1 TDD					
CORESET Reference Channel	Config 1		CR.1.1 FDD					
	Config 2		CR.1.1 TDD					
	Config 3		CR.2.1 TDD					
TRS configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
OCNG Patterns			OCNG pattern OP.1					
SMTC Configuration			SMTC pattern SMTC.1					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					

Parameter		Unit	Cell 1			Cell 3		
			T1	T2	T3	T1	T2	T3
BWP configuraiton	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD					
	Config 2		CSI-RS.1.1 TDD					
	Config 3		CSI-RS.2.1 TDD					
reportConfigType			periodic					
reportQuantity			cri-RI-PMI-CQI					
CSI reporting periodicity	Config 1,2	slot	5					
	Config 3		10					
CSI reporting offset	Config 1,2	slot	3					
	Config 3		5					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15kHz	-98					
N_{oc} Note2	Config 1,2	dBm/SCS	-98					
	Config 3		-95					
$\hat{E}_s / I_{ot}$		dB	8	8	8	8	8	8
$\hat{E}_s / N_{oc}$		dB	8	8	8	8	8	8
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-90	-90	-90
	Config 3	dBm/SCS	-87	-87	-87	-87	-87	-87
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.71	-58.71	-58.71	-58.71	-58.71	-58.71
	Config 3	dBm/ 38.16 MHz	-52.60	-52.60	-52.60	-52.60	-52.60	-52.60
Propagation condition		-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.5.3.5.1-4: Cell specific test parameters for NR SCell for NR FR1-FR1 Intra-frequency handover with direct SCell activation test case

Parameter		Unit	Cell 2		
			T1	T2	T3
NR RF Channel Number			2		
Duplex mode	$Config_{SCell}$ 1		FDD		
	$Config_{SCell}$ 2,3		TDD		
TDD configuration	$Config_{SCell}$ 1		Not Applicable		
	$Config_{SCell}$ 2		TDDConf.1.1		
	$Config_{SCell}$ 3		TDDConf.2.1		
$BW_{channel}$	$Config_{SCell}$ 1	MHz	10: $N_{PRB,c}$ = 52		
	$Config_{SCell}$ 2		10: $N_{PRB,c}$ = 52		
	$Config_{SCell}$ 3		40: $N_{PRB,c}$ = 106		
BWP BW	$Config_{SCell}$ 1	MHz	10: $N_{PRB,c}$ = 52		
	$Config_{SCell}$ 2		10: $N_{PRB,c}$ = 52		
	$Config_{SCell}$ 3		40: $N_{PRB,c}$ = 106		
DRX Cycle		ms	Not Applicable		
PDSCH Reference measurement channel	$Config_{SCell}$ 1		SR.1.1 FDD		
	$Config_{SCell}$ 2		SR.1.1 TDD		
	$Config_{SCell}$ 3		SR.2.1 TDD		
CORESET Reference Channel	$Config_{SCell}$ 1		CR.1.1 FDD		
	$Config_{SCell}$ 2		CR.1.1 TDD		
	$Config_{SCell}$ 3		CR.2.1 TDD		
TRS configuration	$Config_{SCell}$ 1		TRS.1.1 FDD		
	$Config_{SCell}$ 2		TRS.1.1 TDD		
	$Config_{SCell}$ 3		TRS.1.2 TDD		
OCNG Patterns			OCNG pattern OP.1		
SMTC Configuration			SMTC pattern SMTC.1		
SSB Configuration	$Config_{SCell}$ 1,2		SSB.1 FR1		
	$Config_{SCell}$ 3		SSB.2 FR1		
PDSCH/PDCCH subcarrier spacing	$Config_{SCell}$ 1,2	kHz	15 kHz		
	$Config_{SCell}$ 3		30 kHz		
PUCCH/PUSCH subcarrier spacing	$Config_{SCell}$ 1,2	kHz	15 kHz		
	$Config_{SCell}$ 3		30 kHz		
PRACH configuration			FR1 PRACH configuration 1		
BWP configuraiton	Initial DL BWP		DLBWP.0.1		
	Dedicated DL BWP		DLBWP.1.1		
	Initial UL BWP		ULBWP.0.1		
	Dedicated UL BWP		ULBWP.1.1		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2		dBm/15kHz	-98		
N_{oc} Note2	$Config_{SCell}$ 1,2	dBm/SCS	-98		
	$Config_{SCell}$ 3		-95		
$\hat{E}_s / I_{ot}$		dB	8	8	8
$\hat{E}_s / N_{oc}$		dB	8	8	8
SSB_RP	$Config_{SCell}$ 1,2	dBm/SCS	-90	-90	-90
	$Config_{SCell}$ 3	dBm/SCS	-87	-87	-87
Io Note3	$Config_{SCell}$ 1,2	dBm/ 9.36 MHz	-61.41	-61.41	-61.41
	$Config_{SCell}$ 3	dBm/ 38.16 MHz	-55.31	-55.31	-55.31
Propagation condition		-	AWGN		

Parameter	Unit	Cell 2		
		T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.5.3.5.2 Test Requirements

The UE shall be capable to transmit valid CSI report for the directly activated SCell 1 no later than in subframe $n+N_{direct}$.

The rate of correct observed SCell 1 direct activation delay during repeated tests shall be at least 90 %.

NOTE: The SCell activation delay, N_{direct}, can be expressed as: $N_{direct} = T_{RRC_process} + T_{interrupt} + T_2 + T_3 + T_{activation_time} + T_{CSI_Reporting}$ - 3 ms, where:

$T_{RRC_Process}$: RRC procedure delay defined in clause 12 of TS 38.331 [2],

$T_{interrupt}$: Interruption time during handover as specified in clause 6.1.1,

T_2: Delay from slot $n + \frac{T_{RRC_Process} + T_{interrupt}}{\text{NR slot length}}$ until UE has obtained a valid TA command for the target PCell,

T_3: Delay for applying the received TA for uplink transmission in the target PCell, and greater than or equal to k+1 slot, where k is defined in clause 4.2 in TS 38.213,

$T_{activation_time}$ and $T_{CSI_Reporting}$ are specified in clause 8.3.2, where the following definitions of $T_{FirstSSB}$ and $T_{FirstSSB_MAX}$ as defined in section 8.3.5 shall apply:

- $T_{FirstSSB}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $(T_{RRC_Process} + T_{interrupt} + T_2 + T_3)/(NR\ slot\ length)$
- $T_{FirstSSB_MAX}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $(T_{RRCProcess} + T_{interrupt} + T_2 + T_3)/(NR\ slot\ length)$

This gives a total of $N_{direct} = 10 + 52 + T_{IU} + T_2 + T_3 + T_{activation_time} + T_{CSI_Reporting}$ - 3 ms = 62 + 10 + 13 + 6 + 20 + 2 - 3 = 94 ms for test configurations 1 and 2.

This gives a total of $N_{direct} = 10 + 52 + T_{IU} + T_2 + T_3 + T_{activation_time} + T_{CSI_Reporting}$ - 3 ms = 62 + 10 + 13 + 6 + 20 + 2 - 3 = 94 ms for test configuration 3.

During T3 the UE shall send valid CSI reports for PCell and SCell 1 with non-zero CQI index and continue to send CSI reports for PCell and SCell 1 (Cell 2) with non-zero CQI index until the end of T3.

All of the above test requirements shall be fulfilled in order for the observed SCell 1 direct activation delay to be counted as correct.

A.6.5.3.6 PUCCH SCell Activation and deactivation of known SCell in FR1

A.6.5.3.6.1 Test Purpose and Environment

The purpose of this test is to verify that the PUCCH SCell activation and deactivation times are within the requirements stated in clause 8.3, when the PUCCH SCell in FR1 is known by the UE at the time of activation.

The supported test configurations are shown in table A.6.5.3.6.1-1 below. The test parameters are given in tables A.6.5.3.6.1-2 and cell-specific parameters in table A.6.5.3.6.1-3 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. Cell 1 is the PCell in primary Timing Advance Group (pTAG) and Cell 2 is the PUCCH SCell in the secondary Timing Advance Group (sTAG). Before the test starts the UE is connected to Cell 1,

but is not aware of Cell 2. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

The test consists of two sub tests. In Test 1, UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment for sTAG. In Test 2, the TimeAlignmentTimer of sTAG expires before receiving the activation command.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the PUCCH SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. In Test 1, the UE shall be able to report valid CSI on for the activated PUCCH SCell on PUCCH SCell at latest in slot $n+\frac{T_{HARQ}+T_{activation_time}+\max((T_{First_available_CSI}+T_{CSI_processing}),\ 3*T_{target_PL-RS})+T_{CSI_Reporting_after}}{NR\ slot\ length}$, as defined in clause 8.3. In Test 2, the UE shall be able to report valid CSI for the activated PUCCH SCell on PUCCH SCell at latest in slot $n + \frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$, as defined in clause 8.3.

Any PCell interruption due to activation of PUCCH SCell shall occur in the slot $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

Time period T3 starts when a MAC message for deactivation of PUCCH SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the PUCCH SCell in a slot $m + \frac{T_{\text{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3, and The starting point of any PCell interruption due to the deactivation shall occur in the slot $m + 1 + \frac{T_{\text{HARQ}}}{NR\ slot\ length}$ to $m + 1 + \frac{T_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of PUCCH SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the PUCCH SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the PUCCH SCell deactivation command is sent until CQI reporting for PUCCH SCell is discontinued.

Table A.6.5.3.6.1-1: known FR1 SCell activation test configurations

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.6.1-2: General test parameters for known FR1 SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	μs	0	

Parameter	Unit	Value	Comment
Time alignment error between cell2 and cell1	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
TimeAlignmentTimer	ms	500	Test 1 and Test 2
T1	s	7	During this time the PCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.6.5.3.6.1-3: Cell specific test parameters for known FR1 SCell activation case

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1,2	MHz	Note 7					
	Config 3		Note 7					
$BW_{occupied}$	Config 1,2	RB	52 Note 5					
	Config 3		106 Note 6					
Initial BWP configuration			DLBWP.0.2					
TCI state			TCI.State.0					
TRS Configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			-		
	Config 2		SR.1.1 TDD			-		
	Config 3		SR.2.1 TDD			-		
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD			-		
	Config 2		CCR.1.1 TDD			-		
	Config 3		CCR.2.1 TDD			-		
RMSI CORESET parameters	Config 1		CR.1.1 FDD			-		
	Config 2		CR.1.1 TDD			-		
	Config 3		CR.2.1 TDD			-		
OCNG Patterns	Config 1,2		OP.1 Note 5					
	Config 3,		OP.1 Note 6					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
CSI-RS configuration for CSI reporting (Note 8)	Config 1		CSI-RS.1.1 FDD					
	Config 2		CSI-RS.1.1 TDD					
	Config 3		CSI-RS.2.1 TDD					
SMTC configuration			SMTC.1					
reportConfigType			periodic					
reportQuantity			cri-RI-PMI-CQI					

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
CSI reporting periodicity for PCell	Config 1,2	slot	5			-		
	Config 3		10			-		
CSI reporting offset for PCell	Config 1,2	slot	3			-		
	Config 3		5			-		
CSI reporting periodicity for SCell	Config 1,2	slot	-			5		
	Config 3		-			10		
CSI reporting offset for SCell	Config 1,2	slot	-			2		
	Config 3		-			4		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	Config 1,2	dBm/SCS	-104					
	Config 3		-101					
$\hat{E}_s / I_{ot}$		dB	17					
$\hat{E}_s / N_{oc}$		dB	17					
SS-RSRP Note3	Config 1,2	dBm/SCS	-87					
	Config 3		-84					
SCH_RP Note 3		dBm/15 kHz	-87					
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96					
	Config 3	dBm/ 38.16 MHz	-52.87					
Propagation condition		-	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in clause 5.2.2.5 in TS 38.214 [26].

A.6.5.3.6.2 Test Requirements

In Test1, during T2 the UE shall start sending CSI reports for PUCCH SCell with non-zero CQI index at latest in a slot $n+\frac{T_{HARQ}+T_{activation_time}+\max((T_{First_available_CSI}+T_{CSI_processing}),\ 3*T_{target_PL-RS})+T_{CSI_Reporting_after}}{NR\ slot\ length}$, $T_{activation_time} = T_{FirstSSB} + 5ms$, as defined in clause 8.3. In Test2, during T2 the UE shall start sending CSI reports for PUCCH SCell with non-zero CQI index at latest in a slot $n + \frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$, $T_{activation_time} = T_{FirstSSB} + 5ms$, as defined in clause 8.3.

During T3 the UE shall stop sending CSI reports for PUCCH SCell at latest in a slot $m + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell / PSCell during PUCCH SCell activation shall not happen outside the slot $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3.

During T3 the starting point of interruption of PCell during PUCCH SCell deactivation shall not happen outside the slot $\text{m} + 1 + \frac{\text{T}_{\text{HARQ}}}{NR\ slot\ length}$ to $\text{m} + 1 + \frac{\text{T}_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.18.

All of the above test requirements shall be fulfilled in order for the observed PUCCH SCell activation delay and PUCCH SCell deactivation delay to be counted as correct. The rate of correct observed PUCCH SCell activation delay and PUCCH SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in slot $\text{n}+\frac{T_{HARQ}+T_{activation_time}+\max\left((T_{First_available_CSI}+T_{CSI_processing}),\ 3*T_{target_PL-RS}\right)+T_{CSI_Reporting_after}}{NR\ slot\ length}$ in Test 1 or in slot $\text{n} + \frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$ in Test 2 as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.6.5.3.7 SCell Activation and deactivation of unknown SCell in FR1 in non-DRX

A.6.5.3.7.1 Test Purpose and Environment

The purpose of this test is to verify that the PUCCH SCell activation and deactivation times are within the requirements stated in clause 8.3, when the PUCCH SCell in FR1 is unknown by the UE at the time of activation. In this test, UE shall support cross PUCCH group CSI reporting capability *csi-ReportingCrossPUCCH-Grp-r16*.

The supported test configurations are shown in table A.6.5.3.7.1-1 below. The test parameters are given in table A.6.5.3.7.1-2 and cell-specific parameters in table A.6.5.3.7.1-3 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two NR carriers, each with one cell. Cell 1 is the PCell in primary Timing Advance Group (pTAG) and Cell 2 is the PUCCH SCell in the secondary Timing Advance Group (sTAG). Both cells have constant signal levels throughout the test.

There are two sub tests in this section.

For Test 1 (valid TA case), UE is provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment for sTAG.

For Test 2 (invalid TA case), TimeAlignmentTimer of sTAG expires before UE receives the activation command

Before the test starts the UE is connected to PCell, but is not aware of PUCCH SCell. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell becomes configured on NR. During T1 the PUCCH SCell is powered off and UE is not aware of PUCCH SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI on PUCCH SCell for the activated PUCCH SCell at latest in

slot $\text{n}+\frac{T_{HARQ}+T_{activation_time}+\max\left((T_{First_available_CSI}+T_{CSI_processing}),\ 3*T_{target_PL-RS}\right)+T_{CSI_Reporting_after}}{NR\ slot\ length}$ for Test 1, or

slot $\text{n} + \frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$ for Test 2

Note: $T_{delay_PUCCH_SCell} = T_{activation_time} + \max\left((T_{First_available_CSI} + T_{CSI_processing}), (T1+T2+T3), 3*T_{target_PL-RS}\right) + T_{CSI_reporting_after}$, as defined in clause 8.3,

Any PCell interruption due to activation of PUCCH SCell shall occur in the slot $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{\text{HARQ}}+3\text{ms}+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

Time period T3 starts when a MAC message for deactivation of PUCCH SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the PUCCH SCell in a slot $m + \frac{T_{HARQ}+3ms}{NR\ slot\ length}$, as defined in clause 8.3, and the starting point of any PCell interruption due to the deactivation shall occur in the slot $m + 1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to $m + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of PUCCH SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the PUCCH SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the PUCCH SCell deactivation command is sent until CQI reporting for PUCCH SCell is discontinued.

Table A.6.5.3.7.1-1: unknown FR1 PUCCH SCell activation in non-DRX for 160 ms SCell measurement cycle supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.7.1-2: General test parameters for unknown FR1 PUCCH SCell activation case, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated PUCCH secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	µs	0	
Time alignment error between cell2 and cell1	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
TimeAlighmentTimer	ms	500	Identify the whether TA information is valie or not
T1	s	[7]	During this time the PCell shall be known and the PUCCH SCell configured and detected.
T2	s	[1]	During this time the UE shall activate the PUCCH SCell.
T3	s	[1]	During this time the UE shall deactivate the PUCCH SCell.
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.

Parameter	Unit	Value	Comment
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.6.5.3.7.1-3: Cell specific test parameters for unknown FR1 PUCCH SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1,2	MHz	Note 7					
	Config 3		Note 7					
$BW_{occupied}$	Config 1,2	RB	52 Note 5					
	Config 3		106 Note 6					
Initial BWP configuration			DLBWP.0.2					
TCI state			TCI.State.0					
TRS Configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			SR.1.1 FDD		
	Config 2		SR.1.1 TDD			SR.1.1 TDD		
	Config 3		SR.2.1 TDD			SR.2.1 TDD		
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD			CCR.1.1 FDD		
	Config 2		CCR.1.1 TDD			CCR.1.1 TDD		
	Config 3		CCR.2.1 TDD			CCR.2.1 TDD		
RMSI CORESET parameters	Config 1		CR.1.1 FDD			N/A		
	Config 2		CR.1.1 TDD			N/A		
	Config 3		CR.2.1 TDD			N/A		
OCNG Patterns	Config 1,2		OP.1 Note 5					
	Config 3,		OP.1 Note 6					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
CSI-RS configuration for CSI reporting (Note 8)	Config 1		CSI-RS.1.1 FDD					
	Config 2		CSI-RS.1.1 TDD					
	Config 3		CSI-RS.2.1 TDD					
SMTC configuration			SMTC.1					
reportConfigType			periodic					
reportQuantity			cri-RI-PMI-CQI					
CSI reporting (CQI index non 0) periodicity for PUCCH SCell	Config 1,2	slot	N/A			5		
	Config 3		N/A			10		
CSI reporting (CQI index non 0) offset for PUCCH SCell	Config 1,2	slot	N/A			4		
	Config 3		N/A			6		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	Config 1,2	dBm/SCS	-104			N/A	-104	-104

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
	Config 3		-101			N/A	-101	-101
$\hat{E}_s/I_{ot}$		dB	17			-infinity	17	17
$\hat{E}_s/N_{oc}$		dB	17			-infinity	17	17
SS-RSRP Note3	Config 1,2	dBm/SCS	-87			-infinity	-87	-87
	Config 3		-84			-infinity	-84	-84
SCH_RP Note 3		dBm/15 kHz	-87			N/A	-87	-87
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96			N/A	-58.96	-58.96
	Config 3	dBm/ 38.16 MHz	-52.87			N/A	-52.87	-52.87
Propagation condition		-	AWGN			N/A	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in clause 5.2.2.5 in TS 38.214 [26].

A.6.5.3.7.2 Test Requirements

During T2, as defined in clause 8.3, the UE shall start sending CSI reports for PUCCH SCell on PUCCH SCell with non-zero CQI index at latest in

a slot $n+\frac{T_{HARQ}+T_{activation_time}+\max((T_{First_available_CSI}+T_{CSI_processing}),\ 3*T_{target_PL-RS})+T_{CSI_Reporting_after}}{NR\ slot\ length}$ for Test 1. $T_{activation_time}$ = $T_{FirstSSB_MAX}$ + T_{SMTC_MAX} + 2*T_{rs} + 5ms.

a slot $n + \frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$ for Test 2.

During T3 the UE shall stop sending CSI reports for PUCCH SCell at latest in a slot $m + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell during PUCCH SCell activation shall not happen outside the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{interruption}$, as defined in clause 8.3.

During T3 the starting point of interruption of PCell during PUCCH SCell deactivation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to $m + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.18.

All of the above test requirements shall be fulfilled in order for the observed PUCCH SCell activation delay and PUCCH SCell deactivation delay to be counted as correct. The rate of correct observed PUCCH SCell activation delay and PUCCH SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $n+\frac{T_{HARQ}+T_{activation_time}+\max((T_{First_available_CSI}+T_{CSI_processing}),\ 3*T_{target_PL-RS})+T_{CSI_Reporting_after}}{NR\ slot\ length}$ and in a slot n +

$\frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$ for Test 1 and Test 2, respectively, as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.6.5.3.8 SCell Activation and Deactivation of one FR1 known PUCCH SCell and one FR1 unknown SCell with single activation/deactivation command

A.6.5.3.8.1 Test Purpose and Environment

The purpose of this test is to verify the SCell activation and deactivation delay requirements for PUCCH SCell with multiple SCells specified in clause 8.3.13 and 8.3.15, when one configured deactivated known PUCCH SCells in FR1 and one configured unknown SCell in FR1 by the UE at the time of activation.

The supported test configurations are defined in table A.6.5.3.8.1-1 below. The test parameters are given in table A.6.5.3.8.1-2 and cell-specific parameters in table A.6.5.3.8.1-3 below.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three NR carriers. All Cells has constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCC), but is not aware of Cell 2 (PUCCH SCell) and Cell 3(SCell). The UE is monitoring the Cell 1 (PCC). The UE shall be continuously scheduled in the Cell 1 throughout the whole test. PCC, SCC of Cell 2 and SCC of Cell 3 are on different FR1 bands.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell (Cell 2) and SCell (Cell 3) become configured on radio channel 2 and 3 respectively.

A MAC message for activation of PUCCH SCell (Cell 2) and SCell (Cell 3) is sent by the test equipment 100 ms after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of PUCCH SCell (Cell 2) and SCell (Cell 3) is received at the UE antenna connector defines the start of time period T2. Immediately at beginning of T2 the transmission power of Cell 2 and Cell 3 are increased to same level as for Cell 1. The UE shall be able to report valid CSI on PCell for the activated PUCCH SCell (Cell 2) at latest in slot m + $\frac{T_{HARQ}+T_{delay_\mathrm{multiple}_SCells_PUCCH_SCell}}{NR\ slot\ length}$ and be able to report valid CSI on PCell for the activated SCell (Cell 3) at latest in slot m + $\frac{T_{HARQ}+T_{delay_\mathrm{multiple}_SCells_other_SCell}}{NR\ slot\ length}$ as defined in clause 8.3.13 provided the PUCCH SCell can be successfully detected on the first attempt.

For Cell 2 activtion, the UE shall start reporting CSI in PCell in slot $n + \frac{T_{\mathrm{HARQ}}+3\ ms}{\mathrm{NR\ slot\ length}}$ and shall report CQI index 0 (out-of-range) until the PUCCH SCell activation has been completed. For Cell 3 activtion, the UE shall start reporting CSI in PCell in slot $n + \frac{T_{\mathrm{HARQ}}+3\ ms}{\mathrm{NR\ slot\ length}}$ and shall report CQI index 0 (out-of-range) until the DL SCell activation has been completed.

Any PCell interruption due to activation of SCells (including one SCell configured with PUCCH) shall occur in the slot $m + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to slot $m + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in section 8.2.

Time period T3 starts when a MAC message for deactivation of the SCells (Cell 2 and Cell 3), sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the SCells (Cell 2 and Cell 3) at latest in slot n + $\frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$ as defined in clause 8.3. The starting point of PCell interruption due to the deactivation shall occur in the slot n + 1 + $\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to n + 1 + $\frac{\mathrm{T_{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of PUCCH SCell and DL SCell, respectively.

The test equipment verifies the PUCCH SCell activation time by counting the slots from the time when the PUCCH SCell activation command is sent until a CSI report with other than CQI index 0 is received. The test equipment verifies the DL SCell activation time by counting the slots from the time when the DL SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the PUCCH SCell deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for PUCCH SCell is discontinued. The test equipment verifies the DL SCell deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for DL SCell is discontinued.

Table A.6.5.3.8.1-1: Supported test configurations

Configuration	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.8.1-2: General test parameters for unknown FR1 SCell activation case with 2 deactivated SCells, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	Three NR radio channel (1, 2, 3) are used for this test
Active Cell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated PUCCH SCell		Cell 2	Configured deactivated PUCCH SCell on NR RF channel number 2 which is an inter-band CC to PCC of Cell 1;
Configured deactivated SCell		Cell 3	Configured deactivated SCell on NR RF channel number 3 which is an inter-band CC to PCC of Cell 1 and SCC of Cell 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell 2 timing offset to cell1	µs	0	
Cell 3 timing offset to cell1	µs	0	
Time alignment error between cell2 and cell1	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
Time alignment error between cell3 and cell1	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
SCell measurement cycle (measCycleSCell)	ms	160	
T1	ms	100	During this time the PSCell shall be known and the SCell configured, but not detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	k_1NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) TS 38.214 [26] and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
k	slot	$k_1 + 3 \cdot N_{\text{slot}}^{\text{subframe},\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.6.5.3.8.1-3: Cell specific test parameters for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 3		Cell 4	
			T2	T3	T2	T3
SSB ARFCN			Freq2		Freq3	
Duplex mode	Config 1,4		FDD			
	Config 2,3,5,6		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2,5		TDDConf.1.1			
	Config 3,6		TDDConf.2.1			
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			
	Config 2,5		10: $N_{PRB,c}$ = 52			
	Config 3,6		40: $N_{PRB,c}$ = 106			
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1			
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1			
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1			
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD	
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD		CCR.1.1 FDD	
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD		TRS.1.1 FDD	
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns			OP.1			
SMTC configuration			SMTC.1			
SSB configuration	Config 1,2,4,5		SSB.1 FR1			
	Config 3,6		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz			
	Config 3,6		30kHz			
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD			
	Config 2,5		CSI-RS.1.1 TDD			
	Config 3,6		CSI-RS.2.1 TDD			
reportConfigType	Config 1-6		periodic			
reportQuantity	Config 1-6		cri-RI-PMI-CQI			
CSI reporting periodicity	Config 1,2,4,5	slot	5		N/A	
CSI reporting offset	Config 3,6	slot	10		N/A	
	Config 1,2,4,5		2		N/A	
	Config 3,6		4		N/A	
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-104			
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-104			
	Config 3,6		-101			

Parameter		Unit	Cell 3		Cell 4	
			T2	T3	T2	T3
$\hat{E}_s/I_{ot}$		dB	17			
$\hat{E}_s/N_{oc}$		dB	17			
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87			
	Config 3,6		-84			
SCH_RP Note 3		dBm/15 kHz	-87			
Propagation condition		-	AWGN			
Io Note3	Config 1,2,4,5	dBm/ 9.36 MHz	-58.96			
	Config 3,6	dBm/ 38.16 MHz	-52.87			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.]
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.

A.6.5.3.8.2 Test Requirements

During T2, the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available uplink resource if an available uplink resource is subject to interruption. Whether CSI report in slot (m+k) was interrupted is checked by monitoring ACK/NACK sent in PCell in slot (m+k). And the UE shall be able to report valid CSI for the activated PUCCH SCell (Cell 2) at latest in slot m + $\frac{T_{HARQ}+T_{delay_multiple_SCells_PUCCH_SCell}}{NR\ slot\ length}$ and report valid CSI for the activated SCell (Cell 3) at latest in slot m + $\frac{T_{HARQ}+T_{delay_multiple_SCells_other_SCell}}{NR\ slot\ length}$ as defined in clause 8.3.13. And the PCell interruption due to activation of SCells (including one SCell configured with PUCCH) shall occur in the slot $m + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to slot $m + 1 + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in section 8.2.

During T3, the UE shall carry out deactivation of the the SCells (including one SCell configured with PUCCH) at latest in slot n + $\frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$ as defined in clause 8.3. And the starting point of PCell interruption due to the deactivation shall occur in the slot n + 1 + $\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to n + 1 + $\frac{\mathrm{T_{HARQ}}+3\mathrm{ms}}{NR\ slot\ length}$, as defined in clause 8.3.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90 %.

A.6.5.3.9 SCell Activation and deactivation of unknown PUCCH SCell and unknown DL SCell in FR1 in non-DRX

A.6.5.3.9.1 Test Purpose and Environment

The purpose of this test is to verify that the PUCCH SCell and DL SCell activation and deactivation times are within the requirements stated in clause 8.3.13 and clause 8.3.15, when the PUCCH SCell in FR1 and DL SCell in FR1 is unknown to the UE at the time of activation.

The supported test configurations are shown in table A.6.5.3.9.1-1 below. The test parameters are given in table A.6.5.3.9.1-2 and cell-specific parameters in table A.6.5.3.9.1-3 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three NR carriers, each with one cell. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1, but is not aware of Cell 2 (PUCCH SCell) and Cell 3(DL SCell). The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test. PCC, SCC of Cell 2 and SCC of Cell 3 are on different bands. The primary PUCCH group contain Cell 1 and the secondary PUCCH group contains Cell 2 and Cell 3.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell (Cell 2) and DL SCell (Cell 3) becomes configured on radio channel 2 and 3 respectively. The UE starts monitoring the SCC1(Cell 2 CC) and SCC2(Cell 3 CC). The test equipment sends a MAC message for activation of the PUCCH SCell and DL SCell simultaneously.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated PUCCH SCell at latest in slot $n+\frac{T_{HARQ}+T_{delay_multiple_SCells_PUCCH_SCell}}{NR\ slot\ length}$, and report valid CSI in PCell for the activated DL SCell at latest in slot $n+\frac{T_{HARQ}+T_{delay_multiple_SCells_other_SCell}}{NR\ slot\ length}$, as defined in clause 8.3.13. In this test case, both valid TA and invalid TA cases shall be tested.

Test for case when UE has valid TA: the *TimeAlignmentTimer* [2] associated with the TAG containing the PUCCH SCell is running, and $T_{delay_multiple_SCells_PUCCH_SCell} = T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + \max((T_{First_available_CSI} + T_{CSI_processing}), 3*T_{target_PL\text{-}RS}) + T_{CSI_reporting_after}$.

Test for case when UE do not have valid TA: $T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + \max((T_{First_available_CSI} + T_{CSI_processing}), (T1+T2+T3), 3*T_{target_PL\text{-}RS}) + T_{CSI_reporting_after}$.

$T_{delay_multiple_SCells_other_SCell} = T_{activation_time_multiple_scells} + T_{CSI_Reporting}$.

$T_{activation_time_multiple_scells}$ is the target SCell activation delay in millisecond in multiple SCell activation scenario as specified in section 8.3.7

For Cell 2 activtion, the UE shall start reporting CSI in PCell in slot $n + \frac{T_{\mathrm{HARQ}}+3\ ms}{\mathrm{NR\ slot\ length}}$ and shall report CQI index 0 (out-of-range) until the PUCCH SCell activation has been completed. For Cell 3 activtion, the UE shall start reporting CSI in PCell in slot $n + \frac{T_{\mathrm{HARQ}}+3\ ms}{\mathrm{NR\ slot\ length}}$ and shall report CQI index 0 (out-of-range) until the DL SCell activation has been completed.

Any PCell interruption due to activation of PUCCH SCell or DL SCell shall occur in the slot $n + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3.13, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2.2.2.7.

Time period T3 starts when a MAC message for deactivation of PUCCH SCell abd DL SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot m + $\frac{T_{\mathrm{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3.15, and the starting point of any PCell interruption due to the deactivation shall occur in the slot m + 1 + $\frac{T_{\mathrm{HARQ}}}{NR\ slot\ length}$ to m + 1 + $\frac{T_{\mathrm{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.15.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of PUCCH SCell and DL SCell, respectively.

The test equipment verifies the PUCCH SCell activation time by counting the slots from the time when the PUCCH SCell activation command is sent until a CSI report with other than CQI index 0 is received. The test equipment verifies the DL SCell activation time by counting the slots from the time when the DL SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the PUCCH SCell deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for PUCCH SCell is discontinued. The test equipment verifies the DL SCell deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for DL SCell is discontinued.

Table A.6.5.3.9.1-1: unknown FR1 PUCCH SCell and DL SCell activation test configurations

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode, for both PUCCH SCell and DL SCell
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode, for both PUCCH SCell and DL SCell
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode, for both PUCCH SCell and DL SCell
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.6.5.3.9.1-2: General test parameters for unknown FR1 PUCCH SCell and DL SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	Three NR radio channel (1, 2, 3) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated PUCCH SCell		Cell 2	Configured deactivated PUCCH secondary cell on NR RF channel number 2
Configured deactivated DL SCell		Cell 3	Configured deactivated DL secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	For both Cell 2 and Cell 3
Cell 2/Cell 3 timing offset to cell1	µs	0	
Time alignment error between cell2 and cell1; cell3 and cell1; cell3 and cell2	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	0.1	During this time the PCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.6.5.3.9.1-3: Cell specific test parameters for unknown FR1 PUCCH SCell and DL SCell activation case

Parameter		Unit	Cell 1			Cell 2 and Cell 3		
			T1	T2	T3	T1	T2	T3
Duplex mode	Config 1		FDD					

Parameter		Unit	Cell 1			Cell 2 and Cell 3		
			T1	T2	T3	T1	T2	T3
	Config 2,3		TDD					
TDD configuration	Config 1		Not applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1,2	MHz	Note 7					
	Config 3		Note 7					
$BW_{occupied}$	Config 1,2	RB	52 Note 5					
	Config 3		106 Note 6					
Initial BWP configuration			DLBWP.0.2					
TCI state			TCI.State.0					
TRS Configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			-		
	Config 2		SR.1.1 TDD			-		
	Config 3		SR.2.1 TDD			-		
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD			-		
	Config 2		CCR.1.1 TDD			-		
	Config 3		CCR.2.1 TDD			-		
RMSI CORESET parameters	Config 1		CR.1.1 FDD			-		
	Config 2		CR.1.1 TDD			-		
	Config 3		CR.2.1 TDD			-		
OCNG Patterns	Config 1,2		OP.1 Note 5					
	Config 3,		OP.1 Note 6					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
CSI-RS configuration for CSI reporting (Note 8)	Config 1		CSI-RS.1.1 FDD					
	Config 2		CSI-RS.1.1 TDD					
	Config 3		CSI-RS.2.1 TDD					
SMTC configuration			SMTC.1					
reportConfigType			periodic					
reportQuantity			cri-RI-PMI-CQI					
CSI reporting periodicity for PCell	Config 1,2	slot	5			-		
	Config 3		10			-		
CSI reporting offset for PCell	Config 1,2	slot	3			-		
	Config 3		5			-		
CSI reporting periodicity for SCell	Config 1,2	slot	-			5		
	Config 3		-			10		
CSI reporting offset for SCell	Config 1,2	slot	-			2		
	Config 3		-			4		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	Config 1,2	dBm/SCS	-104					
	Config 3		-101					
$\hat{E}_s / I_{ot}$		dB	17					
$\hat{E}_s / N_{oc}$		dB	17					
SS-RSRP Note3	Config 1,2	dBm/SCS	-87					
	Config 3		-84					
SCH_RP Note 3		dBm/15 kHz	-87					
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96					

Parameter		Unit	Cell 1			Cell 2 and Cell 3		
			T1	T2	T3	T1	T2	T3
	Config 3	dBm/ 38.16 MHz	-52.87					
Propagation condition		-	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in TS 38.214 [26] clause 5.2.2.5.

A.6.5.3.9.2 Test Requirements

The test requirements defined in clause A.6.5.3.8.2 shall apply to this test case.

A.6.5.3.10 Fast SCell Activation of known SCell in FR1 in non-DRX for 160 ms SCell measurement cycle

A.6.5.3.10.1 Test Purpose and Environment

The purpose of this test is to verify that the fast SCell activation and deactivation times are within the requirements stated in clause 8.3.16, when the SCell in FR1 is known by the UE at the time of activation.

The supported test configurations are shown in table A.6.5.3.10.1-1 below. The test parameters are given in tables A.6.5.3.10.1-2 and cell-specific parameters in table A.6.5.3.10.1-3 below. The test consists of two successive time periods, with duration of T1and T2, respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1, but is not aware of Cell 2. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the SCell and triggering the aperiodic CSI-RS for fast SCell activation.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n (where n mode 20=1), defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot n + $\frac{T_{\text{HARQ}}+T_{\text{activation_time}}+T_{\text{CSI_Reporting}}}{\text{NR slot length}}$, as defined in clause 8.3. The UE shall start reporting CSI in PCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $n + \frac{T_{\text{HARQ}}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.6.5.3.10.1-1: known FR1 SCell activation in non-DRX for 160 ms SCell measurement cycle supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.10.1-2: General test parameters for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	μs	0	
Time alignment error between cell2 and cell1	μs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PSCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
A3-offset	dB	-15	
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.6.5.3.10.1-3: Cell specific test parameters for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1,2	MHz	Note 7			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Config 3		Note 7			
$BW_{occupied}$	Config 1,2	RB	52 Note 5			
	Config 3		106 Note 6			
Initial BWP configuration			DLBWP.0.2			
TCI state			TCI.State.0			
TRS Configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD		-	
	Config 2		SR.1.1 TDD		-	
	Config 3		SR.2.1 TDD		-	
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD		-	
	Config 2		CCR.1.1 TDD		-	
	Config 3		CCR.2.1 TDD		-	
RMSI CORESET parameters	Config 1		CR.1.1 FDD		-	
	Config 2		CR.1.1 TDD		-	
	Config 3		CR.2.1 TDD		-	
OCNG Patterns	Config 1,2		OP.1 Note 5			
	Config 3,		OP.1 Note 6			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
Aperiodic CSI-RS for Scell activation	Config 1		N/A		TRS.1.3 FDD	
	Config 2		N/A		TRS.1.3 TDD	
	Config 3		N/A		TRS.1.4 TDD	
gapBetweenBursts		slots	N/A			
CSI-RS configuration for CSI reporting (Note 8)	Config 1		CSI-RS.1.1 FDD			
	Config 2		CSI-RS.1.1 TDD			
	Config 3		CSI-RS.2.1 TDD			
SMTC configuration			SMTC.1			
reportConfigType			periodic			
reportQuantity			cri-RI-PMI-CQI			
CSI reporting periodicity for PCell	Config 1,2	slot	5		-	
	Config 3		10		-	
CSI reporting offset for PCell	Config 1,2	slot	3		-	
	Config 3		5		-	
CSI reporting periodicity for SCell	Config 1,2	slot	-		5	
	Config 3		-		10	
CSI reporting offset for SCell	Config 1,2	slot	-		2	
	Config 3		-		4	
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	Config 1,2	dBm/SCS	-104			
	Config 3		-101			
$\hat{E}_s / I_{ot}$		dB	17			
$\hat{E}_s / N_{oc}$		dB	17			
SS-RSRP Note3	Config 1,2	dBm/SCS	-87			
	Config 3		-84			
CSI-RSRP Note3	Config 1,2	dBm/SCS			-87	
	Config 3				-84	
SCH_RP Note 3		dBm/15 kHz	-87			
	Config 1,2	dBm/	-58.96			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Io Note3		9.36 MHz				
	Config 3	dBm/ 38.16 MHz	-52.87			
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP, CSI-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in TS 38.214 [26] clause 5.2.2.5.

A.6.5.3.10.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after at least one CSI-RS transmission occasion for channel measurement and reporting after slot ($n + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption.During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot $n + \frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, $T_{activation_time} = T_{FirstATRS} + 5$ ms, as defined in clause 8.3.16.

During T2 interruption of PCell / PSCell during SCell activation shall not happen outside the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{interruption}$, as defined in clause 8.3.16.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.6.5.3.11 SCell Activation of known SCell in FR1 in non-DRX for 640 ms SCell measurement cycle

A.6.5.3.11.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.6.5.3.10.1. The supported test configurations are the same as defined in clause A.6.5.3.10.1. The test parameters are the same except those described in the following clause. The listed parameter values in table A.6.5.3.11.1-1 will replace the values of corresponding parameters in tables A.6.5.3.10.1-2 and the listed parameter values in table A.6.5.3.11.1-2 will replace the values of corresponding parameters in tables A.6.5.3.10.1-3.

Table A.6.5.3.11.1-1: General test parameters for known FR1 SCell activation case, 640 ms SCell measurement cycle

Parameter	Unit	Value	Comment

SCell measurement cycle (measCycleSCell)	ms	640	

Table A.6.5.3.11.1-2: Cell specific test parameters for known FR1 SCell activation case, 640 ms SCell measurement cycle

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
gapBetweenBursts		slots	2			

A.6.5.3.11.2 Test Requirements

The test requirements defined in clause A.6.5.3.10.2 shall apply to this test case, except $T_{activation_time}$ will be replaced with the value $T_{FirstATRS} + T_{gap} + T_{ATRS} + 5$ ms.

A.6.5.3.12 SCell Activation and deactivation of unknown SCell in FR1 in DRX for UE capable of short measurement interval

A.6.5.3.12.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clauses 8.3.2 and 8.3.3, respectively, when the SCell in FR1 is unknown by the UE at the time of activation and when UE supports *shortMeasInterval-r18* capability.

The supported test configurations are shown in table A.6.5.3.12.1-1 below. The test parameters are given in table A.6.5.3.12.1-2 and cell-specific parameters in table A.6.5.3.12.1-3 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1, but is not aware of Cell 2. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot n + $\frac{T_{\text{HARQ}}+T_{\text{activation_time}}+T_{\text{CSI_Reporting}}}{\text{NR slot length}}$, as defined in clause 8.3.2. The UE shall start reporting CSI in PCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $n + \frac{T_{\text{HARQ}}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot m + $\frac{\text{T}_{\text{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3, and The starting point of any PCell interruption due to the deactivation shall occur in the slot m + 1 + $\frac{\text{T}_{\text{HARQ}}}{NR\ slot\ length}$ to m + 1 + $\frac{\text{T}_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.6.5.3.12.1-1: unknown FR1 SCell activation in DRX for 160 ms SCell measurement cycle supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.12.1-2: General test parameters for unknown FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		DRX.8	DRX cycle = 320 ms and TAT = Infinity
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	μs	0	
Time alignment error between cell2 and cell1	μs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	ms	100	During this time the PCell shall be known and the SCell configured, but not detected.
T2	s	[1]	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.6.5.3.12.1-3: Cell specific test parameters for unknown FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1,2	MHz	Note 7					

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
	Config 3		Note 7					
$BW_{occupied}$	Config 1,2	RB	52 Note 5					
	Config 3		106 Note 6					
Initial BWP configuration			DLBWP.0.2					
TCI state			TCI.State.0					
TRS Configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			SR.1.1 FDD		
	Config 2		SR.1.1 TDD			SR.1.1 TDD		
	Config 3		SR.2.1 TDD			SR.2.1 TDD		
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD			CCR.1.1 FDD		
	Config 2		CCR.1.1 TDD			CCR.1.1 TDD		
	Config 3		CCR.2.1 TDD			CCR.2.1 TDD		
RMSI CORESET parameters	Config 1		CR.1.1 FDD			N/A		
	Config 2		CR.1.1 TDD			N/A		
	Config 3		CR.2.1 TDD			N/A		
OCNG Patterns	Config 1,2		OP.1 Note 5					
	Config 3,		OP.1 Note 6					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
CSI-RS configuration for CSI reporting (Note 8)	Config 1		CSI-RS.1.1 FDD					
	Config 2		CSI-RS.1.1 TDD					
	Config 3		CSI-RS.2.1 TDD					
SMTC configuration			SMTC.3					
reportConfigType			periodic					
reportQuantity			cri-RI-PMI-CQI					
CSI reporting (CQI index non 0) periodicity for SCell	Config 1,2	slot	5			N/A		
	Config 3		10			N/A		
CSI reporting (CQI index non 0) offset for SCell	Config 1,2	slot	4			N/A		
	Config 3		6			N/A		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	Config 1,2	dBm/SCS	-104			N/A	-104	-104
	Config 3		-101			N/A	-101	-101
$\hat{E}_s / I_{ot}$		dB	17			-infinity	17	17
$\hat{E}_s / N_{oc}$		dB	17			-infinity	17	17
SS-RSRP Note3	Config 1,2	dBm/SCS	-87			-infinity	-87	-87
	Config 3		-84			-infinity	-84	-84
SCH_RP Note 3		dBm/15 kHz	-87			N/A	-87	-87
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96			N/A	-58.96	-58.96
	Config 3	dBm/ 38.16 MHz	-52.87			N/A	-52.87	-52.87
Propagation condition		-	AWGN			N/A	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.							
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.							
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.							
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-118] with configured $BW_{channel}$.							
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in TS 38.214 [26] clause 5.2.2.5.							

A.6.5.3.12.2 Test Requirements

The test requirements defined in clause A.6.5.3.1.2 shall apply to this test case, except $T_{activation_time}$ will be replaced with the value below as defined in clause 8.3.2 when UE supports *shortMeasInterval-r18* capability:

$T_{activation_time}$ = 3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + $T_{SMTC_MAX,\ enhanced}$ + $T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP\ ,report}$ + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}), for which $T_{FirstSSB_MAX,\ enhanced}$ = $T_{SMTC_MAX,\ enhanced}$ = $T_{rs,\ enhanced}$ =20 ms; $T_{L1\text{-}RSRP,\ enhanced_measure}$ = 60 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms.

A.6.5.3.13 SCell Activation of multiple unknown SCells in FR1 with L3 reporting with single activation/deactivation commandin non-DRX

A.6.5.3.13.1 Test Purpose and Environment

The purpose of this test is to verify that the multiple SCells activation times are within the requirements stated in clause 8.3.18, when all the multiple SCells in the same FR1 band are unknown to the UE at the time of activation.

The supported test configurations are shown in table A.6.5.3.13.1-1 below. The test parameters are given in tables A.6.5.3.13.1-2. The cell-specific parameters for NR PCell and NR SCell are given in tables A.6.5.3.13.1-3 and A.6.5.3.13.1-4 below. The test consists of two successive time periods, with duration of T1 and T2, respectively. There are three NR carriers, each with one cell. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1(PCell), but is not aware of Cell 2 (DL SCell) and Cell 3(DL SCell). The UE is only monitoring the PCC. TE continuously schedules the downlink data to UE on PCell throughout the whole test. PCC and SCC of Cell 2, Cell 3 are on different bands. SCC of Cell 2 and SCC of Cell 3 are on same band.

The test consists of two sub tests. The slot at which the MAC message is received at the UE antenna connector, is denoted slot #n.

At the beginning of T1 the UE receives an RRC message by which the Cell 2 and Cell 3 becomes configured on radio channel 2 and 3 respectively. The UE starts monitoring the SCC1(Cell 2 CC) and SCC2(Cell 3 CC). The test equipment sends a MAC message for activation of the Cell 2 and Cell 3 simultaneously.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2.

In sub test 1, TE shall transmit DCI 0-1 on PCell to schedule the PUSCH at slot $n + \frac{T_{\mathrm{HARQ}}+7\ ms}{\text{NR slot length}}$, and the UE shall be able to transmit L3 measurement report of SCells at slot $n + \frac{T_{\mathrm{HARQ}}+7\ ms+\mathrm{k2}}{\text{NR slot length}}$, where k2 = 1.

In sub test 2, TE shall transmit DCI 0-1 on PCell to schedule the PUSCH at slot $n + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}+\mathrm{M}-\mathrm{k2}}{\text{NR slot length}}$, where M is defined in clause 8.3.17 and k2 = 1, and the UE shall be able to transmit L3 measurement report of SCells at slot $n + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}+\mathrm{M}}{\text{NR slot length}}$. For sub test 2, TE will send TCI activation command after receiving L3 measurement report of the SCell.

The UE shall be able to report valid CSI in PCell for the activated DL SCells at latest in slot n + $\frac{T_{HARQ}+T_{activation_time_multiple_scells}+T_{CSI_Reporting}}{NR\ slot\ length}$, as defined in clause 8.3.18.

The UE shall start reporting CSI in PCell for the activated SCells(Cell 2 and Cell 3) after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $n + \frac{T_{\text{HARQ}}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the multiple DL SCell activation has been completed.

Any PCell interruption due to activation DL SCell shall occur in the slot $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3.18, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.2.2.2.

The test equipment verifies the activation time for Cell 2 by counting the slots from the time when the SCell activation command is sent until CSI report of acticated Cell 2 with other than CQI index 0 is received.

The test equipment verifies the activation time for Cell 3 by counting the slots from the time when the SCell activation command is sent until CSI report of acticated Cell 3 with other than CQI index 0 is received.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation of multiple DL SCells.

The test equipment verifies the multiple DL SCell activation time by counting the slots from the time when the multiple DL SCell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.6.5.3.13.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode, for all Cells
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode, for all Cells
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode, for all Cells
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.6.5.3.13.1-2: General test parameters for multiple unknown FR1 DL SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	Three NR radio channel (1, 2, 3) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated DL SCell 1		Cell 2	Configured deactivated DL secondary cell on NR RF channel number 2
Configured deactivated DL SCell 2		Cell 3	Configured deactivated DL secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	For both Cell 2 and Cell 3
Cell 2/Cell 3 timing offset to cell1	µs	0	
Time alignment error between cell2 and cell1; cell3 and cell1; cell3 and cell2	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	0.1	During this time the PCell shall be known and the SCell configured but not detected.
T2	s	1	During this time the UE shall activate the SCell 1 and SCell 2.
A2-threshold	dBm	-130	
ReportConfig		reportConfigId = 0: A2-event-triggered reportConfig = 1: reportOnScellActivation-r18	

Parameter	Unit	Value	Comment
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	$k_1 \times$ NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
$T_{uncertainty_RRC}$	ms	0	The CSI reporting for SCell being activated is provided during SCell addition.

Table A.6.5.3.13.1-3: Cell specific test parameters for NR PCell for multiple unknown FR1 SCell activation case

Parameter		Unit	Cell 1	
			T1	T2
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,2	MHz	Note 7	
	Config 3		Note 7	
$BW_{occupied}$	Config 1,2	RB	52 Note 5	
	Config 3		106 Note 6	
Initial BWP configuration			DLBWP.0.1	
TCI state			TCI.State.0	
TRS Configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
RMSI CORESET parameters	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
OCNG Patterns	Config 1,2		OP.1 Note 5	
	Config 3,		OP.1 Note 6	
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
CSI-RS configuration for CSI reporting (Note 8)	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
SMTC configuration			SMTC.1	
reportConfigType			periodic	
reportQuantity			cri-RI-PMI-CQI	
CSI reporting periodicity	Config 1,2	slot	5	
	Config 3		10	
CSI reporting offset	Config 1,2	slot	3	
	Config 3		5	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				

Parameter		Unit	Cell 1	
			T1	T2
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2	dBm/SCS	-104	
	Config 3		-101	
$\hat{E}_s / I_{ot}$		dB	17	
$\hat{E}_s / N_{oc}$		dB	17	
SS-RSRP Note3	Config 1,2	dBm/SCS	-87	
	Config 3		-84	
SCH_RP Note 3		dBm/15 kHz	-87	
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96	
	Config 3	dBm/ 38.16 MHz	-52.87	
Propagation condition		-	AWGN	
Correlation Matrix and Antenna Configuration		-	2x2 Low	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured $BW_{channel}$.
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in clause 5.2.2.5 in TS 38.214 [26].

Table A.6.5.3.13.1-4: Cell specific test parameters for NR SCell for multiple unknown FR1 SCell activation case

Parameter		Unit	Cell 1		Cell 2 and Cell 3	
			T1	T2	T1	T2
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1,2	MHz	Note 7			
	Config 3		Note 7			
$BW_{occupied}$	Config 1,2	RB	52 Note 5			
	Config 3		106 Note 6			
Initial BWP configuration			DLBWP.0.1			
TCI state			TCI.State.0			
TRS Configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD		-	
	Config 2		SR.1.1 TDD		-	
	Config 3		SR.2.1 TDD		-	
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD		-	
	Config 2		CCR.1.1 TDD		-	
	Config 3		CCR.2.1 TDD		-	
	Config 1		CR.1.1 FDD		-	

Parameter		Unit	Cell 1		Cell 2 and Cell 3	
			T1	T2	T1	T2
RMSI CORESET parameters	Config 2		CR.1.1 TDD		-	
	Config 3		CR.2.1 TDD		-	
OCNG Patterns	Config 1,2		OP.1 Note 5			
	Config 3,		OP.1 Note 6			
SSB Configuration	Config 1,2		SSB.3 FR1			
	Config 3		SSB.4 FR1			
CSI-RS configuration for CSI reporting (Note 8)	Config 1		CSI-RS.1.1 FDD			
	Config 2		CSI-RS.1.1 TDD			
	Config 3		CSI-RS.2.1 TDD			
SMTC configuration			SMTC.1			
reportConfigType			periodic			
reportQuantity			cri-RI-PMI-CQI			
CSI reporting periodicity for PCell	Config 1,2	slot	5		-	
	Config 3		10		-	
CSI reporting offset for PCell	Config 1,2	slot	3		-	
	Config 3		5		-	
CSI reporting periodicity for SCell	Config 1,2	slot	5		5 (on Cell 2)	
	Config 3		10		10 (on Cell 2)	
CSI reporting offset for SCell	Config 1,2	slot	2		2 (on Cell 2)	
	Config 3		4		4 (on Cell 2)	
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	Config 1,2	dBm/SCS	-104			
	Config 3		-101			
$\hat{E}_s/I_{ot}$		dB	17			
$\hat{E}_s/N_{oc}$		dB	17			
SS-RSRP Note3	Config 1,2	dBm/SCS	-87			
	Config 3		-84			
SCH_RP Note 3		dBm/15 kHz	-87			
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96			
	Config 3	dBm/ 38.16 MHz	-52.87			
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP, Io and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in Clause 5.2.2.5 in TS 38.214 [26].

A.6.5.3.13.2 Test Requirements

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot n + $\frac{T_{HARQ}+Tactivation_time_multiple_scells+T_{CSI_Reporting}}{NR\ slot\ length}$, where as defined in clause 8.3.18, in sub test 1, $T_{activation_time_multiple_scells}$ = 7 ms + $\frac{k2}{NR\ slot\ length}$ + max (T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}), where $\frac{k2}{NR\ slot\ length}$= 1 ms for Config 1 and 2, and 0.5 ms for config 3.

In sub test 2, $T_{activation_time_multiple_scells}$ = 3 ms + M + max (T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}).

A.6.5.3.14 SCell Activation of unknown SCell with valid L3 measurement results in FR1 in non-DRX for 160 ms SCell measurement cycle

A.6.5.3.14.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation time are within the requirements stated in clause 8.3.17, when the SCell in FR1 is unknown by the UE at the time of activation, but UE has valid L3 measurement results of the SCell.

The supported test configurations for NR PCell are shown in table A.6.5.3.14.1-1 below. Supported test configurations for NR SCell are shown in table A.6.5.3.14.1-1A. Test configuration for NR PCell and test configuration for NR SCell are chosen independently. The test parameters are given in Tables A.6.5.3.14.1-2 and cell-specific parameters in tables A.6.5.3.14.1-3 and A.6.5.3.14.1-4 below. The test consists of three successive time periods, with duration of T1, T2 and T3 respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1, but is not aware of Cell 2. The UE is only monitoring the PCC.

The test consists of three sub tests. The slot at which the MAC message is received at the UE antenna connector, is denoted slot #n. TE continuously schedules the downlink data to UE on PCell. In Sub-test 1, TE shall schedule DCI format 0_1 at slot n + $\frac{T_{HARQ}+7ms}{\text{NR slot length}}$. In Sub-test 2, TE shall schedule DCI format 0_1 at slot n + $\frac{T_{HARQ}+3ms+M-k2}{\text{NR slot length}}$, where M is defined in clause 8.3.17 and k2 = 1. In Sub-test 3, UE shall tranmsit scheduling request on the first SR resource by 7ms+ T_{HARQ} + $T_{SR_Periodicity}$ to obtain the UL grant for L3 report transmission.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. T1 is sufficiently long enough so that UE is able to complete the L3 detection and measurements on the SCell to be activated. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. UE is expected to report L3 measurement result at the first PUSCH scheduled by TE.

The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot n + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{\text{NR slot length}}$, as defined in clause 8.3.17. TE also indicates the TCI, based on L3 report of the UE. The UE shall start reporting CSI in PCell after at least one CSI-RS transmission occasion for channel measurement and reporting after the slot that UE sends the L3 reports and shall report CQI index 0 (out-of-range) until the SCell activation has been completed.

During T2, any PCell interruption due to activation of SCell shall occur in the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3.17, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

At the beginning of T3, the SCell de-activation command is sent. T3 shall be long enough to ensure UE completes the SCell de-activation.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation of SCell.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.6.5.3.14.1-1: known FR1 SCell activation in non-DRX for 160 ms SCell measurement cycle supported test configurations for NR PCell

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.14.1-1A: known FR1 SCell activation in non-DRX for 160 ms SCell measurement cycle supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.14.1-2: General test parameters for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	[160]	
Cell 2 timing offset to cell1	μs	0	
Time alignment error between cell2 and cell1	μs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PCell shall be known and the SCell configured and detected.
T2	ms	< 200 ms	During this time the UE shall activate the SCell.
T3	ms	200 ms	
A2-threshold	dBm	-130	
ReportCofing		reportConfigId = 0: A2-event-triggered reportConfig = 1: reportOnScellActivation-r18	
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.

$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
$T_{uncertainty_RRC}$	ms	0	The CSI reporting for SCell being activated is provided during SCell addition.

Table A.6.5.3.14.1-3: Cell specific test parameters for NR PCell for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 1	
			T1-T3	T4
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,2	MHz	Note 7	
	Config 3		Note 7	
$BW_{occupied}$	Config 1,2	RB	52 Note 5	
	Config 3		106 Note 6	
Initial BWP configuration			DLBWP.0.1	
TCI state			TCI.State.0	
TRS Configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
RMSI CORESET parameters	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
OCNG Patterns	Config 1,2		OP.1 Note 5	
	Config 3,		OP.1 Note 6	
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
CSI-RS configuration for CSI reporting (Note 8)	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
SMTC configuration			SMTC.1	
reportConfigType			periodic	
reportQuantity			cri-RI-PMI-CQI	
CSI reporting periodicity	Config 1,2	slot	5	
	Config 3		10	
CSI reporting offset	Config 1,2	slot	3	
	Config 3		5	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2	dBm/SCS	-104	
	Config 3		-101	
$\hat{E}_s/I_{ot}$		dB	17	

Parameter		Unit	Cell 1	
			T1-T3	T4
$\hat{E}_s / N_{oc}$		dB	17	
SS-RSRP Note3	Config 1,2	dBm/SCS	-87	
	Config 3		-84	
SCH_RP Note 3		dBm/15 kHz	-87	
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96	
	Config 3	dBm/ 38.16 MHz	-52.87	
Propagation condition		-	AWGN	
Correlation Matrix and Antenna Configuration		-	2x2 Low	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured $BW_{channel}$.
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in Clause 5.2.2.5 in TS 38.214 [26].

Table A.6.5.3.14.1-4: Cell specific test parameters for NR SCell for known FR1 SCell activation case, 160 ms SCell measurement cycle

Parameter		Unit	Cell 2	
			T1-T3	T4
Duplex mode	$Config_{SCell}$ 1		FDD	
	$Config_{SCell}$ 2,3		TDD	
TDD configuration	$Config_{SCell}$ 1		Not applicable	
	$Config_{SCell}$ 2		TDDConf.1.1	
	$Config_{SCell}$ 3		TDDConf.2.1	
$BW_{channel}$	$Config_{SCell}$ 1,2	MHz	Note 7	
	$Config_{SCell}$ 3		Note 7	
$BW_{occupied}$	$Config_{SCell}$ 1,2	RB	52 Note 5	
	$Config_{SCell}$ 3		106 Note 6	
Initial BWP configuration			DLBWP.0.1	
TCI state			TCI.State.0	
TRS Configuration	$Config_{SCell}$ 1		TRS.1.1 FDD	
	$Config_{SCell}$ 2		TRS.1.1 TDD	
	$Config_{SCell}$ 3		TRS.1.2 TDD	
PDSCH Reference measurement channel	$Config_{SCell}$ 1		N/A	
	$Config_{SCell}$ 2		N/A	
	$Config_{SCell}$ 3		N/A	
Dedicated CORESET parameters	$Config_{SCell}$ 1		N/A	
	$Config_{SCell}$ 2		N/A	
	$Config_{SCell}$ 3		N/A	
RMSI CORESET parameters	$Config_{SCell}$ 1		N/A	
	$Config_{SCell}$ 2		N/A	
	$Config_{SCell}$ 3		N/A	
OCNG Patterns	$Config_{SCell}$ 1,2		OP.1 Note 5	
	$Config_{SCell}$ 3,		OP.1 Note 6	
SSB Configuration	$Config_{SCell}$ 1,2		SSB.3 FR1	
	$Config_{SCell}$ 3		SSB.4 FR1	
CSI-RS configuration for CSI reporting Note 8	$Config_{SCell}$ 1		CSI-RS.1.1 FDD	
	$Config_{SCell}$ 2		CSI-RS.1.1 TDD	
	$Config_{SCell}$ 3		CSI-RS.2.1 TDD	
SMTC configuration			SMTC.1	
reportConfigType			N/A	
reportQuantity			N/A	

Parameter		Unit	Cell 2	
			T1-T3	T4
CSI reporting periodicity	$Config_{SCell}$ 1,2	slot	N/A	
	$Config_{SCell}$ 3		N/A	
CSI reporting offset	$Config_{SCell}$ 1,2	slot	N/A	
	$Config_{SCell}$ 3		N/A	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
$\hat{N}_{oc}$ Note2	$Config_{SCell}$ 1,2	dBm/SCS	-104	
	$Config_{SCell}$ 3		-101	
$\hat{E}_s / I_{ot}$		dB	17	
$\hat{E}_s / N_{oc}$		dB	17	
SS-RSRP Note3	$Config_{SCell}$ 1,2	dBm/SCS	-87	
	$Config_{SCell}$ 3		-84	
SCH_RP Note 3		dBm/15 kHz	-87	
Io Note3	$Config_{SCell}$ 1,2	dBm/ 9.36 MHz	-58.96	
	$Config_{SCell}$ 3	dBm/ 38.16 MHz	-52.87	
Propagation condition		-	AWGN	
Correlation Matrix and Antenna Configuration			2x2 Low	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $\hat{N}_{oc}$ to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[2] with configured $BW_{channel}$.
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in Clause 5.2.2.5 in TS 38.214 [26].

Table A.6.5.3.14.1-5: Scheduling request parameters

Parameter		Value
schedulingRequestId		0
sr-ProhibitTimer		16ms
sr-TransMax		n4
periodicityAndOffset		SI2
PUCCH resource ID		0
PUCCH resource	Starting PRB	To be determined by RAN5
	intraSlotFrequencyHopping	disabled
	Format	format 2
	nrofPRBs	2
	nrofSymbols	1
	startingSymbolIndex	0

A.6.5.3.14.2 Test Requirements

During T2, the UE shall send the first CSI report for SCell in the first available uplink resource after at least one CSI-RS transmission occasion for channel measurement and reporting after slot ($n + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot $n + \frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$.

For Sub-test 1, $T_{activation_time}$ = 7 ms + k2/SCS + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.17, where k2/SCS is 1 ms for config 1,2 and 0.5 ms for config 3.

For Sub-test 2, $T_{activation_time}$ = 3 ms + M + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.17.

For Sub-test 3, $T_{activation_time}$ = 7ms + $T_{uncertainity_ULgrant}$ + max (T_{HARQ} + $T_{uncertainty_MAC}$ + 5ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.17. Where, $T_{uncertainity_ULgrant}$ is uncertainty in acquiring UL grant after sending scheduling request.

During T2, interruption of PCell during SCell activation shall not happen outside the slot $n + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3.17.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and L3 measurement reporting to be counted as correct. The rate of correct observed SCell activation delay and L3 measurement reporting during repeated tests shall be at least 90 %.

NOTE: During T2, if there are no uplink resources for reporting the valid CSI in a slot $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.6.5.3.15 TRS based SCell Activation of SSB-less SCell in FR1 inter-band CA in non-DRX

A.6.5.3.15.1 Test Purpose and Environment

The purpose of this test is to verify that the SSB-less SCell activation delay is within the requirements stated in clause 8.3.2, when the to be activated SCell in FR1 is provided with periodic CSI-RS for tracking instead of SSB. SCell does not provide neighther SSB configuration (*absoluteFrequencySSB*) nor SMTC configuration.

The supported test configurations are shown in table A.6.5.3.15.1-1A and A.6.5.3.15.1-1B below. The test parameters are given in Tables A.6.5.3.15.1-2 and cell-specific parameters in tables A.6.5.3.15.1-3 and A.6.5.3.15.1-4 below. The test consists of two successive time periods, with duration of T1 and T2, respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1(PCell), but is not aware of Cell 2(SCell). Cell 1 and Cell 2 are in different bands. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. At the same time, UE also receives the indication of reference serving cell in the same RRC message. The Cell 1 is indicated as the reference cell of Cell 2. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n (where n mod 20=1), defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot $n + \frac{T_{\mathrm{HARQ}}+T_{\mathrm{activation_time}}+T_{\mathrm{CSI_Reporting}}}{\mathrm{NR\ slot\ length}}$, as defined in clause 8.3. The UE shall start reporting CSI in PCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $n + \frac{T_{\mathrm{HARQ}}+3\ ms}{\mathrm{NR\ slot\ length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot $n + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.6.5.3.15.1-1A: FR1 inter-band SSB-less SCell activation based on TRS for NR PCell in non-DRX for 160 ms SCell measurement cycle supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.15.1-1B: FR1 inter-band SSB-less SCell activation based on TRS for NR SCell in non-DRX for 160 ms SCell measurement cycle supported test configurations

Config	Description
1	NR 15 kHz SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.15.1-2: General test parameters for TRS based SCell activation of SSB-less SCell in FR1 inter-band CA in non-DRX for 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test, where NR radio chanel 1 and 2 are in different NR bands.
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
Cell 2 timing offset to cell1	μs	Length of CP of Cell 2	
T1	s	7	During this time the PSCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.6.5.3.15.1-3: PCell test configuration parameters for TRS based SCell activation of SSB-less SCell in FR1 inter-band CA in non-DRX for 160 ms measurement cycle

Parameter		Unit	Cell 1	
			T1	T2
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,2	MHz	Note 7	
	Config 3		Note 7	
$BW_{occupied}$	Config 1,2	RB	52 Note 5	
	Config 3		106 Note 6	
Initial BWP configuration			DLBWP.0.1	
TCI state			TCI.State.0	
TRS Configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
RMSI CORESET parameters	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
OCNG Patterns	Config 1,2		OP.1 Note 5	
	Config 3,		OP.1 Note 6	
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
Periodic CSI-RS configuration for CSI reporting (Note 8)	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
SMTC configuration			SMTC.1	
reportConfigType			periodic	
reportQuantity			cri-RI-PMI-CQI	
CSI reporting periodicity	Config 1,2	slot	5	
	Config 3		10	
CSI reporting offset	Config 1,2	slot	3	
	Config 3		5	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2	dBm/SCS	-104	
	Config 3		-101	
$\hat{E}_s / I_{ot}$		dB	19	
$\hat{E}_s / N_{oc}$		dB	19	
SS-RSRP Note3	Config 1,2	dBm/SCS	-85	
	Config 3		-82	
SCH_RP Note 3		dBm/15 kHz	-85	
Io Note3	Config 1,2	dBm/ 9.36 MHz	-56.99	
	Config 3	dBm/ 38.16 MHz	-50.90	
Propagation condition		-	AWGN	

Parameter	Unit	Cell 1	
		T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.			
NOTE 3: Io, SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.			
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.			
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.			
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.			
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in Clause 5.2.2.5 in TS 38.214 [26].			

Table A.6.5.3.15.1-4: SCell test configuration parameters for TRS based SCell activation of SSB-less SCell in FR1 inter-band CA in non-DRX for 160 ms measurement cycle

Parameter		Unit	Cell 2	
			T1	T2
Duplex mode	$Config_{SCell}$ 1		FDD	
	$Config_{SCell}$ 2,3		TDD	
TDD configuration	$Config_{SCell}$ 1		Not applicable	
	$Config_{SCell}$ 2		TDDConf.1.1	
	$Config_{SCell}$ 3		TDDConf.2.1	
referenceCell	$Config_{SCell}$ 1,2,3		Cell 1	
$BW_{channel}$	$Config_{SCell}$ 1,2	MHz	Note 7	
	$Config_{SCell}$ 3		Note 7	
$BW_{occupied}$	$Config_{SCell}$ 1,2	RB	52 Note 5	
	$Config_{SCell}$ 3		106 Note 6	
Initial BWP configuration			DLBWP.0.1	
TCI state			TCI.State.0 Note 9	
TRS Configuration	$Config_{SCell}$ 1		TRS.1.1 FDD	
	$Config_{SCell}$ 2		TRS.1.1 TDD	
	$Config_{SCell}$ 3		TRS.1.2 TDD	
PDSCH Reference measurement channel	$Config_{SCell}$ 1		-	
	$Config_{SCell}$ 2		-	
	$Config_{SCell}$ 3		-	
Dedicated CORESET parameters	$Config_{SCell}$ 1		-	
	$Config_{SCell}$ 2		-	
	$Config_{SCell}$ 3		-	
RMSI CORESET parameters	$Config_{SCell}$ 1		-	
	$Config_{SCell}$ 2		-	
	$Config_{SCell}$ 3		-	
OCNG Patterns	$Config_{SCell}$ 1,2		OP.1 Note 5	
	$Config_{SCell}$ 3		OP.1 Note 6	
SSB Configuration	$Config_{SCell}$ 1,2,3		Not provided	
Periodic CSI-RS configuration for CSI reporting (Note 8)	$Config_{SCell}$ 1		CSI-RS.1.1 FDD	
	$Config_{SCell}$ 2		CSI-RS.1.1 TDD	
	$Config_{SCell}$ 3		CSI-RS.2.1 TDD	
SMTC configuration			Not provided	
reportConfigType			periodic	
reportQuantity			cri-RI-PMI-CQI	
CSI reporting periodicity	$Config_{SCell}$ 1,2	slot	-	
	$Config_{SCell}$ 3		-	
CSI reporting offset	$Config_{SCell}$ 1,2	slot	-	
	$Config_{SCell}$ 3		-	
EPRE ratio of PSS to SSS		dB	N/A	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				

Parameter		Unit	Cell 2	
			T1	T2
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2	dBm/SCS	-120	
	Config 3		-117	
$\hat{E}_s / I_{ot}$		dB	35 - Δ_{EPRE} Note 10	
$\hat{E}_s / N_{oc}$		dB	35 - Δ_{EPRE} Note 10	
SS-RSRP Note3	Config 1,2	dBm/SCS	-	
	Config 3		-	
SCH_RP Note 3		dBm/15 kHz	N/A	
Io Note3	Config 1,2	dBm/ 9.36 MHz	-69.03 (Δ_{EPRE} = 12dB) -85.85 (Δ_{EPRE} = 30dB)	
	Config 3	dBm/ 38.16 MHz	-62.92 (Δ_{EPRE} = 12dB) -79.75 (Δ_{EPRE} = 30dB)	
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: Io, SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in Clause 5.2.2.5 in TS 38.214 [26].
NOTE 9: The SSB in referenceSignal in the TCI state is configured as the SSB in Cell 2.
NOTE 10: Δ_{EPRE} is configured as different values to verify different requirements defined in clause A.6.5.3.15.2.

A.6.5.3.15.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $(n + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length})$. UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot $n + \frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, $T_{activation_time}$ is

- $T_{first_TRS} + T_{TRS} + 5$ ms, if aperiodic CSI-RS resources are not configured for SCell activation or UE do not support *aperiodicCSI-RS-FastScellActivation-r17*, when the the EPRE difference (Δ_{EPRE}) is 12 dB
- $T_{first_TRS} + 2*T_{TRS} + 5$ ms, when the EPRE difference (Δ_{EPRE}) is 30 dB

During T2 interruption of PCell / PSCell during SCell activation shall not happen outside the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3.2.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $\frac{T_{\mathrm{HARQ}}+T_{\mathrm{activtion_time}}+T_{\mathrm{CSI_Reporting}}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.6.5.3.16 Inter-band SSB-less SCell Activation based on A-TRS

A.6.5.3.16.1 Test Purpose and Environment

The purpose of this test is to verify that the inter-band SSB-less SCell activation times are within the requirements stated in clause 8.3.2.

The supported test configurations are shown in table A.6.5.3.16.1-1A and A.6.5.3.16.1-1B below. The test parameters are given in Tables A.6.5.3.16.1-2 and cell-specific parameters in tables A.6.5.3.16.1-3 below. The test consists of two successive time periods, with duration of T1and T2, respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. Before the test starts the UE is connected to PCell Cell 1, but is not aware of Cell 2. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The test equipment sends a MAC message for activation of the SCell and triggering the aperiodic CSI-RS for SCell activation.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n (where n mod 20=1), defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot n + $\frac{T_{\mathrm{HARQ}}+T_{\mathrm{activation_time}}+T_{\mathrm{CSI_Reporting}}}{\mathrm{NR\ slot\ length}}$, as defined in clause 8.3. The UE shall start reporting CSI in PCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $n + \frac{T_{\mathrm{HARQ}}+3\ ms}{\mathrm{NR\ slot\ length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot $n + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.6.5.3.16.1-1A: Inter-band SSB-less SCell Activation based on A-TRS for NR PCell

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.3.16.1-1B: Inter-band SSB-less SCell Activation based on A-TRS for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,

Table A.6.5.3.16.1-2: General test parameters for Inter-band SSB-less SCell Activation based on A-TRS

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test, where NR radio chanel 1 and 2 are in different NR bands.
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell 2 timing offset to cell1	μs	Length of CP of Cell 2	
T1	s	7	During this time the PCell shall be known and the SCell configured
T2	s	1	During this time the UE shall activate the SCell.
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214 [26]) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.6.5.3.16.1-3: PCell test parameters for Inter-band SSB-less SCell Activation based on A-TRS

Parameter		Unit	Cell 1	
			T1	T2
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,2	MHz	Note 7	
	Config 3		Note 7	
$BW_{occupied}$	Config 1,2	RB	52 Note 5	
	Config 3		106 Note 6	
Initial BWP configuration			DLBWP.0.1	
TCI state			TCI.State.0	
TRS Configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
RMSI CORESET parameters	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	

Parameter		Unit	Cell 1	
			T1	T2
	Config 3		CR.2.1 TDD	
OCNG Patterns	Config 1,2		OP.1 Note 5	
	Config 3,		OP.1 Note 6	
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
CSI-RS configuration for CSI reporting (Note 8)	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
SMTC configuration			SMTC.1	
reportConfigType			periodic	
reportQuantity			cri-RI-PMI-CQI	
CSI reporting periodicity	Config 1,2	slot	5	
	Config 3		10	
CSI reporting offset	Config 1,2	slot	3	
	Config 3		5	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2	dBm/SCS	-107	
	Config 3		-104	
$\hat{E}_s / I_{ot}$		dB	10	
$\hat{E}_s / N_{oc}$		dB	10	
SS-RSRP Note3	Config 1,2	dBm/SCS	-97	
	Config 3		-94	
SCH_RP Note 3		dBm/15 kHz	-93	
Io Note3	Config 1,2	dBm/ 9.36 MHz	-68.63	
	Config 3	dBm/ 38.16 MHz	-62.54	
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: Io, SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in Clause 5.2.2.5 in TS 38.214 [26].

Table A.6.5.3.16.1-4: SCell parameters for Inter-band SSB-less SCell Activation based on A-TRS

Parameter		Unit	Cell 2	
			T1	T2
Duplex mode	$Config_{SCell}$ 1		FDD	
	$Config_{SCell}$ 2,3		TDD	
TDD configuration	$Config_{SCell}$ 1		Not applicable	

Parameter		Unit	Cell 2	
			T1	T2
	$Config_{SCell}$ 2		TDDConf.1.1	
	$Config_{SCell}$ 3		TDDConf.2.1	
referenceCell	$Config_{SCell}$ 1,2,3		Cell 1	
$BW_{channel}$	$Config_{SCell}$ 1,2	MHz	Note 7	
	$Config_{SCell}$ 3		Note 7	
$BW_{occupied}$	$Config_{SCell}$ 1,2	RB	52 Note 5	
	$Config_{SCell}$ 3		106 Note 6	
Initial BWP configuration			DLBWP.0.1	
TCI state			TCI.State.0 Note 9	
TRS Configuration	$Config_{SCell}$ 1		TRS.1.1 FDD	
	$Config_{SCell}$ 2		TRS.1.1 TDD	
	$Config_{SCell}$ 3		TRS.1.2 TDD	
PDSCH Reference measurement channel	$Config_{SCell}$ 1		-	
	$Config_{SCell}$ 2		-	
	$Config_{SCell}$ 3		-	
Dedicated CORESET parameters	$Config_{SCell}$ 1		-	
	$Config_{SCell}$ 2		-	
	$Config_{SCell}$ 3		-	
RMSI CORESET parameters	$Config_{SCell}$ 1		-	
	$Config_{SCell}$ 2		-	
	$Config_{SCell}$ 3		-	
OCNG Patterns	$Config_{SCell}$ 1,2		OP.1 Note 5	
	$Config_{SCell}$ 3		OP.1 Note 6	
SSB Configuration	$Config_{SCell}$ 1,2,3		Not provided	
Aperiodic CSI-RS for Scell activation	$Config_{SCell}$ 1		TRS.1.3 FDD	
	$Config_{SCell}$ 2		TRS.1.3 TDD	
	$Config_{SCell}$ 3		TRS.1.4 TDD	
gapBetweenBursts	$Config_{SCell}$ 1,2	slot	2	
	$Config_{SCell}$ 3	slot	3	
CSI-RS configuration for CSI reporting (Note 8)	$Config_{SCell}$ 1		CSI-RS.1.1 FDD	
	$Config_{SCell}$ 2		CSI-RS.1.1 TDD	
	$Config_{SCell}$ 3		CSI-RS.2.1 TDD	
SMTC configuration			Not provided	
reportConfigType			periodic	
reportQuantity			cri-RI-PMI-CQI	
CSI reporting periodicity	$Config_{SCell}$ 1,2	slot	-	
	$Config_{SCell}$ 3		-	
CSI reporting offset	$Config_{SCell}$ 1,2	slot	-	
	$Config_{SCell}$ 3		-	
EPRE ratio of PSS to SSS		dB	N/A	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2	dBm/SCS	-107	
	Config 3		-104	
$\hat{E}_s / I_{ot}$		dB	22	
$\hat{E}_s / N_{oc}$		dB	22	
SS-RSRP Note3	Config 1,2	dBm/SCS	-	
	Config 3		-	
SCH_RP Note 3		dBm/15 kHz	N/A	
Io Note3	Config 1,2	dBm/ 9.36 MHz	-57.02	
	Config 3	dBm/ 38.16 MHz	-50.92	
Propagation condition		-	AWGN	

Parameter	Unit	Cell 2	
		T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.			
NOTE 3: Io, SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.			
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.			
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.			
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.			
NOTE 8: On top of the reference configurations, CSI-RS offset should be set to meet the CSI reference resource timing definition in Clause 5.2.2.5 in TS 38.214 [26].			
NOTE 9: The SSB in referenceSignal in the TCI state is configured as the SSB in Cell 2.			

A.6.5.3.16.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after at least one CSI-RS transmission occasion for channel measurement and reporting after slot ($n + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption.

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot $n + \frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, $T_{activation_time} = T_{first_ATRS} + T_{gap} + T_{ATRS} + 5$ ms, as defined in clause 8.3.2.

During T2 interruption of PCell during SCell activation shall not happen outside the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3.2.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay. The rate of correct observed SCell activation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.6.5.3.17 SCell Activation and deactivation of known SCell in FR1 in non-DRX for 160 ms SCell measurement cycle with less than 5MHz BW

A.6.5.3.17.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell in FR1 is known by the UE at the time of activation, and the SCell operate with a bandwidth of less than 5 MHz. Supported test configurations are specified in Table A.6.5.3.17.1-1 below. General test parameters for known Scell activation case are specified in Table A.6.5.3.1.1-2. Supported Cell specific test parameters for NR PCell specified in Table A.6.5.3.1.1-3. Supported Cell specific test parameters for NR SCell specified in Table A.6.5.3.1.1-4 apply except those specified in Table A.6.5.3.17.1-2.

The test procedure specified in A.6.5.3.1 applies to this test.

Table A.6.5.3.17.1-1: Supported test configurations

Config	Description
1	PCell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode SCell: NR 15 kHz SSB SCS, 3 MHz bandwidth, FDD duplex mode

Table A.6.5.3.17.1-2: Cell specific test parameters for NR SCell

Parameter		Unit	Cell 2		
			T1	T2	T3
$BW_{channel}$	$Config_{SCell}$ 1	MHz	3 MHz		
$BW_{occupied}$	$Config_{SCell}$ 1	RB	12		
PDSCH Reference measurement channel	$Config_{SCell}$ 1		SR.1.3 FDD		
SSB Configuration	$Config_{SCell}$ 1		SSB.13 FR1		
Io Note3	$Config_{SCell}$ 1	dBm/ 2.7 MHz	-60.31	-58.58	-58.58
NOTE : Io levels have been derived from other parameters for information purposes. They are not settable parameters themeselves.					

A.6.5.3.17.2 Test Requirements

Test requirements specified in Clause A.6.5.3.1.2 apply to this test except $T_{activation_time}$ will be replaced with $T_{FirstSSB}$+ T_{Δ} + 5ms.

A.6.5.4 UE UL carrier RRC reconfiguration Delay

A.6.5.4.1 UE UL carrier RRC reconfiguration Delay

Table A.6.5.4.1-1 - Table A.6.5.4.1-4 : Void

A.6.5.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that when the UE receives a RRC message implying NR UL or Supplementary UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within the time limits specified in clause 8.4.2 and 8.4.3 for configuring and deconfiguring, respectively.

There is one cell with two UL carriers: FR1 PCell and FR1 SUL. Both NR uplink and supplementary uplink are broadcast by *ServingCellConfigCommonSIB.* The test parameters for PCell and SUL are given in Table A. 6.5.4.1.1-1, Table A.6.5.4.1.1-2, Table A.6.5.4.1.1-3 and Table A.6.5.4.1.1-4 below. The test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, only NR uplink of PCell is configured to UE. At the start of T2, a supplementary uplink is configured to UE through *RRCReconfiguration*, then UE shall start transmission on the supplementary uplink. At the start of T3, the supplementary uplink is released through *RRCReconfiguration*.

Table A.6.5.4.1.1-1: Supported test configurations

Configuration	PCell	SUL
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	SUL: 15 kHz SCS, 10 MHz bandwidth, SUL duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	SUL: 30kHz SCS, 40 MHz bandwidth, SUL duplex mode
3	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	SUL: 15 kHz SCS, 10 MHz bandwidth, SUL duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	SUL: 30kHz SCS, 40 MHz bandwidth, SUL duplex mode
5	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	SUL: 15 kHz SCS, 10 MHz bandwidth, SUL duplex mode

6	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	SUL: 30kHz SCS, 40 MHz bandwidth, SUL duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: Void		

Table A.6.5.4.1.1-2: General test parameters for NR standalone UE UL carrier RRC reconfiguration Delay on Pcell

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1,2,3, 4, 5, 6	1, 2	Two UL radio channels are used for this test.
Active cell		Config 1,2,3, 4, 5, 6	FR1 PCell FR1 SUL	PCell on RF channel number 1 FR1 SUL on RF channel number 2
CP length		Config 1,2,3, 4, 5, 6	Normal	
DRX		Config 1,2,3, 4, 5, 6	OFF	
Measurement gap pattern Id		Config 1,2,3, 4, 5, 6	OFF	
Filter coefficient		Config 1,2,3, 4, 5, 6	0	L3 filtering is not used
T1	s	Config 1,2,3, 4, 5, 6	5	
T2	s	Config 1,2,3, 4, 5, 6	5	
T3	s	Config 1,2,3, 4, 5, 6	5	

Table A.6.5.4.1.1-3: NR Cell specific test parameters for NR standalone UE UL carrier RRC reconfiguration Delay on PCell

Parameter	Unit	Test Configuration	Test 1		
			T1	T2	T3
Channel number for NR UL carrier		Conf 1, 2, 3, 4, 5, 6	1		
Channel number for supplementary UL		Conf 1, 2, 3, 4, 5, 6	2		
TDD configuration		Conf 1, 2	N/A		
		Conf 3, 4	TDD Conf.1.1		
		Conf 5, 6	TDD Conf.2.1		
$BW_{channel}$	MHz	Conf 1, 2, 3, 4	10: $N_{RB,c}$ = 52		
		Conf 5, 6	40: $N_{RB,c}$ = 10		
$BW_{channel\ for\ supplementary\ UL}$	MHz	Conf 1, 3, 5	10: $N_{RB,c}$ = 52		
		Conf 2, 4, 6	40: $N_{RB,c}$ = 106		
PUSCH parameters for NR UL carrier		Conf 1, 2, 3, 4	G-FR1-A3-9 in [13]	G-FR1-A3-9 in [13]	G-FR1-A3-9 in [13]
		Conf 5, 6	G-FR1-A3-13 in [13]	G-FR1-A3-13 in [13]	G-FR1-A3-13 in [13]
PUCCH parameters For NR UL carrier		Conf 1, 2, 3, 4	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]
		Conf 5, 6	Table 8.3.3.1.2-2 in [13]	Table 8.3.3.1.2-2 in [13]	Table 8.3.3.1.2-2 in [13]
PUSCH parameters for supplementary UL		Conf 1, 3, 5	N/A	G-FR1-A3-9 in [13]	N/A
		Conf 2, 4, 6	N/A	G-FR1-A3-13 in [13]	N/A
PUCCH parameters for supplementary UL		Conf 1, 3, 5	N/A	N/A	N/A
		Conf 2, 4, 6	N/A	N/A	N/A
PDSCH reference measurement channel as defined in clause A.3.1.1		Conf 1, 2	SR.1.1 FDD		
		Conf 3, 4	SR.1.1 TDD		
		Conf 5, 6	SR 2.1 TDD		
RMSI CORESET reference measurement channel as defined in clause A.3.1.2		Conf 1, 2	CR.1.1 FDD		
		Conf 3, 4	CR.1.1 TDD		
		Conf 5, 6	CR.2.1 TDD		
RMC CORESET reference measurement channel as defined in clause A.3.1.3		Conf 1, 2	CCR.1.1 FDD		
		Conf 3, 4	CCR.1.1 TDD		
		Conf 5, 6	CCR.2.1 TDD		
OCNG Pattern Note 1		Conf 1, 2, 3, 4, 5, 6	OP.1		
SSB configuration		Conf 1, 2, 3, 4	SSB.1 FR1		
		Conf 5, 6	SSB.2 FR1		
SMTC configuration		Conf 1, 2, 3, 4, 5, 6	SMTC.1		
CSI-RS for tracking		Conf 1, 2	TRS.1.1 FDD		
		Conf 3, 4	TRS.1.1 TDD		
		Conf 5, 6	TRS.1.2 TDD		
DL initial BWP configuration		Conf 1, 2, 3, 4, 5, 6	DLBWP.0.1		
DL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6	DLBWP.1.1		
UL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6	ULBWP.1.1		
EPRE ratio of PSS to SSS	dB	Conf 1, 2, 3, 4, 5, 6	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					

Parameter	Unit	Test Configuration	Test 1		
			T1	T2	T3
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc} Note 2	dBm / 15kHz	Conf 1, 2, 3, 4	-102		
	dBm/ SCS	Conf 1,2,3,4	-102		
		Conf 5, 6	-99		
$\hat{E}_s / N_{oc}$	dB	Conf 1, 2, 3, 4, 5, 6	16	16	16
$\hat{E}_s / I_{ot}$ Note 3	dB	Conf 1, 2, 3, 4, 5, 6	16	16	16
SS-RSRP Note 3	dBm/ SCS	Conf 1,2,3,4	-86	-86	-86
		Conf 5, 6	-83	-83	-83
Io Note 3	dBm/ 9.36 MHz	Conf 1,2,3,4	-57.9	-57.9	-57.9
	dBm/ 38.16 MHz	Conf 5, 6	-51.8	-51.8	-51.8
Propagation Condition		Conf 1, 2, 3, 4, 5, 6	AWGN		
Antenna configuration		Conf 1, 2, 3, 4, 5, 6	1 x 2		
SUL RSRP threshold (rsrp-ThresholdSSB-SUL)	dBm	Conf 1,2,3,4	-75		
		Conf 5, 6	-72		

NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: $\hat{E}_s / I_{ot}$, Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void.
NOTE 5: Void.
NOTE 6: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.

A.6.5.4.1.2 Test Requirements

The UE shall be ready to start transmission on the supplementary uplink carrier on SUL within 20ms from the start of T2.

The UE shall stop the transmission on the supplementary uplink carrier on SUL within 20ms from the start of T3.

All of the above test requirements shall be fulfilled in order for the observed UE UL carrier configuration delay and UE UL carrier release delay to be counted as correct. The rate of correct observed UE UL carrier configuration delay and UE UL carrier release delay during repeated tests shall be at least 90%.

A.6.5.4.2 Void

A.6.5.5 Beam Failure Detection and Link recovery procedures

A.6.5.5.1 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in non-DRX mode

A.6.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.6.5.5.1.1-1, A.6.5.5.1.1-2, A.6.5.5.1.1-3 and A.6.5.5.1.1-4 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.1.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.6.5.5.1.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test 1.

Table A.6.5.5.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.5.1.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PSCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
BWchannel	Config 1	MHz	10: NRB,c = 52	
	Config 2		10: NRB,c = 52	
	Config 3		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
SSB Configuration	Config 1		SSB.3 FR1	
	Config 2		SSB.3 FR1	
	Config 3		SSB.4 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz	
	Config 3		30 kHz	
PRACH Configuration	Config 1, 2		Table A.3.8.2.2-1	
	Config 3		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	

Parameter		Unit	Value	Comment
			Test 1	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			gp0	
gapOffset			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
SSB Index assigned as RLM RS			0, 1	
T310 Timer		ms	1000	
N310			2	
T1		s	0.2	During this time the the UE shall be fully synchronized to Cell 1
T2		s	0.37	
T3		s	0.24	
T4		s	0	
T5		s	0.17	
D1		s	0.14	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.6.5.5.1.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS	dB	0				

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
SSB_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.6.5.5.1.1-4: Void

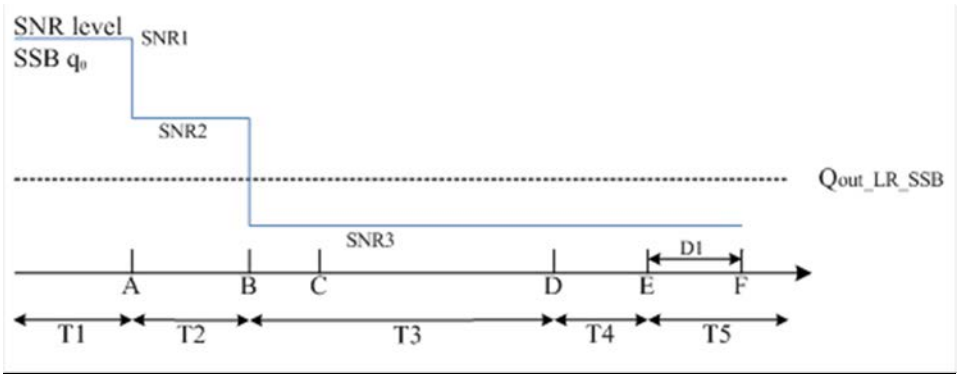


Figure A.6.5.5.1.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

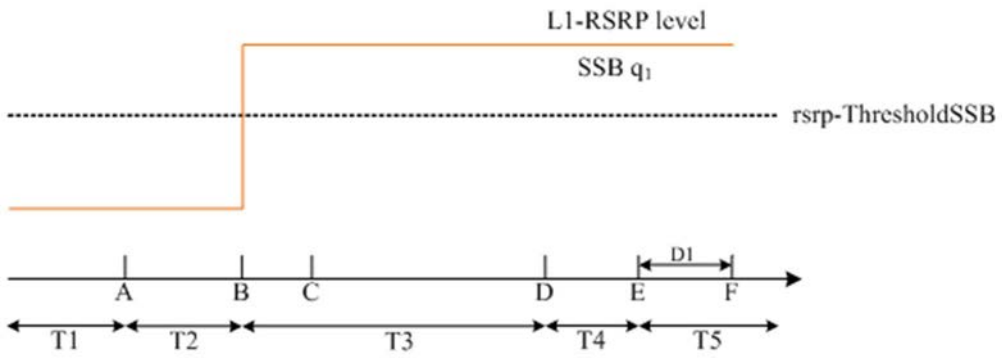


Figure A.6.5.5.1.1-2: L1-RSRP level variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.6.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.5.2 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in DRX mode

A.6.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.6.5.5.2.1-1, A.6.5.5.2.1-2, A.6.5.5.2.1-3, A.6.5.5.2.1-4 and A.6.5.5.2.1-5 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.2.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.6.5.5.2.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.6.5.5.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth

2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.5.2.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PSCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
BWchannel	Config 1	MHz	10: NRB,c = 52	
	Config 2		10: NRB,c = 52	
	Config 3		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
SSB Configuration	Config 1		SSB.3 FR1	
	Config 2		SSB.3 FR1	
	Config 3		SSB.4 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz	
	Config 3		30 kHz	
PRACH Configuration	Config 1, 2		Table A.3.8.2.2-1	
	Config 3		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	

Parameter		Unit	Value	Comment
			Test 1	
rlmInSyncOutOfSyncThreshold			Absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
SSB Index assigned as RLM RS			0, 1	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to Cell 1
T2		s	5.17	
T3		s	3.24	
T4		s	0	
T5		s	1.97	
D1		s	1.94	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.6.5.5.2.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
SSB_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 4: Void							
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.							
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.							
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.							
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.							

Table A.6.5.5.2.1-4: Void

Table A.6.5.5.2.1-5: Void

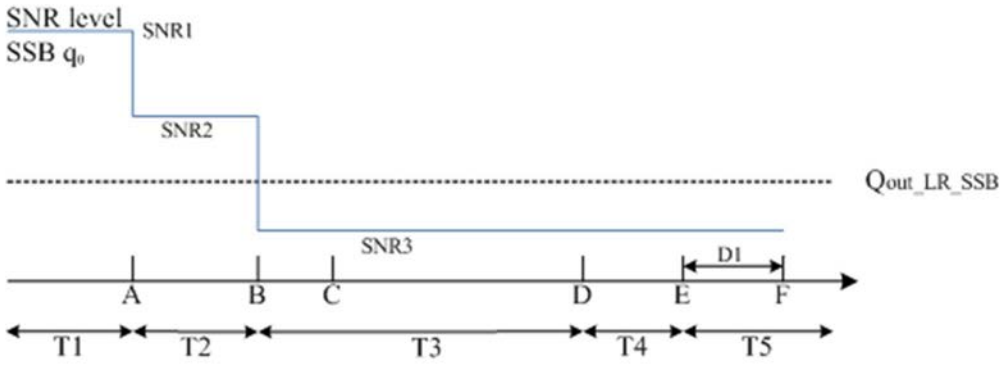


Figure A.6.5.5.2.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in DRX mode

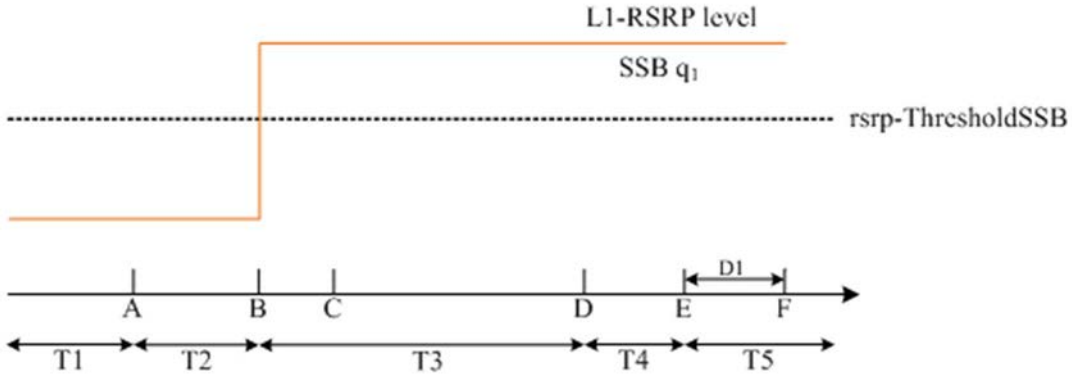


Figure A.6.5.5.2.1-2: L1-RSRP level variation for SSB-based beam failure detection and link recovery testing in DRX mode

A.6.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.5.3 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.6.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.6.5.5.3.1-1, A.6.5.5.3.1-2, and below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.3.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.6.5.5.3.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.6.5.5.3.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.5.3.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	A.3.1.2

Parameter			Unit	Value	Comment
				Test 1	
	Config 2			CR.1.1 TDD	
	Config 3			CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1			CCR.1.1 FDD	A.3.1.3
	Config 2			CCR.1.1 TDD	
	Config 3			CCR.2.1 TDD	
SSB Configuration	Config 1			SSB.3 FR1	A.3.10
	Config 2			SSB.3 FR1	
	Config 3			SSB.4 FR1	
SSB Configuration	Config 1			SSB. 3 FR1	A.3.10
	Config 2			SSB. 3 FR1	
	Config 3			SSB. 4 FR1	
SMTC Configuration	Config 1, 2			SMTC.1	A.3.11
	Config 3			SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2			15 kHz	
	Config 3			30 kHz	
PRACH Configuration	Config 1, 2			FR1 PRACH configuration 4	A.3.8.2
	Config 3			FR1 PRACH configuration 4	A.3.8.2
csi-RS-Index assigned as beam failure detection RS in set q_0				0	
OCNG parameters				OP.1	A.3.2.1
CP length				Normal	
Correlation Matrix and Antenna Configuration				2x2 Low	
Beam failure detection transmission parameters	DCI format			1-0	
	Number of Control OFDM symbols			2	
	Aggregation level		CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy		dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy		dB	0	
	DMRS precoder granularity			REG bundle size	
	REG bundle size			6	
DRX				OFF	
Gap pattern ID				N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1				1	N
rlmInSyncOutOfSyncThreshold				absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdCSI-RS	Config 1, 2		dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_CSI-RS}$
	Config 3			-95	
powerControlOffsetSS				db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount				n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer				pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1		Config 1		CSI-RS.1.2 FDD	A.3.14
		Config 2		CSI-RS.1.2 TDD	

Parameter		Unit	Value	Comment
			Test 1	
	Config 3		CSI-RS.2.2 TDD	
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	A.3.14
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
CSI-RS-Index assigned as RLM RS	Config 1		CSI-RS.1.2 FDD	A.3.14
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	0.2	During this time the the UE shall be fully synchronized to Cell 1
T2		s	0.18	
T3		s	0.14	
T4		s	0	
T5		s	0.08	
D1		s	0.05	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.6.5.5.3.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Void						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.5.3.1-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.						

Table A.6.5.5.3.1-4: Void

Table A.6.5.5.3.1-5: Void

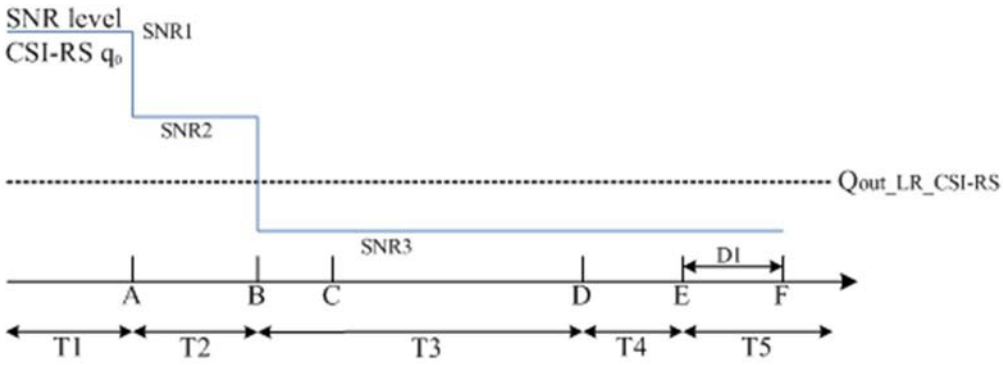


Figure A.6.5.5.3.1-1: SNR variation for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

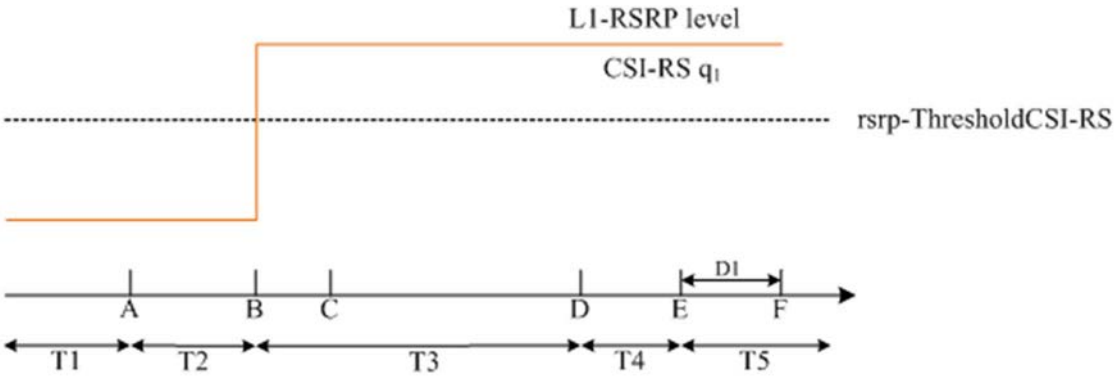


Figure A.6.5.5.3.1-2: L1-RSRP level variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

A.6.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 30+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.5.4 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in DRX mode

A.6.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.6.5.5.4.1-1, A.6.5.5.4.1-2, A.6.5.5.4.1-3, and A.6.5.5.4.1-4 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.4.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.6.5.5.4.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.6.5.5.4.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.5.4.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf..21	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	

Parameter		Unit	Value	Comment
			Test 1	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	A.3.1.3
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
SSB Configuration	Config 1		SSB. 3 FR1	A.3.10
	Config 2		SSB. 3 FR1	
	Config 3		SSB. 4 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	A.3.11
	Config 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz	
	Config 3		30 kHz	
PRACH Configuration	Config 1, 2		FR1 PRACH configuration 4	A.3.8.2
	Config 3		FR1 PRACH configuration 4	A.3.8.2
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdCSI-RS	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_CSI-RS}$
	Config 3		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]

Parameter		Unit	Value	Comment
			Test 1	
CSI-RS configuration for q_0 and q_1	Config 1		CSI-RS.1.2 FDD	A.3.14 .1
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	A.3.14.1
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
CSI-RS-Index assigned as RLM RS	Config 1		CSI-RS.1.2 FDD	
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to Cell 1
T2		s	8.37	
T3		s	6.44	
T4		s	0	
T5		s	1.97	
D1		s	1.94	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.6.5.5.4.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1	dB/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Void						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.5.4.1-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.						

Table A.6.5.5.4.1-4: Void

Table A.6.5.5.4.1-5: Void

Table A.6.5.5.4.1-6: Void

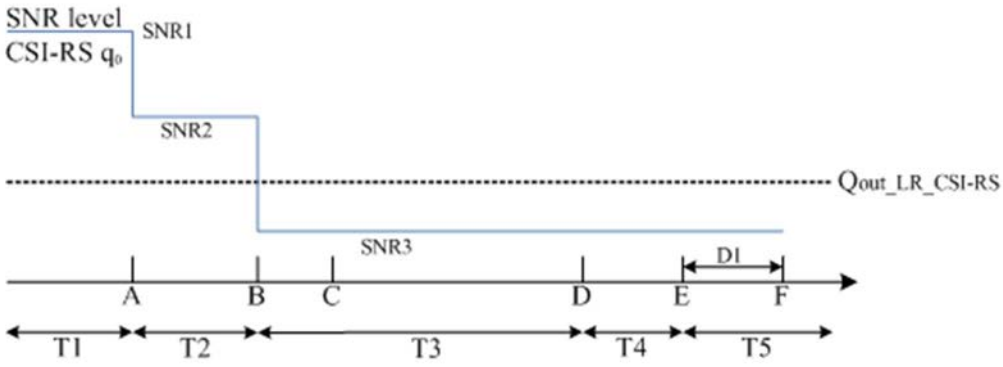


Figure A.6.5.5.4.1-1: SNR variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

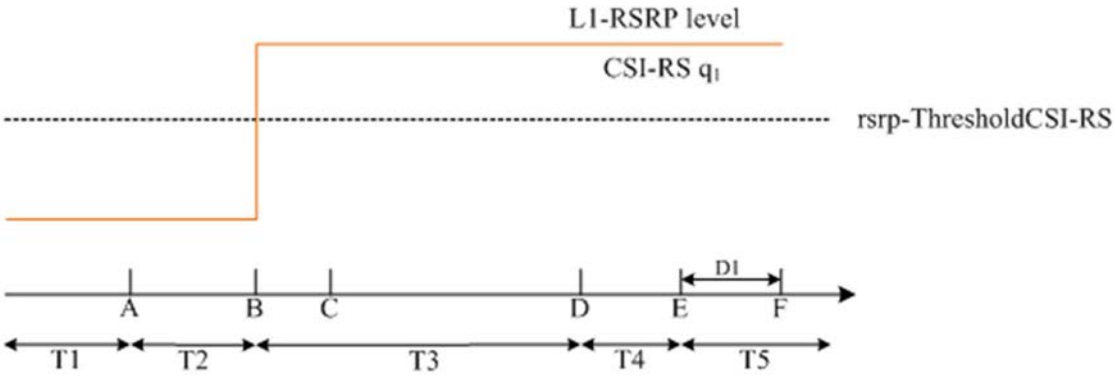


Figure A.6.5.5.4.1-2: L1-RSRP level variation for CSI-RS based beam failure detection and link recovery testing in DRX mode

A.6.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.5.5 Beam Failure Detection and Link Recovery Test for FR1 SCell configured with CSI-RS-based BFD and SSB-based LR in non-DRX mode

A.6.5.5.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP without *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.6.5.5.5.1-1, A.6.5.5.5.1-2, and below. There are two cells, Cell 1 is the PCell and Cell 2 is the SCell, in the test. UE is not provided by *schedulingRequestID-BFR-SCell-r16*, i.e., no configuration for PUCCH transmission resources, and UE shall perform the random access procedure to recover the beam failure. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.5.1-1 shows the SNR of the CSI-RS in set q_0 in the active SCell to emulate beam failure. Figure A.6.5.5.5.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.6.5.5.5.1-1: Supported test configurations for FR1 PCell and SCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.5.5.1-2: General test parameters for FR1 SCell for beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number for PCell			1	
Active SCell			Cell 2	
RF Channel Number for SCell			2	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
BW channel	Config 1		10: NRB,c = 52	

Parameter			Unit	Value	Comment
				Test 1	
	Config 2		MHz	10: NRB,c = 52	
	Config 3			40: NRB,c = 106	
TDD Configuration	Config 1			Not Applicable	
	Config 2			TDDConf.1.1	
	Config 3			TDDConf.2.1	
CORESET Reference Channel	Config 1			CR.1.1 FDD	A.3.1.2
	Config 2			CR.1.1 TDD	
	Config 3			CR.2.1 TDD	
SSB Configuration	Config 1			SSB.1 FR1	A.3.10
	Config 2			SSB.1 FR1	
	Config 3			SSB.2 FR1	
SMTC Configuration	Config 1, 2			SMTC.1	A.3.11
	Config 3			SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		kHz	15	
	Config 3			30	
PRACH Configuration	Config 1, 2, 4, 5			Table A.3.8.2.2-1	
	Config 3, 6			Table A.3.8.2.2-1	
csi-RS-Index assigned as beam failure detection RS in set q_0 in activated SCell				0	
OCNG parameters				OP.1	A.3.2.1
CP length				Normal	
Correlation Matrix and Antenna Configuration				2x2 Low	
Beam failure detection transmission parameters	DCI format			1-0	
	Number of Control OFDM symbols			2	
	Aggregation level		CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy		dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy		dB	0	
	DMRS precoder granularity			REG bundle size	
	REG bundle size			6	
DRX				OFF	
Gap pattern ID				N.A.	
schedulingRequestID-BFR-SCell-r16				absent	When the field is absent, the random access procedure will be triggered for SCell BFR
SSB Index assigned as CBD RS (q1) in activated SCell				0	
rlmInSyncOutOfSyncThreshold				absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdBFR	Config 1, 2		dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3			-95	
powerControlOffsetSS				db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount				n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer				pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 in activated SCell		Config 1		CSI-RS.1.2 FDD	A.3.14
		Config 2		CSI-RS.1.2 TDD	
		Config 3		CSI-RS.2.2 TDD	
		Config 1		CSI-RS.1.1 FDD	A.3.14

Parameter		Unit	Value	Comment
			Test 1	
CSI-RS configuration for CSI reporting	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
CSI-RS-Index assigned as RLM RS in PCell	Config 1		CSI-RS.1.2 FDD	A.3.14
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	0.2	During this time the the UE shall be fully synchronized to Cell 1
T2		s	0.18	
T3		s	0.14	
T4		s	0	
T5		s	0.17	
D1		s	0.13	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.6.5.5.5.1-3: Cell specific test parameters for FR1 SCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Cell 1	Test 1 Cell 2				
			T1 to T5	T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR_CSI-RS of set q_0	Config 1	dB	5	5	-3	-12	-12	-12
	Config 2		5	5	-3	-12	-12	-12
	Config 3		5	5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	-10	-10	-10	10	10	10
	Config 2		-10	-10	-10	10	10	10
	Config 3		-10	-10	-10	10	10	10
SSB_RP of set q_1	Config 1	dBm/ SCS kHz	-108	-108	-108	-88	-88	-88
	Config 2		-108	-108	-108	-88	-88	-88
	Config 3		-105	-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/ 15kHz	-98	-98				
	Config 2		-98	-98				
	Config 3		-98	-98				
Propagation condition			TDL-C 300 ns 100 Hz	TDL-C 300 ns 100 Hz				

Parameter	Unit	Cell 1	Test 1 Cell 2				
		T1 to T5	T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 4: Void							
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.							
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.							
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.5.5.1-1.							
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.							

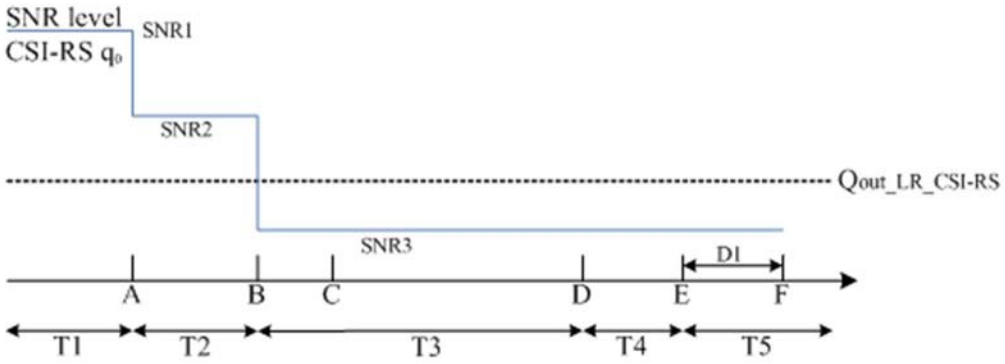


Figure A.6.5.5.5.1-1: SNR variation for beam failure detection and link recovery testing in for SCell non-DRX mode

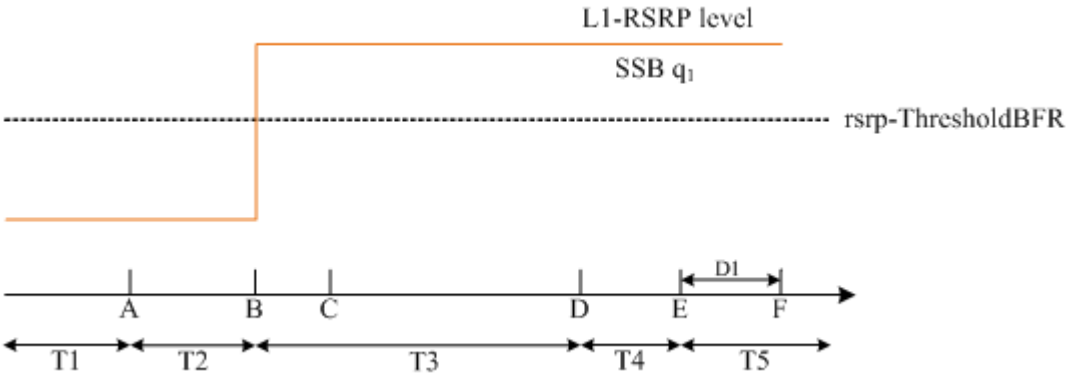


Figure A.6.5.5.5.1-2: L1-RSRP level variation for beam failure detection and link recovery testing for SCell in non-DRX mode

A.6.5.5.5.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+10 ms after the start of T5, the UE shall transmit preamble for UL-SCH resource application, followed by MAC-CE on the assigned uplink resources containing a beam associated with the candidate beam set q_1. The UE shall not transmit preamble earlier than time point B.

During T5, the System Simulator shall transmit a Random Access Response to UE after the System Simulator receives the preamble from UE. The UE shall transmit the msg.3 containing candidate beam set q1 for SCell BFR if UE receives the Random Access Response.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.5.6 Beam Failure Detection and Link Recovery Test for FR1 SCell configured with CSI-RS-based BFD and SSB-based LR in DRX mode

A.6.5.5.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP without *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.6.5.5.6.1-1, A.6.5.5.6.1-2, and A.6.5.5.6.1-3 below. There are two cells, Cell 1 is the PCell and Cell 2 is the SCell, in the test. UE is not provided by *schedulingRequestID-BFR-SCell-r16*, i.e., no configuration for PUCCH transmission resources, and UE shall perform the random access procedure to recover the beam failure. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.6.1-1 shows the SNR of the CSI-RS in set q_0 in the active SCell to emulate beam failure. Figure A.6.5.5.6.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in SCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.6.5.5.6.1-1: Supported test configurations for FR1 PCell and SCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.5.6.1-2: General test parameters for FR1 SCell for beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number for PCell			1	
Active SCell			Cell 2	
RF Channel Number for SCell			2	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
BW channel	Config 1	MHz	10: NRB,c = 52	
	Config 2		10: NRB,c = 52	
	Config 3		40: NRB,c = 106	
TDD Configuration	Config 1		Not Applicable	

Parameter		Unit	Value	Comment
			Test 1	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf..21	
CORESET Reference Channel	Config 1		CR.1.1 FDD	A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
SSB Configuration	Config 1		SSB.1 FR1	A.3.10
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	A.3.11
	Config 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz	
	Config 3		30 kHz	
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.1-1	
	Config 3, 6		Table A.3.8.2.1-1	
csi-RS-Index assigned as beam failure detection RS in set q_0 in activated SCell			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
schedulingRequestID-BFR-SCell-r16			absent	When the field is absent, the random access procedure will be triggered for SCell BFR
SSB Index assigned as CBD RS (q1) in activated SCell			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdBFR	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 in activated SCell	Config 1		CSI-RS.1.2 FDD	A.3.14.1
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	A.3.14.1
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
TRS configuration	Config 1		TRS.1.1 FDD	

Parameter		Unit	Value	Comment
			Test 1	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
CSI-RS-Index assigned as RLM RS in PCell	Config 1		CSI-RS.1.2 FDD	
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to Cell 1
T2		s	8.37	
T3		s	6.44	
T4		s	0	
T5		s	1.97	
D1		s	1.93	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.6.5.5.6.1-3: Cell specific test parameters for FR1 SCell for beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Cell 1	Test 1 Cell 2				
			T1 to T5	T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR_CSI-RS of set q_0	Config 1	dB	5	5	-3	-12	-12	-12
	Config 2	dB	5	5	-3	-12	-12	-12
	Config 3	dB	5	5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	-10	-10	-10	10	10	10
	Config 2	dB	-10	-10	-10	10	10	10
	Config 3	dB	-10	-10	-10	10	10	10
SSB_RP of set q_1	Config 1	dBm/ SCS kHz	-108	-108	-108	-88	-88	-88
	Config 2		-108	-108	-108	-88	-88	-88
	Config 3		-105	-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 kHz	-98	-98				
	Config 2		-98	-98				
	Config 3		-98	-98				
Propagation condition			TDL-C 300 ns 100 Hz	TDL-C 300 ns 100 Hz				

Parameter	Unit	Cell 1	Test 1 Cell 2				
		T1 to T5	T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 4: Void							
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.							
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.							
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.5.6.1-1.							
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.							

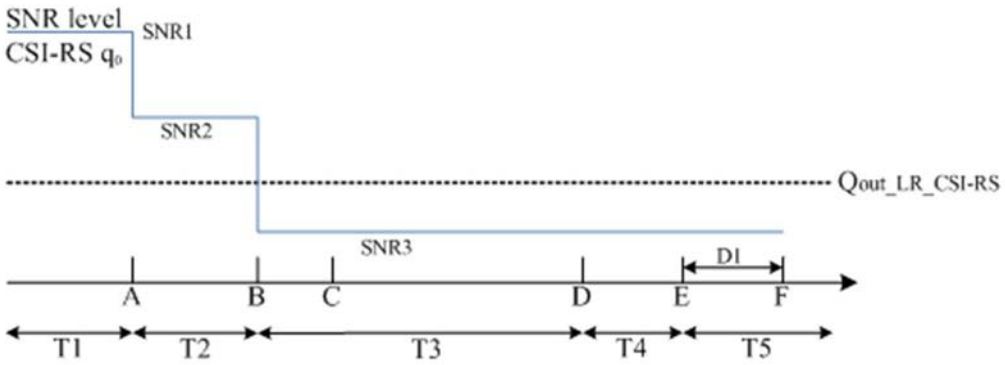


Figure A.6.5.5.6.1-1: SNR variation for beam failure detection and link recovery testing for SCell in DRX mode

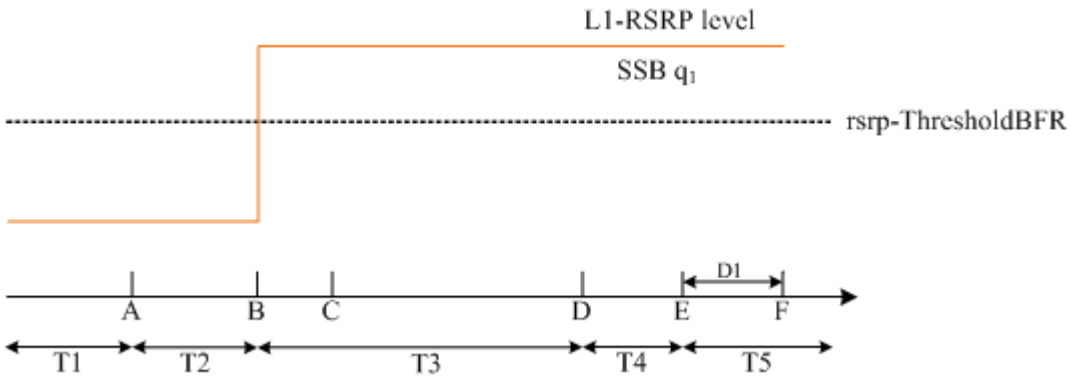


Figure A.6.5.5.6.1-2: L1-RSRP level variation for beam failure detection and link recovery testing for SCell in DRX mode

A.6.5.5.6.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+10 ms after the start of T5, the UE shall transmit preamble for UL-SCH resource application, followed by MAC-CE on the assigned uplink resources containing a beam associated with the candidate beam set q_1. The UE shall not transmit preamble earlier than time point B.

During T5, the System Simulator shall transmit a Random Access Response to UE after the System Simulator receives the preamble from UE. The UE shall transmit the msg.3 containing candidate beam set q1 for SCell BFR if UE receives the Random Access Response.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.5.7 TRP Specific Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in DRX mode

A.6.5.5.7.1 Test Purpose and Environment

The test scenario is NR configured in the test contains two TRPs (i.e., TRP0 and TRP1). Each TRP is configured with different CSI-RS for beam failure detection and candidate beam detection. CSI-RS is configured as BFD-RS and CBD-RS.

The purpose of this test is to verify that the UE properly detects TRP specific CSI-RS-based beam failure in the sets $q_{0,0}$ for TRP0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set $q_{1,0}$. The purpose is to test the downlink monitoring for beam failure detection on TRP0 within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based TRP specific beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.18 with *schedulingRequestID-BFR-r17* configured.

The test parameters are given in Tables A.6.5.5.7.1-1, A.6.5.5.7.1-2, and A.6.5.5.7.1-3 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.7.1-1 shows the variation of the downlink SNR of the CSI-RS in set $q_{0,0}$ and $q_{0,1}$ for TRP0 and TRP1 respectively to emulate CSI-RS based beam failure on TRP0. Figure A.6.5.5.7.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set $q_{1,0}$ and $q_{1,1}$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.6.5.5.7.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.5.7.1-2: General test parameters for FR1 PCell for CSI-RS-based TRP specific beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	A.3.1.2
	Config 2		CR.1.1 TDD	

Parameter			Unit	Value	Comment
				Test1	
	Config 3			CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1			CCR.1.1 FDD	A.3.1.3
	Config 2			CCR.1.1 TDD	
	Config 3			CCR.2.1 TDD	
SSB Configuration	Config 1			SSB.3 FR1	A.3.10
	Config 2			SSB.3 FR1	
	Config 3			SSB.4 FR1	
SMTC Configuration	Config 1, 2			SMTC.1	A.3.11
	Config 3			SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2			15 kHz	
	Config 3			30 kHz	
PRACH Configuration	Config 1, 2,3			FR1 PRACH configuration 4	A.3.8.2
OCNG parameters				OP.1	A.3.2.1
CP length				Normal	
Correlation Matrix and Antenna Configuration				2x2 Low	
Beam failure detection transmission parameters	DCI format			1-0	
	Number of Control OFDM symbols			2	
	Aggregation level		CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy		dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy		dB	0	
	DMRS precoder granularity			REG bundle size	
	REG bundle size			6	
DRX				DRX.7	A.3.3.7
Gap pattern ID				N.A.	
schedulingRequestID-BFR- r17				Configured	
Periodicity of PUCCH for SR configuration for BFR on PCell		Config 1	slot	5	5 ms
		Config 2, 3		10	
rlmInSyncOutOfSyncThreshold				absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdCSI-RS	Config 1, 2		dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_CSI-RS}$
	Config 3			-95	
powerControlOffsetSS				db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount				n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer				pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for TRP0	Config 1			CSI-RS.1.2 FDD	A.3.14.1
	Config 2			CSI-RS.1.2 TDD	
	Config 3			CSI-RS.2.2 TDD	
CSI-RS configuration for TRP1	Config 1			CSI-RS.1.7 FDD	
	Config 2			CSI-RS.1.6 TDD	
	Config 3			CSI-RS.2.7 TDD	
CSI-RS Index assigned as BFD RS (q0,0)				0	
CSI-RS Index assigned as CBD RS (q1,0)				1	
CSI-RS Index assigned as BFD RS (q0,1)				2	
CSI-RS Index assigned as CBD RS (q1,1)				3	
CSI-RS index assigned as RLM RS				0,1,2,3	
CSI-RS configuration for CSI reporting	Config 1			CSI-RS.1.1 FDD	A.3.14.1
	Config 2			CSI-RS.1.1 TDD	
	Config 3			CSI-RS.2.1 TDD	
TRS configuration	Config 1			TRS.1.1 FDD	
	Config 2			TRS.1.1 TDD	
	Config 3			TRS.1.2 TDD	
T310 Timer			ms	1000	

Parameter	Unit	Value	Comment
		Test1	
N310		2	
T1	s	1	During this time the the UE shall be fully synchronized to Cell 1
T2	s	8.37	
T3	s	6.44	
T4	s	0	
T5	s	1.97	
D1	s	1.93	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.5.7.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set $q_{0,0}$	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_CSI-RS of set $q_{0,1}$	Config 1	dB	5	5	5	5	5
	Config 2		5	5	5	5	5
	Config 3		5	5	5	5	5
SNR_CSI-RS of set $q_{1,0}$	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
SNR_CSI-RS of set $q_{1,1}$	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
CSI-RS_RP of set $q_{1,0}$	Config 1	dB/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
CSI-RS_RP of set $q_{1,1}$	Config 1	dB/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.5.7.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

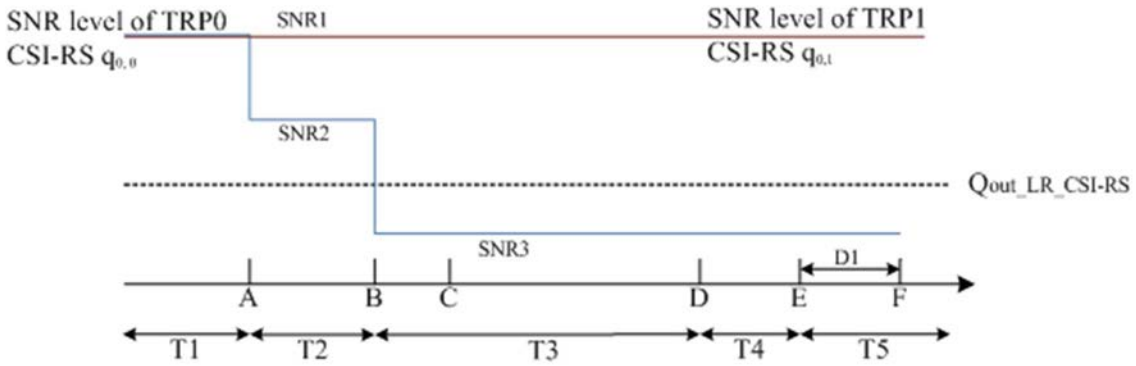


Figure A.6.5.5.7.1-1: SNR variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

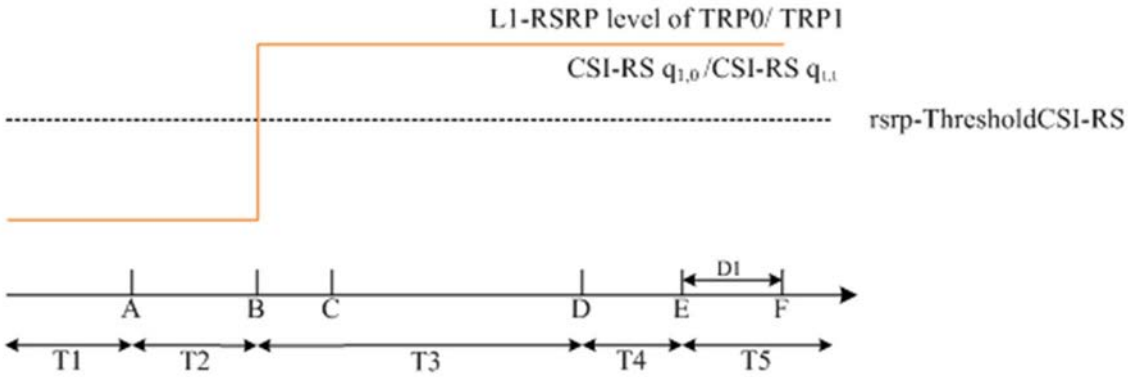


Figure A.6.5.5.7.1-2: L1-RSRP level variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

A.6.5.5.7.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_{1,0}$.

No later than time point F occurring no later than D1 = 1920+10 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set $q_{1,0}$. The UE shall not transmit PUCCH with an LRR with the candidate beam set $q_{1,0}$ earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.5.8 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in non-DRX mode for a UE operating on a cell with less than 5 MHz BW

A.6.5.5.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *support-3MHz-ChannelBW-r18* properly detects SSB-based beam failure in the set q_0 configured for a serving cell operating on a less than 5 MHz bandwidth, and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

Supported test configurations are specified in table A.6.5.5.8.1-1. General test parameters as specified in table A.6.5.5.1.1-2 with config 1 apply except those specified in table A.6.5.5.8.1-2. Cell specific test parameters as specified in table A.6.5.5.1.1-3 apply except those specified in table A.6.5.5.8.1-3.

The test procedure specified in clause A.6.5.5.1.1 applies to this test.

Table A.6.5.5.8.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 3 MHz bandwidth

Table A.6.5.5.8.1-2: General test parameters for FR1 PCell

Parameter			Unit	Value	Comment
				Test 1	
BWchannel		Config 1	MHz	3: $N_{PRB,c}$ = 15	
SSB Configuration		Config 1		SSB.13 FR1	
PRACH Configuration		Config 1		1	
Beam failure detection transmission parameters	Number of Control OFDM symbols			3	
	Aggregation level		CCE	8	
	Mapping from REG to CCE			Non-Distributed	
T1			s	1	During this time the the UE shall be fully synchronized to Cell 1
T2			s	5.17	
T3			s	3.24	
T4			s	0	
T5			s	1.97	
D1			s	1.94	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.6.5.5.8.1-3: Cell specific test parameters for FR1 PCell

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
SNR_SSB of set q_0	Config 1	dB	6	-2	-11	-11	-11

A.6.5.5.8.2 Test Requirements

Test requirements specified in clause A.6.5.5.1.2 apply to this test.

A.6.5.6 Active BWP switch

A.6.5.6.1 DCI-based and Timer-based Active BWP Switch

A.6.5.6.1.1 NR FR1- NR FR1 DL active BWP switch of SCell with non-DRX in SA

A.6.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6, and interruption requirement on other active serving cell defined in clause 8.2.2.2.5.

The supported test configurations for PCell are shown in table A.6.5.6.1.1.1-1 below. Supported test configurations for NR SCell are shown in table A.6.5.6.1.1.1-1A below. Test configuration for NR PCell and test configuration for NR SCell are chosen independently. The test scenario comprises of one NR PCell (Cell 1) and one SCell (Cell 2) as given in table A.6.5.6.1.1.1-2. NR Cell-specific parameters are specified in table A.6.5.6.1.1.1-3 and table A.6.5.6.1.1.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for PCell, BWP-0 in Cell 1 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in SCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in PCell.
- UE is configured with a *bwp-InactivityTimer* timer value for SCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for SCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in SCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of SCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell on PCell no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-2 no later than the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).
>
> The starting time of PCell (Cell 1) interruption due to BWP switch on SCell shall occur within the BWP switch delay.

During T2, the test equipment will not transmit DCI format for PDSCH reception on SCell (Cell 2).

During T3,

> The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.
>
> The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of SCell's slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell on PCell at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-1 no later than the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The starting time of PCell (Cell 1) interruption due to BWP switch of SCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in SCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

The test equipment verifies that potential interruption to PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of SCell, respectively.

Table A.6.5.6.1.1.1-1: DL BWP switch supported test configurations for NR PCell

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.6.1.1.1-1A: DL BWP switch supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration,	

Table A.6.5.6.1.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2	Two NR radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2	SCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and SCell
bwp-InactivityTimer	ms	200	
PDCCH and PDSCH maximum number of HARQ transmission		1	For both PCell and SCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on SCC.
Cell 2 timing offset to cell1	μs	3	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.6.5.6.1.1.1-3: NR Cell specific test parameters for NR PCell for DL BWP switch in SA

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1

Parameter		Unit	Cell 1
	Config 3		TDDConf.1.2
$BW_{channel}$	Config 1,2		Note 7
	Config 3		Note 7
$BW_{occupied}$	Config 1,2	RB	52 Note 5
	Config 3		106 Note 6
Active BWP ID			0
Initial DL BWP Configuration			DLBWP.0.2Note4
Initial UL BWP Configuration			ULBWP.0.2Note4
Active DL BWP-0 Configuration			DLBWP.0.2Note4
Active DL BWP-1 Configuration			N.A.
Active DL BWP-2 Configuration			N.A.
Active UL BWP-0 Configuration			ULBWP.0.2Note4
Active UL BWP-1 Configuration			N.A.
Active UL BWP-2 Configuration			N.A.
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.2 FDD
	Config 2		CCR.1.2 TDD
	Config 3		CCR.2.4 TDD
TRS Configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
OCNG Patterns	Config 1,2		OP.1 Note 5
	Config 3		OP.1 Note 6
SSB Configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc}Note 2	Config 1,2	dBm/SCS	-104
	Config 3		-101
N_{oc}Note 2		dBm/15kHz	-104
SS-RSRP Note 3	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
IoNote3	Config 1,2	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86
Propagation Condition			AWGN

Parameter	Unit	Cell 1
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.		
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].		
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.		
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.		
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.		

Table A.6.5.6.1.1.1-4: NR Cell specific test parameters for NR SCell for DL BWP switch in SA

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	$Config_{SCell}$ 1		FDD
	$Config_{SCell}$ 2,3		TDD
TDD configuration	$Config_{SCell}$ 1		Not Applicable
	$Config_{SCell}$ 2		TDDConf.1.1
	$Config_{SCell}$ 3		TDDConf.1.2
$BW_{channel}$	$Config_{SCell}$ 1,2		Note 7
	$Config_{SCell}$ 3		Note 7
$BW_{occupied}$	$Config_{SCell}$ 1,2	RB	52 Note 5
	$Config_{SCell}$ 3		106 Note 6
Active BWP ID			1, 2
Initial DL BWP Configuration			DLBWP.0.2Note4
Initial UL BWP Configuration			N.A.
Active DL BWP-0 Configuration			N.A.
Active DL BWP-1 Configuration			DLBWP.1.1Note4
Active DL BWP-2 Configuration			DLBWP.1.3Note4
Active UL BWP-0 Configuration			N.A.
Active UL BWP-1 Configuration			N.A.
Active UL BWP-2 Configuration			N.A.
PDSCH Reference measurement channel	$Config_{SCell}$ 1		SR.1.1 FDD
	$Config_{SCell}$ 2		SR.1.1 TDD
	$Config_{SCell}$ 3		SR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell}$ 1		CR.1.1 FDD
	$Config_{SCell}$ 2		CR.1.1 TDD
	$Config_{SCell}$ 3		CR.2.1 TDD
Dedicated CORESET parameters	$Config_{SCell}$ 1		CCR.1.2 FDD
	$Config_{SCell}$ 2		CCR.1.2 TDD
	$Config_{SCell}$ 3		CCR.2.4 TDD
TRS Configuration	$Config_{SCell}$ 1		TRS.1.1 FDD
	$Config_{SCell}$ 2		TRS.1.1 TDD
	$Config_{SCell}$ 3		TRS.1.2 TDD
OCNG Patterns	$Config_{SCell}$ 1,2		OP.1 Note 5
	$Config_{SCell}$ 3		OP.1 Note 6
SSB Configuration	$Config_{SCell}$ 1,2		SSB.1 FR1
	$Config_{SCell}$ 3		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			

Parameter		Unit	Cell 2
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note 2	$Config_{SCell}$ 1,2	dBm/SCS	-104
	$Config_{SCell}$ 3		-101
N_{oc} Note 2		dBm/15kHz	-104
SS-RSRP Note 3	$Config_{SCell}$ 1,2	dBm/SCS	-87
	$Config_{SCell}$ 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	$Config_{SCell}$ 1,2	dBm/ 9.36 MHz	-58.96
	$Config_{SCell}$ 3	dBm/ 38.16 MHz	-52.86
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].
NOTE 5: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 10 MHz, 52 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 6: All UL/DL transmission shall be confined within $BW_{occupied}$ (i.e. 40 MHz, 106 PRBs) from $F_{C,low}$, and Io is independent of the $BW_{channel}$ configured.
NOTE 7: $N_{PRB,c}$. is derived from Table 5.3.2-1 in TS38.101-1[18] with configured $BW_{channel}$.

A.6.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for SCell on PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for SCell on PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in TS 38.321 [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed SCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T1 and T3, the start time of PCell interruption during SCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed SCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first DL slot that occurs after the beginning of DL slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.6.5.6.1.2 NR FR1 DL active BWP switch with non-DRX in SA

A.6.5.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6.

The supported test configurations are shown in table A.6.5.6.1.2.1-1. The test scenario comprises of one cell (Cell 1) as given in table A.6.5.6.1.2.1-2. Cell-specific parameters of the cell are specified in table A.6.5.6.1.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with 2 different UE-specific downlink bandwidth parts, BWP-1 and BWP-2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1.
- UE is configured with a *bwp-InactivityTimer* timer value for Cell 1.

The cell has constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for DL BWP switch, sent from the test equipment to the UE, is received at the UE side in Cell 1's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell 1 no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-2 starting from the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

During T2, the test equipment will not transmit DCI format for PDSCH reception on Cell 1.

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell 1 at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-1 starting from the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The test equipment verifies the DL BWP switch time by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

Table A.6.5.6.1.2.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

NOTE 2: A UE which fulfils the requirements in test case A.6.5.6.1.1 can skip the test cases in A.6.5.6.1.2.

Table A.6.5.6.1.2.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell 1 on RF channel number 1.
CP length		Normal	
DRX		OFF	
bwp-InactivityTimer	ms	200	
PDCCH and PDSCH maximum number of HARQ transmission		1	
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.6.5.6.1.2.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
$BW_{channel}$	Config 1		10 MHz: $N_{PRB,c}$ = 52
	Config 2		10 MHz: $N_{PRB,c}$ = 52
	Config 3		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID			1, 2
Initial DL BWP Configuration	Config 1,2,3		DLBWP.0.2 Note 4
Active DL BWP-1 Configuration	Config 1,2,3		DLBWP.1.1 Note 4
Active DL BWP-2 Configuration	Config 1,2,3		DLBWP.1.3 Note 4
Initial UL BWP Configuration	Config 1,2,3		ULBWP.0.2 Note 4
Active UL BWP-1 Configuration	Config 1,2,3		ULBWP.1.1 Note 4
Active UL BWP-2 Configuration	Config 1		N/A
	Config 2,3		ULBWP.1.3 Note 4
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.2 FDD
	Config 2		CCR.1.2 TDD
	Config 3		CCR.2.4 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			

Parameter			Unit	Cell 1
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		Config 1,2	dBm/SCS	-104
		Config 3		-101
N_{oc} Note 2			dBm/15kHz	-104
SS-RSRP Note 3		Config 1,2	dBm/SCS	-87
		Config 3		-84
$\hat{E}_s/I_{ot}$			dB	17
$\hat{E}_s/N_{oc}$			dB	17
Io Note3		Config 1,2	dBm/ 9.36 MHz	-58.96
		Config 3	dBm/ 38.16 MHz	-52.86
Propagation Condition				AWGN

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

A.6.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in TS 38.321 [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed Cell 1 active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after beginning of DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.6.5.6.2 RRC-based Active BWP Switch

A.6.5.6.2.1 NR FR1 DL active BWP switch of Cell with non-DRX in SA

A.6.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6.

The supported test configurations are shown in table A.6.5.6.2.1.1-1. The test scenario comprises of one Cell (Cell 1) as given in table A.6.5.6.2.1.1-2. Cell-specific parameters of Cell are specified in table A.6.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in Cell 1.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ as defined in clause 8.6.3 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1 on BWP-1 of final condition. The UE shall be continuously scheduled on PCell's BWP-1 of final condition starting from the first DL slot right after slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$.

$T_{\text{RRCprocessingDelay}}$ and $T_{\text{BWPswitchDelayRRC}}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in Cell by counting the time from the time when the RRC Reconfiguration message including updated BWP configuration is sent till the time when a vaild ACK/NACK is received is received.

Table A.6.5.6.2.1.1-1: DL BWP switch supported test configurations in SA scenario

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.6.5.6.2.1.1-2: General test parameters for DL BWP switch in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
PDCCH and PDSCH maximum number of HARQ transmission		1	
T1	s	0.2	

Table A.6.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in SA scenario

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
$BW_{channel}$	Config 1		10 MHz: $N_{PRB,c}$ = 52
	Config 2		10 MHz: $N_{PRB,c}$ = 52
	Config 3		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID			1
Initial DL BWP Configuration	Config 1,2, 3		DLBWP.0.2

Parameter			Unit	Cell 1
Initial UL BWP Configuration		Config 1,2, 3		ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration	Config 1, 2, 3		DLBWP.1.3
	Active UL BWP-1 Configuration	Config 1, 2, 3		ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration	Config 1, 2, 3		DLBWP.1.1
	Active UL BWP-1 Configuration	Config 1, 2, 3		ULBWP.1.1
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD
		Config 2		SR.1.1 TDD
		Config 3		SR2.1 TDD
RMSI CORESET parameters		Config 1		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR2.1 TDD
Dedicated CORESET parameters		Config 1		CCR.1.2 FDD
		Config 2		CCR.1.2 TDD
		Config 3		CCR.2.4 TDD
OCNG Patterns				OP.1
SSB Configuration		Config 1,2		SSB.1 FR1
		Config 3		SSB.2 FR1
SMTC Configuration				SMTC.1
TRS Configuration		Config 1		TRS.1.1 FDD
		Config 2		TRS.1.1 TDD
		Config 3		TRS.1.2 TDD
Antenna Configuration				1x2 Low
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		Config 1,2	dBm/SCS	-104
		Config 3		-101
SS-RSRP Note 3		Config 1,2	dBm/SCS	-87
		Config 3		-84
$\hat{E}_s/I_{ot}$			dB	17
$\hat{E}_s/N_{oc}$			dB	17
Io Note3		Config 1,2	dBm/ 9.36 MHz	-58.96
		Config 3	dBm/ 38.16 MHz	-52.86

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

A.6.5.6.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the Cell from the first DL slot that occurs right after the begining of slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in TS 38.321 [7].

All of the above test requirements shall be fulfilled in order for the observed Cell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.6.3 Simultaneous DCI-based and Timer-based Active BWP Switch on multiple CCs

A.6.5.6.3.1 NR FR1- NR FR1 DL active BWP switch on multiple CCs with non-DRX in SA

A.6.5.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify requirements on the DL BWP switch delay on multiple CCs and interruption requirement for NR victim cell, both defined in clause 8.6.

The supported test configurations for NR PCell are shown in table A.6.5.6.3.1.1-1 below. The supported test configurations for NR SCells are shown in table A.6.5.6.3.1.1-1A below. Test configuration for NR PCell and test configuration for NR SCells are chosen independently. Test configuration for two NR SCells are chosen independently. The test scenario comprises of one NR PCell (Cell 1) and two NR SCells (Cell 2 and Cell 3) as given in table A.6.5.6.3.1.1-2. NR Cell-specific parameters are specified in table A.6.5.6.3.1.1-3, table A.6.5.6.3.1.1-4 and table A.6.5.6.3.1.1-5 below.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) and SCell (Cell 3) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and Cell 3 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 3) to ensure that the UE will have ACK/NACK sending.Before the test starts,

- UE is connected to PCell (Cell 1) on radio channel 1 (PCC), and SCell (Cell 2) on radio channel 2 (SCC) and SCell (Cell 3) on radio channel 3(SCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for SCell (Cell 2) and SCell (Cell 3), BWP-1 and BWP-2, in Cell 2 and Cell 3 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with a single UE-specific downlink bandwidth part, BWP-0, for PCell (Cell 1). BWP-0 includes the bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in SCell (Cell 2) and SCell (Cell 3).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in PCell (Cell 1).
- UE is configured with a *bwp-InactivityTimer* timer value for SCell (Cell 2) and SCell (Cell 3).

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for both SCell (Cell 2) and SCell (Cell 3) DL BWP switch, sent from the test equipment to the UE, is received at the UE side in both SCell (Cell 2)'s and SCell (Cell 3)'s slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2 at both SCell (Cell 2) and SCell (Cell 3).
>
> The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of SCell (Cell 2)'s and SCell (Cell 3)'s DL slot ($i+ T_{MultipleBWPswitchDelay}$) as defined in clause 8.6.2A.1 and starts to report valid ACK/NACK for the both SCell (Cell 2) and SCell (Cell 3) no later than the first UL slot that occurs after the beginning of slot ($i+ T_{MultipleBWPswitchDelay} +k1$). The UE shall be continuously scheduled on both SCell (Cell 2)'s and SCell (Cell 3)'s BWP-2 no later than the first DL slot that occurs after the beginning of slot ($i+ T_{MultipleBWPswitchDelay}$).

The starting time of PCell interruption due to BWP switch on SCell (Cell 2) and SCell (Cell 3) shall occur within the BWP switch delay.

During T2, the test equipment will not transmit DCI format for PDSCH reception on SCell (Cell 2) and SCell (Cell 3).

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1 on both SCell (Cell 2) and SCell (Cell 3).

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of SCell (Cell 2)'s an SCell (Cell 3)'s slot ($j+ T_{MultipleBWPswitchDelay}$) as defined in clause 8.6.2A.1 and starts to report valid ACK/NACK for the SCell (Cell 2) and SCell (Cell 3) no later than the first UL slot that occurs after the beginning of slot ($j+ T_{MultipleBWPswitchDelay} +k1$). The UE shall be continuously scheduled on SCell (Cell 2)'s and SCell (Cell 3)'s BWP-1 no later than the first DL slot that occurs after the beginning of slot ($j+ T_{MultipleBWPswitchDelay}$).

The starting time of PCell interruption due to BWP switch of SCell (Cell 2) and SCell (Cell 3) shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in SCells by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

The test equipment verifies that potential interruption to PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of SCells, respectively.

Table A.6.5.6.3.1.1-1: DL BWP switch supported test configurations for NR PCell

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.6.5.6.3.1.1-1A: DL BWP switch supported test configurations for NR SCells

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration NOTE 3: Test configurations of two NR SCells are selected independently.	

Table A.6.5.6.3.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2	Two NR radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2; Cell 3	SCell on RF channel number 2 and number 3.
CP length		Normal	
DRX		OFF	For both PCell and SCells (Cell 2 and Cell 3)
bwp-InactivityTimer	ms	200	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for Cell 1 on SCC.

Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for Cell 2 on SCC.
Cell 2 and Cell 3 timing offset to cell1	µs	3	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.6.5.6.3.1.1-3: NR Cell specific test parameters for NR PCell for DL BWP switch in SA

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
$BW_{channel}$	Config 1,2		10 MHz: $N_{PRB,c}$ = 52
	Config 3		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID			0
Initial DL BWP Configuration			DLBWP.0.2 Note4
Initial UL BWP Configuration			ULBWP.0.2 Note4
Active DL BWP-0 Configuration			DLBWP.0.2 Note4
Active DL BWP-1 Configuration			N.A.
Active DL BWP-2 Configuration			N.A.
Active UL BWP-0 Configuration			ULBWP.0.2 Note4
Active UL BWP-1 Configuration			N.A.
Active UL BWP-2 Configuration			N.A.
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1,2	dBm/SCS	-104
	Config 3		-101
N_{oc} Note 2		dBm/15kHz	-104
SS-RSRP Note 3	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io^{Note3}	Config 1,2	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86
Propagation Condition			AWGN

Parameter	Unit	Cell 1
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].		

Table A.6.5.6.3.1.1-4: NR Cell specific test parameters for SCell (NR Cell 2) for DL BWP switch in SA

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	$Config_{SCell\ 1}$ 1		FDD
	$Config_{SCell\ 1}$ 2,3		TDD
TDD configuration	$Config_{SCell\ 1}$ 1		Not Applicable
	$Config_{SCell\ 1}$ 2		TDDConf.1.1
	$Config_{SCell\ 1}$ 3		TDDConf.2.1
$BW_{channel}$	$Config_{SCell\ 1}$ 1,2		10 MHz: $N_{PRB,c}$ = 52
	$Config_{SCell\ 1}$ 3		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID			1, 2
Initial DL BWP Configuration			DLBWP.0.2 Note4
Initial UL BWP Configuration			ULBWP.0.2 Note4
Active DL BWP-0 Configuration			N.A.
Active DL BWP-1 Configuration			DLBWP.1.1 Note4
Active DL BWP-2 Configuration			DLBWP.1.3 Note4
Active UL BWP-0 Configuration			N.A.
Active UL BWP-1 Configuration			ULBWP.1.1 Note4
Active UL BWP-2 Configuration			ULBWP.1.3 Note4
PDSCH Reference measurement channel	$Config_{SCell\ 1}$ 1		SR.1.1 FDD
	$Config_{SCell\ 1}$ 2		SR.1.1 TDD
	$Config_{SCell\ 1}$ 3		SR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell\ 1}$ 1		CR.1.1 FDD
	$Config_{SCell\ 1}$ 2		CR.1.1 TDD
	$Config_{SCell\ 1}$ 3		CR.2.1 TDD
Dedicated CORESET parameters	$Config_{SCell\ 1}$ 1		CCR.1.1 FDD
	$Config_{SCell\ 1}$ 2		CCR.1.1 TDD
	$Config_{SCell\ 1}$ 3		CCR.2.1 TDD
OCNG Patterns			OP.1
SSB Configuration	$Config_{SCell\ 1}$ 1,2		SSB.1 FR1
	$Config_{SCell\ 1}$ 3		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	$Config_{SCell\ 1}$ 1,2	dBm/SCS	-104
	$Config_{SCell\ 1}$ 3		-101
N_{oc} Note 2		dBm/15kHz	-104
SS-RSRP Note 3	$Config_{SCell\ 1}$ 1,2	dBm/SCS	-87
	$Config_{SCell\ 1}$ 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	$Config_{SCell\ 1}$ 1,2	dBm/ 9.36 MHz	-58.96
	$Config_{SCell\ 1}$ 3	dBm/ 38.16 MHz	-52.86

Parameter	Unit	Cell 2
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].		

Table A.6.5.6.3.1.1-5: NR Cell specific test parameters for SCell (NR Cell 3) for DL BWP switch in SA

Parameter		Unit	Cell 3
Frequency Range			FR1
Duplex mode	$Config_{SCell2}$ 1		FDD
	$Config_{SCell2}$ 2,3		TDD
TDD configuration	$Config_{SCell2}$ 1		Not Applicable
	$Config_{SCell2}$ 2		TDDConf.1.1
	$Config_{SCell2}$ 3		TDDConf.2.1
$BW_{channel}$	$Config_{SCell2}$ 1,2		10 MHz: $N_{PRB,c}$ = 52
	$Config_{SCell2}$ 3		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID			1,2
Initial DL BWP Configuration			DLBWP.0.2[Note4]
Initial UL BWP Configuration			ULBWP.0.2[Note4]
Active DL BWP-0 Configuration			N.A.
Active DL BWP-1 Configuration			DLBWP.1.1[Note4]
Active DL BWP-2 Configuration			DLBWP.1.3[Note4]
Active UL BWP-0 Configuration			N.A.
Active UL BWP-1 Configuration			ULBWP.1.1[Note4]
Active UL BWP-2 Configuration			ULBWP.1.3[Note4]
PDSCH Reference measurement channel	$Config_{SCell2}$ 1		SR.1.1 FDD
	$Config_{SCell2}$ 2		SR.1.1 TDD
	$Config_{SCell2}$ 3		SR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell2}$ 1		CR.1.1 FDD
	$Config_{SCell2}$ 2		CR.1.1 TDD
	$Config_{SCell2}$ 3		CR.2.1 TDD
Dedicated CORESET parameters	$Config_{SCell2}$ 1		CCR.1.1 FDD
	$Config_{SCell2}$ 2		CCR.1.1 TDD
	$Config_{SCell2}$ 3		CCR.2.1 TDD
OCNG Patterns			OP.1
SSB Configuration	$Config_{SCell2}$ 1,2		SSB.1 FR1
	$Config_{SCell2}$ 3		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc}[Note 2]	$Config_{SCell2}$ 1,2	dBm/SCS	-104
	$Config_{SCell2}$ 3		-101
N_{oc}[Note 2]		dBm/15kHz	-104
SS-RSRP [Note 3]	$Config_{SCell2}$ 1,2	dBm/SCS	-87
	$Config_{SCell2}$ 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io[Note3]	$Config_{SCell2}$ 1,2	dBm/ 9.36 MHz	-58.96

Parameter		Unit	Cell 3
	$Config_{SCell2}$ 3	dBm/ 38.16 MHz	-52.86
Propagation Condition			AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

A.6.5.6.3.1.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for both SCell (Cell 2) and SCell (Cell 3) from the first UL slot that occurs after the beginning of DL slot ($i+ T_{MultipleBWPswitchDelay} +k1$).

During T3, the UE shall start to send the ACK/NACK for both SCell (Cell 2) and SCell (Cell 3) from the first UL slot that occurs after the beginning of DL slot ($j+ T_{MultipleBWPswitchDelay} +k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in TS 38.321 [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{MultipleBWPswitchDelay}$ defined in 8.6.2A.1.

All of the above test requirements shall be fulfilled in order for the observed Cell 2 and Cell 3 active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T1 and T3, the start time of PCell interruption during SCell (Cell 2) and SCell (Cell 3) active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed SCell (Cell 2) and SCell (Cell 3) active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after beginning of DL slot ($i+ T_{MultipleBWPswitchDelay} +k1$), ($j+ T_{MultipleBWPswitchDelay} +k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.6.5.6.4 SCell dormancy switch

A.6.5.6.4.1 NR FR1 PCell SCell dormancy switch of single FR1 SCell outside active time

A.6.5.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify the SCell dormancy switch delay requirements defined in clause 8.6 when the UE is triggered to switch between dormancy to non-dormancy and non-dormancy to dormancy outside the DRX active time. Further the test purpose is to verify the interruption rate on other serving cells when the UE performing CSI and RRM measurements on dormant SCell(s) as defined in clause 8.2.2.2.12 and also to verify the interruption requirement on other active serving cell defined in clause 8.2.2.2.5.

In the test scenario UE is connected to one PCell (Cell 1) in FR1 and one SCell in FR1. In the test the SCell is switched from non-dormancy to dormancy, and vice versa, at a point in time before start of *onDuration*. The UE is configured to monitor PDCCH for DCI format 2_6 at *ps-Offset* before the start of *onDuration*. Two tests are specified, where a UE that only supports triggering within the first three OFDM symbols of a slot shall undergo Test1 only, and a UE that supports

triggering also in remaining OFDM symbols of a slot shall undergo both Test1 and Test2. In the tested scenario, *ps-Offset* is selected to correspond to the dormancy switching time specified in clause 8.6.

The supported test configurations for NR PCell are shown in table A.6.5.6.4.1.1-1, The supported test configurations for NR SCell are shown in table A.6.5.6.4.1.1-1A. Test configuration for NR PCell and test configuration for NR SCell are chosen independently. The general test parameters are given in table A.6.5.6.4.1.1-2. NR Cell-specific parameters are specified in table A.6.5.6.4.1.1-3 and table A.6.5.6.4.1.1-4.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for PCell, BWP-0 in Cell 1 before starting the test.
- UE is configured with 2 different UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in PCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in SCell.
- UE is indicated in *dormantBWP -Id* that the active DL BWP is BWP-2 in the SCell.
- UE is configured with DRX.
- UE is configured to monitor DCI format 2_6, and to be active during *onDuration* even when no DCI format 2_6 is detected (*ps-WakeUp*).

All cells have constant signal levels throughout the test.

The test consists of 4 successive time periods, with durations of T1, T2, T3 and T4, respectively.

During T1,

Time period T1 starts when a DCI format 2_6 command intended for dormant BWP switch in a SCell from non-dormancy to dormancy, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i* (at *ps-Offset* before *onDuration*). Upon reception of the PDCCH indicating entering dormant BWP in PCell (i.e. through cross-carrier scheduling), UE shall switch the DL BWP-1 to DL BWP-2 in SCell, i.e., switching from non-dormant BWP to dormant BWP and the UE shall complete the switching before the start of *onDuration*.

The UE shall be able to receive PDCCH on PCell no later than the first DL slot that occurs after the beginning of PCell's DL slot ($i+ T_{dormantBWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK on the PCell no later than the first UL slot that occurs after the beginning of slot ($i+N$) as defined in clause 10.3 in TS38.213. The UE shall be continuously scheduled on PCell's BWP-0 no later than the first DL slot that occurs after the beginning of slot ($i+ T_{dormantBWPswitchDelay}$).

The starting time of PCell (Cell 1) interruption due to dormancy switching on SCell shall occur within the dormant BWP switch delay, i.e. before start of *onDuration*.

The UE shall not transmit signals on SCell after the beginning of PCell's DL slot (i+ TdormantBWPswitchDelay) as defined in clause 8.6. The UE shall not be scheduled on SCells BWP-1 no later than the first DL slot that occurs after the beginning of slot (i+ TdormantBWPswitchDelay).

Time period T2 starts when T1 is completed. During T2, the test equipment continues to schedule the UE continuously in PCell. The UE shall carry out CSI and RRM measurements on the dormant SCells. The UE shall report ACK/NACK in PCell in response to scheduled PDSCH, with the maximum loss of transmitted ACK/NACKs fulfilling the requirement in clause 8.2.2.2.12. The test equipment verifies that the loss of ACK/NACKs is no larger than 1.5 %.

Time period T3 starts when T2 is completed. During T3, the test equipment does not schedule the UE, by which the inactivity timer expires and the UE stops monitoring PDCCH except for signalling using DCI format 2_6 at wake-up signalling occasions.

During T4,

Time period T4 starts when a DCI format 2_6 command for leaving dormant BWP in SCell, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted j (at ps-Offset before onDuration). Upon reception of the PDCCH indicating leaving dormant BWP in PCell (i.e. through cross-carrier scheduling), UE shall switch the DL BWP-2 to DL BWP-1 in SCell, i.e., switching from dormant BWP to non-dormant BWP.

The UE shall be able to receive PDSCH on PCell and SCell no later than the first DL slot that occurs after the beginning of PCell's DL slot ($j+ T_{dormantBWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK on the PCell (for both PCell and SCell) no later than the first UL slot that occurs after the beginning of slot ($j+N$) as defined in clause 10.3 in TS 38.213. The UE shall be continuously scheduled on PCell's BWP-0 no later than the first DL slot that occurs after the beginning of slot ($j+ T_{dormantBWPswitchDelay}$).

The starting time of PCell (Cell 1) interruption due to dormancy switching on SCell shall occur within the dormant BWP switch delay.

The UE shall be ready to transmit signals on SCell no later than the first DL slot that occurs after the beginning of PCell's DL slot (j+ TdormantBWPswitchDelay) as defined in clause 8.6. The UE shall be ready to continuously scheduled on SCell's BWP-1 no later than the first DL slot that occurs after the beginning of slot (j+ TdormantBWPswitchDelay).

The test equipment verifies the DL dormant BWP switch time in SCell by counting the slots from the time when the dormant BWP switch command is received till an ACK/NACK on PCell is received.

The test equipment verifies that potential interruption to PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during dormant BWP switch of SCell (i.e. before start of *onDuration*), respectively.

Config	**Description**
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.6.5.6.4.1.1-1A: SCell dormancy switch supported test configurations for NR SCell

Config$_{SCell}$	**Description**
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.6.5.6.4.1.1-2: General test parameters for SCell dormancy switch in SA

Parameter	**Unit**	**Value**		**Comment**
		Test 1	**Test 2**	
NR RF Channel Number		1, 2		Two NR radio channels are used for this test
Active PCell		Cell 1		PCell on RF channel number 1.
Active SCell		Cell 2		SCell on RF channel number 2.
CP length		Normal		
DRX		ON		For both PCell and SCell
Cell-individual offset for cells on RF channel number 1	dB	0		Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0		Individual offset for cells on SCC.
Cell2 timing offset to cell1	µs	3		Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.

OFDM symbol range in slot for transmission of DCI with dormancy indication		0 – 2	3 – 11	
T1	s	0.2		
T2	s	0.2		

Table A.6.5.6.4.1.1-3: NR Cell specific test parameters for NR PCell for SCell dormancy switch in SA

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
$BW_{channel}$	Config 1,2		10 MHz: $N_{PRB,c}$ = 52
	Config 3		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID			0
Initial DL BWP Configuration			DLBWP.0.2[Note4]
Initial UL BWP Configuration			ULBWP.0.2[Note4]
Active DL BWP-0 Configuration			DLBWP.0.2[Note4]
Active DL BWP-1 Configuration			N.A.
Active DL BWP-2 Configuration			N.A.
Active UL BWP-0 Configuration			ULBWP.0.2[Note4]
Active UL BWP-1 Configuration			N.A.
Active UL BWP-2 Configuration			N.A.
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET parameters, Test 1	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
Dedicated CORESET parameters, Test 2	Config 1		CCR.1.5 FDD
	Config 2		CCR.1.5 TDD
	Config 3		CCR.2.3 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc}[Note 2]	Config 1,2	dBm/SCS	-104
	Config 3		-101
N_{oc}[Note 2]		dBm/15kHz	-104
SS-RSRP [Note 3]	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io[Note3]	Config 1,2	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86
Propagation Condition			AWGN

Parameter	Unit	Cell 1
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].		

Table A.6.5.6.4.1.1-4: NR Cell specific test parameters for NR SCell for SCell dormancy switch in SA

Parameter		Unit	Cell2
Frequency Range			FR1
Duplex mode	$Config_{SCell}$ 1		FDD
	$Config_{SCell}$ 2,3		TDD
TDD configuration	$Config_{SCell}$ 1		Not Applicable
	$Config_{SCell}$ 2		TDDConf.1.1
	$Config_{SCell}$ 3		TDDConf.2.1
$BW_{channel}$	$Config_{SCell}$ 1,2		10 MHz: $N_{PRB,c}$ = 52
	$Config_{SCell}$ 3		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID			1
Initial DL BWP Configuration			DLBWP.0.2[Note4]
Initial UL BWP Configuration			ULBWP.0.2[Note4]
Active DL BWP-0 Configuration			N.A.
Active DL BWP-1 Configuration			DLBWP.1.1[Note4]
Active DL BWP-2 Configuration			DLBWP.1.3[Note4]
Active UL BWP-0 Configuration			N.A.
Active UL BWP-1 Configuration			ULBWP.1.1[Note4]
Active UL BWP-2 Configuration			ULBWP.1.3[Note4]
PDSCH Reference measurement channel	$Config_{SCell}$ 1		SR.1.1 FDD
	$Config_{SCell}$ 2		SR.1.1 TDD
	$Config_{SCell}$ 3		SR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell}$ 1		CR.1.1 FDD
	$Config_{SCell}$ 2		CR.1.1 TDD
	$Config_{SCell}$ 3		CR.2.1 TDD
Dedicated CORESET parameters, Test 1	$Config_{SCell}$ 1		CCR.1.1 FDD
	$Config_{SCell}$ 2		CCR.1.1 TDD
	$Config_{SCell}$ 3		CCR.2.1 TDD
Dedicated CORESET parameters, Test 2	$Config_{SCell}$ 1		CCR.1.1 FDD
	$Config_{SCell}$ 2		CCR.1.1 TDD
	$Config_{SCell}$ 3		CCR.2.3 TDD
OCNG Patterns			OP.1
SSB Configuration	$Config_{SCell}$ 1,2		SSB.1 FR1
	$Config_{SCell}$ 3		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc}[Note 2]	$Config_{SCell}$ 1,2	dBm/SCS	-104
	$Config_{SCell}$ 3		-101
N_{oc}[Note 2]		dBm/15kHz	-104
SS-RSRP[Note 3]	$Config_{SCell}$ 1,2	dBm/SCS	-87
	$Config_{SCell}$ 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17

Parameter		Unit	Cell2
Io^{Note3}	$Config_{SCell}$ 1,2	dBm/ 9.36 MHz	-58.96
	$Config_{SCell}$ 3	dBm/ 38.16 MHz	-52.86
Propagation Condition			AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

A.6.5.6.4.1.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot (*i+N*) (i.e. from the start of *onDuration*).

During time period T2, the UE shall transmit ACK/NACKs in response to scheduling in PCell and the rate of missed ACK/NACKs shall be no more than 1.5 %.

During T4, the UE shall start to send the ACK/NACK for PCell and SCell from the first UL slot that occurs after the beginning of DL slot (*j+N*) (i.e. from the start of *onDuration*).

Where, *N* is the timing that UE provide HARQ-ACK information in response to a detection of a DCI format 2_6 indicating SCell dormancy as specified in [3].

All of the above test requirements shall be fulfilled in order for the observed SCell dormant BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T1 and T4, the start time of PCell interruption during SCell dormant BWP switch shall not happen outside the dormant BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for dormant BWP switch in clause 8.6.

NOTE: During T1, T4 if there are no uplink resources for reporting the ACK/NACK in the first DL slot that occurs after the beginning of DL slot (*i+ N*), (*j+ N*), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.6.5.6.4.2 NR FR1 PCell SCell dormancy switch of two FR1 SCells inside active time

A.6.5.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify fulfillment of SCell dormancy switching delay requirements in clause 8.6.2A, requirements on interruptions due to SCell dormancy switching in clause 8.2.2.2.12.1, and requirements on interruptions due to CSI and RRM measurements on dormant SCells in clauses 8.2.2.2.12.2 and 8.2.2.2.12.3, respectively. In the tested scenario, the UE is connected to PCell and two SCells in FR1, and the SCells are switched from non-dormancy to dormancy, and back, during active time. Depending on UE capability on whether DCI for dormancy switching can be received also later than within the initial three OFDM symbols of a slot, the UE may have to undergo one or two sets of tests. A UE that only supports triggering during within the first three OFDM symbols of a slot shall only undergo Test1 and Test2, whereas a UE that supports triggering also in remaining OFDM symbols of a slot shall undergo Test1 through Test4.

The supported test configurations for NR PCell are provided in table A.6.5.6.4.2.1-1 below. The supported test configurations for NR SCells are provided in table A.6.5.6.4.2.1-1A below. Test configuration for NR PCell and test configuration for NR SCells are chosen independently. Test configurations for two NR SCells are chosen

independently. General test parameters are provided in table A.6.5.6.4.2.1-2, and cell-specific parameters are provided in table A.6.5.6.4.2.1-3, table A.6.5.6.4.2.1-4 and table A.6.5.6.4.2.1-5 below.

The tests consist of three consecutive time periods T1, T2, and T3, respectively.

Three carriers are used in the test, each within FR1 and each with one cell. Cell 1 (PCell) is on RF channel 1 (PCC), Cell 2 (SCell 1) is on RF channel 2 (SCC1), and Cell 3 (SCell2) is on RF channel 3 (SCC2). All three cells have constant signal levels throughout the test. The UE is continuously scheduled in PCell throughout the test.

Before the test starts,

- UE is connected to Cell 1 (PCell), Cell 2 (SCell 1) and Cell 3 (SCell2).
- UE is configured with a single UE-specific downlink bandwidth part, BWP-0, for Cell 1. BWP-0 includes the bandwidth of the initial DL BWP and SSB.
- UE is configured with one non-dormant and one dormant UE-specific downlink bandwidth part, BWP-0 and BWP-1, respectively, for Cell 2 and Cell 3. BWP-0 includes the bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP in Cell 1 is BWP-0.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP in Cell 2 is BWP-0.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP in Cell 3 is BWP-0.
- UE is continuously scheduled in PCell, SCell 1 and SCell2.

T1 starts at the point in time at which the UE receives a DCI with dormancy indication on PDCCH in PCell at the antenna connector, in a slot # denoted *m*, pertaining to dormancy indication for switching SCell 1 and SCell2 from non-dormancy to dormancy. The UE shall complete switching of the SCells to dormancy by the end of slot *m* + ceil($T_{MultipleBWPswitchDelay}$/NR slot length) + 1 in Test1 and Test2, and slot *m* + ceil($T_{MultipleBWPswitchDelay}$/NR slot length) + 2 in Test3 and Test4, as specified in clause 8.6.2A. Any PCell interruptions due to the switching between non-dormant and dormant BWPs shall fulfill requirements in clause 8.2.2.2.12.1. The test equipment verifies that interruptions due to switching from non-dormancy to dormancy are within the requirements by analysing HARQ feedback transmitted in PCell for PCell.

During T2, the UE is carrying out CSI and RRM measurements on dormant SCell 1 and SCell2. Any PCell interruptions due to CSI and RRM measurements shall fulfill requirements in clauses 8.2.2.2.12.2 and 8.2.2.2.12.3, respectively. The test equipment verifies that the interruptions are within the allowed percentages by counting ACK/NACKs in PCell. At the end of T2, the test equipment transmits a DCI with dormancy indication on PDCCH in PCell carrying a dormany indication for switching SCell 1 and SCell2 from dormancy to non-dormancy.

T3 starts at the point in time at which the UE receives a DCI with dormancy indication on PDCCH in PCell at the antenna connector, in a slot # denoted *n*, pertaining to dormancy indication for switching SCell 1 and SCell2 from dormancy to non-dormancy. The UE shall complete switching of the SCells to non-dormancy by the end of slot *n* + ceil($T_{MultipleBWPswitchDelay}$/NR slot length) + 1 in Test1 and Test2, and slot *n* + ceil($T_{MultipleBWPswitchDelay}$/NR slot length) + 2 in Test3 and test4, as specified in clause 8.6.2A. Any PCell interruptions due to the switching between dormant and non-dormant BWPs shall fulfill requirements in clause 8.2.2.2.12.1. The test equipment verifies that interruptions due to switching from dormancy to non-dormancy are within the requirements by analysing HARQ feedback transmitted in PCell for PCell. The test equipment verifies the switching delay by analysing HARQ feedback transmitted in PCell for SCells.

Table A.6.5.6.4.2.1-1: Supported test configurations for NR PCell

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration.	

Table A.6.5.6.4.2.1-1A: Supported test configurations for NR SCells

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration. NOTE 3: Test configurations for two NR SCells are selected independently.	

Table A.6.5.6.4.2.1-2: General test parameters

Parameter	Unit	Value				Comment
		Test1	Test2	Test3	Test4	
NR RF Channel Number		1, 2, 3				Three NR radio channels are used for this test
Active PCell		Cell 1				Primary cell on NR RF channel number 1 in FR1
SCell 1		Cell 2				SCell 1 on NR RF channel number 2 in FR1
SCell2		Cell 3				SCell2 on NR RF channel number 3 in FR1
CP length		Normal				
DRX		OFF				Continuous monitoring of primary cell
CSI reporting periodicity, Non-dormant BWP	ms	2				CSI reporting periodicity for periodic reporting of CQI for PCell and non-dormant SCells
CSI reporting periodicity, Dormant BWP	ms	40				CSI reporting periodicity for periodic reporting of CQI for dormant SCells
Timing offset between Cell 1 and Cell 2	ns	0				
Timing offset between Cell 1 and Cell 3	ns	0				
Triggering DCI format		1_1	0_1	1_1	0_1	Triggering DCI format for triggering during active time
OFDM symbol range in slot for transmission of DCI with dormancy indication		0 – 2		3 – 11		Test1 and Test3 are based on that triggering DCI is received within the first three OFDM symbols of a slot.Test2 and Test4 are based on that the triggering DCI is received later than within the first three OFDM symbols of a slot.
T1	s	0.2				
T2	s	5				
T3	s	0.2				

Table A.6.5.6.4.2.1-3: NR Cell specific test parameters for NR Pcell

Parameter		Unit	Cell 1
Frequency range			FR1
NR RF channel			1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
Downlink initial BWP configuration			DLBWP.0.1
Uplink initial BWP configuration			ULBWP.0.1
Downlink active non-dormant BWP-0 configuration			DLBWP.1.1
Downlink active dormant BWP-1 configuration			---
Uplink active BWP-0 configuration			ULBWP.1.1
TCI state			TCI.State.0
CSI-RS configuration for CSI reporting, Non-dormant BWP	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
	Config 1		---

Parameter		Unit	Cell 1
CSI-RS configuration for CSI reporting, Dormant BWP	Config 2		
	Config 3		
TRS Configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
Dedicated CORESET parameters, Test 1,2	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
Dedicated CORESET parameters, Test 3,4	Config 1		CCR.1.5 FDD
	Config 2		CCR.1.5 TDD
	Config 3		CCR.2.3 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
OCNG Pattern			OP.1
SSB Configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC configuration			SMTC.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note1			
EPRE ratio of OCNG to OCNG DMRS Note1			
N_{oc} Note2	Config 1,2	dBm/15kHz	-104
	Config 3		-101
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
SS-RSRP Note3	Config 1,2	dBm/SCS	-87
	Config 3		-84
Io Note3	Config 1,2	dBm/9.36 MHz	-59.0
	Config 3	dBm/38.16 MHz	-52.9
Propagation condition			AWGN
Correlation Matrix and Antenna Configuration			1x2 Low

NOTE 1: OCNG shall be used such that the cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP, SCH_RP, and Io levels have been derived from other parameters for information purpose. They are not settable parameters themselves.

Table A.6.5.6.4.2.1-4: NR Cell specific test parameters for NR SCell (Cell 2)

Parameter		Unit	Cell 2
Frequency range			FR1
NR RF channel			2
Duplex mode	$Config_{SCell\ 1}$ 1		FDD
	$Config_{SCell\ 1}$ 2,3		TDD
TDD configuration	$Config_{SCell\ 1}$ 2		TDDConf.1.1
	$Config_{SCell\ 1}$ 3		TDDConf.2.1
$BW_{channel}$	$Config_{SCell\ 1}$ 1,2	MHz	10: $N_{PRB,c}$ = 52
	$Config_{SCell\ 1}$ 3		40: $N_{PRB,c}$ = 106
Downlink initial BWP configuration			DLBWP.0.1
Uplink initial BWP configuration			N/A
Downlink active non-dormant BWP-0 configuration			DLBWP.1.1
Downlink active dormant BWP-1 configuration			DLBWP.1.1
Uplink active BWP-0 configuration			N/A

Parameter		Unit	Cell 2
TCI state			TCI.State.0
CSI-RS configuration for CSI reporting, Non-dormant BWP	$Config_{SCell\ 1}$ 1		CSI-RS.1.1 FDD
	$Config_{SCell\ 1}$ 2		CSI-RS.1.1 TDD
	$Config_{SCell\ 1}$ 3		CSI-RS.2.1 TDD
CSI-RS configuration for CSI reporting, Dormant BWP	$Config_{SCell\ 1}$ 1		CSI-RS.1.6 FDD
	$Config_{SCell\ 1}$ 2		CSI-RS.1.5 TDD
	$Config_{SCell\ 1}$ 3		CSI-RS.2.6 TDD
TRS Configuration	$Config_{SCell\ 1}$ 1		TRS.1.1 FDD
	$Config_{SCell\ 1}$ 2		TRS.1.1 TDD
	$Config_{SCell\ 1}$ 3		TRS.1.2 TDD
PDSCH Reference measurement channel	$Config_{SCell\ 1}$ 1		SR.1.1 FDD
	$Config_{SCell\ 1}$ 2		SR.1.1 TDD
	$Config_{SCell\ 1}$ 3		SR.2.1 TDD
Dedicated CORESET parameters, Test 1,2	$Config_{SCell\ 1}$ 1		CCR.1.1 FDD
	$Config_{SCell\ 1}$ 2		CCR.1.1 TDD
	$Config_{SCell\ 1}$ 3		CCR.2.1 TDD
Dedicated CORESET parameters, Test 3,4	$Config_{SCell\ 1}$ 1		CCR.1.1 FDD
	$Config_{SCell\ 1}$ 2		CCR.1.1 TDD
	$Config_{SCell\ 1}$ 3		CCR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell\ 1}$ 1		N/A
	$Config_{SCell\ 1}$ 2		
	$Config_{SCell\ 1}$ 3		
OCNG Pattern			OP.1
SSB Configuration	$Config_{SCell\ 1}$ 1,2		SSB.1 FR1
	$Config_{SCell\ 1}$ 3		SSB.2 FR1
SMTC configuration			SMTC.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note1			
EPRE ratio of OCNG to OCNG DMRS Note1			
N_{oc} Note2	$Config_{SCell\ 1}$ 1,2	dBm/15kHz	-104
	$Config_{SCell\ 1}$ 3		-101
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
SS-RSRP Note3	$Config_{SCell\ 1}$ 1,2	dBm/SCS	-87
	$Config_{SCell\ 1}$ 3		-84
Io Note3	$Config_{SCell\ 1}$ 1,2	dBm/9.36 MHz	-59.0
	$Config_{SCell\ 1}$ 3	dBm/38.16 MHz	-52.9
Propagation condition			AWGN
Correlation Matrix and Antenna Configuration			1x2 Low

NOTE 1: OCNG shall be used such that the cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP, SCH_RP, and Io levels have been derived from other parameters for information purpose. They are not settable parameters themselves.

Table A.6.5.6.4.2.1-5: NR Cell specific test parameters for NR SCell (Cell 3)

Parameter		Unit	Cell 3
Frequency range			FR1
NR RF channel			3
Duplex mode	$Config_{SCell2}$ 1		FDD
	$Config_{SCell2}$ 2,3		TDD
TDD configuration	$Config_{SCell2}$ 2		TDDConf.1.1
	$Config_{SCell2}$ 3		TDDConf.2.1
$BW_{channel}$	$Config_{SCell2}$ 1,2	MHz	10: $N_{PRB,c}$ = 52
	$Config_{SCell2}$ 3		40: $N_{PRB,c}$ = 106

Parameter		Unit	Cell 3
Downlink initial BWP configuration			DLBWP.0.1
Uplink initial BWP configuration			N/A
Downlink active non-dormant BWP-0 configuration			DLBWP.1.1
Downlink active dormant BWP-1 configuration			DLBWP.1.1
Uplink active BWP-0 configuration			N/A
TCI state			TCI.State.0
CSI-RS configuration for CSI reporting, Non-dormant BWP	$Config_{SCell2}$ 1		CSI-RS.1.1 FDD
	$Config_{SCell2}$ 2		CSI-RS.1.1 TDD
	$Config_{SCell2}$ 3		CSI-RS.2.1 TDD
CSI-RS configuration for CSI reporting, Dormant BWP	$Config_{SCell2}$ 1		CSI-RS.1.6 FDD
	$Config_{SCell2}$ 2		CSI-RS.1.5 TDD
	$Config_{SCell2}$ 3		CSI-RS.2.6 TDD
TRS Configuration	$Config_{SCell2}$ 1		TRS.1.1 FDD
	$Config_{SCell2}$ 2		TRS.1.1 TDD
	$Config_{SCell2}$ 3		TRS.1.2 TDD
PDSCH Reference measurement channel	$Config_{SCell2}$ 1		SR.1.1 FDD
	$Config_{SCell2}$ 2		SR.1.1 TDD
	$Config_{SCell2}$ 3		SR.2.1 TDD
Dedicated CORESET parameters, Test 1,2	$Config_{SCell2}$ 1		CCR.1.1 FDD
	$Config_{SCell2}$ 2		CCR.1.1 TDD
	$Config_{SCell2}$ 3		CCR.2.1 TDD
Dedicated CORESET parameters, Test 3,4	$Config_{SCell2}$ 1		CCR.1.1 FDD
	$Config_{SCell2}$ 2		CCR.1.1 TDD
	$Config_{SCell2}$ 3		CCR.2.1 TDD
RMSI CORESET parameters	$Config_{SCell2}$ 1		N/A
	$Config_{SCell2}$ 2		
	$Config_{SCell2}$ 3		
OCNG Pattern			OP.1
SSB Configuration	$Config_{SCell2}$ 1,2		SSB.1 FR1
	$Config_{SCell2}$ 3		SSB.2 FR1
SMTC configuration			SMTC.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note1			
EPRE ratio of OCNG to OCNG DMRS Note1			
N_{oc} Note2	$Config_{SCell2}$ 1,2	dBm/15kHz	-104
	$Config_{SCell2}$ 3		-101
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
SS-RSRP Note3	$Config_{SCell2}$ 1,2	dBm/SCS	-87
	$Config_{SCell2}$ 3		-84
Io Note3	$Config_{SCell2}$ 1,2	dBm/9.36 MHz	-59.0
	$Config_{SCell2}$ 3	dBm/38.16 MHz	-52.9
Propagation condition			AWGN
Correlation Matrix and Antenna Configuration			1x2 Low

NOTE 1: OCNG shall be used such that the cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP, SCH_RP, and Io levels have been derived from other parameters for information purpose. They are not settable parameters themselves.

A.6.5.6.4.2.2 Test Requirements

During T1, any interruption on PCell due to dormancy switching of SCells shall be within the requirement specified in clause 8.2.2.2.12.1.

During T2, interruptions on PCell due to CSI and RRM measurements on dormant SCells shall be within the interruption rate requirements specified in clauses 8.2.2.2.12.2 and 8.2.2.2.12.3, respectively.

During T3, any interruption on PCell due to dormancy switching of SCells shall be within the requirement specified in clause 8.2.2.2.12.1. Monitoring of PDCCH for SCell in SCell shall be resumed within the dormancy switching time specified in clause 8.6.2A.

For an event to be considered to be correct, all requirements above have to be fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.6.5 Simultaneous RRC-based Active BWP Switch on multiple CCs

A.6.5.6.5.1 NR FR1- NR FR1 DL active BWP switch on multiple CCs with non-DRX in SA

A.6.5.6.5.1.1 Test Purpose and Environment

The purpose of this test is to verify requirements on the RRC-based DL BWP switch delay on multiple CCs defined in clause 8.6.

The supported test configurations for NR PCell are shown in table A.6.5.6.5.1.1-1 below. The supported test configurations for NR SCell are shown in table A.6.5.6.5.1.1-1A below. Test configuration for NR PCell and test configuration for NR SCell are chosen independently. The test scenario comprises of one NR PCell (Cell 1) and one NR SCell (Cell 2) as given in table A.6.5.6.5.1.1-2. NR Cell-specific parameters are specified in table A.6.5.6.5.1.1-3 and A.6.5.6.5.1.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) and SCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (SCell) on radio channel 2 (SCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for PCell and SCell (Cell 2).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PCell and SCell (Cell 2).

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration for both PCell and SCell (Cell 2), sent from the test equipment to the UE, is completely received at the UE side in PCell's and SCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition for both PCell and SCell (Cell 2).

The UE shall be able to receive PDSCH on PCell and SCell (Cell 2) from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$ as defined in clause 8.6.3A.1 and starts to report valid ACK/NACK for the PCell and SCell (Cell 2) from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$ + k1 on BWP-1 of final condition. The UE shall be continuously scheduled on PCell's and SCell (Cell 2)'s BWP-1 of final condition starting from the first DL slot right after slot i + $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$.

$T_{RRCprocessingDelay}$, $T_{BWPswitchDelayRRC}$ and D_{RRC} are defined in clause 8.6.3A.1, N=2 in this test case.

The test equipment verifies the DL BWP switch time in PCell and SCell by counting the slots from the time when the RRC Reconfiguration message including updated BWP configuration is sent till the time when a vaild ACK/NACK is received.

Table A.6.5.6.5.1.1-1: DL BWP switch supported test configurations for NR PCell

Config	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.6.5.6.5.1.1-1A: DL BWP switch supported test configurations for NR SCell

$Config_{SCell}$	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.6.5.6.5.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2	Two NR radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2	SCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and SCell (Cell 2)
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cell on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cell on SCC.
Cell 2 timing offset to Cell 1	µs	3	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	

Table A.6.5.6.5.1.1-3: NR Cell specific test parameters for NR PCell for DL BWP switch in SA

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1		FDD
		Config 2,3		TDD
TDD configuration		Config 1		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
$BW_{channel}$		Config 1,2		10 MHz: $N_{PRB,c}$ = 52
		Config 3		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID				1
Initial DL BWP Configuration				DLBWP.0.2 Note4
Initial UL BWP Configuration				ULBWP.0.2 Note4
Initial Condition	Active DL BWP-1 Configuration			DLBWP.1.3 Note4
	Active UL BWP-1 Configuration			ULBWP.1.3 Note4
Final Condition	Active DL BWP-1 Configuration			DLBWP.1.1 Note4
	Active UL BWP-1 Configuration			ULBWP.1.1 Note4
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD
		Config 2		SR.1.1 TDD
		Config 3		SR.2.1 TDD

Parameter		Unit	Cell 1
RMSI CORESET parameters	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration			SMTC.1
TRS Configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
Correlation Matrix and Antenna Configuration			1x2 Low
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1,2	dBm/SCS	-104
	Config 3		-101
SS-RSRP Note 3	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.6.5.6.5.1.1-4: NR Cell specific test parameters for NR SCell for DL BWP switch in SA

Parameter			Unit	Cell 2
Frequency Range				FR1
Duplex mode		$Config_{SCell}$ 1		FDD
		$Config_{SCell}$ 2,3		TDD
TDD configuration		$Config_{SCell}$ 1		Not Applicable
		$Config_{SCell}$ 2		TDDConf.1.1
		$Config_{SCell}$ 3		TDDConf.2.1
$BW_{channel}$		$Config_{SCell}$ 1,2		10 MHz: $N_{PRB,c}$ = 52
		$Config_{SCell}$ 3		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID				1
Initial DL BWP Configuration				DLBWP.0.2 Note4
Initial UL BWP Configuration				ULBWP.0.2 Note4
Initial Condition	Active DL BWP-1 Configuration			DLBWP.1.3 Note4
	Active UL BWP-1 Configuration			ULBWP.1.3 Note4
Final Condition	Active DL BWP-1 Configuration			DLBWP.1.1 Note4

Parameter			Unit	Cell 2
	Active UL BWP-1 Configuration			ULBWP.1.1 Note4
PDSCH Reference measurement channel		$Config_{SCell}$ 1		SR.1.1 FDD
		$Config_{SCell}$ 2		SR.1.1 TDD
		$Config_{SCell}$ 3		SR.2.1 TDD
RMSI CORESET parameters		$Config_{SCell}$ 1		CR.1.1 FDD
		$Config_{SCell}$ 2		CR.1.1 TDD
		$Config_{SCell}$ 3		CR.2.1 TDD
Dedicated CORESET parameters		$Config_{SCell}$ 1		CCR.1.1 FDD
		$Config_{SCell}$ 2		CCR.1.1 TDD
		$Config_{SCell}$ 3		CCR.2.1 TDD
OCNG Patterns				OP.1
SSB Configuration		$Config_{SCell}$ 1,2		SSB.1 FR1
		$Config_{SCell}$ 3		SSB.2 FR1
SMTC Configuration				SMTC.1
TRS Configuration		$Config_{SCell}$ 1		TRS.1.1 FDD
		$Config_{SCell}$ 2		TRS.1.1 TDD
		$Config_{SCell}$ 3		TRS.1.2 TDD
Correlation Matrix and Antenna Configuration				1x2 Low
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		$Config_{SCell}$ 1,2	dBm/SCS	-104
		$Config_{SCell}$ 3		-101
SS-RSRP Note 3		$Config_{SCell}$ 1,2	dBm/SCS	-87
		$Config_{SCell}$ 3		-84
$\hat{E}_s/I_{ot}$			dB	17
$\hat{E}_s/N_{oc}$			dB	17
Io^{Note3}		$Config_{SCell}$ 1,2	dBm/ 9.36 MHz	-58.96
		$Config_{SCell}$ 3	dBm/ 38.16 MHz	-52.86

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

A.6.5.6.5.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for both PCell and SCell (Cell 2) from the first DL slot that occurs right after the begining of slot (i + $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$) and starts to report valid ACK/NACK for both PCell and SCell (Cell 2) from the first UL slot that occurs after the beginning of DL slot (i + $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$ + k1).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch on PCell and SCell (Cell 2) within the time duration $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC} + D_{RRC}$ defined in 8.6.3A.1.

All of the above test requirements shall be fulfilled in order for the observed PCell and SCell (Cell 2) active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after beginning of DL slot ($i+ \frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length} +k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.6.5.7 DL interruptions at switching between two uplink carriers

A.6.5.7.1 DL interruptions at switching between two uplink carriers in FDD-TDD CA

A.6.5.7.1.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink carriers defined in clause 8.2.2.2.10. The test case is applicable for an uplink band pair of an inter-band FDD-TDD CA configuration when the capability *uplinkTxSwitchingPeriod* is present.

There are two cells: FR1 FDD PCell (Cell 1), FR1 TDD SCell (Cell 2). The test parameters for the two cells are given in table A.6.5.7.1.1-1, table A.6.5.7.1.1-2 and table A.6.5.7.1.1-3 below.

For NR FDD carrier (Cell 1), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6 dB on the following symbol in the slot overlapping with the 1 s^t special slot of every radio frame of the NR TDD carrier (Cell 2):

symbol#12 if UE does not report uplinkTxSwitching-DL-Interruption-r16;

otherwise,

symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 210 us or

symbol #9 if UE capability *uplinkTxSwitchingPeriod* is 140 us or

symbol #10 if UE capability *uplinkTxSwitchingPeriod* is 35 us.

For NR TDD carrier (Cell 2), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6 dB on the following symbol in the 2nd special slot of every radio frame:

symbol#9 if UE does not report uplinkTxSwitching-DL-Interruption-r16;

otherwise,

symbol #2 if UE capability *uplinkTxSwitchingPeriod* is 210 us or

symbol #3 if UE capability *uplinkTxSwitchingPeriod* is 140 us or

symbol #6 if UE capability *uplinkTxSwitchingPeriod* is 35 us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitching* is indicated to UE.

Table A.6.5.7.1.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7.1.1-2: General test parameters for DL interruptions at switching between two uplink carriers in FDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2	Two radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell	FR1 PCell on RF channel number 1 FR1 SCell on RF channel number 2
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.1.5 FDD Cell 2: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7.1.1-3: Cell specific test parameters for DL interruptions at switching between two uplink carriers in FDD-TDD CA

Parameter		Unit	Cell1	Cell2
Frequency Range			FR1	FR1
Duplex mode	Config 1		FDD	TDD
TDD configuration	Config 1		N/A	TDDConf.2.1 except that: S='11DL:1GP:2UL'; *nrofDownlinkSymbols:11* *nrofUplinkSymbols: 2*
$BW_{channel}$	Config 1		10 MHz: $N_{RB,c}$ = 52	40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRS configuration in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl10,6	SRS configuration in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.1 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low	2x2 Low
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				

EPRE ratio of OCNG to OCNG DMRS (Note 1)				
powerControlOffsetSS		dB	6	6
N_{oc} Note 2		dBm/15 kHz	-104	-104
SS-RSRP Note 3		dBm/SSB SCS	-87	-87
CSI-RS RSRP Note6		dBm/SCS	-81	-81
$\hat{E}_s/I_{ot}$		dB	17	14
$\hat{E}_s/N_{oc}$		dB	17	14
N_{oc} Note 2	Config 1	dBm/SCS	-104	-101
Io Note3 on symbols without CSI-RS	Config 1	dBm/9.36 MHz	-58.96	-
		dBm/ 38.16MHz	-	-55.78
Io Note6 on symbols with CSI-RS	Config 1	dBm/9.36 MHz	-56.58	-
		dBm/ 38.16MHz	-	-53.43
Time offset to Cell1 Note 5		µs	-	0
Propagation Condition			AWGN	AWGN

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Void
Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.
Note 6: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.5.7.1.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.7.2 DL interruptions at switching between two uplink carriers in TDD-TDD CA

A.6.5.7.2.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink carriers defined in clause 8.2.2.2.10. The test case is applicable for an uplink band pair of an inter-band TDD-TDD CA configuration when the capability *uplinkTxSwitchingPeriod* is present.

There are two cells: FR1 TDD PCell (Cell 1), FR1 TDD SCell (Cell 2). The test parameters for the two cells are given in table A.6.5.7.2.1-1, table A.6.5.7.2.1-2 and table A.6.5.7.2.1-3 below.

For NR TDD PCell (Cell 1), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6 dB on the following symbol in the 1 s^t special slot of every even radio frame:

symbol#10 if UE does not report uplinkTxSwitching-DL-Interruption-r16;

otherwise,

symbol #4 if UE capability *uplinkTxSwitchingPeriod* is 210 us or

symbol #5 if UE capability *uplinkTxSwitchingPeriod* is 140 us or

symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 35 us.

For NR TDD SCell (Cell 2), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6 dB on the following symbol on the 2nd special slot of every even radio frame:

symbol#10 if UE does not report uplinkTxSwitching-DL-Interruption-r16;

otherwise,

symbol #4 if UE capability *uplinkTxSwitchingPeriod* is 210 us or

symbol #5 if UE capability *uplinkTxSwitchingPeriod* is 140 us or

symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 35 us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test case is only applicable to UE which supports *simultaneousRxTxInterBandCA.*

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitching* is indicated to UE.

Table A.6.5.7.2.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7.2.1-2: General test parameters for DL interruptions at switching between two uplink carriers in TDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2	Two radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell	FR1 PCell on RF channel number 1 FR1 SCell on RF channel number 2
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.2.5 TDD Cell 2: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7.2.1-3: Cell specific test parameters for DL interruptions at switching between two uplink carriers in TDD-TDD CA

Parameter		Unit	Cell1	Cell2
Frequency Range			FR1	FR1
Duplex mode	Config 1		TDD	TDD
TDD configuration	Config 1		TDDConf.2.1 except that S='11DL:1GP:2UL'; *nrofDownlinkSymbols:11* *nrofUplinkSymbols: 2*	TDDConf.2.2
$BW_{channel}$	Config 1		40 MHz: $N_{RB,c}$ = 106	40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1

SRS configuration	Config 1		SRS configuration in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,5	SRS configuration in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2
PDSCH Reference measurement channel	Config 1		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.2 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low	2x2 Low
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
powerControlOffsetSS		dB	6	6
N_{oc} Note 2		dBm/15 kHz	-104	-104
SS-RSRP Note 3		dBm/SSB SCS	-87	-87
CSI-RS RSRP Note6		dBm/SCS	-81	-81
$\hat{E}_s/I_{ot}$		dB	14	14
$\hat{E}_s/N_{oc}$		dB	14	14
N_{oc} Note 2	Config 1	dBm/SCS	-101	-101
Io Note3 on symbols without CSI-RS	Config 1	dBm/ 38.16MHz	-55.78	-55.78
Io Note6 on symbols with CSI-RS	Config 1	dBm/ 38.16MHz	-53.43	-53.43
Time offset to Cell1 Note 5		µs	-	0
Propagation Condition			AWGN	AWGN

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Void
Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.
Note 6: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.5.7.2.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.7A DL interruptions at switching between two uplink carriers with two transmit antenna connectors

A.6.5.7A.1 DL interruptions at switching between two uplink carriers in FDD-TDD CA

A.6.5.7A.1.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink carriers defined in clause 8.2.2.2.10A. The test case is applicable for an uplink band pair of an inter-band FDD-TDD CA configuration when the capability *uplinkTxSwitchingPeriod2T2T* is present, where NR UL carrier 1 is capable of two transmit antenna connectors and NR UL carrier 2 is capable of two transmit antenna connectors, and the two uplink carriers are in different bands with different carrier frequencies.

There are two cells: FR1 FDD PCell (Cell 1), FR1 TDD SCell (Cell 2). The test parameters for the two cells are given in table A.6.5.7A.1.1-1, table A.6.5.7A.1.1-2 and table A.6.5.7A.1.1-3 below.

For NR FDD carrier (Cell 1), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6dB on the following symbol in the slot overlapping with the 1st special slot of every radio frame of the NR TDD carrier (Cell 2):

- symbol#12 if UE does not report uplinkTxSwitching-DL-Interruption-r16;
- otherwise,
  - symbol #8 if UE capability *uplinkTxSwitchingPeriod2T2T* is 210 us or
  - symbol #9 if UE capability *uplinkTxSwitchingPeriod2T2T* is 140 us or
  - symbol #10 if UE capability *uplinkTxSwitchingPeriod2T2T* is 35 us.

For NR TDD carrier (Cell 2), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6dB on the following symbol in the 2nd special slot of every radio frame:

- symbol#9 if UE does not report uplinkTxSwitching-DL-Interruption-r16;
- otherwise,
  - symbol #2 if UE capability *uplinkTxSwitchingPeriod2T2T* is 210 us or
  - symbol #3 if UE capability *uplinkTxSwitchingPeriod2T2T* is 140 us or
  - symbol #6 if UE capability *uplinkTxSwitchingPeriod2T2T* is 35 us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitching* is indicated to UE.

Table A.6.5.7A.1.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7A.1.1-2: General test parameters for DL interruptions at switching between two uplink carriers in FDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2	Two radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell	FR1 PCell on RF channel number 1 FR1 SCell on RF channel number 2
CP length		Config 1	Normal	
DRX		Config 1	OFF	

Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.1.5 FDD Cell 2: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7A.1.1-3: Cell specific test parameters for DL interruptions at switching between two uplink carriers in FDD-TDD CA

Parameter		Unit	Cell1	Cell2
Frequency Range			FR1	FR1
Duplex mode	Config 1		FDD	TDD
TDD configuration	Config 1		N/A	TDDConf.2.1 except that: S='11DL: 1GP:2UL'; *nrofDownlinkSymbols: 11* *nrofUplinkSymbols: 2*
$BW_{channel}$	Config 1		10 MHz: $N_{RB,c}$ = 52	40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl10,6 nrofSRS-Ports: ports2	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.1 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			2x2 Low	2x2 Low
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
powerControlOffsetSS		dB	6	6
N_{oc} Note 2		dBm/15 kHz	-104	-104
SS-RSRP Note 3		dBm/SCS	-87	-87
$\hat{E}_s/I_{ot}$		dB	17	14
$\hat{E}_s/N_{oc}$		dB	17	14
N_{oc} Note 2	Config 1	dBm/SCS	-104	-101
Io Note3	Config 1	dBm/9.36 MHz	-58.96	-

		dBm/ 38.16MHz	-	-55.78
Time offset to Cell1 Note 5		µs	-	0
Propagation Condition			AWGN	AWGN

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Void
Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.6.5.7A.1.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10A.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.7A.2 DL interruptions at switching between two uplink carriers in TDD-TDD CA

A.6.5.7A.2.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink carriers defined in clause 8.2.2.2.10A. The test case is applicable for an uplink band pair of an inter-band TDD-TDD CA configuration when the capability *uplinkTxSwitchingPeriod2T2T* is present, where NR UL carrier 1 is capable of two transmit antenna connectors and NR UL carrier 2 is capable of two transmit antenna connectors, and the two uplink carriers are in different bands with different carrier frequencies.

There are two cells: FR1 TDD PCell (Cell 1), FR1 TDD SCell (Cell 2). The test parameters for the two cells are given in table A.6.5.7A.2.1-1, table A.6.5.7A.2.1-2 and table A.6.5.7A.2.1-3 below.

For NR TDD PCell (Cell 1), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6dB on the following symbol in the 1st special slot of every even radio frame:

- symbol#10 if UE does not report uplinkTxSwitching-DL-Interruption-r16;
- otherwise,
  - symbol #4 if UE capability *uplinkTxSwitchingPeriod2T2T* is 210 us or
  - -s ymbol #5 if UE capability *uplinkTxSwitchingPeriod2T2T* is 140 us or
  - symbol #8 if UE capability *uplinkTxSwitchingPeriod2T2T* is 35 us.

For NR TDD SCell (Cell 2), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6dB on the following symbol on the 2nd special slot of every even radio frame:

- symbol#10 if UE does not report uplinkTxSwitching-DL-Interruption-r16;
- otherwise,
  - symbol #4 if UE capability *uplinkTxSwitchingPeriod2T2T* is 210 us or
  - symbol #5 if UE capability *uplinkTxSwitchingPeriod2T2T* is 140 us or
  - symbol #8 if UE capability *uplinkTxSwitchingPeriod2T2T* is 35 us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test case is only applicable to UE which supports *simultaneousRxTxInterBandCA.*

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitching* is indicated to UE.

Table A.6.5.7A.2.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7A.2.1-2: General test parameters for DL interruptions at switching between two uplink carriers in TDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2	Two radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell	FR1 PCell on RF channel number 1 FR1 SCell on RF channel number 2
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.2.5 TDD Cell 2: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7A.2.1-3: Cell specific test parameters for DL interruptions at switching between two uplink carriers in TDD-TDD CA

Parameter		Unit	Cell1	Cell2
Frequency Range			FR1	FR1
Duplex mode	Config 1		TDD	TDD
TDD configuration	Config 1		TDDConf.2.1 except that S='1 1DL: :2UL'; *nrofDownlinkSymbols: 11* *nrofUplinkSymbols: 2*	TDDConf.2.2
$BW_{channel}$	Config 1		40 MHz: $N_{RB,c}$ = 106	40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,5 nrofSRS-Ports: ports2	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2
PDSCH Reference measurement channel	Config 1		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.2 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			2x2 Low	2x2 Low

EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
powerControlOffsetSS		dB	6	6
N_{oc} Note 2		dBm/15 kHz	-104	-104
SS-RSRP Note 3		dBm/SCS	-87	-87
$\hat{E}_s/I_{ot}$		dB	14	14
$\hat{E}_s/N_{oc}$		dB	14	14
N_{oc} Note 2	Config 1	dBm/SCS	-101	-101
Io Note3	Config 1	dBm/ 38.16MHz	-55.78	-55.78
Time offset to Cell1 Note 5		μs	-	0
Propagation Condition			AWGN	AWGN

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Void
Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.6.5.7A.2.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10A.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.7B DL interruptions at switching between one uplink band with one transmit antenna connector and one uplink band with two transmit antenna connectors

A.6.5.7B.1 DL interruptions at switching between two uplink bands in FDD-TDD CA

A.6.5.7B.1.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink bands defined in clause 8.2.2.2.10B. The test case is applicable for an uplink band pair of an inter-band UL CA configuration when the capability *uplinkTxSwitchingPeriod* is present, where NR UL carrier 1 in band A is capable of one transmit antenna connector, NR UL carrier 2 and carrier 3 in band B are capable of two transmit antenna connectors. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers, and band A and band B are different bands with different carrier frequencies.

There are three cells: FR1 FDD PCell (Cell 1), FR1 TDD SCell (Cell 2) and FR1 TDD SCell (Cell 3) where Cell 1 in band A is with 1TX, cell2 and Cell 3 in band B with 2Tx, cell2 and cell3 are two contiguous aggregated carriers. The test parameters for the three cells are given in table A.6.5.7B.1.1-1, table A.6.5.7B.1.1-2 and table A.6.5.7B.1.1-3 below.

For NR FDD carrier (Cell 1), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6 dB on the following symbol in the slot overlapping with the 1 s^{t} special slot of every radio frame of the NR TDD carrier (Cell 2):

- symbol#12 if UE does not report uplinkTxSwitching-DL-Interruption-r16;
- otherwise,
  - symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 210 us or
  - symbol #9 if UE capability *uplinkTxSwitchingPeriod* is 140 us or
  - symbol #10 if UE capability *uplinkTxSwitchingPeriod* is 35 us.

For NR TDD Cell 2 and NR TDD Cell 3, aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6 dB on the following symbol in the 2nd special slot of every radio frame:

- symbol#9 if UE does not report uplinkTxSwitching-DL-Interruption-r16;
- otherwise,
  - symbol #2 if UE capability *uplinkTxSwitchingPeriod* is 210 us or
  - symbol #3 if UE capability *uplinkTxSwitchingPeriod* is 140 us or
  - symbol #6 if UE capability *uplinkTxSwitchingPeriod* is 35 us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitching* is indicated to UE.

Table A.6.5.7B.1.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7B.1.1-2: General test parameters for DL interruptions at switching between two uplink bands in FDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2, 3	Three radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell Cell 3: FR1 SCell	Cell 1: FR1 PCell on RF channel number 1 in band A Cell 2: FR1 SCell on RF channel number 2 in band B Cell 3: FR1 SCell on RF channel number 3 in band B NOTE: Cell 2 and Cell 3 are two contiguous aggregated carriers
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.1.5 FDD Cell 2: CSI-RS.2.5 TDD Cell 3: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7B.1.1-3: Cell specific test parameters for DL interruptions at switching between two uplink bands in FDD-TDD CA

Parameter		Unit	Cell 1	Cell2	Cell 3
Frequency Range			FR1	FR1	FR1
Duplex mode	Config 1		FDD	TDD	TDD
TDD configuration	Config 1		N/A	TDDConf.2.1 except that: S='11DL: 1GP:2UL'; *nrofDownlinkSymbols: 11* *nrofUplinkSymbols: 2*	TDDConf.2.1 except that: S='11DL: 1GP:2UL'; *nrofDownlinkSymbols: 11* *nrofUplinkSymbols: 2*
$BW_{channel}$	Config 1		10 MHz: $N_{PRB,c}$ = 52	40 MHz: $N_{PRB,c}$ = 106	40 MHz: $N_{PRB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl10,6	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.1 FR1	SSB.2 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low	2x2 Low	2x2 Low
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note 2		dBm/15 kHz	-104	-104	-104
SS-RSRP Note 3		dBm/SCS	-87	-87	-87
$\hat{E}_s/I_{ot}$		dB	17	14	14
$\hat{E}_s/N_{oc}$		dB	17	14	14
N_{oc} Note 2	Config 1	dBm/SCS	-104	-101	-101
Io Note3	Config 1	dBm/9.36 MHz	-58.96	-	-

Parameter	Unit	Cell 1	Cell2	Cell 3
	dBm/ 38.16 MHz	-	-55.79	-55.79
Time offset to Cell 1 Note 5	µs	-	0	0
Propagation Condition		AWGN	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.6.5.7B.1.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10B.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.7B.2 DL interruptions at switching between two uplink bands in TDD-TDD CA

A.6.5.7B.2.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink bands defined in clause 8.2.2.2.10B. The test case is applicable for an uplink band pair of an inter-band UL CA configuration when the capability *uplinkTxSwitchingPeriod* is present, where NR UL carrier 1 in band A is capable of one transmit antenna connector, NR UL carrier 2 and carrier 3 in band B are capable of two transmit antenna connectors. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers, and band A and band B are different bands with different carrier frequencies.

There are three cells: FR1 TDD PCell (Cell 1), FR1 TDD SCell (Cell 2) and FR1 TDD SCell (Cell 3) where Cell 1 in band A is with 1TX, cell2 and Cell 3 in band B with 2Tx, cell2 and cell3 are two contiguous aggregated carriers.The test parameters for the three cells are given in table A.6.5.7B.2.1-1, table A.6.5.7B.2.1-2 and table A.6.5.7B.2.1-3 below.

For NR TDD PCell (Cell 1), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6 dB on the following symbol in the 1 s^{t} special slot of every even radio frame:

- symbol#10 if UE does not report uplinkTxSwitching-DL-Interruption-r16;
- otherwise,
  - symbol #4 if UE capability *uplinkTxSwitchingPeriod* is 210 us or
  - symbol #5 if UE capability *uplinkTxSwitchingPeriod* is 140 us or
  - symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 35 us.

For NR TDD Cell 2 and NR TDD Cell 3, aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6 dB on the following symbol on the 2nd special slot of every even radio frame:

- symbol#10 if UE does not report uplinkTxSwitching-DL-Interruption-r16;
- otherwise,
  - symbol #4 if UE capability *uplinkTxSwitchingPeriod* is 210 us or
  - symbol #5 if UE capability *uplinkTxSwitchingPeriod* is 140 us or
  - symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 35 us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test case is only applicable to UE which supports *simultaneousRxTxInterBandCA.*

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitching* is indicated to UE.

Table A.6.5.7B.2.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7B.2.1-2: General test parameters for DL interruptions at switching between two uplink bands in TDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2, 3	Two radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell Cell 3: FR1 SCell	Cell 1: FR1 PCell on RF channel number 1 in band A Cell 2: FR1 SCell on RF channel number 2 in band B Cell 3: FR1 SCell on RF channel number 3 in band B NOTE: Cell 2 and Cell 3 are two contiguous aggregated carriers
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.2.5 TDD Cell 2: CSI-RS.2.5 TDD Cell 3: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7B.2.1-3: Cell specific test parameters for DL interruptions at switching between two uplink bands in TDD-TDD CA

Parameter		Unit	Cell1	Cell2	Cell3
Frequency Range			FR1	FR1	FR1
Duplex mode	Config 1		TDD	TDD	TDD
TDD configuration	Config 1		TDDConf.2.1 except that S='1 1DL: :2UL'; *nrofDownlinkSymbols: 11 nrofUplinkSymbols: 2*	TDDConf.2.2	TDDConf.2.2
$BW_{channel}$	Config 1		40 MHz: $N_{RB,c}$ = 106	40 MHz: $N_{RB,c}$ = 106	40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,5	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2
PDSCH Reference measurement channel	Config 1		SR.2.1 TDD	SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.2.1 TDD	CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low	2x2 Low	2x2 Low
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					

EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
powerControlOffsetSS		dB	6	6	6
N_{oc} Note 2		dBm/15 kHz	-104	-104	-104
SS-RSRP Note 3		dBm/SCS	-87	-87	-87
$\hat{E}_s/I_{ot}$		dB	14	14	14
$\hat{E}_s/N_{oc}$		dB	14	14	14
N_{oc} Note 2	Config 1	dBm/SCS	-101	-101	-101
Io Note3	Config 1			-	-
		dBm/ 38.16MHz	- 55.79	-55.79	-55.79
Time offset to Cell1 Note 5		µs	-	0	0
Propagation Condition			AWGN	AWGN	AWGN

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: Void

Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.6.5.7B.2.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10B.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.7C DL interruptions at switching between two uplink bands with two transmit antenna connectors

A.6.5.7C.1 DL interruptions at switching between two uplink bands with two transmit antenna connectors in FDD-TDD CA

A.6.5.7C.1.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink bands with two transmit antenna connectors defined in clause 8.2.2.2.10C. The test case is applicable for an uplink band pair of an inter-band FDD-TDD CA configuration when the capability *uplinkTxSwitchingPeriod2T2T* is present, where NR UL carrier 1 in band A is capable of two transmit antenna connector, NR UL carrier 2 and carrier 3 in band B are capable of two transmit antenna connectors. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers, and band A and band B are different bands with different carrier frequencies.

There are three cells: FR1 FDD PCell (Cell 1), FR1 TDD SCell (Cell 2) and FR1 TDD SCell (Cell 3) where Cell 1 in band A is with 2Tx, cell2 and Cell 3 in band B with 2Tx, cell2 and cell3 are two contiguous aggregated carriers. The test parameters for the three cells are given in table A.6.5.7C.1.1-1, table A.6.5.7C.1.1-2 and table A.6.5.7C.1.1-3 below.

For NR FDD carrier (Cell 1), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6dB on the following symbol in the slot overlapping with the 1st special slot of every radio frame of the NR TDD carrier (Cell 2) and NR TDD carrier (Cell 3):

- symbol#12 if UE does not report uplinkTxSwitching-DL-Interruption;
- otherwise,
  - symbol #8 if UE capability *uplinkTxSwitchingPeriod2T2T* is 210us or
  - symbol #9 if UE capability *uplinkTxSwitchingPeriod2T2T* is 140us or
  - symbol #10 if UE capability *uplinkTxSwitchingPeriod2T2T* is 35us.

For NR TDD carrier (Cell 2) and NR TDD carrier (Cell 3), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6dB on the following symbol in the 2nd special slot of every radio frame:

- symbol#9 if UE does not report [uplinkTxSwitching-DL-Interruption];
- otherwise,
  - symbol #2 if UE capability *uplinkTxSwitchingPeriod2T2T* is 210us or
  - symbol #3 if UE capability *uplinkTxSwitchingPeriod2T2T* is 140us or
  - symbol #6 if UE capability *uplinkTxSwitchingPeriod2T2T* is 35us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitchingPeriod2T2T* is indicated to UE.

Table A.6.5.7C.1.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

	NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7C.1.1-2: General test parameters for DL interruptions at switching between two uplink bands with two transmit antenna connectors in FDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2, 3	Three radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell Cell 3: FR1 SCell	FR1 PCell on RF channel number 1 FR1 SCell on RF channel number 2 FR1 SCell on RF channel number 3
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.1.5 FDD Cell 2: CSI-RS.2.5 TDD Cell 3: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7C.1.1-3: Cell specific test parameters for DL interruptions at switching between two uplink bands with two transmit antenna connectors in FDD-TDD CA

Parameter		Unit	Cell1	Cell2	Cell3
Frequency Range			FR1	FR1	FR1
Duplex mode	Config 1		FDD	TDD	TDD
TDD configuration	Config 1		N/A	TDDConf.2.1 except that: S='11DL: 1GP:2UL'; *nrofDownlinkSymbols: 11* *nrofUplinkSymbols: 2*	TDDConf.2.1 except that: S='11DL: 1GP:2UL'; *nrofDownlinkSymbols: 11* *nrofUplinkSymbols: 2*
$BW_{channel}$	Config 1		10 MHz: $N_{RB,c}$ = 52	40 MHz: $N_{RB,c}$ = 106	40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl10,6 nrofSRS-Ports: ports2	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.2.1 TDD	SR.2.1 TDD

RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.1 FR1	SSB.2 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			2x2 Low	2x2 Low	2x2 Low
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
powerControlOffsetSS		dB	6	6	6
N_{oc} Note 2		dBm/15 kHz	-104	-104	-104
SS-RSRP Note 3		dBm/SCS	-87	-87	-87

$\hat{E}_s/I_{ot}$		dB	17	14	14
$\hat{E}_s/N_{oc}$		dB	17	14	14
N_{oc} Note 2	Config 1	dBm/SCS	-104	-101	-101
Io Note3	Config 1	dBm/9.36 MHz	-58.96	-	-
		dBm/38.16MHz	-	-55.79	-55.79
Time offset to Cell1 Note 5		µs	-	0	0
Propagation Condition			AWGN	AWGN	AWGN

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Void
Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.6.5.7C.1.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10C.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.7C.2 DL interruptions at switching between two uplink bands with two transmit antenna connectors in TDD-TDD CA

A.6.5.7C.2.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink carriers defined in clause 8.2.2.2.10C. The test case is applicable for an uplink band pair of an inter-band TDD-TDD CA configuration when the capability *uplinkTxSwitchingPeriod2T2T* is present, , where NR UL carrier 1 in band A is capable of two transmit antenna connector, NR UL carrier 2 and carrier 3 in band B are capable of two transmit antenna connectors. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers, and band A and band B are different bands with different carrier frequencies.

There are three cells: FR1 TDD PCell (Cell 1), FR1 TDD SCell (Cell 2) and FR1 TDD SCell (Cell 3) where cell 1 in band A is with 2Tx, cell2 and cell 3 in band B with 2Tx, cell2 and cell3 are two contiguous aggregated carriers. The test parameters for the three cells are given in Table A.6.5.7C.2.1-1, Table A.6.5.7C.2.1-2 and Table A.6.5.7C.2.1-3 below.

For NR TDD PCell (Cell 1), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6dB on the following symbol in the 1st special slot of every even radio frame:

- symbol#10 if UE does not report uplinkTxSwitching-DL-Interruption;
- otherwise,
  - symbol #4 if UE capability *uplinkTxSwitchingPeriod2T2T* is 210us or
  - symbol #5 if UE capability *uplinkTxSwitchingPeriod2T2T* is 140us or
  - symbol #8 if UE capability *uplinkTxSwitchingPeriod2T2T* is 35us.

For NR TDD SCell (Cell 2) and NR TDD SCell (Cell 3), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6dB on the following symbol on the 2nd special slot of every even radio frame:

- symbol#10 if UE does not report *uplinkTxSwitching-DL-Interruption*;
- otherwise,
  - symbol #4 if UE capability *uplinkTxSwitchingPeriod2T2T* is 210us or
  - symbol #5 if UE capability *uplinkTxSwitchingPeriod2T2T* is 140us or
  - symbol #8 if UE capability *uplinkTxSwitchingPeriod2T2T* is 35us.

This test verifies that the UE correctly report the L1-RSRP reporting. The test case is only applicable to UE which supports *simultaneousRxTxInterBandCA.*

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitchingPeriod2T2T* is indicated to UE.

Table A.6.5.7C.2.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7C.2.1-2: General test parameters for DL interruptions at switching between two uplink bands with two transmit antenna connectors in TDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2, 3	Three radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell Cell 3: FR1 SCell	FR1 PCell on RF channel number 1 FR1 SCell on RF channel number 2 FR1 SCell on RF channel number 3
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.2.5 TDD Cell 2: CSI-RS.2.5 TDD Cell 3: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7C.2.1-3: Cell specific test parameters for DL interruptions at switching between two uplink bands with two transmit antenna connectors in TDD-TDD CA

Parameter		Unit	Cell1	Cell2	Cell3
Frequency Range			FR1	FR1	FR1
Duplex mode	Config 1		TDD	TDD	TDD
TDD configuration	Config 1		TDDConf.2.1 except that S='1 1DL: :2UL'; *nrofDownlinkSymbols: 11* *nrofUplinkSymbols: 2*	TDDConf.2.2	TDDConf.2.2
$BW_{channel}$	Config 1		40 MHz: $N_{RB,c}$ = 106	40 MHz: $N_{RB,c}$ = 106	40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,5 nrofSRS-Ports: ports2	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2
PDSCH Reference measurement channel	Config 1		SR.2.1 TDD	SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.2.1 TDD	CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			2x2 Low	2x2 Low	2x2 Low
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					

EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
powerControlOffsetSS		dB	6	6	6
N_{oc} Note 2		dBm/15 kHz	-104	-104	-104
SS-RSRP Note 3		dBm/SCS	-87	-87	-87
$\hat{E}_s/I_{ot}$		dB	14	14	14
$\hat{E}_s/N_{oc}$		dB	14	14	14
N_{oc} Note 2	Config 1	dBm/SCS	-101	-101	-101
Io Note3	Config 1			-	-
		dBm/ 38.16MHz	-55.79	-55.79	-55.79
Time offset to Cell1 Note 5		µs	-	0	0
Propagation Condition			AWGN	AWGN	AWGN

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Void
Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.6.5.7C.2.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10C.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.7D DL interruptions at UE switching across three or four uplink bands

A.6.5.7D.1 DL interruptions at switching across three uplink bands in TDD-TDD CA for single TAG

A.6.5.7D.1.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching across three uplink bands for single TAG defined in clause 8.2.2.2.10D. The test case is applicable for an inter-band TDD-TDD CA configuration when the capability *BandCombination-UplinkTxSwitch-v1800* is present, where NR UL carrier 1 in band A is capable of one transmit antenna connector, NR UL carrier 2 in band B is capable of one transmit antenna connector and NR UL carrier 3 in band C is capable of two transmit antenna connectors. NR UL carrier 1, carrier 2 and carrier 3 in band A, band B and band C, respectively, are different bands with different carrier frequencies. All cells belong to the same TAG.

There are three cells: FR1 TDD PCell (Cell 1), FR1 TDD SCell (Cell 2) and FR1 TDD SCell (Cell 3) where Cell 1 with 1TX is on band A, Cell 2 with 1TX is on band B, and Cell 3 with 2TX is on band C. The test parameters for the three cells are given in table A.6.5.7D.1.1-1, table A.6.5.7D.1.1-2 and table A.6.5.7D.1.1-3 below. TX switching is from band A and band B to band C.

For NR TDD PCell (Cell 1) and NR TDD SCell (Cell 2), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6 dB on the following symbol in the 1 s^{t} special slot of every even radio frame:

- symbol#10 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;
- otherwise,
  - symbol #4 if UE capability uplink Tx switching period is 210 μs or
  - symbol #5 if UE capability uplink Tx switching period is 140 μs or
  - symbol #8 if UE capability uplink Tx switching period is 35 μs.

For NR TDD SCell (Cell 3), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6dB on the following symbol on the 2nd special slot of every even radio frame:

- symbol#10 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;
- otherwise,
  - symbol #4 if UE capability uplink Tx switching period is 210 μs or
  - symbol #5 if UE capability uplink Tx switching period is 140 μs or
  - symbol #8 if UE capability uplink Tx switching period is 35 μs .

This test verifies that the UE correctly report the L1-RSRP reporting. The test case is only applicable to UE which supports *simultaneousRxTxInterBandCA.*

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *UplinkTxSwitchingMoreBands-r18* is indicated to UE.

Table A.6.5.7D.1.1-1: Supported test configurations

Configuration	Description

1	NR Cell 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7D.1.1-2: General test parameters for DL interruptions at switching across three uplink bands in TDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2, 3	Three radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell Cell 3: FR1 SCell	FR1 PCell on RF channel number 1 FR1 SCell on RF channel number 2 FR1 SCell on RF channel number 3
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.2.5 TDD Cell 2: CSI-RS.2.5 TDD Cell 3: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7D.1.1-3: Cell specific test parameters for DL interruptions at switching across three uplink bands in TDD-TDD CA

Parameter		Unit	Cell 1	Cell2	Cell 3
Frequency Range			FR1	FR1	FR1
Duplex mode	Config 1		TDD	TDD	TDD
TDD configuration	Config 1		TDDConf.2.1 except that S='11DL: 1GP :2UL'; *nrofDownlinkSymbols: 11* *nrofUplinkSymbols: 2*	TDDConf.2.1 except that S='11DL: 1GP :2UL'; *nrofDownlinkSymbols: 11* *nrofUplinkSymbols: 2*	TDDConf.2.2
$BW_{channel}$	Config 1	MHz	40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,5	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,5	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2
PDSCH Reference measurement channel	Config 1		SR.2.1 TDD	SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.2.1 TDD	CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	2x2 Low
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					

Parameter		Unit	Cell 1	Cell2	Cell 3
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
powerControlOffsetSS		dB	6	6	6
N_{oc} Note 2		dBm/15 kHz	-104	-104	-104
SS-RSRP Note 3		dBm/SCS	-87	-87	-87
$\hat{E}_s/I_{ot}$		dB	14	14	14
$\hat{E}_s/N_{oc}$		dB	14	14	14
N_{oc} Note 2	Config 1	dBm/SCS	-101	-101	-101
Io Note3	Config 1	dBm/ 38.16 MHz	-55.79	-55.79	-55.79
Time offset to Cell 1 Note 5		µs	-	0	0
Propagation Condition			AWGN	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Receive time difference between slot boundaries of signals received from the three cells at the UE antenna connector including time alignment error between the three cells.

A.6.5.7D.1.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10D.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.7D.2 DL interruptions at switching across four uplink bands in FDD-TDD CA for single TAG

A.6.5.7D.2.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching across four uplink bands for single TAG defined in clause 8.2.2.2.10D. The test case is applicable an NR inter-band CA configuration when the capability *BandCombination-UplinkTxSwitch-v1800* is present, where NR UL carrier 1 in band A, NR UL carrier 2 in band B, NR UL carrier 3 in band C and NR UL carrier 4 in band D are capable of one transmit antenna connector respectively. All cells belong to the same TAG.

There are four cells: FR1 FDD PCell (Cell 1), FR1 FDD SCell (Cell 2), FR1 TDD SCell (Cell 3) and FR1 TDD SCell (Cell 4) where Cell 1 in band A is with 1TX, Cell 2 in band B is with 1TX, Cell 3 in band C is with 1TX and Cell 4 in band D is with 1TX. The test parameters for the four cells are given in table A.6.5.7D.2.1-1, table A.6.5.7D.2.1-2 and table A.6.5.7D.2.1-3 below. TX switching is from band A and band B to band C and band D.

For NR FDD carrier Cell 1 and NR FDD carrier Cell2, aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6 dB on the following symbol in the slot overlapping with the 1 s^t special slot of every radio frame of the NR TDD carrier (Cell 3):

- symbol#12 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;
- otherwise,
  - symbol #8 if UE indicated uplink Tx switching period is 210 μs or
  - symbol #9 if UE indicated uplink Tx switching period is 140 μs or
  - symbol #10 if UE indicated uplink Tx switching period is 35 μs.

For NR TDD Cell 3 and NR TDD Cell 4, aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6 dB on the following symbol in the 2^{nd} special slot of every radio frame:

- symbol#9 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;
- otherwise,
  - symbol #2 if UE indicated uplink Tx switching period is 210 μs or
  - symbol #3 if UE indicated uplink Tx switching period is 140 μs or
  - symbol #6 if UE indicated uplink Tx switching period is 35 μs.

This test verifies that the UE correctly report the L1-RSRP reporting. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *UplinkTxSwitchingMoreBands-r18* is indicated to UE.

Table A.6.5.7D.2.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR Cell 2: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 4: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7D.2.1-2: General test parameters for DL interruptions at switching across four uplink bands in FDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2, 3, 4	Four radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell Cell 3: FR1 SCell Cell 4: FR1 SCell	Cell 1: FR1 PCell on RF channel number 1 in band A Cell 2: FR1 SCell on RF channel number 2 in band B Cell 3: FR1 SCell on RF channel number 3 in band C Cell 4: FR1 SCell on RF channel number 4 in band D
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.1.5 FDD Cell 2: CSI-RS.1.5 FDD Cell 3: CSI-RS.2.5 TDD Cell 4: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7D.2.1-3: Cell specific test parameters for DL interruptions at switching across four uplink bands in FDD-TDD CA

Parameter		Unit	Cell 1	Cell 2	Cell 3	Cell4
Frequency Range			FR1	FR1	FR1	FR1
Duplex mode	Config 1		FDD	FDD	TDD	TDD
TDD configuration	Config 1		N/A	N/A	TDDConf.2.1 except that: S='11DL: 1GP:2UL'; *nrofDownlinkSymbols: 11 nrofUplinkSymbols: 2*	TDDConf.2.1 except that: S='11DL: 1GP:2UL'; *nrofDownlinkSymbols: 11 nrofUplinkSymbols: 2*
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52	40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1	DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl10,6	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl10,6	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.1.1 FDD	SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.1.1 FDD	CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.1.1 FDD	CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1	OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1	SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.1 FR1	SSB.1 FR1	SSB.2 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low	1x2 Low
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						

Parameter		Unit	Cell 1	Cell 2	Cell 3	Cell4
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
powerControlOffsetSS		dB	6	6	6	6
N_{oc} Note 2		dBm/15 kHz	-104	-104	-104	-104
SS-RSRP Note 3		dBm/SCS	-87	-87	-87	-87
$\hat{E}_s/I_{ot}$		dB	17	17	14	14
$\hat{E}_s/N_{oc}$		dB	17	17	14	14
N_{oc} Note 2	Config 1	dBm/SCS	-104	-104	-101	-101
Io Note3	Config 1	dBm/9.36 MHz	-58.96	-58.96	-	-
		dBm/ 38.16 MHz	-	-	-55.79	-55.79
Time offset to Cell 1 Note 5		µs	-	0	0	0
Propagation Condition			AWGN	AWGN	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.6.5.7D.2.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10D.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.7D.3 DL interruptions at switching across three uplink bands in FDD-TDD CA for two TAGs

A.6.5.7D.3.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching across 3 bands with one or two transmit antenna connectors defined in clause 8.2.2.2.10D for two TAGs. The test case is applicable for an NR inter-band CA configuration when the capability *BandCombination-UplinkTxSwitch-v1800* is present, where in NR inter-band CA configuration, the number of NR uplink bands with different carrier frequencies is three. NR UL carrier(s) in each of the three uplink bands are capable of one or two transmit antenna connector(s), according to the UE capability. Cell 1 and Cell 2 belong to one TAG, and Cell 3 belongs to the other TAG.

There are three cells: FR1 FDD PCell (Cell 1), FR1 FDD SCell (Cell 2) and FR1 TDD SCell (Cell 3) where Cell 1 with 1TX is on band A, Cell 2 with 1TX is on band B, and Cell 3 with 2TX is on band C. The test parameters for the three cells are given in table A.6.5.7D.3.1-1, table A.6.5.7D.3.1-2 and table A.6.5.7D.3.1-3 below. TX switching is from band A and band B to band C.

For NR FDD carrier Cell 1 and NR FDD carrier Cell2, aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6 dB on the following symbol in slot overlapping with the 1 s^{t} special slot of every radio frame of the NR TDD carrier (Cell 3):

- symbol#12 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;
- otherwise,
    - symbol #8 if UE indicated uplink Tx switching period is 210 μs or
    - symbol #9 if UE indicated uplink Tx switching period is 140 μs or
    - symbol #10 indicated uplink Tx switching period is 35 μs .

For NR TDD carrier (Cell 3), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6 dB on the following symbol in the 2nd special slot of every radio frame:

- symbol#9 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;
- otherwise,
    - symbol #1 if UE indicated uplink Tx switching period is 210 μs or
    - symbol #3 if UE indicated uplink Tx switching period is 140 μs or
    - symbol #6 if UE indicated uplink Tx switching period is 35 μs.

This test verifies that the UE correctly report the L1-RSRP reporting. The test case is only applicable to UE which supports *simultaneousRxTxInterBandCA.*

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *UplinkTxSwitchingMoreBands-r18* is indicated to UE.

Table A.6.5.7D.3.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR Cell 2: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7D.3.1-2: General test parameters for DL interruptions at switching across 3 bands with one or two transmit antenna connectors in FDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2, 3	Three radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell Cell 3: FR1 SCell	FR1 PCell on RF channel number 1 FR1 SCell on RF channel number 2 FR1 SCell on RF channel number 3
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.1.5 FDD Cell 2: CSI-RS.1.5 FDD Cell 3: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7D.3.1-3: Cell specific test parameters for DL interruptions at switching across 3 bands with one or two transmit antenna connectors in FDD-TDD CA

Parameter		Unit	Cell 1	Cell2	Cell 3
Frequency Range			FR1	FR1	FR1
Duplex mode	Config 1		FDD	FDD	TDD
TDD configuration	Config 1		N/A	N/A	TDDConf.2.1 except that: S='11DL: 1GP:2UL'; *nrofDownlinkSymbols: 11* *nrofUplinkSymbols: 2*
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52	40: $N_{PRB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl10,6	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl10,6	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3 nrofSRS-Ports: ports2
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.1.1 FDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.1.1 FDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.1.1 FDD	CCR.2.1 TDD except that duration of CORESET is 1
OCNG Patterns			OP.1	OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.1 FR1	SSB.1 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	2x2 Low
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					

Parameter		Unit	Cell 1	Cell2	Cell 3
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
powerControlOffsetSS		dB	6	6	6
N_{oc} Note 2		dBm/15 kHz	-104	-104	-104
SS-RSRP Note 3		dBm/SCS	-87	-87	-87
$\hat{E}_s/I_{ot}$		dB	17	17	14
$\hat{E}_s/N_{oc}$		dB	17	17	14
N_{oc} Note 2	Config 1	dBm/SCS	-104	-104	-101
Io Note3	Config 1	dBm/9.36 MHz	-58.96	-58.96	-
		dBm/ 38.16 MHz	-	-	-55.79
Time offset to Cell 1 Note 5		µs	-	0	9
Propagation Condition			AWGN	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.6.5.7D.3.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10D for two TAGs case and provided in table 8.2.2.2.10D-2.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.7D.4 DL interruptions at switching across four uplink bands in TDD-TDD CA for two TAGs

A.6.5.7D.4.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic across four bands with one or two transmit antenna connectors defined in clause 8.2.2.2.10D for two TAGs. The test cases are applicable for an NR inter-band CA configuration when the capability *BandCombination-UplinkTxSwitch-v1800* is present, where in NR inter-band CA configuration, the number of NR uplink bands with different carrier frequencies is four. NR UL carrier(s) in each of the four uplink bands are capable of one transmit antenna connector(s), according to the UE capability. Cell 1 and Cell 2 belong to one TAG, and Cell 3 and Cell 4 belong to the other TAG.

There are four cells: FR1 TDD PCell (Cell 1), FR1 TDD SCell (Cell 2), FR1 TDD SCell (Cell 3) and FR1 TDD SCell (Cell 4) where Cell 1 in band A is with 1TX, Cell 2 in band B is with 1TX, Cell 3 in band C is with 1TX and Cell 4 in band D is with 1TX. The test parameters for the four cells are given in table A.6.5.7D.4.1-1, table A.6.5.7D.4.1-2 and table A.6.5.7D.4.1-3 below. TX switching is from band A and band B to band C and band D.

For NR TDD PCell (Cell 1) and NR TDD SCell (Cell 2), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting 6 dB on the following symbol in the 1 s^t special slot of every even radio frame:

- symbol#10 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;
- otherwise,
    - symbol #3 if UE capability uplink Tx switching period is 210 μs or
    - symbol #5 if UE capability uplink Tx switching period is 140 μs or
    - symbol #8 if UE capability uplink Tx switching period is 35 μs .

For NR TDD SCell (Cell 3) and NR TDD SCell (Cell 4), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting 6dB on the following symbol on the 2nd special slot of every even radio frame:

- symbol#10 if UE does not report *uplinkTxSwitching-DL-Interruption-r18*;
- otherwise,
    - symbol #3 if UE capability uplink Tx switching period is 210 μs or
    - symbol #5 if UE capability uplink Tx switching period is 140 μs or
    - symbol #8 if UE capability uplink Tx switching period is 35 μs .

This test verifies that the UE correctly report the L1-RSRP reporting. The test case is only applicable to UE which supports *simultaneousRxTxInterBandCA.*

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *UplinkTxSwitchingMoreBands-r18* is indicated to UE.

Table A.6.5.7D.4.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

	NR Cell 4: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7D.4.1-2: General test parameters for DL interruptions at switching across 4 bands with one or two transmit antenna connectors in TDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2, 3, 4	Four radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell Cell 3: FR1 SCell Cell 4: FR1 SCell	FR1 PCell on RF channel number 1 FR1 SCell on RF channel number 2 FR1 SCell on RF channel number 3 FR1 SCell on RF channel number 4
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.2.5 TDD Cell 2: CSI-RS.2.5 TDD Cell 3: CSI-RS.2.5 TDD Cell 4: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7D.7.1-3: Cell specific test parameters for DL interruptions at switching across 4 bands with one or two transmit antenna connectors in TDD-TDD CA

Parameter		Unit	Cell 1	Cell2	Cell 3	Cell4
Frequency Range			FR1	FR1	FR1	FR1
Duplex mode	Config 1		TDD	TDD	TDD	TDD
TDD configuration	Config 1		TDDConf.2.1 except that S='1 1DL: :2UL'; *nrofDownlinkSymbols: 11 nrofUplinkSymbols: 2*	TDDConf.2.1 except that S='1 1DL: :2UL'; *nrofDownlinkSymbols: 11 nrofUplinkSymbols: 2*	TDDConf.2.2	TDDConf.2.2
$BW_{channel}$	Config 1	MHz	40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1	DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,5	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,5	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3	SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2 periodicityAndOffset-p: sl20,3
PDSCH Reference measurement channel	Config 1		SR.2.1 TDD	SR.2.1 TDD	SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.2.1 TDD	CR.2.1 TDD	CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1	OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1	SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1

Parameter	Unit	Cell 1	Cell2	Cell 3	Cell4
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low	1x2 Low
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
powerControlOffsetSS	dB	6	6	6	6
N_{oc} Note 2	dBm/15 kHz	-104	-104	-104	-104
SS-RSRP Note 3	dBm/SCS	-87	-87	-87	-87
$\hat{E}_s/I_{ot}$	dB	14	14	14	14
$\hat{E}_s/N_{oc}$	dB	14	14	14	14
N_{oc} Note 2 Config 1	dBm/SCS	-101	-101	-101	-101
Io Note3 Config 1	dBm/ 38.16 MHz	-55.79	-55.79	-55.79	-55.79
Time offset to Cell 1 Note 5	µs	-	0	9	9
Propagation Condition		AWGN	AWGN	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.6.5.7D.7.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10D for two TAGs case and provided in table 8.2.2.2.10D-2.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.8 UE specific CBW change

A.6.5.8.1 UE specific CBW change on PCell in FR1 in non-DRX

A.6.5.8.1.1 Test Purpose and Environment

The purpose of this test is to verify the UE specific CBW change delay requirement defined in clause 8.13.

The supported test configurations are shown in table A.6.5.8.1.1-1. The test scenario comprises of one Cell (Cell 1), which is PCell as given in table A.6.5.8.1.1-2. Cell-specific parameters are specified in table A.6.5.8.1.1-3.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE sends ACK/NACK during the test.

Before the test starts:

- UE is connected to Cell 1 (PCell) on radio channel 1.
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PCell.
- UE has been configured with UE specific CBW (CBW-1).
- UE is indicated in *SCS-SpecificCarrier* [2] that the UE specific CBW is CBW-1 as the initial condition in Cell 1 (PCell).

Cell 1 (PCell) has constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* containing *SCS-SpecificCarrier* with updated UE specific CBW, sent from the test equipment to the UE, is completely received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its UE specific CBW with the updated CBW-2 for the final condition.

The UE shall be able to receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ as defined in clause 8.13 and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length} + k1$ on the PCell's BWP-1 on CBW-2 for the final condition. The UE shall be continuously scheduled on the PCell's BWP-1 on CBW-2 for the final condition starting from the first DL slot right after slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$.

$T_{RRCprocessingDelay}$ and $T_{CBWchangeDelayRRC}$ are defined in clause 8.13.

The test equipment verifies the UE specific CBW switching delay in PCell by estimating the time from the moment the RRC Reconfiguration message including updated UE specific CBW configuration is sent until the moment a vaild ACK/NACK is received.

Table A.6.5.8.1.1-1: Supported test configurations for UE specific CBW change in SA scenario

Configuration	Description

1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.6.5.8.1.1-2: General test parameters for UE specific CBW change in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	

Table A.6.5.8.1.1-3: NR Cell specific test parameters for UE specific CBW change in SA scenario

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1		FDD
		Config 2,3		TDD
TDD configuration		Config 1		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
$BW_{channel}$		Config 1		10 MHz: $N_{PRB,c}$ = 52
		Config 2		10 MHz: $N_{PRB,c}$ = 52
		Config 3		40 MHz: $N_{PRB,c}$ = 106
Active DL BWP ID		Config 1,2, 3		1
Initial DL BWP Configuration (BWP-1)		Config 1,2, 3		DLBWP.0.2
Initial UL BWP Configuration		Config 1,2, 3		ULBWP.0.2
Initial Condition	Active DL CBW-1 Configuration	Config 1, 2, 3		DLCBW.1.1
	Active UL CBW-1 Configuration	Config 1, 2, 3		ULCBW.1.1
Final Condition	Active DL CBW-2 Configuration	Config 1, 2, 3		DLCBW.1.2
	Active UL CBW-2 Configuration	Config 1, 2, 3		ULCBW.1.2
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD
		Config 2		SR.1.1 TDD
		Config 3		SR2.1 TDD
RMSI CORESET parameters		Config 1		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR2.1 TDD
Dedicated CORESET parameters		Config 1		CCR.1.1 FDD
		Config 2		CCR.1.1 TDD
		Config 3		CCR.2.1 TDD
OCNG Patterns				OP.1
SSB Configuration		Config 1,2		SSB.1 FR1
		Config 3		SSB.2 FR1
SMTC Configuration				SMTC.1
TRS Configuration		Config 1		TRS.1.1 FDD
		Config 2		TRS.1.1 TDD
		Config 3		TRS.1.2 TDD
Antenna Configuration				1x2 Low
Propagation Condition				AWGN

Parameter		Unit	Cell 1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS (Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1,2	dBm/SCS	-104
	Config 3		-101
SS-RSRP Note 3	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.1 is linked with ULBWP.0.1; DLBWP.1.1 is linked with ULBWP.1.1; as defined in clause 12 of TS 38.213 [3].			

A.6.5.8.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the PCell from the first DL slot that occurs right after the begining of slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length} + k1$.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in TS 38.321 [7].

All of the above test requirements shall be fulfilled in order for the observed UE specific CBW change delay on the PCell to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.9 Pathloss reference signal switching delay

A.6.5.9.1 MAC-CE based pathloss reference signal switch delay

A.6.5.9.1.1 Test Purpose and Environment

The purpose of this test is to verify the MAC-CE based pathloss reference signal switch delay requirement defined in clause 8.14.

The supported test configurations are shown in table A.6.5.9.1.1-1. The test scenario comprises of one cell (Cell 1) as given in table A.6.5.9.1.1-2. Cell-specific parameters of the cell are specified in table A.6.5.9.1.1-3 below.

The test consists of 3 successive time periods, with duration of T1, T2 and T3, respectively.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 on radio channel 1.
- UE shall be fully synchronized to SSB #0.

During T1,

- The UE shall track SSB #1 so that SSB #1 as a pathloss reference signal is known to the UE.

Time period T2 starts when the UE is configured of the power headroom reporting functionality by upper layers by the test equipment and the UE shall transmit a PHR during T2.

During T2,

- UE is configured with a *phr-ProhibitTimer* timer value for Cell 1.
- UE is configured with a *phr-Tx-PowerFactorChange* value for Cell 1.

During T3,

Time period T3 starts when a PDSCH carrying MAC-CE activation for pathloss reference signal switch, sent from the test equipment to the UE to swicth the pathloss reference signal from SSB 0 to SSB 1, is received at the UE side in Cell 1's slot # denoted *i*. The UE shall switch its pathloss reference signal to the target one and send PHR.

The UE shall be able to apply the target pathloss reference signal of the serving cell on which pathloss reference signal switch occurs no later than the slot $i + T_{HARQ} + \left\lceil \frac{3\text{ ms} + 5 * T_{target_PL-RS} + 2\text{ ms}}{NR\ slot\ length} \right\rceil$ as defined in clause 8.14. The UE shall be able to apply old pathloss reference signals until the slot $i + T_{HARQ} + 3\text{N}_{\text{slot}}^{\text{subframe},\mu}$ as defined in clause 8.14.

The test equipment verifies the pathloss RS switch time by counting the slots from the time when the pathloss RS switch command is transmitted till a PHR is received during T3.

Table A.6.5.9.1.1-1: MAC-CE based pathloss reference signal switch supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.5.9.1.1-2: General test parameters for MAC-CE based pathloss reference signal switch in SA

Parameter		Unit	Value	Comment
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
SSB Configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	
	Config 3		SMTC.1	
	Config 1, 2		15 kHz	

Parameter		Unit	Value	Comment
PDSCH/PDCCH subcarrier spacing	Config 3		30 kHz	
SSB index assigned as pathloss RS			0 in T1, 0 in T2, 1 in T3	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			1x2 Low	
DRX			OFF	
Gap pattern ID			gp0	
phr-ProhibitTimer		sub frame	0	
phr-Tx-PowerFactorChange		dB	5	
phr-PeriodicTimer		sub frame	infinity	
Filter coefficient			0	L3 filtering is not used
T1		s	[2]	
T2		s	[2]	
T3		s	0.2	

Table A.6.5.9.1.1-3: NR Cell specific test parameters for MAC-CE based pathloss reference signal switch in SA

Parameter			Unit	Test 1		
				T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS			dB	4		
EPRE ratio of PDCCH to PDCCH DMRS			dB	0		
EPRE ratio of PBCH DMRS to SSS			dB	0		
EPRE ratio of PBCH to PBCH DMRS			dB			
EPRE ratio of PSS to SSS			dB			
EPRE ratio of PDSCH DMRS to SSS			dB			
EPRE ratio of PDSCH to PDSCH DMRSDMRS			dB			
EPRE ratio of OCNG DMRS to SSS			dB			
EPRE ratio of OCNG to OCNG DMRS			dB			
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	[7]		
	N_{oc}	Config 1, 2, 3	dBm/15kHz	[-101]		
	$\hat{E}_s / N_{oc}$		dB	[7]		
	SS-RSRP Note 4	Config 1, 2	dBm/ SCS	[-94]		
		Config 3		[-91]		
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	[-3]		
	N_{oc}	Config 1, 2, 3	dBm/15kHz	[-101]		
	$\hat{E}_s / N_{oc}$		dB	[-3]		
	SS-RSRP Note 4	Config 1, 2	dBm/ SCS	[-104]		
		Config 3		[-101]		
Io Note 5	Config 1, 2		dBm	-65.3/9.36 MHz		
	Config 3			-59.2/38.16 MHz		
Propagation condition				AWGN		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 5: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.

A.6.5.9.1.2 Test Requirements

During T3, the UE shall start to send the PHR for PCell no later than the slot $i + T_{HARQ} + \left\lceil \frac{3\text{ ms} + 5 * T_{target_PL-RS} + 2\text{ ms}}{NR\ slot\ length} \right\rceil$.

During T3, the UE shall start to send the PHR for PCell no earlier than the slot $i + T_{HARQ} + 3N_{slot}^{subframe,\mu}$.

Where, T_{HARQ} is the timing between pathloss reference MAC-CE activation command and acknowledgement as specified in TS 38.321 [7], T_{target_PL-RS} is the periodicity of the target pathloss reference signal which is SSB in this test.

During T3, UE shall send L1-RSRP report with measurement results for both SSB0 and SSB1.

All of the above test requirements shall be fulfilled in order for the observed pathloss RS switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The UE shall be given proper uplink transmission grant during T2 and T3.

A.6.5.10 Conditional PSCell addition and release delay (FR1 NR-DC)

A.6.5.10.1 Conditional PSCell Addition and Release Delay

A.6.5.10.1.1 Test purpose and environment

The purpose of this test is to verify that the NR conditional PSCell addition and release delay under NR-DC is within the requirements stated in clause 8.9A.2.

A.6.5.10.1.2 Test Parameters

Supported test configurations are shown in clause A.6.5.10.1.2-1. The test scenario comprises two NR cells, Cell 1 and Cell 2, on radio channel 1 in FR1 and radio channel 2 in FR1, respectively. Test parameters are given in Tables A.6.5.10.1.2-2 below.

The test parameters for NR cell are given in Tables A.6.5.10.1.2-2 and cell-specific parameters in table A.6.5.10.1.2-3 below. The test consists of four successive time periods with duration of T1, T2, T3 and T4 respectively. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (NR PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell1 is known to the UE.

At the start of time duration T1, the UE does not have any timing information of Cell 2. The network shall configure a condition and the target PSCell configuration implying addition to Cell 2 during T1, at a time earlier than T_{RRC_delay} before the beginning of T2.

At the start of T2, Cell 2 becomes detectable and meets the addition condition. UE shall be able to measure and detect that the condition is fulfilled during time $T_{measure}$. After which it will transmit the PRACH preamble. Reception by the test system of the PRACH preamble defines the start of T3.

During T3, the UE shall send periodic CSI reports in PSCell. After having received at least one such report, the test system shall send an RRC message instructing the UE to release the PSCell. Reception by the UE of the RRC message defines the start of T4.

During T4, the UE shall release the PSCell.

Table A.6.5.10.1.2-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	FR1 FDD, NR SCS 15 kHz, BW 10 MHz, FDD
2	FR1 FDD, NR SCS 15 kHz, BW 10 MHz, TDD
3	FR1 FDD, NR SCS 30 kHz, BW 40 MHz, TDD
4	FR1 TDD, NR SCS 15 kHz, BW 10 MHz, FDD
5	FR1 TDD, NR SCS 15 kHz, BW 10 MHz, TDD
6	FR1 TDD, NR SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.10.1.2-2: General Test Parameters for Conditional PSCell Addition and Release

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for PCell and second for NR PSCell
Initial	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell2	Neighbour cell on RF channel number 1.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour Cell		Cell2	PSCell released on RF channel number 1.
A4	Hysteresis	dB	0	Hysteresis for event A4
	Threshold RSRP	dBm	-118	Threshold for event A4
	Time to Trigger	s	0	Time to trigger for event A4
DRX			OFF	Continuous monitoring of primary cell
Measurement gap pattern Id			0	Gaps are configured before T2 and released before T3.
PRACH configuration on cell2			FR1 PRACH configuration 1	Captured in clause A.3.8.2.1
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on carrier frequency of cell2.
T1		s	5	During this time the PCell is known and Cell 2 is unknown.
T2		s	≤7	During this time Cell 2 meets the addition condition and UE adds this PSCell.
T3		s	1	During this time the UE sends CSI reports for Cell 2. And the test system shall send an RRC message instructing the UE to release the PSCell.
T4		s	1	During this time the UE releases the Cell 2.

Table A.6.5.10.1.2-3: Cell Specific Parameters for Conditional PSCell Addition and Release

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
NR RF Channel Number		1,2,3,4,5,6	1			
NR RF Channel Number		1,2,3,4,5,6	1			
TDD configuration		1,4	Not Applicable			
		2,5	TDDConf.1.1			
		3,6	TDDConf.2.1			
$BW_{channel}$	MHz	1,4	10: $N_{PRB,c}$ = 52			
		2,5	10: $N_{PRB,c}$ = 52			
		3,6	40: $N_{PRB,c}$ = 106			
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1			
PDSCH Reference measurement channel		1,4	SR.1.1 FDD			
		2,5	SR.1.1 TDD			
		3,6	SR.2.1 TDD			
RMSI CORESET Reference Channel		1,4	CR.1.1 FDD			
		2,5	CR.1.1 TDD			
		3,6	CR.2.1 TDD			
Dedicated CORESET Reference Channel		1,4	CCR.1.1 FDD			
		2,5	CCR.1.1 TDD			
		3,6	CCR.2.1 TDD			
OCNG Patterns		1,2,3,4,5,6	OP.1			
SSB configuration		1,2,4,5	SSB.1 FR1			
		3,6	SSB.2 FR1			
SMTC configuration		1,2,4,5	SMTC.1			
		3,6	SMTC.1			
TRS Configuration		1,4	TRS.1.1 FDD			
		2,5	TRS.1.1 TDD			
		3,6	TRS.1.2 TDD			
		1,4	CSI-RS.1.1 FDD			

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
CSI-RS configuration for CSI reporting		2,5	CSI-RS.1.1 TDD			
		3,6	CSI-RS.2.1 TDD			
reportConfigType		1,2,3,4,5,6	periodic			
reportQuantity		1,2,3,4,5,6	cri-RI-PMI-CQI			
CSI reporting periodicity	slot	1,2,4,5	5			
		3,6	10			
CSI reporting offset	slot	1,2,4,5	2			
		3,6	4			
EPRE ratio of PSS to SSS	dB	1,2,3,4,5,6	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	N/A	-85		
N_{oc} Note2	dBm/SCS	1,2,4,5	N/A	-85		
		3,6	N/A	-82		
$\hat{E}_s / I_{ot}$		1,2,3,4,5,6	-infinity	0		
$\hat{E}_s / N_{oc}$		1,2,3,4,5,6	-infinity	0		
SS-RSRP Note3	dBm/SCS	1,2,4,5	-infinity	-85		
		3,6	-infinity	-82		
Io Note3	dBm/9.36 MHz	1,2,4,5	N/A	-57		
	dBm/38.1 MHz	3,6	N/A	-51		
Propagation condition		1,2,3,4,5,6	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.5.10.1.3 Test Requirements

T_{RRC_delay} + T_{Event_DU} occurs during T1 as the addition condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure}$ + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ} + T_{PSCell_DU} + 2 ms = 920+10+20+20+20+2 ms=992 ms from the start of T2.

The UE shall transmit at least one periodic CSI report for PSCell during T3.

The UE shall stop transmitting CSI reports for PSCell at latest 20 ms into T4.
All of the above test requirements shall be fulfilled in order for the observed conditional PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.11 PSCell addition and release delay

A.6.5.11.1 Addition and Release Delay of unknown NR FR1 PSCell

A.6.5.11.1.1 Test purpose and environment

The purpose of this test is to verify that the NR PSCell addition and release delay requirements under NR-DC defined in clauses 8.9.2 and 8.9.3 respectively, for the case where the PSCell is unknown to the UE at the time of addition.

The supported test configurations are shown in table A.6.5.11.1.1-1. The test scenario comprises two NR cells, Cell 1 and Cell 2, on radio channel 1 and radio channel 2 in FR1, respectively. Test parameters are given in Tables A.6.5.11.1.1-2 and A.6.5.11.1.1-3 below. The test consists of six successive time periods with duration of T1, T2, T3 and T4 respectively. Cell 1 is the NR PCell, Cell 2 is an NR neighbour cell. The Cell 1 once set up is not changed across time.

At the start of T1, the UE shall be connected to Cell 1 (PCell) on radio channel 1 (PCC) and shall only monitor PCC and hence be unaware of Cell 2 (PSCell-to-be) on radio channel 2. the UE does not have any timing information of Cell 2. At the end of T1, the test system shall send a RRC message instructing the UE to add PSCell (Cell 2), and further instructing the UE to report CSI periodically in the PSCell once it has been added. Reception by the UE of this RRC message defines the start of T2.

During T2, the UE shall identify PSCell (Cell 2) and carry out random access towards the PSCell (Cell 2). Reception by the test system of the PRACH preamble defines the start of T3.

During T3, the UE shall send periodic CSI reports in PSCell (Cell 2). After having received at least one such report, the test system shall send a RRC message instructing the UE to release the PSCell (Cell 2). Reception by the UE of the RRC message defines the start of T4.

During T4, the UE shall release the PSCell (Cell 2).

Table A.6.5.11.1.1-1: Supported test configurations for FR1 PSCell Addition and Release

Configuration	Description
1	NR SCS 15 kHz, BW 10 MHz, FDD
2	NR SCS 15 kHz, BW 10 MHz, TDD
3	NR SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.11.1.1-2: General Test Parameters for FR1 PSCell Addition and Release

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two NR FR1 radio channels are used in this test.
Initial Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell 2	Neighbour cell on RF channel number 2.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour Cell		Cell 2	PSCell released on RF channel number 2.
DRX			OFF	Continuous monitoring of primary cell
PRACH configuration on Cell 2			FR1 PRACH configuration 1	Captured in clause A.3.8.2.1
CSI reporting periodicity and offset configuration for Cell 2		ms	2	
T1		s	5	During this time the PCell shall be known and Cell 2 shall be unknown.
T2		s	0.5	During this time the UE adds the PSCell.
T3		s	0.5	During this time the UE sends CSI reports for PSCell.
T4		s	0.5	During this time the UE releases the PSCell.

Table A.6.5.11.1.1-3: Cell Specific Parameters for FR1 PSCell Addition and Release

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
Frequency Range		1,2,3	FR1				
Duplex mode		1	FDD				
		2,3	TDD				
TDD configuration		1	Not Applicable				
		2	TDDConf.1.1				
		3	TDDConf.2.1				
$BW_{channel}$	MHz	1,2	10: $N_{PRB,c}$ = 52				
		3	40: $N_{PRB,c}$ = 106				
Data PRBs allocated		1,2	52				
		3	106				
Initial Downlink BWP configuration		1,2,3	DLBWP.0.1				
Initial Uplink BWP configuration		1,2,3	ULBWP.0.1				
Dedicated Downlink BWP configuration		1,2,3	DLBWP.1.1				
Dedicated Uplink BWP configuration		1,2,3	ULBWP.1.1				
PDSCH Reference Measurement Channel		1	SR.1.1 FDD				
		2	SR.1.1 TDD				
		3	SR.2.1 TDD				
RMSI CORESET parameters		1	CR.1.1 FDD				
		2	CR.1.1 TDD				
		3	CR.2.1 TDD				
Dedicated CORESET parameters		1	CCR.1.1 FDD				
		2	CCR.1.1 TDD				
		3	CCR.2.1 TDD				
OCNG Patterns[Note1]		1,2,3	OP.1				
PDSCH/PDCCH subcarrier spacing	kHz	1,2	15				
		3	30				
SSB configuration		1,2	SSB.1 FR1				
		3	SSB.2 FR1				
SMTC configuration		1,2,3	SMTC.1				
TRS Configuration		1	TRS.1.1 FDD				
		2	TRS.1.1 TDD				
		3	TRS.1.2 TDD				
CSI-RS configuration for CSI reporting		1	CSI-RS.1.1 FDD				
		2	CSI-RS.1.1 TDD				
		3	CSI-RS.2.1 TDD				
reportConfigType		1,2,3	periodic				
reportQuantity		1,2,3	cri-RI-PMI-CQI				
CSI reporting periodicity	slot	1,2	5				
		3	10				
CSI reporting offset	slot	1,2	2				
		3	4				
EPRE ratio of PSS to SSS	dB	1,2,3	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS							
EPRE ratio of OCNG to OCNG DMRS							
N_{oc} [Note2]	dBm/15 kHz	1,2,3	-100	N/A		-85	
N_{oc} [Note2]	dBm/SCS	1,2	-100	N/A		-85	
		3	-97	N/A		-82	
$\hat{E}_s / I_{ot}$		1,2,3	12	-infinity		0	
$\hat{E}_s / N_{oc}$		1,2,3	12	-infinity		0	
SS-RSRP[Note3]	dBm/SCS	1,2	-88	-infinity		-85	
		3	-85	-infinity		-82	
Io[Note3]	dBm/9.36 MHz	1,2	-59.78	N/A		-57	

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
	dBm/38.1 MHz	3	-53.68	N/A	-51		
Propagation Condition		1,2,3	AWGN				
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							

A.6.5.11.1.2 Test Requirements

The UE shall transmit the PRACH preamble to PSCell no later than 172 ms[Note1] from the start of T2.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T3.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T3.

The UE shall stop sending CSI reports for PSCell no later than 20 ms from the start of T4.

All the above test requirements shall be fulfilled in order for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90 %.

Note1: The PSCell addition delay can be expressed as follows as specified in clause 8.9.2:

$T_{config_PSCell} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell_DU} + 2$ ms

Where:

$T_{RRC_delay} = 50$ ms

$T_{processing} = 20$ ms

$T_{search} = 60$ ms

$T_{\Delta} = 20$ ms

$T_{PSCell_DU} = 1*10+10 = 20$ ms

A.6.5.11.2 Addition and Release Delay of unknown NR FR1 PSCell with less than 5 MHz

A.6.5.11.2.1 Test purpose and environment

The purpose of this test is to verify that the NR PSCell addition and release delay under NR-DC with a bandwidth of less than 5 MHz meets the requirements defined in Clauses 8.9.2 and 8.9.3, where the PSCell is unknown to the UE at the time of addition.

Supported test configurations are shown in Table A.6.5.11.2.1-1. The test scenario comprises two NR cells, Cell 1 and Cell 2, on radio channel 1 and radio channel 2 in FR1, respectively. Test parameters are given in Table A.6.5.11.1.1-2. The cell-specific parameters as specified in Table A.6.5.11.1.1-3 with config 1 apply except those specified in Table A.6.5.11.2.1-2 .

The test procedure specified in A.6.5.11.1 applies to this test.

Table A.6.5.11.2.1-1: Supported test configurations for FR1 PSCell Addition and Release with less than 5 MHz

Configuration	Description
1	NR SCS 15 kHz, BW 3 MHz (12 PRB), FDD

Table A.6.5.11.2.1-2: Cell Specific Parameters for FR1 PSCell Addition and Release with less than 5 MHz

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
$BW_{channel}$	MHz	1		3: $N_{PRB,c}$ = 12			
Data PRBs allocated		1		12			
PDSCH Reference Measurement Channel		1		SR.1.3 FDD			
RMSI CORESET parameters		1		CR.1.2 FDD			
Dedicated CORESET parameters		1		CCR.1.6 FDD			
PDSCH/PDCCH subcarrier spacing	kHz	1		15			
SSB configuration		1		SSB.13 FR1			
Io[Note]	dBm/2.7MHz	1		N/A	–63.4 dBm		
NOTE : Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							

A.6.5.11.2.2 Test Requirements

The UE shall transmit the PRACH preamble to PSCell no later than 212ms[Note1] with 12 PRB SSB bandwidth from the start of T2.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T3.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T3.

The UE shall stop sending CSI reports for PSCell no later than 20 ms from the start of T4.

All the above test requirements shall be fulfilled in order for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90 %.

Note1: The PSCell addition delay can be expressed as follows as specified in clause 8.9.2:

$T_{config_PSCell} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell_DU}$ + 2 ms with 12 PRB SSB bandwidth.

Where:

T_{RRC_delay} = 50 ms

$T_{processing}$ = 20 ms

T_{search} = 60 ms

T_{Δ} = 60 ms

T_{PSCell_DU} = 1*10+10 = 20 ms

A.6.5.12 Subsequent conditional PSCell addition/change

A.6.5.12.1 Intra-frequency subsequent CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC

A.6.5.12.1.1 Test purpose and environment

The purpose of this test is to verify that the subsequent conditional NR PSCell change under NR-DC is within the requirements stated in clause 8.11E.2.

For UE supporting subsequent conditional PSCell addition/change, UE only needs to pass either intra-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC defined in clause A.6.5.12.1 or intra-frequency CPC from FR1-FR2 NR-DC to FR1-FR2 NR-DC defined in clause A.7.5.18.1.

For UE which can pass this test, test of conditional PSCell addition and release delay defined in clauseA.6.5.10 can be skipped.

A.6.5.12.1.2 Test Parameters

Supported test configurations are shown in table A.6.5.12.1.2-1. The test scenario comprises three NR cells, Cell 1, Cell 2 and Cell 3. Cell1 is on radio channel 1 in FR1. Cell 2 and 3 are on radio channel 2 in FR1. Test parameters are given in Tables A.6.5.12.1.2-2 and A.6.5.12.1.2-3 below.

The test consists of three successive time periods with duration of T1, T2, and T3 respectively. Before the test starts the UE is connected to Cell 1 (NR PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell 1 is known to the UE.

At the start of time duration T1, the UE does not have any timing information of Cell 2. The TE shall configure subsequent conditional PSCell addition/change with Cell 2 and Cell 3 as target PSCells during T1, at a time earlier than T_{RRC_delay} before the beginning of T2.

At the start of T2, Cell 2 becomes detectable and meets the PSCell addition condition. UE shall be able to measure and detect that the condition is fulfilled, after which it will transmit the PRACH preamble to Cell 2. Upon PSCell addition complete (UE transmits SN RRCReconfigurationcomplete message), T3 starts.

At the start of T3, Cell 3 becomes detectable and meets the PSCell change condition. UE shall be able to measure and detect that the condition is fulfilled, after which it will transmit the PRACH preamble to Cell 3.

Table A.6.5.12.1.2-1: Supported test configurations for Intra-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode. PSCell: FDD
2	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode. PSCell: FDD
3	PCell: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode. PSCell: FDD
4	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode. PSCell: TDD
5	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode. PSCell: TDD
6	PCell: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode. PSCell: TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.5.12.1.2-2: General Test Parameters for Intra-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for PCell and second for NR PSCell
Initial	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell2, Cell 3	Neighbour cells on RF channel number 2.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	active PSCell		Cell 3	PSCell on RF channel number 2.
A4	Hysteresis	dB	0	Used to trigger conditional PSCell addition of Cell 2
	Threshold RSRP	dBm	-118	
	Time to Trigger	s	0	
A3		dB	0	Used to trigger conditional PSCell change from Cell 2 to Cell 3
DRX			OFF	Continuous monitoring of primary cell
Measurement gap pattern Id			0	Gaps are configured during T1, T2 and released upon T3 starts.

PRACH configuration on cell2 and cell3		FR1 PRACH configuration 1	Captured in clause A.3.8.2.1
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on carrier frequency of cell2.
T1	s	1	During this time the PCell is known and Cell 2 is unknown.
T2	s	≤5	During this time Cell 2 meets the PSCell addition condition and UE adds this PSCell.
T3	s	≤5	During this time Cell 3 meets the PSCell change condition and UE sends PRACH to Cell 3.

Table A.6.5.12.1.2-3: Cell Specific Parameters for Intra-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Parameter	Unit	Config	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number		1,2,3,4,5,6	1			1		
NR RF Channel Number		1,2,3,4,5,6	1			1		
TDD configuration		1,4	Not Applicable			Not Applicable		
		2,5	TDDConf.1.1			TDDConf.1.1		
		3,6	TDDConf.2.1			TDDConf.2.1		
$BW_{channel}$	MHz	1,4	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52		
		2,5	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52		
		3,6	40: $N_{PRB,c}$ = 106			40: $N_{PRB,c}$ = 106		
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1			DLBWP.0.1 ULBWP.0.1		
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1			DLBWP.1.1 ULBWP.1.1		
PDSCH Reference measurement channel		1,4	SR.1.1 FDD			SR.1.1 FDD		
		2,5	SR.1.1 TDD			SR.1.1 TDD		
		3,6	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET Reference Channel		1,4	CR.1.1 FDD			CR.1.1 FDD		
		2,5	CR.1.1 TDD			CR.1.1 TDD		
		3,6	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET Reference Channel		1,4	CCR.1.1 FDD			CCR.1.1 FDD		
		2,5	CCR.1.1 TDD			CCR.1.1 TDD		
		3,6	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Patterns		1,2,3,4,5,6	OP.1			OP.1		
SSB configuration		1,2,4,5	SSB.1 FR1			SSB.1 FR1		
		3,6	SSB.2 FR1			SSB.2 FR1		
SMTC configuration		1,2,4,5	SMTC.1			SMTC.1		
		3,6	SMTC.1			SMTC.1		
TRS Configuration		1,4	TRS.1.1 FDD			TRS.1.1 FDD		
		2,5	TRS.1.1 TDD			TRS.1.1 TDD		
		3,6	TRS.1.2 TDD			TRS.1.2 TDD		
CSI-RS configuration for CSI reporting		1,4	CSI-RS.1.1 FDD			CSI-RS.1.1 FDD		
		2,5	CSI-RS.1.1 TDD			CSI-RS.1.1 TDD		
		3,6	CSI-RS.2.1 TDD			CSI-RS.2.1 TDD		
reportConfigType		1,2,3,4,5,6	Periodic			periodic		
reportQuantity		1,2,3,4,5,6	cri-RI-PMI-CQI			cri-RI-PMI-CQI		
CSI reporting periodicity	slot	1,2,4,5	5			5		
		3,6	10			10		
CSI reporting offset	slot	1,2,4,5	2			2		
		3,6	4			4		
EPRE ratio of PSS to SSS								
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								

Parameter	Unit	Config	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS	dB	1,2,3,4,5,6	0			0		
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	-98					
N_{oc} Note2	dBm/SCS	1,2,4,5	-98					
		3,6	-95					
$\hat{E}_s/I_{ot}$		1,2,3,4,5,6	-infinity	8	-3.3	-infinity	-infinity	2.36
$\hat{E}_s/N_{oc}$		1,2,3,4,5,6	-infinity	8	8	-infinity	-infinity	11
SS-RSRP Note3	dBm/SCS	1,2,4,5	-infinity	-90	-90	-infinity	-infinity	-87
		3,6	-infinity	-87	-87	-infinity	-infinity	-84
Io Note3	dBm/9.36 MHz	1,2,4,5	-70.05	-61.41	-57.06	-70.05	-61.41	-57.06
	dBm/38.1 MHz	3,6	-63.94	-55.31	-50.96	-63.94	-55.31	-50.96
Propagation condition		1,2,3,4,5,6	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.5.12.1.3 Test Requirements

T_{RRC_delay} + T_{Event_DU} for PSCell addition (Cell 2) occurs during T1 as the addition condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure}$ + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ} + T_{PSCell_DU} + 2 ms = 920+10+62 ms=992 ms from the start of T2.

The UE shall start to transmit the PRACH to Cell 3 less than T_{Event_DU} + $T_{measure}$ + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ} + T_{PSCell_DU} + 2 ms = 0+920+10+62 ms=992 ms from the start of T3.
All of the above test requirements shall be fulfilled in order for the observed conditional PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.12.2 Inter-frequency subsequent CPA from FR1-FR1 NR-DC to FR1-FR1 NR-DC

A.6.5.12.2.1 Test purpose and environment

The purpose of this test is to verify that the subsequent conditional NR PSCell addition under NR-DC is within the requirements stated in clause 8.9C.2.

For UE supporting subsequent conditional PSCell addition/change, UE only needs to pass either inter-frequency CPA from FR1-FR1 NR-DC to FR1-FR1 NR-DC defined in clause A.6.5.12.2 or inter-frequency CPA from FR1-FR2 NR-DC to FR1-FR2 NR-DC defined in clause A.7.5.18.2.

For UE which can pass this test, test of conditional PSCell addition and release delay defined in clause A.6.5.10 can be skipped.

A.6.5.12.2.2 Test Parameters

Supported test configurations are shown in table A.6.5.12.2.2-1. The test scenario comprises three NR cells, Cell 1, Cell 2 and Cell 3. Cell 1 is on radio channel 1 in FR1. Cell 2 is on radio channel 2 in FR1. Cell 3 is on radio channel 3 in FR1.

The test parameters for NR Cell 2 and Cell 3 are given in Tables A.6.5.12.2.2-2 and cell-specific parameters in table A.6.5.12.2.2-3 below.

The test consists of four successive time periods with duration of T1, T2, T3 and T4 respectively. Before the test starts the UE is connected to Cell 1 (NR PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell 1 is known to the UE.

At the start of time duration T1, the UE does not have any timing information of Cell 2. The TE shall configure subsequent conditional PSCell addition with Cell 2 and Cell 3 as target PSCells during T1, at a time earlier than T_{RRC_delay} before the beginning of T2.

At the start of T2, Cell 2 becomes detectable and meets the PSCell addition condition. UE shall be able to measure and detect that the condition is fulfilled, after which it will transmit the PRACH preamble to Cell 2. Upon PSCell addition complete (UE transmits SN *RRCReconfigurationcomplete* message), T3 starts.

At the start of T3, the test system shall send a *RRCRconfiguration* message to the UE to release PSCell (Cell 2) on radio channel 2. Upon PSCell release complete (UE transmits SN *RRCReconfigurationcomplete* message), T4 starts.

At the start of T4, Cell 3 becomes detectable and meets the subsequent PSCell addition condition. UE shall be able to measure and detect that the condition is fulfilled during time $T_{measure}$, after which it will transmit the PRACH preamble to Cell 3.

Table A.6.5.12.2.2-1: Supported test configurations for Inter-frequency Subsequent CPA from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode. PSCell: FDD
2	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode. PSCell: FDD
3	PCell: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode. PSCell: FDD
4	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode. PSCell: TDD
5	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode. PSCell: TDD
6	PCell: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode. PSCell: TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.12.2.2-2: General Test Parameters for Subsequent Conditional PSCell Addition and Release

Parameter		Unit	Value	Comment
RF Channel Number			1, 2, 3	Three radio channels are used for NR Cells for this test.
Initial	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell 2	Neighbour cell on RF channel number 2.
			Cell 3	Neighbour cell on RF channel number 3.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Active PSCell		Cell 3	PSCell on RF channel number 3
	Neighbour Cell		Cell 2	Neighbour cell on RF channel number 2
A4	Hysteresis	dB	0	Hysteresis for evaluation of event A1.
	Threshold RSRP	dBm	-118	A4 event is used to trigger conditional PSCell addition of Cell 2.
	Time to Trigger	s	0	
DRX			OFF	Continuous monitoring of primary cell
Measurement gap pattern Id			0	Gaps are configured during T1, T2, T3 and T4.
PRACH configuration on cell2			FR1 PRACH configuration 1	Captured in clause A.3.8.2.1
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.

Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on carrier frequency of Cell 2.
Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for cells on carrier frequency of Cell 3.
T1	s	1	During this time the PCell is known, PSCell 1 and PSCell 2 are unknown.
T2	s	≤7	During this time PSCell 1 meets the PSCell addition condition and UE adds this PSCell.
T3	s	≤1	During this time the UE releases the PSCell 1.
T4	s	≤7	During this time PSCell 2 meets the addition condition and UE adds this PSCell.

Table A.6.5.12.2.2-3: Cell Specific Parameters for Subsequent Conditional PSCell Addition and Release

Parameter	Unit	Config	Cell 2				Cell 3			
			T1	T2	T3	T4	T1	T2	T3	T4
NR RF Channel Number		1,2,3,4,5,6	2				3			
TDD configuration		1,4	Not Applicable				Not Applicable			
		2,5	TDDConf.1.1				TDDConf.1.1			
		3,6	TDDConf.2.1				TDDConf.2.1			
$BW_{channel}$	MHz	1,4	10: $N_{PRB,c}$ = 52				10: $N_{PRB,c}$ = 52			
		2,5	10: $N_{PRB,c}$ = 52				10: $N_{PRB,c}$ = 52			
		3,6	40: $N_{PRB,c}$ = 106				40: $N_{PRB,c}$ = 106			
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1				DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1				DLBWP.1.1 ULBWP.1.1			
PDSCH Reference measurement channel		1,4	SR.1.1 FDD				SR.1.1 FDD			
		2,5	SR.1.1 TDD				SR.1.1 TDD			
		3,6	SR.2.1 TDD				SR.2.1 TDD			
RMSI CORESET Reference Channel		1,4	CR.1.1 FDD				CR.1.1 FDD			
		2,5	CR.1.1 TDD				CR.1.1 TDD			
		3,6	CR.2.1 TDD				CR.2.1 TDD			
Dedicated CORESET Reference Channel		1,4	CCR.1.1 FDD				CCR.1.1 FDD			
		2,5	CCR.1.1 TDD				CCR.1.1 TDD			
		3,6	CCR.2.1 TDD				CCR.2.1 TDD			
OCNG Patterns		1,2,3,4,5,6	OP.1				OP.1			
SSB configuration		1,2,4,5	SSB.1 FR1				SSB.1 FR1			
		3,6	SSB.2 FR1				SSB.2 FR1			
SMTC configuration		1,2,4,5	SMTC.1				SMTC.1			
		3,6	SMTC.1				SMTC.1			
TRS Configuration		1,4	TRS.1.1 FDD				TRS.1.1 FDD			
		2,5	TRS.1.1 TDD				TRS.1.1 TDD			
		3,6	TRS.1.2 TDD				TRS.1.2 TDD			
CSI-RS configuration for CSI reporting		1,4	CSI-RS.1.1 FDD				CSI-RS.1.1 FDD			
		2,5	CSI-RS.1.1 TDD				CSI-RS.1.1 TDD			
		3,6	CSI-RS.2.1 TDD				CSI-RS.2.1 TDD			
reportConfigType		1,2,3,4,5,6	Periodic				periodic			
reportQuantity		1,2,3,4,5,6	cri-RI-PMI-CQI				cri-RI-PMI-CQI			
CSI reporting periodicity	slot	1,2,4,5	5				5			
		3,6	10				10			
CSI reporting offset	slot	1,2,4,5	2				2			
		3,6	4				4			
EPRE ratio of PSS to SSS										
EPRE ratio of PBCH DMRS to SSS										
EPRE ratio of PBCH to PBCH DMRS										
EPRE ratio of PDCCH DMRS to SSS										

Parameter	Unit	Config	Cell 2				Cell 3			
			T1	T2	T3	T4	T1	T2	T3	T4
EPRE ratio of PDCCH to PDCCH DMRS	dB	1,2,3,4,5,6	0				0			
EPRE ratio of PDSCH DMRS to SSS										
EPRE ratio of PDSCH to PDSCH DMRS										
EPRE ratio of OCNG DMRS to SSS(Note 1)										
EPRE ratio of OCNG to OCNG DMRS (Note 1)										
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	-85							
N_{oc} Note2	dBm/SCS	1,2,4,5	-85							
		3,6	-82							
$\hat{E}_s/I_{ot}$		1,2,3,4,5,6	-infinity	0	-infinity	-infinity	-infinity	-infinity	-infinity	0
$\hat{E}_s/N_{oc}$		1,2,3,4,5,6	-infinity	0	-infinity	-infinity	-infinity	-infinity	-infinity	0
SS-RSRP Note3	dBm/SCS	1,2,4,5	-infinity	-85	-infinity	-infinity	-infinity	-infinity	-infinity	-85
		3,6	-infinity	-82	-infinity	-infinity	-infinity	-infinity	-infinity	-82
Io Note3	dBm/9.36 MHz	1,2,4,5	-57	-54	-57	-57	-57	-57	-57	-54
	dBm/38.1 MHz	3,6	-57	-48	-57	-57	-57	-57	-57	-48
Propagation condition		1,2,3,4,5,6	AWGN				AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.5.12.2.3 Test Requirements

T_{RRC_delay} + T_{Event_DU} for PSCell addition (Cell 2) occurs during T1 as the addition condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure}$ + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ} + T_{PSCell_DU} + 2 ms = 1040+10+62 ms=1112 ms from the start of T2.

The UE shall start to transmit the PRACH to Cell 3 less than T_{Event_DU} + $T_{measure}$ + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ} + T_{PSCell_DU} + 2 ms = 0+1040+10+62 ms=1112 ms from the start of T4.

All of the above test requirements shall be fulfilled in order for the observed conditional PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.12.3 Intra-frequency subsequent CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC with 12 PRB SSB bandwidth

A.6.5.12.3.1 Test purpose and environment

The purpose of this test is to verify that the subsequent conditional NR PSCell change with 12 PRB SSB bandwidth under NR-DC is within the requirements stated in clause 8.11E.2.

For UE supporting subsequent conditional PSCell addition/change, UE only needs to pass one of addition and release delay of PSCell with 12 PRB SSB bandwidth defined in clause A.6.5.11.2 and intra-frequency subsequent CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC with 12 PRB SSB bandwidth defined in clause A.6.5.12.3 and inter-frequency subsequent CPA from FR1-FR1 NR-DC to FR1-FR1 NR-DC with 12 PRB SSB bandwidth defined in clause A.6.5.12.4 and handover with PSCell delay defined in clause A.6.3.1.19.

A.6.5.12.3.2 Test Parameters

Supported test configurations are shown in table A.6.5.12.3.2-1. The test scenario comprises three NR cells, Cell 1, Cell 2 and Cell 3. Cell1 is on radio channel 1 in FR1. Cell 2 and 3 are on radio channel 2 in FR1. General test parameters as specified in table A.6.5.12.1.2-2 with config 1 apply except those specified in table A.6.5.12.3.2-2. Cell specific test parameters as specified in table A.6.5.12.1.2-3 with config 1 apply except those specified in table A.6.5.12.3.2-3.

The test procedure specified in clause A.6.5.12.1.2 applies to this test. The Cell 3 is the target cell operating with 12 PRB SSB bandwidth.

Table A.6.5.12.3.2-1: Supported test configurations for Intra-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode. PSCell: 15 kHz SSB SCS, 3 MHz bandwidth, FDD duplex mode.

Table A.6.5.12.3.2-2: General Test Parameters for Intra-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Parameter		Unit	Value	Comment
Initial	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell2, Cell 3	Neighbour cells with 12 PRB SSB bandwidth on RF channel number 2.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	active PSCell		Cell 3	PSCell with 12 PRB SSB bandwidth on RF channel number 2.
	Neighbour cell		Cell2	Neighbour cell with 12 PRB SSB bandwidth on RF channel number 2.

Table A.6.5.12.3.2-3: Cell Specific Parameters for Intra-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Parameter	Unit	Test configuration	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Duplex mode		Config 1	FDD					
$BW_{channel}$	MHz	Config 1	3: $N_{PRB,c}$ = 15					
BWP BW	MHz	Config 1	3: $N_{PRB,c}$ = 15					
PDSCH Reference measurement channel		Config 1	SR.1.2 FDD					
RMSI CORESET Reference Channel		Config 1	CR.1.2 FDD					
Dedicated CORESET Reference Channel		Config 1	CCR.1.6 FDD					
SSB parameters		Config 1	SSB.13 FR1					
Io^{Note1}	dBm/3 MHz	Config 1	-75.45	-66.81	-62.46	-75.45	-66.81	-62.46

Propagation Condition		Config 1	AWGN	AWGN
NOTE 1: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.5.12.3.3 Test Requirements

T_{RRC_delay} + T_{Event_DU} for PSCell addition (Cell 2) occurs during T1 as the addition condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure}$ + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ} + T_{PSCell_DU} + 2 ms = 920+10+102 ms=1032 ms from the start of T2.

The UE shall start to transmit the PRACH to Cell 3 less than T_{Event_DU} + $T_{measure}$ + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ} + T_{PSCell_DU} + 2 ms = 0+920+10+102 ms=1032 ms from the start of T3.
All of the above test requirements shall be fulfilled in order for the observed conditional PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.12.4 Inter-frequency subsequent CPA from FR1-FR1 NR-DC to FR1-FR1 NR-DC with 12 PRB SSB bandwidth

A.6.5.12.4.1 Test purpose and environment

The purpose of this test is to verify that the subsequent conditional NR PSCell addition with 12 PRB SSB bandwidth under NR-DC is within the requirements stated in clause 8.9C.2.

For UE supporting subsequent conditional PSCell addition/change, UE only needs to pass one of addition and release delay of PSCell with 12 PRB SSB bandwidth defined in clause A.6.5.11.2 and intra-frequency subsequent CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC with 12 PRB SSB bandwidth in clause A.6.5.12.3 and inter-frequency subsequent CPA from FR1-FR1 NR-DC to FR1-FR1 NR-DC with 12 PRB SSB bandwidth defined in clause A.6.5.12.4 and handover with PSCell delay defined in clause A.6.3.1.19.

A.6.5.12.4.2 Test Parameters

Supported test configurations are shown in table A.6.5.12.4.2-1. The test scenario comprises three NR cells, Cell 1, Cell 2 and Cell 3. Cell 1 is on radio channel 1 in FR1. Cell 2 is on radio channel 2 in FR1. Cell 3 is on radio channel 3 in FR1.

General test parameters as specified in table A.6.5.12.2.2-2 with config 1 apply except those specified in table A.6.5.12.4.2-2. Cell specific test parameters as specified in table A.6.5.12.2.2-3 with config 1 apply except those specified in table A.6.5.12.4.2-3.

The test procedure specified in clause A.6.5.12.2.2 applies to this test. The Cell 3 is the target cell operating with 12 PRB SSB bandwidth.

Table A.6.5.12.4.2-1: Supported test configurations for Inter-frequency Subsequent CPA from FR1-FR1 NR-DC to FR1-FR1 NR-DC

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode. PSCell: 15 kHz SSB SCS, 3 MHz bandwidth, FDD duplex mode.

Table A.6.5.12.4.2-2: General Test Parameters for Subsequent Conditional PSCell Addition and Release

Parameter		Unit	Value	Comment
Initial	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell2	Neighbour cell with 12 PRB SSB bandwidth on RF channel number 2.
			Cell 3	Neighbour cell with 12 PRB SSB bandwidth on RF channel number 3.
Final	Active PCell		Cell 1	PCell on RF channel number 1.

Condition	active PSCell		Cell 3	PSCell with 12 PRB SSB bandwidth on RF channel number 3.
	Neighbour Cell		Cell 2	Neighbour cell with 12 PRB SSB bandwidth on RF channel number 2

Table A.6.5.12.4.2-3: Cell Specific Parameters for Subsequent Conditional PSCell Addition and Release

Parameter	Unit	Test configuration	Cell 2				Cell 3			
			T1	T2	T3	T4	T1	T2	T3	T4
Duplex mode		Config 1	FDD							
$BW_{channel}$	MHz	Config 1	3: $N_{PRB,c}$ = 15							
BWP BW	MHz	Config 1	3: $N_{PRB,c}$ = 15							
PDSCH Reference measurement channel		Config 1	SR.1.2 FDD							
RMSI CORESET Reference Channel		Config 1	CR.1.2 FDD							
Dedicated CORESET Reference Channel		Config 1	CCR.1.6 FDD							
SSB parameters		Config 1	SSB.13 FR1							
Io^{Note1}	dBm/3 MHz	Config 1	-62.4	-59.4	-62.4	-62.4	-62.4	-62.4	-62.4	-59.4
Propagation Condition		Config 1	AWGN				AWGN			
NOTE 1: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.										

A.6.5.12.4.3 Test Requirements

T_{RRC_delay} + T_{Event_DU} for PSCell addition (Cell 2) occurs during T1 as the addition condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure}$ + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ} + T_{PSCell_DU} + 2 ms = 1040+10+102 ms=1152 ms from the start of T2.

The UE shall start to transmit the PRACH to Cell 3 less than T_{Event_DU} + $T_{measure}$ + $T_{UE_preparation}$ + $T_{processing}$ + T_{Δ} + T_{PSCell_DU} + 2 ms = 0+1040+10+102 ms=1152 ms from the start of T4.

All of the above test requirements shall be fulfilled in order for the observed conditional PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.5.13 Active TCI state switch delay

A.6.5.13.1 MAC-CE based joint TCI state switch for mDCI with two TA when RTD is larger than CP

A.6.5.13.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.22.3. Supported test configuration is shown in table A.6.5.13.1.1-1.

The test scenario comprises of one NR PCell (Cell 1) containing two TRPs (i.e., TRP 0 and TRP 1) belonging to two TAGs as given in table A.6.5.13.1.1-2. Cell-specific parameters of NR PCell are specified in table A.6.5.13.1.1-3 below.

PDCCHs associated with corsetPoolIndex 0 and 1 indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending on PUCCH associated with TRP 0.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is configured with 1 TCI stats associated with coresetPoolIndex 0 for PCell, PDCCH TCI state 0 (QCL'd to SSB0), in Cell 1 before starting the test. UE is configured with 2 TCI states associated with coresetPoolIndex 1 for PCell, PDCCH TCI state 0 (QCL'd to SSB2) and TCIstate 1 (QCL'd to SSB3),.
- UE is indicated in TCI state 0 as the active PDCCH TCI state for PDCCH associated with coresetPoolIndex 0, and UE is indicated in TCI state 0 as the active PDCCH TCI state for PDCCH associated with coresetPoolIndex 1.
- Target TCI state is not in the active TCI state list.

The test consists of two time periods, T1 and T2. During T1 only SSB0 and SSB2 are transmitted. At the beginning of T2, the SSB3 corresponding to TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB2 and SSB3, UE receives a MAC-CE command indicating a switch to TCI state 1 for PDCCH associated with coresetPoolIndex 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies that UE can be scheduled on PCell on TCI state 0 associated with coresetPoolIndex 1 till n+ T_{HARQ} +3 ms. The test equipment also verifies the TCI state switch time in PCell by scheduling the UE on TCI state 1 associated with coresetPoolIndex 1 after n+ T_{HARQ} +3 ms + ($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$).

Table A.6.5.13.1.1-1: Supported test configurations

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.13.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
Timing offset between SSB 0 and SSB1	μs	25	
Timing offset between SSB0 and SSB2	μs	33	
DRX		OFF	
T1	s	0.2	
T2	s	0.2	

Table A.6.5.13.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.1.2
$BW_{channel}$	Config 1,2		10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1

Parameter		Unit	Cell 1
PDSCH Reference measurement channel Note 4	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.2 FDD
	Config 2		CCR.1.2 TDD
	Config 3		CCR.2.4 TDD
TRS Configuration for TRP 0	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
TRS Configuration for TRP 1 Set 1	Config 1		TRS.1.5 FDD
	Config 2		TRS.1.5 TDD
	Config 3		TRS.1.7 TDD
TRS Configuration for TRP 1 Set 2	Config 1		TRS.1.6 FDD
	Config 2		TRS.1.6 TDD
	Config 3		TRS.1.8 TDD
OCNG Patterns	Config 1,2		OP.1
	Config 3		OP.1
SSB Configuration for TRP 0	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SSB Configuration for TRP 1	Config 1,2		SSB.7 FR1
	Config 3		SSB.8 FR1
TCI state 0 associated with coresetPoolIndex 0			DLorJoint TCI.State.0
TCI state 0 associated with coresetPoolIndex 1			DLorJoint TCI.State.1.1
TCI state 1 associated with coresetPoolIndex 1			DLorJoint TCI.State.1.2
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1,2	dBm/SCS	-104
	Config 3		-101
N_{oc} Note 2		dBm/15kHz	-104
SS-RSRP Note 3	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: PDSCH RMC for TRP0 and TRP1 are scheduled in non-overlapping PRBs

A.6.5.13.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall be able to continue receive on TRP 0, and for TRP 1, UE shall:

- be able to continue to receive on TCI state 0 till n+ T_{HARQ} +3 ms
- be able to start receiving on TCI state 1 after n+ T_{HARQ} +5 ms + $T_{first-SSB}$

The rate of correct events observed during repeated tests shall be at least 90 %.

A.6.6 Measurement procedure

A.6.6.1 Intra-frequency Measurements

A.6.6.1.1 SA event triggered reporting tests without gap under non-DRX

A.6.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2.5.1 and 9.2.5.2.

A.6.6.1.1.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.6.6.1.1.1-1 and A.6.6.1.1.1-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.6.6.1.1.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.1.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	

Table A.6.6.1.1.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.2 SA event triggered reporting tests without gap under DRX

A.6.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2.5.1 and 9.2.5.2.

A.6.6.1.2.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.6.6.1.2.2-1, A.6.6.1.2.2-2 and A.6.6.1.2.2-3 below. In the measurement controlinformation, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.1.2.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.2.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2, 3	Cell 1		
Neighbour cell		1, 2, 3	Cell 2		Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2		
SSB configuration		1	SSB.1 FR1		
		2	SSB.1 FR1		
		3	SSB.2 FR1		
SMTC configuration		1	SMTC.2		
		2	SMTC.1		
		3	SMTC.1		
A3-Offset	dB	1, 2, 3	-4.5		
CP length		1, 2, 3	Normal		
Hysteresis	dB	1, 2, 3	0		
Time To Trigger	s	1, 2, 3	0		
Filter coefficient		1, 2, 3	0		L3 filtering is not used
DRX		1, 2, 3	DRX.1	DRX. 7	

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Time offset between serving and neighbour cells		1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 μs		Synchronous cells
		3	3 μs		Synchronous cells
T1	s	1, 2, 3	5		
T2	s	1, 2, 3	5	10	

Table A.6.6.1.2.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s / I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s / N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1, 2, 3	AWGN			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.1.2.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 6400 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.3 SA event triggered reporting tests with per-UE gaps under non-DRX

A.6.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.6.6.1.3.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.6.6.1.3.1-1 and A.6.6.1.3.1-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.6.6.1.3.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.3.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	

Parameter	Unit	Test configuration	Value	Comment
Measurement gap type		1, 2, 3	Per-UE gaps	
Measurement gap repitition periodicity	ms	1, 2, 3	40	
Measurement gap length	ms	1, 2, 3	6	
Measurement gap offset	ms	1, 2, 3	39	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CSI-RS parameters		1	CSI-RS.1.2 FDD resource #0	
		2	CSI-RS.1.2 TDD resource #0	
		3	CSI-RS.2.2 TDD resource #0	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX	ms	1, 2, 3		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	

Table A.6.6.1.3.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.2 FDD		N/A	
		2	CCR.1.2 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2, 3	CSI-RS		SSB	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.1.3.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.4 SA event triggered reporting tests with per-UE gaps under DRX

A.6.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.6.6.1.4.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.6.6.1.4.2-1, A.6.6.1.4.2-2 and A.6.6.1.4.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.1.4.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.4.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2, 3	Cell 1		
Neighbour cell		1, 2, 3	Cell 2		Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2		
Measurement gap type		1, 2, 3	Per-UE gaps		
Measurement gap repitition periodicity	ms	1, 2, 3	40		
Measurement gap length	ms	1, 2, 3	6		
Measurement gap offset	ms	1, 2, 3	39		
SSB configuration		1	SSB.1 FR1		
		2	SSB.1 FR1		
		3	SSB.2 FR1		
SMTC configuration		1	SMTC.2		
		2	SMTC.1		
		3	SMTC.1		
CSI-RS parameters		1	CSI-RS.1.2 FDD resource #0		
		2	CSI-RS.1.2 TDD resource #0		
		3	CSI-RS.2.2 TDD resource #0		
A3-Offset	dB	1, 2, 3	-4.5		
CP length		1, 2, 3	Normal		
Hysteresis	dB	1, 2, 3	0		
Time To Trigger	s	1, 2, 3	0		
Filter coefficient		1, 2, 3	0		L3 filtering is not used
DRX		1, 2, 3	DRX.1	DRX. 7	
Time offset between serving and neighbour cells		1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 μs		Synchronous cells
		3	3 μs		Synchronous cells
T1	s	1, 2, 3	5		
T2	s	1, 2, 3	5	10	

Table A.6.6.1.4.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.2 FDD		N/A	
		2	CCR.1.2 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2, 3	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: Table A.6.6.1.4.2-1The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Table A.6.6.1.4.2-1Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Table A.6.6.1.4.2-1SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.1.4.2-4: Void

Table A.6.6.1.4.2-5: Void

A.6.6.1.4.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 6400 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.5 SA event triggered reporting tests without gap under non-DRX with SSB index reading

A.6.6.1.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.6.6.1.5.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cell are given in table A.6.6.1.5.2-1 and A.6.6.1.5.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.6.6.1.5.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

Table A.6.6.1.5.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	
Neighbour cell		1	Cell 2	Cell to be identified.
RF Channel Number		1	1: Cell 1 and Cell 2	
SSB configuration		1	SSB.1 FR1	
SMTC configuration		1	SMTC.2	
A3-Offset	dB	1	-4.5	
CP length		1	Normal	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX	ms	1		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	1	5	
T2	s	1	5	

Table A.6.6.1.5.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
IInitial BWP configuration		1	DLBWP.0,1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
N_{oc} Note 2	dBm/15 kHz	1	-98			
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.1.5.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.6 SA event triggered reporting tests with per-UE gaps under non-DRX with SSB index reading

A.6.6.1.6.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.6.6.1.6.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cell are given in table A.6.6.1.6.2-1 and A.6.6.1.6.2-2 below. In the measurement control information, a measurement object is configured for the frequency of

the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.6.6.1.6.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

Table A.6.6.1.6.2-2: General test parameters for SA intra-frequency event triggered reporting with gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	
Neighbour cell		1	Cell 2	Cell to be identified.
RF Channel Number		1	1: Cell 1 and Cell 2	
Measurement gap type		1	Per-UE gaps	
Measurement gap repitition periodicity	ms	1	40	
Measurement gap length	ms	1	6	
Measurement gap offset	ms	1	39	
SSB configuration		1	SSB.1 FR1	
SMTC configuration		1	SMTC.2	
CSI-RS parameters		1	CSI-RS.1.2 FDD resource #0	
A3-Offset	dB	1	-4.5	
CP length		1	Normal	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX	ms	1		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	1	5	
T2	s	1	5	

Table A.6.6.1.6.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.2 FDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
IInitial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
N_{oc} Note 2	dBm/15 kHz	1	-98			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.1.6.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.7 SA event triggered reporting tests under DRX for UE configured with highSpeedMeasFlag-r16

A.6.6.1.7.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event for UE configured with highSpeedMeasFlag-r16. This test will partly verify the intra-frequency cell search requirements in clauses 9.2.5.1 and 9.2.5.2.

A.6.6.1.7.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.6.6.1.7.2-1, A.6.6.1.7.2-2 and A.6.6.1.7.2-3 below. In the measurement controlinformation, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.1.7.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.7.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Test configuration	Value	Comment
highSpeedMeasFlag-r16		1,2,3	Present	To enable high speed measurement enhancements
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3	DRX.7	640 ms DRX cycle
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	6	

Table A.6.6.1.7.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2	AWGN		AWGN 1944 Hz Note 4	
		3	AWGN		AWGN 3334 Hz Note 5	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.
NOTE 5: The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334 Hz.

A.6.6.1.7.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 5120 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.8 SA event triggered reporting tests without gap under DRX for UE configured with highSpeedMeasCA-Scell-r17

A.6.6.1.8.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event for UE configured with highSpeedMeasCA-Scell-r17. This test will partly verify the intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.6.6.1.8.2 Test parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1), a FR1 deactivated SCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the SCell (Cell 2). The test parameters for PCell are given in table A.6.6.1.8.21, A.6.6.1.8.2-2 and A.6.6.1.8.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the SCell, and it is indicated to the UE that event-triggered reporting with Event A6 is

used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.1.8.2-1: Supported PCell test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: The UE is only required to be tested in one of the supported test configurations with the smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration.	

Table 6.6.1.8.4.1-1A: Supported SCell test configurations

$Configuration_{SCell}$	Description
1A	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2A	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3A	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: The UE is only required to be tested in one of the supported test configurations with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth (BWchannel) defined in each test configuration. NOTE 3: NR Cell 3 has the same SCS, BW and duplex mode as NR Cell 2.	

Table A.6.6.1.8.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for deactivated SCell in FR1 with DRX highSpeedMeasCA-Scell-r17

Parameter	Unit	Test configuration	Value	Comment
highSpeedMeasCA-Scell-r17		1,2,3	Present	To enable high speed measurement enhancements
Active cell		1, 2, 3	Cell 1	
Deactivated SCell		1A, 2A, 3A	Cell 2	
Neighbour cell		1A, 2A, 3A	Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 2: Cell 2 and 3	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A6-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3	DRX.6	
measCycleSCell		1, 2, 3	640 ms	
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		2	3 μs	Synchronous cells
		3	3 μs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	

Table A.6.6.1.8.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for deactivated SCell in FR1 with DRX highSpeedMeasCA-Scell-r17

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
TDD configuration		1,1A	N/A		N/A		N/A	
		2,2A	TDDConf.1.1		TDDConf.1.1		TDDConf.1.1	
		3,3A	TDDConf.2.1		TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1,1A	SR.1.1 FDD		N/A		N/A	
		2,2A	SR.1.1 TDD					
		3,3A	SR.2.1 TDD					
RMSI CORESET RMC configuration		1,1A	CR.1.1 FDD		N/A		N/A	
		2,2A	CR.1.1 TDD		N/A		N/A	
		3,3A	CR.2.1 TDD		N/A		N/A	
Dedicated CORESET RMC configuration		1,1A	CCR.1.1 FDD		N/A		N/A	
		2,2A	CCR.1.1 TDD		N/A		N/A	
		3,3A	CCR.2.1 TDD		N/A		N/A	
OCNG Patterns		1, 2, 3,1A,2A,3A	OP.1		OP.1		OP.1	
TRS configuration		1,1A	TRS.1.1 FDD		N/A		N/A	
		2,2A	TRS.1.1 TDD		N/A		N/A	
		3,3A	TRS.1.2 TDD		N/A		N/A	
IInitial BWP configuration		1, 2, 3,1A,2A,3A	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3,1A,2A,3A	DLBWP.1.1		DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3,1A,2A,3A	ULBWP.1.1		ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3,1A,2A,3A	SSB		SSB		SSB	
N_{oc} Note 2	dBm/SCS	1,1A	-98					
		2,2A	-98					
		3,3A	-95					
N_{oc} Note 2	dBm/15 kHz	1,1A	-98					
		2,2A						
		3,3A						
$\hat{E}_s/I_{ot}$	dB	1,1A	4	4	4	-1.46	-Infinity	-1.46
		2,2A						
		3,3A						
$\hat{E}_s/N_{oc}$	dB	1,1A	4	4	4	4	-Infinity	4
		2,2A						
		3,3A						
SSB_RP Note 3	dBm/SCS kHz	1,1A	-94	-94	-94	-94	-Infinity	-94
		2,2A	-94	-94	-94	-94	-Infinity	-94
		3,3A	-91	-91	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1,1A	-64.60	-64.60	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2,2A	-64.60	-64.60	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3,3A	-58.50	-58.50	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1,2,1A,2A	AWGN				AWGN 1944 Hz Note 4	
		3,3A	AWGN				AWGN 3334 Hz Note 5	

Parameter	Unit	Test configuration	Cell 1	Cell 2	Cell 3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz. NOTE 5: The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334 Hz.					

A.6.6.1.8.3 Test Requirements

The UE shall send one Event A6 triggered measurement report, with a measurement reporting delay less than 5760 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.9 SA event triggered reporting tests with MUSIM gap configured

A.6.6.1.9.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event on an intra-frequency layer based on measurement performed without measurement gaps when the UE is also configured with MUSIM gaps. This test will partly verify the intra-frequency cell search requirements in clauses 9.2.5.1 and 9.2.5.2.

A.6.6.1.9.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.6.6.1.9.2-1 and A.6.6.1.9.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.6.6.1.9.2.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.9.2.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
MUSIM gap Pattern ID		1,2,3	0	
MUSIM gap offset	ms	1,2,3	0	

Parameter	Unit	Test configuration	Value	Comment
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	

Table A.6.6.1.9.2.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.1.9.3 Test requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.10 SA event triggered reporting tests without gap under non-DRX when CD-SSB is outside active BWP

A.6.6.1.10.1 Test purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* makes correct reporting of an event when CD-SSB is outside active BWP. This test will partly verify the intra-frequency cell search requirements in clauses 9.2.5.1 and 9.2.5.2.

The test environment is the same as in clause A.6.6.1.1 with following exceptions in table Table A.6.6.1.1.2-3.

Table A.6.6.1.1.2-3: Test environment exceptions

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		-	
Active DL BWP configuration		1, 2, 3	DLBWP.1.2		-	
Active UL BWP configuration		1, 2, 3	ULBWP.1.2		-	

A.6.6.1.10.2 Test Requirements

The test requirements are the same as in clause A.6.6.1.1.3.

A.6.6.1.11 SA event triggered reporting tests without gap under non-DRX with NCD-SSB

A.6.6.1.11.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements when NCD-SSB is configured in clauses 9.2.5.1 and 9.2.5.2.

A.6.6.1.11.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.6.6.1.11.1-1 and A.6.6.1.11.1-2 below. The CD-SSB is configured outside active DL BWP and NCD-SSB is configured fully within active DL BWP of FR1 PCell. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.6.6.1.11.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.11.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
CD-SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
NCD-SSB configuration		1	SSB.9 FR1	
		2	SSB.9 FR1	
		3	SSB.10 FR1	
SMTC configuration for NCD-SSB		1	SMTC.11	
		2	SMTC.10	
		3	SMTC.10	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	
NOTE 1: The starting PRB index of the CD-SSB can be any possible PRB index of the RF channel BW occurring after the last PRB of the DL active BWP.				
NOTE 2: The starting PRB index of the NCD-SSB can be the same as the starting PRB index for DL active BWP.				

Table A.6.6.1.11.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2, 3	NCD-SSB		NCD-SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.1.11.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1000 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.12 SA event triggered reporting tests without gap under non-DRX with SSB index reading and 12 PRB SSB

A.6.6.1.12.1 Test purpose and Environment

The purpose of this test is to verify that the UE supporting *support-3MHz-ChannelBW-r18* makes correct reporting of an event when the intra-frequency target cell is transmitting 12 PRB SSB. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2 for 3 MHz Channel Bandwidth configured without SSB time index detection when DRX is not used and with 15 PRB PDCCH configuration.

A.6.6.1.12.2 Test parameters

The test procedure in clause A.6.6.1.5.2 applies for this test. Supported test configurations are specified in table A.6.6.1.12.2-1. General test parameters as specified in table A.6.6.1.5.2-2 with config 1 apply to this test, except those specified in table A.6.6.1.12.2-2. Cell specific test parameters as specified in table A.6.6.1.5.2-3 with config 1 apply to this test, except those specified in table A.6.6.1.12.2-3.

Table A.6.6.1.12.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 3 MHz bandwidth, FDD duplex mode

Table A.6.6.1.12.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
SSB configuration		1	SSB.13 FR1	

Table A.6.6.1.12.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$BW_{channel}$	MHz	1	3: $N_{PRB,c}$ = 15		3: $N_{PRB,c}$ = 15	
PDSCH RMC configuration		1	SR.1.2 FDD		N/A	
RMSI CORESET RMC configuration		1	CR.1.3 FDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.7 FDD		N/A	
Io	dBm/2.7 MHz	1	-70.00	-67.65	-70.00	-67.65

A.6.6.1.12.3 Test Requirements

The test requirements in clause A.6.6.1.5.3 applies to this test, except that the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 940 ms from the beginning of time period T2.

A.6.6.1.13 SA event triggered reporting tests without gap under Cell DTX

A.6.6.1.13.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2.5.1 and 9.2.5.2 under Cell DTX configuration.

A.6.6.1.13.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.6.6.1.13.2-1 and A.6.6.1.13.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two

successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. During time duration T2, NW triggers the Cell DTX.

UE is allocated with PUSCH resource at every Cell DTX cycle.

Table A.6.6.1.13.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: The UE fulfils the requirements in this Cell DTX test case can skip the test case in A.6.6.1.2 DRX.1 configuration.	

Table A.6.6.1.13.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1 with Cell DTX

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3	DRX.1	
Cell DTX		1,2,3	DTX.1	
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 μs	Synchronous cells
		3	3 μs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	

Table A.6.6.1.13.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1 with Cell DTX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD		N/A	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.1.13.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 + 160 = 1080 ms from the beginning of time period T2, while 160 ms is the Cell DTX cycle length, which is the delay uncertainty for next available PUSCH for L3 MR reporting during cell DTX. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.14 Deactivated PSCell measurement test with 12 PRB SSB bandwidth in FR1

A.6.6.1.14.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of deactivated PSCell measurement results when the PSCell is configured with 12 PRB SSB bandwidth. This test verifies the deactivated PSCell measurement period requirements specified in clause 9.2.5.1.

A.6.6.1.14.2 Test Parameters

The supported test configurations are given in table A.6.6.1.14.2-1. Only 15kHz FDD cases are considered. The test scenario comprises 2 NR cells – PCell (Cell 1) and target PSCell (Cell 2).

Cell 1 is on radio channel 1 in FR1. Cell 2 is on radio channel 2 in FR1. Test parameters are given in Tables A.6.6.1.14.2-2, A.6.6.1.14.2-3 below. Note that for Cell 2 the SSB configuration refers to SSB pattern 13 in FR1: SSB allocation for SSB SCS=15kHz in 3 MHz. In the test, the SSB is configured with 12PRB bandwidth.

The test consists of two successive time periods, with time duration of T1, and T2 respectively.

At the start of T1, the UE is in connected mode to Cell 1. During time duration T1, the UE is configured to add Cell 2 as PSCell so that Cell 1 and Cell 2 serve UE under NR-DC operation. Meanwhile the UE is configured to measure on both Cell 1 and Cell 2 serving carrier frequencies. The UE is configured to read the SSB index for measurement of PSCC.

At the end of T1, the UE deactivates Cell 2. T2 starts exactly when the UE receives deactivation command for Cell 2. During T2, Cell 2 remains detectable to the UE.

Measurement gap or DRX is not configured.

The UE is required to make correct and timely reporting during T2. This test case verifies that the UE reporting is within the delay requirement and measurement accuracy is tested in other test cases.

Table A.6.6.1.14.2-1: Supported test configuration

Config	Description
1	NR 15 kHz SSB SCS, PCell with 10 MHz bandwidth and PSCell with 3 MHz bandwidth, both FDD duplex mode

Table A.6.6.1.14.2-2: General test parameters for deactivated PSCell measurements when PSCell is configured with 12 PRB SSB bandwidth

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR1 NR carrier frequencies are
PCell		Config 1	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Deactivated PSCell		Config 1	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
measCyclePSCell	ms	Config 1	160	Same as SMTC and SSB periodicity
Gap Pattern Id		Config 1	Not configured	
Measurement gap offset		Config 1	Not configured	
SMTC parameters		Config 1	SMTC.1 for PCC SMTC.2 for PSCC	As specified in clause A.3.10.1
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	Config 1	5	
T2	s	Config 1	3	

Table A.6.6.1.14.2-3: Cell specific test parameters for deactivated PSCell measurement with 12 PRB SSB bandwidth

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	FDD			
TDD configuration			Config 1	Not Applicable			
$BW_{channel}$		MHz	Config 1	10: $N_{PRB,c}$ = 52		3: $N_{PRB,c}$ = 15	
BWP BW		MHz	Config 1	10: $N_{PRB,c}$ = 52		3: $N_{PRB,c}$ = 15	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		DLBWP.0.1	
	Initial UL BWP			ULBWP.0.1		ULBWP.0.1	
	Dedicated DL BWP			DLBWP.1.1		DLBWP.1.1	
	Dedicated UL BWP			ULBWP.1.1		ULBWP.1.1	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		SR.1.2FDD	
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD		CR.1.2 FDD	
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD		CCR1.6 FDD	
SSB parameters			Config 1	SSB.1 FR1		SSB.13 FR1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	15			
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1	-98		-98	
SS-RSRP Note 3		dBm/SCS	Config 1	-94		-91	
$\hat{E}_s/I_{ot}$		dB	Config 1	4		7	
$\hat{E}_s/N_{oc}$		dB	Config 1	4		7	
Io Note3		dBm/SCS MHz	Config 1	-92.6		-90.2	
Propagation Condition			Config 1	AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.6.6.1.14.3 Test Requirements

The UE shall send one measurement report for the deactivated PSCell, with a measurement reporting delay less than 2720 ms from the beginning of time period T2.

The UE is required to successfully detect PSS/SSS for Cell 2 within

$$\text{Ceil}(5 \times K_p) \times \text{measCyclePSCell} \times CSSF_{intra};$$

The UE is required successfully read the SSB index for Cell 2 within

$$\text{Ceil}(7 \times K_p) \times \text{measCyclePSCell} \times CSSF_{intra};$$

The UE is required to successfully measure on Cell 2 within

$$\text{Ceil}(5 \times K_p) \times \text{measCyclePSCell} \times CSSF_{intra};$$

Where

- measCyclePSCell = 160 ms,
- $K_p = 1$,
- $CSSF_{intra} = 1$.

This sums up as 2720 ms in total, consisting of 800 ms of PSS/SSS detection, 1120 ms of SSB index detection and 800 ms of measurement time.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.15 SA event triggered reporting test without gap under non-DRX with SSB index reading and 12 PRB SSB for a deactivated SCell

A.6.6.1.15.1 Test purpose and Environment

The purpose of this test is to verify that the UE supporting *support-3MHz-ChannelBW-r18* makes correct reporting of an event on an intra-frequency layer measurement performed without measurement gaps when the UE is also configured deactivated SCell. This test will partly verify the intra-frequency cell search requirements in clauses 9.2.5.1 and 9.2.5.2.

A.6.6.1.15.2 Test parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1) on Carrier 1, FR1 Neighbouring cell (Cell 2) and a FR1 SCell (Cell 3) on Carrier 2. Carrier 2 is on a different frequency than the PCell.

The test parameters for PCell, SCell and neighbour cell are given in table A.6.6.1.15.2-1, A.6.6.1.15.2-2 and A.6.6.1.15.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and the SCell and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.6.6.1.15.2-1: Supported test configurations

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; Neighbouring cell: 15 kHz SSB SCS, 3 MHz bandwidth, FDD duplex mode Scell: 15 kHz SSB SCS, 3 MHz bandwidth, FDD duplex mode

Table A.6.6.1.15.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1 with 12 PRB SSB for SCell

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	**PCell**
Neighbour cell			Cell 2	**Cell to be identified.**
Deactivated SCell			Cell 3	**Deactivated throughout the test.**
RF Channel Number			1: Cell 1 2: Cell 2 and Cell 3	**1: Cell 1 is PCell** **2: Cell 2 is neighbouring cell to be detected**
SSB configuration			SSB.1 FR1	**Cell 1**
			SSB.13 FR1	**12 PRB** **Cell 2 and Cell 3**
SMTC configuration			SMTC.2	**Cell 1**
			SMTC.1	**Cell 2 and Cell 3**
A3-Offset	dB		-4.5	
CP length			Normal	
Hysteresis	dB		0	
Time To Trigger	s		0	
Filter coefficient			0	**L3 filtering is not used**
DRX				**OFF**
measCycleScell	ms		160ms	
Time offset between serving and neighbour cells			3 ms	**Asynchronous cells.** **The timing of Cell 2 is 3 ms later than the timing of Cell 1.**
			3 μs	**Synchronous cells**
T1	s		5	
T2	s		5	

Table A.6.6.1.15.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1 with 12 PRB SSB for SCell

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
PDSCH RMC configuration		1	SR.1.1 FDD		SR.1.3 FDD			
RMSI CORESET RMC configuration			CCR.1.1 FDD		CCR.1.7 FDD			
Dedicated CORESET RMC configuration			CCR.1.1 FDD		CCR.1.7 FDD			
OCNG Patterns			OP.1					
TRS Configuration			TRS.1.1 FDD					
IInitial BWP configuration			DLBWP.0.1 ULBWP.0.1					
Active DL BWP configuration			DLBWP.1.1					
Active UL BWP configuration			ULBWP.1.1					

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
RLM-RS			SSB					
N_{oc} Note 2	dBm/SCS		-98					
N_{oc} Note 2	dBm/15 kHz		-98					
$\hat{E}_s/I_{ot}$	dB		4	-1.46	-Infinity	-1.46	4	-1.46
$\hat{E}_s/N_{oc}$	dB		4	4	-Infinity	4	4	4
SS-RSRP Note 3	dBm/SCS kHz		-94	-94	-Infinity	-94	-94	-94
Io	dBm/2.7 MHz		-70.00	-70.00	-75.44	-67.65	-70.00	-67.65
Propagation Condition			AWGN					

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.1.15.3 Test requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 2720 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index in this test. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2 Inter-frequency Measurements

A.6.6.2.1 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is not used

A.6.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.2.1.1-1, A.6.6.2.1.1-2 and A.6.6.2.1.1-3.

Measurement gap pattern configuration is defined in table A.6.6.2.1.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.6.6.2.1.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

NOTE 1: The UE is only required to be tested in one of the supported test configurations
NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell

Table A.6.6.2.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9	
SMTC-SSB parameters		Config 1	SSB.1 FR1	As specified in clause A.3.10.1
		Config 2	SSB.1 FR1	As specified in clause A.3.10.1
		Config 3	SSB.2 FR1	As specified in clause A.3.10.1
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1	

Table A.6.6.2.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		Config 2	SR.1.1 TDD			
		Config 3	SR2.1 TDD			
RMSI CORESET Reference Channel		Config 1	CR.1.1 FDD			
		Config 2	CR.1.1 TDD			
		Config 3	CR2.1 TDD			
Dedicated CORESET Reference Channel		Config 1	CCR.1.1 FDD			
		Config 2	CCR.1.1 TDD			
		Config 3	CCR.2.1 TDD			
SSB parameters		Config 1	SSB.1 FR1		SSB.5 FR1	
		Config 2	SSB.1 FR1		SSB.5 FR1	
		Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11		Config 1	SMTC.2		SMTC.5	
		Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	15			
		Config 3	30			
EPRE ratio of PSS to SSS		Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.2.1.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.2 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is used

A.6.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.2.2.1-1, A.6.6.2.2.1-2 and A.6.6.2.2.1-3.

Measurement gap pattern configuration is defined in table A.6.6.2.2.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.2.2.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.2.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9		
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.7	As specified in clause A.3.3

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Time offset between serving and neighbour cells		Config 1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	1.1	11	

Table A.6.6.2.2.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP		Config 1, 2, 3	ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD		NA	
			Config 3	SR2.1 TDD		NA	
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD		NA	
			Config 2	CR.1.1 TDD		NA	
			Config 3	CR.2.1 TDD		NA	
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD		NA	
			Config 2	CCR.1.1 TDD		NA	
			Config 3	CCR.2.1 TDD		NA	
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	Config 1,2,3	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.2
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.6.6.2.2.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test1&3	Test2&4	Comment
	Value	Value	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.6.6.2.2.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.6.6.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2, UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.3 Void

A.6.6.2.4 Void

A.6.6.2.5 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is not used

A.6.6.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.2.5.1-1, A.6.6.2.5.1-2 and A.6.6.2.5.1-3.

Measurement gap pattern configuration is defined in table A.6.6.2.5.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.6.6.2.5.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.5.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9	

Parameter	Unit	Test configuration	Value	Comment
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1.1	

Table A.6.6.2.5.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD		-	
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PSS to SSS		Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.2
	dBm/38.16 MHz	Config 3	-58.4	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.2.5.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1040 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.6 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is used

A.6.6.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.2.6.1-1, A.6.6.2.6.1-2 and A.6.6.2.6.1-3.

Measurement gap pattern configuration is defined in table A.6.6.2.6.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.2.6.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.6.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9		
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3 μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	1.3	13.5	

Table A.6.6.2.6.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3	1		2	
Duplex mode		Config 1	FDD			
		Config 2,3	TDD			
TDD configuration		Config 1	Not Applicable			
		Config 2	TDDConf.1.1			
		Config 3	TDDConf.2.1			

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD		-	
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-98	
			Config 3	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
			Config 3	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$		dB	Config 1,2,3	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$		dB	Config 1,2,3	4	4	-Infinity	7

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Io[Note3]	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.6.6.2.6.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 12160 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2, UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.7 Void

A.6.6.2.8 Void

A.6.6.2.9 SA event triggered reporting tests with additional mandatory gap pattern

A.6.6.2.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event when mandatory gap pattern with 3 ms MGL is configured.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.2.9.1-1, A.6.6.2.9.1-2 and A.6.6.2.9.1-3.

Measurement gap pattern configuration defined in table A.6.6.2.9.1-2 does not depend on per-FR gap capability of UE.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.6.6.2.9.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell

Table A.6.6.2.9.1-2: General test parameters for SA inter-frequency event triggered reporting with additional mandatory gap pattern

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	3	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	12	
		Config 2,3	9	
SMTC-SSB parameters		Config 1	SSB.1 FR1	As specified in clause A.3.10.1
		Config 2	SSB.1 FR1	As specified in clause A.3.10.1
		Config 3	SSB.2 FR1	As specified in clause A.3.10.1
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3µs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1	

Table A.6.6.2.9.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting with additional mandatory gap pattern

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
CORESET Reference Channel		Config 1	CR.1.1 FDD			
		Config 2	CR.1.1 TDD			
		Config 3	CR2.1 TDD			
SSB parameters		Config 1	SSB.1 FR1		SSB.5 FR1	
		Config 2	SSB.1 FR1		SSB.5 FR1	
		Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11		Config 1	SMTC.1		SMTC.9	
		Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	15			
		Config 3	30			
EPRE ratio of PSS to SSS		Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS (Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.2.9.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.10 SA event triggered reporting tests for FR1 when DRX is used

A.6.6.2.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE which supports interFrequencyMeas-Nogap-r16 makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search without measurement gap requirements in clause 9.3.9.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on RF channel 2. The SSB of Cell 2 is completely within UE's active BWP BW. The RBs containing SSB from Cell 1 and Cell 2 should be different in frequency location within the cell bandwidth. The test parameters are given in tables A.6.6.2.10.1-1, A.6.6.2.10.1-2 and A.6.6.2.10.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.2.10.1-1: SA event triggered reporting tests when DRX is used for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.10.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 when DRX is used

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	DRX.1	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1	

Table A.6.6.2.10.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 when DRX is used

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3	1		2	
Duplex mode		Config 1	FDD			
		Config 2,3	TDD			

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP		Config 1, 2, 3	ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD		NA	
			Config 3	SR2.1 TDD		NA	
CORESET Reference Channel			Config 1	CR.1.1 FDD		NA	
			Config 2	CR.1.1 TDD		NA	
			Config 3	CR2.1 TDD		NA	
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS (Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2,3	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-98	
			Config 3	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
			Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2,3	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.2
		dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1,2,3	AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

Table A.6.6.2.10.1-4: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting when DRX is used

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.6.6.2.10.2 Test Requirements

In test config 1, UE is required to report SSB time index. UE is not required to report SSB time index. The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test config 2 and 3, UE is not required to report SSB time index. The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 900 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.11 SA event triggered reporting tests for FR1 without gap when DRX is not used

A.6.6.2.11.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.9.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The SSB of Cell 2 is completely within UE's active BWP BW. The RBs containing SSB from Cell 1 and Cell 2 should be different in frequency location within the cell bandwidth. The test parameters are given in tables A.6.6.2.11.1-1, A.6.6.2.11.1-2 and A.6.6.2.11.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.6.6.2.11.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.11.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without gap

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1	

Table A.6.6.2.11.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without gap

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD			
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.2.11.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

The UE is not required to read the neighbour cell SSB index in this test.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.12 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is used for UE configured with highSpeedMeasInterFreq-r17

A.6.6.2.12.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event when UE is configured with *highSpeedMeasInterFreq-r17*. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.2.12.1-1, A.6.6.2.12.1-2 and A.6.6.2.12.1-3.

Measurement gap pattern configuration is defined in table A.6.6.2.12.1-2. In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.2.12.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.12.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection for UE configured with *highSpeedMeasInterFreq-r17*

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	DRX.14	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	2.3	

Table A.6.6.2.12.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection for UE configured with *highSpeedMeasInterFreq-r17*

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3	1		2	
Duplex mode		Config 1	FDD			
		Config 2,3	TDD			
TDD configuration		Config 1	Not Applicable			
		Config 2	TDDConf.1.1			
		Config 3	TDDConf.2.1			
$BW_{channel}$	MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
		Config 3	40: $N_{PRB,c}$ = 106			

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP		Config 1, 2, 3	ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD		NA	
			Config 3	SR2.1 TDD		NA	
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD		NA	
			Config 2	CR.1.1 TDD		NA	
			Config 3	CR.2.1 TDD		NA	
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD		NA	
			Config 2	CCR.1.1 TDD		NA	
			Config 3	CCR.2.1 TDD		NA	
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2,3	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-98	
			Config 3	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
			Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3	4	4	-Infinity	7

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io[Note3]	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.2
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2	AWGN		AWGN 1944 Hz [Note 5]	
		Config 3	AWGN		AWGN 3334 Hz [Note 6]	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.
NOTE 6: The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334 Hz.

A.6.6.2.12.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 2240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.13 SA event triggered reporting tests for FR1 with measurement gap with priority and periodic MUSIM gap configured

A.6.6.2.13.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event on an inter-frequency layer based on measurement performed within measurement gap when UE is also configured with MUSIM gaps. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4. In addition, the test will verify that UE makes correct transmission/reception during occasions of measurement gaps and MUSIM gaps that are dropped due to collision handling as defined in clause 9.1.10.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.2.13.1-1, A.6.6.2.13.1-2 and A.6.6.2.13.1-3.

Measurement gap and MUSIM gap pattern configurations defined in table A.6.6.2.13.1-2 are provided to the UE.

NOTE: The signaling procedure to trigger the UE to request MUSIM gaps before the test equipment configures MUSIM gaps to the UE is left to comformance test implementation.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of 4 successive time periods, with time duration of T1, T2, T3 and T4 respectively. During T1 and T3, the UE shall not have any timing information of NR Cell 2. During T1 and T2, MUSIM gap is configured with lower priority than the measurement gap. At the beginning of T3, test equipment reconfigures the priority of MUSIM gap such that MUSIM gap is configured with higher priority than the measurement gap during T3 and T4.

The TE schedules continuous DL data on PCell throughout the test.

Table A.6.6.2.13.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.13.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Measurement gap Pattern Id		Config 1,2,3	0	As specified in clause 9.1.2-1.
Measurement gap offset	ms	Config 1,2,3	9	
MUSIM gap Pattern Id		Config 1,2,3	1	
MUSIM gap offset	ms	Config 1,2,3	2	
SMTC-SSB parameters		Config 1	SSB.1 FR1	As specified in clause A.3.10.1
		Config 2	SSB.1 FR1	As specified in clause A.3.10.1
		Config 3	SSB.2 FR1	As specified in clause A.3.10.1
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1	
T3	s	Config 1,2,3	5	
T4	s	Config 1,2,3	1.3	

Table A.6.6.2.13.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1, T3	T2, T4	T1, T3	T2, T4
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1, T3	T2, T4	T1, T3	T2, T4
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD			
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD			
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-98	
			Config 3	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
			Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2,3	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
		dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.2.13.2 Test Requirements

During T1 and T2, UE shall send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with the measurement gap occasions.

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

During T3 and T4, after UE sends RRC ReconfigurationComplete message for the reconfiguration of MUSIM gap priority, UE shall send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with

- MUSIM gap occasions, and
- measurement gap occasions that are not colliding with MUSIM gap.

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T4. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

UE is not required to report SSB time index.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.14 SA event triggered reporting tests for FR1 with measurement gap without priority and periodic MUSIM gap configured

A.6.6.2.14.1 Test Purpose and Environment

The purpose of this test is to verify that the MUSIM gap capable UE makes correct reporting of an event when MUSIM gap collides with measurement gaps without assigned priority. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4. This test is conducted assuming that the measurement gap is configured as Gap(s) configured via GapConfig without suffix, and the MUSIM gap parameters are configured as requested by UE.

NOTE: The signaling procedure to trigger the UE to request MUSIM gaps before the test equipment configures MUSIM gaps to the UE is left to comformance test implementation.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.2.14.1-1, A.6.6.2.14.1-2 and A.6.6.2.14.1-3.

Measurement gap pattern configuration defined in table A.6.6.2.14.1-2 is provided for a UE.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.6.6.2.14.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.14.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 measurement gap and periodic MUSIM gap with partially partial overlapping scenario for SSB-based measurements in inter-frequency layers

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.

Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	1	As specified in table 9.1.2-1.
Measurement gap offset		Config 1,2,3	4	
MUSIM Gap Pattern Id		Config 1,2,3	0	As specified in table 9.1.10-1
MUSIM gap offset		Config 1,2,3	39	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1	

Table A.6.6.2.14.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 measurement gap and periodic MUSIM gap with partially partial overlapping scenario for SSB-based measurements in inter-frequency layers

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD			
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD			
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11		Config 1,2,3	SMTC.7		SMTC.7	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	15			
		Config 3	30			
EPRE ratio of PSS to SSS		Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.2.14.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.15 SA event triggered reporting tests for FR1 with 3 MHz Channel Bandwidth configured without SSB time index detection when DRX is used

A.6.6.2.15.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *support-3MHz-ChannelBW-r18* makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4 for 3 MHz Channel Bandwidth configured without SSB time index detection when DRX is used and with 15 PRB PDCCH configuration.

Supported test configurations are specified in table A.6.6.2.15.1-1. General test parameters as specified in table A.6.6.2.2.1-2 with config 1 apply to this test. Cell specific test parameters as specified in table A.6.6.2.2.1-3 with config 1 apply except those specified in table A.6.6.1.13.1-2. DRX-Configuration and *TimeAlignmentTimer* -Configuration specified in table A.6.6.2.2.1-4 and table A.6.6.2.2.1-5, respectively, apply to this test case.

The test environment specified in A.6.6.2.2.1 applies to this test.

Table A.6.6.2.15.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 3 MHz bandwidth, FDD duplex mode
NOTE 1: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.15.1-2: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Duplex mode		Config 1	FDD			
$BW_{channel}$	MHz	Config 1	3: $N_{PRB,c}$ = 15			
BWP BW	MHz	Config 1	3: $N_{PRB,c}$ = 15			
PDSCH Reference measurement channel		Config 1	SR.1.2 FDD		NA	
RMSI CORESET Reference Channel		Config 1	CR.1.3 FDD		NA	
Dedicated CORESET Reference Channel		Config 1	CCR.1.7 FDD		NA	
SSB parameters		Config 1	SSB.13 FR1		SSB.13 FR1	
Io^{Note3}	dBm/3 MHz	Config 1	-69.9	-69.9	-75.4	-67.6

A.6.6.2.15.2 Test Requirements

Test requirements specified in clause A.6.6.2.2.2 apply to this test, except that the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1920 ms and 14720 ms from the beginning of time period T2 in test 1 and test, respectively.

A.6.6.3 Inter-RAT Measurements

A.6.6.3.1 SA NR - E-UTRAN event-triggered reporting in non-DRX in FR1

A.6.6.3.1.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in clauses 9.4.2 and 9.4.3.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. In the measurement control information from the PCell it is indictated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively.

Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are shown in table A.6.6.3.1.1-1. General test parameters are provided in table A.6.6.3.1.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.6.6.3.1.1-3 and A.6.6.3.1.1-4, respectively.

Table A.6.6.3.1.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.3.1.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		2	1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.6.6.3.1.1-2 and A.6.6.3.1.1-3.	
Active cell		Cell 1	Cell 1 is on RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on RF channel number 2
Gap Pattern Id		0	As specified in clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP	Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP	Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1	SS-RSRP threshold for SS-RSRP measurement on cell1 for event B2
b2-Threshold2EUTRA	dBm	-95	E-UTRAN RSRP threshold for SS-RSRP measurement on cell1 for event B2
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	OFF
T1	s	5	
T2	s	5	
NOTE 1: Values are defined in table A.6.6.3.1.1-3			

Table A.6.6.3.1.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in non-DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 4	FDD	
			2, 3, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)	
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RMSI CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
Dedicated CORSET reference channel			1, 4	CCR.1.1 FDD	
			2, 5	CCR.1.1 TDD	
			3, 6	CCR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	
CSI-RS for tracking			1, 4	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
b2-Threshold1		dBm	1, 2, 4, 5	--96	
			3, 6	--93	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6	-104	
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-104	
			3, 6	-101	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	16	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	16	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104
			3, 6	-85	-101
SSB_RP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104
			3, 6	-85	-101
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-59.94	-73.04
		dBm/38.16 MHz	3, 6	-53.84	-66.93
Propagation condition			1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6	1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.3.1.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	2	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25	

Parameter	Unit	Configuration	Cell 2	
			T1	T2
			10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	-Infinity	17
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
Io[Note5]	dBm/9 MHz	1, 2, 3, 4, 5, 6	-73.21+10log ($N_{PRB,c}$ /50)	-56.12+10log ($N_{PRB,c}$ /50)
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.3.1.2 Test Requirements

The UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.3.2 SA NR - E-UTRAN event-triggered reporting in DRX in FR1

A.6.6.3.2.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1 when DRX is used. This test shall partly verify the cell search and measurement requirements in clauses 9.4.2 and 9.4.3. There are two test cases. In test 1 the UE shall be configured with DRX cycle of 40 ms. In test 2 the UE shall be configured with DRX cycle of 640 ms.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. In the measurement control information from the PCell it is indctated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

In each test the UE shall be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore the UE shall be allocated with PUSCH resource at every DRX cycle.

Supported test configurations are shown in table A.6.6.3.2.1-1. General test parameters are provided in table A.6.6.3.2.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.6.6.3.2.1-3 and A.6.6.3.2.1-4, respectively.

Table A.6.6.3.2.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.3.2.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Test 1	Test 2	Comment
		Value		
NR RF Channel Number		1		1 NR carrier frequency is used in the test
LTE RF Channel Number		2		1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.6.6.3.2.1-2 and A.6.6.3.2.1-3.		
Active cell		Cell 1		Cell 1 is on RF channel number 1
Neighbour cell		Cell 2		Cell 2 is on RF channel number 2
Gap Pattern Id		0		As specified in clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP		Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP		Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1		SS-RSRP threshold for SS-RSRP measurement on cell1 for event B2
b2-Threshold2EUTRA	dBm	-95		E-UTRAN RSRP threshold for SS-RSRP measurement on cell1 for event B2
Hysteresis	dB	0		
TimeToTrigger	s	0		
Filter coefficient		0		L3 filtering is not used
DRX		DRX.1	DRX. 7	DRX cycle configurations DRX.1 and DRX. 7 are defined in table A.3.3.1-1 and table A.3.3. 7-1 respectively.

Parameter	Unit	Test 1	Test 2	Comment
		Value		
T1	s	5		
T2	s	5	15	
NOTE 1: Values are defined in table A.6.6.3.2.1-3				

Table A.6.6.3.2.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 4	FDD	
			2, 3, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)	
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
RMSI CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
Dedicated CORSET reference channel			1, 4	CCR.1.1 FDD	
			2, 5	CCR.1.1 TDD	
			3, 6	CCR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	
CSI-RS for tracking			1, 4	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
b2-Threshold1		dBm	1, 2, 4, 5	-96	
			3, 6	-93	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6	-104	
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-104	
			3, 6	-101	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	16	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	16	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104
			3, 6	-85	-101
SSB_RP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104
			3, 6	-85	-101
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-59.94	-73.04
		dBm/38.16 MHz	3, 6	-53.84	-66.93

Parameter	Unit	Configuration	Cell 1	
			T1	T2
Propagation condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

Table A.6.6.3.2.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	2	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	-Infinity	17
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87

Parameter	Unit	Configuration	Cell 2	
			T1	T2
Io Note5	dBm/9 MHz	1, 2, 3, 4, 5, 6	-73.21+10log ($N_{PRB,c}$ /50)	-56.12+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2, 3, 4, 5, 6	1x2	
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].				
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.				
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].				

A.6.6.3.2.2 Test Requirements

In test 1, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

In test 2, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 12.8 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.3.3 SA NR - E-UTRAN event-triggered reporting in DRX in FR1 for UE configured with highSpeedMeasFlag-r16

A.6.6.3.3.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements for UE configured with highSpeedMeasFlag-r16 in standalone (SA) operation with PCell in FR1 when DRX is used. This test shall partly verify the cell search and measurement requirements in clauses 9.4.2 and 9.4.3.

In the test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. In the measurement control information from the PCell it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

The UE shall be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore the UE shall be allocated with PUSCH resource at every DRX cycle.

Supported test configurations are shown in table A.6.6.3.3.1-1. General test parameters are provided in table A.6.6.3.3.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.6.6.3.3.1-3 and A.6.6.3.3.1-4, respectively.

Table A.6.6.3.3.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1 for UE configured with highSpeedMeasFlag-r16

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD

4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.3.3.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1 for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		2	1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.6.6.3.3.1-2 and A.6.6.3.3.1-3.	
Active cell		Cell 1	Cell 1 is on RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on RF channel number 2
Gap Pattern Id		0	As specified in clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP	Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP	Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1	SS-RSRP threshold for SS-RSRP measurement on cell1 for event B2
b2-Threshold2EUTRA	dBm	-97	E-UTRAN RSRP threshold for SS-RSRP measurement on cell1 for event B2
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		DRX.6	DRX cycle configurations DRX.6 is defined in table A.3.3.1-6.
T1	s	5	
T2	s	5	
NOTE 1: Values are defined in table A.6.6.3.3.1-3			

Table A.6.6.3.3.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in DRX with PCell in FR1 for UE configured with highSpeedMeasFlag-r16

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 4	FDD	
			2, 3, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)	
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
RMSI CORESET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
Dedicated CORESET reference channel			1, 4	CCR.1.1 FDD	
			2, 5	CCR.1.1 TDD	
			3, 6	CCR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
OCNG pattern[Note1]		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration		1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration		1, 2, 4, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
CSI-RS for tracking		1, 4	TRS.1.1 FDD	
		2, 5	TRS.1.1 TDD	
		3, 6	TRS.1.2 TDD	
b2-Threshold1	dBm	1, 2, 4, 5	-98	
		3, 6	-95	
EPRE ratio of PSS to SSS	dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH_DMRS to SSS				
EPRE ratio of PBCH to PBCH_DMRS				
EPRE ratio of PDCCH_DMRS to SSS				
EPRE ratio of PDCCH to PDCCH_DMRS				
EPRE ratio of PDSCH_DMRS to SSS				
EPRE ratio of PDSCH to PDSCH_DMRS				
EPRE ratio of OCNG DMRS to SSS				
EPRE ratio of OCNG to OCNG DMRS				
N_{oc}[Note2]	dBm/15 KHz	1, 2, 3, 4, 5, 6	-106	
N_{oc}[Note2]	dBm/SCS	1, 2, 4, 5	-106	
		3, 6	-103	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	18	-2
$\hat{E}_s/I_{ot}$[Note3]	dB	1, 2, 3, 4, 5, 6	18	-2
SS-RSRP[Note3]	dBm/SCS	1, 2, 4, 5	-88	-108
		3, 6	-85	-105
SSB_RP[Note3]	dBm/SCS	1, 2, 4, 5	-88	-108
		3, 6	-85	-105
Io[Note3]	dBm/9.36 MHz	1, 2, 4, 5	-59.98	-75.92
	dBm/38.16 MHz	3, 6	-53.88	-69.82
Propagation condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.3.3.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1 for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	2	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD	

Parameter	Unit	Configuration	Cell 2	
			T1	T2
			20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel Note2		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns Note2		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15 kHz	1, 2, 3, 4, 5, 6	-106	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	19
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2, 3, 4, 5, 6	-Infinity	19
RSRP Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
SCH_RP Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
Io Note5	dBm/9 MHz	1, 2, 3, 4, 5, 6	-78.22+10log ($N_{PRB,c}$ /50)	-59.16+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2, 3, 4, 5, 6	AWGN1944	
Antenna Configuration and Correlation Matrix Note6		1, 2, 3, 4, 5, 6	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.6.6.3.3.2 Test Requirements

In the test, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 4.8 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.4 L1-RSRP measurement for beam reporting

A.6.6.4.1 SSB based L1-RSRP measurement when DRX is not used

A.6.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.6.6.4.1.1-1.

Table A.6.6.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.1.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.6.4.1.2-1 and table A.6.6.4.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.6.6.4.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
OCNG Patterns	1~3		OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~3		Off

Parameter	Config	Unit	Value
reportConfigType	1~3		periodic
reportQuantity	1~3		ssb-Index-RSRP
Number of reported RS	1~3		2
L1-RSRP reporting period	1~3	slot	80
T1	1~3	s	5
T2	1~3	s	1
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.6.6.4.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~3	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~3	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.4.1.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.4.2 SSB based L1-RSRP measurement when DRX is used

A.6.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.6.6.4.2.1-1.

Table A.6.6.4.2.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.2.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.6.4.2.2-1 and table A.6.6.4.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.6.6.4.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
OCNG Patterns	1~3		OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~3		DRX.3
reportConfigType	1~3		periodic
reportQuantity	1~3		ssb-Index-RSRP
Number of reported RS	1~3		2
L1-RSRP reporting period	1~3	slot	80
T1	1~3	s	5
T2	1~3	s	1
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			

Parameter	Config	Unit	Value
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.6.6.4.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~3	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~3	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.4.2.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.4.3 CSI-RS based L1-RSRP measurement when DRX is not used

A.6.6.4.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.6.6.4.3.1-1.

Table A.6.6.4.3.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.3.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.6.4.3.2-1 and table A.6.6.4.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (0 for Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.6.6.4.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.6.6.4.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
CSI-RS configuration	1		CSI-RS 1.3 FDD
	2		CSI-RS 1.3 TDD
	3		CSI-RS 2.3 TDD
OCNG Patterns	1~3		OP.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
DRX configuration	1~3		Off
reportConfigType	1~3		aperiodic
reportQuantity	1~3		cri-RSRP
Number of reported RS	1~3		2
qcl-Info	1~3		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1~3	slots	8
T1	1~3	s	5
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS[Note 1]			

EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.6.6.4.3.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~3	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2	dBm/SSB SCS	-94.65	
	3		-91.65	
$\hat{E}_s / I_{ot}$	1~3	dB	0	3
CSI-RS RSRP Note2	1,2	dBm/SSB SCS	-94.65	-91.65
	3		-91.65	-88.65
Io Note2	1,2	dBm/9.36 MHz	-63.69	-61.93
	3	dBm/38.16 MHz	-57.59	-55.84
$\hat{E}_s / N_{oc}$	1~3	dB	0	3
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.6.4.3.3 Test Requirements

After 80ms from the beginning of the test, the UE shall send L1-RSRP report at the 8th slot from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.20.1.1 and relative accuracy requirement in clause 10.1.20.1.2.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.4.4 CSI-RS based L1-RSRP measurement when DRX is used

A.6.6.4.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.6.6.4.4.1-1.

Table A.6.6.4.4.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.4.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.6.4.4.2-1 and table A.6.6.4.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (0 for Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.6.6.4.4.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.6.6.4.4.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
CSI-RS configuration	1		CSI-RS 1.3 FDD
	2		CSI-RS 1.3 TDD
	3		CSI-RS 2.3 TDD
OCNG Patterns	1~3		OP.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
DRX configuration	1~3		DRX.3
reportConfigType	1~3		aperiodic
reportQuantity	1~3		cri-RSRP
Number of reported RS	1~3		2
qcl-Info	1~3		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1~3	slots	8
T1	1~3	s	5
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.6.6.4.4.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~3	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2	dBm/SSB SCS	-94.65	
	3		-91.65	
$\hat{E}_s/I_{ot}$	1~3	dB	0	3
CSI-RS RSRP Note2	1,2	dBm/SSB SCS	-94.65	-91.65
	3		-91.65	-88.65
Io Note2	1,2	dBm/9.36 MHz	-63.69	-61.93
	3	dBm/38.16 MHz	-57.59	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	3
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.6.4.4.3 Test Requirements

After 80 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.20.1.1 and relative accuracy requirement in clause 10.1.20.1.2.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.4.5 SSB based L1-RSRP measurement when DRX is used for UE configured with *highSpeedMeasFlag-r16*

A.6.6.4.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement when UE is configured with *highSpeedMeasFlag-r16*. This test will partly verify the L1-RSRP measurement requirements for UE configured with *highSpeedMeasFlag-r16* in clause 9.5.4.1, with the testing configurations for NR cells in table A.6.6.4.5.1-1.

Table A.6.6.4.5.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.5.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.6.4.5.2-1 and table A.6.6.4.5.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.6.6.4.5.2-1: General test parameters for UE configured with *highSpeedMeasFlag-r16*

Parameter	Config	Unit	Value
SSB ARFCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
OCNG Patterns	1~3		OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~3		DRX.3
reportConfigType	1~3		periodic
reportQuantity	1~3		ssb-Index-RSRP
Number of reported RS	1~3		2
L1-RSRP reporting period	1~3	slot	80
T1	1~3	s	5
T2	1~3	s	2
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.6.6.4.5.2-2: SSB specific test parameters for UE configured with *highSpeedMeasFlag-r16*

Parameter	Config	Unit	SSB#0	SSB#1

			T1	T2	T1	T2
N_{oc} Note2	1~3	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~3	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	0	-Infinity	3
Propagation conditions	1,2		AWGN		AWGN 1944 Hz	
	3		AWGN		AWGN 3334 Hz	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.4.5.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.4.6 Inter-cell SSB based L1-RSRP measurements on FR1 PCell when DRX is used

A.6.6.4.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement for SSB of a cell with additional PCI. This test will partly verify the L1-RSRP measurement requirements in clause 9.13.4.1, with the testing configurations for NR serving cells in table A.6.6.4.6.1-1.

Table A.6.6.4.6.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.6.2 Test parameters

There are two cells in the test, the FR1 PCell (Cell 1) and a cell with additional PCI (Cell 2). The test parameters for the Cell 1 are given in table A.6.6.4.6.2-1. The test parameters for Cell 2 are given in table A.6.6.4.6.2-2 below.

SSB#0 and SSB#1 are transmitted on Cell 1 and Cell 2. In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSB#0 and report measurement results periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. At the beginning of T2, SSB#1 starts transmission and the UE is configured for L1-RSRP measurement on SSB#1. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured in CSI-ReportConfig and *additionalPCIList* configured in *CSI-SSB-ResourceSet.*

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the the SSB#0 for Cell 1.

Table A.6.6.4.6.2-1: General test parameters

Parameter	Config	Unit	Value
Active cell	1~3		Cell 1
A cell with additional PCI	1~3		Cell 2
RF Channel Number	1~3		1: Cell 1 and Cell 2
SSB ARFCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1 for Cell 1 and Cell 2
	2		SSB.3 FR1 for Cell 1 and Cell 2
	3		SSB.4 FR1 for Cell 1 and Cell 2
OCNG Patterns	1~3		OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~3		DRX.3
reportConfigType	1~3		periodic
reportQuantity	1~3		ssb-Index-RSRP
Number of reported RS	1~3		2
L1-RSRP reporting period	1~3	slot	80
T1	1~3	s	5
T2	1~3	s	1
CP length	1~3		Normal
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			

Parameter	Config	Unit	Value
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN
Time offset between serving and a cell with additional PCI	1		< CP
	2		< CP
	3		< CP
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.6.6.4.6.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0 of Cell 1		SSB#1 of Cell 2	
			T1	T2	T1	T2
N_{oc} Note2	1~3	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s / I_{ot}$	1~3	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1~3	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.4.6.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than X ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of SSB#1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2, where X is

- 680 for Config 1&2
- 660 for Config 3

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.4.7 SSB based L1-RSRP measurement when DRX is not used when CD-SSB is outside active BWP

A.6.6.4.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* makes correct reporting of L1-RSRP measurement when CD-SSB is outside active BWP. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.6.6.4.1.1-1.

The test environment is the same as in A.6.6.4.1 with following exceptions in table A.6.6.4.1.2-1.

Table A.6.6.4.1.2-1

Parameter	Config	Unit	Value

Dedicated BWP configuration	1~3		DLBWP.1.2 ULBWP.1.2

A.6.6.4.7.2 Test Requirements

The test requirements are the same as in A.6.6.4.1.3.

A.6.6.4.8 CSI-RS based L1-RSRP measurement when DRX is not used when CD-SSB is outside active BWP

A.6.6.4.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement when CD-SSB is outside active BWP. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.6.6.4.3.1-1.

The test is for UE supporting *rlm-BM-BFD-CSI-RS-OutsideActiveBWP-r18* and the UE is not required past legacy test in A.6.6.4.3.

The test environment is the same as in A.6.6.4.3.2 with following exceptions in table Table A.6.6.4.3.2-1.

The value of parameter “Dedicated BWP configuration” is DLBWP.1.2 and ULBWP.1.2.

NOTE: The starting PRB index of the SSB can be any possible PRB index of the RF channel BW occurring after the last PRB of the DL active BWP.

The test requirements are the same as in A.6.6.4.3.3.

A.6.6.4.9 SSB based L1-RSRP measurement for UE supporting NCD-SSB based L1 measurement outside active BWP when DRX is not used

A.6.6.4.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.6.6.4.9.1-1.

Table A.6.6.4.9.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.9.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.6.4.9.2-1 and table A.6.6.4.9.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured. During time duration T1, the UE shall not have any timing information of NR Cell 2.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.6.6.4.9.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
CD-SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
NCD-SSB configuration	1		[SSB.9 FR1]
	2		[SSB.9 FR1]
	3		[SSB.10 FR1]
OCNG Patterns	1~3		OP.1
SMTC configuration for NCD-SSB	1~3		[SMTC.2 RedCap]
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		[DLBWP.1.1 RedCap] [ULBWP.1.1 RedCap]
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~3		Off
reportConfigType	1~3		periodic
reportQuantity	1~3		ssb-Index-RSRP
Number of reported RS	1~3		2
L1-RSRP reporting period	1~3	slot	80
T1	1~3	s	5
T2	1~3	s	1
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2:NCD-SSB is configured within dedicated DL BWP.			

Table A.6.6.4.9.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~3	dBm/15 kHz	-94.65			

N_{oc} Note2	1,2	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~3	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/18.36 MHz	-60.77	-60.77	-63.78	-59.01
$\hat{E}_s/N_{oc}$	1~3	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.4.9.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than [620]ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.5 Inter-RAT UTRAN FDD measurements

A.6.6.5.1 SA NR - UTRAN FDD event-triggered reporting in non-DRX in FR1

A.6.6.5.1.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT UTRAN FDD measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in clause 9.4.6.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT UTRAN FDD neighbour cell. In the measurement control information from the PCell it is indictated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are shown in table A.6.6.5.1.1-1. General test parameters are provided in table A.6.6.5.1.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.6.6.5.1.1-3 and A.6.6.5.1.1-4, respectively.

Table A.6.6.5.1.1-1: Supported test configurations in SA inter-RAT UTRAN FDD event triggered reporting in non-DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, UTRA FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, UTRA FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, UTRA FDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.5.1.1-2: General test parameters for SA inter-RAT UTRAN FDD event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Value	Comment

NR RF Channel Number		1	1 NR carrier frequency is used in the test
UTRA RF Channel Number		2	1 UTRA carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.6.6.5.1.1-3 and A.6.6.5.1.1-4.	
Active cell		Cell 1	Cell 1 is on RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on RF channel number 2
Gap Pattern Id		0	As specified in clause Table 9.1.2-1. Per-UE gap pattern.
Inter-RAT UTRA measurement quantity		CPICH Ec/Io	Measurement quantity for Cell 2
b1-ThresholdUTRA-FDD	dB	-16.5	CPICH Ec/Io threshold for SS-RSRP measurement on cell1 for event B1
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	OFF
T1	s	5	
T2	s	5	
NOTE 1: Values are defined in table A.6.6.5.1.1-3			

Table A.6.6.5.1.1-3: PCell specific test parameters for SA inter-RAT UTRAN FDD event triggered reporting in non-DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3	1	
Duplex mode			1, 2, 3	FDD	
TDD Configuration	SCS=15 KHz		2	TDDConf.1.1	
	SCS=30 KHz		3	TDDConf.2.1	
$BW_{channel}$		MHz	1	10: $N_{PRB,c}$ = 52 (FDD)	
			2	10: $N_{PRB,c}$ = 52 (TDD)	
			3	40: $N_{PRB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1	SR.1.1 FDD	
			2	SR.1.1 TDD	
			3	SR.2.1 TDD	
CORESET reference channel			1	CR.1.1 FDD	
			2	CR.1.1 TDD	
			3	CR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3	DLBWP.1.1	
	Initial UL BWP		1, 2, 3	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3	ULBWP.1.1	
OCNG pattern[Note1]			1, 2, 3	OP.1	
SMTC configuration			1, 2, 3	SMTC.1	
SSB configuration			1, 2	SSB.1 FR1	
			3	SSB.2 FR1	
CSI-RS for tracking			1	TRS.1.1 FDD	
			2	TRS.1.1 TDD	
			3	TRS.1.2 TDD	
EPRE ratio of PSS to SSS		dB	1, 2, 3	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3	-106	
N_{oc}[Note2]		dBm/SCS	1, 2	-106	
			3	-103	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3	18	-2
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3	18	-2

Parameter	Unit	Configuration	Cell 1	
			T1	T2
SS-RSRP[Note3]	dBm/SCS	1, 2	-88	-108
		3	-85	-105
SSB_RP[Note3]	dBm/SCS	1, 2	-88	-108
		3	-85	-105
Io[Note3]	dBm/9.36 MHz	1, 2	-59.98	-75.92
	dBm/38.16 MHz	3	-53.88	-69.82
Propagation condition		1, 2, 3	ETDLA30	
Antenna Configuration and Correlation Matrix		1, 2, 3	1x2 Low	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

Table A.6.6.5.1.1-4: UTRAN neighbour cell specific test parameters for SA inter-RAT UTRAN FDD event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Cell 2	
		T1	T2
UTRA RF Channel Number		2	
CPICH_Ec/Ior	dB	-10	
PCCPCH_Ec/Ior	dB	-12	
SCH_Ec/Ior	dB	-12	
PICH_Ec/Ior	dB	-15	
DPCH_Ec/Ior	dB	N/A	
OCNS		-0.941	
$\hat{I}_{or}/I_{oc}$	dB	-Infinity	-1.8
I_{oc}	dBm/3.84 MHz	-70	
CPICH_Ec/Io	dB	-Infinity	-14
Propagation Condition		AWGN	
NOTE 1: The DPCH level is controlled by the power control loop. NOTE 2: The power of the OCNS channel that is added shall make the total power from the cell to be equal to I_{or}.			

A.6.6.5.1.2 Test Requirements

The UE shall send one Event B1 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 2.4 s from the start of period T2, i.e. when Cell 2 becomes detectable. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.6 CLI measurements

A.6.6.6.1 SRS-RSRP measurement with DRX

A.6.6.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of SRS-RSRP measurement. This test will verify the SRS-RSRP measurement requirements in clause 9.7.2.5 with the testing configurations for NR cells in table A.6.6.6.1.1-1.

Table A.6.6.6.1.1-1: Applicable NR configurations for FR1 SRS-RSRP test

Configuration	Description
1	NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.6.1.2 Test Parameters

One cell is deployed in the test, which is FR1 PCell (Cell 1). The test parameters for PCell is given in table A.6.6.6.1.2-1 and A.6.6.6.1.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system transmits SRS resource for measurement in the DL slot according to the SRS configuration in table A.6.6.6.1.2-4 and the test parameters for the (virtual) neighbour cell UE in table A. 6.6.6.1.2-3. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 1 data symbol before SRS to be transmitted.

Table A.6.6.6.1.2-1: General test parameters for SRS-RSRP event triggered reporting for PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	Cell 1	
RF Channel Number		1, 2	1: Cell 1	
SSB configuration		1	SSB.1 FR1	
		2	SSB.2 FR1	
SMTC configuration		1	SMTC.1	
		2	SMTC.1	
SRS configuration		1	SRSConf.1	Table A.6.6.6.1.2-3
		2	SRSConf.2	
CP length		1, 2	Normal	
i1-Threshold	dBm	1	-97	
		2	-95	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	DRX.7	
Time offset between DL from serving cell and SRS from test system	µs	1,2	17.67	
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.6.6.6.1.2-2: NR Cell specific test parameters for SRS-RSRP event triggered reporting for PCell in FR1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1	TDDConf.1.1	
		2	TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 TDD	
		2	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 TDD	
		2	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 TDD	
		2	CCR.2.1 TDD	
OCNG Patterns		1, 2	OP.1	
TRS Configuration		1	TRS.1.1 TDD	
		2	TRS.1.2 TDD	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1	

Active UL BWP configuration		1, 2	ULBWP.1.1
N_{oc} Note 2	dBm/15 kHz	1	-98
		2	
N_{oc} Note 2	dBm/SCS	1	-98
		2	-95
Propagation Condition		1, 2	AWGN
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			

Table A.6.6.6.1.2-3: NR Cell specific test parameters for SRS-RSRP event triggered reporting for neighbour cell UE

Parameter	Unit	Test configuration	Neighbour cell UE	
			T1	T2
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-95	
$\hat{E}_s/I_{ot}$	dB	1	-infinity	4
		2		
$\hat{E}_s/N_{oc}$	dB	1	-infinity	4
		2		
SRS-RSRP Note 3	dBm/SCS kHz	1	-infinity	-94
		2	-infinity	-91
Io	dBm/9.36 MHz	1	-70.05	-64.59
	dBm/38.16 MHz	2	-63.96	-58.50
Propagation Condition		1, 2	AWGN	
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

Table A.6.6.6.1.2-4: SRS configuration for measurement reporting

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	12	12	
	freqHopping	0	0	

	b-SRS			
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset	sl640, 4	sl640, 9	
	sequenceId	0	0	Any 10 bit number

A.6.6.6.1.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 1920 ms from the beginning of time period T2.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.6.2 CLI-RSSI measurement with DRX

A.6.6.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of CLI-RSSI measurement. This test will verify the CLI-RSSI measurement requirements in clause 9.7.3.5 with the testing configurations for NR cells in table A.6.6.6.2.1-1.

Table A.6.6.6.2.1-1: Applicable NR configurations for FR1 CLI-RSSI test

Configuration	Description
1	NR 15 kHz SCS, 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.6.2.2 Test Parameters

One cell is deployed in the test, which are FR1 PCell (Cell 1). The test parameters for PCell is given in table A.6.6.6.2.2-1 and A.6.6.6.2.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI measurement resource and on 1 data symbol before. The CLI-RSSI measurement resource configuration is in table A.6.6.6.2.2-3.

Table A.6.6.6.2.2-1: General test parameters for CLI-RSSI event triggered reporting for PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	NR Cell 1	
RF Channel Number		1, 2	1: Cell 1	
SSB configuration		1	SSB.1 FR1	
		2	SSB.2 FR1	
SMTC configuration		1	SMTC.1	
		2	SMTC.1	
CLI-RSSI configuration		1	CLI-RSSIConf.1	Table A.6.6.6.2.2-3
		2	CLI-RSSIConf.2	
CP length		1, 2	Normal	
i1-Threshold	dBm	1	-93	
		2	-93	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	

Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	DRX.7	
Time offset between DL from serving cell and OCNG from test system	μs	1,2	17.67	
T1	s	1, 2	5	
T2	s	1, 2	2	

Table A.6.6.6.2.2-2: NR Cell specific test parameters for CLI-RSSI event triggered reporting for PCell in FR1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1	TDDConf.1.1	
		2	TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 TDD	
		2	SR.2.1 TDD	
PUSCH parameters		1	N/A	
		2		
RMSI CORESET RMC configuration		1	CR.1.1 TDD	
		2	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 TDD	
		2	CCR.2.1 TDD	
OCNG Patterns Note 3		1, 2	OP.1	
TRS Configuration		1	TRS.1.1 TDD	
		2	TRS.1.2 TDD	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1	
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/15 kHz	1	-116	-108
		2		
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/SCS	1	-116	-108
		2	-113	-105
Io on CLI-RSSI measurement resource	dBm/9.36 MHz	1	-88.05	-80.05
	dBm/38.16 MHz	2	-81.96	-74.00
Io on CLI-RSSI measurement resource	dBm/1.08 MHz	1	-97.43	-89.43
	dBm/1.08 MHz	2	-97.44	-89.44
Propagation Condition		1, 2	AWGN	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: OCNG is not transmitted in the CLI-RSSI measurement resources.

Table A.6.6.6.2.2-3: CLI-RSSI measurement resource configuration for measurement reporting

	Field	CLI-RSSIConf.1	CLI-RSSIConf.2
RSSI-Resource	rssi-ResourceId	0	0
	rssi-SCS	15	30
	startPRB	0	0
	nrofPRBs	52	106
	startPosition	3	3
	nrofSymbols	11	11
	rssi-PeriodicityAndOffset	sl640, 4	sl640, 9

A.6.6.6.2.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 640 ms from the beginning of time period T2. The nominal RSSI used to evaluate the requirement shall be based on Io.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.7 NR measurements with autonomous gaps

A.6.6.7.1 SA intra-frequency CGI identification of NR neighbor cell in FR1

A.6.6.7.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of intra-frequency CGI identification of an NR neighbour cell in FR1 with autonomous gaps. This test shall partly verify the measurement requirements in clause 9.11.

A.6.6.7.1.2 Test Parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the FR1 PCell and Cell 2 is an FR1 neighbour cell on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.6.6.7.1.1-2 and A.6.6.7.1.3-2 below. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable. A measurement object is configured for the frequency of the PCell and it is indicated to the UE that event-triggered reporting with Event A3 is used. The UE is expected to detect and send a measurement report with Event A3.

A new RRC message triggering CGI identification shall be sent to the UE during period T2, after the UE has reported Event A3. The RRC message shall create a measurement report configuration with purpose *reportCGI* and *useAutonomousGaps* set to *setup*. The start of T3 is the instant when the last TTI containing the RRC message implying CGI identification is sent to the UE.

The test equipment verifies that potential interruption is carried out correctly by monitoring ACK/NACK sent in PCell during T3 untill a measurement report with CGI is sent.

Table A.6.6.71.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.7.1.2-2: General test parameters for SA intra-frequency CGI identification of NR neighbor cell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A3-Offset	dB	1, 2, 3	-4.5	

CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	
T3	s	1, 2, 3	5	

Table A.6.6.7.1.2-3: NR Cell specific test parameters for SA intra-frequency CGI identification of NR neighbor cell in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			N/A		
		2	SR.1.1 TDD					
		3	SR.2.1 TDD					
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Patterns		1, 2, 3	OP.1			OP.1		
TRS Configuration		1	TRS.1.1 FDD			N/A		
		2	TRS.1.1 TDD			N/A		
		3	TRS.1.2 TDD			N/A		
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1			DLBWP.0.1 ULBWP.0.1		
Active DL BWP configuration		1, 2, 3	DLBWP.1.1			DLBWP.1.1		
Active UL BWP configuration		1, 2, 3	ULBWP.1.1			ULBWP.1.1		
RLM-RS		1, 2, 3	SSB			SSB		
N_{oc} Note 2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note 2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-1.46	-Infinity	-1.46	-1.46
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	4	4	4	-Infinity	4	4
		2						
		3						
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-94	-Infinity	-94	-94
		2	-94	-94	-94	-Infinity	-94	-94
		3	-91	-91	-91	-Infinity	-91	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	-62.25	--64.60	-62.25	-62.25

	dBm/9.36 MHz	2	-64.60	-62.25	-62.25	--64.60	-62.25	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	-56.16	--58.50	-56.16	-56.16
Propagation Condition		1, 2, 3	AWGN					
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.								
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

A.6.6.7.1.3 Test Requirements

The UE shall send a measurement report containing the CGI of Cell 2 within 255 ms from the start of time period T3.

Test requirement = RRC Procedure delay + $T_{identify_CGI}$ + TTI insertion uncertainty.

= 10 + 240 + 2 ms from the start of T3

= 252 ms, allow 255 ms

The UE shall be scheduled continuously throughout the test. From the start of T3 until 252 ms, the interruption on PCell shall not be more than the values specified for SA in clause 8.2.2.2.14.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.7.2 Identification of a new CGI of inter-RAT E-UTRA cell using autonomous gaps in NR SA

A.6.6.7.2.1 Test Purpose and Environment

This test is to verify the requirement for identification of a new CGI of E-UTRA cell with autonomous gaps in NR SA in clause 9.4.7.

The test scenario comprises of one NR carrier and an E-UTRA carrier and two cells as given in tables A.6.6.7.2.1-1, A.6.6.7.2.1-2, A.6.6.7.2.1-3 and A.6.6.7.2.1-4. PDCCHs indicating new transmissions shall be sent continuously to ensure that the UE would have ACK/NACK sending during identifying a new CGI of E-UTRAN cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report.

A RRC message implying SI reading shall be sent to the UE during period T2, after the UE has reported Event B2. The RRC message shall create a measurement report configuration with purpose *reportCGI* and *useAutonomousGaps* set to setup. The start of T3 is the instant when the last TTI containing the RRC message implying SI reading is sent to the UE.

Table A.6.6.7.2.1-1: Supported test configurations of inter-RAT E-UTRAN cell using autonomous gap in SA

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.7.2.1-2: General test parameters for identification of a new CGI of inter-RAT E-UTRA cell using autonomous gaps in NR SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		2	1 LTE carrier frequency is used in the test
Active cell		Cell 1	
Neighbour cell		Cell 2	Cell to be identified.
LTE Channel Bandwidth	MHz	10	
LTE PDSCH/PCFICH/PDCCH/PHICH parameters			As specified in clause A.3.7.2.1
CP length		Normal	
Hysteresis	dB	0	
Time To Trigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	
useAutonomousGaps		setup	As specified in clause 5.5.3.1 in TS 38.331.
Time offset between cells	ms	3	Asynchronous cells
T1	s	5	
T2	s	≤10	
T3	s	5	

Table A.6.6.7.2.1-3: PCell specific test parameters for identification of a new CGI of inter-RAT E-UTRA cell using autonomous gaps in NR

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3, 4, 5, 6	1		
Duplex mode			1, 2, 3	FDD		
			4, 5, 6	TDD		
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1		
	SCS=30 KHz		3, 6	TDDConf.2.1		
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)		
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)		
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)		
PDSCH reference measurement channel			1, 4	SR.1.1 FDD		
			2, 5	SR.1.1 TDD		
			3, 6	SR.2.1 TDD		
CORSET reference channel			1, 4	CR.1.1 FDD		
			2, 5	CR.1.1 TDD		
			3, 6	CR.2.1 TDD		
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1		
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1		
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1		
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1		
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1		
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration			1, 2, 4, 5	SSB.1 FR1		
			3, 6	SSB.2 FR1		
b2-Threshold1		dBm/SCS	1, 2, 4, 5	-98		
			3, 6	-95		
b2-Threshold2EUTRA		dBm/15 kHz	1, 2, 3, 4, 5, 6	-109		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0		
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS						

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]	dBm/15 KHz	1, 2, 3, 4, 5, 6	-106		
N_{oc}[Note2]	dBm/SCS	1, 2, 4, 5	-106		
		3, 6	-103		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	18	-2	
$\hat{E}_s/I_{ot}$[Note3]	dB	1, 2, 3, 4, 5, 6	18	-2	
SS-RSRP[Note3]	dBm/SCS	1, 2, 4, 5	-88	-108	
		3, 6	-85	-105	
SSB_RP[Note3]	dBm/SCS	1, 2, 4, 5	-88	-108	
		3, 6	-85	-105	
Io[Note3]	dBm/9.36 MHz	1, 2, 4, 5	-59.98	-75.92	
	dBm/38.16 MHz	3, 6	-53.88	-69.82	
Propagation condition		1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.7.2.1-4: Cell specific test parameters for inter-RAT E-UTRAN cell for identification of a new CGI of E-UTRA cell using autonomous gaps

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6	2		
Duplex mode		1, 2, 3	FDD		
		4, 5, 6	TDD		
TDD special subframe configuration[Note1]		4, 5, 6	6		
TDD uplink-downlink configuration[Note1]		4, 5, 6	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	10 MHz: $N_{PRB,c}$ = 50		
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	10 MHz: R.3 FDD		
		4, 5, 6	10 MHz: R.0 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	10 MHz: R.6 FDD		
		4, 5, 6	10 MHz: R.6 TDD		
OCNG Patterns[Note2]		1, 2, 3	10 MHz: OP.10 FDD		
		4, 5, 6	10 MHz: OP.1 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note3]					
OCNG_RB[Note3]					
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-106		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7	7
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	-Infinity	7	7
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-99	-99
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-99	-99

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low		
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].					
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.					
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					

A.6.6.7.2.2 Test Requirements

The UE shall transmit a measurement report containing the cell global identifier of Cell 2 within 200 milliseconds from the start of T3.

Test requirement = RRC Procedure delay with additional margin + $T_{identify_CGI,E\text{-}UTRAN}$ + TTI insertion uncertainty.

= 15 + 30 + 150 + 2 ms from the start of T3

= 197 ms, allow 200 ms.

- The UE shall be scheduled continuously throughout the test, and from the start of T3 until 200 ms at least the number of ACK/NACK specified in NOTE 2 shall be detected as being transmitted by the UE.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE 1: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

NOTE 2: The overall ACK/NACK number is caused by two parts. Firstly, at least X ACK/NACK shall be sent during identifying the cell global identifier of Cell 2, where X is defined in table 8.2.2.2.15-1. Secondly, given that continuous DL data allocation, additional 43, 14 and 34 ACK/NACK shall be sent for FDD 15 kHz, TDD 15 kHz and TDD 30 kHz, respectively, from the start of T3 until 200 ms excludes 150 ms for identifying the cell global identifier of Cell 2.

A.6.6.8 L1-SINR measurement for beam reporting

A.6.6.8.1 L1-SINR measurement with CSI-RS based CMR and no dedicated IMR configured when DRX is used

A.6.6.8.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements in clause 9.8.4.1, with the testing configurations for NR cells in table A.6.6.8.1.1-1.

Table A.6.6.8.1.1-1: Applicable NR configurations for FR1 CSI-RS based L1-SINR test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.8.1.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.6.8.1.2-1 and table A.6.6.8.1.2-2 below.

In the CSI-RS measurement configuration, UE is indicated to perform L1-SINR measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (1 Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.6.6.8.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.6.6.8.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
CSI-RS configuration	1		CSI-RS.1.3 FDD
	2		CSI-RS.1.3TDD
	3		CSI-RS.2.3TDD
OCNG Patterns	1~3		OP.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
DRX configuration	1~3		DRX.3
reportConfigType	1~3		aperiodic
reportQuantity-r16	1~3		cri-SINR-r16
Number of reported RS	1~3		2
qcl-Info	1~3		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~3	slots	26
T1	1~3	s	5
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			

Parameter	Config	Unit	Value
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.6.6.8.1.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~3	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2	dBm/SSB SCS	-94.65	
	3		-91.65	
$\hat{E}_s / I_{ot}$	1~3	dB	0	3
CSI-RS RSRP Note3	1,2	dBm/SSB SCS	-94.65	-91.65
	3		-91.65	-88.65
Io Note2	1,2	dBm/9.36 MHz	-63.69	-61.93
	3	dBm/38.16 MHz	-57.59	-55.84
$\hat{E}_s / N_{oc}$	1~3	dB	0	3
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.6.8.1.3 Test Requirements

After 80 ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.27.1.1 and relative accuracy requirement in clause 10.1.27.1.2.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.8.2 L1-SINR measurement with SSB based CMR and dedicated IMR when DRX is not used

A.6.6.8.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements in clause 9.8.4.2, with the testing configurations for NR cells in table A.6.6.8.2.1-1.

Table A.6.6.8.2.1-1: Applicable NR configurations for FR1 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

Config	Description

1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.8.2.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.6.8.2.2-1 and table A.6.6.8.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the SSBs and the associated CSI-RS resources, and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD measurements based on the SSBs, and UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-RS resources as IMR.

Table A.6.6.8.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	c		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
CSI-RS configuration	1		CSI-RS 1.1A FDD
	2		CSI-RS 1.1A TDD
	3		CSI-RS 2.1A TDD
OCNG Patterns	1~3		OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~3		off
reportConfigType	1~3		periodic
reportQuantity-r16	1~3		ssb-Index-SINR-r16
Number of reported RS	1~3		2
L1-SINR reporting period	1~3	slot	80
T1	1~3	s	5
T2	1~3	s	1
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			

Parameter	Config	Unit	Value
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.6.6.8.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~3	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~3	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

Table A.6.6.8.2.2-3: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0		CSI-RS#1	
			T1	T2	T1	T2
N_{oc} Note2	1~3	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2	dBm/CSI-RS SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~3	dB	0	0	-Infinity	3
CSI-RS RSRP Note3	1,2	dBm/CSI-RS SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.8.2.3 Test Requirements

The UE shall send L1-SINR report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-SINR report including results of both SSB#0+CSI-RS#0 and SSB#1+CSI-RS#1 while meeting the accuracy requirement in clause 10.1.27.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.8.3 L1-SINR measurement with CSI-RS based CMR and dedicated IMR configured when DRX is not used

A.6.6.8.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements with CSI-RS based CMR and dedicated IMR cofigured in clause 9.8.4.3, with the testing configurations for NR cells in table A.6.6.8.3.1-1.

Table A.6.6.8.3.1-1: Applicable NR configurations for FR1 L1-SINR test with CMR and dedicated IMR

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.8.3.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.6.8.3.2-1 and table A.6.6.8.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the configured CSI-RS as CMR and an associated CSI-IM as IMR, and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources. UE is also configured to measure L1-SINR based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (1 Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.6.6.8.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs, and UE is configured to perform L1-SINR measurement based on the CSI-RS as CMR and the CSI-IM as IMR.

Table A.6.6.8.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1

Parameter	Config	Unit	Value
	3		SSB.4 FR1
CSI-RS configuration	1		CSI-RS 1.3 FDD
	2		CSI-RS 1.3 TDD
	3		CSI-RS 2.3 TDD
CSI-IM configuration	1		CSI-IM.1.2 FDD
	2		CSI-IM.1.2 TDD
	3		CSI-IM.2.2 TDD
OCNG Patterns	1~3		OP.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
DRX configuration	1~3		Off
reportConfigType	1~3		aperiodic
reportQuantity-r16	1~3		cri-SINR-r16
Number of reported RS	1~3		2
qcl-Info	1~3		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~3	slots	26
T1	1~3	s	5
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

A.6.6.8.3.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~3	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2	dBm/SSB SCS	-94.65	
	3		-91.65	
$\hat{E}_s/I_{ot}$	1~3	dB	0	3
CSI-RS RSRP Note2	1,2	dBm/SSB SCS	-94.65	-91.65
	3		-91.65	-88.65
Io Note2	1,2	dBm/9.36 MHz	-63.69	-61.93
	3	dBm/38.16 MHz	-57.59	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	3
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.6.8.3.3 Test Requirements

After 80 ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 as CMR + CSI-IM#0 as IMR and CSI-RS#1 as CMR + CSI-IM#1 as IMR while meeting the accuracy requirement in clause 10.1.27.3.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.9 Idle Mode CA/DC Measurements

A.6.6.9.1 SA Idle mode CA/DC measurement for FR1

A.6.6.9.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE performs the required measurements on the serving cell and the configured inter-frequency carrier for idle mode measurement reporting after the UE has entered Idle mode. This test will partly verify the Idle mode CA/DC measurements requirements in clause 4.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.9.1.1-1, A.6.6.9.1.1-2, A.6.6.9.1.1-3 and A.6.6.9.1.1-4.

The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. During T1, the UE is connected to Cell 1 only and shall not have any timing information of Cell 2. UE is configured with early measurement reporting with channel 2. Beam level reporting for early measurements is not configured. The connection is released at the end of T1. T2 starts when the connection is released. During the time periods T2 UE is in Idle mode. At T3 the UE is paged for connection setup and requested by the network to send idle mode measurements.

Table A.6.6.9.1.1-1: supported test configuration

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.9.1.1-2: General test parameters for SA Idle mode CA/DC measurement for FR1

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
SMTC-SSB parameters		Config 1	SSB.1 FR1	As specified in clause A.3.10.1
		Config 2	SSB.1 FR1	As specified in clause A.3.10.1
		Config 3	SSB.2 FR1	As specified in clause A.3.10.1
Hysteresis	dB	Config 1,2,3	0	
PRACH configuration index		Config 1,2,3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX in connected mode		Config 1,2,3	OFF	DRX is not used
DRX in idle mode	s	Config 1,2,3	0.32	The value shall be used for all cells in the test.

Parameter	Unit	Test configuration	Value	Comment
T331	s		300	
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	10	
T2	s	Config 1,2,3	11.52	
T3	s	Config 1,2,3	10	

Table A.6.6.9.1.1-3: Cell specific test parameters for connected mode for SA Idle mode CA/DC measurement for FR1

Parameter		Unit	Test configuration	Cell 1			Cell 2		
				T1	T2	T3	T1	T2	T3
NR RF Channel Number			Config 1,2,3	1			2		
Duplex mode			Config 1	FDD					
			Config 2,3	TDD					
TDD configuration			Config 1	Not Applicable					
			Config 2	TDDConf.1.1					
			Config 3	TDDConf.2.1					
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
			Config 3	40: $N_{PRB,c}$ = 106					
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
			Config 3	40: $N_{PRB,c}$ = 106					
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1			NA		
	Initial UL BWP			ULBWP.0.1			NA		
	Dedicated DL BWP			DLBWP.1.1			NA		
	Dedicated UL BWP			ULBWP.1.1			NA		
TRS configuration			Config 1	TRS.1.1 FDD			NA		
			Config 2	TRS.1.1 TDD			NA		
			Config 3	TRS.1.2 TDD			NA		
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1			OP.1		
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			SR.1.1 FDD		
			Config 2	SR.1.1 TDD			SR.1.1 TDD		
			Config 3	SR2.1 TDD			SR2.1 TDD		
CORESET Reference Channel			Config 1	CR.1.1 FDD			CR.1.1 FDD		
			Config 2	CR.1.1 TDD			CR.1.1 TDD		
			Config 3	CR2.1 TDD			CR2.1 TDD		
SSB parameters			Config 1	SSB.1 FR1			SSB.5 FR1		
			Config 2	SSB.1 FR1			SSB.5 FR1		
			Config 3	SSB.2 FR1			SSB.6 FR1		
SMTC configuration defined in A.3.11			Config 1	SMTC.2			SMTC.5		
			Config 2, 3	SMTC.1			SMTC.4		
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15					
			Config 3	30					
EPRE ratio of PSS to SSS			Config 1,2,3	0			0		
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz		-98			-98		
N_{oc} Note2	dBm/SCS	Config 1,2	-98			-98		
		Config 3	-95			-95		
SS-RSRP Note 3	dBm/SCS	Config 1,2	-91	-91	-91	-infinity	-98	-98
		Config 3	-88	-88	-88	-infinity	-95	-95
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	7	7	7	-infinity	0	0
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	7	7	7	infinity	0	0
Io Note3	dBm/9.36 MHz	Config 1,2	-62.26	-62.26	-62.26	-70.5	-67.04	-67.04
	dBm/38.16 MHz	Config 3	-56.15	-56.15	-56.15	-63.94	-60.93	-60.93
Propagation Condition		Config 1,2,3	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.6.6.9.1.1-4: Cell specific test parameters for idle mode for SA Idle mode CA/DC measurement for FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number		1,2,3	1			2		
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-140			-140		
		3	-137			-137		
Pcompensation	dB	1, 2, 3	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
$\hat{E}_s/I_{ot}$	dB	1	14	14	14	-infinity	12	12
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	7	7	7	-infinity	0	0
		2						
		3						
$\hat{E}_s/I_{ot}$	dB	1, 2, 3	7	7	7	-infinity	0	0
SS-RSRP Note3	dBm/SCS	1	-91	-91	-91	-infinity	-98	-98
		2	-91	-91	-91	-infinity	-98	-98
		3	-88	-88	-88	-infinity	-95	-95
Io	dBm/9.36 MHz	1	-62.26	-62.26	-62.26	-70.5	-67.04	-67.04
	dBm/9.36 MHz	2	-62.26	-62.26	-62.26	-70.5	-67.04	-67.04
	dBm/38.16 MHz	3	-56.15	-56.15	-56.15	-63.94	-60.93	-60.93
Treselection	s	1, 2, 3	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2, 3	Not sent			Not sent		
Propagation Condition		1, 2, 3	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.9.1.2 Test Requirements

The UE behaviour during time durations T2 and T3 shall be as follows:

During the time period T2 the UE is in Idle mode and the signal level of Cell 2 is changed. The UE shall not perform reselection. The UE shall perform Idle Mode CA measurement according to section 4.4.

At the start of T3 the UE is paged for connection setup. During the connection setup the UE is requested to transmit early measurement report for Cell 2. The UE shall send early measurement report to the PCell.

After receiving the requested early measurement report, the test equipment verifies the accuracy of measurement reported for Cell 2 meets the requirements in section 10.1.4B for SS-RSRP and in section 10.1.8B for SS-RSRQ and test ends.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.9.2 Idle mode fast CA/DC eEMR measurement for FR1 without valid reporting

A.6.6.9.2.1 Test Purpose and Environment

The purpose of this test is to verify UE measurement reporting behaviour as specified in clause 4.7 when the UE supports *measValidationReportEMR-r18*. This test will partly verify the fast CA/DC measurement reporting requirements in clause 4.7 when *measIdleValidityDuration-r18* is configured for the test case when there are no measurement results to report at RRC connection setup.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as inter-frequency neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.9.2.1-1, A.6.6.9.2.1-2, A.6.6.9.2.1-3.

The test consists of 4 successive time periods, with time duration of T1, T2, T3 and T4 respectively.

During T1, the UE is connected to Cell 1 only and shall not have any timing information of Cell 2. UE is configured with early measurement reporting for Cell 2 in *measIdleCarrierListNR-r16*. Beam level reporting for early measurements is not configured. The time point when UE receives RRC_Release message from the TE defines the starting point of T2.

During T2 and T3 the UE is in idle mode.

At the beginning of T2, Cell 2 becomes detectable however cell reselection shall not be performed. Signal level of Cell 2 is set to the value given in table A.6.6.9.2.1-3. The time when T331 timer expires defines the ending point of T2.

At the beginning of T3, the signal level of the neighbour cell is set to turned off. The duration of the T3 equals to *measIdleValidityDuration-r18.*

The time when TE sends the paging message is defined as the starting point of T4. During T4, in this test the UE shall not send measurement report.

Table A.6.6.9.2.1-1: supported test configuration

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.9.2.1-2: General test parameters for Idle mode fast CA/DC eEMR measurement for FR1

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies are used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
SMTC-SSB parameters		Config 1	SSB.1 FR1	As specified in clause A.3.10.1
		Config 2	SSB.1 FR1	As specified in clause A.3.10.1
		Config 3	SSB.2 FR1	As specified in clause A.3.10.1
Hysteresis	dB	Config 1,2,3	0	
PRACH configuration index		Config 1,2,3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX in connected mode		Config 1,2,3	OFF	DRX is not used
DRX in idle mode	s	Config 1,2,3	0.32	The value shall be used for all cells in the test.
T331	s		30	
measIdleValidityDuration-r18	s		10	

Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	30	
T3	s	Config 1,2,3	10	
T4	s	Config 1,2,3	1	

Table A.6.6.9.2.1-3: Cell specific test parameters for Idle and connected mode for fast CA/DC eEMR measurement for FR1

Parameter		Unit	Test configuration	Cell 1				Cell 2			
				T1	T2	T3	T4	T1	T2	T3	T4
NR RF Channel Number			Config 1,2,3	1				2			
Duplex mode			Config 1	FDD							
			Config 2,3	TDD							
TDD configuration			N.A	N.A							
			TDDConf.1.1	TDDConf.1.1							
			TDDConf.2.1	TDDConf.2.1							
BWchannel		MHz	Config 1,2	10: NRB,c = 52							
			Config 3	40: NRB,c = 106							
BWP BW		MHz	Config 1,2	10: NRB,c = 52							
			Config 3	40: NRB,c = 106							
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1				NA			
	Initial UL BWP			ULBWP.0.1				NA			
	Dedicated DL BWP			DLBWP.1.1				NA			
	Dedicated UL BWP			ULBWP.1.1				NA			
TRS configuration			Config 1	TRS.1.1 FDD				NA			
			Config 2	TRS.1.1 TDD				NA			
			Config 3	TRS.1.2 TDD				NA			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1				OP.1			
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD				SR.1.1 FDD			
			Config 2	SR.1.1 TDD				SR.1.1 TDD			
			Config 3	SR2.1 TDD				SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD				CR.1.1 FDD			
			Config 2	CR.1.1 TDD				CR.1.1 TDD			
			Config 3	CR2.1 TDD				CR2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1				SSB.5 FR1			
			Config 2	SSB.1 FR1				SSB.5 FR1			
			Config 3	SSB.2 FR1				SSB.6 FR1			
SMTC configuration defined in A.3.11			Config 1	SMTC.2				SMTC.5			
			Config 2, 3	SMTC.1				SMTC.4			
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15							
			Config 3	30							
EPRE ratio of PSS to SSS			Config 1,2,3	0				0			
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											

Parameter	Unit	Test configuration	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
EPRE ratio of PDCCH DMRS to SSS										
EPRE ratio of PDCCH to PDCCH DMRS										
EPRE ratio of PDSCH DMRS to SSS										
EPRE ratio of PDSCH to PDSCH										
EPRE ratio of OCNG DMRS to SSS(Note 1)										
EPRE ratio of OCNG to OCNG DMRS (Note 1)										
N_{oc} Note2	dBm/15 kHz		-98				-98			
N_{oc} Note2	dBm/SCS	Config 1,2	-98				-98			
		Config 3	-95				-95			
SS-RSRP Note 3	dBm/SCS	Config 1,2	-91				-infinity	-98	infinity	infinity
		Config 3	-88				-infinity	-95	infinity	infinity
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	7				- infinity	0	infinity	infinity
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	7				infinity	0	infinity	infinity
IoNote3	dBm/9.36 MHz	Config 1,2	-62.26				-70.05	-67.04	-70.05	-70.05
	dBm/38.16 MHz	Config 3	-56.15				-63.96	-60.93	-63.96	-63.96
Propagation Condition		Config 1,2,3	AWGN				AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.9.2.2 Test Requirements

During the period T2 and T3, the UE shall not perform reselection.

At the start of T4 the UE is paged for connection setup. During the connection setup the UE is requested to transmit early measurement report for Cell 2.

The UE shall NOT send early measurement report to the PCell in this test.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.9.3 Idle mode fast CA/DC cell reselection measurement for FR1 without valid reporting

A.6.6.9.3.1 Test Purpose and Environment

The purpose of this test is to verify UE measurement reporting behaviour as specified in clause 4.7 when the UE supports *measValidationReportReselectionMeasurements-r18*. This test will partly verify the fast CA/DC measurement reporting requirements in clause 4.7 when *measReselectionValidityDuration-r18* is configured for the test case when there are no measurement results to report at RRC connection setup.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as inter-frequency neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.9.3.1-1, A.6.6.9.3.1-2, A.6.6.9.3.1-3.

The test consists of 4 successive time periods, with time duration of T1, T2, T3 and T4 respectively.

During T1, the UE is connected to Cell 1 only and shall not have any timing information of Cell 2. UE is configured with inter-frequency measurement reporting for Cell 2 in *MeasReselectionCarrierListNR-r18*. Beam level reporting for early measurements is not configured. The time point when UE receives RRC_Release message from the TE defines the starting point of T2.

During T2 and T3 the UE is in idle mode.

At the beginning of T2, Cell 2 becomes detectable however cell reselection shall not be performed. Signal level of Cell 2 is set to the value given in table A.6.6.9.3.1-3. The duration of T2 is set to fixed value according to the Table A.6.6.9.3.1-2.

At the beginning of T3, the signal level of Cell 2 is set to turned off. The duration of the T3 equals to *measReselectionValidityDuration-r18.*

The time when TE sends the paging message defined as the starting point of T4. During T4, in this test the UE shall not send measurement report.

Table A.6.6.9.3.1-1: supported test configuration

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.9.3.1-2: General test parameters for Idle mode fast CA/DC cell-reselection measurement for FR1

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies are used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
SMTC-SSB parameters		Config 1	SSB.1 FR1	As specified in clause A.3.10.1
		Config 2	SSB.1 FR1	As specified in clause A.3.10.1
		Config 3	SSB.2 FR1	As specified in clause A.3.10.1
Hysteresis	dB	Config 1,2,3	0	
PRACH configuration index		Config 1,2,3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX in connected mode		Config 1,2,3	OFF	DRX is not used
DRX in idle mode	s	Config 1,2,3	0.32	The value shall be used for all cells in the test.
measReselectionValidityDuration-r18	s		5	
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.

		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	30	
T3	s	Config 1,2,3	5	
T4	s	Config 1,2,3	1	

Table A.6.6.9.3.1-3: Cell specific test parameters for Idle and connected mode for fast CA/DC cell re-selection measurement for FR1

Parameter		Unit	Test configuration	Cell 1				Cell 2			
				T1	T2	T3	T4	T1	T2	T3	T4
NR RF Channel Number			Config 1,2,3	1				2			
Duplex mode			Config 1	FDD							
			Config 2,3	TDD							
TDD configuration			N.A	N.A							
			TDDConf.1.1	TDDConf.1.1							
			TDDConf.2.1	TDDConf.2.1							
BWchannel		MHz	Config 1,2	10: NRB,c = 52							
			Config 3	40: NRB,c = 106							
BWP BW		MHz	Config 1,2	10: NRB,c = 52							
			Config 3	40: NRB,c = 106							
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1				NA			
	Initial UL BWP			ULBWP.0.1				NA			
	Dedicated DL BWP			DLBWP.1.1				NA			
	Dedicated UL BWP			ULBWP.1.1				NA			
TRS configuration			Config 1	TRS.1.1 FDD				NA			
			Config 2	TRS.1.1 TDD				NA			
			Config 3	TRS.1.2 TDD				NA			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1				OP.1			
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD				SR.1.1 FDD			
			Config 2	SR.1.1 TDD				SR.1.1 TDD			
			Config 3	SR2.1 TDD				SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD				CR.1.1 FDD			
			Config 2	CR.1.1 TDD				CR.1.1 TDD			
			Config 3	CR2.1 TDD				CR2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1				SSB.5 FR1			
			Config 2	SSB.1 FR1				SSB.5 FR1			
			Config 3	SSB.2 FR1				SSB.6 FR1			
SMTC configuration defined in A.3.11			Config 1	SMTC.2				SMTC.5			
			Config 2, 3	SMTC.1				SMTC.4			
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15							
			Config 3	30							
EPRE ratio of PSS to SSS			Config 1,2,3	0				0			
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of PDCCH DMRS to SSS											
EPRE ratio of PDCCH to PDCCH DMRS											

Parameter	Unit	Test configuration	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
EPRE ratio of PDSCH DMRS to SSS										
EPRE ratio of PDSCH to PDSCH										
EPRE ratio of OCNG DMRS to SSS(Note 1)										
EPRE ratio of OCNG to OCNG DMRS (Note 1)										
N_{oc} Note2	dBm/15 kHz		-98				-98			
N_{oc} Note2	dBm/SCS	Config 1,2	-98				-98			
		Config 3	-95				-95			
SS-RSRP Note 3	dBm/SCS	Config 1,2	-91				-infinity	-98	infinity	infinity
		Config 3	-88				-infinity	-95	infinity	infinity
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	7				- infinity	0	infinity	infinity
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	7				infinity	0	infinity	infinity
IoNote3	dBm/9.36 MHz	Config 1,2	-62.26				-70.05	-67.04	-70.05	-70.05
	dBm/38.16 MHz	Config 3	-56.15				-63.96	-60.93	-63.96	-63.96
Propagation Condition		Config 1,2,3	AWGN				AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.9.3.2 Test Requirements

During the period T2 and T3, the UE shall not perform reselection.

At the start of T4 the UE is paged for connection setup. During the connection setup the UE is requested to transmit early measurement report for Cell 2.

The UE shall NOT send early measurement report to the PCell in this test.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.9.4 Idle mode fast CA/DC cell reselection measurement for FR1 with valid reporting

A.6.6.9.4.1 Test Purpose and Environment

The purpose of this test is to verify UE measurement reporting behaviour as specified in clause 4.7 when the UE supports *measValidationReportReselectionMeasurements-r18* . This test will partly verify the fast CA/DC measurement reporting requirements in clause 4.7 when *measReselectionValidityDuration-r18* is configured for the test case when there are measurement results to report at RRC connection setup.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.9.4.1-1, A.6.6.9.4.1-2, A.6.6.9.4.1-3.

The test consists of 4 successive time periods, with time duration of T1, T2, T3 and T4 respectively.

During T1, the UE is connected to Cell 1 only and shall not have any timing information of Cell 2. UE is configured with inter-frequency measurement reporting for Cell 2 in *MeasReselectionCarrierListNR-r18*. Beam level reporting for early measurements is not configured. The time point when UE receives RRC_Release message from the TE defines the starting point of T2.

During T2 and T3 the UE is in idle mode.

At the beginning of T2, Cell 2 becomes detectable however cell reselection shall not be performed. Signal level of Cell 2 is set to the value given in table A.6.6.9.4.1-3. The duration of T2 is set to fixed value according to the Table A.6.6.9.4.1-2.

At the beginning of T3, the signal level of Cell 2 is set to another value according to the Table A.6.6.9.4.1-3. The duration of T3 equals to *measReselectionValidityDuration-r18* .

The time when TE sends the paging message is defined as the starting point of T4. During T4, in this test the UE shall send measurement report within the duration of T4.

Table A.6.6.9.4.1-1: supported test configuration

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.9.4.1-2: General test parameters for Idle mode fast CA/DC cell-reselection measurement for FR1

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies are used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
SMTC-SSB parameters		Config 1	SSB.1 FR1	As specified in clause A.3.10.1
		Config 2	SSB.1 FR1	As specified in clause A.3.10.1
		Config 3	SSB.2 FR1	As specified in clause A.3.10.1
Hysteresis	dB	Config 1,2,3	0	
PRACH configuration index		Config 1,2,3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX in connected mode		Config 1,2,3	OFF	DRX is not used
DRX in idle mode	s	Config 1,2,3	0.32	The value shall be used for all cells in the test.
measReselectionValidityDuration-r18	s		5	
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	10	
T2	s	Config 1,2,3	30	
T3	s	Config 1,2,3	5	
T4	s	Config 1,2,3	1	

Table A.6.6.9.4.1-3: Cell specific test parameters for Idle and connected mode for fast CA/DC cell re-selection measurement for FR1

Parameter		Unit	Test configuration	Cell 1				Cell 2			
				T1	T2	T3	T4	T1	T2	T3	T4
NR RF Channel Number			Config 1,2,3	1				2			
Duplex mode			Config 1	FDD							
			Config 2,3	TDD							
TDD configuration			N.A	N.A							
			TDDConf.1.1	TDDConf.1.1							
			TDDConf.2.1	TDDConf.2.1							
BWchannel		MHz	Config 1,2	10: NRB,c = 52							
			Config 3	40: NRB,c = 106							
BWP BW		MHz	Config 1,2	10: NRB,c = 52							
			Config 3	40: NRB,c = 106							
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1				NA			
	Initial UL BWP			ULBWP.0.1				NA			
	Dedicated DL BWP			DLBWP.1.1				NA			
	Dedicated UL BWP			ULBWP.1.1				NA			
TRS configuration			Config 1	TRS.1.1 FDD				NA			
			Config 2	TRS.1.1 TDD				NA			
			Config 3	TRS.1.2 TDD				NA			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1				OP.1			
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD				SR.1.1 FDD			
			Config 2	SR.1.1 TDD				SR.1.1 TDD			
			Config 3	SR2.1 TDD				SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD				CR.1.1 FDD			
			Config 2	CR.1.1 TDD				CR.1.1 TDD			
			Config 3	CR2.1 TDD				CR2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1				SSB.5 FR1			
			Config 2	SSB.1 FR1				SSB.5 FR1			
			Config 3	SSB.2 FR1				SSB.6 FR1			
SMTC configuration defined in A.3.11			Config 1	SMTC.2				SMTC.5			
			Config 2, 3	SMTC.1				SMTC.4			
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15							
			Config 3	30							
EPRE ratio of PSS to SSS			Config 1,2,3	0				0			
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of PDCCH DMRS to SSS											
EPRE ratio of PDCCH to PDCCH DMRS											
EPRE ratio of PDSCH DMRS to SSS											
EPRE ratio of PDSCH to PDSCH											
EPRE ratio of OCNG DMRS to SSS(Note 1)											
EPRE ratio of OCNG to OCNG DMRS (Note 1)											
N_{oc} Note2		dBm/15 kHz		-98				-98			
N_{oc} Note2		dBm/SCS	Config 1,2	-98				-98			

Parameter	Unit	Test configuration	Cell 1	Cell 2			
		Config 3	-95	-95			
SS-RSRP Note 3	dBm/SCS	Config 1,2	-88	-infinity	-91	-100	-100
		Config 3	-85	-infinity	-88	-97	-97
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,	10	- infinity	7	-2	-2
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	10	-infinity	7	-2	-2
IoNote3	dBm/9.36 MHz	Config 1,2	-59.63	-70.5	-62.26	-67.92	-67.92
	dBm/38.16 MHz	Config 3	-53.54	-63.96	-56.17	-61.83	-61.83
Propagation Condition		Config 1,2,3	AWGN	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.9.4.2 Test Requirements

During the period T2 and T3 the UE shall not perform reselection.

At the start of T4 the UE is paged for connection setup. During the connection setup the UE is requested to transmit early measurement report for Cell 2.

The UE shall send early measurement report to the PCell with valid measurement results.

After receiving the requested early measurement report, the test equipment verifies the accuracy of measurement reported for Cell 2 meets the requirements in section 10.1.4B for SS-RSRP and in section 10.1.8B for SS-RSRQ and test ends. In the test case, the reported measurements are considered valid if they fulfil measurement accuracy requirements according to Cell 2 signal level during T3.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.9.5 SA Idle mode CA/DC measurement for FR1 with 12RB SSB

A.6.6.9.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE performs the required measurements on the serving cell and the configured inter-frequency carrier for idle mode measurement reporting after the UE has entered Idle mode, with 12 RB SSB on the target carrier. This test will partly verify the Idle mode CA/DC measurements requirements in clause 4.4.

The test environment in clause A.6.6.9.1.1 apply to this test, except that beam level reporting for early measurements is configured. Supported test configuration is given in table A.6.6.9.5.1-1. General test parameters as specified in table A.6.6.9.1.1-2 with config 1 apply to this test. Cell specific test parameters as specified in table A.6.6.9.1.1-3 with config 1 apply to this test, except those specified in table A.6.6.9.5.1-2.

Table A.6.6.9.5.1-1: supported test configuration

Config	Description
1	Serving cell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode. Target cell: 15 kHz SSB SCS, 3 MHz bandwidth, FDD duplex mode.

Table A.6.6.9.5.1-2: Cell specific test parameters for connected mode for SA Idle mode CA/DC measurement for FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
$BW_{channel}$	MHz	Config 1	3: $N_{PRB,c}$ = 15					
BWP BW	MHz	Config 1	3: $N_{PRB,c}$ = 15					
PDSCH Reference measurement channel		Config 1	SR.1.2 FDD			N/A		
CORESET Reference Channel		Config 1	CR.1.3 FDD			N/A		
SSB parameters		Config 1	SSB.1 FR1			SSB.13 FR1		
Io for Cell 1	dBm/9.36 MHz	Config 1	-62.26			N/A		
Io for Cell 2	dBm/2.7 MHz	Config 1	N/A			-75.45	-72.44	-72.44

A.6.6.9.5.2 Test Requirements

The test requirements in clause A.6.6.9.1.2 apply to this test.

A.6.6.10 CSI-RS based intra-frequency Measurements

A.6.6.10.1 SA event triggered reporting tests without gap under non-DRX

A.6.6.10.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA CSI-RS based L3 intra-frequency requirements in clauses 9.10.2.

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.6.6.10.1.1-1 and A.6.6.10.1.1-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.6.6.10.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.10.1.1-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified and measured.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	

Parameter	Unit	Test configuration	Value	Comment
		3	SMTC.1	
CSI-RS configuration for RRM		1	CSI-RS.RRM.FR1.1 FDD	
		2	CSI-RS.RRM.FR1.1 TDD	
		3	CSI-RS.RRM.FR1.2 TDD	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3		OFF
Time offset between serving and neighbour cells	μs	1	4.7	The timing of Cell 2 is CP later than the timing of Cell 1.
		2	4.7	
		3	2.35	
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	2	

Table A.6.6.10.1.1-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$ for SSB	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/I_{ot}$ for CSI-RS	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$ for SSB	dB	1	4	4	-Infinity	4
		2				
		3				
	dB	1	4	4	-Infinity	4
		2				

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$\hat{E}_s/N_{oc}$ for CSI-RS		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
CSI-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.10.1.2 Test Requirements

In this test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1600 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.11 CSI-RS based inter-frequency Measurements

A.6.6.11.1 SA event triggered reporting tests with gap under DRX

A.6.6.11.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA CSI-RS based L3 inter-frequency measurement requirements in clause 9.10.3.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.6.6.11.1.1-1, A.6.6.11.1.1-2 and A.6.6.11.1.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in table A.6.6.11.1.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in table A.6.6.11.1.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE is allocated with PUSCH resource at every DRX cycle.

NOTE: TAT= infinite based on the DRX configuration used in test.

Table A.6.6.11.1.1-1: SA event triggered reporting tests for FR1-FR1

Config	Description

1	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.11.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0	4	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39	19	
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	DRX.5	DRX.5	As specified in clause A.3.3
Time offset between serving and neighbour cells	µs	Config 1	4.7		The timing of Cell 2 is CP later than the timing of Cell 1.
		Config 2	4.7		
		Config 3	2.35		
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	21	21	

Table A.6.6.11.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD		-	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		Config 2	CR.1.1 TDD			
		Config 3	CR2.1 TDD			
SSB parameters		Config 1	SSB.1 FR1		SSB.5 FR1	
		Config 2	SSB.1 FR1		SSB.5 FR1	
		Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11		Config 1	SMTC.2		SMTC.5	
		Config 2, 3	SMTC.1		SMTC.4	
CSI-RS configuration for RRM		Config 1	CSI-RS.RRM.FR1.1 FDD		CSI-RS.RRM.FR1.1 FDD	
		Config 2	CSI-RS.RRM.FR1.1 TDD		CSI-RS.RRM.FR1.1 TDD	
		Config 3	CSI-RS.RRM.FR1.2 TDD		CSI-RS.RRM.FR1.2 TDD	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	15			
		Config 3	30			
EPRE ratio of PSS to SSS		Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
CSI-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$ for SSB	dB	Config 1,2,3	4	4	-Infinity	7
$\hat{E}_s/I_{ot}$ for CSI-RS	dB	Config 1,2,3	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$ for SSB	dB	Config 1,2,3	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$ for CSI-RS	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.11.1.2 Test Requirements

In test 1 with per-UE gap and test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 20480 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

The UE is required to read the SSB index indicated by associatedSSB in the neighbour cell in this test

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.12 RSTD measurements

A.6.6.12.1 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA

A.6.6.12.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 9.9.2 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.6.6.12.1.1-1.

Table A.6.6.12.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #0 before T2.

The general test parameters are listed in table A.6.6.12.1.1-2, and cell specific test parameters are listed in table A.6.6.12.1.1-3.

Table A.6.6.12.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter	Unit	Value	Comment
Reference cell		Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.

Parameter		Unit	Value	Comment
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Config 1,2,3		DLBWP.1.1	
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.1 FR1	
	Config 3		PRS.2.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#0	GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			4	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.6.6.12.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
EPRE ratio of PSS to SSS		dB	0	N/A	N/A
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08 MHz	-56.54	-56.54	-56.54
	Config 2	dBm/ 19.08 MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 47.88 MHz	-52.56	-52.56	-52.56
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.6.12.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
NR RF Channel Number		1	1	1
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1		OP.1	OP.1	OP.1
PRACH configuration		FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
EPRE ratio of PSS to SSS	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS				

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
SSB $\hat{E}_s/N_{oc}$	Config 1~3	dB	10	3	3
Io Note 4	Config 1	dBm/ 19.08 MHz	-65.43	-65.43	-65.43
	Config 2	dBm/ 19.08 MHz	-65.43	-65.43	-65.43
	Config 3	dBm/ 47.88 MHz	-61.44	-61.44	-61.44
SSB RP Note4	Config 1	dBm/SCS	-88	-95	-95
	Config 2	dBm/SCS	-88	-95	-95
	Config 3	dBm/SCS	-85	-92	-92
PRS $\hat{E}_s/I_{ot}$		dB	-6.00	-12.98	-12.98
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.

A.6.6.12.1.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 9.9.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 9.9.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD1970049

A.6.6.12.2 NR RSTD measurement reporting delay test case for dual positioning frequency layers in FR1 SA

A.6.6.12.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 9.9.2 in an environment with AWGN propagation conditions in FR1 in standalone scenario when dual positioning frequency layers are configured.

The supported test configurations are specified in table A.6.6.12.2.1-1.

Table A.6.6.12.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. Cell 3 is on a different RF channel with Cell 1 and Cell 2.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #0 before T2.

The general test parameters are listed in table A.6.6.12.2.1-2, and cell specific test parameters are listed in table A.6.6.12.2.1-3.

Table A.6.6.12.2.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first place in the respective neighbour cell list in the DL-TDOA assistance data for two positioning frequency layers.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	

Parameter		Unit	Value	Comment
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Config 1,2,3		DLBWP.1.1	
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.1 FR1	
	Config 3		PRS.2.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#0	GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355[34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			4	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.6.6.12.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter	Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number		1	1	2
Positiong frequency layer		1	1	2
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1		OP.1	N/A	N/A
EPRE ratio of PSS to SSS	dB	0	N/A	N/A
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				

Parameter		Unit	Cell 1	Cell 2	Cell 3
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08 MHz	-56.54	-56.54	-66.96
	Config 2	dBm/ 19.08 MHz	-56.54	-56.54	--66.96
	Config 3	dBm/ 47.88 MHz	-52.56	-52.56	-62.97
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.6.12.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
NR RF Channel Number		1	1	2
Positiong frequency layer		1	1	2
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1		OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS				
PRACH configuration		FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
Config 1	dBm/SCS	-98	-98	-98

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
N_{oc} Note 3	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.7	-11.9	-13
	Config 2	dB	-5.7	-11.9	-13
	Config 3	dB	-5.7	-11.9	-13
Io Note 4	Config 1	dBm/ 19.08 MHz	-65.70	-65.70	-66.74
	Config 2	dBm/ 19.08 MHz	-65.70	-65.70	-66.74
	Config 3	dBm/ 47.88 MHz	-61.72	-61.72	-62.76
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.

A.6.6.12.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 9.9.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 9.9.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.6.6.12.3 NR RSTD measurement reporting delay test case for single positioning frequency layer with reduced number of samples in FR1 SA

A.6.6.12.3.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement with the reduced samples meets the requirements specified in clause 9.9.2 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.6.6.12.3.1-1.

Table A.6.6.12.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request. UE can support *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED*, and the LMF indicates the UE to perform positioning measurements with reduced number of samples.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #0 before T2.

The general test parameters are listed in table A.6.6.12.3.1-2, and cell specific test parameters are listed in table A.6.6.12.3.1-3.

Table A.6.6.12.3.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Config 1,2,3		DLBWP.1.1	
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.2 FR1	As specified in clause A.3.31
	Config 2		PRS.1.2 FR1	
	Config 3		PRS.2.2 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	

Parameter	Unit	Value	Comment
Measurement gap		GP#24 or GP#0	GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured
Radio frame receive time offset between the cells at the UE antenna connector	µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD	µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells	µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		4	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.6.6.12.3.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08 MHz	-56.54	-56.54	-56.54
	Config 2	dBm/ 19.08 MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 47.88 MHz	-52.56	-52.56	-52.56
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-88	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.6.12.3.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	1	-1.2	-1.2
	Config 2	dB	1	-1.2	-1.2
	Config 3	dB	1	-1.2	-1.2
Io Note 4	Config 1	dBm/ 19.08 MHz	-61.18	-61.18	-61.18
	Config 2	dBm/ 19.08 MHz	-61.18	-61.18	-61.18
	Config 3	dBm/ 47.88 MHz	-57.20	-57.20	-57.20
PRS $\hat{E}_s/I_{ot}$		dB	-3	-6	-6
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T3) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

A.6.6.12.3.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 9.9.2.5

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration X1 specified in section 9.9.2.5 starting from the beginning of time interval T2, where X1 is 320 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD1970049.

A.6.6.12.4 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA without measurement gap

A.6.6.12.4.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the gapless RSTD measurement period requirement specified in clause 9.9.2.7 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured. Reporting delay test for gapless PRS measurement is

conducted assuming that the PRS has higher priority, i.e., state 1, than all other DL signals/channels and is transmitted within active DL BWP of UE. Two sub-tests are defined, sub-test 1 is for N_{sample} = 4 and sub-test 2 is for N_{sample} = 1. For sub-test 2 LMF indicates UE to perform PRS measurement with N_{sample} = 1. The cell specific parameters for sub-test 1 and sub-test 2 are defined in table A.6.6.12.4.1-4.

The supported test configurations are specified in table A.6.6.12.4.1-1.

Table A.6.6.12.4.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first PPW instance containing the PRS resources.

The UE is configured with PPW before start of T2.

The general test parameters are listed in table A.6.6.12.4.1-2, and cell specific test parameters are listed in table A.6.6.12.4.1-3.

Table A.6.6.12.4.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
$BW_{channel}$	Config 1	MHz	20: $N_{PRB,c}$ = 106	
	Config 2		20: $N_{PRB,c}$ = 106	
	Config 3		50: $N_{PRB,c}$ = 133	
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	

Parameter		Unit	Value	Comment
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Config 1,2,3		DLBWP.1.1	Cell 2 and cell 3 also transmit PRS on active DL BWP configured to the UE
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.4 FR1	As specified in clause A.3.31
	Config 2		PRS.1.4 FR1	
	Config 3		PRS.2.4 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
PPW configuration			PPW.1	As defined in A.3.33
Time offset between serving and neighbour cells		µs	set to the UE reported capability for receive time difference threshold if the UE reported value is < 3µs 3µs otherwise	PRS are transmitted from synchronous cells
Expected RSTD		µs	0	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	Same as time offset	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			4	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		ms	10	The length of the time interval that follows after time interval T1 and processing time of assistance data. In this test UE is configured to measure single PFL within the configured PPW.

Table A.6.6.12.4.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		

Parameter		Unit	Cell 1	Cell 2	Cell 3
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08 MHz	-56.54	-56.54	-56.54
	Config 2	dBm/ 19.08 MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 47.88 MHz	-52.56	-52.56	-52.56
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-88	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.6.12.4.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1		Cell 2		Cell 3	
			Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2
NR RF Channel Number			1		1		1	
Correlation Matrix and Antenna Configuration			1x2 Low		1x2 Low		1x2 Low	
OCNG patterns defined in A.3.2.1			OP.1		OP.1		OP.1	
PRACH configuration			FR1 PRACH configuration 1		FR1 PRACH configuration 1		FR1 PRACH configuration 1	
N_{oc} Note 3	Config 1,2	dBm/SCS	-98		-98		-98	
	Config 3	dBm/SCS	-95		-95		-95	
PRS $\hat{E}_s/N_{oc}$	Config 1,2,3	dB	-5.45	1	-11.67	-1.2	-11.67	-1.2
Io Note 4	Config 1,2	dBm/ 19.08 MHz	-65.43	-61.18	-65.43	-61.18	-65.43	-61.18
	Config 3	dBm/ 47.88 MHz	-61.44	-57.20	-61.44	-57.20	-61.44	-57.20
PRS $\hat{E}_s/I_{ot}$	Config 1,2,3	dB	-6	-3	-13	-6	-13	-6
PRS-RSRP Note 4	Config 1,2	dBm/SCS	-103.45	-97	-109.67	-99.2	-109.67	-99.2
	Config 3		-100.45	-94	-106.67	-96.2	-106.67	-96.2
SS-RSRP Note 4	Config 1,2	dBm/SCS	-88	-97	-88	-99.2	-88	-99.2
	Config 3		-85	-94	-85	-96.2	-85	-96.2
Propagation Condition			AWGN					

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.12.4.2 Test Requirements

The RSTD measurement time fulfils the gapless RSTD measurement period requirements specified in clause 9.9.2.7.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 9.9.2.7 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD1970049.

A.6.6.12.5 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA in RRC_CONNECTED state with Rx TEG

A.6.6.12.5.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the Rx TEG based measurement period requirements specified in clause 9.9.2.5 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.6.6.12.5.1-1.

Table A.6.6.12.5.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #0 before T2.

The test applies to the UE supporting Rx TEG indicated via *NR-UE-TEG-Capability* and is requested to provide the Rx TEG in the test via *nr-UE-RxTEG-Request-r17* in *NR-TDOA-RequestLocationInformation*. In the location request *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* is set to n0. The UE shall perform and optionally report the Rx TEG based RSTD measurements.

The general test parameters are listed in table A.6.6.12.5.1-2, and cell specific test parameters are listed in table A.6.6.12.5.1-3.

Table A.6.6.12.5.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
$BW_{channel}$	Config 1	MHz	20: $N_{PRB,c}$ = 106	
	Config 2		20: $N_{PRB,c}$ = 106	
	Config 3		50: $N_{PRB,c}$ = 133	
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Config 1,2,3		DLBWP.1.1	
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.4 FR1	As specified in clause A.3.31
	Config 2		PRS.1.4 FR1	
	Config 3		PRS.2.4 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#0	GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			4	Including the reference cell

Parameter	Unit	Value	Comment
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	[1.28*$k_{multiTEG}$] Note 1	The length of the time interval that follows immediately after time interval T1

NOTE 1: $k_{multiTEG}=\left\lceil \frac{N_{TEG}}{k_{TEG,simul}} \right\rceil$ if UE is capable of receiving the same DL PRS resource from the same TRP simultaneously from multiple Rx TEGs, where N_{TEG} is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource, and $k_{TEG,simul}$ is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

Table A.6.6.12.5.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08 MHz	-56.54	-56.54	-56.54
	Config 2	dBm/ 19.08 MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 47.88 MHz	-52.56	-52.56	-52.56
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-88	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.6.12.5.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
NR RF Channel Number		1	1	1
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1		OP.1	OP.1	OP.1
PRACH configuration		FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
Io Note 4	Config 1	dBm/ 19.08 MHz	-65.43	-65.43	-65.43
	Config 2	dBm/ 19.08 MHz	-65.43	-65.43	-65.43
	Config 3	dBm/ 47.88 MHz	-61.44	-61.44	-61.44
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		
NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS. NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					

A.6.6.12.5.2 Test Requirements

The RSTD measurement time fulfils the Rx TEG based RSTD measurement period requirements specified in clause 9.9.2.5. The UE shall perform and report the Rx TEG based RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 9.9.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD1970049.

A.6.6.12.6 NR RSTD measurement reporting delay test case for PRS aggregation in FR1 SA in RRC_CONNECTED mode

A.6.6.12.6.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement by aggregating PRS resources from two positioning frequency layers (PFLs) meets the measurement period requirements specified in clause 9.9.2.10 in an environment with AWGN propagation conditions in FR1.

The supported test configurations are specified in table A.6.6.12.6.1-1.

Table A.6.6.12.6.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth per PFL, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth per PFL, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth per PFL, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. Each cell is associated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel #1. In addition, all cells/TRPs transmit DL PRS in two intra-band contiguous PFLs in RF channel #1 and RF channel #2. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS resources on two positioning frequency layers during T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.10, shall be provided to the UE during T1. The UE is capable of performing RSTD measurements by aggregating PRS resources from two PFLs and is configured by the LMF to perform measurements by aggregating the PRS resources from two positioning frequency layers via *nr-DL-PRS-JointMeasurementRequestedPFL-List*. The *NR-DL-TDOA-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2.

The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the DL-TDOA assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first measurement gap instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or measurement gap pattern ID # 0 before T2.

The general test parameters are listed in table A.6.6.12.6.1-2, and cell specific test parameters are listed in table A.6.6.12.6.1-3.

Table A.6.6.12.6.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first place in the respective neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
	Config 1		CCR.1.1 FDD	

Dedicated CORESET RMC configuration	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Config 1,2,3		DLBWP.1.1	
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration per PFL	Config 1		PRS.1.2 FR1	As specified in clause A.3.31.
	Config 2		PRS.1.2 FR1	
	Config 3		PRS.2.2 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2) mod 6=0 and (PCI of Cell 1 – PCI of Cell 3) mod 6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#0	GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expected RSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the *expectedRSTD-Uncertainty* index
Number of cells provided in DL-TDOA assistance data			3	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to *NR-MutingPattern* defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.6.6.12.6.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter	Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number		1	1	1
Correlation Matrix and Antenna Configuration		1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in A.3.2.1		OP.1	N/A	N/A
EPRE ratio of PSS to SSS	dB	0	N/A	N/A
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				

EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08MHz	-56.54	-56.54	-66.96
	Config 2	dBm/ 19.08MHz	-56.54	-56.54	--66.96
	Config 3	dBm/ 47.88MHz	-52.56	-52.56	-62.97
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.6.12.6.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
NR RF Channel Number Note 5		1,2	1,2	1,2
Positiong frequency layer (PFL)		1,2	1,2	1,2
Correlation Matrix and Antenna Configuration		1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in clause A.3.2.1		OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				

EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
EPRE ratio of PRS to SSS					
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.7	-11.9	-13
	Config 2	dB	-5.7	-11.9	-13
	Config 3	dB	-5.7	-11.9	-13
Io Note 4	Config 1	dBm/ 19.08MHz per PFL	-65.70	-65.70	-66.74
	Config 2	dBm/ 19.08MHz per PFL	-65.70	-65.70	-66.74
	Config 3	dBm/ 47.88MHz per PFL	-61.72	-61.72	-62.76
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.
Note 5: Carriers are intra-band and contiguous.

A.6.6.12.6.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 9.9.2.10.

The UE shall perform and report the RSTD measurements by aggregating PRS resources from multiple positioning frequency layers for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 9.9.2.10 starting from the beginning of time interval T2.

NOTE*: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.*

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23A.3, i.e., between RSTD_000000000 and RSTD_126083073.

A.6.6.13 PRS-RSRP measurements

A.6.6.13.1 PRS-RSRP reporting delay test case for single positioning frequency layer

A.6.6.13.1.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement meets the delay requirements specified in clause 9.9.3.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.6.13.1.1-1.

Table A.6.6.13.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.6.13.1.1-2, and cell specific test parameters are listed in table A.6.6.13.1.1-3.

Table A.6.6.13.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	NA	OFF
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
Number of cells provided in assistance data		1, 2, 3	4	Including the reference cell
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	5	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.6.6.13.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	‘10’		‘01’	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
	dB	1	-Infinity	-2	-Infinity	-10

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
PRS $\hat{E}_s/N_{oc}$		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.13.1.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9.3.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time limit above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.13.2 PRS-RSRP reporting delay test case for dual positioning frequency layer

A.6.6.13.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement meets the delay requirements specified in clause 9.9.3.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.6.13.2.1-1.

Table A.6.6.13.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell on NR RF channel #1 in FR1. Cell 2 is a neighbour cell on a different NR RF channel #2 in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.6.13.2.1-2, and cell specific test parameters are listed in table A.6.6.13.2.1-3.

Table A.6.6.13.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 2: Cell 2	Cell 1 and Cell 2 are on differnet positioning frequency layers
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	NA	OFF
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
Number of cells provided in assistance data		1, 2, 3	4	Including the reference cell
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	10	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.6.6.13.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-13
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-3	-Infinity	-13
		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-Infinity	-101	-Infinity	-111
		2	-Infinity	-101	-Infinity	-111
		3	-Infinity	-98	-Infinity	-108
Io	dBm/19.08 MHz	1	N/A	-65.19	N/A	-66.74
	dBm/19.08 MHz	2		-65.19		-66.74
	dBm/47.88 MHz	3		-61.21		-62.76
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.13.2.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9.3.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time limit above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.13.3 PRS-RSRP reporting delay test case for reduced number of samples

A.6.6.13.3.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement meets the delay requirements for reduced number of samples specified in clause 9.9.3.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.6.13.3.1-1.

Table A.6.6.13.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.6.13.3.1-2, and cell specific test parameters are listed in table A.6.6.13.3.1-3.

Table A.6.6.13.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	NA	OFF
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
Number of cells provided in assistance data		1, 2, 3	4	Including the reference cell
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	5	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.6.6.13.3.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	0	-Infinity	-6
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	2.23	-Infinity	-1.73
		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-Infinity	-95.77	-Infinity	-99.73
		2	-Infinity	-95.77	-Infinity	-99.73
		3	-Infinity	-92.77	-Infinity	-96.73
Io	dBm/19.08 MHz	1	N/A	-61.71	N/A	-61.71
	dBm/19.08 MHz	2		-61.71		-61.71
	dBm/47.88 MHz	3		-57.73		-57.73
Propagation Condition		1, 2, 3	AWGN			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						

A.6.6.13.3.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit for reduced number of samples specified in clause 9.9.3.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.13.4 PRS-RSRP reporting delay test case for single positioning frequency layer outside MG

A.6.6.13.4.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement outside MG meets the delay requirements specified in clause 9.9.3.6 in an environment with AWGN propagation conditions. There are two sub-tests in the test, sub-test 1 is to verify the delay requirements with Nsample=1, and sub-test 2 is to verify the delay requirements with Nsample=4.

The supported test configurations are specified in table A.6.6.13.4.1-1.

Table A.6.6.13.4.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In sub-test 1, *reducedDL-PRS-ProcessingSamples* shall be included in the location information request and set to '*requested*'.

During T1, a PPW shall be configured for the PCell and be activated via DL MAC CE. The last PDSCH containing the MAC CE shall be transmitted before slot #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first PPW instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.6.13.4.1-2, and cell specific test parameters during T2 are listed in table A.6.6.13.4.1-3.

Table A.6.6.13.4.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
PPW configuration		1	PPW.1	As defined in A.3.33
		2	PPW.1	As defined in A.3.33
		3	PPW.1	As defined in A.3.33
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	NA	OFF
Time offset between serving and neighbour cells	µs	1	3	
		2	3	
		3	3 or 2.34 Note 1	
Expected RSTD	µs	1, 2, 3	0	
Expected RSTD uncertainty	µs	1, 2, 3	Same as time offset between serving and neighbour cells	
Number of cells provided in assistance data		1, 2, 3	4	Including the reference cell
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	5	
NOTE 1: If UE indicates support of CP length for the receive time difference threshold, the time offset is set to 2.34 us, otherwise 3 us.				

Table A.6.6.13.4.1-3: Cell specific test parameters during T2

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	0	-2.41	-6	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	2.23	-2	-1.73	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-95.77	-100	-99.73	-108
		2	-95.77	-100	-99.73	-108
		3	-92.77	-97	-96.73	-105
SS-RSRP Note 3	dBm/SCS kHz	1	-101	-101	-104	-108
		2	-101	-101	-104	-108
		3	-98	-98	-101	-105
Io	dBm/19.08 MHz	1	-61.71	-64.57	-61.71	-64.57
	dBm/19.08 MHz	2	-61.71	-64.57	-61.71	-64.57
	dBm/47.88 MHz	3	-57.73	-60.59	-57.73	-60.59
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.13.4.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9.3.6, starting from the beginning of time interval T2, with Nsample=1 for sub-test 1 and Nsample=4 for sub-test 2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.14 UE Rx-Tx time difference measurements

A.6.6.14.1 UE Rx-Tx time difference measurement for single positioning frequency layer in FR1 SA

A.6.6.14.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 9.9.4.5 in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations in listed in table A.6.6.14.1.1-1.

Table A.6.6.14.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode

2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID #0 or ID #24 before T2.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.6.6.14.1.1-2 and table A.6.6.14.1.1-3 respectively.

Table A.6.6.14.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	OFF	
Time offset between serving and neighbour cells	μs	1, 2, 3	3	Synchronous cells
Number of cells provided in assistance data		1, 2, 3	4	Including the reference cell
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.6.6.14.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
SRS configuration		1	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.14.1.1-4: Void

A.6.6.14.1.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.6.6.14.2 UE Rx-Tx time difference measurement for dual positioning frequency layers in FR1 SA

A.6.6.14.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 9.9.4.5 in AWGN propagation condition in FR1 in standalone scenario when dual positioning frequency layers are configured.

The supported test configurations in listed in table A.6.6.9.2.1-1.

Table A.6.6.14.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Cell 1 and Cell 2 are on different RF channels in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID #0 or ID #24 before T2.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.6.6.14.2.1-2 and table A.6.6.14.2.1-3 respectively.

Table A.6.6.14.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment

Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3	1	For Cell 1
RF Channel Number		1, 2, 3	2	For Cell 2
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	OFF	
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Number of cells provided in assistance data		1, 2, 3	4	Including the reference cell
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.6.6.14.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
SRS configuration		1	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-13
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-3	-Infinity	-13
		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-Infinity	-101	-Infinity	-111
		2	-Infinity	-101	-Infinity	-111
		3	-Infinity	-98	-Infinity	-108
Io	dBm/19.08 MHz	1	N/A	-65.19	N/A	-66.74
	dBm/19.08 MHz	2		-65.19		-66.74
	dBm/47.88 MHz	3		-61.21		-62.76
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.14.2.1-4: Void

A.6.6.14.2.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.6.6.14.3 UE Rx-Tx time difference measurement for single positioning frequency layer in FR1 SA with reduced sample number

A.6.6.14.3.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 9.9.4.5 with Nsample = 1 in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations in listed in table A.6.6.14.3.1-1.

Table A.6.6.14.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. *reducedDL-PRS-ProcessingSamples* shall be included in the location information request and set to '*requested*'. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID #0 or ID #24 before T2.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.6.6.14.3.1-2 and table A.6.6.14.3.1-3 respectively.

Table A.6.6.14.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	20: $N_{PRB,c} = 106$	
		2	20: $N_{PRB,c} = 106$	
		3	50: $N_{PRB,c} = 133$	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	OFF	
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Number of cells provided in assistance data		1, 2, 3	4	Including the reference cell
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.6.6.14.3.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
SRS configuration		1	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	0	-Infinity	-6
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	2.23	-Infinity	-1.73
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-95.77	-Infinity	-99.73
		2	-Infinity	-95.77	-Infinity	-99.73
		3	-Infinity	-92.77	-Infinity	-96.73
SS-RSRP Note 3	dBm/SCS kHz	1	-100	-100	-Infinity	-104
		2	-100	-100	-Infinity	-104
		3	-97	-97	-Infinity	-101
Io	dBm/19.08 MHz	1	N/A	-61.71	N/A	-61.71
	dBm/19.08 MHz	2		-61.71		-61.71
	dBm/47.88 MHz	3		-57.73		-57.73
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.14.3.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.5 with Nsample=1.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.6.6.14.4 UE Rx-Tx time difference measurement without gaps in FR1 SA

A.6.6.14.4.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 9.9.4.6 in AWGN propagation condition in FR1 in standalone scenario. There are two sub-tests in the test, sub-test 1 is to verify the delay requirements with Nsample=1, and sub-test 2 is to verify the delay requirements with Nsample=4.

The supported test configurations in listed in table A.6.6.14.4.1-1.

Table A.6.6.14.4.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of PRS processing window containing the PRS resources.

The UE is configured with PRS processing window before T2.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.6.6.14.4.1-2 and table A.6.6.14.4.1-3 respectively.

Table A.6.6.14.4.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	

Parameter	Unit	Test configuration	Value	Comment
PRS processing window		1,2,3	PPW.1	As defined in A.3.33
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	OFF	
Time offset between serving and neighbour cells	µs	1	3 Note1	
		2	3 Note1	
		3	3 or 2.34 Note1	
Expected RSTD	µs	1,2,3	0	
Expected RSTD uncertainty	µs	1,2,3	Same as time offset between serving and neighbour cells	
Number of cells provided in assistance data		1, 2, 3	4	Including the reference cell
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	
NOTE 1: The value is up to the UE capability. The possible UE capability value: (1/4 symbol, 1/2 symbol, CP length, half of slot). When the UE reported value is > 3 us, the time offset between serving and neighbour cells is set to 3 us; when the UE reported value is < 3 us, the time offset between serving and neighbour cells is set to the UE reported value.				

Table A.6.6.14.4.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			Sub-test 1	Sub-test 2	Sub-tets 1	Sub-test 2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS muting info		1, 2, 3	‘10’		‘01’	
SRS configuration		1	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	0	-2.41	-6	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	2.23	-2	-1.73	-10
		2				
		3				

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			Sub-test 1	Sub-test 2	Sub-tets 1	Sub-test 2
PRS-RSRP Note 3	dBm/SCS kHz	1	-95.77	-100	-99.73	-108
		2	-95.77	-100	-99.73	-108
		3	-92.77	-97	-96.73	-105
Io	dBm/19.08 MHz	1	-61.71	-64.57	-61.71	-64.57
	dBm/19.08 MHz	2	-61.71	-64.57	-61.71	-64.57
	dBm/47.88 MHz	3	-57.73	-60.59	-57.73	-60.59
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.14.4.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.6.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.6.6.14.5 UE Rx-Tx time difference measurement for single positioning frequency layer in FR1 SA with multiple RxTx TEGs

A.6.6.14.4.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 9.9.4.5 in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured, and when UE is requested to measure a PRS resource with multiple RxTx TEGs.

The supported test configurations in listed in table A.6.6.14.4.1-1.

Table A.6.6.14.4.11: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request. In *nr-Multi-RTT-RequestLocationInformation*, *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* shall be set to 'n2'.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID #0 or ID #24 before T2.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.6.6.14.4.1-2 and table A.6.6.14.4.1-3 respectively.

Table A.6.6.14.4.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	OFF	
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Number of cells provided in assistance data		1, 2, 3	4	Including the reference cell
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.6.6.14.4.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
SRS configuration		1	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.14.4.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.5, with $k_{multiTEG}$=2 if UE does not support or indicate value 'n1' for *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*, and $k_{multiTEG}$=1 otherwise.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.6.6.14.6 UE Rx-Tx time difference measurements with PRS bandwidth aggregation in FR1 SA

A.6.6.14.6.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 9.9.4.9 for UE Rx-Tx measurements with PRS bandwidth aggregation. The tests are conducted under AWGN propagation condition with the UE operating in FR1 stand-alone mode and configured to perform UE Rx-Tx measurements by aggregating two intra-band contiguous positioning frequency layers (PFLs) in FR1.

The supported test configurations in listed in table A.6.6.14.6.1-1.

Table A.6.6.14.6.1-1: Supported test configurations

PCell configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: Cell 1 (PCell) and Cell 2 (neighbor cell). Each cell is sssociated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel #1. In addition, both cells/TRPs transmit DL PRS in two intra-band contiguous PFLs in RF channel #1 and RF channel #2. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 transmit PRS only during the second time interval of duration T2. Similarly, the UE is configured to transmit positioning SRS during only during the second time interval of duration T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request.

The *NR-Multi-RTT-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2.

The *NR-Multi-RTT-RequestLocationInformation* message provided to the UE must request bandwidth aggregated measurements via *jointMeasurementsReq* and *nr-DL-PRS-JointMeasurementRequestedPFL-List.*

The UE is configured with measurement gap pattern ID #0 or ID #24 before T2.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The general test parameters and cell specific test parameters are as given in table A.6.6.14.6.1-2 and table A.6.6.14.6.1-3, respectively.

Table A.6.6.14.6.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2, all signals/channels except PRS in PFL2 are allocated within this channel.
			2	For both Cell 1 and Cell 2, only PRS in PFL2 is allocated within this channel.
$BW_{channel}$	MHz	1	20: $N_{RB,c}$ = 106	For both RF channels
		2	20: $N_{RB,c}$ = 106	
		3	50: $N_{RB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	OFF	

Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells/TRPs
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	
NOTE 1: GP#24 is configured if the UE supports it, otherwise GP#0 is configured.				

Table A.6.6.14.6.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns Note 1		1, 2, 3	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1,4						
EPRE ratio of OCNG to OCNG DMRS Note 1, 4						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration (for both PFL1 and PFL2)		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS muting info (*dl-PRS-MutingOption1* for both PFL1 and PFL2)		1, 2, 3	‘10’		‘01’	
SRS configuration		1	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			

		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-13
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-3	-Infinity	-13
		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-Infinity	-101	-Infinity	-111
		2	-Infinity	-101	-Infinity	-111
		3	-Infinity	-98	-Infinity	-108
Io Note 3 (on symbols where PRS is not allocated)	dBm/19.08 MHz	1	N/A	-65.05	N/A	-65.05
	dBm/19.08 MHz	2		-65.05		-65.05
	dBm/47.88 MHz	3		-61.06		-61.06
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.

NOTE 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

A.6.6.14.6.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.9.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25A.3.

A.6.6.15 Idle Mode measurements of inter-RAT DC candidate cells for early reporting

A.6.6.15.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly retains the detected cell status for the idle mode CA/DC measurement when UE transitions from RRC Connected mode to Idle mode, when the UE has entered Idle mode. Additionally, test that the UE performs the required measurements on the serving cell and the configured inter-RAT carrier for idle mode measurement reporting. This test will partly verify the Idle mode CA measurements in clause 4.4. In the test, connected mode DRX configuration is not configured in either PCell or PSCell.

Additionally, the purpose of this test is to verify that the SS-RSRP, SS-RSRQ, RSRP and RSRQ measurement accuracy is within the specified limits. This test will verify the accuracy requirements in sections 10.1.2B and 10.1.7B for intra-frequency measurements and section 10.2.2 and 10.2.3 for the inter-RAT measurements for the supported test configurations in tables A.6.6.15.1-4 and A.6.6.15.1-5.

The supported test configurations are given in table A.6.6.15.1-1. The test parameters are given in tables A.6.6.15.1-2, A.6.6.15.1-3, A.6.6.15.1-4 and A.6.6.15.1-5 below. In the test there are two cells, Cell 1, which is the PCell in connected, and serving cell in idle mode, on radio channel 1 in FR1, and Cell 2, which is the PSCell in connected, and measured LTE inter-RAT cell in idle mode, on radio channel 2 in LTE.

For the purpose of testing absolute accuracy in idle mode in this set of test cases the cells in idle mode are on different carrier frequencies (NR FR1 and LTE). The absolute accuracy of RSRP and RSRQ inter-RAT measurements are tested by using the parameters in table A.6.6.15.1-4 and table A.6.6.15.1-5. In all test cases, Cell 1 is the serving and Cell 2 the target cell.

The test consists of 5 successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. During T1 Cell 2, the PSCell, shall be configured.

Time duration T2 starts when UE has transmitted random access preamble on the PSCell. During T2, the UE is configured with idle mode CA measurements with the PSCell carrier as the target carrier. The connection is released 500 ms after T2 when the UE has sent random access preamble on the PSCell.

T3 starts when the connection is released. During the time periods T3 and T4 the UE is in Idle mode with the serving cell on the FR1 carrier. The UE is configured to perform inter-RAT idle mode CA/DC measurements on Cell 2 carrier. After the connection release and during T3, 1000 ms after T3 is started, the signal level of the inter-RAT carrier configured for idle mode CA/DC measurements is changed at which time T4 starts. T5 starts 65 s after T4, when the UE is paged for connection setup and UE is requested by the network to report idle mode CA/DC measurements.

Table A.6.6.15.1-1: Supported test configurations for Idle Mode measurements of inter-RAT DC candidate cells for early reporting

Config	Description
1	FR1 FDD SSB SCS 15 kHz BW 10 MHz – LTE FDD 10 MHz
2	FR1 FDD SSB SCS 15 kHz BW 10 MHz – LTE TDD 10 MHz
3	FR1 TDD SSB SCS 30 kHz BW 40 MHz – LTE FDD 10 MHz
4	FR1 TDD SSB SCS 30 kHz BW 40 MHz – LTE TDD 10 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.15.1-2: General test parameters for Idle Mode measurements of inter-RAT DC candidate cells for early reporting

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1 in FR1
PSCell		Cell 2	PSCell on RF channel number 2 in LTE. Cell 2 is of higher priority.
DRX		OFF	For both PCell and PSCell once configured
PRACH configuration in Cell 2		PRACH_2CE	PRACH configuration as specified in clause A.3.16 in TS 36.133
T331	s	300	
CSI reporting periodicity and offset configuration for Cell 2	ms	2	
T1	s	0.5	During this time the PCell is known and PSCell is configured.
T2	s	0.5	PSCell access.
T3 + T4	s	66	During this time the UE is configured to perform inter-RAT measurements in idle mode on the PSCell carrier.
T5	s	0.5	UE is paged and connection is setup. Network requests measurement report from the UE.

Table A.6.6.15.1-3: Cell specific test parameters for NR cell for Idle Mode measurements of inter-RAT DC candidate cells for early reporting

Parameter	Unit	Config	Test 1				
			Cell 1				
			T1	T2	T3	T4	T5
AoA setup		1,2,3,4	N/A				
Assumption for UE beams Note 5 R: Rough		1,2,3,4	N/A	N/A	R	R	N/A
Frequency Range		1,2,3,4	FR1				
Duplex mode		1, 2	FDD				
		3, 4	TDD				
TDD Confguration		1,2	-				
1: TDDConf.1.1 2: TDDConf.2.1		3,4	1	1	2	2	1
$BW_{channel}$	MHz	1, 2	1	1	-	-	1
1: 10: $N_{PRB,c}$ = 52 2: 40: $N_{PRB,c}$ = 106		3, 4	2	2	-	-	2
Initial Downlink BWP configuration		1,2,3,4	DLBWP.0.1				
Initial Uplink BWP configuration		1,2,3,4	ULBWP.0.1				
Dedicated Downlink BWP configuration 1: DLBWP.1.1		1,2,3,4	1	1	-	-	1
Dedicated Uplink BWP configuration 1: ULBWP.1.1		1,2,3,4	1	1	-	-	1
PDSCH Reference Measurement	FDD	1,2	1	1	1	1	1
Channel 1: SR.1.1 FDD 2: SR.2.1 TDD	TDD	3,4	2	2	2	2	2
TRS configuration		1,2,3,4	-				
TCI state		1,2,3,4	-				
RMSI CORESET parameters	FDD	1,2	CR.1.1 FDD				
	TDD	3,4	CR.2.1 TDD				
Dedicated CORESET parameters	FDD	1,2	CCR.1.1 FDD				
	TDD	3,4	CCR.2.1 TDD				
OCNG Patterns Note1		1,2,3,4	OP.1 defined in A.3.2.1				
SSB configuration		1,2	1				
1: SSB.1 FR1 2: SSB.2 FR1		3,4	2				
SMTC configuration		1,2,3,4	SMTC.2				
Correlation Matrix and Antenna config		1,2,3,4	1x2 Low				
EPRE ratio of PSS to SSS	dB	1,2,3,4	0	0	-	-	0
EPRE ratio of PBCH DMRS to SSS			0	0	-	-	0
EPRE ratio of PBCH to PBCH DMRS			0	0	-	-	0
EPRE ratio of PDCCH DMRS to SSS			0	0	-	-	0
EPRE ratio of PDCCH to PDCCH DMRS			0	0	-	-	0
EPRE ratio of PDSCH DMRS to SSS			0	0	-	-	0
EPRE ratio of PDSCH to PDSCH			0	0	-	-	0
EPRE ratio of OCNG DMRS to SSS			0	0	-	-	0
N_{oc} Note2	dBm/ 15 kHz	1,2	-98	-98	-98	-98	-98
		3,4					
N_{oc} Note2	dBm/SCS	1,2	-98	-98	-98	-98	-98
		3,4	-95	-95	-95	-95	-95
$\hat{E}_s/I_{ot}$	dB	1,2,3,4	5	5	5	5	5
$\hat{E}_s/N_{oc}$	dB	1,2,3,4	5	5	5	5	5
SS-RSRP Note3,4	dBm/SCS	1,2	-93	-93	-93	-93	-93
		3,4	-90	-90	-90	-90	-90
Io Note3,4	dBm/ 9.36 MHz	1,2	-63.85	-63.85	-63.85	-63.85	-63.85
	dBm/ 38.16 MHz	3,4	-57.76	-57.76	-57.76	-57.76	-57.76
Qrxlevmin	dBm/SCS	1, 2	-	-	-140		-
		3, 4	-	-	-137		-

Parameter	Unit	Config	Test 1				
			Cell 1				
			T1	T2	T3	T4	T5
Pcompensation	dB	1,2,3,4	-	-	0	0	-
$Qhyst_s$	dB	1,2,3,4	-	-	0	0	-
$Qoffset_{s,n}$	dB	1,2,3,4	-	-	0	0	-
Cell_selection_and_ reselection_quality_measurement		1,2,3,4	SS-RSRP				
Treselection	s	1,2,3,4	-		0		-
SnonintrasearchP	dB	1,2,3,4	-		Not Sent		-
SnonintrasearchQ	dB	1,2,3,4	-		Not Sent		-
$Thresh_{x,high}$	dB	1,2,3,4	-		48		-
$Thresh_{serving,low}$	dB	1,2,3,4	-		44		-
$Thresh_{x,low}$	dB	1,2,3,4	-		50		-
Propagation Condition	dB	1,2,3,4	-		AWGN		-

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.6.6.15.1-4: Cell specific test parameters for LTE cell for Idle Mode measurements of inter-RAT DC candidate cells for early reporting

Parameter	Unit	Config	Test 1				
			Cell 2				
			T1	T2	T3	T4	T5
Frequency Range		1,2,3,4	LTE				
Duplex mode		1, 3	FDD				
		2, 4	TDD				
$BW_{channel}$	MHz	1,2,3,4	10	10	-	-	10
Measurement bandwidth	n_{PRB}	1,2,3,4	-	-	22-27	22-27	-
PDSCH Reference Measurement Channel 1: R.1 FDD 2: R.1 TDD	FDD	1,3	1	1	-	-	1
	TDD	2,4	2	2	-	-	2
PDCCH/PCFICH/PHICH Reference measurement channel defined in A.3.1.2.1 and A.3.1.2.2 in 36.133 1: R.6 FDD 2: R.6 TDD		1,3	1	1	-	-	1
		2,4	2	2	-	-	2
OCNG Patterns defined in A.3.2.1.1 (OP.2 FDD) and A.3.2.1.2 (OP.2 TDD) in 36.133 1: OP.2 FDD 2: OP.2 TDD		1,3	1				
		2,4	2				
Correlation Matrix and Antenna config		1,2,3,4	1x2 Low				
PBCH_RA	dB	1,2,3,4	N/A	N/A	0	0	N/A
PBCH_RB			N/A	N/A	0	0	N/A
PSS_RA			N/A	N/A	0	0	N/A
SSS_RA			N/A	N/A	0	0	N/A
PCFICH_RB			N/A	N/A	0	0	N/A
PHICH_RA			N/A	N/A	0	0	N/A
PHICH_RB			N/A	N/A	0	0	N/A
PDCCH_RA			N/A	N/A	0	0	N/A
PDCCH_RB			N/A	N/A	0	0	N/A
PDSCH_RA			N/A	N/A	0	0	N/A
PDSCH_RB			N/A	N/A	0	0	N/A
OCNG_RA[Note 1]			N/A	N/A	0	0	N/A
OCNG_RB[Note 1]			N/A	N/A	0	0	N/A

Parameter	Unit	Config	Test 1				
			Cell 2				
			T1	T2	T3	T4	T5
N_{oc} Note2	dBm/ 15 kHz	1,2	-98	-98	-98	-98	-98
		3,4					
$\hat{E}_s/I_{ot}$	dB	1,2,3,4	5	5	-3	8	5
$\hat{E}_s/N_{oc}$	dB	1,2,3,4	5	5	-3	8	5
SS-RSRP Note3,4	dBm/SCS	1,2,3,4	-93	-93	-101	-90	-93
Io Note3,4	dBm/ 9.36 MHz	1,2, 3, 4	-61.01	-61.01	-65.44	-58.57	-61.01
Qrxlevmin	dBm/SCS	1,2, 3, 4	-	-	-140		-
Pcompensation	dB	1,2,3,4	-	-	0	0	-
$Qhyst_s$	dB	1,2,3,4	-	-	0	0	-
$Qoffset_{s, n}$	dB	1,2,3,4	-	-	0	0	-
Cell_selection_and_ reselection_quality_measurement		1,2,3,4	RSRP and RSRQ				
Treselection	s	1,2,3,4	-		0		-
SnonintrasearchP	dB	1,2,3,4	-		Not Sent		-
SnonintrasearchQ	dB	1,2,3,4	-		Not Sent		-
$Thresh_{x, high}$	dB	1,2,3,4	-		48		-
$Thresh_{serving, low}$	dB	1,2,3,4	-		44		-
$Thresh_{x, low}$	dB	1,2,3,4	-		50		-
Propagation Condition	dB	1,2,3,4	-		AWGN		-

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.6.6.15.1-5: General idle mode test parameters for Idle Mode measurements of inter-RAT DC candidate cells for early reporting

Parameter	Unit	Test configuration	Value	Comment
Serving cell		1, 2, 3, 4	Cell 1	The UE camps on Cell 1 which is the former PCell.
Neighbour cell		1, 2, 3, 4	Cell 2	The UE shall perform inter-RAT measurements on Cell 2 which is the former PSCell.
RF Channel Number		1, 2, 3, 4	1, 2	
Time offset between cells		1, 2, 3, 4	3 µs	Synchronous cells
Access Barring Information	-	1, 2, 3,4	Not Sent	No additional delays in random access procedure.
SSB configuration		1, 2	SSB.1 FR1	Serving cell
		3, 4	SSB.2 FR1	Serving cell
SMTC configuration Serving cell		1, 2, 3, 4	SMTC.2	
DRX cycle length	s	1, 2, 3, 4	1.28	The value shall be used for all cells in the test.
PRACH configuration index		1, 2, 3, 4	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell		1, 2, 3, 4	Not configured	
T3	s	1, 2, 3, 4	0.5	T3 needs to be defined so that cell measurement time is taken into account.
T4	s	1, 2, 3, 4	65	T4 needs to be defined so that cell measurement time is taken into account.

A.6.6.15.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During time durations T1 the UE shall start transmitting preamble on PSCell. During T2 the UE perform intra-frequency measurements on the PCell and the PSCell.

During the time-period T3 the connection is released, and UE enters idle mode. During the time period T3 and T4 the UE is camped in Idle mode and at T4 the signal level of Cell 2 is changed. The UE shall not perform reselection. The UE shall perform Idle Mode CA measurement according to section 4.4.

At the start of T5 the UE is paged for connection setup. During the connection setup the UE is requested to transmit early measurement report. The UE shall send early measurement report to the PCell including idle mode CA/DC measurement from Cell 2.

After receiving the requested early measurement report, the test equipment verifies that the accuracy of measurement reported for serving Cell 1 and Cell 2 meets the requirements in sections 10.1.2B and 10.1.7B and sections 10.2.4 and 10.2.5, respectively and test ends.

A.6.6.16 PRS-RSRPP measurements

A.6.6.16.1 PRS-RSRPP reporting delay test case for single positioning frequency layer in FR1 in RRC_CONNECTED state

A.6.6.16.1.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement meets the delay requirements specified in clause 9.9.6.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.6.16.1.1-1.

Table A.6.6.16.1.11: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.6.16.1.1-2, and cell specific test parameters are listed in table A.6.6.16.1.1-3.

Table A.6.6.16.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	

Parameter	Unit	Test configuration	Value	Comment
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	NA	OFF
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	5	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.6.6.16.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ µs and $f_D = 5$ Hz			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.16.1.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9.6.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.16.2 PRS-RSRPP reporting delay test case with reduced number of samples for single positioning frequency layer in FR1 in RRC_CONNECTED state

A.6.6.16.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement meets the reduced sample measurement delay requirements specified in clause 9.9.6.5 in an environment with AWGN propagation conditions for reduced number of samples. In this test UE that supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* is configured by LMF to perform PRS measurement with reduced number of samples.

The supported test configurations are specified in table A.6.6.16.2.1-1.

Table A.6.6.16.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.6.16.2.1-2, and cell specific test parameters are listed in table A.6.6.16.2.1-3.

Table A.6.6.16.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	NA	OFF
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	5	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.6.6.16.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	‘10’		‘01’	
	dBm/SCS	1	-98			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note 2		2	-98			
		3	-95			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	0	-Infinity	-6
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	2.23	-Infinity	-1.73
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-95.77	-Infinity	-99.73
		2	-Infinity	-95.77	-Infinity	-99.73
		3	-Infinity	-92.77	-Infinity	-96.73
SS-RSRP Note 3	dBm/SCS kHz	1	-100	-100	-Infinity	-104
		2	-100	-100	-Infinity	-104
		3	-97	-97	-Infinity	-101
Io	dBm/19.08 MHz	1	N/A	-61.71	N/A	-61.71
	dBm/19.08 MHz	2		-61.71		-61.71
	dBm/47.88 MHz	3		-57.73		-57.73
Propagation Condition		1, 2, 3	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, τ_d = 0.45 µs and f_D = 5 Hz			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.16.2.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9.6.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.16.3 PRS-RSRPP reporting delay test case for single positioning frequency layer in FR1 in RRC_CONNECTED state without measurement gap

A.6.6.16.3.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement meets the delay requirements specified in clause 9.9.6.6 in an environment with AWGN propagation conditions. Reporting delay test for gapless PRS measurement is conducted assuming that the PRS has higher priority, i.e., state 1, than all other DL signals/channels and is transmitted within active DL BWP of UE. Two sub-tests are defined, sub-test 1 is for N_{sample} = 4 and sub-test 2 is for N_{sample} = 1. For sub-test 2 LMF indicates UE to perform PRS measurement with reduced number of samples N_{sample} via *reducedDL-PRS-ProcessingSamples*. The cell specific parameters for sub-test 1 and sub-test 2 are defined in table A.6.6.16.3.1-3.

The supported test configurations are specified in table A.6.6.16.3.1-1.

Table A.6.6.16.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first PRS processing window instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The UE is configured with PPW before start of T2.

The general test parameters are listed in table A.6.6.16.3.1-2, and cell specific test parameters are listed in table A.6.6.16.3.1-3.

Table A.6.6.16.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
PPW configuration		1,2,3	PPW.1	As defined in A.3.33
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	NA	OFF
Time offset between serving and neighbour cells	µs	1, 2, 3	- set to the UE reported capability for receive time difference threshold if the UE reported value is < 3µs - 3µs otherwise	Synchronous cells
Expected RSTD	µs	1, 2, 3	0	
Expected RSTD uncertainty	µs	1, 2, 3	Same as time offset	
T1	s	1, 2, 3	2	
T2	ms	1, 2, 3	10	In this test UE is configured to measure single PFL within the configured PPW.

Table A.6.6.16.3.1-3: Cell specific test parameters T2

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	0	-12.12	-6
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-2	2.23	-10	-1.72
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-100	-95.77	-108	-99.73
		2	-100	-95.77	-108	-99.73
		3	-97	-92.77	-105	-96.73
SS-RSRP Note 3	dBm/SCS kHz	1	-100	-100	-104	-104
		2	-100	-100	-104	-104
		3	-97	-97	-101	-101
Io	dBm/19.08 MHz	1	-64.57	-61.71	-64.57	-61.71
	dBm/19.08 MHz	2	-64.57	-61.71	-64.57	-61.71
	dBm/47.88 MHz	3	-60.59	-57.73	-60.59	-57.73
Propagation Condition		1, 2, 3	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ µs and $f_D = 5$ Hz			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.16.3.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9.6.6, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.17 SA event triggered reporting tests with Pre-MG

A.6.6.17.1 SA event triggered reporting tests with autonomous activation/deactivation Pre-MG

A.6.6.17.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3. And this test will also jointly verify Pre-configured measurement gap activation/deactivation delay in clause 8.19.2.

A.6.6.17.1.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.6.6.17.1.2-1 and A.6.6.17.1.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively.

During the duration of T1,

- UE is configured with 2 different UE-specific bandwidth parts for Cell 1 (PCell), BWP-1 and BWP-2, before starting the test.
- BWP-1 includes bandwidth of the initial DL BWP and SSB. UE is expected to deactivate the Pre-MG when this BWP is active.
- BWP-2 does not include bandwidth of the initial DL BWP and SSB. UE is expected to activate the Pre-MG when this BWP is active.

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.

- At the start of time duration T2, the serving gNB can trigger Pre-MG activation starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted i. The UE shall switch its bandwidth part from BWP-1 to BWP-2. And UE is expected to complete the Pre-MG activation within T2.
- At the start of time duration T3, the UE may not have any timing information of neighbor cell to be measured (e.g. Cell 2). And UE was expected to complete the measurements of SSBs with the activated Pre-MG within T3.

There are two BWPs configured in Cell 1, BWP-1 which contains the cell defining SSB, and BWP-2 which does not contain any SSB of Cell 1.

Table A.6.6.17.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.17.1.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
Measurement gap type		1, 2, 3	Per-UE gaps	
Measurement gap repetition periodicity	ms	1, 2, 3	40	
Measurement gap length	ms	1, 2, 3	6	

Parameter	Unit	Test configuration	Value	Comment
Measurement gap offset	ms	1, 2, 3	39	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CSI-RS parameters		1	CSI-RS.1.2 FDD resource #0	
		2	CSI-RS.1.2 TDD resource #0	
		3	CSI-RS.2.2 TDD resource #0	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX	ms	1, 2, 3		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 μs	Synchronous cells
		3	3 μs	Synchronous cells
T1	s	1, 2, 3	0.1	
T2	s	1, 2, 3	0.2	
T3	s	1,2, 3	5	
bwp-InactivityTimer	ms		500	

Table A.6.6.17.1.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
Intial BWP configuration		1,2,3	DLBWP.0.1 ULBWP.0.1			DLBWP.0.1 ULBWP.0.1		
BWP-1 Configuration		1,2,3	DLBWP.1.3 ULBWP.1.3			N/A		
BWP-2 Configuration		1,2,3	DLBWP.1.2 ULBWP.1.2			N/A		
PDSCH RMC configuration		1	SR.1.1 FDD			N/A		
		2	SR.1.1 TDD					
		3	SR.2.1 TDD					
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.2 FDD			CCR.1.1 FDD		
		2	CCR.1.2 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Patterns		1, 2, 3	OP.1			OP.1		
TRS configuration		1	TRS.1.1 FDD			N/A		
		2	TRS.1.1 TDD			N/A		
		3	TRS.1.2 TDD			N/A		
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1			DLBWP.0.1 ULBWP.0.1		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Active DL BWP configuration		1, 2, 3	DLBWP.1.2			DLBWP.1.1		
Active UL BWP configuration		1, 2, 3	ULBWP.1.2			ULBWP.1.1		
RLM-RS		1, 2, 3	CSI-RS			SSB		
N_{oc} Note 2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note 2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46		-Infinity	-1.46	
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	4	4		-Infinity	4	
		2						
		3						
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94		-Infinity	-94	
		2	-94	-94		-Infinity	-94	
		3	-91	-91		-Infinity	-91	
Io	dBm/9.36 MHz	1	-64.60	-62.25		-64.60	-62.25	
	dBm/9.36 MHz	2	-64.60	-62.25		-64.60	-62.25	
	dBm/38.16 MHz	3	-58.50	-56.16		-58.50	-56.16	
Propagation Condition		1, 2, 3	AWGN					

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.17.1.3 Test Requirements

During T1 the UE shall report corresponding valid ACK/NACK for those PDSCHs scheduled in the slots overlapped with the Pre-MG occasions, starting from the 1 s^t complete Pre-MG occasion after the beginning of PCell's DL slot $(i+T_{BWPswitchDelay})$ + 5 ms as defined in clause 8.19.2.

During T3, the UE shall NOT be able to receive PDSCH and report corresponding valid ACK/NACK for those PDSCHs scheduled in the slots overlapped with the Pre-MG occasions.

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T3.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.17.2 SA event triggered reporting tests with pre-configured measurement gaps and network-controlled activation/deactivation

A.6.6.17.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE correctly activates and deactivates the pre-MG and makes correct measurement and reporting of an event with activated and deactivated pre-MG. This test will partly verify the pre-MG activation and deactivation delay requirements in clause 8.19.2 and the intra-frequency cell search requirements in clause 9.2.6.2 and 9.3.4.

A.6.6.17.2.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The supported test configurations are listed in table A.6.6.17.2.2-1, general test parameters are listed in table A.6.6.17.2.2-2, and cell specific test parameters are listed in table A.6.6.17.2.2-3.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. A pre-MG is configured before the test.

The UE is configured with 2 dedicated BWPs, BWP-1 and BWP-2. BWP-1 includes bandwidth of the SSB, and *preConfGapStatus* for BWP-1 is set to '0'; BWP-2 does not include bandwidth of the SSB, and *preConfGapStatus* for BWP-2 is set to '1'.

The test consists of 3 successive time periods, with time duration of T1, T2, and T3 respectively. Before the test starts, UE is switched to BWP-1.

The time period T2 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2 and complete pre-MG activation during T2.

During T3, UE shall perform intra-frequency measurement with pre-MG activated.

During time duration T1 and T2, the UE shall not have any timing information of Cell 2.

Table A.6.6.17.2.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.17.2.2-2: General test parameters for SA intra-frequency event triggered reporting with with pre-configured measurement gaps and network-controlled activation/deactivation

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
Measurement gap type		1, 2, 3	Per-UE gaps	
Measurement gap repitition periodicity	ms	1, 2, 3	40	
Measurement gap length	ms	1, 2, 3	6	
Measurement gap offset	ms	1, 2, 3	39	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CSI-RS parameters		1	CSI-RS.1.2 FDD resource #0	
		2	CSI-RS.1.2 TDD resource #0	
		3	CSI-RS.2.2 TDD resource #0	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	

Parameter	Unit	Test configuration	Value	Comment
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX	ms	1, 2, 3		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3	0.1	
T2	s	1, 2, 3	0.1	
T3	s	1, 2, 3	5	

Table A.6.6.17.2.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with with pre-configured measurement gaps and network-controlled activation/deactivation

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			N/A		
		2	SR.1.1 TDD					
		3	SR.2.1 TDD					
RMSI CORESET RMC configuration		1	CR.1.1 FDD			N/A		
		2	CR.1.1 TDD			N/A		
		3	CR.2.1 TDD			N/A		
Dedicated CORESET RMC configuration		1	CCR.1.2 FDD			N/A		
		2	CCR.1.2 TDD			N/A		
		3	CCR.2.1 TDD			N/A		
OCNG Patterns		1, 2, 3	OP.1			OP.1		
TRS configuration		1	TRS.1.1 FDD			N/A		
		2	TRS.1.1 TDD			N/A		
		3	TRS.1.2 TDD			N/A		
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1			N/A		
Active DL BWP configuration for BWP-1		1, 2, 3	DLBWP.1.3			N/A		
Active UL BWP configuration for BWP-1		1, 2, 3	ULBWP.1.3			N/A		
Active DL BWP configuration for BWP-2		1, 2, 3	DLBWP.1.2			N/A		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Active UL BWP configuration for BWP-2		1, 2, 3	ULBWP.1.2			N/A		
RLM-RS		1, 2, 3	CSI-RS			N/A		
N_{oc} Note 2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note 2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/I_{ot}$	dB	1,2,3	4	4	-1.46	-Infinity	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1,2,3	4	4	4	-Infinity	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1,2	-94	-94	-94	-Infinity	-Infinity	-94
		3	-91	-91	-91	-Infinity	-Infinity	-91
Io	dBm/9.36 MHz	1,2	-64.60	-64.60	-62.25	-64.60	-64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-58.50	-56.16	-58.50	-58.50	-56.16
Propagation Condition		1, 2, 3	AWGN					

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2 and T4.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.17.2.3 Test Requirements

During T1, UE shall report corresponding HARQ-ACK/NACK for those PDSCHs scheduled in the slots overlapped with the pre-MG occasions.

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T3. During T3, UE is not required to report corresponding HARQ-ACK/NACK for those PDSCHs scheduled in the slots overlapped with the pre-MG occasions.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.17.3 Void

A.6.6.17.3.1 Void

A.6.6.17.3.2 Void

A.6.6.17.3.3 Void

A.6.6.18 SA event triggered reporting tests with concurrent gaps

A.6.6.18.1 SA event triggered reporting tests for FR1 concurrent gaps with non-overalpping scenario for SSB-based measurements in both inter-frequency layers

A.6.6.18.1.1 Test Purpose and Environment

The purpose of this test is to verify that the concurrent gaps capable UE makes correct reporting of events. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1, NR Cell 2 as neighbour cell in FR1 on NR RF channel 2, and NR cell 3 as neighbour cell in FR1 on NR RF channel 3. The test parameters are given in tables A.6.6.18.1.1-1, A.6.6.18.1.1-2 and A.6.6.18.1.1-3.

Two measurement gap patterns (MeasGapId #1 and MeasGapId #2) are configured with the gap pattern ID #0 and #1 as defined in table A.6.6.18.1.1-2. MeasGapId #2 is configured with a higher priority than MeasGapId #1. MeasGapId #1 and MeasGapId #2 are associated with the MOs for RF channel numbers #2 and #3, respectively.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used for both frequency layers. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2 and NR cell 3.

Table A.6.6.18.1.1-1: SA event triggered reporting tests for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR cells have the same SCS, BW and duplex mode as NR serving cells	

Table A.6.6.18.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 concurrent gaps with fully non-overalpping scenario for SSB-based measurements in both inter-frequency layers

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2, 3	Three FR1 NR carrier frequencies are used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cells 2 and 3	NR Cell 2 is on NR RF channel number 2. NR cell 3 is on NR RF channel number 3.
Gap Pattern Id		Config 1,2,3	0 for MeasGapId #1 1 for MeasGapId #2	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39 for MeasGapId #1 19 for MeasGapId #2	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cell 1		Config 1, 2, 3	3μs	Synchronous.
Time offset between serving and neighbour Cell 2		Config 1, 2, 3	5 ms	Asynchronous. The timing of Cell 3 is 5 ms later than the timing of Cell 1.

Parameter	Unit	Test configuration	Value		Comment
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	1.5	1.5	

Table A.6.6.18.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 concurrent gaps with fully non-overalpping scenario for SSB-based measurements in both inter-frequency layers

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2		3	
Duplex mode			Config 1	FDD					
			Config 2,3	TDD					
TDD configuration			Config 1	Not Applicable					
			Config 2	TDDConf.1.1					
			Config 3	TDDConf.2.1					
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
			Config 3	40: $N_{PRB,c}$ = 106					
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
			Config 3	40: $N_{PRB,c}$ = 106					
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA		NA	
	Initial UL BWP			ULBWP.0.1		NA		NA	
	Dedicated DL BWP			DLBWP.1.1		NA		NA	
	Dedicated UL BWP			ULBWP.1.1		NA		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA		NA	
			Config 2	TRS.1.1 TDD		NA		NA	
			Config 3	TRS.1.2 TDD		NA		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD					
			Config 2	SR.1.1 TDD					
			Config 3	SR.2.1 TDD					
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD					
			Config 2	CR.1.1 TDD					
			Config 3	CR.2.1 TDD					
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD					
			Config 2	CCR.1.1 TDD					
			Config 3	CCR.2.1 TDD					
SSB parameters			Config 1,2,3	SSB.1 FR1		SSB.1 FR1		SSB.1 FR1	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.2		SMTC.2		SMTC.2	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15					
			Config 3	30					
EPRE ratio of PSS to SSS			Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz		-98		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98		-98	
		Config 3	-95		-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	4	4	-Infinity	7	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.18.1.2 Test Requirements

The UE shall send one Event A3 triggered measurement report for each neighboring cell, with a measurement reporting delay less than 920 ms for Cell 2 and 1280 ms for cell 3 from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.18.2 SA event triggered reporting tests for FR1 concurrent gap with partially partial overalpping scenario for SSB-based measurements in both inter-frequency layers

A.6.6.18.2.1 Test Purpose and Environment

The purpose of this test is to verify that the concurrent gap capable UE makes correct reporting of events. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1, NR Cell 2 as neighbour cell in FR1 on NR RF channel 2, and NR cell 3 as neighbour cell in FR1 on NR RF channel 3. The test parameters are given in tables A.6.6.18.2.1-1, A.6.6.18.2.1-2 and A.6.6.18.2.1-3. The TE schedules continuous DL data on PCell throughout the test.

Two measurement gap patterns (MeasGapId #1 and MeasGapId #2) are configured with the gap pattern ID #0 and #1 as defined in table A.6.6.18.2.1-2. MeasGapId #2 is configured with a higher priority than MeasGapId #1. MeasGapId #1 and MeasGapId #2 are associated with the MOs for RF channel numbers #2 and #3, respectively.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used for both frequency layers. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2 and NR cell 3.

Table A.6.6.18.2.1-1: SA event triggered reporting tests for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR cells have the same SCS, BW and duplex mode as NR serving cells	

Table A.6.6.18.2.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 concurrent gap with partially partial overalpping scenario for SSB-based measurements in both inter-frequency layers

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2, 3	Three FR1 NR carrier frequencies are used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cells 2 and 3	NR Cell 2 is on NR RF channel number 2. NR cell 3 is on NR RF channel number 3.
Gap Pattern Id		Config 1,2,3	0 for MeasGapId #1 1 for MeasGapId #2	As specified in clause 9.1.2-1.
Measurement gap offset	ms	Config 1,2,3	39 for MeasGapId #1 4 for MeasGapId #2	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour Cell 1		Config 1, 2, 3	3μs	Synchronous.
Time offset between serving and neighbour Cell 2		Config 1, 2, 3	5 ms	Asynchronous. The timing of Cell 3 is 5 ms later than the timing of Cell 1.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1.5 | 1.5	

Table A.6.6.18.2.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 concurrent gap with partially-partial overalpping scenario for SSB-based measurements in both inter-frequency layers

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3	1		2		3	
Duplex mode		Config 1	FDD					
		Config 2,3	TDD					
TDD configuration		Config 1	Not Applicable					
		Config 2	TDDConf.1.1					
		Config 3	TDDConf.2.1					
$BW_{channel}$	MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
		Config 3	40: $N_{PRB,c}$ = 106					
BWP BW	MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
		Config 3	40: $N_{PRB,c}$ = 106					

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA		NA	
	Initial UL BWP			ULBWP.0.1		NA		NA	
	Dedicated DL BWP			DLBWP.1.1		NA		NA	
	Dedicated UL BWP			ULBWP.1.1		NA		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA		NA	
			Config 2	TRS.1.1 TDD		NA		NA	
			Config 3	TRS.1.2 TDD		NA		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD					
			Config 2	SR.1.1 TDD					
			Config 3	SR.2.1 TDD					
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD					
			Config 2	CR.1.1 TDD					
			Config 3	CR.2.1 TDD					
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD					
			Config 2	CCR.1.1 TDD					
			Config 3	CCR.2.1 TDD					
SSB parameters			Config 1,2,3	SSB.1 FR1		SSB.1 FR1		SSB.1 FR1	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.2		SMTC.2		SMTC.7	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15					
			Config 3	30					
EPRE ratio of PSS to SSS			Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		dBm/15 kHz		-98		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-98		-98	
			Config 3	-95		-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-Infinity	-91	-Infinity	-91
			Config 3	-91	-91	-Infinity	-88	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3	4	4	-Infinity	7	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2,3	4	4	-Infinity	7	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26	-70.05	-62.26
		dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15	-63.94	-56.15
Propagation Condition			Config 1,2,3	AWGN		AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.								

A.6.6.18.2.2 Test Requirements

The UE shall send one Event A3 triggered measurement report for each neighboring cell, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.18.3 SA NR - E-UTRAN and NR FR1 concurrent event-triggered reporting in non-DRX in FR1

A.6.6.18.3.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of concurrent inter-RAT E-UTRAN and NR FR1 measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in clauses 9.4.2, 9.4.3, 9.3.4 and 9.3.5.

In each test there are three cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the NR PCell, Cell 2 is an Inter-frequency NR FR1 neighbour cell on NR RF channel 2 and Cell 3 is an inter-RAT E-UTRAN neighbour cell on LTE RF channel 3.

In the measurement control information from the PCell it is indictated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used for the E-UTRAN cell (cell 3). In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used for the NR FR1 cell (Cell 2).

Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2 and Cell 3.

In the test two concurrent per-UE measurement gap pattern configurations # 0 as defined in table A.6.6.18.3.1-2 are provided for a UE. Two measurement gap patterns (MeasGapId #1 and MeasGapId #2) are configured with the gap pattern ID #1 as defined in table A.6.6.18.3.1-2. MeasGapId #2 is configured with a higher priority than MeasGapId #1. MeasGapId #1 and MeasGapId #2 are associated with the MOs for NR RF channel numbers #2 and LTE RF channel #3, respectively.

Supported test configurations are shown in table A.6.6.18.3.1-1. General test parameters are provided in table A.6.6.18.3.1-2 below. Test parameters for Cell 1, Cell 2 and Cell 3, valid for both time duration T1 and T2, are provided in tables A.6.6.18.3.1-3 and A.6.6.18.3.1-4, respectively.

The test parameters and configurations are given in tables A.6.6.18.3.1-1, A.6.6.18.3.1-2, and A.6.6.18.3.1-3.

Table A.6.6.18.3.1-1: Supported test configurations in SA concurrent inter-RAT E-UTRAN and NR FR1 inter-frequency event triggered reporting in non-DRX with PCell in FR1

Configuration	Description	Description of target cell

1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE: FDD. NR: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE: FDD. NR: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE: FDD. NR: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE: TDD. NR: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE: TDD. NR: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE: TDD. NR: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.6.6.18.3.1-2: General test parameters for SA concurrent inter-RAT E-UTRAN and NR FR1 inter-frequency event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		1 - 6	1, 2	2 NR carrier frequency is used in the test.
LTE RF Channel Number			3	1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	1 - 6	As specified in tables A.6.6.18.3.1-3 and A.6.6.18.3.1-4.	
Active cell		1 - 6	NR Cell 1 (PCell in FR1)	Cell 1 is on NR RF channel number 1
Neighbour Cell 1		1 - 6	Cell 2 (NR FR1)	Cell 2 is on NR RF channel number 2
Neighbour Cell 2		1 - 6	Cell 3 (LTE)	Cell 3 is on LTE RF channel number 3
Gap Pattern Id		1 - 6	1 for MeasGapId #1 1 for MeasGapId #2	As specified in clause Table 9.1.2-1. Per-UE gap pattern.
Measurement gap offset	ms	1 – 6	19 for MeasGapId #1 39 for MeasGapId #2	
NR measurement quantity			SS-RSRP	Measurement quantity for Cell 1 and Cell 2
Inter-RAT E-UTRAN measurement quantity			RSRP	Measurement quantity for Cell 3
b2-Threshold1	dBm		As specified in table A.6. 6.18.3.1-3	SS-RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
b2-Threshold2EUTRA	dBm		-101	E-UTRAN RSRP threshold for SS-RSRP measurement on Cell 3 for event B2
Hysteresis	dB	1 – 6	0	
TimeToTrigger	s	1 – 6	0	
Filter coefficient		1 – 6	0	L3 filtering is not used
offsetMO	dB	1 - 6	6	NR Cell 2
a4-Threshold	dBm	1 – 6	-105	NR Cell 2
DRX			OFF	N.A
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells NR cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3μs	Synchronous NR cells.
T1	s	1 – 6	5	for LTE Cell 3 and NR FR1 Cell 2
T2	s	1 - 6	5	for LTE Cell 3
			10.3 for PC1 and PC5; 6.5 for other PC	for NR FR1 Cell 2

Table A.6.6.18.3.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1-6	1		2	
Duplex mode			Config 1, 4	FDD		FDD	
			Config 2, 3, 5, 6	TDD		TDD	
TDD configuration			Config 1, 4	Not Applicable		Not Applicable	
			Config 2, 5	TDDConf.1.1		TDDConf.1.1	
			Config 3, 6	TDDConf.2.1		TDDConf.2.1	
$BW_{channel}$		MHz	Config 1, 4	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
			Config 2, 5	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
			Config 3, 6	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1-6	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
CSI-RS for tracking parameters on NR RF Channel 1			Config 1, 4	TRS.1.1 FDD			
			Config 2, 5	TRS.1.1 TDD			
			Config 3, 6	TRS.1.2 TDD			
OCNG Patterns			Config 1-6	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1, 4	SR.1.1 FDD		-	
			Config 2, 5	SR.1.1 TDD			
			Config 3, 6	SR.2.1 TDD			
RMSI CORESET Reference Channel			Config 1, 4	CR.1.1 FDD		-	
			Config 2, 5	CR.1.1 TDD			
			Config 3, 6	CR.2.1 TDD			
Dedicated CORESET RMC configuration			Config 1, 4	CCR.1.1 FDD		-	
			Config 2, 5	CCR.1.1 TDD			
			Config 3, 6	CCR.2.1 TDD			
SMTC configuration			Config 1, 4	SMTC.2		SMTC.2	
			Config 2, 3, 5, 6	SMTC.1		SMTC.1	
SSB configuration			Config 1, 4	SSB.1 FR1		SSB.1 FR1	
			Config 2, 5	SSB.1 FR1		SSB.1 FR1	
			Config 3, 6	SSB.2 FR1		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1, 2, 4, 5	15		15	
			Config 3, 6	30		30	
b2-Threshold1		dBm	Config 1, 2, 4, 5	-81		-	
			Config 3, 6	-78		-	
EPRE ratio of PSS to SSS			Config 1-6	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} note2		dBm/15 KHz	1-6	-98			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} note2	dBm/SCS	Config 1, 2, 4, 5	-98			
		Config 3, 6	-95			
$\hat{E}_s/N_{oc}$	dB	Config 1 - 6	4		-Infinity	4
$\hat{E}_s/I_{ot}$ note3	dB	Config 1 - 6	4		-Infinity	4
SSB_RP note3	dBm/SCS	Config 1, 2, 4, 5	-94		-Infinity	-94
		Config 3, 6	-91		-Infinity	-91
Io note3	dBm/9.36 MHz	Config 1, 2, 4, 5	-64.59		-70.05	-64.59
	dBm/38.16 MHz	Config 3, 6	-58.49		-63.94	-58.49
Propagation condition		Config 1 - 6	AWGN			
Antenna Configuration and Correlation Matrix		Config 1 - 6	1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS B_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Void
NOTE 6: Void
NOTE 7: Void
NOTE 8: Void

Table A.6.6.18.3.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 3	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	3	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration Note1		4, 5, 6	6	
TDD uplink-downlink configuration Note1		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel Note2		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel Note2		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns Note2		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	

Parameter	Unit	Configuration	Cell 3	
			T1	T2
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15 kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2, 3, 4, 5, 6	-Infinity	17
RSRP Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
SCH_RP Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
Io Note5	dBm/9 MHz	1, 2, 3, 4, 5, 6	-76.22+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.18.3.2 Test Requirements

In this test with per-UE gap, the UE shall send one Event A4 triggered measurement report for Cell 2, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

10240 for UE supporting power class 1 and 5, or

6400 for UE supporting other power class.

The UE shall send one Event B2 triggered measurement report for Cell 3 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2.

The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.18.4 SA event triggered reporting tests for PRS and SSB measurement in FR1 without SSB time index detection when DRX is not used

A.6.6.18.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA NR measurements with concurrent gaps requirements in clause 9.2.6(when one of concurrent gaps in same frequency

layer of serving cells), 9.3.6(when one of concurrent gaps in the different frequency layer of serving cells) and 9.9.2(when one of concurrent gaps used for PRS measurement).

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1, NR Cell 2 as neighbour cell in FR1 on NR RF channel 2 and NR cell 3 as neighbor cell in FR1 on NR RF channel 1. The test parameters are given in tables A.6.6.18.4.1-1, A.6.6.18.4.1-2 and A.6.6.18.4.1-3.

Two measurement gap patterns (MeasGapId #1 and MeasGapId #2) are configured with the gap pattern ID #0 and #24 as defined in table A.6.6.18.4.1-2. MeasGapId #2 is configured with a higher priority than MeasGapId #1. MeasGapId #1 and MeasGapId #2 are associated with the MOs for RF channel numbers #1 and #2, respectively.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2 and NR cell 3. Cell 1 and cell 3 transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance of MeasGapId #2 containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

Table A.6.6.18.4.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.18.4.1-2: General test parameters for SA inter-frequency event triggered reporting for concurrent gaps with partially partial overalpping scenario for SSB-based measurements and PRS measurement

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		1,2,3	1: Cell 1 and Cell 3 2: Cell 2	Two FR1 carrier frequencies are used for the NR cells.
Active cell		1,2,3	NR Cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1,2,3	NR Cell 2, NR cell 3	Cell 2 is an inter-frequency cell neighbor cell Cell 3 is an intra-frequency neighbour cell in the positioning assistance data.
Gap Pattern Id		1,2,3	0 for MeasGapId #1 24 for MeasGapId #2	
Measurement gap offset	ms	1,2,3	7 for MeasGapId #1 11 for MeasGapId #2	
A3-Offset	dB	1, 2, 3	-9	
Hysteresis	dB	1, 2, 3	0	
DRX		1, 2, 3	NA	OFF
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	5	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.6.6.18.4.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 concurrent gap with partially-partial overalpping scenario for SSB-based measurements and PRS measurement

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
TDD configuration			1	N/A		N/A		N/A	
			2	TDDConf.1.1		TDDConf.1.1		TDDConf.1.1	
			3	TDDConf.2.1		TDDConf.2.1		TDDConf.2.1	
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
			3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
			3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A		N/A	
	Initial UL BWP			ULBWP.0.1		N/A		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH RMC configuration			1	SR.1.1 FDD		N/A		N/A	
			2	SR.1.1 TDD					
			3	SR.2.1 TDD					
RMSI CORESET RMC configuration			1	CR.1.1 FDD		N/A		N/A	
			2	CR.1.1 TDD		N/A		N/A	
			3	CR.2.1 TDD		N/A		N/A	
Dedicated CORESET RMC configuration			1	CCR.1.1 FDD		N/A		N/A	
			2	CCR.1.1 TDD		N/A		N/A	
			3	CCR.2.1 TDD		N/A		N/A	
SSB parameters			1	SSB.1 FR1		SSB.1 FR1		SSB.1 FR1	
			2	SSB.1 FR1		SSB.1 FR1		SSB.1 FR1	
			3	SSB.2 FR1		SSB.2 FR1		SSB.2 FR1	
SMTC configuration defined in A.3.11			1	SMTC.2		SMTC.2		SMTC.2	
			2	SMTC.1		SMTC.1		SMTC.1	
			3	SMTC.1		SMTC.1		SMTC.1	
TRS Configuration			1	TRS.1.1 FDD		N/A		N/A	
			2	TRS.1.1 TDD		N/A		N/A	
			3	TRS.1.2 TDD		N/A		N/A	
PRS configuration			1	PRS.1.4 FR1		N/A		PRS.1.4 FR1	
			2	PRS.1.4 FR1		N/A		PRS.1.4 FR1	
			3	PRS.2.4 FR1		N/A		PRS.2.4 FR1	
PRS muting configuation			1, 2, 3	‘10’		‘01’		‘01’	
PDSCH/PDCCH subcarrier spacing		KHz	1, 2	15					
			3	30					
N_{oc} Note2		dBm/15 kHz Note5	1	-98		-98		-98	
			2	-98		-98		-98	
			3	-98		-98		-98	
N_{oc} Note2		dBm/SCS Note4	1	-98		-98		-98	
			2	-98		-98		-98	
			3	-95		-95		-95	
SS-RSRP Note 3		dBm/SCS Note5	1	-94	-94	-Infinity	-94	N/A	N/A
			2	-94	-94	-Infinity	-94	N/A	N/A
			3	-91	-91	-Infinity	-94	N/A	N/A
PRS-RSRP Note 3		dBm/SCS Note5	1	-Infinity	-101	N/A	N/A	-Infinity	-108
			2	-Infinity	-101	N/A	N/A	-Infinity	-108
			3	-Infinity	-98	N/A	N/A	-Infinity	-105

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
PRS $\hat{E}_s/I_{ot}$	dB	1,2,3	-Infinity	-3	N/A	N/A	-Infinity	-10
PRS $\hat{E}_s/N_{oc}$	dB	1,2,3	-Infinity	-3	N/A	N/A	-Infinity	-10
Io[Note3]	dBm/9.36 MHz	1	-64.59		-70.05	-64.59	-64.59	
	dBm/9.36 MHz	2	-64.59		-70.05	-64.59	-64.59	
	dBm/38.16 MHz	3	-58.49		-63.94	-58.49	-58.49	
Propagation Condition		1,2,3	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io values are derived without considering PRS-RSRP.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Void
NOTE 6: Void
NOTE 7: Void

A.6.6.18.4.2 Test Requirements

The UE shall send one Event A3 triggered measurement report for Cell 2, with a measurement reporting delay less than 1840 ms from the beginning of time period T2.

The PRS RSRP measurement time fulfils the requirements specified in clause 9.9.3.5. The UE shall perform and report the PRS RSRP measurements for Cell 3 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in section 9.9.3.5 starting from the beginning of time interval T2.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1.24.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

IUE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.19 SA event triggered reporting tests with NCSG

A.6.6.19.1 SA event triggered reporting tests with NCSG under non-DRX in FR1

A.6.6.19.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.7.1 and 9.2.7.2, and also verify the scheduling availability during intra-frequency measurement with NCSG in clause 9.2.7.3.

The serving frequency should be selected for which UE reports ‘ncsg’.

A.6.6.19.1.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.6.6.19.1.2-1, A.6.6.19.1.2-2 and A.6.6.19.1.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

During T2, the UE is continuously scheduled with data on the PCell.

The UE is capable of NCSG and report '*ncsg*' through *NeedForGapNCSG-InfoNR* for PCell.

NCSG pattern configuration # 0 as defined in table A.6.6.19.1.2-2 is provided for UE regardless of UE capable or incapable of supporting per-FR NCSG.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.6.6.19.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.19.1.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
NCSG type		1, 2, 3	Per-UE	Per-UE NCSG patter is configured.
NCSG pattern		1, 2, 3	0	
Visible interruption repetition periodicity	ms	1, 2, 3	40	
Measurement length	ms	1, 2, 3	5	
NCSG offset	ms	1, 2, 3	39	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CSI-RS parameters		1	CSI-RS.1.2 FDD resource #0	
		2	CSI-RS.1.2 TDD resource #0	
		3	CSI-RS.2.2 TDD resource #0	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX	ms	1, 2, 3		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
		2	3 μs	Synchronous cells
		3	3 μs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	1	

Table A.6.6.19.1.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with NCSG for PCell in FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.2 FDD		N/A	
		2	CCR.1.2 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2, 3	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.19.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

During T2, UE shall send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with the VIL of NCSG pattern.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.19.2 SA event triggered reporting tests for FR1 with NCSG for inter-frequency measurement

A.6.6.19.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.10.

The serving frequency and the target frequency should be selected such that UE reports 'ncsg' for the target frequency given the serving frequency.

A.6.6.19.2.2 Test parameters

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. NR RF channel 1 and NR RF channel 2 should be selected such that UE reports 'ncsg' for the target frequency on NR RF channel 2.

The test parameters are given in tables A.6.6.19.2.2-1, A.6.6.19.2.2-2 and A.6.6.19.2.2-3.

NCSG pattern configuration # 0 as defined in table A.6.6.19.2.2-2 is provided for UE regardless of UE capable or incapable of supporting per-FR NCSG.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

During T2, the UE is continuously scheduled with data on the PCell.

Table A.6.6.19.2.2-1: SA event triggered reporting tests for FR1 with NCSG for inter-frequency measurement

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.19.2.2-2: General test parameters for event triggered reporting for FR1 with NCSG for inter-frequency measurement

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
NCSG Pattern Id		Config 1,2,3	0	As specified in table 9.1.9.3-1.
NCSG offset		Config 1,2,3	9	
SMTC-SSB parameters		Config 1	SSB.1 FR1	As specified in clause A.3.10.1
		Config 2	SSB.1 FR1	As specified in clause A.3.10.1
		Config 3	SSB.2 FR1	As specified in clause A.3.10.1
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1	

Table A.6.6.19.2.2-3: Cell specific test parameters for SA event triggered reporting for FR1 with NCSG for inter-frequency measurement

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
RMSI CORESET Reference Channel		Config 1	CR.1.1 FDD			
		Config 2	CR.1.1 TDD			
		Config 3	CR2.1 TDD			
Dedicated CORESET Reference Channel		Config 1	CCR.1.1 FDD			
		Config 2	CCR.1.1 TDD			
		Config 3	CCR.2.1 TDD			
SSB parameters		Config 1	SSB.1 FR1		SSB.5 FR1	
		Config 2	SSB.1 FR1		SSB.5 FR1	
		Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11		Config 1	SMTC.2		SMTC.5	
		Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	15			
		Config 3	30			
EPRE ratio of PSS to SSS		Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.19.2.3 Test Requirements

In test 1 and 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

During T2, UE shall send HARQ-ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with the VIL of NCSG pattern.

The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2, the UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.19.3 SA NR - E-UTRAN event-triggered reporting in non-DRX in FR1 with NCSG

A.6.6.19.3.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements based on NCSG when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in clauses 9.4.2 and 9.4.3.

The serving frequency and the target frequency should be selected such that UE reports ‘ncsg’ for the target frequency given the serving frequency.

A.6.6.19.3.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. In the measurement control information from the PCell it is indictated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are shown in table A.6.6.19.3.2-1. General test parameters are provided in table A.6.6.19.3.2-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.6.6.19.3.2-3 and A.6.6.19.3.2-4, respectively.

Table A.6.6.19.3.2-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.19.3.2-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		2	1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.6.6.3.1.1-2 and A.6.6.3.1.1-3.	
Active cell		Cell 1	Cell 1 is on NR RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on LTE RF channel number 2
NCSG Pattern Id		0	As specified in clause Table 9.1.9.3-1.

Parameter	Unit	Value	Comment
NCSG offset	ms	39	
NCSG mgta	ms	0	
NR measurement quantity		SS-RSRP	Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP	Measurement quantity for Cell 2
b2-Threshold1	dBm	As specified in table A.6.3.1.4-3	SS-RSRP threshold for SS-RSRP measurement on cell1 for event B2
b2-Threshold2EUTRA	dBm	-95	E-UTRAN RSRP threshold for SS-RSRP measurement on cell1 for event B2
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	OFF
T1	s	5	
T2	s	5	
NOTE 1: Values are defined in table A.6.6.3.1.1-3			

Table A.6.6.19.3.2-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in non-DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 2, 3	FDD	
			4, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)	
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
RMSI CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
Dedicated CORSET reference channel			1, 4	CCR.1.1 FDD	
			2, 5	CCR.1.1 TDD	
			3, 6	CCR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	
CSI-RS for tracking			1, 4	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
b2-Threshold1		dBm	1, 2, 4, 5	--96	
			3, 6	--93	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6	-104	
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-104	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
		3, 6	-101	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	16	0
$\hat{E}_s/I_{ot}$ Note3	dB	1, 2, 3, 4, 5, 6	16	0
SS-RSRP Note3	dBm/SCS	1, 2, 4, 5	-88	-104
		3, 6	-85	-101
SSB_RP Note3	dBm/SCS	1, 2, 4, 5	-88	-104
		3, 6	-85	-101
Io Note3	dBm/9.36 MHz	1, 2, 4, 5	-59.94	-73.04
	dBm/38.16 MHz	3, 6	--53.84	--66.93
Propagation condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.19.3.2-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration Note1		4, 5, 6	6	
TDD uplink-downlink configuration Note1		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel Note2		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel Note2		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns Note2		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				

Parameter	Unit	Configuration	Cell 2	
			T1	T2
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15 kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2, 3, 4, 5, 6	-Infinity	17
RSRP Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
SCH_RP Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
Io Note5	dBm/9 MHz	1, 2, 3, 4, 5, 6	-76.22+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.19.3.3 Test Requirements

The UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

During T2, UE shall send HARQ-ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with the VIL of NCSG pattern.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.19.4 Event triggered reporting on SCC with deactivated SCell test with per-UE NCSG under non-DRX

A.6.6.19.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the cell search requirements on SCC with deactivated SCell in clauses 9.2.7.1 and 9.2.7.2.

A.6.6.19.4.2 Test parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1), FR1 SCell (Cell 2) and FR1 neighbour cell (Cell 3) on the same frequency as the SCell. The SCell is deactivated during the test. The test parameters for PCell, the SCell and the neighbour cell are given in table A.6.6.19.4.2-1 and A.6.6.19.4.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the SCell, and it is indicated to the UE that event-triggered reporting with Event A6 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 3. The PCell shall continuously scheduled with data in the DL starting from T1 until the UE has sent the measurement report during T2.

Table A.6.6.19.4.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.19.4.2-2: General test parameters for event triggered reporting on SCC with deactivated SCell with per-UE NCSG for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Configured deactivated SCell		1, 2, 3	Cell 2	
Neighbour cell		1, 2, 3	Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1	
RF Channel Number		1, 2, 3	2: Cell 2 and Cell 3	
Measurement gap type		1, 2, 3	Per-UE NCSG	
NCSG pattern		1, 2, 3	ID # 0	Defined in table 9.1.9.3-1
MGTA	ms	1, 2, 5	0	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A6-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3		OFF
SCell measurement cycle (measCycleSCell)	ms	1, 2, 3	160	
Cell 2 timing offset to Cell 1	µs	1, 2, 3	0	
Time alignment error between Cell 2 and Cell 1	µs	1, 2, 3	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
Cell 3 timing offset to Cell 1	µs	1, 2, 3	3	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	

Table A.6.6.19.4.2-3: NR Cell specific test parameters for event triggered reporting on SCC with deactivated SCell with per-UE NCSG for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
TDD configuration		1	N/A		N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A		N/A	
		2	SR.1.1 TDD					
		3	SR.2.1 TDD					
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A		N/A	
		2	CR.1.1 TDD		N/A		N/A	
		3	CR.2.1 TDD		N/A		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A		N/A	
		2	CCR.1.1 TDD		N/A		N/A	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
		3	CCR.2.1 TDD		N/A		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		TRS.1.1 FDD			
		2	TRS.1.1 TDD		TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		ULBWP.1.1		N/A	
N_{oc} Note 2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note 2	dBm/15 kHz	1, 2, 3	-98					
$\hat{E}_s/I_{ot}$	dB	1, 2, 3	4	4	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2, 3	4	4	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-94	-94	-Infinity	-94
		2	-94	-94	-94	-94	-Infinity	-94
		3	-91	-91	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-64.60	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-64.60	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-58.50	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3	AWGN					

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.19.4.3 Test Requirements

The UE shall send one Event A6 triggered measurement report, with a measurement reporting delay less than 1600 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall be scheduled on PCell continuously throughout the test. From the start of T1 until the measurement report is received during T2, UE shall send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with the VIL of NCSG pattern.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

For a test to be considered successful requirements on both Event A6 detection and percentage of transmitted ACK/NACKs have to be fulfilled simultaneously.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.20 UE Rx-Tx time difference measurement for propagation delay compensation

A.6.6.20.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement for RTT-based PDC meets the requirements specified in clause 9.12.4.1 for measurement delay and clause 10.1.39.2 for measurement accuracy in AWGN propagation condition in FR1 in standalone scenario.

The supported test configurations in listed in table A.6.6.20.1-1.

Table A.6.6.20.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

The test is considered with one cell (Cell 1) in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. If the test is based on PRS, the Cell 1 mutes PRS transmission during T1 and transmits PRS during T2.

If the test is based on PRS, the *MeasObjectRxTxDiff-r17* with *prs-Ref-r17* , *measObject* with *measObjectRxTxDiff-17,* and *NR-DL-PRS-PDC-Info as defined in TS 38.331* shall be provided to the UE during T1.

The last TTI containing the RRC configuration shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 10$ ms.

The beginning of the time interval T2 shall be aligned with the beginning of the first PRS resources.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.6.6.20.1-2. The test parameters for PRS are given Table A.6.6.20.1-3.

Table A.6.6.20.1-2: General test parameters

Parameter	Unit	Test configuration	Value
Active cell		1, 2, 3	Cell 1
RF Channel Number		1, 2, 3	1
$BW_{channel}$	MHz	1	10: $N_{PRB,c} = 52$
		2	10: $N_{PRB,c} = 52$
		3	40: $N_{PRB,c} = 106$
SSB configuration		1	SSB.1 FR1
		2	SSB.1 FR1
		3	SSB.2 FR1
SMTC configuration		1	SMTC.2
		2	SMTC.1
		3	SMTC.1
CP length		1, 2, 3	Normal
DRX		1, 2, 3	OFF
T1	s	1, 2, 3	5
T2	s	1, 2, 3	10

Table A.6.6.20.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1	N/A	
		2	TDDConf.1.1	
		3	TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD	
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD	
		2	CR.1.1 TDD	

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
		3	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD	
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1	
TRS Configuration		1	TRS.1.1 FDD	
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1	
PRS configuration		1	PRS.1.2 FR1	
		2	PRS.1.2 FR1	
		3	PRS.2.2 FR1	
PRS muting info		1, 2, 3	'10'	
SRS configuration		1	PDC-SRS.1	
		2	PDC-SRS.1	
		3	PDC-SRS.2	
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-98	
		3	-95	
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2	-98	
		3	-98	
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41
		2		
		3		
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2
		2		
		3		
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-100
		2	-Infinity	-100
		3	-Infinity	-97
Io	dBm/9.36 MHz	1	N/A	-67.67
	dBm/9.36 MHz	2		-67.67
	dBm/38.16 MHz	3		-61.57
Propagation Condition		1, 2, 3	AWGN	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: The noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.20.2 Test requirements

If the test is based on PRS, the UE Rx-Tx time difference measurement time fulfils the requirements specified in 9.12.4.1.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

The reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

The UE Rx-Tx time difference measurement time fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.39.2 for Cell 1.

A.6.6.21 UE Rx-Tx time difference measurement with TRS for RTT-based PDC in FR1 SA

A.6.6.21.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement with TRS for RTT-based PDC meets the requirements specified in clause 9.12.4.2 for measurement delay and clause 10.1.39.3 for measurement accuracy in AWGN propagation condition in FR1 in standalone scenario.

The supported test configurations in listed in table A.6.6.21.1-1.

Table A.6.6.21.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There is a single cell in the test: PCell (Cell 1) on RF channel 1 in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 does not have TRS transmission during T1 and transmits TRS during T2.

The measurement control information with *MeasObjectRxTxDiff* set to 'csi-RS-Ref' as defined in TS 38.331 [2], shall be provided to the UE during T1. The last TTI containing the RRC message shall be provided to the UE ΔT ms before the start of T2, where ΔT = 10 ms is the maximum processing time of the measurement request.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.6.6.21.1-2 and table A.6.6.21.1-3 respectively. The test consists two sub-tests with different TRS BW.

Table A.6.6.21.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell
RF Channel Number		1, 2, 3	1	
$BW_{channel}$	MHz	1	10: $N_{PRB,c}$ = 52	
		2	10: $N_{PRB,c}$ = 52	
		3	40: $N_{PRB,c}$ = 106	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	OFF	
T1	s	1, 2, 3	1	
T2	s	1, 2, 3	1	

Table A.6.6.21.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Values	
			T1	T2
TDD configuration		1	N/A	
		2	TDDConf.1.1	
		3	TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD	
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD	
		2	CR.1.1 TDD	

Parameter	Unit	Test configuration	Values	
			T1	T2
		3	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD	
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1	
TRS Configuration		1	TRS.1.1 FDD	
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1	
SRS configuration		1	PDC-SRS.1	
		2	PDC-SRS.1	
		3	PDC-SRS.2	
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-98	
		3	-95	
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
		3		
TRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3
		2		
		3		
TRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-3
		2		
		3		
TRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-101
		2	-Infinity	-101
		3	-Infinity	-98
Io	dBm/9.36 MHz	1	N/A	-68.28
	dBm/9.36 MHz	2		-68.28
	dBm/38.16 MHz	3		-62.19
Propagation Condition		1, 2, 3	AWGN	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: TRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.21.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.12.4.2.

The UE shall perform and report the UE Rx-Tx time difference measurement for Cell 1 within the specified UE Rx-Tx time difference measurement time starting from the beginning of T2.

The UE Rx-Tx time difference measurement time fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.39.3

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%.

A.6.6.22 SA event triggered reporting tests for concurrent measurement gaps with Pre-MG

A.6.6.22.1 SA event triggered reporting tests for FR1 concurrent gap with Pre-MG with partially partial overalpping scenario for SSB-based measurements in both intra-frequency and inter-frequency layers

A.6.6.22.1.1 Test Purpose and Environment

The purpose of this test is to verify that the concurrent gap with Pre-MG capable UE makes correct reporting of events. This test will partly verify the SA intra-frequency and inter-frequency NR cell search requirements in clauses 9.2.6 and 9.3.4/9.3.5, respectively. Also, this test will also jointly verify pre-configured measurement gap autonomous activation/deactivation delay in clause 8.19.2.

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1, NR Cell 2 as intra-frequency neighbour cell in FR1 on the same frequency as the PCell, and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. There are two BWPs configured in Cell 1, BWP-1 which contains the cell defining SSB, and BWP-2 which does not contain any SSB of Cell 1. The test parameters are given in tables A.6.6.22.1.1-1, A.6.6.22.1.1-2 and A.6.6.22.1.1-3. The TE schedules continuous DL data on PCell throughout the test.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. Before the test starts, the UE shall not have any timing information of NR Cell 2 or NR Cell 3.

Before the test starts,

- For Cell 1, the UE is configured with 2 different UE-specific bandwidth parts for Cell 1 (PCell), BWP-1 and BWP-2, before starting the test.
  - BWP-1 includes bandwidth of the initial DL BWP and SSB. UE is expected to deactivate the Pre-MG when this BWP is active.
  - BWP-2 does not include bandwidth of the initial DL BWP and SSB. UE is expected to activate the Pre-MG when this BWP is active.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used.

During T1, UE active DL BWP is BWP-1, and the pre-configured gap (MeasGapId #1) is deactivated. Cell 3 is switched ON from the beginning of T1, and UE is expected to search for Cell 3 in MeasGapId #2.

At the start of time duration T2, Cell 3 is switched OFF and the serving gNB can trigger Pre-MG activation starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted i. The UE shall switch its bandwidth part from BWP-1 to BWP-2. The UE is expected to complete the Pre-MG activation within T2. Cell 2 is switched ON from the beginning of T2, and UE is expected to search for Cell 2 in MeasGapId #1.

Two measurement gap patterns (MeasGapId #1 (Pre-MG) and MeasGapId #2) are configured with the gap pattern ID #1 and #0 as defined in table A.6.6.22.1.1-2. MeasGapId #1 is configured with a higher priority than MeasGapId #2. MeasGapId #1 and MeasGapId #2 are associated with the MOs for RF channel numbers #1 and #2, respectively.

Table A.6.6.22.1.1-1: SA event triggered reporting tests for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR cells have the same SCS, BW and duplex mode as NR serving cells	

Table A.6.6.22.1.1-2: General test parameters for SA intra-frequency and inter-frequency event triggered reporting for FR1 concurrent gap with Pre-MG with partially partial overalpping scenario for SSB-based measurements in both intra-frequency and inter-frequency layers

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies are used.

Parameter	Unit	Test configuration	Value	Comment
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2 and 3	NR Cell 2 is on NR RF channel number 1. NR Cell 3 is on the NR RF channel 2.
Gap Pattern Id		Config 1,2,3	1 for MeasGapId #1 (80 ms MGRP) 0 for MeasGapId #2 (40 ms MGRP)	As specified in clause 9.1.2-1.
Measurement gap offset	ms	Config 1,2,3	79 for MeasGapId #1 4 for MeasGapId #2	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cell		Config 1, 2, 3	3μs	The timing of Cell 2 is 3μs later than the timing of Cell 1.
		Config 1, 2, 3	5 ms	The timing of Cell 3 is 5 ms later than the timing of Cell 1.
T1	s	Config 1,2,3	2	
T2	s	Config 1,2,3	2	

Table A.6.6.22.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 concurrent gap with Pre-MG with partially-partial overalpping scenario for SSB-based measurements in both inter-frequency layers

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3	1		1		2	
Duplex mode		Config 1	FDD					
		Config 2,3	TDD					
TDD configuration		Config 1	Not Applicable					
		Config 2	TDDConf.1.1					
		Config 3	TDDConf.2.1					
$BW_{channel}$	MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
		Config 3	40: $N_{PRB,c}$ = 106					
BWP BW	MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
		Config 3	40: $N_{PRB,c}$ = 106					
Initial BWP Configuration		Config 1, 2, 3	DLBWP.0.1 ULBWP.0.1		NA		NA	
BWP-1 Configuration		Config 1, 2, 3	DLBWP.1.3 ULBWP.1.3		NA		NA	
BWP-2 Configuration		Config 1, 2, 3	DLBWP.1.2 ULBWP.1.2		NA		NA	
TRS configuration		Config 1	TRS.1.1 FDD		NA		NA	
		Config 2	TRS.1.1 TDD		NA		NA	
		Config 3	TRS.1.2 TDD		NA		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel		Config 1	SR.1.1 FDD		NA		NA	
		Config 2	SR.1.1 TDD		NA		NA	
		Config 3	SR.2.1 TDD		NA		NA	
RMSI CORESET Reference Channel		Config 1	CR.1.1 FDD		NA		NA	
		Config 2	CR.1.1 TDD		NA		NA	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
		Config 3	CR.2.1 TDD		NA		NA	
Dedicated CORESET Reference Channel		Config 1	CCR.1.1 FDD		NA		NA	
		Config 2	CCR.1.1 TDD		NA		NA	
		Config 3	CCR.2.1 TDD		NA		NA	
SSB parameters		Config 1,2	SSB.1 FR1					
		Config 3	SSB.2 FR1					
SMTC configuration defined in A.3.11		Config 1,2,3	SMTC.2		SMTC.2		SMTC.7	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	15					
		Config 3	30					
EPRE ratio of PSS to SSS		Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz		-98		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98		-98	
		Config 3	-95		-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-94	-91	-Infinity
		Config 3	-91	-91	-Infinity	-91	-88	-Infinity
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	4	-1.46	-Infinity	-1.46	7	-Infinity
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	4	7	-Infinity
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-62.25	-64.59	-62.26	-62.26	-70.05
	dBm/38.16 MHz	Config 3	-58.49	-56.16	-58.49	-56.15	-56.15	-63.94
Propagation Condition		Config 1,2,3	AWGN		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.22.1.2 Test Requirements

For UE supporting *dynamicCollision-r18*:

During T1, the UE shall report corresponding valid ACK/NACK for those PDSCHs scheduled in the slots that are not overlapped with the MeasGapId#2 occasions. The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms for cell 3 from the beginning of time period T1. The

measurement reporting delay is derived based on the requirements for inter-frequency measurement in clause 9.3.4 and 9.3.5.

For UE not supporting *dynamicCollision-r18*:

During T1, the UE shall report corresponding valid ACK/NACK for those PDSCHs scheduled in the slots that are not overlapped with the non-dropped MeasGapId#2 occasions. The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms for cell 3 from the beginning of time period T1. The measurement reporting delay is derived based on the requirements for inter-frequency measurement in clause 9.3.4 and 9.3.5.

For both UE supporting *dynamicCollision-r18* and not supporting *dynamicCollision-r18*:

During T2, the UE shall report ACK/NACK for PDSCHs scheduled in the slots that are not overlapped with the MeasGapId #1 occasions or non-dropped MeasGapId #2 occasions after MeasGapId #1 is activated, i.e. starting from the 1 s^t complete MeasGapId #1 occasion after the beginning of PCell's DL slot $(i+T_{BWPswitchDelay}) + \frac{5}{\text{NR slot length}}$ as defined in clause 8.19.2.

The UE shall send one Event A3 triggered measurement report for each neighboring cell, with a measurement reporting delay less than 1080 ms for Cell 2 from the beginning of time period T2. The measurement reporting delay is derived based on the requirements for intra-frequency measurement in clause 9.2.6 plus 80 ms, considering that the frist MeasGapId #1 occasion in T2 may collide with the pre-configured gap activation delay.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%. UE is not required to report SSB time index.

NOTE 1: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.22.2 SA event triggered reporting tests for concurrent gap with pre-configured gaps and network-controlled activation/deactivation

A.6.6.22.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE correctly activates and deactivates the pre-MGs and makes correct measurement and reporting of an event with activated and deactivated pre-MG. This test will partly verify the multiple Pre-MG activation/deactivation delay in clause 8.19.5.2, the intra-frequency cell search requirements in clause 9.2.6 and inter-frequency cell search requirements in clause 9.3.4 and 9.3.5..

A.6.6.22.2.2 Test parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1) in FR1 on NR RF channel 1 and a neighbour cell (Cell 2) in FR1 on NR RF channel 1 and a neighbour cell (Cell 3) in FR1 on NR RF channel 2. The supported test configurations are listed in table A.6.6.22.2.2-1, general test parameters are listed in table A.6.6.22.2.2-2, and cell specific test parameters are listed in table A.6.6.22.2.2-3.

Two Pre-MG gaps (MeasGapId #1 and MeasGapId #2) are configured with the Pre-MG gap pattern ID #0 and #1 as defined in table A.6.6.22.2.2-2. MeasGapId #2 is configured with a higher priority than MeasGapId #1.

In the measurement control information, two measurement objects (MOs) are configured, the measurement object #1 (MO1) for NR RF channel 1 is associated with MeasGapId #1, and measurement object #2 (MO2) for NR RF channel 2 is associated with MeasGapId #2. And it is indicated to the UE that event-triggered reporting with Event A3 is used.

Before the test, UE is connected to Cell 1 (PCell) on radio channel 1. The UE is configured with two dedicated BWPs for Cell 1 (PCell), BWP-1 and BWP-2. BWP-1 includes bandwidth of the SSB, and *preConfGapStatus* of the pre-MG (MeasGapId #1) for measurements on BWP-1 is set to '0', *preConfGapStatus* of the pre-MG (MeasGapId #2) for measurements on BWP-1 is set to '1'; BWP-2 does not include bandwidth of the SSB, and *preConfGapStatus* of the pre-MG (MeasGapId #1) for measurements on BWP-2 is set to '1', *preConfGapStatus* of the pre-MG (MeasGapId #2) for measurements on BWP-2 is set to '0'.

The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively.

During T1, UE active DL BWP is BWP-1, and the pre-configured gap (MeasGapId #1) is deactivated, pre-configured gap (MeasGapId #2) is activated. Cell 3 is switched ON from the beginning of T1, and UE is supposed to search Cell 3 in MeasGapId #2.

The time period T2 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its DL active BWP from BWP-1 to BWP-2, and the pre-configured gap (MeasGapId #1) is activated and pre-configured gap (MeasGapId #2) is deactivated. Cell 3 is switched OFF.

At the beginning of T3, Cell 2 is switched ON, and UE is supposed to search Cell 2 in MeasGapId#1.

During T1, UE shall perform inter-frequency measurement with pre-MG (MeasGapId #2) activated.

During T3, UE shall perform intra-frequency measurement with pre-MG (MeasGapId #1) activated.

The TE schedules continuous DL data on PCell throughout the test.

Table A.6.6.22.2.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.22.2.2-2: General test parameters for SA intra-frequency event triggered reporting with concurrent gap with pre-configured gaps and network-controlled activation/deactivation

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2, Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2, 2: Cell 3	
Measurement gap type		1, 2, 3	Per-UE Pre-MG gaps	
Pre-MG Gap Pattern Id		1, 2, 3	0 for MeasGapId #1 1 for MeasGapId #2	
Measurement gap offset		1, 2, 3	39 for MeasGapId #1 19 for MeasGapId #2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	Same configuration for MO1 and MO2
		2	SMTC.1	Same configuration for MO1 and MO2
		3	SMTC.1	Same configuration for MO1 and MO2
CSI-RS parameters		1	CSI-RS.1.2 FDD resource #0	
		2	CSI-RS.1.2 TDD resource #0	
		3	CSI-RS.2.2 TDD resource #0	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX	ms	1, 2, 3	OFF	DRX is not used
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 and Cell 3 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	0.1	
T3	s	1, 2, 3	5	

Table A.6.6.22.2.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with concurrent gap with pre-configured gaps and network-controlled activation/deactivation

Parameter	Unit	Test configuration	Cell 1			Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			N/A			N/A		
		2	SR.1.1 TDD								
		3	SR.2.1 TDD								
RMSI CORESET RMC configuration		1	CR.1.1 FDD			N/A			N/A		
		2	CR.1.1 TDD			N/A			N/A		
		3	CR.2.1 TDD			N/A			N/A		
Dedicated CORESET RMC configuration		1	CCR.1.2 FDD			N/A			N/A		
		2	CCR.1.2 TDD			N/A			N/A		
		3	CCR.2.1 TDD			N/A			N/A		
OCNG Patterns		1, 2, 3	OP.1			OP.1			OP.1		
TRS configuration		1	TRS.1.1 FDD			N/A			N/A		
		2	TRS.1.1 TDD			N/A			N/A		
		3	TRS.1.2 TDD			N/A			N/A		
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1			N/A			N/A		
Active DL BWP configuration for BWP-1		1, 2, 3	DLBWP.1.3			N/A			N/A		
Active UL BWP configuration for BWP-1		1, 2, 3	ULBWP.1.3			N/A			N/A		
Active DL BWP configuration for BWP-2		1, 2, 3	DLBWP.1.2			N/A			N/A		
Active UL BWP configuration for BWP-2		1, 2, 3	ULBWP.1.2			N/A			N/A		
RLM-RS		1, 2, 3	CSI-RS			N/A			N/A		
N_{oc} Note 2	dBm/SCS	1	-98			-98			-98		
		2	-98			-98			-98		
		3	-95			-95			-95		
N_{oc} Note 2	dBm/15 kHz	1	-98			-98			-98		
		2	-98			-98			-98		
		3	-95			-95			-95		
$\hat{E}_s/I_{ot}$	dB	1,2,3	4		-1.46	-Infinity		-1.46	4		-Infinity
$\hat{E}_s/N_{oc}$	dB	1,2,3	4		4	-Infinity		4	4		-Infinity
SS-RSRP Note 3	dBm/SCS kHz	1,2	-94		-94	-Infinity		-94	-94		-Infinity
		3	-91		-91	-Infinity		-91	-91		-Infinity

Parameter	Unit	Test configuration	Cell 1			Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
Io	dBm/9.36 MHz	1,2	-64.60		-62.25	-Infinity		-62.25	-64.60	-Infinity	
	dBm/38.16 MHz	3	-58.50		-56.16	-Infinity		-56.16	-58.50	-Infinity	
Propagation Condition		1, 2, 3	AWGN								
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2 and T4. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.											

A.6.6.22.2.3 Test Requirements

During T1, UE shall report corresponding HARQ-ACK/NACK for those PDSCHs scheduled in the slots that are not overlapped with the pre-MG occasions of MeasGapId #2; and

The UE shall send one Event A3 triggered measurement report of cell 3 on RF channel 2, with a measurement reporting delay less than 1280 ms from the beginning of time period T1.

During T2 and starting from the 1 s^t complete Pre-MG occasion after the beginning of PCell's DL slot $(i+T_{BWPswitchDelay})$ + $\frac{7}{\text{NR slot length}}$ as defined in clause 8.19.5.2, the UE shall report corresponding HARQ-ACK/NACK for those PDSCHs scheduled in the slots that are not overlapped with the pre-MG occasions of MeasGapId #1.

The UE shall send one Event A3 triggered measurement report of Cell 2 on RF channel 1, with a measurement reporting delay less than 800 ms from the beginning of time period T3.

During T3, the UE shall report corresponding HARQ-ACK/NACK for those PDSCHs scheduled in the slots that are not overlapped with the pre-MG occasions of MeasGapId #1.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.23 SA event triggered reporting tests for concurrent measurement gaps with NCSG

A.6.6.23.1 SA event triggered reporting tests for FR1 concurrent gaps with NCSG for partially partial overalpping scenario for SSB-based measurements in both inter-frequency layers [one MG + one NCSG]

A.6.6.23.1.1 Test Purpose and Environment

The purpose of this test is to verify that the concurrent gaps with NCSG capable UE makes correct reporting of events. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.10.

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1, NR Cell 2 as neighbour cell in FR1 on NR RF channel 2, and NR Cell 3 as neighbour cell in FR1 on NR RF channel 3. The test parameters are given in tables A.6.6.23.1.1-1, A.6.6.23.1.1-2 and A.6.6.23.1.1-3.

One measurement gap and one NCSG are configured to UE with measurement gap pattern #0 and NCSG pattern #1 respectively. Measurement gap with pattern #0 is associated with inter-frequency measurement on NR Cell 2, and NCSG with pattern #1 is associated with inter-frequency measurement on NR Cell 3 as defined in table A.6.6.23.1.1-2.

NCSG is configured with higher priority than measurement gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used for both frequency layers. The test consists of two successive time periods, with time duration of T1, and T2 respectively.

During time duration T1, the UE shall not have any timing information of NR Cell 2 and NR Cell 3.

During T2, the UE is continuously scheduled with data on the PCell.

Table A.6.6.23.1.1-1: SA event triggered reporting tests for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR cells have the same SCS, BW and duplex mode as NR serving cells	

Table A.6.6.23.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 concurrent NCSGs with partially partially overalpping scenario for SSB-based measurements in both inter-frequency layers

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2, 3	Three FR1 NR carrier frequencies are used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cells 2 and 3	NR Cell 2 is on NR RF channel number 2. NR Cell 3 is on NR RF channel number 3.
Measurement Gap Pattern Id		Config 1,2,3	0	As specified in Table 9.1.2-1.
Measurement Gap offset		Config 1,2,3	39	
NCSG Pattern Id		Config 1,2,3	1	As specified in Table 9.1.9.3-1.
NCSG offset		Config 1,2,3	4	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between Cell 1 and Cell 2		Config 1, 2, 3	3 μs	Synchronous. The timing of Cell 2 is 3 μs later than the timing of Cell 1.
Time offset between Cell 1 and Cell 3		Config 1, 2, 3	5 ms	Asynchronous. The timing of Cell 3 is 5 ms later than the timing of Cell 1.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1.5	

Table A.6.6.23.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 Con-NCSG gaps with partially partially overalpping scenario for SSB-based measurements in both inter-frequency layers

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2		3	
Duplex mode			Config 1	FDD					
			Config 2,3	TDD					
TDD configuration			Config 1	Not Applicable					
			Config 2	TDDConf.1.1					
			Config 3	TDDConf.2.1					
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
			Config 3	40: $N_{PRB,c}$ = 106					
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
			Config 3	40: $N_{PRB,c}$ = 106					
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA		NA	
	Initial UL BWP			ULBWP.0.1		NA		NA	
	Dedicated DL BWP			DLBWP.1.1		NA		NA	
	Dedicated UL BWP			ULBWP.1.1		NA		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA		NA	
			Config 2	TRS.1.1 TDD		NA		NA	
			Config 3	TRS.1.2 TDD		NA		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD					
			Config 2	SR.1.1 TDD					
			Config 3	SR.2.1 TDD					
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD					
			Config 2	CR.1.1 TDD					
			Config 3	CR.2.1 TDD					
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD					
			Config 2	CCR.1.1 TDD					
			Config 3	CCR.2.1 TDD					
SSB parameters			Config 1,2,3	SSB.1 FR1		SSB.1 FR1		SSB.1 FR1	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.2		SMTC.2		SMTC.2	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15					
			Config 3	30					
EPRE ratio of PSS to SSS			Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		dBm/15 kHz		-98		-98		-98	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98		-98	
		Config 3	-95		-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	4	4	-Infinity	7	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.23.1.2 Test Requirements

The UE shall send one Event A3 triggered measurement report for each neighboring cell, with a measurement reporting delay less than 1280 ms for Cell 2 and 1280 ms for Cell 3 from the beginning of time period T2.

During T2, UE shall send HARQ-ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with the VIL of NCSG pattern and the non-dropped measurement gap occasions after considering the collision between NCSG and measurement gap.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.23.2 SA event triggered reporting tests for FR1 concurrent gaps with NCSG for partially partial overalpping scenario for SSB-based measurements in both inter-frequency layers [two NCSG]

A.6.6.23.2.1 Test Purpose and Environment

The purpose of this test is to verify that the concurrent gaps with NCSG capable UE makes correct reporting of events. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.10.

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1, NR Cell 2 as neighbour cell in FR1 on NR RF channel 2, and NR Cell 3 as neighbour cell in FR1 on NR RF channel 3. The test parameters are given in tables A.6.6.23.2.1-1, A.6.6.23.2.1-2 and A.6.6.23.2.1-3.

Two NCSG patterns (NCSGId #0 and NCSGId #1) are configured with the NCSG pattern ID #0 and #1 as defined in table A.6.6.23.2.1-2. NCSGId #1 is configured with a higher priority than NCSGId #0.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used for both frequency layers. The test consists of two successive time periods, with time duration of T1, and T2 respectively.

During time duration T1, the UE shall not have any timing information of NR Cell 2 and NR Cell 3.

During T2, the UE is continuously scheduled with data on the PCell.

Table A.6.6.23.2.1-1: SA event triggered reporting tests for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR cells have the same SCS, BW and duplex mode as NR serving cells	

Table A.6.6.23.2.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 concurrent NCSGs with partially partially overalpping scenario for SSB-based measurements in both inter-frequency layers

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2, 3	Three FR1 NR carrier frequencies are used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2 and 3	NR Cell 2 is on NR RF channel number 2. NR cell 3 is on NR RF channel number 3.
NCSG Pattern Id		Config 1,2,3	0 for NCSGId #0 1 for NCSGId #1	As specified in Table 9.1.9.3-1.
NCSG offset		Config 1,2,3	39 for NCSGId #0 4 for NCSGId #1	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between Cell 1 and Cell 2		Config 1, 2, 3	3 μs	Synchronous. The timing of Cell 2 is 3 μs later than the timing of Cell 1.
Time offset between Cell 1 and Cell 3		Config 1, 2, 3	5 ms	Asynchronous. The timing of Cell 3 is 5 ms later than the timing of Cell 1.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1.5	

Table A.6.6.23.2.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 Con-NCSG gaps with partially partially overalpping scenario for SSB-based measurements in both inter-frequency layers

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2		3	
Duplex mode			Config 1	FDD					
			Config 2,3	TDD					
TDD configuration			Config 1	Not Applicable					
			Config 2	TDDConf.1.1					
			Config 3	TDDConf.2.1					
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
			Config 3	40: $N_{PRB,c}$ = 106					
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
			Config 3	40: $N_{PRB,c}$ = 106					
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA		NA	
	Initial UL BWP			ULBWP.0.1		NA		NA	

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
	Dedicated DL BWP			DLBWP.1.1		NA		NA	
	Dedicated UL BWP			ULBWP.1.1		NA		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA		NA	
			Config 2	TRS.1.1 TDD		NA		NA	
			Config 3	TRS.1.2 TDD		NA		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD					
			Config 2	SR.1.1 TDD					
			Config 3	SR.2.1 TDD					
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD					
			Config 2	CR.1.1 TDD					
			Config 3	CR.2.1 TDD					
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD					
			Config 2	CCR.1.1 TDD					
			Config 3	CCR.2.1 TDD					
SSB parameters			Config 1,2,3	SSB.1 FR1		SSB.1 FR1		SSB.1 FR1	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.2		SMTC.2		SMTC.2	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15					
			Config 3	30					
EPRE ratio of PSS to SSS			Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		dBm/15 kHz		-98		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-98		-98	
			Config 3	-95		-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-Infinity	-91	-Infinity	-91
			Config 3	-91	-91	-Infinity	-88	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3	4	4	-Infinity	7	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2,3	4	4	-Infinity	7	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26	-70.05	-62.26
		dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15	-63.94	-56.15
Propagation Condition			Config 1,2,3	AWGN		AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.								

A.6.6.23.2.2 Test Requirements

The UE shall send one Event A3 triggered measurement report for each neighboring cell, with a measurement reporting delay less than 1280 ms for Cell 2 and 1280 ms for cell 3 from the beginning of time period T2.

During T2, UE shall send HARQ-ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with the VIL of non-dropped NCSG patterns after considering the collision between NCSGs.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.23.3 Event triggered reporting on SCC with deactivated SCell test with per-UE Con-NCSG under non-DRX

A.6.6.23.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the cell search requirements on SCC with deactivated SCell in clauses 9.2.7.1 and 9.2.7.2.

A.6.6.23.3.2 Test parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1) on NR RF channel 1, FR1 SCell (Cell 2) and FR1 neighbour cell (Cell 3) on the same frequency as the SCell on NR RF channel 2.

The SCell is deactivated during the test. The test parameters for PCell, the SCell and the neighbour cell are given in table A.6.6.23.3.2-1 and A.6.6.23.3.2-2 below.

One measurement gap patterns (MeasGapId #1) and one NCSG pattern (NCSGId #1) are configured with the gap pattern ID #0 and NCSG pattern ID #0 as defined in table A.6.6.x.1.1-2. [NCSGId #1 is associated with the MO for RF channel numbers #2, respectively.]

In the measurement control information, a measurement object is configured for the frequency of the SCell, and it is indicated to the UE that event-triggered reporting with Event A6 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 3. The PCell shall continuously scheduled with data in the DL starting from T1 until the UE has sent the measurement report during T2.

Table A.6.6.23.3.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.23.3.2-2: General test parameters for event triggered reporting on SCC with deactivated SCell with per-UE Con-NCSG for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Configured deactivated SCell		1, 2, 3	Cell 2	
Neighbour cell		1, 2, 3	Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1	
RF Channel Number		1, 2, 3	2: Cell 2 and Cell 3	
NCSG type		1, 2, 3	Per-UE NCSG	
NCSG pattern Id		1, 2, 3	ID # 1	Defined in table 9.1.9.3-1
NCSG offset		1, 2, 3	39	
Measurement gap type		1, 2, 3	Per-UE MG	
MG pattern Id		1, 2, 3	ID #1	Defined in table 9.1.2-1
Measurement gap offset		1, 2, 3	19	
MGTA	ms	1, 2, 3	0	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A6-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3		OFF
SCell measurement cycle (measCycleSCell)	ms	1, 2, 3	640	
Cell 2 timing offset to Cell 1	µs	1, 2, 3	0	
Time alignment error between Cell 2 and Cell 1	µs	1, 2, 3	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
Cell 3 timing offset to Cell 1	µs	1, 2, 3	3	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	

Table A.6.6.23.3.2-3: NR Cell specific test parameters for event triggered reporting on SCC with deactivated SCell with per-UE Con-NCSG for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
TDD configuration		1	N/A		N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A		N/A	
		2	SR.1.1 TDD					
		3	SR.2.1 TDD					
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A		N/A	
		2	CR.1.1 TDD		N/A		N/A	
		3	CR.2.1 TDD		N/A		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A		N/A	
		2	CCR.1.1 TDD		N/A		N/A	
		3	CCR.2.1 TDD		N/A		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1		OP.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
TRS Configuration		1	TRS.1.1 FDD		TRS.1.1 FDD			
		2	TRS.1.1 TDD		TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		ULBWP.1.1		N/A	
N_{oc} Note 2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note 2	dBm/15 kHz	1, 2, 3	-98					
$\hat{E}_s/I_{ot}$	dB	1, 2, 3	4	4	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2, 3	4	4	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-94	-94	-Infinity	-94
		2	-94	-94	-94	-94	-Infinity	-94
		3	-91	-91	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-64.60	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-64.60	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-58.50	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3	AWGN					

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.23.3.3 Test Requirements

The UE shall send one Event A6 triggered measurement report, with a measurement reporting delay less than [6400] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall be scheduled on PCell continuously throughout the test. From the start of T1 until the measurement report is received during T2, UE shall send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with the VIL of NCSG pattern and MGL of MG pattern.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

For a test to be considered successful requirements on both Event A6 detection and percentage of transmitted ACK/NACKs have to be fulfilled simultaneously.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.24 SA event triggered reporting tests with NeedForGap in FR1

A.6.6.24.1 SA event triggered reporting tests without gaps, with interruptions, under non-DRX

A.6.6.24.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event, and to verify that the interruption ratio does not exceed the limits for the NR PCell during the measurement without gaps and with interruptions. This test will partly verify the cell search requirements in clauses 9.2.5.1 and 9.2.5.2 for measurements performed without gaps and with interruptions. This test will also verify the interruption ratio for PCell in standalone NR specified in clause 8.2.2.2.19. The test will measure that the measurement delay is within the specified boundaries.

The serving frequency should be selected for which UE reports 'no-gap' in NeedForGapsIntraFreq-r16 and 'no-gap-with-interruption' in interruptionIndication-r18.

A.6.6.24.1.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.6.6.24.1.2-1, A.6.6.24.1.2-2 and A.6.6.24.1.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

The UE is capable of measurements without gaps with interruption and report 'no-gap' through NeedForGapsIntraFreq-r16 and 'no-gap-with-interruption' in interruptionIndication-r18 for PCell. UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment.

Table A.6.6.24.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.24.1.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 without DRX

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 μs	Synchronous cells
		3	3 μs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	

Table A.6.6.24.1.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 without DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.2		DLBWP.1.2	
Active UL BWP configuration		1, 2, 3	ULBWP.1.2		ULBWP.1.2	
RLM-RS		1, 2, 3	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.24.1.3 Test Requirements

The UE shall be continuously scheduled on PCell during the entire length of T1 and T2.

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1000 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

During 1000 ms from the beginning of time period T2, the UE shall transmit ACK/NACK in PCell and the rate of missed ACK/NACK shall no more than 2.5%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.24.2 SA event triggered reporting tests for FR1 without gap with interruption for inter-frequency measurement with SSB time index detection when DRX is not used

A.6.6.24.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.9 and interruption requirements during measurement without gap in clause 8.2.2.2.19.

The serving frequency and the target frequency should be selected such that UE reports 'no-gap' via needForGapsInfoNR-r16 and 'no-gap-with-interruption' via NeedForInterruptionNR-r18 for the target frequency given the serving frequency.

A.6.6.24.2.2 Test parameters

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. NR RF channel 1 and NR RF channel 2 should be selected such that UE reports 'no-gap-with-interruption' for the target frequency on NR RF channel 2. The test parameters are given in tables A.6.6.24.2.2-1, A.6.6.24.2.2-2 and A.6.6.24.2.2-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

During T2, the UE is continuously scheduled with data on the PCell.

Table A.6.6.24.2.2-1: SA event triggered reporting tests for FR1 for inter-frequency measurement without gap with interruption

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.24.2.2-2: General test parameters for SA event triggered reporting tests for FR1 for inter-frequency measurement without gap with interruption

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies are used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3µs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	2	

Table A.6.6.24.2.2-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without gap

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD			
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PSS to SSS		Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.24.2.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1520 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

During 1520 ms from the beginning of time period T2, the UE shall transmit ACK/NACK in PCell and the rate of missed ACK/NACKs shall no more than 2.5%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.24.3 SA event triggered reporting tests for FR1 with 'no-gap-with-interruption', without measurement gap or DRX

A.6.6.24.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

The serving frequency and the target frequency should be selected such that UE reports 'no-gap-with-interruption' for the target frequency given the serving frequency.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. Supported test configurations are shown in table A.6.6.24.3.1-1. The general test parameters are given in tables A.6.6.24.3.1-2, and cell specific test parameters are given in table A.6.6.24.3.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

The TE schedules continuous DL data on PCell during the test duration.

Table A.6.6.24.3.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.24.3.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
SMTC for NR RF channel number 2		Config 1,2,3	SMTC.3	As specified in clause A.3.11
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1	

Table A.6.6.24.3.1-3: Cell specific test parameters for inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3	1		2	
Duplex mode		Config 1	FDD			
		Config 2,3	TDD			
TDD configuration		Config 1	Not Applicable			
		Config 2	TDDConf.1.1			
		Config 3	TDDConf.2.1			
$BW_{channel}$	MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
		Config 3	40: $N_{PRB,c}$ = 106			
BWP BW	MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
		Config 3	40: $N_{PRB,c}$ = 106			

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD			
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
Dedicated CORESET Reference Channel			Config 1	CCR.1.1 FDD			
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1		SSB.1 FR1	
			Config 2	SSB.1 FR1		SSB.1 FR1	
			Config 3	SSB.2 FR1		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-98	
			Config 3	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
			Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2,3	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
		dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1,2,3	AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.6.6.24.3.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 2560 ms from the beginning of time period T2, where 2560 ms is derived based on inter-frequency measurement requirements in clause 9.3.4.

In the test, UE shall send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots with an interruption ratio between number of interrupted slot over the total number of slots no larger than 1.25%.

In the test UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.24.4 SA event triggered reporting tests for FR1 NeedForGaps without gap without interruption when DRX is not used

A.6.6.24.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.9 and also verify the interruption during inter-frequency measurement with NeedForGaps.

The serving frequency and the target frequency should be selected for which UE supports *NeedForInterruptionInfoNR-R18* measurements and indicates '*no-gap-no-interruption*' for the target frequency given the serving frequency.

A.6.6.24.4.2 Test parameters

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. NR RF channel 1 and NR RF channel 2 should be selected such that UE reports '*no-gap-no-interruption*' for the target frequency on NR RF channel 2.

The test parameters are given in tables A.6.6.24.4.1-1, A.6.6.24.4.1-2 and A.6.6.24.4.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

During T2, the UE is continuously scheduled with data on the PCell.

Table A.6.6.24.4.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

NOTE 1: The UE is only required to be tested in one of the supported test configurations
NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell

Table A.6.6.24.4.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with NeedForInterruption 'no-gap-no-interruption'

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1	

Table A.6.6.24.4.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with NeedForInterruption 'no-gap-no-interruption'

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD			
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
SMTC configuration defined in A.3.11		Config 1	SMTC.2		SMTC.5	
		Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	15			
		Config 3	30			
EPRE ratio of PSS to SSS		Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.6.24.4.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [200] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

During T2, UE shall send HARQ-ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots.

The rate of correct events observed during repeated tests shall be at least 90%.

The UE is not required to read the neighbour cell SSB index in this test.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.24.5 SA event triggered reporting tests without gap under non-DRX for UE indicating *no-gap-no-interruption*

A.6.6.24.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE which supports '*no-gap*' makes correct reporting of an event and the UE performs intra-frequency measurement without gap without interuption when the UE indicates '*no-gap*' via *intraFreq-needForGap* and the UE indicates *no-gap-no-interruption* via *NeedForInterruptionInfoNR-r18*. This test will partly verify the intra-frequency cell search requirements in clauses 9.2.5.1 and 9.2.5.2.

A.6.6.24.5.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.6.6.24.5.2-2 and A.6.6.24.5.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.6.6.24.5.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.24.5.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 μs	Synchronous cells
		3	3 μs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	

Table A.6.6.24.5.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.2		DLBWP.1.2	
Active UL BWP configuration		1, 2, 3	ULBWP.1.2		ULBWP.1.2	
RLM-RS		1, 2, 3	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.24.5.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

UE is not allowed to cause interruption during intra-frequency measurement without gap.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.25 SA NR - E-UTRAN event-triggered without measurement gaps

A.6.6.25.1 SA NR - E-UTRAN event-triggered reporting in non-DRX in FR1

A.6.6.25.1.1 Test Purpose and Environment

The purpose of this set of tests is to verify that if UE reports "*nogap-noncsg*" via *NeedForGapNCSG-InfoEUTRA-r17*, the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in clause 9.4.8.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. In the measurement control information from the PCell it is indictated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are shown in table A.6.6.25.1.1-1. General test parameters are provided in table A.6.6.25.1.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.6.6.25.1.1-3 and A.6.6.25.1.1-4, respectively.

Table A.6.6.25.1.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.25.1.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		2	1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.6.6.25.1.1-1 and A.6.6.25.1.1-3.	
Active cell		Cell 1	Cell 1 is on RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on RF channel number 2
Effective Measurement Window (EMW) Id		0	As specified in table 9.4.8.2-1
NR measurement quantity		SS-RSRP	Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP	Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1	SS-RSRP threshold for SS-RSRP measurement on cell1 for event B2

Parameter	Unit	Value	Comment
b2-Threshold2EUTRA	dBm	-95	E-UTRAN RSRP threshold for SS-RSRP measurement on cell1 for event B2
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	OFF
T1	s	5	
T2	s	5	
NOTE 1: Values are defined in table A.6.6.25.1.1-3			

Table A.6.6.25.1.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in non-DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 4	FDD	
			2, 3, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)	
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
RMSI CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
Dedicated CORSET reference channel			1, 4	CCR.1.1 FDD	
			2, 5	CCR.1.1 TDD	
			3, 6	CCR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	
CSI-RS for tracking			1, 4	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
b2-Threshold1		dBm	1, 2, 4, 5	-96	
			3, 6	-93	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6	-104	
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-104	
			3, 6	-101	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	16	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	16	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104

Parameter	Unit	Configuration	Cell 1	
			T1	T2
		3, 6	-85	-101
SSB_RP[Note3]	dBm/SCS	1, 2, 4, 5	-88	-104
		3, 6	-85	-101
Io[Note3]	dBm/9.36 MHz	1, 2, 4, 5	-59.94	-73.04
	dBm/38.16 MHz	3, 6	-53.84	-66.93
Propagation condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.25.1.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	2	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				

Parameter	Unit	Configuration	Cell 2	
			T1	T2
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	-Infinity	17
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
Io[Note5]	dBm/9 MHz	1, 2, 3, 4, 5, 6	-73.21+10log ($N_{PRB,c}$ /50)	-56.12+10log ($N_{PRB,c}$ /50)
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.25.1.2 Test Requirements

The UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria are not fulfilled.

During the T2, UE shall be able to report ACK/NACK for all slots with PDCCH/PDSCH on PCell excluding those symbles as defined in 9.4.8.3.5 or 9.4.8.4.5.

The rate of correct events observed during repeated tests shall be at least 90%

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.25.2 SA NR - E-UTRAN event-triggered reporting without gap under non-DRX in FR1

A.6.6.25.2.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements without gap as there are vacant RF chains available for UE measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in clause 9.4.8, and also verify the scheduling availability during inter-RAT E-UTRAN measurement without gap in clauses 9.4.8.3.5 and 9.4.8.4.5.

The serving frequency and the target frequency should be selected such that UE reports '*nogap-noncsg*' via *NeedForGapNCSG-InfoEUTRA-r17* for the target frequency given the serving frequency and '*eutra-MeasEMW-r18*'.

A.6.6.25.2.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. In the measurement control information from the PCell it is indictated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT E-UTRAN neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are given in Table A.6.6.25.1.1-1 and for EMW configuration in table A.6.6.25.2.2-1 with EMW configuration specified in table 9.4.8.2-1. General test parameters are provided in Table A.6.6.25.2.2-2. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A. A.6.6.25.1.1-3 and A. A.6.6.25.1.1-4, respectively.

Table A.6.6.25.2.2-1: EMW configuration test parameters for SA inter-RAT E-UTRA without gap event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Configuration	EMW configuration
EMW configuration		**1, 2, 3, 4, 5, 6**	**0**

Table A.6.6.25.2.2-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Test 1	Test 2	Comment
		Value		
NR RF Channel Number		1		1 NR carrier frequency is used in the test
LTE RF Channel Number		2		1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.6.6.3.2.1-2 and A.6.6.3.2.1-3.		
Active cell		Cell 1		Cell 1 is on RF channel number 1
Neighbour cell		Cell 2		Cell 2 is on RF channel number 2
NR measurement quantity		SS-RSRP		Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP		Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1		SS-RSRP threshold for SS-RSRP measurement on cell1 for event B2
b2-Threshold2EUTRA	dBm	-95		E-UTRAN RSRP threshold for RSRP measurement on cell 2 for event B2
Hysteresis	dB	0		
TimeToTrigger	s	0		
Filter coefficient		0		L3 filtering is not used
DRX		OFF		Non-DRX
T1	s	5		
T2	s	5		
NOTE 1: Values are defined in table A.6.6.3.2.1-3				

A.6.6.25.2.3 Test Requirements

The actual overall measurement delay test requirements can refer to the requirements in A.6.6.3.1.2. And during T2, for the two subtests regarding to EMW configuration, UE shall or not send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell based on the requirements defined in clauses 9.4.8.3.5 and 9.4.8.4.5.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.25.3 SA NR - E-UTRAN event-triggered reporting in non-DRX in FR1 for UE capable of inter-RAT EUTRAN measurement without gap when CRS is contained within UE's active DL BWP

A.6.6.25.3.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE which supports inter-RAT E-UTRAN measurement without gap when CRS is contained within UE's active DL BWP makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in clause 9.4.8, and also verify the scheduling availability during inter-RAT E-UTRAN measurement in clauses 9.4.8.3.5 and 9.4.8.4.5.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. The CRS of Cell 2 is completely within UE's active BWP BW.

In the measurement control information from the PCell, it is indictated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT E-UTRAN neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are shown in table A.6.6.25.3.1-1. General test parameters are provided in table A.6.6.25.3.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.6.6.25.3.1-3 and A.6.6.25.3.1-4, respectively.

Table A.6.6.25.3.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.25.3.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		2	1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.6.6.3.1.1-2 and A.6.6.3.1.1-3.	
Active cell		Cell 1	Cell 1 is on RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on RF channel number 2
Effective Measurement Window (EMW) Id		0	As specified in table 9.4.8.2-1
NR measurement quantity		SS-RSRP	Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP	Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1	SS-RSRP threshold for SS-RSRP measurement on cell1 for event B2
b2-Threshold2EUTRA	dBm	-95	E-UTRAN RSRP threshold for SS-RSRP measurement on cell1 for event B2
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	OFF

Parameter	Unit	Value	Comment
T1	s	5	
T2	s	5	
NOTE 1: Values are defined in table A.6.6.3.1.1-3			

Table A.6.6.25.3.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in non-DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 4	FDD	
			2, 3, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)	
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
RMSI CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
Dedicated CORSET reference channel			1, 4	CCR.1.1 FDD	
			2, 5	CCR.1.1 TDD	
			3, 6	CCR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	
CSI-RS for tracking			1, 4	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
b2-Threshold1		dBm	1, 2, 4, 5	- 96	
			3, 6	- 93	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6	-104	
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-104	
			3, 6	-101	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	16	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	16	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104
			3, 6	-85	-101
SSB_RP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104
			3, 6	-85	-101
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-59.94	-73.04
		dBm/38.16 MHz	3, 6	-53.84	-66.93
Propagation condition			1, 2, 3, 4, 5, 6	AWGN	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.25.3.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	2	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	-Infinity	17

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
Io[Note5]	dBm/9 MHz	1, 2, 3, 4, 5, 6	-73.21+10log ($N_{PRB,c}$ /50)	-56.12+10log ($N_{PRB,c}$ /50)
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.25.3.2 Test Requirements

The UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

During T2, UE does not cause interruption due to inter-RAT E-UTRAN measurement without gap.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.26 LTM Intra-frequency L1-RSRP measurement

A.6.6.26.1 Intra-frequency SSB based L1-RSRP measurement in FR1

A.6.6.26.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of SSB based intra-frequency L1-RSRP measurement on neighbor cell in FR1. This test will partly verify the requirements for SSB based intra-frequency L1-RSRP measurement on neighbor cell specified in clause 9.14, with the testing configurations for NR cells in table A.6.6.26.1.1-1.

Table A.6.6.26.1.1-1: Applicable NR configurations for SSB based intra-frequency L1-RSRP LTM measurement test in FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.6.6.26.1.2 Test Parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. Measurement period [and measurement accuracy] is tested by using the parameters in table A.6.6.26.1.2-1, and A.6.6.26.1.2-2.

There are two tests in the test case, test 1 and test 2:

In test 1, time offset between cells is within CP length.

In test 2, time offset between cells is larger than CP length.

If a UE does not support *multiCellL1-measRTD-greaterThan-CP-r18*, it is only required to pass test 1. Otherwise, it is only required to pass test 2.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. SSB_RP of Cell 2 in T1 and T2 are different. No gap patterns are configured in the test case.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 (PCell) on RF channel 1 (PCC).
- A measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. Before the start of the T1, event is triggered, and UE has sent a measurement report for the Cell 2 with SSB Index.
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.

At the beginning of T2, SSB_RP of Cell 2 changes to a different value from T1. T2 starts at the beginning of a frame with an odd SFN.

Table A.6.6.26.1.2-1: General test parameters for SSB based intra-frequency L1-RSRP LTM measurement test in FR1

Parameter		Unit	Value		Comment
			Test 1	Test 2	
Active cell			Cell 1		
Neighbouring cell			Cell 2		Cell 2 is the candidate cell
A3-Offset		dB	-6		
Hysteresis		dB	0		
Time To Trigger		ms	0		
Filter coefficient			0		L3 filtering is not used
DRX			OFF		DRX is not used
Time offset between cells			2 μs	20μs	The timing of Cell 2 is later than the timing of Cell 1
deriveSSB-IndexFromCell			Enabled		
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	20		Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1		Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1		
	spCellInclusion		N/A		
ltm-ConfigComplete			True		Candidate cell's configuration is complete configuration
T1		s	0.3		
T2		s	≤ 0.5		

Table A.6.6.26.1.2-2: Cell specific test parameters for SSB based intra-frequency L1-RSRP LTM measurement test in FR1

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1			
SSB ARFCN			freq1			
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD		N/A	
	Config 2		SR.1.1 TDD		N/A	
	Config 3		SR.2.1 TDD		N/A	
CORESET Reference Channel	Config 1		CR.1.1 FDD		N/A	
	Config 2		CR.1.1 TDD		N/A	
	Config 3		CR.2.1 TDD		N/A	
CP length			Normal			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	KHz	15			
	Config 3		30			
PUCCH/PUSCH subcarrier spacing	Config 1,2	KHz	15			
	Config 3		30			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-101			
N_{oc} Note2	Config 1,2	dBm/SCS	-101			
	Config 3		-98			
$\hat{E}_s / I_{ot}$		dB	-1.76	-0.19	-1.76	-0.19
$\hat{E}_s / N_{oc}$		dB	3	13.5	3	13.5
SSB_RP	Config 1,2	dBm/SCS	-98	-87.5	-98	-87.5
	Config 3	dBm/SCS	-95	-84.5	-95	-84.5
Io Note3	Config 1,2	dBm/ 9.36 MHz	-66.07	-56.44	-66.07	-56.44
	Config 3	dBm/ 38.16 MHz	-59.96	-50.34	-59.96	-50.34
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.26.1.3 Test Requirements

The UE shall send L1-RSRP report every 20 slots. The UE shall start to report a larger L1-RSRP value of Cell 2 in no later than 20 ms plus 20 slots from the beginning of time period T2. UE shall send L1-RSRP report including results of Cell 2 while meeting the L1-RSRP absolute accuracy requirement in clause 10.1.19D.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.27 LTM Inter-frequency L1-RSRP measurement with measurement gap

A.6.6.27.1 Inter-frequency SSB based L1-RSRP measurement with measurement gap

A.6.6.27.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of inter-frequency L1-RSRP measurement with measurement gap on candidate neighbour cell. This test will partly verify the L1-RSRP measurement requirements in clause 9.15.5, with the testing configurations for NR cells in table A.6.6.27.1.1-1.

Table A.6.6.27.1.1-1: Applicable NR configurations for SSB based inter-frequency L1-RSRP LTM measurement with MG test in FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR cell has the same SCS, BW and duplex mode as NR serving cell	

A.6.6.27.1.2 Test parameters

There are two carriers and one cell on each carrier in the test, NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters for the Cell 1 and Cell 2 are given in table A.6.6.27.1.2-1 and table A.6.6.27.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform inter-frequency L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively.

Measurement gap pattern configuration defined in table A.6.6.27.1.2-1 is provided.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 (PCell) on RF channel 1 (PCC).
- A measurement object is configured for the RF channel 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used. Before the start of the T1, event is triggered, and UE has sent a measurement report for the Cell 2 with SSB Index.
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.

At the beginning of T2, SSB_RP of Cell 2 changes to a different value from T1.

Table A.6.6.27.1.2-1: General test parameters for SSB based inter-frequency L1-RSRP LTM measurement with MG test in FR1

Parameter	Unit	Value	Comment
Active cell		Cell 1	

Parameter		Unit	Value	Comment
Neighbouring cell			Cell 2	Cell 2 is the candidate cell
A3-Offset		dB	-6	
Hysteresis		dB	0	
Time To Trigger		ms	160	
Filter coefficient			0	L3 filtering is not used
reportQuantityRS-Indexes			rsrp	
maxNrofRS-IndexesToReport			1	
includeBeamMeasurements			True	
DRX			OFF	DRX is not used
Time offset between cells			3 μs	The timing of Cell 2 is later than the timing of Cell 1
deriveSSB-IndexFromCell			Enabled	Not relevant to this test case
Gap Pattern Id			0	
Measurement gap offset		ms	39	
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	80	Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1	Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1	
	spCellInclusion		N/A	
ltm-ConfigComplete			True	Candidate cell's configuration is complete configuration
T1		s	0.3	
T2		s	≤ 0.5	

Table A.6.6.27.1.2-2: Cell specific test parameters for SSB based inter-frequency L1-RSRP LTM measurement with MG test in FR1

Parameter	Config	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
SSB ARFCN	1~3		freq1		freq2	
Duplex mode	1		FDD			
	2		TDD			
	3		TDD			
TDD Configuration	1		N/A			
	2		TDDConf.1.1			
	3		TDDConf.2.1			
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52			
	2		10: $N_{PRB,c}$ = 52			
	3		40: $N_{PRB,c}$ = 106			
PDSCH Reference measurement channel	1		SR.1.1 FDD		N/A	
	2		SR.1.1 TDD		N/A	
	3		SR.2.1 TDD		N/A	
RMSI CORESET Reference Channel	1		CR.1.1 FDD		N/A	
	2		CR.1.1 TDD		N/A	
	3		CR.2.1 TDD		N/A	
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD		N/A	
	2		CCR.1.1 TDD		N/A	
	3		CCR.2.1 TDD		N/A	
SSB configuration	1		SSB.1 FR1			
	2		SSB.1 FR1			
	3		SSB.2 FR1			
OCNG Patterns	1~3		OP.1		OP.1	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1			
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1			
SMTC configuration	1~3		SMTC.1			
TRS Configuration	1		TRS.1.1 FDD		N/A	
	2		TRS.1.1 TDD		N/A	
	3		TRS.1.2 TDD		N/A	
EPRE ratio of PSS to SSS	1~3	dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						

Parameter	Config	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PDCCH DMRS to SSS EPRE ratio of PDCCH to PDCCH DMRS EPRE ratio of PDSCH DMRS to SSS EPRE ratio of PDSCH to PDSCH DMRS EPRE ratio of OCNG DMRS to SSS Note 1 EPRE ratio of OCNG to OCNG DMRS Note 1						
N_{oc} Note2	1~3	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2	dBm/SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~3	dB	0	0	0	8
$\hat{E}_s/N_{oc}$	1~3	dB	0	0	0	8
SSB RSRP Note3	1,2	dBm/SSB SCS	-94.65	-94.65	-94.65	-86.65
	3		-91.65	-91.65	-91.65	-83.65
Io Note3	1,2	dBm/9.36 MHz	-63.69	-63.69	-63.69	-58.06
	3	dBm/38.16 MHz	-57.59	-57.59	-57.59	-51.97
Propagation condition	1~3		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves..

A.6.6.27.1.3 Test Requirements

During T1 The UE shall send inter-frequency L1-RSRP report every 80 slots. No later than 80 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report of Cell 2. The RSRP report during T2 shall be larger than that during T1. These reported measurement report shall meet the absolute accuracy requirement in clause 10.1.19E. The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.28 LTM Inter-frequency L1-RSRP measurement without measurement gap

A.6.6.28.1 Inter-frequency SSB based L1-RSRP measurement without measurement gap

A.6.6.28.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting inter-frequency L1-RSRP measurements without gap makes correct reporting of inter-frequency L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.15.6, with the testing configurations for NR serving cells in table A.6.6.28.1.1-1.

Table A.6.6.28.1.1-1: Applicable NR configurations for SSB based inter-frequency L1-RSRP measurement without measurement gap in test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

NOTE 1: The UE is only required to be tested in one of the supported test configurations
NOTE 2: Target NR cell has the same SCS, BW and duplex mode as NR serving cell

A.6.6.28.1.2 Test parameters

There are two cells in the test, the FR1 PCell (Cell 1) on NR RF channel 1 and Cell 2 as neighbour cell in FR1 on NR RF channel 2. The SSB of Cell 2 is completely within UE's active BWP BW. The RBs containing SSB from Cell 1 and Cell 2 should be different in frequency location within the cell bandwidth. The test parameters are given in table A.6.6.28.1.2-1 and table A.6.6.28.1.2-2 below.

There are two tests in the test case, test 1 and test 2:

In test 1, time offset between cells is within CP length.

In test 2, time offset between cells is larger than CP length.

UE not capable of *multiCellL1-measRTD-greaterThan-CP-r18* is only required to pass test 1. Otherwise, it is only required to pass test 2.

The test consists of two successive time periods, with time duration of T1 and T2 respectively. There is no measurement gap configured in the test.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 (PCell) on RF channel 1 (PCC).
- A measurement object is configured for RF channel 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used. Before the start of the T1, event is triggered, and UE has sent a measurement report for the Cell 2 with SSB Index.
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.

At the beginning of T2, SSB_RP of Cell 2 changes to a different value from T1. T2 starts at the beginning of a frame with an even SFN.

Table A.6.6.28.1.2-1: General test parameters for SSB based inter-frequency L1-RSRP measurement without measurement gap in test

Parameter		Unit	Value		Comment
			Test 1	Test 2	
Active cell			Cell 1		
Neighbour cell			Cell 2		Cell 2 is candidate cell
RF Channel Number			1: Cell 1 2: Cell 2		
A3-Offset		dB	-6		
Hysteresis		dB	0		
Time To Trigger		s	0		
Filter coefficient			0		L3 filtering is not used
maxNrofRS-IndexesToReport			1		
includeBeamMeasurements			True		
Time offset between cells		µs	2	20	
DRX			OFF		
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	20		Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1		Report candidate cell's (Cell 2) L1-RSRP measurement results
	nrOfReportedRS-PerCell		n1		
	spCellInclusion		N/A		
ltm-ConfigComplete			True		Candidate cell's configuration is complete configuration
T1		s	0.3		
T2		s	0.5		

Table A.6.6.28.1.2-2: Cell specific test parameters for SSB based inter-frequency L1-RSRP measurement without measurement gap in test

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
SSB ARFCN			freq1		freq2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD		N/A	
	Config 2		SR.1.1 TDD		N/A	
	Config 3		SR.2.1 TDD		N/A	
CORESET Reference Channel	Config 1		CR.1.1 FDD		N/A	
	Config 2		CR.1.1 TDD		N/A	
	Config 3		CR.2.1 TDD		N/A	
CP length			Normal			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC Configuration	Config 1		SMTC.2		SMTC.5	
	Config 2,3		SMTC.1		SMTC.4	
SSB Configuration	Config 1,2		SSB.1 FR1		SSB.5 FR1	
	Config 3		SSB.2 FR1		SSB.6 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
BWP configuration	Initial DL BWP		DLBWP.0.1		NA	
	Dedicated DL BWP		DLBWP.1.1		NA	
	Initial UL BWP		ULBWP.0.1		NA	
	Dedicated UL BWP		ULBWP.1.1		NA	
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-101			
N_{oc} Note2	Config 1,2	dBm/SCS	-101			
	Config 3		-98			
$\hat{E}_s / I_{ot}$		dB	-1.76	-0.19	-1.76	-0.19
$\hat{E}_s / N_{oc}$		dB	3	14.5	3	14.5
SSB_RP	Config 1,2	dBm/SCS	-98	-87.5	-98	-87.5
	Config 3	dBm/SCS	-95	-84.5	-95	-84.5
Io Note3	Config 1,2	dBm/ 9.36 MHz	-66.07	-56.44	-66.07	-56.44
	Config 3	dBm/	-59.96	-50.34	-59.96	-50.34

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
		38.16 MHz				
Propagation condition		-	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.28.1.3 Test Requirements

The UE shall send L1-RSRP report every 20 slots. No later than 20 ms plus 20 slots from the beginning of time period T2, UE shall send L1-RSRP report of Cell 2 while meeting the absolute accuracy requirement in clause 10.1.19E.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.29 RSCPD Measurements

A.6.6.29.1 NR RSCPD with RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA in RRC_CONNECTED state

A.6.6.29.1.1 Test Purpose and Environment

The purpose of the test is to verify that the DL RSCPD measurement reported together with the RSTD measurement meets the requirements specified in clause 9.9.7 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured to the UE.

The supported test configurations are specified in table A.6.6.29.1.1-1.

Table A.6.6.29.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *NR-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.10, shall be provided to the UE during T1. In *NR-DL-TDOA-RequestLocationInformation,* the UE is configured to perform DL RSCPD measurement via *dl-PRS-RSCPD-Request*. The UE is configured to perform both RSCPD and RSTD measurements within the time window indicated to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig*. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the DL-TDOA assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources to be measured within the configured time window.

The UE is configured with measurement gap pattern ID # 24 or # 0 before T2.

The general test parameters are listed in table A.6.6.29.1.1-2, and cell specific test parameters are listed in table A.6.6.29.1.1-3.

Table A.6.6.29.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSCPD and RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Config 1,2,3		DLBWP.1.1	
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.1 FR1	
	Config 3		PRS.2.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2) mod 6=0 and (PCI of Cell 1 – PCI of Cell 3) mod 6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#0	GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured
Time window configuration			MTW.1	As specified in clause A.3.38

Radio frame receive time offset between the cells at the UE antenna connector	μs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD	μs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells	μs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		3	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to *NR-MutingPattern* defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.6.6.29.1.1-3: Cell-specific test parameters for RSCPD with RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in clause A.3.2.1			OP.1	N/A	N/A
EPRE ratio of PSS to SSS		dB	0	N/A	N/A
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08MHz	-56.54	-56.54	-56.54

	Config 2	dBm/ 19.08MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 47.88MHz	-52.56	-52.56	-52.56
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.6.29.1.1-4: Cell-specific test parameters for RSCPD with RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in clause A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
	Config 1	dB	-5.45	-11.67	-11.67

PRS $\hat{E}_s/N_{oc}$	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
SSB $\hat{E}_s/N_{oc}$	Config 1,2,3	dB	10	3	3
Io Note 4	Config 1	dBm/ 19.08MHz	-65.43	-65.43	-65.43
	Config 2	dBm/ 19.08MHz	-65.43	-65.43	-65.43
	Config 3	dBm/ 47.88MHz	-61.44	-61.44	-61.44
SSB RP Note4	Config 1	dBm/SCS	-88	-95	-95
	Config 2	dBm/SCS	-88	-95	-95
	Config 3	dBm/SCS	-85	-92	-92
PRS $\hat{E}_s/I_{ot}$		dB	-6.00	-12.98	-12.98
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.

A.6.6.29.1.2 Test Requirements

The RSCPD reported together with RSTD measurement time fulfils the requirements specified in the clause 9.9.7.

The UE shall perform and report the RSCPD and RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 9.9.7 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for DL RSCPD measurement for each neighbour cell observed during the repeated tests shall be at least 90%. The reported DL RSCPD measurement shall be within the DL RSCPD reporting range specified in the clause 10.1.43 and the reported RSTD measurement shall be within the RSTD reporting range specified in the clause 10.1.23.

A.6.6.30 RSCP Measurements

A.6.6.30.1 DL RSCP with UE Rx-Tx time difference measurement for single positioning frequency layer in FR1 SA

A.6.6.30.1.1 Test purpose and environment

The purpose of the test is to verify that the DL RSCP and UE Rx-Tx time difference measurements meet the requirements specified in clause 9.9.8.5 in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured for both DL RSCP measurement and UE Rx-Tx time difference measurement.

The supported test configurations are listed in table A.6.6.30.1.1-1.

Table A.6.6.30.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message as defined in TS 37.355 [34], shall be provided to the UE during T1. In *NR-Multi-RTT-RequestLocationInformation*, the UE is configured to perform DL RSCP measurement via *nr-DL-PRS-RSCP-Request*. The UE is configured to perform both DL RSCP and UE Rx-Tx time difference measurements within the time window indicated to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig*. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources to be measured within the configured time window.

The UE is configured with measurement gap pattern ID #0 or ID #24 before T2.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are listed in table A.6.6.30.1.1-2 and table A.6.6.30.1.1-3.

Table A.6.6.30.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	20: $N_{RB,c}$ = 106	
		2	20: $N_{RB,c}$ = 106	
		3	50: $N_{RB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	OFF	
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Time window configuration		1, 2, 3	MTW.1	As specified in clause A.3.38
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.6.6.30.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS muting info		1, 2, 3	‘10’		‘01’	
SRS configuration		1	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108

PRP Note 3		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.30.1.2 Test requirements

The DL RSCP with UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.8 with Nsample=4 for UE Rx-Tx time difference.

The UE shall perform and report the DL RSCP and UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified DL RSCP with UE Rx-Tx time difference measurement time specified in clause 9.9.8 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%. The reported DL RSCP measurement shall be within the DL RSCP reporting range specified in clause 10.1.44 and the reported UE Rx-Tx measurement shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.

A.6.7 Measurement Performance requirements

Unless explicitly stated otherwise:

- Reported measurements shall be within defined range of accuracy limits defined in clause 10 for at least 90 % of the reported cases. If multiple measurement performance requirements are verified in the same test, the reported measurements for each requirement shall be within defined range of accuracy limits of the corresponding requirement defined in clause 10 for at least 90% of the reported cases.
- Measurements are performed in RRC_CONNECTED state.
- The reference channels assume transmission of PDSCH with a maximum number of 5 HARQ transmissions unless otherwise specified.

A.6.7.1 SS-RSRP

A.6.7.1.1 SA: intra-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.2.1.1 and 10.1.2.1.2 for intra-frequency measurements.

A.6.7.1.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in A.6.7.1.1.2-2. In all test cases, Cell 1 is the PCell, and Cell 2 is the target cell.

Table A.6.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.7.1.1.2-2: SS-RSRP Intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0	489	0
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1		10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
TRS configuration	Config 1		TRS.1.1 FDD	NA	TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
	Config 2		TRS.1.1 TDD	NA	TRS.1.1 TDD	NA	TRS.1.1 TDD	NA
	Config 3		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
SSB configuration	Config 1		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		Config 2		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
		Config 3		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1		Config 1	ms	-	3	-	3	-	3
		Config 2,3	µs	-	3	-	3	-	3
SMTC configuration		Config 1		SMTC.2					
		Config 2,3		SMTC.1					
OCNG Patterns				OCNG pattern 1					
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15 kHz					
		Config 3		30 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-106		-88		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-94		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2		dBm/SCS	-106		-88		Same as Noc/15 kHz	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-91		-111	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$			dB	2.46	-5.97	2.46	-5.97	-0.01	-4.76
$\hat{E}_s/N_{oc}$			dB	6	1	6	1	3	0
SS-RSRP[Note3]	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-100	-105	-82	-87	-111.00	-114.00
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.50	-113.50
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110.00	-113.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.50	-112.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109.00	-112.00
		NR_FDD_FR1_F						-108.50	-111.50
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108.00	-111.00
		NR_FDD_FR1_H						-107.50	-110.50
		NR_FDD_FR1_N						-104.50	-107.50
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable[Note 5]	Not applicable[Note 5]	-85	-90	-108.00	-111.00
		NR_FDD_FR1_B, NR_TDD_FR1_B						-107.50	-110.50
		NR_FDD_FR1_C, NR_TDD_FR1_C						-107.00	-110.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-106.50	-109.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-106.00	-109.00
		NR_FDD_FR1_F						-105.50	-108.50
		NR_FDD_FR1_G, NR_TDD_FR1_G						-105.00	-108.00
		NR_FDD_FR1_H						-104.50	-107.50
		NR_FDD_FR1_N						-101.50	-104.50
Io[Note3]	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-70.09		-52.09		-80.03	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-79.53	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-79.03	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-78.53	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-78.03	
		NR_FDD_FR1_F						-77.53	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-77.03	
		NR_FDD_FR1_H						-76.53	
		NR_FDD_FR1_N						-73.53	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	Not applicable Note 5		-51.99		-73.94	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-73.44	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-72.94	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-72.44	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-71.94	
		NR_FDD_FR1_F						-71.44	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-70.94	
		NR_FDD_FR1_H						-70.44	
		NR_FDD_FR1_N						-67.44	
Propagation condition			-	AWGN					
Antenna configuration				1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Subtest 1 is not used when testing with 30 kHz SSB SCS.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.6.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil absolute requirement in clause 10.1.2.1.1 and relative requirement in clause 10.1.2.1.2.

A.6.7.1.2 SA inter-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.4.1.1 and 10.1.4.1.2 for inter-frequency measurements with the testing configurations for NR cells in table A.6.7.1.2.1-1.

Table A.6.7.1.2.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.1.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.6.7.1.2.2-1 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in table A.6.7.1.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.6.7.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		1~3		freq1	freq2	freq1	freq2
$BW_{channel}$		1	MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
		2		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
		3		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
Duplex mode		1		FDD		FDD	
		2		TDD		TDD	
		3		TDD		TDD	
TDD configuration		1		N/A		N/A	
		2		TDDConf.1.1		TDDConf.1.1	
		3		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel		1		SR.1.1 FDD	-	SR.1.1 FDD	-
		2		SR.1.1 TDD		SR.1.1 TDD	
		3		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel		1		CR.1.1 FDD	-	CR.1.1 FDD	-
		2		CR.1.1 TDD	-	CR.1.1 TDD	-
		3		CR.2.1 TDD	-	CR.2.1 TDD	-
Dedicated CORESET Reference Channel		1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
		2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
		3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration		1		SSB.1 FR1		SSB.1 FR1	
		2		SSB.1 FR1		SSB.1 FR1	
		3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns		1~3		OP.1		OP.1	
TRS configuration		1		TRS.1.1 FDD	-	TRS.1.1 FDD	
		2		TRS.1.1 TDD		TRS.1.1 TDD	
		3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration		1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration		1~3		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1		1	ms	-	3	-	3
		2,3	µs	-	3	-	3
SMTC configuration		1		SMTC.2		SMTC.2	
		2,3		SMTC.1		SMTC.1	
EPRE ratio of PSS to SSS		1~3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~3	dBm/15 kHz	-94.65		(N_{oc} for Channel 2 +8 dB)	-115
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_N						-108.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2	dBm/SSB SCS	-94.65		(N_{oc} for Channel 2 +8 dB)	-115
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_N						-108.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3		-91.65		(N_{oc} for Channel 2 +8 dB)	-112.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-111.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-111.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-110.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-110.00
	NR_FDD_FR1_F						-109.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-109.00
	NR_FDD_FR1_H						-108.50
	NR_FDD_FR1_N						-105.50
$\hat{E}_s/I_{ot}$		1~3	dB	10	10	13	-3
SS-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2	dBm/SCS	-84.65		(RSRP for Cell 2 +24 dB)	-118.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-117.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-117.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-116.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-116.00
	NR_FDD_FR1_F						-115.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-115.00
	NR_FDD_FR1_H						-114.50
	NR_FDD_FR1_N						-111.50
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3		-81.65		(RSRP for Cell 2 +24 dB)	-115.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113.00
	NR_FDD_FR1_F						-112.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112.00
	NR_FDD_FR1_H						-111.50
	NR_FDD_FR1_N						-108.50

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
Io[Note3]	NR_FDD_FR1_A, NR_TDD_FR1_A [NOTE 5],	1,2	dBm/ 9.36 MHz	-56.28		(Io for Channel 2 +19.45 dB)	-85.28
	NR_FDD_FR1_B, NR_TDD_FR1_B						-84.78
	NR_FDD_FR1_C, NR_TDD_FR1_C						-84.28
	NR_FDD_FR1_D, NR_TDD_FR1_D						-83.78
	NR_FDD_FR1_E, NR_TDD_FR1_E						-83.28
	NR_FDD_FR1_F						-82.78
	NR_FDD_FR1_G, NR_TDD_FR1_G						-82.28
	NR_FDD_FR1_H						-81.78
	NR_FDD_FR1_N						-78.78
	NR_FDD_FR1_A, NR_TDD_FR1_A [NOTE 5],	3	dBm/ 38.16 MHz	-50.19		(Io for Channel 2 +19.45 dB)	-79.19
	NR_FDD_FR1_B, NR_TDD_FR1_B						-78.69
	NR_FDD_FR1_C, NR_TDD_FR1_C						-78.19
	NR_FDD_FR1_D, NR_TDD_FR1_D						-77.69
	NR_FDD_FR1_E, NR_TDD_FR1_E						-77.19
	NR_FDD_FR1_F						-76.69
	NR_FDD_FR1_G, NR_TDD_FR1_G						-76.19
	NR_FDD_FR1_H						-75.69
	NR_FDD_FR1_N						-72.69
$\hat{E}_s / N_{oc}$		1~3	dB	10	10	13	-3
Propagation condition		1~3	-	AWGN		AWGN	
Antenna configuration		1~3		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirement in clause 10.1.4.1.1 and relative requirement in clause 10.1.4.1.2.

A.6.7.1.3 Void

A.6.7.2 SS-RSRQ

A.6.7.2.1 SA: Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.7.1.1.

A.6.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.6.7.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is tested by using the parameters in table A.6.7.2.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.6.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
Cell 2			Cell 1		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0	489	0
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Control Channel RMC	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
TRS Configuration	Config 1		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns			OP. 1					
SS-RSSI-Measurement			Not Applicable					
Time offset with Cell 1	Config 1	ms	-	3	-	3	-	3
	Config 2,3	µs	-	3	-	3	-	3
SMTC configuration	Config 1		SMTC.2					
	Config 2,3		SMTC.1					
SSB configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
CSI-RS for tracking	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					

Parameter Cell 2			Unit	Test 1		Test 2		Test 3	
				Cell 1		Cell 1	Cell 2	Cell 1	Cell 2
		Config 3		TRS.1.2 TDD					
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15 kHz					
		Config 3		30 kHz					
EPRE ratio of PSS to SSS EPRE ratio of PBCH DMRS to SSS EPRE ratio of PBCH to PBCH DMRS EPRE ratio of PDCCH DMRS to SSS EPRE ratio of PDCCH to PDCCH DMRS EPRE ratio of PDSCH DMRS to SSS EPRE ratio of PDSCH to PDSCH EPRE ratio of OCNG DMRS to SSS(Note 1) EPRE ratio of OCNG to OCNG DMRS (Note 1)			dB	0	0	0	0	0	0
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-85		-101		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-91		-		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-85		-101		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	

Parameter			Unit	Test 1		Test 2		Test 3	
Cell 2				Cell 1		Cell 1	Cell 2	Cell 1	Cell 2
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-88		-		-111	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$			dB	-1.76		-4.7		-5..46	-5.46
$\hat{E}_s/N_{oc}$			dB	3	3	-2.9	-2.9	-4	-4
SS-RSRP Note3	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-82	-82	-103.9	-103.9	-118	-118
		NR_FDD_FR1_B, NR_TDD_FR1_B						-117.5	-117.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-117	-117
		NR_FDD_FR1_D, NR_TDD_FR1_D						-116.5	-116.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-116	-116
		NR_FDD_FR1_F						-115.5	-115.5
		NR_FDD_FR1_G, NR_TDD_FR1_G						-115	-115
		NR_FDD_FR1_H						-114.5	-114.5
		NR_FDD_FR1_N						-111.5	-111.5
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85	-85	-	-	-115	-115
		NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5	-114.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-114	-114
		NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5	-113.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-113	-113
		NR_FDD_FR1_F						-112.5	-112.5
		NR_FDD_FR1_G, NR_TDD_FR1_G						-112	-112
		NR_FDD_FR1_H						-111.5	-111.5
		NR_FDD_FR1_N						-108.5	-108.5
SS-RSRQ Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	-14.77	-14.77	-16.76	-16.76	-17.34	-17.34
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D, NR_TDD_FR1_D							
		NR_FDD_FR1_E, NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G, NR_TDD_FR1_G							

Parameter			Unit	Test 1		Test 2		Test 3	
Cell 2				Cell 1		Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io[Note3]	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-50		-70		-83.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-83	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-82.5	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-82	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-81.5	
		NR_FDD_FR1_F						-81	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-80.5	
		NR_FDD_FR1_H						-80	
		NR_FDD_FR1_N						-77	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-50		-		-77.4	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-76.9	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-76.4	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-75.9	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-75.4	
		NR_FDD_FR1_F						-74.9	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-74.4	
		NR_FDD_FR1_H						-73.9	
		NR_FDD_FR1_N						-70.9	
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.7.1.1.

A.6.7.2.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.9.1.1 and 10.1.9.1.2.

A.6.7.2.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.6.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in table A.6.7.2.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.6.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.2.2.2-2: SS-RSRQ Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
Gap pattern ID	Config 1,2,3		0					
BWP BW	Config 1		10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: NRB,c = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	R.1.1 FDD	-	CR.1.1 FDD	
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
TRS Configuration	Config 1		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns			OCNG pattern 1					
Time offset with Cell 1	Config 1	ms	-	3	-	3	-	3
	Config 2,3	µs	-	3	-	3	-	3
SMTC configuration	Config 1		SMTC pattern 2					
	Config 2,3		SMTC pattern 1					
SSB configuration	Config 1,2		SSB pattern 1 in FR1					
	Config 3		SSB pattern 2 in FR1					
CSI-RS for tracking	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15 kHz					
		Config 3		30 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-80.18		-106		-116	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
N_{oc} Note2	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-86.27		-113		-116	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-80.18		-106		-116	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-83.27		-110		-113	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_B, NR_TDD_FR1_B						-112.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-112	
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	
		NR_FDD_FR1_F						-110.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-110	
		NR_FDD_FR1_H						-109.5	
		NR_FDD_FR1_N						-106.5	
$\hat{E}_s / I_{ot}$			dB	-1.75		-1.75		3	-1.75
$\hat{E}_s / N_{oc}$			dB	-1.75		-1.75		3	-1.75
SS-RSRP[Note3]	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-81.93	-81.93	-107.75	-107.75	-113	-117.75
		NR_FDD_FR1_B, NR_TDD_FR1_B						-112.5	-117.25
		NR_FDD_FR1_C, NR_TDD_FR1_C						-112	-116.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	-116.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	-115.75
		NR_FDD_FR1_F						-110.5	-115.2
		NR_FDD_FR1_G, NR_TDD_FR1_G						-110	-114.75
		NR_FDD_FR1_H						-109.5	-114.25
		NR_FDD_FR1_N						-106.5	-111.25
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85.02	-85.02	-111.75	-111.75	-110	-114.75
		NR_FDD_FR1_B, NR_TDD_FR1_B						-109.5	-114.25
		NR_FDD_FR1_C, NR_TDD_FR1_C						-109	-113.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-108.5	-113.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-108	-112.75
		NR_FDD_FR1_F						-107.5	-112.2
		NR_FDD_FR1_G, NR_TDD_FR1_G						-107	-111.75
		NR_FDD_FR1_H						-106.5	-111.25
		NR_FDD_FR1_N						-103.5	-108.25
SS-RSRQ[Note3]		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-14.77	-14.77	-14.77	-14.77	12.56	14.76
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_F							

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_G, NR_TDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io^{Note3}	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-50		-75.83		-83.28	-85.83
		NR_FDD_FR1_B, NR_TDD_FR1_B						-82.78	-85.33
		NR_FDD_FR1_C, NR_TDD_FR1_C						-82.28	-84.83
		NR_FDD_FR1_D NR_TDD_FR1_D						-81.78	-84.33
		NR_FDD_FR1_E NR_TDD_FR1_E						-81.28	-83.83
		NR_FDD_FR1_F						-80.78	-83.33
		NR_FDD_FR1_G, NR_TDD_FR1_G						-80.28	-82.83
		NR_FDD_FR1_H						-79.78	-82.33
		NR_FDD_FR1_N						-76.78	-79.33
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-50		-76.73		-77.19	-79.73
		NR_FDD_FR1_B, NR_TDD_FR1_B						-76.69	-79.23
		NR_FDD_FR1_C, NR_TDD_FR1_C						-76.19	-78.73
		NR_FDD_FR1_D NR_TDD_FR1_D						-75.69	-78.23
		NR_FDD_FR1_E NR_TDD_FR1_E						-75.19	-77.73
		NR_FDD_FR1_F						-74.69	-77.23
		NR_FDD_FR1_G, NR_TDD_FR1_G						-74.19	-76.73
		NR_FDD_FR1_H						-73.69	-76.53
		NR_FDD_FR1_N						-70.69	-73.53
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.9.1.1 and 10.1.9.1.2.

A.6.7.3 SS-SINR

A.6.7.3.1 SA intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.12.1.1.

A.6.7.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.6.7.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in table A.6.7.3.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.6.7.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
DRX Cycle configuration		ms	Not Applicable			
TRS configuration	Config 1		TRS.1.1 FDD		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR.2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns			OP.1			
SS-RSSI-Measurement			Not Applicable			
SMTC configuration	Config 1		SMTC.2			
	Config 2,3		SMTC.1			
Time offset with Cell 1	Config 1	ms	-	3	-	3
	Config 2,3	µs	-	3	-	3
SSB configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15			
		Config 3		30			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-93		-116	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-115.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-115	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-114.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-114	
		NR_FDD_FR1_F				-113.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-113	
		NR_FDD_FR1_H				-112.5	
		NR_FDD_FR1_N				-109.5	
N_{oc} Note2	Config 1,2		dBm/SCS	-93		Same as Noc for 15 kHz	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-90		-113	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-112.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-112	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-111.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-111	
		NR_FDD_FR1_F				-110.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-110	
		NR_FDD_FR1_H				-109.5	
		NR_FDD_FR1_N				-106.5	
$\hat{E}_s / I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	4.54	2.66	-4	-4
SS-RSRP Note3	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-88.46	-90.34	-120	-120
		NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5	-119.5
		NR_FDD_FR1_C, NR_TDD_FR1_C				-119	-119
		NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5	-118.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-118	-118
		NR_FDD_FR1_F				-117.5	-117.5
		NR_FDD_FR1_G, NR_TDD_FR1_G				-117	-117
		NR_FDD_FR1_H				-116.5	-116.5

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_N				-113.5	-113.5
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85.46	-87.34	-117	-117
		NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5	-116.5
		NR_FDD_FR1_C, NR_TDD_FR1_C				-116	-116
		NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5	-115.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-115	-115
		NR_FDD_FR1_F				-114.5	-114.5
		NR_FDD_FR1_G, NR_TDD_FR1_G				-114	-114
		NR_FDD_FR1_H				-113.5	-113.5
		NR_FDD_FR1_N				-110.5	-110.5
SS-SINR Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	0	-3.19	-5.46	-5.46
		NR_FDD_FR1_B, NR_TDD_FR1_B					
		NR_FDD_FR1_C, NR_TDD_FR1_C					
		NR_FDD_FR1_D, NR_TDD_FR1_D					
		NR_FDD_FR1_E, NR_TDD_FR1_E					
		NR_FDD_FR1_F					
		NR_FDD_FR1_G, NR_TDD_FR1_G					
		NR_FDD_FR1_H					
		NR_FDD_FR1_N					
Io Note3	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.5		-85.51	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-85.01	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-84.51	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-84.01	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-83.51	
		NR_FDD_FR1_F				-83.01	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-82.51	
		NR_FDD_FR1_H				-82.01	
		NR_FDD_FR1_N				-79.01	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-51.41		-79.41	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-78.91	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-78.41	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-77.91	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-77.41	
		NR_FDD_FR1_F				-76.91	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-76.41	
		NR_FDD_FR1_H				-75.91	
		NR_FDD_FR1_N				-72.91	

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Propagation condition	-	AWGN			
Antenna configuration	-	1x2			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 5: NR operating band groups are as defined in clause 3.5.2.					
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.					

A.6.7.3.1.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.12.1.1.

A.6.7.3.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.14.1.1 and 10.1.14.1.2.

A.6.7.3.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.6.7.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in table A.6.7.3.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.6.7.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.3.2.2-2: SS-SINR Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
DRX Cycle configuration		ms	Not Applicable					
Gap pattern ID			0	-	0	-	0	-

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
TRS configuration		Config 1		TRS.1.1 FDD		TRS.1.1 FDD		TRS.1.1 FDD	
		Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
		Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
		Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel		Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
		Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
		Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Dedicated CORESET Reference Channel		Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
		Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 1		Config 1	ms	-	3	-	3	-	3
		Config 2,3	µs	-	3	-	3	-	3
SMTC configuration		Config 1		SMTC pattern 2					
		Config 2,3		SMTC pattern 1					
SSB configuration		Config 1,2		SSB.1 FR1					
		Config 3		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15					
		Config 3		30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-88		-108.5		-119.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-119	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-118.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-118	
		NR_FDD_FR1_E NR_TDD_FR1_E						-117.5	
		NR_FDD_FR1_F						-117	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-116.5	
		NR_FDD_FR1_H						-116	
		NR_FDD_FR1_N						-113	
N_{oc} Note2	Config 1,2		dBm/SCS	-88		-108.5		Same as Noc for 15 kHz	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85		-105.5		-116.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-116	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-115	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114.5	
		NR_FDD_FR1_F						-114	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-114.5	
		NR_FDD_FR1_H						-113	
		NR_FDD_FR1_N						-110	
$\hat{E}_s/I_{ot}$			dB	-1.75	-1.75	20	20	-4.0	-4.0
$\hat{E}_s/N_{oc}$			dB	-1.75		20		-4.0	
SS-RSRP Note3	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-89.75		-88.5		-123.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-123	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-122.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-122	
		NR_FDD_FR1_E NR_TDD_FR1_E						-121.5	
		NR_FDD_FR1_F						-121	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-120.5	
		NR_FDD_FR1_H						-120	
		NR_FDD_FR1_N						-117	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-86.75		-85.5		-120.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-120	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-119.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-119	
		NR_FDD_FR1_E NR_TDD_FR1_E						-118.5	
		NR_FDD_FR1_F						-118	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-117.5	
		NR_FDD_FR1_H						-117	
		NR_FDD_FR1_N						-114	
SS-SINR Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-1.75		20		-4.0	
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D							

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G, NR_TDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io[Note3]	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.83		-60.5		-90.09	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-89.59	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-89.09	
		NR_FDD_FR1_D NR_TDD_FR1_D						-88.59	
		NR_FDD_FR1_E NR_TDD_FR1_E						-88.09	
		NR_FDD_FR1_F						-87.59	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-87.09	
		NR_FDD_FR1_H						-86.59	
		NR_FDD_FR1_N						-83.59	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-51.73		-54.41		-84	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-83.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-83	
		NR_FDD_FR1_D NR_TDD_FR1_D						-82.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-82	
		NR_FDD_FR1_F						-81.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-81	
		NR_FDD_FR1_H						-80.5	
		NR_FDD_FR1_N						-77.5	
Propagation condition			-	AWGN					
Antenna configuration			-	1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.3.2.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.14.1.1 and 10.1.14.1.2.

A.6.7.4 L1-RSRP measurement for beam reporting

A.6.7.4.1 SSB based L1-RSRP measurement

A.6.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.5.2 and clause 10.1.19.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.6.7.4.1.1-1.

Table A.6.7.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.4.1.2 Test parameters

In this set of test cases there one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.7.4.1.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.6.7.4.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.6.7.4.1.2-1: FR1 SSB based L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~3		freq1	freq1
Duplex mode	1		FDD	FDD
	2		TDD	TDD
	3		TDD	TDD
TDD Configuration	1		N/A	N/A
	2		TDDConf.1.1	TDDConf.1.1
	3		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD	SR.1.1 FDD
	2		SR.1.1 TDD	SR.1.1 TDD
	3		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD	CR.1.1 FDD
	2		CR.1.1 TDD	CR.1.1 TDD
	3		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	CCR.1.1 FDD
	2		CCR.1.1 TDD	CCR.1.1 TDD
	3		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1	SSB.3 FR1
	2		SSB.3 FR1	SSB.3 FR1
	3		SSB.4 FR1	SSB.4 FR1
OCNG Patterns	1~3		OP.1	OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
TRS configuration	1		TRS.1.1 FDD	TRS.1.1 FDD
	2		TRS.1.1 TDD	TRS.1.1 TDD
	3		TRS.1.2 TDD	TRS.1.2 TDD
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1	SMTC.1
reportConfigType	1~3		periodic	periodic
reportQuantity	1~3		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1~3		2	2
L1-RSRP reporting period	1~3		slot80	slot80

Parameter		Config	Unit	Test 1	Test 2
EPRE ratio of PSS to SSS		1~3	dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~3	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/SSB SCS	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-91.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
$\hat{E}_s/I_{ot}$		1~3	dB	10	-3
SSB RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/SSB SCS	-84.65	-120
	NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_C, NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_N				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-81.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B, NR_TDD_FR1_B				-86.78
	NR_FDD_FR1_C, NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G, NR_TDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_N				-80.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3	dBm/38.16 MHz	-50.19	-81.19
	NR_FDD_FR1_B, NR_TDD_FR1_B				-80.69
	NR_FDD_FR1_C, NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G, NR_TDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
	NR_FDD_FR1_N				-74.69
$\hat{E}_s/N_{oc}$		1~3	dB	10	-3
Propagation condition		1~3		AWGN	AWGN
Antenna configuration		1~3		1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Config	Unit	Test 1	Test 2
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.				

A.6.7.4.1.3 Test Requirements

The L1-RSRP measurement accuracy for SSB resource reported by UE in L1-RSRP report (SSB#0 or SSB#1) of Cell 2 shall fulfil the requirements in clauses 10.1.19.1.

A.6.7.4.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.6.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.5.3 and clause 10.1.19.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in table A.6.7.4.2.1-1.

Table A.6.7.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.4.2.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.7.4.2.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.6.7.4.2.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.6.7.4.2.2-1: FR1 CSI-RS based L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~3		freq1	freq1
Duplex mode	1		FDD	FDD
	2		TDD	TDD
	3		TDD	TDD
TDD Configuration	1		N/A	N/A
	2		TDDConf.1.1	TDDConf.1.1
	3		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD	SR.1.1 FDD
	2		SR.1.1 TDD	SR.1.1 TDD
	3		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD	CR.1.1 FDD
	2		CR.1.1 TDD	CR.1.1 TDD
	3		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	CCR.1.1 FDD

Parameter		Config	Unit	Test 1	Test 2
		2		CCR.1.1 TDD	CCR.1.1 TDD
		3		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration		1		SSB.3 FR1	SSB.3 FR1
		2		SSB.3 FR1	SSB.3 FR1
		3		SSB.4 FR1	SSB.4 FR1
OCNG Patterns		1~3		OP.1	OP.1
TRS configuration		1		TRS.1.1 FDD	TRS.1.1 FDD
		2		TRS.1.1 TDD	TRS.1.1 TDD
		3		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration		1~3		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration		1~3		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration		1~3		SMTC.1	SMTC.1
CSI-RS		1		CSI-RS 1.2 FDD	CSI-RS 1.2 FDD
		2		CSI-RS 1.2 TDD	CSI-RS 1.2 TDD
		3		CSI-RS 2.2 TDD	CSI-RS 2.2 FDD
reportConfigType		1~3		periodic	periodic
reportQuantity		1~3		cri-RSRP	cri-RSRP
Number of reported RS		1~3		2	2
L1-RSRP reporting period		1~3		slot80	slot80
EPRE ratio of PSS to SSS		1~3	dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~3	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/CSI-RS SCS	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-91.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
$\hat{E}_s/I_{ot}$		1~3	dB	10	-3
CSI-RS RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/CSI-RS SCS	-84.65	-120
	NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_N				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-81.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B, NR_TDD_FR1_B				-86.78
	NR_FDD_FR1_C, NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G, NR_TDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_N				-80.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3	dBm/38.16 MHz	-50.19	-81.19

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_B, NR_TDD_FR1_B				-80.69
	NR_FDD_FR1_C, NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G, NR_TDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
	NR_FDD_FR1_N				-74.69
$\hat{E}_s/N_{oc}$		1~3	dB	10	-3
Propagation condition		1~3		AWGN	AWGN
Antenna configuration		1~3		1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.					

A.6.7.4.2.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS resource reported by UE in L1-RSRP report (CSI-RS#0 or CSI-RS#1) of Cell 1 shall fulfil the requirements in clause 10.1.19.2.

A.6.7.5 E-UTRAN RSRP

A.6.7.5.1 SA: inter-RAT measurement accuracy with FR1 serving cell

A.6.7.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the E-UTRAN RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.2.2 for SA inter-RAT E-UTRAN RSRP measurements.

A.6.7.5.1.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an E-UTRAN inter-RAT neighbour cell. Supported test configurations are shown in table A.6.7.5.1.2-1. The measurement accuracy of SA inter-RAT E-UTRAN RSRP are tested by using the parameters in A.6.7.5.1.2-2 and A.6.7.5.1.2-3.

Table A.6.7.5.1.2-1: Inter-RAT E-UTRAN RSRP supported test configurations with FR1 serving cell

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.5.1.2-2: NR Cell specific test parameters for SA Inter-RAT E-UTRAN RSRP test parameters

Parameter		Unit	Cell 1
NR RF channel number			1
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		N/A
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
$BW_{channel}$	Config 1, 4	MHz	10: $N_{PRB,c}$ = 52 (FDD)
	Config 2, 5		10: $N_{PRB,c}$ = 52 (TDD)
	Config 3, 6		40: $N_{PRB,c}$ = 106 (TDD)
Gap pattern Id			0
PDSCH reference measurement channel	Config 1, 4		SR.1.1 FDD
	Config 2, 5		SR.1.1 TDD
	Config 3, 6		SR.2.1 TDD
RMSI CORSET reference channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
Dedicated CORSET reference channel	Config 1, 4		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
BWP configurations	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
OCNG pattern[Note1]			OP.1
SMTC configuration			SMTC.1
SSB configuration	Config 1, 2, 4, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS			
EPRE ratio of OCNG to OCNG DMRS			
N_{oc}[Note2]		dBm/15 kHz	-104
N_{oc}[Note2]	Config 1, 2, 4, 5	dBm/SCS	-104
	Config 3, 6		-101
$\hat{E}_s/N_{oc}$		dB	17
$\hat{E}_s/I_{ot}$[Note3]		dB	17
SS-RSRP[Note3]	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
SSB_RP[Note3]	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
Io[Note3]	Config 1, 2, 4, 5	dBm/9.36 MHz	-58.96
	Config 3, 6	dBm/38.16 MHz	-52.87
Propagation condition			AWGN
Antenna Configuration and Correlation Matrix			1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.7.5.1.2-3: E-UTRAN Cell specific test parameters for SA Inter-RAT E-UTRAN RSRP test parameters

Parameter		Unit	Cell 2	
			Test 1	Test 2
E-UTRA RF channel number			1	
Duplex mode	Config 1, 2, 3		FDD	
	Config 4, 5, 6		TDD	
TDD special subframe configuration[Note1]	Config 1, 2, 3		N/A	
	Config 4, 5, 6		6	
TDD uplink-downlink configuration[Note1]	Config 1, 2, 3		N/A	
	Config 4, 5, 6		1	
$BW_{channel}$		MHz	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]			-	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]	Config 1, 2, 3		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
	Config 4, 5, 6		5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]	Config 1, 2, 3		5 MHz: OP.19 FDD 10 MHz: OP.6 FDD 20 MHz: OP.14 FDD	
	Config 4, 5, 6		5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD	
PBCH_RA		dB	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-91.65	-117
	Bands FDD_B1, FDD_B2 [Note 10]			-116.5
	Bands FDD_C, TDD_C			-116
	Bands FDD_D			-115.5
	Bands FDD_E, FDD_F [Note 7], TDD_E			-115
	Bands FDD_G [Note 8]			-114
	Bands FDD_H			-113.5
$\hat{E}_s/N_{oc}$		dB	10	-4
$\hat{E}_s/I_{ot}$[Note5]		dB	10	-4
RSRP[Note5]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-81.65	-121
	Bands FDD_B1, FDD_B2 [Note 10]			-120.5
	Bands FDD_C, TDD_C			-120
	Bands FDD_D			-119.5
	Bands FDD_E, FDD_F [Note 7], TDD_E			-119
	Bands FDD_G [Note 8]			-118

Parameter		Unit	Cell 2	
			Test 1	Test 2
	Bands FDD_H			-117.5
SCH_RP Note5	Bands FDD_A Note 9, TDD_A	dBm/15 kHz	-81.65	-121
	Bands FDD_B1, FDD_B2 Note 10			-120.5
	Bands FDD_C, TDD_C			-120
	Bands FDD_D			-119.5
	Bands FDD_E, FDD_F Note 7, TDD_E			-119
	Bands FDD_G Note 8			-118
	Bands FDD_H			-117.5
Io Note5	Bands FDD_A Note 9, TDD_A	dBm/Ch BW	-53.45 + 10log($N_{PRB,c}$/50)	-87.76 + 10log($N_{PRB,c}$/50)
	Bands FDD_B1, FDD_B2 Note 10			-87.26 + 10log($N_{PRB,c}$/50)
	Bands FDD_C, TDD_C			-86.76 + 10log($N_{PRB,c}$/50)
	Bands FDD_D			-86.26 + 10log($N_{PRB,c}$/50)
	Bands FDD_E, FDD_F Note 7, TDD_E			-85.76 + 10log($N_{PRB,c}$/50)
	Bands FDD_G Note 8			-84.76 + 10log($N_{PRB,c}$/50)
	Bands FDD_H			-84.26 + 10log($N_{PRB,c}$/50)
Propagation Condition			AWGN	
Antenna Configuration and Correlation Matrix			1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: E-UTRA operating band groups are as defined in clause 3.5 of TS 36.133 [15].
NOTE 7: For Band 26, the tests shall be performed with the carrier frequency of assigned E-UTRA channel bandwidth within 865-894 MHz.
NOTE 8: Except Band 29.
NOTE 9: Except Band 32, Band 75 and Band 76.
NOTE 10: For Band 74, the tests shall be performed with the carrier frequency of the assigned E-UTRA channel bandwidth within 1475.9-1510.9 MHz.

A.6.7.5.1.3 Test Requirements

The SA inter-RAT E-UTRAN RSRP measurement accuracy for Cell 2 shall fulfil absolute requirement in clause 10.2.2.

A.6.7.6 E-UTRAN RSRQ

A.6.7.6.1 SA: inter-RAT measurement accuracy with FR1 serving cell

A.6.7.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the E-UTRAN RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.2.3 for SA inter-RAT E-UTRAN RSRQ measurements.

A.6.7.6.1.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an E-UTRAN inter-RAT neighbour cell. Supported test configurations are shown in table A.6.7.6.1.2-1. The measurement accuracy of SA inter-RAT E-UTRAN RSRQ are tested by using the parameters in A.6.7.6.1.2-2 and A.6.7.6.1.2-3.

Table A.6.7.6.1.2-1: Inter-RAT E-UTRAN RSRQ supported test configurations with FR1 serving cell

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.6.1.2-2: NR Cell specific test parameters for SA Inter-RAT E-UTRAN RSRQ test parameters

Parameter		Unit	Cell 1
NR RF channel number			1
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		N/A
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
$BW_{channel}$	Config 1, 4	MHz	10: $N_{PRB,c}$ = 52 (FDD)
	Config 2, 5		10: $N_{PRB,c}$ = 52 (TDD)
	Config 3, 6		40: $N_{PRB,c}$ = 106 (TDD)
Gap pattern Id			0
PDSCH reference measurement channel	Config 1, 4		SR.1.1 FDD
	Config 2, 5		SR.1.1 TDD
	Config 3, 6		SR.2.1 TDD
RMSI CORSET reference channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
Dedicated CORSET reference channel	Config 1, 4		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
BWP configurations	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
OCNG pattern[Note1]			OP.1
SMTC configuration			SMTC.1
SSB configuration	Config 1, 2, 4, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS			
EPRE ratio of OCNG to OCNG DMRS			
N_{oc}[Note2]		dBm/15 kHz	-104
N_{oc}[Note2]	Config 1, 2, 4, 5	dBm/SCS	-104
	Config 3, 6		-101
$\hat{E}_s/N_{oc}$		dB	dB
$\hat{E}_s/I_{ot}$[Note3]		dB	dB

Parameter		Unit	Cell 1
SS-RSRQ[Note3]	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
SSB_RP[Note3]	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
Io[Note3]	Config 1, 2, 4, 5	dBm/9.36 MHz	-58.96
	Config 3, 6	dBm/38.16 MHz	-52.87
Propagation condition			AWGN
Antenna Configuration and Correlation Matrix			1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRQ, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

Table A.6.7.6.1.2-3: E-UTRAN Cell specific test parameters for SA Inter-RAT E-UTRAN RSRQ test parameters

Parameter		Unit	Cell 2		
			Test 1	Test 2	Test 3
E-UTRA RF channel number			1		
Duplex mode	Config 1, 2, 3		FDD		
	Config 4, 5, 6		TDD		
TDD special subframe configuration[Note1]	Config 1, 2, 3		N/A		
	Config 4, 5, 6		6		
TDD uplink-downlink configuration[Note1]	Config 1, 2, 3		N/A		
	Config 4, 5, 6		1		
$BW_{channel}$		MHz	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PDSCH parameters: DL Reference Measurement Channel[Note2]			-		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]	Config 1, 2, 3		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
	Config 4, 5, 6		5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note2]	Config 1, 2, 3		5 MHz: OP.19 FDD 10 MHz: OP.6 FDD 20 MHz: OP.14 FDD		
	Config 4, 5, 6		5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD		
PBCH_RA		dB	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note3]					
OCNG_RB[Note3]					
N_{oc}[Note4]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-83	-104.70	-119.5
	Bands FDD_B1, FDD_B2 [Note 10]				-119

Parameter		Unit	Cell 2		
			Test 1	Test 2	Test 3
	Bands FDD_C, TDD_C				-118.5
	Bands FDD_D				-118
	Bands FDD_E, FDD_F Note 7, TDD_E				-117.5
	Bands FDD_G Note 8				-116.5
	Bands FDD_H				-116
$\hat{E}_s/N_{oc}$		dB	-1.75	-4.0	-4.0
$\hat{E}_s/I_{ot}$ Note5		dB	-1.75	-4.0	-4.0
RSRP Note5	Bands FDD_A Note 9, TDD_A	dBm/15 kHz	-84.75	-108.70	-123.5
	Bands FDD_B1, FDD_B2 Note 10				-123
	Bands FDD_C, TDD_C				-122.5
	Bands FDD_D				-122
	Bands FDD_E, FDD_F Note 7, TDD_E				-121.5
	Bands FDD_G Note 8				-120.5
	Bands FDD_H				-120
RSRQ Note5	Bands FDD_A Note 9, TDD_A	dB	-14.76	-16.25	-16.25
	Bands FDD_B1, FDD_B2 Note 10				
	Bands FDD_C, TDD_C				
	Bands FDD_D				
	Bands FDD_E, FDD_F Note 7, TDD_E				
	Bands FDD_G Note 8				
	Bands FDD_H				
Io Note5	Bands FDD_A Note 9, TDD_A	dBm/Ch BW	-53 + 10log($N_{PRB,c}$ /50)	-75.46 + 10log($N_{PRB,c}$ /50)	-90.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_B1, FDD_B2 Note 10				-89.76 + 10log($N_{PRB,c}$ /50)
	Bands FDD_C, TDD_C				-89.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_D				-88.76 + 10log($N_{PRB,c}$ /50)
	Bands FDD_E, FDD_F Note 7, TDD_E				-88.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_G Note 8				-87.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_H				-86.76 + 10log($N_{PRB,c}$ /50)
Propagation Condition			AWGN		
Antenna Configuration and Correlation Matrix			1x2		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, RSRQ and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: E-UTRA operating band groups are as defined in clause 3.5 of TS 36.133 [15].
NOTE 7: For Band 26, the tests shall be performed with the carrier frequency of assigned E-UTRA channel bandwidth within 865-894 MHz.
NOTE 8: Except Band 29.
NOTE 9: Except Band 32, Band 75 and Band 76.

Parameter	Unit	Cell 2		
		Test 1	Test 2	Test 3
NOTE 10: For Band 74, the tests shall be performed with the carrier frequency of the assigned E-UTRA channel bandwidth within 1475.9-1510.9 MHz.				

A.6.7.6.1.3 Test Requirements

The SA inter-RAT E-UTRAN RSRQ measurement accuracy for Cell 2 shall fulfil absolute requirement in clause 10.2.3.

A.6.7.7 E-UTRAN RS-SINR

A.6.7.7.1 SA: inter-RAT measurement accuracy with FR1 serving cell

A.6.7.7.1.1 Test Purpose and Environment

The purpose of this test is to verify that the E-UTRAN RS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.2.4 for SA inter-RAT E-UTRAN RS-SINR measurements.

A.6.7.7.1.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an E-UTRAN inter-RAT neighbour cell. Supported test configurations are shown in table A.6.7.7.1.2-1. The measurement accuracy of SA inter-RAT E-UTRAN RS-SINR are tested by using the parameters in A.6.7.7.1.2-2 and A.6.7.7.1.2-3.

Table A.6.7.7.1.2-1: Inter-RAT E-UTRAN RS-SINR supported test configurations with FR1 serving cell

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.7.1.2-2: NR Cell specific test parameters for SA Inter-RAT E-UTRAN RS-SINR test parameters

Parameter		Unit	Cell 1
NR RF channel number			1
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		N/A
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
$BW_{channel}$	Config 1, 4	MHz	10: $N_{PRB,c}$ = 52 (FDD)
	Config 2, 5		10: $N_{PRB,c}$ = 52 (TDD)
	Config 3, 6		40: $N_{PRB,c}$ = 106 (TDD)
Gap pattern Id			0
PDSCH reference measurement channel	Config 1, 4		SR.1.1 FDD
	Config 2, 5		SR.1.1 TDD
	Config 3, 6		SR.2.1 TDD
RMSI CORSET reference channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
Dedicated CORSET reference channel	Config 1, 4		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD

Parameter		Unit	Cell 1
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
BWP configurations	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
OCNG pattern[Note1]			OP.1
SMTC configuration			SMTC.1
SSB configuration	Config 1, 2, 4, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS			
EPRE ratio of OCNG to OCNG DMRS			
N_{oc}[Note2]		dBm/15 kHz	-104
N_{oc}[Note2]	Config 1, 2, 4, 5	dBm/SCS	-104
	Config 3, 6		-101
$\hat{E}_s/N_{oc}$		dB	17
$\hat{E}_s/I_{ot}$[Note3]		dB	17
SS-RS-SINR[Note3]	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
SSB_RP[Note3]	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
Io[Note3]	Config 1, 2, 4, 5	dBm/9.36 MHz	-58.96
	Config 3, 6	dBm/38.16 MHz	-52.87
Propagation condition			AWGN
Antenna Configuration and Correlation Matrix			1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RS-SINR, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.7.7.1.2-3: E-UTRAN Cell specific test parameters for SA Inter-RAT E-UTRAN RS-SINR test parameters

Parameter		Unit	Cell 2		
			Test 1	Test 2	Test 3
E-UTRA RF channel number			1		
Duplex mode	Config 1, 2, 3		FDD		
	Config 4, 5, 6		TDD		
TDD special subframe configuration[Note1]	Config 1, 2, 3		N/A		
	Config 4, 5, 6		6		
TDD uplink-downlink configuration[Note1]	Config 1, 2, 3		N/A		
	Config 4, 5, 6		1		
$BW_{channel}$		MHz	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PDSCH parameters: DL Reference Measurement Channel[Note2]			-		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]	Config 1, 2, 3		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		

Parameter		Unit	Cell 2		
			Test 1	Test 2	Test 3
	Config 4, 5, 6		5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note2]	Config 1, 2, 3		5 MHz: OP.19 FDD 10 MHz: OP.6 FDD 20 MHz: OP.14 FDD		
	Config 4, 5, 6		5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD		
PBCH_RA		dB	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note3]					
OCNG_RB[Note3]					
N_{oc}[Note4]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-88	-108.50	-119.5
	Bands FDD_B1, FDD_B2 [Note 10]				-119
	Bands FDD_C, TDD_C				-118.5
	Bands FDD_D				-118
	Bands FDD_E, FDD_F [Note 7], TDD_E				-117.5
	Bands FDD_G [Note 8]				-116.5
	Bands FDD_H				-116
CRS $\hat{E}_s/N_{oc1}$		dB	-1.75	20.0	-4.0
CRS $\hat{E}_s/I_{ot}$[Note5]		dB	-1.75	20.0	-4.0
RSRP[Note5]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-89.75	-88.50	-123.5
	Bands FDD_B1, FDD_B2 [Note 10]				-123
	Bands FDD_C, TDD_C				-122.5
	Bands FDD_D				-122
	Bands FDD_E, FDD_F [Note 7], TDD_E				-121.5
	Bands FDD_G [Note 8]				-120.5
	Bands FDD_H				-120
RS-SINR[Note5]	Bands FDD_A [Note 9], TDD_A	dB	-1.75	20	-4.0
	Bands FDD_B1, FDD_B2 [Note 10]				
	Bands FDD_C, TDD_C				
	Bands FDD_D				
	Bands FDD_E, FDD_F [Note 7], TDD_E				
	Bands FDD_G [Note 8]				
	Bands FDD_H				
Io[Note5]	Bands FDD_A [Note 9], TDD_A	dBm/Ch BW	-53.79 + 10log($N_{PRB,c}$/50)	-60.56 + 10log($N_{PRB,c}$/50)	-93.48 + 10log($N_{PRB,c}$/50)
	Bands FDD_B1, FDD_B2 [Note 10]				-92.98 + 10log($N_{PRB,c}$/50)
	Bands FDD_C, TDD_C				-92.48 + 10log($N_{PRB,c}$/50)

Parameter		Unit	Cell 2		
			Test 1	Test 2	Test 3
	Bands FDD_D				-91.98 + 10log($N_{PRB,c}$ /50)
	Bands FDD_E, FDD_F Note 7, TDD_E				-91.48 + 10log($N_{PRB,c}$ /50)
	Bands FDD_G Note 8				-90.48 + 10log($N_{PRB,c}$ /50)
	Bands FDD_H				-89.98 + 10log($N_{PRB,c}$ /50)
Propagation Condition			AWGN		
Antenna Configuration and Correlation Matrix			1x2		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 4a: Void.
NOTE 5: CRS $\hat{E}_s/I_{ot}$, RSRP, RS-SINR and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: E-UTRA operating band groups are as defined in clause 3.5 of TS 36.133 [15].
NOTE 7: For Band 26, the tests shall be performed with the carrier frequency of assigned E-UTRA channel bandwidth within 865-894 MHz.
NOTE 8: Except Band 29.
NOTE 9: Except Band 32, Band 75 and Band 76.
NOTE 10: For Band 74, the tests shall be performed with the carrier frequency of the assigned E-UTRA channel bandwidth within 1475.9-1510.9 MHz.

A.6.7.7.1.3 Test Requirements

The SA inter-RAT E-UTRAN RS-SINR measurement accuracy for Cell 2 shall fulfil absolute requirement in clause 10.2.4.

A.6.7.8 CLI measurements

A.6.7.8.1 SA SRS-RSRP measurement accuracy with FR1 serving cell

A.6.7.8.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SRS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.22.1.1 with the testing configurations for NR cells in table A.6.7.8.1.1-1.

Table A.6.7.8.1.1-1: Applicable NR configurations for FR1 SRS-RSRP accuracy test

Config	Description
1	15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	30 kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.8.1.2 Test parameters

In this set of test cases there is one cell in the test, FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.7.8.1.2-1 below. The test parameter for the (virtual) neighbor cell UE transmitting SRS are given in table A.6.7.8.1.2-2.

Before the test UE is configured to perform SRS-RSRP measurement. During the test, the test system transmits SRS resources for measurement in the DL slots according to the SRS configuration in table A.6.7.8.1.2-3. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 1 data symbol before SRS to be transmitted.

Table A.6.7.8.1.2-1: FR1 test parameters for SRS-RSRP accuracy for PCell

Parameter		Config	Unit	Test 1	Test 2	Test 3
SSB ARFCN		1~2		freq1	freq1	freq1
Duplex mode		1~2		TDD	TDD	TDD
TDD configuration		1		TDDConf.1.1	TDDConf.1.1	TDDConf.1.1
		2		TDDConf.2.1	TDDConf.2.1	TDDConf.2.1
$BW_{channel}$		1	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
		2		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel		1		SR.1.1 TDD	SR.1.1 TDD	SR.1.1 TDD
		2		SR.2.1 TDD	SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel		1		CR.1.1 TDD	CR.1.1 TDD	CR.1.1 TDD
		2		CR.2.1 TDD	CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel		1		CCR.1.1 TDD	CCR.1.1 TDD	CCR.1.1 TDD
		2		CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration		1		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
		2		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
OCNG Patterns		1~2		OP.1	OP.1	OP.1
TRS configuration		1		TRS.1.1 TDD	TRS.1.1 TDD	TRS.1.1 TDD
		2		TRS.1.2 TDD	TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration		1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration		1~2		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration		1~2		SMTC.1	SMTC.1	SMTC.1
Time offset between DL from serving cell and SRS from test system		1~2	μs	17.67	17.67	17.67
EPRE ratio of PSS to SSS		1~2	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS[Note 1]						
EPRE ratio of OCNG to OCNG DMRS [Note 1]						
N_{oc} [Note2]	NR_TDD_FR1_A [NOTE 3]	1	dBm/15 kHz	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A [NOTE 5]	2		Not applicable[Note 4]	-91	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
N_{oc} [Note2]	NR_TDD_FR1_A [NOTE 3]	1	dBm/SRS SCS	-106	-88	-114

Parameter		Config	Unit	Test 1	Test 2	Test 3
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A NOTE 3	2		Not applicable Note 4	-88	-111
	NR_TDD_FR1_C					-110
	NR_TDD_FR1_D					-109.5
	NR_TDD_FR1_E					-109

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification
NOTE 4: Test 1 is not used when testing with 30 kHz SSB SCS

Table A.6.7.8.1.2-2: FR1 test parameters for SRS-RSRP accuracy for neighbour cell UE

Parameter		Config	Unit	Test 1	Test 2	Test 3
N_{oc} Note2	NR_TDD_FR1_A NOTE 5	1	dBm/15 kHz	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A NOTE 5	2		Not applicable Note 6	-91	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
N_{oc} Note2	NR_TDD_FR1_A NOTE 5	1	dBm/SRS SCS	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A NOTE 5	2		Not applicable Note 6	-88	-111
	NR_TDD_FR1_C					-110
	NR_TDD_FR1_D					-109.5
	NR_TDD_FR1_E					-109
$\hat{E}_s/I_{ot}$ on SRS		1~2	dB	1	1	1
SRS RSRP Note3	NR_TDD_FR1_A NOTE 5	1	dBm/SRS SCS	-105	-87	-113
	NR_TDD_FR1_C					-112
	NR_TDD_FR1_D					-111.5
	NR_TDD_FR1_E					-111
	NR_TDD_FR1_A NOTE 5	2		Not applicable Note 6	-87	-110
	NR_TDD_FR1_C					-109
	NR_TDD_FR1_D					-108.5
	NR_TDD_FR1_E					-108
Io Note3	NR_TDD_FR1_A NOTE 5	1	dBm/9.36 MHz	-74.51	-56.51	-82.51
	NR_TDD_FR1_C					-81.51
	NR_TDD_FR1_D					-81.01
	NR_TDD_FR1_E					-79.51
	NR_TDD_FR1_A NOTE 5	2	dBm/38.16 MHz	Not applicable Note 6	-53.42	-76.42
	NR_TDD_FR1_C					-75.42
	NR_TDD_FR1_D					-74.92
	NR_TDD_FR1_E					-74.42

Parameter	Config	Unit	Test 1	Test 2	Test 3
$\hat{E}_s / N_{oc}$ on SRS	1~2	dB	1	1	1
Propagation condition	1~2		AWGN	AWGN	AWGN
Antenna configuration	1~2		1x2	1x2	1x2
SRS configuration	1		SRSConf.1	SRSConf.1	SRSConf.1
	2		SRSConf.2	SRSConf.2	SRSConf.2

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of the test.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification
NOTE 6: Test 1 is not used when testing with 30 kHz SSB SCS

Table A.6.7.8.1.2-3: SRS configuration parameters for FR1 SRS-RSRP accuracy

	Field	SRSConf.1	SRSConf.2
SRS-ResourceSet	srs-ResourceSetId	0	0
	srs-ResourceIdList	0	0
	resourceType	Periodic	Periodic
	Usage	Codebook	Codebook
SRS-Resource	SRS-ResourceId	0	0
	nrofSRS-Ports	Port1	Port1
	transmissionComb	n2	n2
	combOffset-n2	0	0
	cyclicShift-n2	0	0
	resourceMapping startPosition	0	0
	resourceMapping nrofSymbols	n1	n1
	resourceMapping repetitionFactor	n1	n1
	freqDomainPosition	0	0
	freqDomainShift	0	0
	freqHopping c-SRS	12	12
	freqHopping b-SRS	0	0
	freqHopping b-hop	0	0
	groupOrSequenceHopping	Neither	Neither
	resourceType	Periodic	Periodic
	periodicityAndOffset-p	sl20, 9	sl40, 19
	sequenceId	0	0

A.6.7.8.1.3 Test Requirements

The SRS-RSRP measurement accuracy shall fulfil the requirements in clauses 10.1.22.1.1.

A.6.7.8.2 SA CLI-RSSI measurement accuracy with FR1 serving cell

A.6.7.8.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CLI-RSSI measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.22.2.1 with the testing configurations for NR cells in table A.6.7.8.2.1-1.

Table A.6.7.8.2.1-1: Applicable NR configurations for FR1 CLI-RSSI accuracy test

Config	Description
1	NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.8.2.2 Test parameters

In this set of test cases there is one cell in the test, the FR1 PSCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.7.8.2.2-1 below.

Before the test UE is configured to perform CLI-RSSI measurement. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI resource and on 1 data symbol before. The CLI-RSSI measurement resource configuration is in table A.6.7.8.2.2-2.

Table A.6.7.8.2.2-1: FR1 test parameters for CLI-RSSI accuracy

Parameter	Config	Unit	Value
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD configuration	1		TDDConf.1.1
	2		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52
	2		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 TDD
	2		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 TDD
	2		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 TDD
	2		CCR.2.1 TDD
SSB configuration	1		SSB.1 FR1
	2		SSB.2 FR1
OCNG Patterns Note6	1~2		OP.1
TRS configuration	1		TRS.1.1 TDD
	2		TRS.1.2 TDD
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~2		SMTC.1
Time offset between DL from serving cell and OCNG from test system	1~2	µs	17.67
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} on CLI-RSSI measurement resource Note2	1	dBm/15 kHz	-106
	2		-106
N_{oc} on CLI-RSSI measurement resource Note2	1	dBm/ BWP SCS	-106
	2		-103
$\hat{E}_s/I_{ot}$ on CLI-RSSI measurement resource	1~2	dB	-Infinity
RSRP on CLI-RSSI measurement resource Note3	1~2	dBm/ BWP SCS	-Infinity

Parameter	Config	Unit	Value
Io on CLI-RSSI measurement resource Note3	1	dBm/9.36 MHz	-78.05
	2	dBm/38.16 MHz	-71.96
Io on CLI-RSSI measurement resource Note3	1	dBm/1.08 MHz	-87.43
	2		-87.44
$\hat{E}_s / N_{oc}$ on CLI-RSSI measurement resource	1~2	dB	-Infinity
Propagation condition	1~2		AWGN
Antenna configuration	1~2		1x2
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification			
NOTE 6: OCNG is not transmitted in the CLI-RSSI measurement resources.			

Table A.6.7.8.2.2-2: CLI-RSSI measurement resource configuration for FR1 CLI-RSSI accuracy

	Field	Config	SRSConf.1
CLI-RSSI measurement resource	rssi-ResourceId	1~2	0
	rssi-SCS	1	15 kHz
		2	30 kHz
	startPRB	1~2	0
	nrofPRBs	1	52
		2	106
	startPosition	1~2	3
	nrofSymbols	1~2	11
	rssi-PeriodicityAndOffset	1	sl20, 9
		2	sl40, 19

A.6.7.8.2.3 Test Requirements

The CLI-RSSI measurement accuracy shall fulfil the requirements in clauses 10.1.22.2.1.

A.6.7.9 L1-SINR measurement for beam reporting

A.6.7.9.1 L1-SINR measurement with CSI-RS based CMR and no dedicated IMR configured and CSI-RS resource set with repetition off

A.6.7.9.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.8.4.1 and clause 10.1.27.1 for L1-SINR measurements based on CSI-RS with the testing configurations for NR cells in table A.6.7.9.1.1-1.

Table A.6.7.9.1.1-1: Applicable NR configurations for FR1 L1-SINR test with CSI-RS based CMR and no dedicated IMR configured

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.9.1.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.7.9.1.2-1 below. The absolute and relative accuracy of L1-SINR measurements are tested by using the parameters in table A.6.7.9.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.6.7.9.1.2-1: FR1 CSI-RS based L1-SINR test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~3		freq1	freq1
Duplex mode	1		FDD	FDD
	2		TDD	TDD
	3		TDD	TDD
TDD Configuration	1		N/A	N/A
	2		TDDConf.1.1	TDDConf.1.1
	3		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD	SR.1.1 FDD
	2		SR.1.1 TDD	SR.1.1 TDD
	3		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD	CR.1.1 FDD
	2		CR.1.1 TDD	CR.1.1 TDD
	3		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	CCR.1.1 FDD
	2		CCR.1.1 TDD	CCR.1.1 TDD
	3		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1		SSB.1 FR1	SSB.1 FR1
	2		SSB.1 FR1	SSB.1 FR1
	3		SSB.2 FR1	SSB.2 FR1
OCNG Patterns	1~3		OP.1	OP.1
TRS configuration	1		TRS.1.1 FDD	TRS.1.1 FDD
	2		TRS.1.1 TDD	TRS.1.1 TDD
	3		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1	SMTC.1
CSI-RS	1		CSI-RS 1.2 FDD	CSI-RS 1.2 FDD
	2		CSI-RS 1.2 TDD	CSI-RS 1.2 TDD
	3		CSI-RS 2.2 TDD	CSI-RS 2.2 FDD
reportConfigType	1~3		periodic	periodic
reportQuantity-r16	1~3		cri-SINR-r16	cri-SINR-r16
nrofReportedRS	1~3		2	2
L1-SINR reporting period	1~3		slot80	slot80
EPRE ratio of PSS to SSS	1~3	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				

Parameter		Config	Unit	Test 1	Test 2
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~3	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/CSI-RS SCS	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-91.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
$\hat{E}_s/I_{ot}$		1~3	dB	10	-3
CSI-RS RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/CSI-RS SCS	-84.65	-120
	NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_N				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-81.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B, NR_TDD_FR1_B				-86.78
	NR_FDD_FR1_C, NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G, NR_TDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_N				-80.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3	dBm/38.16 MHz	-50.19	-81.19
	NR_FDD_FR1_B, NR_TDD_FR1_B				-80.69
	NR_FDD_FR1_C, NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G, NR_TDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
	NR_FDD_FR1_N				-74.69
$\hat{E}_s/N_{oc}$		1~3	dB	10	-3
Propagation condition		1~3		AWGN	AWGN
Antenna configuration		1~3		1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.9.1.3 Test Requirements

The L1-SINR measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 1 shall fulfil the requirements in clause 10.1.27.1.

A.6.7.9.2 L1-SINR measurement with SSB based CMR and dedicated IMR

A.6.7.9.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.8.4.2 and clause 10.1.27.2 for L1-SINR measurements with SSB based CMR and dedicated CSI-RS based IMR, with the testing configurations for NR cells in table A.6.7.9.2.1-1.

Table A.6.7.9.2.1-1: Applicable NR configurations for FR1 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.9.2.2 Test parameters

In this set of test cases there one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.7.9.2.2-1 below. The absolute accuracy of L1-SINR measurements are tested by using the parameters in table A.6.7.9.2.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources and one CSI-RS resource set with two CSI-RS resource. UE is configured to perform RLM and BFD measurement based on the SSB resources 0 and 1. UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-RS resources as IMR.

Table A.6.7.9.2.2-1: FR1 SSB based L1-SINR test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~3		freq1	freq1
Duplex mode	1		FDD	FDD
	2		TDD	TDD
	3		TDD	TDD
TDD Configuration	1		N/A	N/A
	2		TDDConf.1.1	TDDConf.1.1
	3		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD	SR.1.1 FDD
	2		SR.1.1 TDD	SR.1.1 TDD
	3		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD	CR.1.1 FDD
	2		CR.1.1 TDD	CR.1.1 TDD
	3		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	CCR.1.1 FDD
	2		CCR.1.1 TDD	CCR.1.1 TDD
	3		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1	SSB.3 FR1
	2		SSB.3 FR1	SSB.3 FR1
	3		SSB.4 FR1	SSB.4 FR1
CSI-RS configuration	1		CSI-RS 1.1A FDD	CSI-RS 1.1A FDD
	2		CSI-RS 1.1A TDD	CSI-RS 1.1A TDD
	3		CSI-RS 2.1A TDD	CSI-RS 2.1A TDD
OCNG Patterns	1~3		OP.1	OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
TRS configuration	1		TRS.1.1 FDD	TRS.1.1 FDD
	2		TRS.1.1 TDD	TRS.1.1 TDD
	3		TRS.1.2 TDD	TRS.1.2 TDD
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1	SMTC.1

Parameter		Config	Unit	Test 1	Test 2
reportConfigType		1~3		periodic	periodic
reportQuantity-r16		1~3		ssb-Index-SINR-r16	ssb-Index-SINR-r16
Number of reported RS		1~3		2	2
L1-SINR reporting period		1~3		slot80	slot80
EPRE ratio of PSS to SSS EPRE ratio of PBCH DMRS to SSS EPRE ratio of PBCH to PBCH DMRS EPRE ratio of PDCCH DMRS to SSS EPRE ratio of PDCCH to PDCCH DMRS EPRE ratio of PDSCH DMRS to SSS EPRE ratio of PDSCH to PDSCH DMRS EPRE ratio of OCNG DMRS to SSS Note 1 EPRE ratio of OCNG to OCNG DMRS Note 1		1~3	dB	0	0
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~3	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/SSB SCS	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-91.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
$\hat{E}_s/I_{ot}$		1~3	dB	10	0
$\hat{E}_s/N_{oc}$		1~6	dB	10	0

Parameter		Config	Unit	Test 1	Test 2
SSB RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/SSB SCS	-84.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-81.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
CSI-RS RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/CSI-RS SCS	-84.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-81.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-113
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/9.36 MHz	-56.28	-86.04
	NR_FDD_FR1_B, NR_TDD_FR1_B				-85.54

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_C, NR_TDD_FR1_C				-85.04
	NR_FDD_FR1_D, NR_TDD_FR1_D				-84.54
	NR_FDD_FR1_E, NR_TDD_FR1_E				-84.04
	NR_FDD_FR1_F				-83.54
	NR_FDD_FR1_G, NR_TDD_FR1_G				-83.04
	NR_FDD_FR1_H				-82.54
	NR_FDD_FR1_N				-79.54
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3	dBm/38.16 MHz	-50.19	-79.94
	NR_FDD_FR1_B, NR_TDD_FR1_B				-79.44
	NR_FDD_FR1_C, NR_TDD_FR1_C				-78.94
	NR_FDD_FR1_D, NR_TDD_FR1_D				-78.44
	NR_FDD_FR1_E, NR_TDD_FR1_E				-77.94
	NR_FDD_FR1_F				-77.44
	NR_FDD_FR1_G, NR_TDD_FR1_G				-76.94
	NR_FDD_FR1_H				-76.44
	NR_FDD_FR1_N				-73.44
Propagation condition		1~3		AWGN	AWGN
Antenna configuration		1~3		1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.9.2.3 Test Requirements

The L1-SINR measurement accuracy for SSB#0+CSI-RS#0 and SSB#1+CSI-RS#1 of Cell 1 shall fulfil the requirements in clauses 10.1.27.2.

A.6.7.9.3 L1-SINR measurement with CSI-RS based CMR and dedicated IMR

A.6.7.9.3.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will partly verify the requirements in clauses 9.8.4.3 and clause 10.1.27.3 for L1-SINR measurements based on CSI-RS as CMR and CSI-IM as IMR with the testing configurations for NR cells in table A.6.7.9.3.1-1.

Table A.6.7.9.3.1-1: Applicable NR configurations for FR1 L1-SINR measurement test with CSI-RS based CMR and CSI-IM based IMR

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.9.3.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.7.9.3.2-1 below. The absolute and relative accuracy of L1-SINR measurements are tested by using the parameters in table A.6.7.9.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources and one CSI-IM resource set with two CSI-IM resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB. UE is configured to perform L1-SINR measurement based on the configured CSI-RS as CMR and CSI-IM as IMR.

Table A.6.7.9.3.2-1: FR2 L1-SINR measurement test with CSI-RS based CMR and CSI-IM based IMR

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~3		freq1	freq1
Duplex mode	1		FDD	FDD
	2		TDD	TDD
	3		TDD	TDD
TDD Configuration	1		N/A	N/A
	2		TDDConf.1.1	TDDConf.1.1
	3		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	3		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD	SR.1.1 FDD
	2		SR.1.1 TDD	SR.1.1 TDD
	3		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD	CR.1.1 FDD
	2		CR.1.1 TDD	CR.1.1 TDD
	3		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	CCR.1.1 FDD
	2		CCR.1.1 TDD	CCR.1.1 TDD
	3		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1		SSB.1 FR1	SSB.1 FR1
	2		SSB.1 FR1	SSB.1 FR1
	3		SSB.2 FR1	SSB.2 FR1
OCNG Patterns	1~3		OP.1	OP.1
TRS configuration	1		TRS.1.1 FDD	TRS.1.1 FDD
	2		TRS.1.1 TDD	TRS.1.1 TDD
	3		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1	SMTC.1
CSI-RS configuration as CMR	1		CSI-RS 1.2 FDD	CSI-RS 1.2 FDD
	2		CSI-RS 1.2 TDD	CSI-RS 1.2 TDD
	3		CSI-RS 2.2 TDD	CSI-RS 2.2 FDD
CSI-IM configuration as IMR	1		CSI-IM 1.3 FDD	CSI-IM 1.3 FDD
	2		CSI-IM 1.3 TDD	CSI-IM 1.3 TDD
	3		CSI-IM 2.3 TDD	CSI-IM 2.3 TDD
reportConfigType	1~3		periodic	periodic
reportQuantity-r16	1~3		cri-SINR-r16	cri-SINR-r16
nrofReportedRS	1~3		2	2
L1-RSRP reporting period	1~3		slot80	slot80
EPRE ratio of PSS to SSS	1~3	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				

Parameter		Config	Unit	Test 1	Test 2
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~3	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/CSI-RS SCS	-94.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-91.65	-114
	NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
	NR_FDD_FR1_N				-107.5
$\hat{E}_s/I_{ot}$		1~3	dB	10	-3
CSI-RS RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/CSI-RS SCS	-84.65	-120
	NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_G, NR_TDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_N				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-81.65	-117
	NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5
	NR_FDD_FR1_C, NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G, NR_TDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_N				-110.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B, NR_TDD_FR1_B				-86.78
	NR_FDD_FR1_C, NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G, NR_TDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_N				-80.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3	dBm/38.16 MHz	-50.19	-81.19
	NR_FDD_FR1_B, NR_TDD_FR1_B				-80.69
	NR_FDD_FR1_C, NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G, NR_TDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
	NR_FDD_FR1_N				-74.69
$\hat{E}_s/N_{oc}$		1~3	dB	10	-3
Propagation condition		1~3		AWGN	AWGN
Antenna configuration		1~3		1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.9.3.3 Test Requirements

The L1-SINR measurement accuracy for CSI-RS#0+CSI-IM#0 and CSI-RS#1+CSI-IM# of Cell 1 shall fulfil the requirements in clause 10.1.27.3.

A.6.7.10 CSI-RSRP

A.6.7.10.1 SA: intra-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.10.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.2.3.1 and 10.1.2.3.2 for CSI-RS intra-frequency measurements.

A.6.7.10.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.7.10.1.2-1. Both absolute and relative accuracy of CSI-RSRP intra-frequency measurements are tested by using the parameters in A.6.7.10.1.2-2. In all test cases, Cell 1 is the PCell, and Cell 2 is the target cell.

Table A.6.7.10.1.2-1: CSI-RSRP intra frequency supported test configurations

Config	Description
1	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.7.10.1.2-2: CSI-RSRP intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0	489	0
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1		10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
TRS configuration	Config 1		TRS.1.1 FDD	NA	TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
	Config 2		TRS.1.1 TDD	NA	TRS.1.1 TDD	NA	TRS.1.1 TDD	NA
	Config 3		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		Config 3		SR.2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel		Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
		Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
		Config 3		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Control channel RMC		Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
		Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
SSB configuration		Config 1		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
		Config 2		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
		Config 3		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1		Config 1,2	μs	-	4.7	-	4.7	-	4.7
		Config 3	μs	-	2.35	-	2.35	-	2.35
SMTC configuration		Config 1		SMTC.2					
		Config 2,3		SMTC.1					
CSI-RS configuration for RRM		Config 1		CSI-RS.RRM.FR1.1 FDD					
		Config 2		CSI-RS.RRM.FR1.1 TDD					
		Config 3		CSI-RS.RRM.FR1.2 TDD					
OCNG Patterns				OCNG pattern 1					
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15 kHz					
		Config 3		30 kHz					
EPRE ratio of PSS to SSS EPRE ratio of PBCH DMRS to SSS EPRE ratio of PBCH to PBCH DMRS EPRE ratio of PDCCH DMRS to SSS EPRE ratio of PDCCH to PDCCH DMRS EPRE ratio of PDSCH DMRS to SSS EPRE ratio of PDSCH to PDSCH EPRE ratio of OCNG DMRS to SSS(Note 1) EPRE ratio of OCNG to OCNG DMRS (Note 1)			dB	0	0	0	0	0	0
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-106		-88		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-94		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2		dBm/SCS	-106		-88		Same as Noc/15 kHz	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-91		-111	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$ for SSB			dB	2.46	-5.97	2.46	-5.97	-0.01	-4.76
$\hat{E}_s/I_{ot}$ for CSI-RS			dB	2.46	-5.97	2.46	-5.97	-0.01	-4.76
$\hat{E}_s/N_{oc}$ for SSB			dB	6	1	6	1	3	0
$\hat{E}_s/N_{oc}$ for CSI-RS			dB	6	1	6	1	3	0
CSI-RSRP Note3	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-100	-105	-82	-87	-111.00	-114.00
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.50	-113.50
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110.00	-113.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.50	-112.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109.00	-112.00
		NR_FDD_FR1_F						-108.50	-111.50
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108.00	-111.00
		NR_FDD_FR1_H						-107.50	-110.50
		NR_FDD_FR1_N						-104.50	-107.50
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5	Not applicable Note 5	-85	-90	-108.00	-111.00
		NR_FDD_FR1_B, NR_TDD_FR1_B						-107.50	-110.50
		NR_FDD_FR1_C, NR_TDD_FR1_C						-107.00	-110.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-106.50	-109.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-106.00	-109.00
		NR_FDD_FR1_F						-105.50	-108.50

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_G, NR_TDD_FR1_G						-105.00	-108.00
		NR_FDD_FR1_H						-104.50	-107.50
		NR_FDD_FR1_N						-101.50	-104.50
Io[Note3]	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-70.09		-52.09		-80.03	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-79.53	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-79.03	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-78.53	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-78.03	
		NR_FDD_FR1_F						-77.53	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-77.03	
		NR_FDD_FR1_H						-76.53	
		NR_FDD_FR1_N						-73.53	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	Not applicable[Note 5]-		-51.99		-73.94	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-73.44	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-72.94	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-72.44	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-71.94	
		NR_FDD_FR1_F						-71.44	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-70.94	
		NR_FDD_FR1_H						-70.44	
		NR_FDD_FR1_N						-67.44	
Propagation condition			-	AWGN					
Antenna configuration				1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: Subtest 1 is not used when testing with 30 kHz SSB and CSI-RS SCS.

NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.6.7.10.1.3 Test Requirements

The CSI-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil absolute requirement in clause 10.1.2.3.1 and relative requirement in clause 10.1.2.3.2.

A.6.7.10.2 SA inter-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.10.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.4.3.1 and 10.1.4.3.2 for CSI-RS inter-frequency measurements with the testing configurations for NR cells in table A.6.7.9.2.1-1.

Table A.6.7.10.2.1-1: Applicable NR configurations for FR1 inter-frequency CSI-RSRP accuracy test

Config	Description
1	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.10.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.6.7.10.2.2-1 below. Both absolute and relative accuracy of CSI-RSRP inter-frequency measurements are tested by using the parameters in table A.6.7.10.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.6.7.10.2.2-1: CSI-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN	1~3		freq1	freq2	freq1	freq2
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	2		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	3		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
TDD configuration	1		N/A		N/A	
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1		SSB.1 FR1	
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~3		OP.1		OP.1	
TRS configuration	1		TRS.1.1 FDD	-	TRS.1.1 FDD	
	2		TRS.1.1 TDD		TRS.1.1 TDD	
	3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1,2	µs	-	4.7	-	4.7
	3	µs	-	2.35	-	2.35
SMTC configuration	1		SMTC.2		SMTC.2	

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
		2,3		SMTC.1		SMTC.1	
CSI-RS configuration for RRM		1		CSI-RS.RRM.FR1.1 FDD		CSI-RS.RRM.FR1.1 FDD	
		2		CSI-RS.RRM.FR1.1 TDD		CSI-RS.RRM.FR1.1 TDD	
		3		CSI-RS.RRM.FR1.2 TDD		CSI-RS.RRM.FR1.2 TDD	
EPRE ratio of PSS to SSS		1~3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSSNote 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~3	dBm/15 kHz	-94.65		(N_{oc} for Channel 2 +8 dB)	-115
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_N						-108.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2	dBm/SSB SCS	-94.65		(N_{oc} for Channel 2 +8 dB)	-115
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_N						-108,5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3		-91.65		(N_{oc} for Channel 2 +8 dB)	-112.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-112.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-112.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-111.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-111.00
	NR_FDD_FR1_F						-110.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-110.00
	NR_FDD_FR1_H						-110.50

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
	NR_FDD_FR1_N						-107.50
$\hat{E}_s/I_{ot}$ for SSB		1~3	dB	10	10	13	-3
$\hat{E}_s/I_{ot}$ for CSI-RS		1~3	dB	10	10	13	-3
CSI-RSRP[Note3]	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2	dBm/SCS	-84.65		(RSRP for Cell 2 +24dB)	-118.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-117.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-117.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-116.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-116.00
	NR_FDD_FR1_F						-115.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-115.00
	NR_FDD_FR1_H						-114.50
	NR_FDD_FR1_N						-111.50
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3		-81.65		(RSRP for Cell 2 +24dB)	-115.00
	NR_FDD_FR1_B, NR_TDD_FR1_B						-114.50
	NR_FDD_FR1_C, NR_TDD_FR1_C						-114.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113.00
	NR_FDD_FR1_F						-112.50
	NR_FDD_FR1_G, NR_TDD_FR1_G						-112.00
	NR_FDD_FR1_H						-111.50
	NR_FDD_FR1_N						-108.50
Io[Note3]	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2	dBm/ 9.36 MHz	-56.28		Io for Channel 2 +19.45dB	-85.28
	NR_FDD_FR1_B, NR_TDD_FR1_B						-84.78
	NR_FDD_FR1_C, NR_TDD_FR1_C						-84.28
	NR_FDD_FR1_D, NR_TDD_FR1_D						-83.78
	NR_FDD_FR1_E, NR_TDD_FR1_E						-83.28
	NR_FDD_FR1_F						-82.78
	NR_FDD_FR1_G, NR_TDD_FR1_G						-82.28
	NR_FDD_FR1_H						-81.78
	NR_FDD_FR1_N						-78.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3	dBm/ 38.16 MHz	-50.19		Io for Channel 2 +19.45dB	-79.19
	NR_FDD_FR1_B, NR_TDD_FR1_B						-78.69
	NR_FDD_FR1_C, NR_TDD_FR1_C						-78.19
	NR_FDD_FR1_D, NR_TDD_FR1_D						-77.69
	NR_FDD_FR1_E, NR_TDD_FR1_E						-77.19
	NR_FDD_FR1_F						-76.69

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
	NR_FDD_FR1_G, NR_TDD_FR1_G						-76.19
	NR_FDD_FR1_H						-75.69
	NR_FDD_FR1_N						-72.69
$\hat{E}_s/N_{oc}$ for SSB		1~3	dB	10	10	13	-3
$\hat{E}_s/N_{oc}$ for CSI-RS		1~3	dB	10	10	13	-3
Propagation condition		1~3	-	AWGN		AWGN	
Antenna configuration		1~3		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.10.2.3 Test Requirements

The CSI-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirement in clause 10.1.4.3.1 and relative requirement in clause 10.1.4.3.2.

A.6.7.11 CSI-RSRQ

A.6.7.11.1 SA: Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.11.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.7.2.

A.6.7.11.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.6.7.11.1.2-1. The absolute accuracy of CSI-RSRQ intra-frequency measurement is tested by using the parameters in table A.6.7.11.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.6.7.11.1.2-1: Intra frequency CSI-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.11.1.2-2: CSI-RSRQ Intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		Config 3		TDDConf.2.1					
$BW_{channel}$		Config 1	MHz	10: $N_{PRB,c}$ = 52					
		Config 2		10: $N_{PRB,c}$ = 52					
		Config 3		40: $N_{PRB,c}$ = 106					
Gap Pattern ID				0					
BWP configuration		Initial DL BWP		DLBWP.0.1					
		Dedicated DL BWP		DLBWP.1.1					
		Initial UL BWP		ULBWP.0.1					
		Dedicated UL BWP		ULBWP.1.1					
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
		Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
		Config 3		SR.2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel		Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
		Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
		Config 3		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Control Channel RMC		Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
		Config 3		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
TRS Configuration		Config 1		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
		Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OP. 1					
Time offset with Cell 1		Config 1	µs	-	4.7	-	4.7	-	4.7
		Config 2,3	µs	-	2.35	-	2.35	-	2.35
CSI-RS configuration for RRM		Config 1		CSI-RS.RRM.FR1.1 FDD					
		Config 2		CSI-RS.RRM.FR1.1 TDD					
		Config 3		CSI-RS.RRM.FR1.2 TDD					
SMTC configuration		Config 1		SMTC.2					
		Config 2,3		SMTC.1					
SSB configuration		Config 1,2		SSB.1 FR1					
		Config 3		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15 kHz					
		Config 3		30 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-85		-101		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-91		-		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-85		-101		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-113.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-88		-		-111	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-110.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$ for SSB			dB	-1.76		-4.7		-5.46	-5.46
$\hat{E}_s/I_{ot}$ for CSI-RS			dB	-1.76		-4.7		-5.46	-5.46
$\hat{E}_s/N_{oc}$ for SSB			dB	3	3	-2.9	-2.9	-4	-4
$\hat{E}_s/N_{oc}$ for CSI-RS			dB	3	3	-2.9	-2.9	-4	-4
SS-RSRP/	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-82	-82	-103.9	-103.9	-118	-118

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
CSI-RSRP Note3		NR_FDD_FR1_B, NR_TDD_FR1_B						-117.5	-117.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-117	-117
		NR_FDD_FR1_D, NR_TDD_FR1_D						-116.5	-116.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-116	-116
		NR_FDD_FR1_F						-115.5	-115.5
		NR_FDD_FR1_G, NR_TDD_FR1_G						-115	-115
		NR_FDD_FR1_H						-114.5	-114.5
		NR_FDD_FR1_N						-111.5	-111.5
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85	-85	-	-	-115	-115
		NR_FDD_FR1_B, NR_TDD_FR1_B						-114.5	-114.5
		NR_FDD_FR1_C, NR_TDD_FR1_C						-114	-114
		NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5	-113.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-113	-113
		NR_FDD_FR1_F						-112.5	-112.5
		NR_FDD_FR1_G, NR_TDD_FR1_G						-112	-112
		NR_FDD_FR1_H						-111.5	-111.5
		NR_FDD_FR1_N						-108.5	-108.5
SS-RSRQ/CSI-RSRQ Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	-14.77	-14.77	-16.76	-16.76	-17.34	-17.34
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D, NR_TDD_FR1_D							
		NR_FDD_FR1_E, NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G, NR_TDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io Note3	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-50		-70		-83.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-83	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-82.5	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-82	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-81.5	
		NR_FDD_FR1_F						-81	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-80.5	
		NR_FDD_FR1_H						-80	
		NR_FDD_FR1_N						-77	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-50		-		-77.4	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_B, NR_TDD_FR1_B						-76.9	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-76.4	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-75.9	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-75.4	
		NR_FDD_FR1_F						-74.9	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-74.4	
		NR_FDD_FR1_H						-73.9	
		NR_FDD_FR1_N						-70.9	
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ/CSI-RSRQ, SS-RSRP/CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ/CSI-RSRQ, SS-RSRP/CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.11.1.3 Test Requirements

The CSI-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.7.2.

A.6.7.11.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.11.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.9.2.1 and 10.1.9.2.2.

A.6.7.11.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.6.7.11.2.2-1. Both absolute accuracy and relative accuracy requirements of CSI-RSRQ inter-frequency measurement are tested by using test parameters in table A.6.7.11.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.6.7.11.2.2-1: CSI-RSRQ Inter frequency CSI-RSRQ supported test configurations

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.11.2.2-2: CSI-RSRQ Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Duplex mode	Config 1		FDD					

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		Config 2,3		TDD					
TDD configuration		Config 1		Not Applicable					
		Config 2		TDDConf.1.1					
		Config 3		TDDConf.2.1					
$BW_{channel}$		Config 1	MHz	10: $N_{PRB,c}$ = 52					
		Config 2		10: $N_{PRB,c}$ = 52					
		Config 3		40: $N_{PRB,c}$ = 106					
Gap pattern ID		Config 1,2,3		0					
BWP BW		Config 1		10: $N_{PRB,c}$ = 52					
		Config 2		10: $N_{PRB,c}$ = 52					
		Config 3		40: NRB,c = 106					
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
		Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
		Config 3,6		SR.2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel		Config 1		CR.1.1 FDD	-	R.1.1 FDD	-	CR.1.1 FDD	
		Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
		Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Dedicated CORESET Reference Channel		Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
		Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
TRS Configuration		Config 1		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
		Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OCNG pattern 1					
Time offset with Cell 1		Config 1,2	µs	-	4.7	-	4.7	-	4.7
		Config 3	µs	-	2.35	-	2.35	-	2.35
CSI-RS configuration for RRM		Config 1		CSI-RS.RRM.FR1.1 FDD					
		Config 2		CSI-RS.RRM.FR1.1 TDD					
		Config 3		CSI-RS.RRM.FR1.2 TDD					
SSB configuration		Config 1,2		SSB.1 FR1					
		Config 3		SSB.2 FR1					
SMTC configuration		Config 1,2		SMTC.2					
		Config 3		SMTC.1					
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15 kHz					
		Config 3		30 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-80.18		-106		-116	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
N_{oc} Note2	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-86.27		-113		-116	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-80.18		-106		-116	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-115.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-83.27		-110		-113	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-112.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-112	
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	
		NR_FDD_FR1_F						-110.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-110	
		NR_FDD_FR1_H						-109.5	
		NR_FDD_FR1_N						-106.5	
$\hat{E}_s/I_{ot}$ for SSB			dB	-1.75		-1.75		3	-1.75
$\hat{E}_s/I_{ot}$ for CSI-RS			dB	-1.75		-1.75		3	-1.75
$\hat{E}_s/N_{oc}$ for SSB			dB	-1.75		-1.75		3	-1.75
$\hat{E}_s/N_{oc}$ for CSI-RS			dB	-1.75		-1.75		3	-1.75

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SS-RSRP/CSI-RSRP[Note3]	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-81.93	-81.93	-107.75	-107.75	-113	-117.75
		NR_FDD_FR1_B, NR_TDD_FR1_B						-112.5	-117.25
		NR_FDD_FR1_C, NR_TDD_FR1_C						-112	-116.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	-116.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	-115.75
		NR_FDD_FR1_F						-110.5	-115.2
		NR_FDD_FR1_G, NR_TDD_FR1_G						-110	-114.75
		NR_FDD_FR1_H						-109.5	-114.25
		NR_FDD_FR1_N						-106.5	-111.25
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85.02	-85.02	-111.75	-111.75	-110	-114.75
		NR_FDD_FR1_B, NR_TDD_FR1_B						-109.5	-114.25
		NR_FDD_FR1_C, NR_TDD_FR1_C						-109	-113.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-108.5	-113.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-108	-112.75
		NR_FDD_FR1_F						-107.5	-112.2
		NR_FDD_FR1_G, NR_TDD_FR1_G						-107	-111.75
		NR_FDD_FR1_H						-106.5	-111.25
		NR_FDD_FR1_N						-103.5	-108.25
SS-RSRQ/CSI-RSRQ[Note3]		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-14.77	-14.77	-40.59	-40.59	12.56T	14.76T
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G, NR_TDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io[Note3]	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-50		-75.83		-83.28	-85.83
		NR_FDD_FR1_B, NR_TDD_FR1_B						-82.78	-85.33
		NR_FDD_FR1_C, NR_TDD_FR1_C						-82.28	-84.83
		NR_FDD_FR1_D NR_TDD_FR1_D						-81.78	-84.33
		NR_FDD_FR1_E NR_TDD_FR1_E						-81.28	-83.83
		NR_FDD_FR1_F						-80.78	-83.33

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_G, NR_TDD_FR1_G						-80.28	-82.83
		NR_FDD_FR1_H						-79.78	-82.33
		NR_FDD_FR1_N						-76.78	-79.33
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-50		-76.73		-77.19	-79.73
		NR_FDD_FR1_B, NR_TDD_FR1_B						-76.69	-79.23
		NR_FDD_FR1_C, NR_TDD_FR1_C						-76.19	-78.73
		NR_FDD_FR1_D NR_TDD_FR1_D						-75.69	-78.23
		NR_FDD_FR1_E NR_TDD_FR1_E						-75.19	-77.73
		NR_FDD_FR1_F						-74.69	-77.23
		NR_FDD_FR1_G, NR_TDD_FR1_G						-74.19	-76.73
		NR_FDD_FR1_H						-73.69	-76.53
		NR_FDD_FR1_N						-70.69	-73.53
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ/CSI-RSRQ, SS-RSRP/CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ/CSI-RSRQ, SS-RSRP/CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.11.2.3 Test Requirements

The CSI-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.9.2.1 and 10.1.9.2.2.

A.6.7.12 CSI-SINR

A.6.7.12.1 SA intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.12.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.12.2.1.

A.6.7.12.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.6.7.11.1.2-1. The absolute accuracy of CSI-SINR intra-frequency measurement is tested by using the parameters in table A.6.7.11.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.6.7.12.1.2-1: CSI-SINR Intra frequency CSI-SINR supported test configurations

Config	Description
1	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode

3	NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.12.1.2-2: CSI-SINR Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
DRX Cycle configuration		ms	Not Applicable			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR.2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns			OP.1			
CSI-RSSI-Measurement			Not Applicable			
Time offset with Cell 1	Config 1,2	µs	-	2.35	-	2.35
	Config 3	µs	-	1.17	-	1.17
SSB configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
SMTC configuration	Config 1		SMTC.2			
	Config 2,3		SMTC.1			
CSI-RS for mobility	Config 1		CSI-RS.RRM.FR1.1 FDD			
	Config 2		CSI-RS.RRM.FR1.1 TDD			
	Config 3		CSI-RS.RRM.FR1.2 TDD			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-93		-116	
	NR_FDD_FR1_B, NR_TDD_FR1_B				-115.5	
	NR_FDD_FR1_C, NR_TDD_FR1_C				-115	

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_D, NR_TDD_FR1_D				-114.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-114	
		NR_FDD_FR1_F				-113.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-113	
		NR_FDD_FR1_H				-112.5	
		NR_FDD_FR1_N				-109.5	
N_{oc} Note2	Config 1,2		dBm/SCS	-93		Same as Noc for 15 kHz	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-90		-113	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-112.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-112	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-111.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-111	
		NR_FDD_FR1_F				-110.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-110	
		NR_FDD_FR1_H				-109.5	
		NR_FDD_FR1_N				-106.5	
$\hat{E}_s / I_{ot}$ for SSB			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s / I_{ot}$ for CSI-RS			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s / N_{oc}$ for SSB			dB	4.54	2.66	-4	-4
$\hat{E}_s / N_{oc}$ for CSI-RS			dB	4.54	2.66	-4	-4
CSI-RSRP Note3	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-88.46	-90.34	-120	-120
		NR_FDD_FR1_B, NR_TDD_FR1_B				-119.5	-119.5
		NR_FDD_FR1_C, NR_TDD_FR1_C				-119	-119
		NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5	-118.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-118	-118
		NR_FDD_FR1_F				-117.5	-117.5
		NR_FDD_FR1_G, NR_TDD_FR1_G				-117	-117
		NR_FDD_FR1_H				-116.5	-116.5
		NR_FDD_FR1_N				-113.5	-113.5
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85.46	-87.34	-117	-117
		NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5	-116.5
		NR_FDD_FR1_C, NR_TDD_FR1_C				-116	-116
		NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5	-115.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-115	-115
		NR_FDD_FR1_F				-114.5	-114.5
		NR_FDD_FR1_G, NR_TDD_FR1_G				-114	-114
		NR_FDD_FR1_H				-113.5	-113.5
		NR_FDD_FR1_N				-113.5	-113.5
CSI-SINR Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	0	-3.19	-5.46	-5.46

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_B, NR_TDD_FR1_B					
		NR_FDD_FR1_C, NR_TDD_FR1_C					
		NR_FDD_FR1_D, NR_TDD_FR1_D					
		NR_FDD_FR1_E, NR_TDD_FR1_E					
		NR_FDD_FR1_F					
		NR_FDD_FR1_G, NR_TDD_FR1_G					
		NR_FDD_FR1_H					
		NR_FDD_FR1_N				-110.5	-110.5
Io Note3	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.5		-85.51	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-85.01	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-84.51	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-84.01	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-83.51	
		NR_FDD_FR1_F				-83.01	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-82.51	
		NR_FDD_FR1_H				-82.01	
		NR_FDD_FR1_N				-79.01	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-51.41		-79.41	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-78.91	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-78.41	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-77.91	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-77.41	
		NR_FDD_FR1_F				-76.91	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-76.41	
		NR_FDD_FR1_H				-75.91	
		NR_FDD_FR1_N				-72.91	
Propagation condition			-	AWGN			
Antenna configuration			-	1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-SINR, CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.12.1.3 Test Requirements

The CSI-SINR measurement accuracy shall fulfil the requirements in clause 10.1.12.2.1.

A.6.7.12.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.12.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.14.2.1 and 10.1.14.2.2.

A.6.7.12.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.6.7.12.2.2-1. Both absolute accuracy and relative accuracy requirements of CSI-SINR inter-frequency measurement are tested by using test parameters in table A.6.7.12.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.6.7.12.2.2-1: CSI-SINR Inter frequency CSI-SINR supported test configurations

Config	Description
1	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.12.2.2-2: CSI-SINR Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
DRX Cycle configuration		ms	Not Applicable					
TRS configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR.2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	R.1.1 FDD	-	CR.1.1 FDD	
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns			OP.1					
CSI-RSSI-Measurement			Not Applicable					
Time offset with Cell 1	Config 1,2	µs	-	2.35	-	2.35	-	2.35

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		Config 3	μs	-	1.17	-	1.17	-	1.17
SMTC configuration		Config 1		SMTC.2					
		Config 2,3		SMTC.1					
SSB configuration		Config 1,2		SSB.1 FR1					
		Config 3		SSB.2 FR1					
CSI-RS for mobility		Config 1		CSI-RS.RRM.FR1.1 FDD					
		Config 2		CSI-RS.RRM.FR1.1 TDD					
		Config 3		CSI-RS.RRM.FR1.2 TDD					
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15					
		Config 3		30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-88		-108.5		-119.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-119	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-118.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-118	
		NR_FDD_FR1_E NR_TDD_FR1_E						-117.5	
		NR_FDD_FR1_F						-117	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-116.5	
		NR_FDD_FR1_H						-116	
		NR_FDD_FR1_N						-113	
N_{oc} Note2	Config 1,2 N		dBm/SCS	-88		-108.5		Same as Noc for 15 kHz T	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85		-105.5		-116.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-116	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-115.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-115	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114.5	
		NR_FDD_FR1_F						-114	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-114.5	
		NR_FDD_FR1_H						-113	
		NR_FDD_FR1_N						-110	
$\hat{E}_s/I_{ot}$ for SSB			dB	-1.75	-1.75	15	15	-4.0	-4.0
$\hat{E}_s/I_{ot}$ for CSI-RS			dB	-1.75	-1.75	15	15	-4.0	-4.0
$\hat{E}_s/N_{oc}$ for SSB			dB	-1.75		15		-4.0	
$\hat{E}_s/N_{oc}$ for CSI-RS			dB	-1.75		15		-4.0	
CSI-RSRP Note3	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-89.75		-93.5		-123.5	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_B, NR_TDD_FR1_B						-123	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-122.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-122	
		NR_FDD_FR1_E NR_TDD_FR1_E						-121.5	
		NR_FDD_FR1_F						-121	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-120.5	
		NR_FDD_FR1_H						-120	
		NR_FDD_FR1_N						-117	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-86.75		-90.5		-120.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-120	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-119.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-119	
		NR_FDD_FR1_E NR_TDD_FR1_E						-118.5	
		NR_FDD_FR1_F						-118	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-117.5	
		NR_FDD_FR1_H						-117	
		NR_FDD_FR1_N						-114	
CSI-SINR Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-1.75		15		-4.0	
		NR_FDD_FR1_B, NR_TDD_FR1_B							
		NR_FDD_FR1_C, NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G, NR_TDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io Note3	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.83		-65.4		-90.09	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-89.59	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-89.09	
		NR_FDD_FR1_D NR_TDD_FR1_D						-88.59	
		NR_FDD_FR1_E NR_TDD_FR1_E						-88.09	
		NR_FDD_FR1_F						-87.59	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-87.09	
		NR_FDD_FR1_H						-86.59	
		NR_FDD_FR1_N						-83.59	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-51.73		-59.3		-84	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_B, NR_TDD_FR1_B						-83.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-83	
		NR_FDD_FR1_D NR_TDD_FR1_D						-82.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-82	
		NR_FDD_FR1_F						-81.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-81	
		NR_FDD_FR1_H						-80.5	
		NR_FDD_FR1_N						-77.5	
Propagation condition			-	AWGN					
Antenna configuration			-	1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-SINR, CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.12.2.3 Test Requirements

The CSI-SINR measurement accuracy shall fulfil the requirements in clause 10.1.14.2.1 and 10.1.14.2.2.

A.6.7.13 RSTD measurements

A.6.7.13.1 RSTD measurement accuracy test case for single positioning frequency layer

A.6.7.13.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.7.13.1.1-1.

Table A.6.7.13.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cells. Both cells are on the same NR RF channel in FR1. GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9.2.

Table A.6.7.13.1.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN	1~3		freq1	Freq1	freq1	Freq1
$BW_{channel}$	1	MHz	20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	2		20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	3		50: $N_{PRB,c}$ = 133		50: $N_{PRB,c}$ = 133	
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
TDD configuration	1		N/A		N/A	
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
Measurement gap	1, 2, 3		GP#24 or GP#0		GP#24 or GP#0	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1		SSB.1 FR1	
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~3		OP.1		OP.1	
TRS configuration	1		TRS.1.1 FDD	-	TRS.1.1 FDD	
	2		TRS.1.1 TDD		TRS.1.1 TDD	
	3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1	µs	-	3	-	3
	2,3		-	3	-	3
SMTC configuration	1		SMTC.2		SMTC.2	
	2,3		SMTC.1		SMTC.1	
PRS configuration	1		PRS.1.1 FR1		PRS.1.2 FR1	
	2		PRS.1.1 FR1		PRS.1.2 FR1	
	3		PRS.2.1 FR1		PRS.2.2 FR1	
PRS Resource slot offset	1, 2, 3	slot	0	2	0	2
Expected RSTD	1, 2, 3	µs	N/A	3	N/A	3
Expected RSTD uncertainty	1, 2, 3	µs	N/A	5	N/A	5
EPRE ratio of PSS to SSS	1~3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS	1~3	dB	0	0	0	0
N_{oc} Note2	1,2	dBm/ SCS	-98		-98	
	3		-95		-95	
PRS $\hat{E}_s / I_{ot}$	1~3	dB	-6	-13	-6	-13
PRP Note3	1,2	dBm/SCS	-103.7	-109.9	-103.7	-109.9
	3		-100.7	-106.9	-100.7	-106.9
Io Note3	1,2	dBm/	-65.70	-65.70	-65.70	-65.70

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
		19.08 MHz				
	3	dBm/ 47.88 MHz	-61.72	-61.72	-61.72	-61.72
PRS $\hat{E}_s / N_{oc}$	1~3	dB	-65.70	-65.70	-65.70	-65.70
SSB $\hat{E}_s / N_{oc}$	1~3	dB	-5.7		-11.9	
Propagation condition	1~3	-	AWGN		AWGN	
Antenna configuration	1~3		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.13.1.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.6.7.13.2 RSTD measurement accuracy test case for dual positioning frequency layer

A.6.7.13.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.7.13.2.1-1.

Table A.6.7.13.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell on NR RF channel #1 in FR1. Cell 2 is a neighbour cell on a different NR RF channel #2 in FR1. GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9.2.

Table A.6.7.13.2.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN	1~3		freq1	freq2	freq1	freq2
$BW_{channel}$	1	MHz	20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	2		20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	3		50: $N_{PRB,c}$ = 133		50: $N_{PRB,c}$ = 133	
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
TDD configuration	1		N/A		N/A	

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
Measurement gap	1, 2, 3		GP#24 or GP#0		GP#24 or GP#0	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1		SSB.1 FR1	
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~3		OP.1		OP.1	
TRS configuration	1		TRS.1.1 FDD	-	TRS.1.1 FDD	
	2		TRS.1.1 TDD		TRS.1.1 TDD	
	3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1	µs	-	3	-	3
	2,3		-	3	-	3
SMTC configuration	1		SMTC.2		SMTC.2	
	2,3		SMTC.1		SMTC.1	
PRS configuration	1		PRS.1.1 FR1		PRS.1.2 FR1	
	2		PRS.1.1 FR1		PRS.1.2 FR1	
	3		PRS.2.1 FR1		PRS.2.2 FR1	
PRS Resource slot offset	1, 2, 3	slot	0	2	0	2
Expected RSTD	1, 2, 3	µs	N/A	3	N/A	3
Expected RSTD uncertainty	1, 2, 3	µs	N/A	5	N/A	5
EPRE ratio of PSS to SSS	1~3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS	1~3	dB	0	0	0	0
N_{oc} Note2	1,2	dBm/ SCS	-98		-98	
	3		-95		-95	
PRS $\hat{E}_s/I_{ot}$	1~3	dB	-6	-13	-6	-13
PRP Note3	1,2	dBm/SCS	-104	-111	-104	-111
	3		-101	-108	-101	-108
Io Note3	1,2	dBm/ 19.08 MHz	-65.98	-66.74	-65.98	-66.74
	3	dBm/ 47.88 MHz	-62.00	-62.76	-62.00	-62.76
PRS $\hat{E}_s/N_{oc}$	1~3	dB	-6	-13	-6	-13
Propagation condition	1~3	-	AWGN		AWGN	
Antenna configuration	1~3		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.						
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.						

A.6.7.13.2.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.6.7.13.3 RSTD measurement accuracy test case with reduced number of samples for single positioning frequency layer in FR1 in RRC_CONNECTED state

A.6.7.13.3.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the accuracy requirements for reduced number of samples specified in clause 10.1.23.2 in an environment with AWGN propagation conditions. In this test UE that supports *supportedDL-PRS-ProcessingSamples* is configured by LMF to perform PRS measurement with reduced number of samples.

The supported test configurations are specified in table A.6.7.13.3.1-1.

Table A.6.7.13.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cells. Both cells are on the same NR RF channel in FR1. GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 shall be provided to the UE before the start of the test. The test duration should be longer than the UE measurement period as defined in clause 9.9.2.7.

Table A.6.7.13.3.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN	1~3		freq1	Freq1	freq1	Freq1
$BW_{channel}$	1	MHz	20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	2		20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	3		50: $N_{PRB,c}$ = 133		50: $N_{PRB,c}$ = 133	
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
TDD configuration	1		N/A		N/A	
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1		SSB.1 FR1	
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~3		OP.1		OP.1	
TRS configuration	1		TRS.1.1 FDD	-	TRS.1.1 FDD	
	2		TRS.1.1 TDD		TRS.1.1 TDD	
	3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1	µs	-	3	-	3
	2,3		-	3	-	3
SMTC configuration	1		SMTC.2		SMTC.2	
	2,3		SMTC.1		SMTC.1	
PRS configuration	1		PRS.1.3 FR1		PRS.1.4 FR1	
	2		PRS.1.3 FR1		PRS.1.4 FR1	
	3		PRS.2.3 FR1		PRS.2.4 FR1	
PRS BW	1,2		52 PRBs		-	
	3		48 PRBs		-	
PRS muting info	1~3		‘10’	‘01’	‘10’	‘01’
Expected RSTD	1, 2, 3	µs	N/A	3	N/A	3
Expected RSTD uncertainty	1, 2, 3	µs	N/A	5	N/A	5
EPRE ratio of PSS to SSS	1~3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
N_{oc} Note2	1,2	dBm/ SCS	-98		-98	
	3		-95		-95	
$\hat{E}_s/I_{ot}$	1~3	dB	-3	-6	-3	-6
PRS-RSRP Note3	1,2	dBm/SCS	-99.44	-101.65	-99.44	-101.65
	3		-96.44	-98.65	-96.44	-98.65
SS-RSRP Note3	1,2	dBm/SCS	-99.44	-101.65	-99.44	-101.65
	3		-96.44	-98.65	-96.44	-98.65
Io Note3	1,2	dBm/ 19.08 MHz	-63.63	-63.63	-63.63	-63.63
	3	dBm/ 47.88 MHz	-59.65	-59.65	-59.65	-59.65
$\hat{E}_s/N_{oc}$	1~3	dB	-1.44	-3.65	-1.44	-3.65
Propagation condition	1~3	-	AWGN		AWGN	
Antenna configuration	1~3		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.13.3.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.6.7.13.4 RSTD measurement accuracy test case with Rx TEG

A.6.7.13.4.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement when the measurements of reference cell and neighbor cell are within the same Rx TEG meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.7.13.4.1-1.

Table A.6.7.13.4.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. GP#24 is configured if UE supports GP#24, otherwise GP#0 is configured. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9.2.

The UE is requested to provide the Rx TEG in the test via *nr-UE-RxTEG-Request-r17* in *NR-TDOA-RequestLocationInformation*.

The test applies to the UE supporting *Rx TEG* defiend in *NR-UE-TEG-Capability* and reporting the same Rx TEG for the measurements of reference cell and neighbour cell.

Table A.6.7.13.4.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN	1~3		freq1	Freq1	freq1	Freq1
$BW_{channel}$	1	MHz	20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	2		20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	3		50: $N_{PRB,c}$ = 133		50: $N_{PRB,c}$ = 133	
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
TDD configuration	1		N/A		N/A	
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1		SSB.1 FR1	
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
OCNG Patterns	1~3		OP.1		OP.1	
EPRE ratio of PSS to SSS	1~3	dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS configuration	1		TRS.1.1 FDD	-	TRS.1.1 FDD	
	2		TRS.1.1 TDD		TRS.1.1 TDD	
	3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1	μs	-	3	-	3
	2,3		-	3	-	3
SMTC configuration	1		SMTC.2		SMTC.2	
	2,3		SMTC.1		SMTC.1	
PRS configuration	1		PRS.1.1 FR1		PRS.1.2 FR1	
	2		PRS.1.1 FR1		PRS.1.2 FR1	
	3		PRS.2.1 FR1		PRS.2.2 FR1	
PRS Resource slot offset	1~3	slot	0	2	0	2
Expected RSTD	1, 2, 3	μs	N/A	3	N/A	3
Expected RSTD uncertainty	1, 2, 3	μs	N/A	5	N/A	5
N_{oc} Note2	1,2	dBm/ SCS	-98		-98	
	3		-95		-95	
PRS $\hat{E}_s/I_{ot}$	1~3	dB	-6	-13	-6	-13
PRP Note3	1,2	dBm/SCS	-103.7	-109.9	-103.7	-109.9
	3		-100.7	-106.9	-100.7	-106.9
Io Note3	1,2	dBm/ 19.08 MHz	-65.70	-65.70	-65.70	-65.70
	3	dBm/ 47.88 MHz	-61.72	-61.72	-61.72	-61.72
PRS $\hat{E}_s/N_{oc}$	1~3	dB	-5.7	-11.9	-5.7	-11.9
Propagation condition	1~3	-	AWGN		AWGN	
Antenna configuration	1~3		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.13.4.2 Test Requirements

The RSTD measurement for Cell 1 and Cell 2 should fulfil the absolute accuracy requirements with same Rx TEG in clause 10.1.23.2.

A.6.7.13.5 NR RSTD measurement accuracy test case for PRS aggregation in FR1 SA in RRC_CONNECTED mode

A.6.7.13.5.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement by aggregating PRS resoureces from multiple positioning frequency layers (PFLs) meets the measurement accuracy requirements specified in clause 10.1.23A.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.7.13.5.1-1.

Table A.6.7.13.5.1-1: Supported test configurations for PRS aggregation

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth per PFL, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth per PFL, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth per PFL, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Each cell is associated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel #1. In addition, all cells/TRPs transmit DL PRS in two intra-band contiguous PFLs in RF channel #1 and RF channel #2. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34], shall be provided to the UE before the start of the test. The UE is capable of performing RSTD measurements by aggregating PRS resources from two PFLs and is configured by the LMF to perform measurements by aggregating the PRS resources from two positioning frequency layers via *nr-DL-PRS-JointMeasurementRequestedPFL-List*. The *NR-DL-TDOA-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2.

The test duration should be larger than the UE measurement period as defined in clause 9.9.2.

Table A.6.7.13.5.1-2: RSTD accuracy test parameters for PRS aggregation

Parameter	Config	Unit	Cell 1	Cell 2
PRS ARFCN	1,2,3		freq1, freq2	freq1, freq2
$BW_{channel}$ per carrier	1	MHz	20: $N_{RB,c}$ = 106	
	2		20: $N_{RB,c}$ = 106	
	3		50: $N_{RB,c}$ = 133	
Duplex mode	1		FDD	
	2		TDD	
	3		TDD	
TDD configuration	1		N/A	
	2		TDDConf.1.1	
	3		TDDConf.2.1	
Measurement gap	1, 2, 3		GP#24 or GP#0	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-
	2		SR.1.1 TDD	
	3		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-
	2		CR.1.1 TDD	-
	3		CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-

SSB configuration	1		SSB.1 FR1	
	2		SSB.1 FR1	
	3		SSB.2 FR1	
OCNG Patterns	1,2,3		OP.1	
TRS configuration	1		TRS.1.1 FDD	-
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
Initial BWP Configuration	1,2,3		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1,2,3		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1	μs	-	3
	2,3		-	3
SMTC configuration	1		SMTC.2	
	2,3		SMTC.1	
PRS configuration	1		PRS.1.2 FR1	
	2		PRS.1.2 FR1	
	3		PRS.2.2 FR1	
PRS Resource slot offset	1, 2, 3	slot	0	4
Expected RSTD	1, 2, 3	μs	N/A	3
Expected RSTD uncertainty	1, 2, 3	μs	N/A	5
EPRE ratio of PSS to SSS	1,2,3	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS				
EPRE ratio of OCNG to OCNG DMRS				
EPRE ratio of PRS to SSS	1,2,3	dB	0	0
N_{oc} Note2	1,2	dBm/ SCS	-98	
	3		-95	
PRS $\hat{E}_s/I_{ot}$	1,2,3	dB	-6	-13
PRP	1,2	dBm/SCS	-103.7	-109.9
	3		-100.7	-106.9
Io	1,2	dBm/ 19.08MHz per PFL	-65.70	-65.70
	3	dBm/ 47.88MHz per PFL	-61.72	-61.72
PRS $\hat{E}_s/N_{oc}$	1,2,3	dB	-65.70	-65.70
SSB $\hat{E}_s/N_{oc}$	1,2,3	dB	-5.7	
Propagation condition	1,2,3	-	AWGN	

A.6.7.13.5.2 Test Requirements

The RSTD measurement accuracy shall fulfil the requirements defined in clause 10.1.23A.2.

A.6.7.14 PRS-RSRP measurements

A.6.7.14.1 SA: measurement accuracy with PRS in FR1

A.6.7.14.1.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.24.2.1 and 10.1.24.2.2.

A.6.7.14.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.7.14.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in A.6.7.14.1.2-2. In all test cases, Cell 1 is the PCell.

Table A.6.7.14.1.2-1: PRS-RSRP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.7.14.1.2-2: PRS-RSRP test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	20: $N_{PRB,c}$ = 106			
	Config 2		20: $N_{PRB,c}$ = 106			
	Config 3		50: $N_{PRB,c}$ = 133			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
TRS configuration	Config 1		TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
	Config 2		TRS.1.1 TDD	NA	TRS.1.1 TDD	NA
	Config 3		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable			
Measurement gap			GP#24 or GP#0 Note 7			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
	Config 2			CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3			CCR2.1 TDD		CCR2.1 TDD	
PRS configuration	Config 1			PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 2			PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 3			PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.4 FR1	PRS.2.4 FR1
PRS Resource slot offset (slot)	Config 1,2,3		slot	0	2	0	2
SSB configuration	Config 1			SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2			SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3			SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1	Config 1		µs	-	3	-	3
	Config 2,3			-	3	-	3
Expected RSTD	Config 1,2,3		µs	3			
Expected RSTD uncertainty	Config 1,2,3		µs	5			
SMTC configuration	Config 1			SMTC.2			
	Config 2,3			SMTC.1			
OCNG Patterns				OCNG pattern 1			
PDSCH/PDCCH subcarrier spacing	Config 1,2		kHz	15 kHz			
	Config 3			30 kHz			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
EPRE ratio of PRS to SSS			dB	0	0	0	0
N_{oc} Note2	Config 1,2		dBm/15 kHz	-98		-98	
	Config 3			-98		-98	
N_{oc} Note2	Config 1,2		dBm/SCS	-98		-98	
	Config 3			-95		-95	
PRS $\hat{E}_s/I_{ot}$			dB	-2.41	-12.12	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$			dB	-2	-10	-2	-10
PRP Note3	Config 1, 2		dBm/SCS	-100	-108	-100	-108
	Config 3			-97	-105	-97	-105
Io Note3	Config 1,2		dBm/19.08 MHz	-64.57		-64.57	
	Config 3		dBm/47.88 MHz	-60.59		-60.59	
Propagation condition				AWGN			
Antenna configuration				1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: PRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: Void.

NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

NOTE 7: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.

A.6.7.14.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.24.2.1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1.24.2.2.

A.6.7.14.2 SA: measurement accuracy with PRS in FR1 with reduced sample number

A.6.7.14.2.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRP measurement with reduced sample number is within the specified limits provided that PRS is transmitted within the active BWP of the UE. UE can support *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED*, and the LMF indicates the UE to perform positioning measurements with reduced number of samples N_{sample} via *reducedDL-PRS-ProcessingSamples*. This test will verify the requirements in clauses 10.1.24.2.1 and 10.1.24.2.2.

A.6.7.14.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.7.14.2.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in A.6.7.14.2.2-2. In all test cases, Cell 1 is the PCell.

Table A.6.7.14.2.2-1: PRS-RSRP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.7.14.2.2-2: PRS-RSRP test parameters

Parameter		Unit	Test 1	
			Cell 1	Cell 2
Cell ID			489	0
SSB ARFCN			freq1	
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	20: $N_{PRB,c}$ = 106	
	Config 2		20: $N_{PRB,c}$ = 106	
	Config 3		50: $N_{PRB,c}$ = 133	
BWP BW	Config 1		20: $N_{PRB,c}$ = 106	
	Config 2		20: $N_{PRB,c}$ = 106	
	Config 3		50: $N_{PRB,c}$ = 133	
Downlink initial BWP configuration			DLBWP.0.1	
Downlink dedicated BWP configuration			DLBWP.1.1	
Uplink initial BWP configuration			ULBWP.0.1	
Uplink dedicated BWP configuration			ULBWP.1.1	
TRS configuration	Config 1		TRS.1.1 FDD	NA
	Config 2		TRS.1.1 TDD	NA
	Config 3		TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable	
Measurement gap			GP#24 or GP#0 Note 7	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-
	Config 2		SR.1.1 TDD	
	Config 3		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-

Parameter			Unit	Test 1	
				Cell 1	Cell 2
	Config 2			CR.1.1 TDD	
	Config 3			CR2.1 TDD	
Control channel RMC	Config 1			CCR.1.1 FDD	-
	Config 2			CCR.1.1 TDD	
	Config 3			CCR2.1 TDD	
PRS configuration	Config 1			PRS.1.4 FR1	PRS.1.4 FR1
	Config 2			PRS.1.4 FR1	PRS.1.4 FR1
	Config 3			PRS.2.4 FR1	PRS.2.4 FR1
PRS Resource slot offset (slot)	Config 1,2,3		slot	0	2
SSB configuration	Config 1			SSB.1 FR1	SSB.1 FR1
	Config 2			SSB.1 FR1	SSB.1 FR1
	Config 3			SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1	Config 1		ms	-	3
	Config 2,3		µs	-	3
SMTC configuration	Config 1			SMTC.2	
	Config 2,3			SMTC.1	
OCNG Patterns				OCNG pattern 1	
PDSCH/PDCCH subcarrier spacing	Config 1,2		kHz	15 kHz	
	Config 3			30 kHz	
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	Config 1,2		dBm/15 kHz	-98	
	Config 3			-98	
N_{oc} Note2	Config 1,2		dBm/SCS	-98	
	Config 3			-95	
$\hat{E}_s/I_{ot}$			dB	0	-6
$\hat{E}_s/N_{oc}$			dB	2.23	-1.73
SS-RSRP			dB	Same as PRS-RSRP	
PRS-RSRP Note3	Config 1, 2		dBm/SCS	-95.77	-99.73
	Config 3			-92.77	-96.73
Io Note3	Config 1,2		dBm/19.08 MHz	-61.71	
	Config 3		dBm/47.88 MHz	-57.73	
Propagation condition				AWGN	
Antenna configuration				1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Void.
NOTE 6: Void.
NOTE 7: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.

A.6.7.14.2.3 Test Requirements

In the test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.24.2.1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1.24.2.2.

A.6.7.14.3 Void

A.6.7.14.3.1 Void

A.6.7.14.3.2 Void

A.6.7.14.3.3 Void

A.6.7.15 UE Rx-Tx time difference measurements

A.6.7.15.1 UE Rx-Tx time difference measurement accuracy for single positioning frequency layer in FR1 SA

A.6.7.15.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.25.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations in listed in table A.6.7.15.1.1-1.

Table A.6.7.15.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE before the start of the test.

The UE is configured with measurement gap pattern ID #0 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.6.7.15.1.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.6.7.15.1.2-1.

Table A.6.7.15.1.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
RF Channel Number		1,2,3	1	1	1	1
Measurement gap		1,2,3	GP#24 or GP#0 Note 4		GP#24 or GP#0 Note 4	
DRX		1,2,3	OFF		OFF	
Time offset with Cell 1	μs	1, 2, 3	N/A	3	N/A	3
TDD configuration		1	N/A	N/A	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1	TDDConf.2.1	TDDConf.2.1

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
PDSCH RMC configuration		1	SR.1.1 FDD	N/A	SR.1.1 FDD	N/A
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD	N/A	CR.1.1 FDD	N/A
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD	N/A	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1	OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1, 2, 3	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD	N/A	TRS.1.1 FDD	N/A
		2	TRS.1.1 TDD		TRS.1.1 TDD	
		3	TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1	N/A	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1, 2, 3	DLBWP.1.1	N/A	DLBWP.1.1	N/A
Active UL BWP configuration		1, 2, 3	ULBWP.1.1	N/A	ULBWP.1.1	N/A
PRS configuration		1	PRS.1.1 FR1	PRS.1.1 FR1	PRS.1.2 FR1	PRS.1.2 FR1
		2	PRS.1.1 FR1	PRS.1.1 FR1	PRS.1.2 FR1	PRS.1.2 FR1
		3	PRS.2.1 FR1	PRS.2.1 FR1	PRS.2.2 FR1	PRS.2.2 FR1
PRS Resource slot offset	slot	1, 2, 3	0	2	0	2
SRS configuration		1	POS-SRS.1	N/A	POS-SRS.1	N/A
		2	POS-SRS.1	N/A	POS-SRS.1	N/A
		3	POS-SRS.2	N/A	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1	-98		-98	
		2	-98		-98	
		3	-95		-95	
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	-12.12	-2.41	-12.12
		2				
		3				
	dB	1	-2	-10	-2	-10

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
PRS $\hat{E}_s/N_{oc}$		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-100	-108	-100	-108
		2	-100	-108	-100	-108
		3	-97	-105	-97	-105
Io	dBm/19.08 MHz	1	-64.57	-64.57	-64.57	-64.57
	dBm/19.08 MHz	2	-64.57	-64.57	-64.57	-64.57
	dBm/47.88 MHz	3	-60.59	-60.59	-60.59	-60.59
Propagation Condition		1, 2, 3	AWGN		AWGN	
NOTE 1: Void. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.						

Table A.6.7.15.1.2-2: Void

A.6.7.15.1.3 Test requirements

The UE Rx-Tx time difference measurement fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25.2 for both Cell 1 and Cell 2.

A.6.7.15.2 UE Rx-Tx time difference measurement accuracy with reduced number of samples in FR1 SA

A.6.7.15.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy with reduced number of samples is within the specified limits. This test will verify the requirements in clause 10.1.25.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations in listed in table A.6.7.15.2.1-1.

Table A.6.7.15.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR1.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE before the start of the test.

The UE is configured to measure UE Rx-Tx time difference using reduced number of samples via *requestedDL-PRS-ProcessingSamples* in *NR-Multi-RTT-RequestLocationInformation* during the test.

The UE is configured with measurement gap pattern ID #0 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.6.7.15.2.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.6.7.15.2.2-1.

Table A.6.7.15.2.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
RF Channel Number		1,2,3	1	1
Measurement gap		1,2,3	GP#24 or GP#0 Note 4	
DRX		1,2,3	OFF	
Time offset with Cell 1	µs	1, 2, 3	N/A	3
TDD configuration		1	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1	SR.1.1 FDD	N/A
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD	N/A
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1, 2, 3	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.1.1 FDD	N/A
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1, 2, 3	DLBWP.1.1	N/A
Active UL BWP configuration		1, 2, 3	ULBWP.1.1	N/A
PRS configuration		1	PRS.1.1 FR1	PRS.1.1 FR1
		2	PRS.1.1 FR1	PRS.1.1 FR1
		3	PRS.2.1 FR1	PRS.2.1 FR1
PRS BW		1	52 PRBs	52 PRBs
		2	52 PRBs	52 PRBs
		3	48 PRBs	48 PRBs
PRS Resource slot offset	slot	1, 2, 3	0	2
SRS configuration		1	POS-SRS.1	N/A
		2	POS-SRS.1	N/A

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
		3	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-98	
		3	-95	
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
		3		
PRS $\hat{E}_s/I_{ot}$	dB	1	0	-6
		2		
		3		
PRS $\hat{E}_s/N_{oc}$	dB	1	2.23	-1.73
		2		
		3		
PRP Note 3	dBm/SCS kHz	1	-95.77	-99.73
		2	-95.77	-99.73
		3	-92.77	-96.73
Io	dBm/19.08 MHz	1	-61.71	-61.71
	dBm/19.08 MHz	2	-61.71	-61.71
	dBm/47.88 MHz	3	-57.73	-57.73
Propagation Condition		1, 2, 3	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.

A.6.7.15.2.3 Test requirements

The UE Rx-Tx time difference measurement with reduced number of samples fulfils the UE Rx-Tx measurement accuracy.

A.6.7.15.3 UE Rx-Tx time difference measurement accuracy with RxTx TEG

A.6.7.15.3.1 Test purpose and environment

The purpose of the test is to verify that the relative UE Rx-Tx time difference measurement accuracy when the two measurements are within the same RxTx TEG is within the specified limits. This test will verify the requirements in clause 10.1.25.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations is listed in table A.6.7.15.3.1-1.

Table A.6.7.15.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE before the start of the test.

The UE is requested to provide the RxTx TEG in the test via *nr-UE-RxTxTEG-Request-r17* in *NR-Multi-RTT-RequestLocationInformation*.

The test applies to the UE supporting *RxTx TEG* defiend in *NR-UE-TEG-Capability* and reporting the same RxTx TEG for the two UE Rx-Tx measurements.

The UE is configured with measurement gap pattern ID #0 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The UE Rx-Tx time difference is derived by the difference of the receiving timing and the transmit timing for each cell.

A.6.7.15.3.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.6.7.15.3.2-1. y requirements specified in clause 10.1.25.2 for both Cell 1 and Cell 2.

Table A.6.7.15.3.2-2: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
RF Channel Number		1,2,3	1	1	1	1
Measurement gap		1,2,3	GP#24 or GP#0 Note 4		GP#24 or GP#0 Note 4	
DRX		1,2,3	OFF		OFF	
Time offset with Cell 1	μs	1, 2, 3	N/A	3	N/A	3
TDD configuration		1	N/A	N/A	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1	SR.1.1 FDD	N/A	SR.1.1 FDD	N/A
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD	N/A	CR.1.1 FDD	N/A
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD	N/A	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1	OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1, 2, 3	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD	N/A	TRS.1.1 FDD	N/A
		2	TRS.1.1 TDD		TRS.1.1 TDD	
		3	TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1	N/A	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1, 2, 3	DLBWP.1.1	N/A	DLBWP.1.1	N/A
Active UL BWP configuration		1, 2, 3	ULBWP.1.1	N/A	ULBWP.1.1	N/A
PRS configuration		1	PRS.1.1 FR1	PRS.1.1 FR1	PRS.1.2 FR1	PRS.1.2 FR1
		2	PRS.1.1 FR1	PRS.1.1 FR1	PRS.1.2 FR1	PRS.1.2 FR1
		3	PRS.2.1 FR1	PRS.2.1 FR1	PRS.2.2 FR1	PRS.2.2 FR1
PRS Resource slot offset	slot	1, 2, 3	0	2	0	2
SRS configuration		1	POS-SRS.1	N/A	POS-SRS.1	N/A
		2	POS-SRS.1	N/A	POS-SRS.1	N/A
		3	POS-SRS.2	N/A	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1	-98		-98	
		2	-98		-98	
		3	-95		-95	
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	-12.12	-2.41	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-2	-10	-2	-10
		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-100	-108	-100	-108
		2	-100	-108	-100	-108
		3	-97	-105	-97	-105
Io	dBm/19.08 MHz	1	-64.57	-64.57	-64.57	-64.57
	dBm/19.08 MHz	2	-64.57	-64.57	-64.57	-64.57
	dBm/47.88 MHz	3	-60.59	-60.59	-60.59	-60.59
Propagation Condition		1, 2, 3	AWGN		AWGN	

NOTE 1: Void.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.

A.6.7.15.3.3 Test requirements

The relative accuracy is derived by the difference of the UE Rx-Tx measurements on the two cells.

The UE Rx-Tx time difference measurements for Cell 1 and Cell 2 fulfil the relative UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25.x.

A.6.7.15.4 UE Rx-Tx time difference measurement accuracy with PRS bandwidth aggregation in FR1 SA

A.6.7.15.4.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.25A. The tests are conducted under AWGN propagation condition with the UE operating in FR1 stand-alone mode and configured to perform UE Rx-Tx measurements by aggregating two intra-band contiguous positioning frequency layers (PFLs) in FR1.

The supported test configurations are listed in table A.6.7.15.4.1-1.

Table A.6.7.15.4.1-1: Supported test configurations

PCell configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: Cell 1 (PCell) and Cell 2 (neighbor cell). Each cell is sssociated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* 37.355 [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel #1. In addition, both cells/TRPs transmit DL PRS in two intra-band contiguous PFLs in RF channel #1 and RF channel #2.. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE before the start of the test.

The *NR-Multi-RTT-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2.

The *NR-Multi-RTT-RequestLocationInformation* message provided to the UE must request bandwidth aggregated measurements via *jointMeasurementsReq* and *nr-DL-PRS-JointMeasurementRequestedPFL-List.*

The UE is configured with measurement gap pattern ID #0 or ID #24 before the start of the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

The general test parameters and cell specific test parameters are as given in table A.6.7.15.4.1-2 and table A.6.7.15.4.1-3 respectively.

Table A.6.7.15.4.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2, all signals/channels except PRS in PFL2 are allocated within this channel.
			2	For both Cell 1 and Cell 2, only PRS in PFL2 is allocated within this channel.
$BW_{channel}$	MHz	1	20: $N_{RB,c}$ = 106	For both RF channels
		2	20: $N_{RB,c}$ = 106	

		3	50: $N_{RB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3	GP#24 or GP#0 Note 1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	OFF	
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells/TRPs
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
Note 1: GP#24 is configured if the UE supports it, otherwise GP#0 is configured.				

Table A.6.7.15.4.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1	Cell 2
TDD configuration		1	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1	SR.1.1 FDD	N/A
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD	N/A
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns Note 1		1, 2, 3	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1, 2, 3	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.1.1 FDD	N/A
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1	N/A
Active BWP configuration		1, 2, 3	DLBWP.1.1 ULBWP.1.1	N/A
PRS configuration (for both PFL1 and PFL2)		1	PRS.1.2 FR1	PRS.1.2 FR1
		2	PRS.1.2 FR1	PRS.1.2 FR1
		3	PRS.2.2 FR1	PRS.2.2 FR1
PRS Resource slot offset (for both PFL1 and PFL2)	slot	1, 2, 3	0	4

SRS configuration		1	POS-SRS.1	N/A
		2	POS-SRS.1	N/A
		3	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-98	
		3	-95	
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
		3		
PRS $\hat{E}_s/I_{ot}$	dB	1, 2, 3	-3	-13
PRS $\hat{E}_s/N_{oc}$	dB	1, 2, 3	-3	-13
PRP Note 3	dBm/SCS kHz	1	-101	-111
		2	-101	-111
		3	-98	-108
Io Note 3 (on symbols where PRS is not allocated)	dBm/19.08 MHz	1	-65.05	-65.05
	dBm/19.08 MHz	2	-65.05	-65.05
	dBm/47.88 MHz	3	-61.06	-61.06
Propagation Condition		1, 2, 3	AWGN	

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.

A.6.7.15.4.2 Test requirements

The UE Rx-Tx time difference measurement fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25A for both Cell 1 and Cell 2.

A.6.7.16 PRS-RSRPP measurements

A.6.7.16.1 SA: measurement accuracy with PRS in FR1

A.6.7.16.1.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRPP measurement in RRC_CONNECTED is within the specified limits. This test will verify the requirements in clauses 10.1.38.2.

A.6.7.16.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.7.16.1.2-1. Both absolute accuracy of PRS-RSRPP measurements are tested by using the parameters in A.6.7.16.1.2-2. In all test cases, Cell 1 is the PCell.

Table A.6.7.16.1.2-1: PRS-RSRPP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.7.16.1.2-2: PRS-RSRPP test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	20: $N_{PRB,c}$ = 106			
	Config 2		20: $N_{PRB,c}$ = 106			
	Config 3		50: $N_{PRB,c}$ = 133			
BWP BW	Config 1		20: $N_{PRB,c}$ = 106			
	Config 2		20: $N_{PRB,c}$ = 106			
	Config 3		50: $N_{PRB,c}$ = 133			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
TRS configuration	Config 1		TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
	Config 2		TRS.1.1 TDD	NA	TRS.1.1 TDD	NA
	Config 3		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable			
Measurement gap			GP#24 or GP#0 Note 7			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD	
PRS configuration	Config 1		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 2		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 3		PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.4 FR1	PRS.2.4 FR1
PRS Resource slot offset (slot)	Config 1,2,3	slot	0	2	0	2
SSB configuration	Config 1		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1	Config 1	ms	-	3	-	3
	Config 2,3	µs	-	3	-	3
SMTC configuration	Config 1		SMTC.2			
	Config 2,3		SMTC.1			
OCNG Patterns			OCNG pattern 1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config 1,2		dBm/15 kHz	-98		-98	
	Config 3			-98		-98	
N_{oc} Note2	Config 1,2		dBm/SCS	-98		-98	
	Config 3			-95		-95	
$\hat{E}_s/I_{ot}$			dB	-2.41	-12.12	-2.41	-12.12
$\hat{E}_s/N_{oc}$			dB	-2	-10	-2	-10
PRS-RSRP Note3	Config 1, 2		dBm/SCS	-100	-108	-100	-108
	Config 3			-97	-105	-97	-105
Io Note3	Config 1,2		dBm/19.08 MHz	-64.57		-64.57	
	Config 3		dBm/47.88 MHz	-60.59		-60.59	
Propagation condition				Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, τ_d = 0.45 µs and f_D = 5 Hz			
Antenna configuration				1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRPP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Void.
NOTE 6: Void.
NOTE 7: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.

A.6.7.16.1.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.38.2.

A.6.7.16.2 SA: measurement accuracy with reduced PRS samples in FR1

A.6.7.16.2.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRPP measurement accuracy with N_{sample} = 1 in FR1 is within the specified limits. This test will verify the requirements in clauses 10.1.38.2.

The UE under test should support *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED*, and the TE indicates the UE to perform positioning measurements with reduced number of samples. The PRS bandwidth is contained within the active BWP and the power difference between the serving cell SS-RSRP and neighbour cell PRS-RSRP is within 6 dB, so that N_{sample} = 1 is assumed.

A.6.7.16.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.7.16.2.2-1. In all test cases, Cell 1 is the PCell.

Table A.6.7.16.2.2-1: PRS-RSRPP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.7.16.2.2-2: PRS-RSRPP test parameters

Parameter		Unit	Test 1	
			Cell 1	Cell 2
Cell ID			489	0
SSB ARFCN			freq1	
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	20: $N_{PRB,c}$ = 106	
	Config 2		20: $N_{PRB,c}$ = 106	
	Config 3		50: $N_{PRB,c}$ = 133	
BWP BW	Config 1		20: $N_{PRB,c}$ = 106	
	Config 2		20: $N_{PRB,c}$ = 106	
	Config 3		50: $N_{PRB,c}$ = 133	
Downlink initial BWP configuration			DLBWP.0.1	
Downlink dedicated BWP configuration			DLBWP.1.1	
Uplink initial BWP configuration			ULBWP.0.1	
Uplink dedicated BWP configuration			ULBWP.1.1	
TRS configuration	Config 1		TRS.1.1 FDD	NA
	Config 2		TRS.1.1 TDD	NA
	Config 3		TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable	
Measurement gap			GP#24 or GP#0 Note 5	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-
	Config 2		SR.1.1 TDD	
	Config 3		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-
	Config 2		CR.1.1 TDD	
	Config 3		CR2.1 TDD	
Control channel RMC	Config 1		CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD	
PRS configuration	Config 1		PRS.1.4 FR1	PRS.1.4 FR1
	Config 2		PRS.1.4 FR1	PRS.1.4 FR1
	Config 3		PRS.2.4 FR1	PRS.2.4 FR1
PRS bandwidth	Config 1,2,3		52 PRBs	52 PRBs
PRS Resource slot offset (slot)	Config 1,2,3	slot	0	2
SSB configuration	Config 1		SSB.1 FR1	SSB.1 FR1
	Config 2		SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1	Config 1	ms	-	3
	Config 2,3	µs	-	3
SMTC configuration	Config 1		SMTC.2	
	Config 2,3		SMTC.1	
OCNG Patterns			OCNG pattern 1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz	
	Config 3		30 kHz	

Parameter		Unit	Test 1	
			Cell 1	Cell 2
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	Config 1,2	dBm/15 kHz	-98	
	Config 3			
N_{oc} Note2	Config 1,2	dBm/SCS	-98	
	Config 3		-95	
$\hat{E}_s/I_{ot}$		dB	0	-6
$\hat{E}_s/N_{oc}$		dB	2.23	-1.73
PRS-RSRP Note3	Config 1, 2	dBm/SCS	-95.77	-99.73
	Config 3		-92.77	-96.73
SS-RSRP Note3	Config 1, 2	dBm/SCS	-95.77	-99.73
	Config 3		-92.77	-96.73
Io Note3	Config 1,2	dBm/19.08 MHz	-61.71	
	Config 3	dBm/47.88 MHz	-57.73	
Propagation condition			Two-tap channel Note6	
Antenna configuration			1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.
NOTE 6: The two-tap channel model is defined in 38.101-4 annex B.2.4 (a = 1, τ_d=0.45 μs and f_D=5 Hz).

A.6.7.16.2.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.38.2.

A.6.7.17 LTM L1-RSRP measurement

A.6.7.17.1 Inter-frequency L1-RSRP accuracy requirements for neighbour cell in FR1

A.6.7.17.1.1 Test Purpose and Environment

The purpose of this test is to verify that the inter-frequency L1-RSRP measurement accuracy on neigbor cell is within the specified limits. This test will verify the requirements in clause 9.15.5 and clause 10.1.19E for inter-frequency L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.6.7.17.1.1-1.

Table A.6.7.17.1.1-1: Applicable NR configurations for FR1 SSB based inte-frequency L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

NOTE 1: The UE is only required to be tested in one of the supported test configurations in each supported band
NOTE 2: Target NR cell has the same SCS, BW and deplex mode as NR serving cell.

A.6.7.17.1.2 Test parameters

In this set of test cases there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters for the Cell 2 are given in table A.6.7.17.1.2-1 below. The absolute accuracy of L1-RSRP measurements are tested by using the parameters in table A.6.7.17.1.2-1.

Measurement gap pattern configuration defined in table A.6.7.17.1.2-1 is provided. Before the test,

- UE is connected to Cell 1 (PCell) on RF channel 1 (PCC)
- UE is configured one SSB resource set with one SSB resource on Cell 2
- A measurement object is configured for the RF channel 2, and it is indicated to the UE to reprort periodica reporting with with SSB Index.
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.

Table A.6.7.17.1.2-1: FR1 inter-frequency SSB based L1-RSRP test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN	**1~3**		**freq1**	**freq2**	**freq1**	**freq2**
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
Gap Pattern Id	1~3		0			
Measurement gap offset	1~3		39			
TDD Configuration	1		N/A		N/A	
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	2		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	3		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD	-	SR.1.1 TDD	-
	3		SR.2.1 TDD	-	SR.2.1 TDD	-
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 TDD	-	CR.2.1 TDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1		SSB.1 FR1	
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~3		OP.1		OP.1	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
TRS configuration	1		TRS.1.1 FDD	-	TRS.1.1 FDD	-

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		**1~3**		**freq1**	**freq2**	**freq1**	**freq2**
		2		TRS.1.1 TDD	-	TRS.1.1 TDD	-
		3		TRS.1.2 TDD	-	TRS.1.2 TDD	-
Dedicated BWP configuration		1~3		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
SMTC configuration		1~3		SMTC.1		SMTC.1	
reportConfigType		1~3		periodic		periodic	
reportQuantity		1~3		ssb-Index-RSRP		ssb-Index-RSRP	
Number of reported RS		1~3		1		1	
L1-RSRP reporting period		1~3		slot80		slot80	
EPRE ratio of PSS to SSS		1~3	dB	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~3	dBm/15 kHz	-94.65		(N_{oc} for Channel 2 +8 dB)	-117
	s						-116.5
	NR_TDD_FR1_C						-116
	NR_FDD_FR1_D, NR_TDD_FR1_D						-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-115
	NR_FDD_FR1_F						-114.5
	NR_FDD_FR1_G						-114
	NR_FDD_FR1_H						-113.5
	NR_FDD_FR1_N						-110.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/SSB SCS	-94.65		(N_{oc} for Channel 2 +8 dB)	-117
	NR_FDD_FR1_B						-116.5
	NR_TDD_FR1_C						-116
	NR_FDD_FR1_D, NR_TDD_FR1_D						-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-115
	NR_FDD_FR1_F						-114.5
	NR_FDD_FR1_G						-114
	NR_FDD_FR1_H						-113.5
	NR_FDD_FR1_N						-110.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-91.65		(N_{oc} for Channel 2 +8 dB)	-114
	NR_FDD_FR1_B						-113.5
	NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-112
	NR_FDD_FR1_F						-111.5
	NR_FDD_FR1_G						-111
	NR_FDD_FR1_H						-110.5
	NR_FDD_FR1_N						-107.5
$\hat{E}_s/I_{ot}$		1~3	dB	10	10	13	-3
SSB RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/SSB SCS	-84.65		(RSRP for Cell 2 +24 dB)	-120

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		1~3		freq1	freq2	freq1	freq2
	NR_FDD_FR1_B						-119.5
	NR_TDD_FR1_C						-119
	NR_FDD_FR1_D, NR_TDD_FR1_D						-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-118
	NR_FDD_FR1_F						-117.5
	NR_FDD_FR1_G						-117
	NR_FDD_FR1_H						-116.5
	NR_FDD_FR1_N						-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-81.65		(RSRP for Cell 2 +24 dB)	-117
	NR_FDD_FR1_B						-116.5
	NR_TDD_FR1_C						-116
	NR_FDD_FR1_D, NR_TDD_FR1_D						-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-115
	NR_FDD_FR1_F						-114.5
	NR_FDD_FR1_G						-114
	NR_FDD_FR1_H						-113.5
	NR_FDD_FR1_N						-110.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/9.36 MHz	-56.28		(Io for Channel 2 +19.75 dB)	-87.28
	NR_FDD_FR1_B						-86.78
	NR_TDD_FR1_C						-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D						-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E						-85.28
	NR_FDD_FR1_F						-84.78
	NR_FDD_FR1_G						-84.28
	NR_FDD_FR1_H						-83.78
	NR_FDD_FR1_N						-80.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3	dBm/38.16 MHz	-50.19		(Io for Channel 2 +19.75 dB)	-81.19
	NR_FDD_FR1_B						-80.69
	NR_TDD_FR1_C						-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D						-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E						-79.19
	NR_FDD_FR1_F						-78.69
	NR_FDD_FR1_G						-78.19
	NR_FDD_FR1_H						-77.69
	NR_FDD_FR1_N						-74.69
$\hat{E}_s / N_{oc}$		1~3	dB	10	10	13	-3
Propagation condition		1~3		AWGN		AWGN	
Antenna configuration		1~3		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.17.1.3 Test Requirements

The inter-frequency L1-RSRP measurement accuracy for SSB resource reported by UE in L1-RSRP report (SSB#0 of Cell 2) shall fulfil the requirements in clauses 10.1.19E.

A.6.7.18 TDCP amplitude measurement accuracy

A.6.7.18.1 TDCP amplitude measurement accuracy in FR1

A.6.7.18.1.1 Test Purpose and Environment

The purpose of this test is to verify that the TRS based TDCP amplitude measurement accuracy is within the specified limits in the test requirements section. The cofigurations for the test are specified in table A.6.7.18.1.1-1.

The test consists of two tests, Test 1 and Test 2. Each test further consists of two subtests Test 1A, 1B and Test 2A, 2B.

Test 1A: 10 Hz doppler + 15 kHz SCS FDD + 20 dB SNR

Test 1B: 10 Hz doppler + 30 kHz SCS TDD + 20 dB SNR

Test 2A: 300 Hz doppler + 15 kHz SCS FDD + 10 dB SNR

Test 2B: 300 Hz doppler + 30 kHz SCS TDD + 10 dB SNR

Relevant parmeters for each test are provided in the table A.6.7.18.1.2-1. UE needs to pass Test 1A, 1B, 2A, 2B.

Table A.6.7.18.1.1-1: Applicable NR configurations for FR1 TRS based TDCP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

A.6.7.18.1.2 Test parameters

In this set of test cases there is one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.6.7.18.1.2-1. Ampliutude of TDCP is tested by using the parameters in table A.6.7.18.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured with 1 TRS set with the TRS resources in the set are configured in adjacent slot. UE is configured to perform L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.6.7.18.1.2-1: FR1 TRS based TDCP test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~2		freq1	freq1
Duplex mode	1		FDD	FDD
	2		TDD	TDD
TDD Configuration	1		N/A	N/A
	2		TDDConf.1.1	TDDConf.1.1
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	2		40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD	SR.1.1 FDD
	2		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD	CR.1.1 FDD
	2		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	CCR.1.1 FDD
	2		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1	SSB.3 FR1
	2		SSB.4 FR1	SSB.4 FR1
OCNG Patterns	1~2		OP.1	OP.1

Parameter	Config	Unit	Test 1	Test 2
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
TRS configuration	1		TRS.1.5 FDD	TRS.1.5 FDD
	2		TRS.1.5 TDD	TRS.1.5 TDD
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~2		SMTC.1	SMTC.1
reportConfigType	1~2		periodic	periodic
reportQuantity	1~2		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1~2		2	2
L1-RSRP reporting period	1~2		slot80	slot80
EPRE ratio of PSS to SSS	1~2	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc}	dBm/15 kHz	1	-98	-98
		2		
N_{oc} Note 2	dBm/SCS	1	-98	-98
		2	-95	-95
$\hat{E}_s/I_{ot}$	1~2	dB	TBD	TBD
$\hat{E}_s/N_{oc}$	1~2	dB	10	20
SSB_RP	1		-88	-78
Propagation condition	1~2		TDL-A 30 ns 10 Hz	TDL-A 30 ns 300 Hz
Antenna configuration	1~2		1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

A.6.7.18.1.3 Test Requirements

For Test 1A, the reported TDCP index shall be smaller than or equal to 6 for the 80% of the times over repeated tests

For Test 1B: the reported TDCP index shall be smaller than or equal to 5 for the 80% of the times over repeated tests

For Test 2A: the reported TDCP index shall be lrager than 8 for the 80% of the times over repeated tests

For Test 2B: the reported TDCP index shall be larger than 6 for the 80% of the times over repeated tests

A.6.7.19 RSCPD Measurements

A.6.7.19.1 RSCPD with RSTD measurement accuracy in FR1 SA in RRC_CONNECTED

A.6.7.19.1.1 Test purpose and environment

The purpose of the test is to verify that accuracy of RSCPD measurement reported with RSTD measurement is within the specified limits. This test will verify the requirements in clause 10.1.43.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.6.7.19.1.1-1.

Table A.6.7.19.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* with *dl-PRS-RSCPD-Request* from LMF via LPP [34] as defined in TS 37.355 [34], clause 6.5.12, to enable UE to perform and report RSCPD in RRC CONNECTED, shall be provided to the UE before the start of the test. The UE is configured with measurement gap pattern ID #0 or ID #24 before the test.

A.6.7.19.1.2 Test parameters

The RSCPD with RSTD accuracy test parameters are given in table A.6.7.19.1.2-1.

Table A.6.7.19.1.2-1: RSCPD with UE RSTD measurement accuracy test parameters

Parameter	Config	Unit	Test 1	
			Cell 1	Cell 2
PRS ARFCN	1,2,3		Freq1	Freq1
$BW_{channel}$	1	MHz	20: $N_{RB,c}$ = 106	
	2		20: $N_{RB,c}$ = 106	
	3		50: $N_{RB,c}$ = 133	
Duplex mode	1		FDD	
	2		TDD	
	3		TDD	
TDD configuration	1		N/A	
	2		TDDConf.1.1	
	3		TDDConf.2.1	
Measurement gap	1, 2, 3		GP#24 or GP#0	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-
	2		SR.1.1 TDD	
	3		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-
	2		CR.1.1 TDD	-
	3		CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1	
	2		SSB.1 FR1	
	3		SSB.2 FR1	
OCNG Patterns	1,2,3		OP.1	
TRS configuration	1		TRS.1.1 FDD	-

Parameter	Config	Unit	Test 1	
			Cell 1	Cell 2
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
Initial BWP Configuration	1,2,3		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1,2,3		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1	µs	-	3
	2,3		-	3
SMTC configuration	1		SMTC.2	
	2,3		SMTC.1	
PRS configuration	1		PRS.1.1 FR1	
	2		PRS.1.1 FR1	
	3		PRS.2.1 FR1	
PRS Resource slot offset	1, 2, 3	slot	0	4
Expected RSTD	1, 2, 3	µs	N/A	3
Expected RSTD uncertainty	1, 2, 3	µs	N/A	5
EPRE ratio of PSS to SSS	1,2,3	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS	1,2,3	dB	0	0
N_{oc} Note2	1,2	dBm/ SCS	-98	
	3		-95	
PRS $\hat{E}_s/I_{ot}$	1,2,3	dB	-6	-13
PRP Note3	1,2	dBm/ SCS	-103.7	-109.9
	3		-100.7	-106.9
Io Note3	1,2	dBm/ 19.08 MHz	-65.70	-65.70
	3	dBm/ 47.88 MHz	-61.72	-61.72
PRS $\hat{E}_s/N_{oc}$	1,2,3	dB	-5.7	-11.9
SSB $\hat{E}_s/N_{oc}$	1,2,3	dB	-5.7	
Propagation condition	1,2,3	-	AWGN	
Antenna configuration	1,2,3		1x2	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.

A.6.7.19.1.3 Test requirements

The RSCPD reported together with RSTD fulfils RSCPD measurement accuracy requirements specified in clause 10.1.43.2 for Cell 2.

A.6.7.20 RSCP Measurements

A.6.7.20.1 RSCP with UE Rx-Tx time difference measurement accuracy in FR1 SA

A.6.7.20.1.1 Test purpose and environment

The purpose of the test is to verify that the accuracy of RSCP measurement with UE Rx-Tx time difference measurement is within the specified limits. This test will verify the requirements in clause 10.1.44.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations in listed in table A.6.7.20.1.1-1.

Table A.6.7.20.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR1.

The *NR-Multi-RTT-ProvideAssistanceData* , *NR-Multi-RTT-RequestLocationInformation* with *nr-DL-PRS-RSCP-Request* from LMF via LPP and *NR-Multi-RTT-MeasurementCapability* as defined in TS 37.355 [34], clause 6.5.12, to enable UE to perform and report RSCP in RRC CONNECTED, shall be provided to the UE before the start of the test. The UE is configured with measurement gap pattern ID #0 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.6.7.20.1.2 Test parameters

The RSCP with UE Rx-Tx time difference accuracy test parameters are given in table A.6.7.20. 1.2-1.

Table A.6.7.20.1.2-1: RSCP with UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
RF Channel Number		1,2,3	1	1
Measurement gap		1,2,3	GP#24 or GP#0 Note 4	
DRX		1,2,3	OFF	
Time offset with Cell 1	μs	1, 2, 3	N/A	3
TDD configuration		1	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1	SR.1.1 FDD	N/A
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD	N/A
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
		1	CCR.1.1 FDD	N/A

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
Dedicated CORESET RMC configuration		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1, 2, 3	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.1.1 FDD	N/A
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1, 2, 3	DLBWP.1.1	N/A
Active UL BWP configuration		1, 2, 3	ULBWP.1.1	N/A
PRS configuration		1	PRS.1.1 FR1	PRS.1.1 FR1
		2	PRS.1.1 FR1	PRS.1.1 FR1
		3	PRS.2.1 FR1	PRS.2.1 FR1
PRS BW		1	52 PRBs	52 PRBs
		2	52 PRBs	52 PRBs
		3	48 PRBs	48 PRBs
PRS Resource slot offset	slot	1, 2, 3	0	4
SRS configuration		1	POS-SRS.1	N/A
		2	POS-SRS.1	N/A
		3	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-98	
		3	-95	
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
		3		
PRS $\hat{E}_s/I_{ot}$	dB	1	0	-6
		2		
		3		
PRS $\hat{E}_s/N_{oc}$	dB	1	2.23	-1.73
		2		
		3		
PRP Note 3	dBm/SCS kHz	1	-95.77	-99.73
		2	-95.77	-99.73
		3	-92.77	-96.73
Io	dBm/19.08 MHz	1	-61.71	-61.71
	dBm/19.08 MHz	2	-61.71	-61.71
	dBm/47.88 MHz	3	-57.73	-57.73
Propagation Condition		1, 2, 3	AWGN	

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
Note 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
Note 4: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

A.6.7.20.1.3 Test requirements

The RSCP reported with UE Rx-Tx time difference measurement fulfils RSCP measurement accuracy specified in clause 10.1.44.2 for both Cell 1 and Cell 2.

A.6.8 Measurement procedure in RRC_INACTIVE

A.6.8.1 RSTD measurements

A.6.8.1.1 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA in RRC_INACTIVE state

A.6.8.1.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 5.6.2.5 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.6.8.1.1.1-1.

Table A.6.8.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell 3. During T2 UE shall be in RRC_INACTIVE state and all three cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s).

The UE is configured with DRX cycle of 1.28 s.

The general test parameters are listed in table A.6.8.1.1.1-2, and cell specific test parameters are listed in table A.6.8.1.1.1-3 and table A.6.8.1.1.1-4.

Table A.6.8.1.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.2 FR1	
	Config 3		PRS.2.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	1.28	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			4	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets

Parameter	Unit	Value	Comment
T1	s	3	The length of the time interval from the beginning of each test
T2	s	5	The length of the time interval that follows immediately after time interval T1.

Table A.6.8.1.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08 MHz	-56.54	-56.54	-56.54
	Config 2	dBm/ 19.08 MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 47.88 MHz	-52.56	-52.56	-52.56
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.8.1.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
Io Note 4	Config 1	dBm/ 19.08 MHz	-65.43	-65.43	-65.43
	Config 2	dBm/ 96.48 MHz	-65.43	-65.43	-65.43
	Config 3	dBm/ 47.88 MHz	-61.44	-61.44	-61.44
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T2) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

A.6.8.1.1.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 5.6.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 5.6.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD1970049.

A.6.8.1.2 NR RSTD measurement reporting delay test case with reduced number of samples in RRC_INACTIVE, FR1 SA

A.6.8.1.2.1 Test Purpose and Environment

A.6.8.1.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 5.6.2 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single-sample measurements are requested by the LMF. This test is applicable to UEs that support *supportedDL-PRS-ProcessingSamples-RRC-Inactive*.

The supported test configurations are specified in table A.6.8.1.2.1-1.

Table A.6.8.1.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and in RRC_INACTIVE state during T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2. PRS resources from all three cells are transmitted within the initial DL BWP of the UE and with the same numerology as the initial DL BWP.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle in RRC_INACTIVE.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The *nr-DL-TDOA-RequestLocationInformation* IE should indicate to the UE that single-sample measurements are requested, i.e. requestedDL-PRS-ProcessingSamples-r17 is set to *requested*.

The general test parameters are listed in table A.6.8.1.2.1-2, and cell specific test parameters are listed in table A.6.8.1.2.1-3 and table A.6.8.1.2.1-4.

Table A.6.8.1.2.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
PRS Configuration	Config 1		PRS.1.2 FR1	As specified in clause A.3.31.
	Config 2		PRS.1.2 FR1	
	Config 3		PRS.2.2 FR1	
PRS Resource slot offset	Config 1, 2, 3	slots	Cell 1, 2, 3: 0	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX cycle length		s	1.28	

Parameter	Unit	Value	Comment
Radio frame receive time offset between the cells at the UE antenna connector	µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD	µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells	µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		4	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	5	The length of the time interval that follows immediately after time interval T1

Table A.6.8.1.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	0	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08 MHz	-63.94	-63.94	-63.94
	Config 2	dBm/ 19.08 MHz	-63.94	-63.94	-63.94
	Config 3	dBm/ 47.88 MHz	-59.96	-59.96	-59.96
SSB RP Note4	Config 1	dBm/SCS	-98	-Infinity	-Infinity
	Config 2	dBm/SCS	-98	-Infinity	-Infinity
	Config 3	dBm/SCS	-95	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.8.1.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	1	-1.2	-1.2
	Config 2	dB	1	-1.2	-1.2
	Config 3	dB	1	-1.2	-1.2
Io Note 4	Config 1	dBm/ 19.08 MHz	-61.18	-61.18	-61.18
	Config 2	dBm/ 19.08 MHz	-61.18	-61.18	-61.18
	Config 3	dBm/ 47.88 MHz	-57.20	-57.20	-57.20
PRS $\hat{E}_s/I_{ot}$		dB	-3	-6	-6
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that all active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols, except for slots where PRS is transmitted by any of the cells.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: Io levels apply only for symbols where PRS is transmitted.

A.6.8.1.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 5.6.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in section 5.6.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.6.8.1.3 NR RSTD measurement reporting delay test case for PRS aggregation in FR1 SA in RRC_INACTIVE state

A.6.8.1.3.1 Test purpose and environment

The purpose of the test is to verify that the RSTD measurement with PRS aggregation in RRC_INACTIVE state meets the requirements specified in clause 5.6.2.6 in AWGN propagation condition in FR1 in standalone scenario when two intra-band contiguous positioning frequency layers (PFL) are configured.

The supported test configurations are listed in table A.6.8.1.3.1-1.

Table A.6.8.1.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are 6 synchronous cells in the test: Cell 1, Cell 2, Cell 3 Cell 4, Cell 5 and Cell 6. Cell 1 is the PCell on NR RF channel 1 in FR1. Cell 2 and Cell 3 are neighbour cells on the same RF channel as Cell 1. Cell 4, Cell 5 and Cell 6 are the neighbour cells on a different NR RF channel, i.e., RF channel 2, in FR1. Cell 1 and Cell 4, Cell 2 and Cell 5, Cell 3 and Cell 6 are respectively intra-band contiguous and PRS resources are transmitted by the same Tx chain for each combination.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2, Cell 3, Cell 4, Cell 5 and Cell 6. During T2 UE shall be in RRC_INACTIVE state and all 6 cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

In *NR-TDOA-ProvideAssistanceData*, there are three *NR-linkedDL-PRS-ResourceSetID-PRS-AggregationList*. The first list indicates aggregation of PRS resource sets from Cell 1 and Cell 4, and the second list indicates aggregation of PRS resource sets from Cell 2 and Cell 5. The third list indicates aggregation of PRS resource sets from Cell 3 and Cell 6. In *NR-TDOA-RequestLocationInformation*, the IE *nr-DL-PRS-JointMeasurementRequestedPFL-List* is included and indicates aggregation of PFLs on RF channel 1 and RF channel 2.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s).

The UE is configured with DRX cycle of 1.28s.

The general test parameters are given in table A.6.8.1.3.1-2, and cell specific test parameters for T1 and T2 are listed in tables A.6.8.1.3.1-3 and A.6.8.1.3.1-4, respectively.

Table A.6.8.1.3.1-2: General test parameters for RSTD measurement with PRS aggregation reporting delay

Parameter	Unit	Value	Comment
Reference cell		Cell 1, Cell 4	Reference cells are the cells in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell 1 is the PCell in this test case.
Neighbor cells		Cell 2, Cell 3, Cell 4, Cell 5 and Cell 6	Cell 2, Cell 3, Cell 4, Cell 5 and Cell 6 appear at the first, second,

				third, fourth and fifth places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.2 FR1	
	Config 3		PRS.2.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0 and (PCI of Cell 1 – PCI of Cell 4)mod6=0 and (PCI of Cell 1 – PCI of Cell 5)mod6=0 and (PCI of Cell 1 – PCI of Cell 6)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	1.28	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2, Cell 4, Cell 5 to Cell 1: 0 Cell 3, Cell 6 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2 to Cell 6: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			6	Including the reference cells
PRS muting info			Cell 1, Cell 4: ‘10’ Cell 2, Cell 5: ‘01’	Correponds to prs-MutingInfo defined in TS 37.355 [34]

		Cell 3, Cell 6: '10'	
PRS resource RE offset		Cell 1, Cell 4: 0 Cell 2, Cell 5: 0 Cell 3, Cell 6: 1	Cell 1, Cell 2, Cell 3, Cell 4, Cell 5 and Cell 6
T1	s	3	The length of the time interval from the beginning of each test
T2	s	5	The length of the time interval that follows immediately after time interval T1.

Table A.6.8.1.3.1-3: Cell-specific test parameters for RSTD measurement with PRS aggregation reporting delay during T1

Parameter		Unit	Cell 1, Cell 4	Cell 2, Cell 5	Cell 3, Cell 6
NR RF Channel Number #			1, 2	1, 2	1, 2
Positiong frequency layer			PFL 1, 2	PFL 1, 2	PFL 1, 2
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in clause A.3.2.1 Note 1			OP.1	N/A	N/A
N_{oc} Note 3, 5	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$ Note 5		dB	10	-Infinity	-Infinity
Io Note 4, 5	Config 1	dBm/ 19.08MHz	-56.54	-56.54	-56.54
	Config 2	dBm/ 19.08MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 47.88MHz	-52.56	-52.56	-52.56
SSB RP Note4, 5	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.
Note 5: The values are defined separately for the cells from which the transmitted PRS resources are aggregated.

Table A.6.8.1.3.1-4: Cell-specific test parameters for RSTD measurement with PRS aggregation reporting delay during T2

Parameter	Unit	Cell 1, Cell 4	Cell 2, Cell 5	Cell 3, Cell 6
		T2	T2	T2
NR RF Channel Number #		1, 2	1, 2	1, 2
Positiong frequency layer		PFL 1, 2	PFL 1, 2	PFL 1, 2
Correlation Matrix and		1x2 Low	1x2 Low	1x2 Low

Antenna Configuration					
OCNG patterns defined in clause A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3, 4	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$ Note 4	Config 1	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
Io Note 3, 4	Config 1	dBm/ 19.08MHz	-65.43	-65.43	-65.43
	Config 2	dBm/ 96.48MHz	-65.43	-65.43	-65.43
	Config 3	dBm/ 47.88MHz	-61.44	-61.44	-61.44
PRS $\hat{E}_s/I_{ot}$ Note 4		dB	-6	-13	-13
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

Note 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.

Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 4: The values are defined separately for the cells from which the transmitted PRS resources are aggregated.

A.6.8.1.3.2 Test requirements

The RSTD measurement time with PRS aggregation in RRC_INACTIVE state fulfils the requirements specified in clause 5.6.2.6.

The UE shall perform and report the RSTD measurements by aggregating PRS resources from Cell 2 and Cell 5, Cell 3 and Cell 6 respectively with respect to the Cell 1 and Cell 4 from which the transmitted PRS resources are also aggregated, within the time duration specified in section 5.6.2.6 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events observed during repeated tests shall be at least 90%, where the reported RSTD measurement with PRS aggregation for each correct event shall be within the RSTD reporting range specified in clause 10.1.23A.3.

A.6.8.1.4 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA in RRC_INACTIVE state when eDRX cycle > 10.24s for non-RedCap UE

A.6.8.1.4.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 5.6.2.5 when the configured eDRX cycle is longer than 10.24s in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.6.8.1.4.1-1.

Table A.6.8.1.4.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell 3. During T2 UE shall be in RRC_INACTIVE state and all three cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.10, shall be provided to the UE during T1. The UE is configured to report positioning measurements every 20s via *reportingInterval* in *nr-DL-TDOA-RequestLocationInformation* such the value of *reportingInterval* is set to "*ri20*". The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the DL-TDOA assistance data and location information request.

The beginning of the time interval T2 is not limited to PTW.

The UE is configured with eDRX cycle of 40.96s.

The general test parameters are listed in table A.6.8.1.4.1-2, and cell specific test parameters are listed in table A.6.8.1.4.1-3 and table A.6.8.1.4.1-4.

Table A.6.8.1.4.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	

SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.2 FR1	
	Config 3		PRS.2.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2) mod 6 = 0 and (PCI of Cell 1 – PCI of Cell 3) mod 6 = 0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	1.28	
CN and RAN eDRX configuration		s	eDRX length = 40.96 PTW length = 1.28	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			3	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to *NR-MutingPattern* defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		s	5	The length of the time interval that follows immediately after time interval T1.

Table A.6.8.1.4.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter	Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number		1	1	1
Positiong frequency layer		1	1	1

Correlation Matrix and Antenna Configuration			1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in clause A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08MHz	-56.54	-56.54	-56.54
	Config 2	dBm/ 19.08MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 47.88MHz	-52.56	-52.56	-52.56
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.8.1.4.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
Io Note 4	Config 1	dBm/ 19.08MHz	-65.43	-65.43	-65.43
	Config 2	dBm/ 96.48MHz	-65.43	-65.43	-65.43
	Config 3	dBm/ 47.88MHz	-61.44	-61.44	-61.44

PRS $\hat{E}_s/I_{ot}$	dB	-6	-13	-13
Propagation Condition		AWGN		
Note 1: OCNG shall be used such that active cells (all, except Cell 3 in T2) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.				
Note 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.				
Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

A.6.8.1.4.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 5.6.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

A test is considered complete after the UE reports the first set of positioning measurements based on the configured *reportingInterval*.

The rate of the correct events for each neighbour cell observed during the repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in the clause 10.1.23.3, i.e., between RSTD_000000000 and RSTD_126083073.

A.6.8.2 PRS-RSRP measurements

A.6.8.2.1 PRS-RSRP reporting delay test case for single positioning frequency layer in RRC_INACTIVE

A.6.8.2.1.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement in RRC_INACTIVE meets the delay requirements specified in clause 5.6.3.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.8.2.1.1-1.

Table A.6.8.2.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

During T1 UE is in RRC_CONNECTED, the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.8.2.1.1-2, and cell specific test parameters are listed in table A.6.8.2.1.1-3.

Table A.6.8.2.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	1.28 s	
Time offset between serving and neighbour cells	μs	1, 2, 3	3	Synchronous cells
Expected RSTD	μs	1, 2, 3	3	
Expected RSTD uncertainty	μs	1, 2, 3	5	
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	6	

Table A.6.8.2.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.8.2.1.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 5.6.3.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.8.2.2 PRS-RSRP reporting delay test case with reduced number of samples in RRC_INACTIVE

A.6.8.2.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement meets the delay requirements specified in clause 5.6.3.5 in an environment with AWGN propagation conditions when single-sample measurements are requested by the LMF. This test is applicable to UEs that support *supportedDL-PRS-ProcessingSamples-RRC-Inactive* .

The supported test configurations are specified in table A.6. 8.2.2.1-1.

Table A.6. 8.2.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and in RRC_INACTIVE state during T2. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2. PRS resources from both cells are transmitted within the initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle in RRC_INACTIVE.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-AoD assistance* data and location information request.

The *nr-DL-AoD-RequestLocationInformation* IE should indicate to the UE that single-sample measurements are requested, i.e. requestedDL-PRS-ProcessingSamples-r17 is set to m1.

The general test parameters are listed in table A.6.8.2.2.1-2, and cell specific test parameters are listed in table A.6.8.2.2.1-3.

Table A.6.8.2.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX cycle length	s	1, 2, 3	1.28	
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
T1	s	1, 2, 3	3	
T2	s	1, 2, 3	5	

Table A.6.8.2.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Dedicated CORESET RMC configuration		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration Note 5		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS Resource slot offset	slots	1, 2, 3	0		0	
PRS muting info		1, 2, 3	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	0	-Infinity	-6
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	2.23	-Infinity	-1.73
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-95.77	-Infinity	-99.73
		2	-Infinity	-95.77	-Infinity	-99.73
		3	-Infinity	-92.77	-Infinity	-96.73
SS-RSRP Note 3	dBm/SCS kHz	1	-98	-98	-Infinity	-98
		2	-98	-98	-Infinity	-98
		3	-95	-95	-Infinity	-95
Io Note 3	dBm/19.08 MHz	1	N/A	-61.71	N/A	-61.71
	dBm/19.08 MHz	2		-61.71		-61.71
	dBm/47.88 MHz	3		-57.73		-57.73
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io levels apply only for symbols where PRS is transmitted.
NOTE 4: OCNG shall be used such that all active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols, except for slots where PRS is transmitted by any of the cells.
NOTE 5: Void.

A.6.8.2.2.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 5.6.3.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.8.2.3 PRS-RSRP reporting delay test case in RRC_INACTIVE state in FR1 with eDRX cycle > 10.24s

A.6.8.2.3.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement in RRC_INACTIVE with eDRX meets the delay requirements specified in clause 5.6.3.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.8.2.3.1-1.

Table A.6.8.2.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

During T1 UE is in RRC_CONNECTED, the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.8.2.3.1-2, and cell specific test parameters are listed in table A.6.8.2.3.1-3.

Table A.6.8.2.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{RB,c}$ = 106	
		2	20: $N_{RB,c}$ = 106	
		3	50: $N_{RB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX	s	1, 2, 3	1.28	
eDRX cycle length (for both RAN and CN)	s	1, 2, 3	40.96	
PTW window length	s	1, 2, 3	1.28	
Reporting periodicity	s	1, 2, 3	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34].

Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	

Table A.6.8.2.3.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	‘10’		‘01’	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	AWGN			

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.8.2.3.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 5.6.3.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

A test is considered complete after the UE reports the first set of positioning measurements based on the configured *reportingInterval*.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.8.3 UE Rx-Tx time difference measurements

A.6.8.3.1 UE Rx-Tx time difference measurement for single positioning frequency layer in FR1 SA

A.6.8.3.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement in RRC_INACTIVE state meets the requirements specified in clause 5.6.4 in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations in listed in table A.6.8.3.1.1-1.

Table A.6.8.3.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.6.8.3.1.1-2 and table A.6.8.3.1.1-3 respectively.

Table A.6.8.3.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].

Parameter	Unit	Test configuration	Value	Comment
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX cycle		1, 2, 3	1.28 s	
Time offset between serving and neighbour cells	μs	1, 2, 3	3	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	

Table A.6.8.3.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS muting info		1, 2, 3	‘10’		‘01’	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
SRS configuration		1	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

A.6.8.3.1.2 Test requirements

The UE Rx-Tx time difference measurement time in RRC_INACTIVE state fulfils the requirements specified in clause 5.6.4.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.6.8.3.2 UE Rx-Tx time difference measurement with reduced number of samples in RRC_INACTIVE, FR1 SA

A.6.8.3.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 5.6.4.5 in AWGN propagation condition in FR1 in standalone scenario when single-sample measurements are requested by the LMF. This test is applicable to UEs that support *supportedDL-PRS-ProcessingSamples-RRC-Inactive*.

The supported test configurations in listed in table A.6.8.3.2.1-1.

Table A.6.8.3.2.1-1: Supported test configurations

Configuration	Description

1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and in RRC_INACTIVE state during T2. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2. PRS resources from both cells are transmitted within the initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle in RRC_INACTIVE.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request.

The *nr-Multi-RTT-RequestLocationInformation* IE should indicate to the UE that single-sample measurements are requested, i.e. requestedDL-PRS-ProcessingSamples-r17 is set to m1.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.6.8.3.2.1-2 and table A.6.8.3.2.1-3 respectively.

Table A.6.8.3.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX cycle length	s	1, 2, 3	1.28	
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
T1	s	1, 2, 3	3	
T2	s	1, 2, 3	5	

Table A.6.8.3.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration Note 5		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS Resource slot offset	slots	1, 2, 3	0		0	
PRS muting info		1, 2, 3	‘10’		‘01’	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	0	-Infinity	-6
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	2.23	-Infinity	-1.73
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-95.77	-Infinity	-99.73
		2	-Infinity	-95.77	-Infinity	-99.73
		3	-Infinity	-92.77	-Infinity	-96.73
SS-RSRP Note 3	dBm/SCS kHz	1	-98	-98	-98	-98
		2	-98	-98	-98	-98
		3	-95	-95	-95	-95
Io Note 3	dBm/19.08 MHz	1	N/A	-61.71	N/A	-61.71
	dBm/19.08 MHz	2		-61.71		-61.71
	dBm/47.88 MHz	3		-57.73		-57.73
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io levels apply only for symbols where PRS is transmitted.
NOTE 4: OCNG shall be used such that all active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols, except for slots where PRS is transmitted by any of the cells.
NOTE 5: Void.

A.6.8.3.2.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 5.6.4.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.6.8.3.3 UE Rx-Tx time difference measurement for single positioning frequency layer with eDRX > 10.24s in FR1 SA

A.6.8.3.3.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 5.6.4.5 for UE Rx-Tx measurements in RRC_INACTIVE with eDRX. The tests are conducted under AWGN propagation condition with the UE operating in FR1 stand-alone mode and configured to perform UE Rx-Tx measurements on a single positioning frequency layer (PFL) in FR1.

The supported test configuration in listed in table A.6.8.3.3.1-1.

Table A.6.8.3.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB and PRS SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB and PRS SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB and PRS SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and in RRC_INACTIVE state during T2. Cell 1 and Cell 2 transmit PRS only during the second time interval of duration T2. Similarly, the UE is configured to transmit positioning SRS during only during the second time interval of duration T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle in RRC_INACTIVE.

The general test parameters and cell specific test parameters are as given in table A.6.8.3.3.1-2 and table A.6.8.3.3.1-3, respectively.

Table A.6.8.3.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].

Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	20: $N_{RB,c}$ = 106	
		2	20: $N_{RB,c}$ = 106	
		3	50: $N_{RB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX cycle		1, 2, 3	1.28s	
eDRX cycle length (for both RAN and CN)	s	1, 2, 3	40.96	
PTW window length	s	1, 2, 3	1.28	
Reporting periodicity	s	1, 2, 3	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34]
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	

Table A.6.8.3.3.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			

		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
SRS configuration		1	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	AWGN			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

A.6.8.3.3.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 5.6.4.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

A test is considered complete after the UE reports the first set of positioning measurements based on the configured *reportingInterval*.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.6.8.3.4 UE Rx-Tx time difference measurements with PRS bandwidth aggregation in FR1 SA

A.6.8.3.4.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 5.6.4.6 for UE Rx-Tx measurements with PRS bandwidth aggregation. The tests are conducted under AWGN propagation condition with the UE operating in FR1 stand-alone mode and configured to perform UE Rx-Tx measurements by aggregating two intra-band contiguous positioning frequency layers (PFLs) in FR1.

The supported test configurations in listed in table A.6.8.3.4.1-1.

Table A.6.8.3.4.1-1: Supported test configurations

PCell configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: Cell 1 (PCell) and Cell 2 (neighbor cell). Each cell is sssociated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* TS 37.355 [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel #1. In addition, both cells/TRPs transmit DL PRS in two intra-band contiguous PFLs in RF channel #1 and RF channel #2. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and in RRC_INACTIVE state during T2. Cell 1 and Cell 2 transmit PRS only during the second time interval of duration T2. Similarly, the UE is configured to transmit positioning SRS during only during the second time interval of duration T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE at least ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle in RRC_INACTIVE.

The *NR-Multi-RTT-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2.

The *NR-Multi-RTT-RequestLocationInformation* message provided to the UE must request bandwidth aggregated measurements via *jointMeasurementsReq* and *nr-DL-PRS-JointMeasurementRequestedPFL-List.*

The general test parameters and cell specific test parameters are as given in table A.6.8.3.4.1-2 and table .6.8.3.4.1-3 respectively.

Table A.6.8.3.4.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].

RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2, all signals/channels except PRS in PFL2 are allocated within this channel.
			2	For both Cell 1 and Cell 2, only PRS in PFL2 is allocated within this channel.
$BW_{channel}$	MHz	1	20: $N_{RB,c}$ = 106	For both RF channels
		2	20: $N_{RB,c}$ = 106	
		3	50: $N_{RB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX cycle	s	1, 2, 3	1.28	
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells/TRPs
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	

Table A.6.8.3.4.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns Note 1		1, 2, 3	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1,4						
EPRE ratio of OCNG to OCNG DMRS Note 1, 4						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			

Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration (for both PFL1 and PFL2)		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS Resource slot offset	slots	1, 2, 3	0		0	
PRS muting info (*dl-PRS-MutingOption1* for both PFL1 and PFL2)		1, 2, 3	'10'		'01'	
SRS configuration		1	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-13
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-3	-Infinity	-13
		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-Infinity	-101	-Infinity	-111
		2	-Infinity	-101	-Infinity	-111
		3	-Infinity	-98	-Infinity	-108
Io Note 3 (on symbols where PRS is not allocated)	dBm/19.08 MHz	1	N/A	-65.05	N/A	-65.05
	dBm/19.08 MHz	2		-65.05		-65.05
	dBm/47.88 MHz	3		-61.06		-61.06
Propagation Condition		1, 2, 3	AWGN			

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.

Note 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

A.6.8.3.4.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 5.6.4.6.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25A.2.

A.6.8.4 PRS-RSRPP measurements

A.6.8.4.1 PRS-RSRPP reporting delay test case for single positioning frequency layer in FR1 in RRC_INACTIVE state

A.6.8.4.1.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement meets the delay requirements specified in clause 5.6.5.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.8.4.1.1-1.

Table A.6.8.4.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2. During T2 UE shall be in RRC_INACTIVE state and all both cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.8.4.1.1-2, and cell specific test parameters are listed in table A.6.8.4.1.1-3.

Table A.6.8.4.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX	s	1, 2, 3	1.28	ON

Parameter	Unit	Test configuration	Value	Comment
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	5	

Table A.6.8.4.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-10
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ µs and $f_D = 5$ Hz			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.8.4.1.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 5.6.5.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.8.4.2 PRS-RSRPP reporting delay test case for single positioning frequency layer in FR1 in RRC_INACTIVE state for reduced number of samples

A.6.8.4.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement meets the delay requirements specified in clause 5.6.5.5 in an environment with AWGN propagation conditions for reduced number of samples. In this test UE that supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* is configured by LMF to perform PRS measurement with reduced number of samples.

The supported test configurations are specified in table A.6.8.4.2.1-1.

Table A.6.8.4.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2. During T2 UE shall be in RRC_INACTIVE state and both cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.8.4.2.1-2, and cell specific test parameters are listed in table A.6.8.4.2.1-3.

Table A.6.8.4.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{PRB,c}$ = 106	
		2	20: $N_{PRB,c}$ = 106	
		3	50: $N_{PRB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX	s	1, 2, 3	1.28	ON
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	5	

Table A.6.8.4.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS BW		1,2,3	48 PRBs		48PRBs	
PRS muting info		1, 2, 3	‘10’		‘01’	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	0	-Infinity	-6
		2				

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	2.23	-Infinity	-1.73
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-95.77	-Infinity	-99.73
		2	-Infinity	-95.77	-Infinity	-99.73
		3	-Infinity	-92.77	-Infinity	-96.73
SS-RSRP Note 3	dBm/SCS kHz	1	-88	-100	-Infinity	-104
		2	-88	-100	-Infinity	-104
		3	-85	-97	-Infinity	-101
Io	dBm/19.08 MHz	1	N/A	-61.71	N/A	-61.71
	dBm/19.08 MHz	2		-61.71		-61.71
	dBm/47.88 MHz	3		-57.73		-57.73
Propagation Condition		1, 2, 3	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, τ_d = 0.45 µs and f_D = 5 Hz			

NOTE 1: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.8.4.2.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 5.6.5.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.8.4.3 PRS-RSRPP reporting delay in RRC_INACTIVE with eDRX

A.6.8.4.3.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement meets the delay requirements specified in clause 5.6.5.5 in an environment with a 2-tap channel propagation conditions in RRC_INACTIVE when configured with eDRX. The supported test configurations are specified in table A.6.8.4.3.1-1.

Table A.6.8.4.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2. During T2 UE shall be in RRC_INACTIVE state and all both cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34], shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.8.4.3.1-2, and cell specific test parameters are listed in table A.6.8.4.3.1-3.

Table A.6.8.4.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{RB,c}$ = 106	
		2	20: $N_{RB,c}$ = 106	
		3	50: $N_{RB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX	s	1, 2, 3	1.28	ON
CN and RAN eDRX configuration		1, 2, 3	eDRX cycle = 40.96s PTW length = 1.28s	
reportingInterval	s	1, 2, 3	20	PRS measurement reporting periodicity
Time offset between serving and neighbour cells	μs	1, 2, 3	3	Synchronous cells
Expected RSTD	μs	1, 2, 3	3	
Expected RSTD uncertainty	μs	1, 2, 3	5	
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	5	

Table A.6.8.4.3.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			

Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-10
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	Two-tap channel defined in 38.101-4 [21] annex B.2.4, a = 1, τ_d = 0.45 μs and f_D = 5 Hz			

Note 1: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.8.4.3.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 5.6.5.5 with $T_{available_PRS}$ = 1.28s, starting from the beginning of time interval T2.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The test is considered complete after the UE reports the first set of positioning measurements based on the configured reportingInterval.

A test is considered complete after the UE reports the first set of positioning measurements based on the configured *reportingInterval*.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.8.5 RSCPD Measurements

A.6.8.5.1 DL RSCPD reported with RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA in RRC_INACTIVE state

A.6.8.5.1.1 Test Purpose and Environment

The purpose of the test is to verify that the DL RSCPD reported with RSTD measurement meets the requirements specified in clause 5.6.7.5 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The test environment is the same as in clause A.6.8.1.1 with the following additional configuration in table A.6.8.5.1.1-1 and description.

In *NR-DL-TDOA-RequestLocationInformation,* the UE is configured to perform DL RSCPD measurement via *dl-PRS-RSCPD-Request*. The UE also is configured to perform both RSCPD and RSTD measurements within the time window indicated to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig*.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s) to be measured within the configured time window.

Table A.6.8.5.1.1-1: Time window configuration

Parameter		Unit	Value	Comment
Indicated time window configuration	Config 1,2,3		MTW.1	As specified in clause A.3.38

A.6.8.5.1.2 Test Requirements

The DL RSCPD reported with RSTD measurement time fulfils the requirements specified in clause 5.6.7.5.

The UE shall perform and report the DL RSCPD and DL RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6.7.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3 and the reported RSCPD measurement for each correct event shall be within the RSCPD reporting range specified in clause 10.1.43.3.

A.6.8.6 RSCP Measurements

A.6.8.6.1 DL RSCP with UE Rx-Tx time difference measurement for single positioning frequency layer in FR1 SA

A.6.8.6.1.1 Test purpose and environment

The purpose of the test is to verify that the DL RSCP and UE Rx-Tx time difference measurements in RRC_INACTIVE state meet the requirements specified in clause 5.6.8.5 in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured for both DL RSCP measurement and UE Rx-Tx time difference measurement.

The supported test configurations are listed in table A.6.8.6.1.1-1.

Table A.6.8.6.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message as defined in TS 37.355 [34], shall be provided to the UE during T1. In *NR-Multi-RTT-RequestLocationInformation*, the UE is configured to perform DL RSCP measurement via *nr-DL-PRS-RSCP-Request*. The UE is configured to perform both DL RSCP and UE Rx-Tx time difference measurements within the time window indicated to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig* but the time window periodicity is not configured. The last slot containing the two messages for the multi-RTTI assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 shall be aligned with the start of the configured time window containing the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are listed in table A.6.8.6.1.1-2 and table A.6.8.6.1.1-3.

Table A.6.8.6.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	20: $N_{RB,c}$ = 106	
		2	20: $N_{RB,c}$ = 106	
		3	50: $N_{RB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX cycle		1, 2, 3	1.28s	
Time offset between serving and neighbour cells	μs	1, 2, 3	3	Synchronous cells
Time window configuration		1, 2, 3	MTW.2	As specified in clause A.3.38
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	10	

Table A.6.8.6.1.1-3: Cell specific test parameters

Parameter	Unit		Cell 1	Cell 2

		Test configuration	T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.2 FR1		PRS.2.2 FR1	
PRS muting info		1, 2, 3	‘10’		‘01’	
SRS configuration		1	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
PRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105

Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	AWGN			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

A.6.8.6.1.2 Test requirements

The DL RSCP with UE Rx-Tx time difference measurement time in RRC_INACTIVE state fulfils the requirements specified in clause 5.6.8.

The UE shall perform and report the DL RSCP and UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified DL RSCP with UE Rx-Tx time difference measurement time specified in clause 5.6.8 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported DL RSCP measurement for each correct event shall be within the DL RSCP reporting range specified in clause 10.1.44 and the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.

A.6.9 Measurement performance requirements in RRC_INACTIVE

A.6.9.1 RSTD measurements

A.6.9.1.1 RSTD measurement accuracy test case for single positioning frequency layer in FR1 in RRC_INACTIVE state

A.6.9.1.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement in RRC_INACTIVE state meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.9.1.1.1-1.

Table A.6.9.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The UE is configured with DRX cycle of 1.28 s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 5.6.2.5.

Table A.6.9.1.1.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN	1~3		freq1	Freq1	freq1	Freq1
$BW_{channel}$	1	MHz	20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	2		20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	3		50: $N_{PRB,c}$ = 133		50: $N_{PRB,c}$ = 133	
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
TDD configuration	1		N/A		N/A	
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1		SSB.1 FR1	
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~3		OP.1		OP.1	
TRS configuration	1		TRS.1.1 FDD	-	TRS.1.1 FDD	
	2		TRS.1.1 TDD		TRS.1.1 TDD	
	3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Time offset with Cell 1	1	µs	-	3	-	3
	2,3		-	3	-	3
SMTC configuration	1		SMTC.2		SMTC.2	
	2,3		SMTC.1		SMTC.1	
PRS configuration	1		PRS.1.3 FR1		PRS.1.4 FR1	
	2		PRS.1.3 FR1		PRS.1.4 FR1	
	3		PRS.2.3 FR1		PRS.2.4 FR1	
PRS muting info	1~3		‘10’	‘01’	‘10’	‘01’
Expected RSTD	1, 2, 3	µs	N/A	3	N/A	3
Expected RSTD uncertainty	1, 2, 3	µs	N/A	5	N/A	5
EPRE ratio of PSS to SSS	1~3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS[Note 1]						

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of OCNG to OCNG DMRS Note 1						
N_{oc} Note2	1,2	dBm/ SCS	-98		-98	
	3		-95		-95	
$\hat{E}_s/I_{ot}$	1~3	dB	-6	-13	-6	-13
PRS-RSRP Note3	1,2	dBm/SCS	-103.7	-109.9	-103.7	-109.9
	3		-100.7	-106.9	-100.7	-106.9
Io Note3	1,2	dBm/ 19.08 MHz	-65.70	-65.70	-65.70	-65.70
	3	dBm/ 47.88 MHz	-61.72	-61.72	-61.72	-61.72
$\hat{E}_s/N_{oc}$	1~3	dB	-5.7	-11.9	-5.7	-11.9
Propagation condition	1~3	-	AWGN		AWGN	
Antenna configuration	1~3		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Void.

A.6.9.1.1.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.6.9.1.2 RSTD measurement accuracy test case with reduced number of samples for single positioning frequency layer in FR1 in RRC_INACTIVE state

A.6.9.1.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement in RRC_INACTIVE state meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions. In this test UE that supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* is configured by LMF to perform PRS measurement with reduced number of samples.

The supported test configurations are specified in table A.6.9.1.2.1-1.

Table A.6.9.1.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The UE is configured with DRX cycle of 1.28 s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 5.6.2.5.

Table A.6.9.1.2.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN	1~3		freq1	Freq1	freq1	Freq1
$BW_{channel}$	1	MHz	20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	2		20: $N_{PRB,c}$ = 106		20: $N_{PRB,c}$ = 106	
	3		50: $N_{PRB,c}$ = 133		50: $N_{PRB,c}$ = 133	
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
TDD configuration	1		N/A		N/A	
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1		SSB.1 FR1	
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~3		OP.1		OP.1	
TRS configuration	1		TRS.1.1 FDD	-	TRS.1.1 FDD	
	2		TRS.1.1 TDD		TRS.1.1 TDD	
	3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		-	
Time offset with Cell 1	1	µs	-	3	-	3
	2,3		-	3	-	3
SMTC configuration	1		SMTC.2		SMTC.2	
	2,3		SMTC.1		SMTC.1	
PRS configuration	1		PRS.1.3 FR1		PRS.1.4 FR1	
	2		PRS.1.3 FR1		PRS.1.4 FR1	
	3		PRS.2.3 FR1		PRS.2.4 FR1	
PRS BW	1,2,3		52 PRBs for test 1			
PRS muting info	1~3		'10'	'01'	'10'	'01'
Expected RSTD	1, 2, 3	µs	N/A	3	N/A	3
Expected RSTD uncertainty	1, 2, 3	µs	N/A	5	N/A	5
EPRE ratio of PSS to SSS	1~3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
N_{oc} Note2	1,2	dBm/ SCS	-98		-98	
	3		-95		-95	
$\hat{E}_s / I_{ot}$	1~3	dB	-3	-6	-3	-6
PRS-RSRP Note3	1,2	dBm/SCS	-99.44	-101.65	-99.44	-101.65
	3		-96.44	-98.65	-96.44	-98.65

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SS-RSRP[Note3]	1,2	dBm/SCS	-99.44	-101.65	-99.44	-101.65
	3		-96.44	-98.65	-96.44	-98.65
Io[Note3]	1,2	dBm/ 19.08 MHz	-63.63	-63.63	-63.63	-63.63
	3	dBm/ 47.88 MHz	-59.65	-59.65	-59.65	-59.65
$\hat{E}_s / N_{oc}$	1~3	dB	-1.44	-3.65	-1.44	-3.65
Propagation condition	1~3	-	AWGN		AWGN	
Antenna configuration	1~3		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Void.

A.6.9.1.2.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.6.9.1.3 RSTD measurement accuracy for PRS aggregation in FR1 in RRC_INACTIVE state

A.6.9.1.3.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement with PRS aggregation on two PFLs meets the accuracy requirements specified in clause 10.1.23A.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.9.1.3.1-1.

Table A.6.9.1.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

In the test there are four synchronous cells: Cell 1, Cell 2, Cell 3 and Cell 4. Cell 1 is the reference as well as the PCell on NR RF channel #1 in FR1. Cell 2 is a neighbour cell on the same NR RF channel as Cell 1. Cell 3 and Cell 4 are neighbor cells in a different NR RF channel #2 in FR1. Cell 1 and Cell 3 are intra-band contiguous, and PRS resources from Cell 1 and Cell 3 are transmitted by the same Tx chain. Cell 2 and Cell 4 are intra-band contiguous, and PRS resources from Cell 2 and Cell 4 are transmitted by the same Tx chain.

The UE is configured with DRX cycle of 1.28 s.

The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34], shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 5.6.2.6.

In *NR-TDOA-ProvideAssistanceData*, there are two *NR-linkedDL-PRS-ResourceSetID-PRS-AggregationList*. The first list indicates aggregation of resource sets from Cell 1 and Cell 3, and the second list indicates aggregation of resource

sets from Cell 2 and Cell 4. In *NR-TDOA-RequestLocationInformation*, *nr-DL-PRS-JointMeasurementRequestedPFL-List* is included, and indicates aggregation of PFLs on NR RF channel #1 and NR RF channel #2.

Table A.6.9.1.3.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Cell 1	Cell 2	Cell 3	Cell 4
PRS ARFCN	1,2,3		freq1	freq1	freq2	freq2
$BW_{channel}$	1	MHz	20: $N_{RB,c}$ = 106			
	2		20: $N_{RB,c}$ = 106			
	3		50: $N_{RB,c}$ = 133			
Duplex mode	1		FDD			
	2		TDD			
	3		TDD			
TDD configuration	1		N/A			
	2		TDDConf.1.1			
	3		TDDConf.2.1			
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	-	-
	2		SR.1.1 TDD	-	-	
	3		SR.2.1 FDD	-	-	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	-	-
	2		CR.1.1 TDD	-	-	-
	3		CR.2.1 FDD	-	-	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	-	-
	2		CCR.1.1 TDD	-	-	-
	3		CCR.2.1 TDD	-	-	-
SSB configuration	1		SSB.1 FR1			
	2		SSB.1 FR1			
	3		SSB.2 FR1			
OCNG Patterns	1,2,3		OP.1			
TRS configuration	1		TRS.1.1 FDD	-	-	-
	2		TRS.1.1 TDD	-	-	-
	3		TRS.1.2 TDD	-	-	-
Initial BWP Configuration	1,2,3		DLBWP.0.1 ULBWP.0.1			
Dedicated BWP configuration	1,2,3		DLBWP.1.1 ULBWP.1.1			
Time offset with Cell 1	1	µs	-	3	0	3
	2,3		-	3	0	3
PRS configuration	1		PRS.1.2 FR1			
	2		PRS.1.2 FR1			
	3		PRS.2.2 FR1			
PRS Resource slot offset	1, 2, 3	slot	0	4	0	4
Expected RSTD	1, 2, 3	µs	N/A	3	0	3
Expected RSTD uncertainty	1, 2, 3	µs	N/A	5	0	5
EPRE ratio of PSS to SSS	1,2,3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS	1,2,3	dB	0	0	0	0
N_{oc} Note2	1,2	dBm/ SCS	-98		-98	
	3		-95		-95	
PRS $\hat{E}_s/I_{ot}$	1,2,3	dB	-6	-13	-6	-13

PRP[Note3]	1,2	dBm/SCS	-104	-111	-104	-111
	3		-101	-108	-101	-108
Io[Note3]	1,2	dBm/ 19.08MHz	-65.98	-66.74	-65.98	-66.74
	3	dBm/ 47.88MHz	-62.00	-62.76	-62.00	-62.76
PRS $\hat{E}_s / N_{oc}$	1,2,3	dB	-6	-13	-6	-13
Propagation condition	1,2,3	-	AWGN		AWGN	
Antenna configuration	1,2,3		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.9.1.3.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23A.2.

A.6.9.2 PRS-RSRP measurements

A.6.9.2.1 SA: measurement accuracy with PRS in FR1 in RRC_INACTIVE

A.6.9.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRP measurement accuracy in RRC_INACTIVE is within the specified limits. This test will verify the requirements in clauses 10.1.24.2.1 and 10.1.24.2.2.

A.6.9.2.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.9.2.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in A.6.9.2.1.2-2. In all test cases, Cell 1 is the PCell.

Table A.6.9.2.1.2-1: PRS-RSRP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.9.2.1.2-2: PRS-RSRP test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	20: $N_{PRB,c}$ = 106			
	Config 2		20: $N_{PRB,c}$ = 106			
	Config 3		50: $N_{PRB,c}$ = 133			
BWP BW	Config 1		20: $N_{PRB,c}$ = 106			
	Config 2		20: $N_{PRB,c}$ = 106			
	Config 3		50: $N_{PRB,c}$ = 133			
Downlink initial BWP configuration			DLBWP.0.1			
Uplink initial BWP configuration			ULBWP.0.1			
DRX Cycle		ms	1280			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD	
PRS configuration	Config 1		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 2		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 3		PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.4 FR1	PRS.2.4 FR1
PRS Resource slot offset (slot)	Config 1,2,3	slot	0	4	0	4
SSB configuration	Config 1		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1	Config 1	ms	-	3	-	3
	Config 2,3	µs	-	3	-	3
SMTC configuration	Config 1		SMTC.2			
	Config 2,3		SMTC.1			
OCNG Patterns			OCNG pattern 1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	Config 1,2	dBm/15 kHz	-98		-98	
	Config 3		-98		-98	

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
N_{oc} Note2	Config 1,2		dBm/SCS	-98		-98	
	Config 3			-95		-95	
$\hat{E}_s/I_{ot}$			dB	-2.41	-12.12	-2.41	-12.12
$\hat{E}_s/N_{oc}$			dB	-2	-10	-2	-10
PRS-RSRP Note3	Config 1, 2		dBm/SCS	-100	-108	-100	-108
	Config 3			-97	-105	-97	-105
Io Note3	Config 1,2		dBm/19.08 MHz	-64.57		-64.57	
	Config 3		dBm/47.88 MHz	-60.59		-60.59	
Propagation condition				AWGN			
Antenna configuration				1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Void.
NOTE 6: Void

A.6.9.2.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.24.2.1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1.24.2.2.

A.6.9.2.2 SA: measurement accuracy with PRS in FR1 with reduced number of samples in RRC_INACTIVE state

A.6.9.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRP measurement accuracy is within the specified limits provided that PRS is transmitted within the initial BWP of the UE. UE can support *supportedDL-PRS-ProcessingSamples-RRC-Inactive*, and the LMF indicates the UE to perform positioning measurements with reduced number of samples N_{sample} via *reducedDL-PRS-ProcessingSamples*. This test will verify the requirements in clauses 10.1.24.2.1 and 10.1.24.2.2.

A.6.9.2.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.9.2.2.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in A.6.9.2.2.2-2. In all test cases, Cell 1 is the PCell.

Table A.6.9.2.2.2-1: PRS-RSRP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.9.2.2.2-2: PRS-RSRP test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	20: $N_{PRB,c}$ = 106			
	Config 2		20: $N_{PRB,c}$ = 106			
	Config 3		50: $N_{PRB,c}$ = 133			
BWP BW	Config 1		20: $N_{PRB,c}$ = 106			
	Config 2		20: $N_{PRB,c}$ = 106			
	Config 3		50: $N_{PRB,c}$ = 133			
Downlink initial BWP configuration			DLBWP.0.1			
Uplink initial BWP configuration			ULBWP.0.1			
DRX Cycle		s	1.28			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD	
PRS configuration	Config 1		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 2		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 3		PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.4 FR1	PRS.2.4 FR1
PRS BW	Config 1		52 PRBs	52 PRBs		
	Config 2		52 PRBs	52 PRBs		
	Config 3		48 PRBs	48 PRBs		
PRS Resource slot offset (slot)	Config 1,2,3	slot	0	4	0	4
SSB configuration	Config 1		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1	Config 1	ms	-	3	-	3
	Config 2,3	µs	-	3	-	3
SMTC configuration	Config 1		SMTC.2			
	Config 2,3		SMTC.1			
OCNG Patterns			OCNG pattern 1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
EPRE ratio of PRS to SSS						
N_{oc} Note2	Config 1,2	dBm/15Khz	-98		-98	
	Config 3					
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s/I_{ot}$		dB	0	-6	0	-6
$\hat{E}_s/N_{oc}$		dB	2.23	-1.73	2.23	-1.73
PRS-RSRP Note3	Config 1, 2	dBm/SCS	-95.77	-99.73	-95.77	-99.73
	Config 3		-92.77	-96.73	-92.77	-96.73
Io Note3	Config 1,2	dBm/19.08 MHz	-61.71		-61.71	
	Config 3	dBm/47.88 MHz	-57.73		-57.73	
Propagation condition			AWGN			
Antenna configuration			1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.9.2.2.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.24.2.1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1.24.2.2.

A.6.9.3 UE Rx-Tx time difference measurements

A.6.9.3.1.1 UE Rx-Tx time difference measurement accuracy in FR1 SA

A.6.9.3.1.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.25.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario.

The supported test configurations in listed in table A.6.9.3.1.1.1-1.

Table A.6.9.3.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR1.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE before the start of the test.

The UE is configured to transmit SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.6.9.3.1.1.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.6.9.3.1.1.1-1.

Table A.6.9.3.1.1.1-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
RF Channel Number		1,2,3	1	1	1	1
DRX	s	1,2,3	1.28		1.28	
Time offset with Cell 1	μs	1, 2, 3	N/A	3	N/A	3
TDD configuration		1	N/A	N/A	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1	SR.1.1 FDD	N/A	SR.1.1 FDD	N/A
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD	N/A	CR.1.1 FDD	N/A
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD	N/A	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1	OP.1	OP.1	OP.1
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1	N/A	DLBWP.0.1 ULBWP.0.1	N/A
PRS configuration		1	PRS.1.1 FR1	PRS.1.1 FR1	PRS.1.2 FR1	PRS.1.2 FR1
		2	PRS.1.1 FR1	PRS.1.1 FR1	PRS.1.2 FR1	PRS.1.2 FR1
		3	PRS.2.1 FR1	PRS.2.1 FR1	PRS.2.2 FR1	PRS.2.2 FR1
PRS Resource slot offset	slot	1, 2, 3	0	4	0	4
SRS configuration		1	POS-SRS.1	N/A	POS-SRS.1	N/A
		2	POS-SRS.1	N/A	POS-SRS.1	N/A
		3	POS-SRS.2	N/A	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1	-98		-98	
		2	-98		-98	
		3	-95		-95	
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	-12.12	-2.41	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-2	-10	-2	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-100	-108	-100	-108
		2	-100	-108	-100	-108
		3	-97	-105	-97	-105
Io	dBm/19.08 MHz	1	-64.57	-64.57	-64.57	-64.57

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
	dBm/19.08 MHz	2	-64.57	-64.57	-64.57	-64.57
	dBm/47.88 MHz	3	-60.59	-60.59	-60.59	-60.59
Propagation Condition		1, 2, 3	AWGN		AWGN	

NOTE 1: Void.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.9.3.1.1.3 Test requirements

The UE Rx-Tx time difference measurement time fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25.2 for both Cell 1 and Cell 2.

A.6.9.3.2 UE Rx-Tx time difference measurement accuracy with reduced number of samples

A.6.9.3.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy with reduced number of samples in RRC_INACTIVE state is within the specified limits. This test will verify the requirements in clause 10.1.25.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations in listed in table A.6.9.3.2.1-1.

Table A.6.9.3.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34, clause 6.5.12.1], shall be provided to the UE before the start of the test. The UE is configured to measure UE Rx-Tx time difference using reduced number of samples via *requestedDL-PRS-ProcessingSamples* in *NR-Multi-RTT-RequestLocationInformation*.

UE shall be configured to enter into RRC_INACTIVE state before the start of the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.6.9.3.2.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.6.9.3.2.2-1.

Table A.6.9.3.2.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
RF Channel Number		1,2,3	1	1
DRX cycle		1,2,3	1.28 s	
Time offset with Cell 1	μs	1, 2, 3	N/A	3
TDD configuration		1	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1	SR.1.1 FDD	N/A
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD	N/A
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1, 2, 3	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.1.1 FDD	N/A
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1	N/A
PRS configuration		1	PRS.1.1 FR1	PRS.1.1 FR1
		2	PRS.1.1 FR1	PRS.1.1 FR1
		3	PRS.2.1 FR1	PRS.2.1 FR1
PRS BW		1	52 PRBs	52 PRBs
		2	52 PRBs	52 PRBs
		3	48 PRBs	48 PRBs
PRS Resource slot offset	slot	1, 2, 3	0	4
SRS configuration		1	POS-SRS.1	N/A
		2	POS-SRS.1	N/A
		3	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-98	
		3	-95	
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
		3		
PRS $\hat{E}_s/I_{ot}$	dB	1	0	-6
		2		
		3		
PRS $\hat{E}_s/N_{oc}$	dB	1	2.23	-1.73
		2		
		3		

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
PRP Note 3	dBm/SCS kHz	1	-95.77	-99.73
		2	-95.77	-99.73
		3	-92.77	-96.73
Io	dBm/19.08 MHz	1	-61.71	-61.71
	dBm/19.08 MHz	2	-61.71	-61.71
	dBm/47.88 MHz	3	-57.73	-57.73
Propagation Condition		1, 2, 3	AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.9.3.2.3 Test requirements

The UE Rx-Tx time difference measurement with reduced number of samples in RRC_INACTIVE state fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25.2 for both Cell 1 and Cell 2.

A.6.9.3.3 UE Rx-Tx time difference measurement accuracy with PRS bandwidth aggregation in FR1 SA

A.6.9.3.3.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.25A. The tests are conducted under AWGN propagation condition with the UE operating in FR1 stand-alone mode and configured to perform UE Rx-Tx measurements by aggregating two intra-band contiguous positioning frequency layers (PFLs) in FR1.

The supported test configurations are listed in table A.6.9.3.3.1-1.

Table A.6.9.3.3.1-1: Supported test configurations

PCell configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: Cell 1 (PCell) and Cell 2 (neighbor cell). Each cell is sssociated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* TS 37.355 [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel #1. In addition, both cells/TRPs transmit DL PRS in two intra-band contiguous PFLs in RF channel #1 and RF channel #2. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE before the start of the test.

The *NR-Multi-RTT-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2.

The *NR-Multi-RTT-RequestLocationInformation* message provided to the UE must request bandwidth aggregated measurements via *jointMeasurementsReq* and *nr-DL-PRS-JointMeasurementRequestedPFL-List.*

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

The general test parameters and cell specific test parameters are as given in table A.6.9.3.3.1-2 and table A.6.9.3.3.1-3, respectively.

Table A.6.9.3.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3	1	For both Cell 1 and Cell 2, all signals/channels except PRS in PFL2 are allocated within this channel.
			2	For both Cell 1 and Cell 2, only PRS in PFL2 is allocated within this channel.
$BW_{channel}$	MHz	1	20: $N_{RB,c}$ = 106	For both RF channels
		2	20: $N_{RB,c}$ = 106	
		3	50: $N_{RB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX cycle	s	1, 2, 3	1.28	
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells/TRPs
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	

Table A.6.9.3.3.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1	Cell 2
TDD configuration		1	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1	SR.1.1 FDD	N/A
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD	N/A
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns Note 1		1, 2, 3	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1, 2, 3	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				

EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.1.1 FDD	N/A
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1	N/A
Active BWP configuration		1, 2, 3	DLBWP.1.1 ULBWP.1.1	N/A
PRS configuration (for both PFL1 and PFL2)		1	PRS.1.2 FR1	PRS.1.2 FR1
		2	PRS.1.2 FR1	PRS.1.2 FR1
		3	PRS.2.2 FR1	PRS.2.2 FR1
PRS Resource slot offset	slots	1, 2, 3	0	4
SRS configuration		1	POS-SRS.1	N/A
		2	POS-SRS.1	N/A
		3	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-98	
		3	-95	
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
		3		
PRS $\hat{E}_s/I_{ot}$	dB	1	-3	-13
		2		
		3		
PRS $\hat{E}_s/N_{oc}$	dB	1	-3	-13
		2		
		3		
PRP Note 3	dBm/SCS kHz	1	-101	-111
		2	-101	-111
		3	-98	-108
Io Note 3 (on symbols where PRS is not allocated)	dBm/19.08 MHz	1	-65.05	-65.05
	dBm/19.08 MHz	2	-65.05	-65.05
	dBm/47.88 MHz	3	-61.06	-61.06
Propagation Condition		1, 2, 3	AWGN	

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.

A.6.9.3.3.2 Test requirements

The UE Rx-Tx time difference measurement fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25A for both Cell 1 and Cell 2.

A.6.9.4 PRS-RSRPP measurements

A.6.9.4.1 SA: PRS-RSRPP measurement accuracy in FR1 in RRC INACTIVE

A.6.9.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRPP measurement accuracy in FR1 in RRC_INACTIVE state is within the specified limits. This test will verify the requirements in clauses 10.1.38.2.

A.6.9.4.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.9.4.1.2-1. In all test cases, Cell 1 is the PCell.

Table A.6.9.4.1.2-1: PRS-RSRPP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.9.4.1.2-2: PRS-RSRPP test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	20: $N_{PRB,c}$ = 106			
	Config 2		20: $N_{PRB,c}$ = 106			
	Config 3		50: $N_{PRB,c}$ = 133			
BWP BW	Config 1		20: $N_{PRB,c}$ = 106			
	Config 2		20: $N_{PRB,c}$ = 106			
	Config 3		50: $N_{PRB,c}$ = 133			
Downlink initial BWP configuration			DLBWP.0.1			
Uplink initial BWP configuration			ULBWP.0.1			
TRS configuration	Config 1		TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
	Config 2		TRS.1.1 TDD	NA	TRS.1.1 TDD	NA
	Config 3		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX cycle length	Config 1,2,3	ms	1280			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD	

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
Control channel RMC	Config 1			CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2			CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3			CCR2.1 TDD		CCR2.1 TDD	
PRS configuration	Config 1			PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 2			PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 3			PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.4 FR1	PRS.2.4 FR1
PRS Resource slot offset (slot)	Config 1,2,3		slot	0	4	0	4
SSB configuration	Config 1			SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2			SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3			SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1	Config 1		ms	-	3	-	3
	Config 2,3		µs	-	3	-	3
SMTC configuration	Config 1			SMTC.2			
	Config 2,3			SMTC.1			
OCNG Patterns				OCNG pattern 1			
PDSCH/PDCCH subcarrier spacing	Config 1,2		kHz	15 kHz			
	Config 3			30 kHz			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config 1,2		dBm/15 kHz	-98		-98	
	Config 3			-98		-98	
N_{oc} Note2	Config 1,2		dBm/SCS	-98		-98	
	Config 3			-95		-95	
$\hat{E}_s/I_{ot}$			dB	-2.41	-12.12	-2.41	-12.12
$\hat{E}_s/N_{oc}$			dB	-2	-10	-2	-10
PRS-RSRP Note3	Config 1, 2		dBm/SCS	-100	-108	-100	-108
	Config 3			-97	-105	-97	-105
Io Note3	Config 1,2		dBm/19.08 MHz	-64.57		-64.57	
	Config 3		dBm/47.88 MHz	-60.59		-60.59	
Propagation condition				Two-tap channel Note 7			
Antenna configuration				1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 5: Void.					
NOTE 6: Void					
NOTE 7: The two-tap channel model is defined in 38.101-4 annex B.2.4 (a = 1, τ_d=0.45 μs and f_D=5 Hz).					

A.6.9.4.1.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.38.2.

A.6.9.4.2 SA: measurement accuracy with reduced PRS samples in FR1 in RRC INACTIVE

A.6.9.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRPP measurement accuracy with N_{sample} = 1 in FR1 in RRC_INACTIVE state is within the specified limits. This test will verify the requirements in clauses 10.1.38.2.The UE under test should support *supportedDL-PRS-ProcessingSamples-RRC-Inactive*, and the TE indicates the UE to perform positioning measurements with reduced number of samples. The PRS bandwidth is contained within the initial DL BWP and the power difference between the serving cell SS-RSRP and neighbour cell PRS-RSRP is within [6]dB, so that N_{sample} = 1 is assumed.

A.6.9.4.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.9.4.2.2-1. Both absolute and relative accuracy of PRS-RSRPP measurements are tested by using the parameters in A.6.9.4.2.2-2. In all test cases, Cell 1 is the PCell.

Table A.6.9.4.2.2-1: PRS-RSRPP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.9.4.2.2-2: PRS-RSRPP test parameters

Parameter		Unit	Test 1	
			Cell 1	Cell 2
Cell ID			489	0
SSB ARFCN			freq1	
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	20: $N_{PRB,c}$ = 106	
	Config 2		20: $N_{PRB,c}$ = 106	
	Config 3		50: $N_{PRB,c}$ = 133	
BWP BW	Config 1		20: $N_{PRB,c}$ = 106	
	Config 2		20: $N_{PRB,c}$ = 106	
	Config 3		50: $N_{PRB,c}$ = 133	
Downlink initial BWP configuration			DLBWP.0.1	
Uplink initial BWP configuration			ULBWP.0.1	

Parameter		Unit	Test 1	
			Cell 1	Cell 2
TRS configuration	Config 1		TRS.1.1 FDD	NA
	Config 2		TRS.1.1 TDD	NA
	Config 3		TRS.1.2 TDD	NA
DRX Cycle length	Config 1,2,3	ms	1280	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-
	Config 2		SR.1.1 TDD	
	Config 3		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-
	Config 2		CR.1.1 TDD	
	Config 3		CR2.1 TDD	
Control channel RMC	Config 1		CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD	
PRS configuration	Config 1		PRS.1.4 FR1	PRS.1.4 FR1
	Config 2		PRS.1.4 FR1	PRS.1.4 FR1
	Config 3		PRS.2.4 FR1	PRS.2.4 FR1
PRS bandwidth	Config 1,2,3		52 PRBs	52 PRBs
PRS Resource slot offset (slot)	Config 1,2,3	slot	0	4
SSB configuration	Config 1		SSB.1 FR1	SSB.1 FR1
	Config 2		SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1	Config 1	ms	-	3
	Config 2,3	µs	-	3
SMTC configuration	Config 1		SMTC.2	
	Config 2,3		SMTC.1	
OCNG Patterns			OCNG pattern 1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz	
	Config 3		30 kHz	
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	Config 1,2	dBm/15 kHz	-98	
	Config 3			
N_{oc} Note2	Config 1,2	dBm/SCS	-98	
	Config 3		-95	
$\hat{E}_s/I_{ot}$		dB	0	-6
$\hat{E}_s/N_{oc}$		dB	2.23	-1.73
PRS-RSRP Note3	Config 1, 2	dBm/SCS	-95.77	-99.73
	Config 3		-92.77	-96.73
SS-RSRP Note3	Config 1, 2	dBm/SCS	-95.77	-99.73
	Config 3		-92.77	-96.73
Io Note3	Config 1,2	dBm/19.08 MHz	-61.71	
	Config 3	dBm/47.88 MHz	-57.73	
Propagation condition			Two-tap channel Note5	
Antenna configuration			1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Parameter	Unit	Test 1	
		Cell 1	Cell 2
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: PRS-RSRP, SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			
NOTE 5: The two-tap channel model is defined in 38.101-4 annex B.2.4 (a = 1, τ_d=0.45 μs and f_D=5 Hz).			

A.6.9.4.2.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.38.2.

A.6.9.5 RSCPD Measurements

A.6.9.5.1 RSCPD with RSTD measurement accuracy in FR1 SA in RRC_INACTIVE

A.6.9.5.1.1 Test purpose and environment

The purpose of the test is to verify that the accuracy of RSCPD measurement reported with RSTD measurement accuracy in RRC_INACTIVE. This test will verify the requirements in clause 10.1.43.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.6.9. 5.1.1-1.

Table A.6.9. 5.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR1.

The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* with *dl-PRS-RSCPD-Request* from LMF via LPP as defined in TS 37.355 [34], clause 6.5.12, to enable UE to perform and report RSCPD in RRC_INACTIVE shall be provided to the UE before the start of the test. The UE is configured with DRX cycle of 1.28s.

A.6.9.5.1.2 Test parameters

The RSCPD with RSTD accuracy test parameters are given in table A.6.9.5.1.2-1.

Table A.6.9. 5.1.2-1: RSCPD with UE RSTD measurement accuracy test parameters

Parameter	Config	Unit	Test 1	
			Cell 1	Cell 2
PRS ARFCN	1,2,3		Freq1	Freq1
$BW_{channel}$	1	MHz	20: $N_{RB,c}$ = 106	
	2		20: $N_{RB,c}$ = 106	
	3		50: $N_{RB,c}$ = 133	
Duplex mode	1		FDD	
	2		TDD	
	3		TDD	
TDD configuration	1		N/A	

	2		TDDConf.1.1	
	3		TDDConf.2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-
	2		SR.1.1 TDD	
	3		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-
	2		CR.1.1 TDD	-
	3		CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1	
	2		SSB.1 FR1	
	3		SSB.2 FR1	
OCNG Patterns	1,2,3		OP.1	
TRS configuration	1		TRS.1.1 FDD	-
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
Initial BWP Configuration	1,2,3		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1,2,3		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1	µs	-	3
	2,3		-	3
SMTC configuration	1		SMTC.2	
	2,3		SMTC.1	
PRS configuration	1		PRS.1.1 FR1	
	2		PRS.1.1 FR1	
	3		PRS.2.1 FR1	
PRS Resource slot offset	1, 2, 3	slot	0	4
Expected RSTD	1, 2, 3	µs	N/A	3
Expected RSTD uncertainty	1, 2, 3	µs	N/A	5
EPRE ratio of PSS to SSS	1,2,3	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS	1,2,3	dB	0	0
N_{oc} Note2	1,2	dBm/ SCS	-98	
	3		-95	
PRS $\hat{E}_s / I_{ot}$	1,2,3	dB	-6	-13
PRP Note3	1,2	dBm/ SCS	-103.7	-109.9
	3		-100.7	-106.9
Io Note3	1,2	dBm/ 19.08 MHz	-65.70	-65.70
	3	dBm/ 47.88 MHz	-61.72	-61.72
PRS $\hat{E}_s / N_{oc}$	1,2,3	dB	-5.7	-11.9

SSB $\hat{E}_s/N_{oc}$	1,2,3	dB	-5.7
Propagation condition	1,2,3	-	AWGN
Antenna configuration	1,2,3		1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.			

A.6.9.5.1.3 Test requirements

The RSCPD reported together with RSTD fulfils RSCPD measurement accuracy requirements specified in clause 10.1.43.2 for Cell 2.

A.6.9.6 RSCP Measurements

A.6.9.6.1 RSCP with UE Rx-Tx time difference measurement accuracy in FR1 SA

A.6.9.6.1.1 Test purpose and environment

The purpose of the test is to verify that the accuracy of RSCP measurement reported with UE Rx-Tx time difference measurement in RRC_INACTIVE is within the specified limits. This test will verify the requirements in clause 10.1.44.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.6.9.6.1.1-1.

Table A.6.9.6.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR1.

The *NR-Multi-RTT-ProvideAssistanceData* , *NR-Multi-RTT-RequestLocationInformation* with *nr-DL-PRS-RSCP-Request* from LMF via LPP and *NR-Multi-RTT-MeasurementCapability* as defined in TS 37.355 [34], clause 6.5.12, to enable UE to perform and report RSCP in RRC INACTIVE, shall be provided to the UE before the start of the test. The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.6.9.6.1.2 Test parameters

The RSCP with UE Rx-Tx time difference accuracy test parameters are given in table A.6.9.6.1.2-1.

Table A.6.9.6.1.2-1: RSCP with UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1

			Cell 1	Cell 2
RF Channel Number		1,2,3	1	1
DRX	s	1,2,3	1.28	
Time offset with Cell 1	μs	1, 2, 3	N/A	3
TDD configuration		1	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1	SR.1.1 FDD	N/A
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD	N/A
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1, 2, 3	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.1.1 FDD	N/A
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1, 2, 3	DLBWP.1.1	N/A
Active UL BWP configuration		1, 2, 3	ULBWP.1.1	N/A
PRS configuration		1	PRS.1.1 FR1	PRS.1.1 FR1
		2	PRS.1.1 FR1	PRS.1.1 FR1
		3	PRS.2.1 FR1	PRS.2.1 FR1
PRS BW		1	52 PRBs	52 PRBs
		2	52 PRBs	52 PRBs
		3	48 PRBs	48 PRBs
PRS Resource slot offset	slot	1, 2, 3	0	4
SRS configuration		1	POS-SRS.1	N/A
		2	POS-SRS.1	N/A
		3	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-98	
		3	-95	
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
		3		
PRS $\hat{E}_s/I_{ot}$	dB	1	0	-6
		2		
		3		
PRS $\hat{E}_s/N_{oc}$	dB	1	2.23	-1.73
		2		
		3		
	dBm/SCS kHz	1	-95.77	-99.73

PRP Note 3		2	-95.77	-99.73
		3	-92.77	-96.73
Io	dBm/19.08 MHz	1	-61.71	-61.71
	dBm/19.08 MHz	2	-61.71	-61.71
	dBm/47.88 MHz	3	-57.73	-57.73
Propagation Condition		1, 2, 3	AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Void.

A.6.9.6.1.3 Test requirements

The RSCP with UE Rx-Tx time difference measurement fulfils RSCP measurement accuracy specified in clause 10.1.44.2 for both Cell 1 and Cell 2.

A.6.10 Measurement Procedure in RRC_IDLE

A.6.10.1 RSTD Measurements

A.6.10.1.1 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA in RRC_IDLE state for non-RedCap UE

A.6.10.1.1.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 4.5.2.5 for RSTD measurements in RRC_IDLE without eDRX. The tests are conducted under AWGN propagation condition with the UE operating in FR1 stand-alone mode and configured to perform RSTD measurements on a single positioning frequency layer (PFL) in FR1.

The supported test configurations are listed in table A.6.10.1.1.1-1.

Table A.6.10.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are three cells in the test: Cell 1 (PCell and RSTD reference cell), Cell 2 (neighbor cell) and Cell 3 (neighbor cell). All cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and released to RRC_IDLE state before the start of T2. All cells transmit PRS only during the second time interval of duration T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *NR-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE at least ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the DL-TDOA assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the start of the first PRS resource instance received after the UE has transitioned to RRC_IDLE.

The general test parameters are listed in table A.6. 10.1.1.1-2 and cell specific test parameters are listed in table A.6.10.1.1.1-3 and table A.6.10.1.1.1-4.

Table A.6.10.1.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.2 FR1	
	Config 3		PRS.2.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	1.28	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data

			specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells	µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		3	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	5	The length of the time interval that follows immediately after time interval T1.

Table A.6.10.1.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08MHz	-56.54	-56.54	-56.54
	Config 2	dBm/ 19.08MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 47.88MHz	-52.56	-52.56	-52.56
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.10.1.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2

NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
Io Note 4	Config 1	dBm/ 19.08MHz	-65.43	-65.43	-65.43
	Config 2	dBm/ 96.48MHz	-65.43	-65.43	-65.43
	Config 3	dBm/ 47.88MHz	-61.44	-61.44	-61.44
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cells (all, except Cell 3 in T2) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

Note 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.

Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

A.6.10.1.1.2 Test requirements

The RSTD measurement time shall fulfill the requirements specified in clause 4.5.2.5.

The UE shall perform and report the RSTD measurements for Cell 1, Cell 2 and Cell 3 within the specified measurement period duration starting from the beginning of time interval T2.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3.

A.6.10.1.2 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA in RRC_IDLE state with eDRX cycle > 10.24s for non-RedCap UE

A.6.10.1.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement in RRC_IDLE state meets the requirements specified in clause 4.5.2.5 when eDRX cycle is longer than 10.24s in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.6.10.1.2.1-1.

Table A.6.10.1.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell 3. During T2 UE shall be in RRC_IDLE state and all three cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.10, shall be provided to the UE during T1. The UE is configured to report positioning measurements every 20s by setting the value of *reportingInterval* to "*ri20*" in *nr-DL-TDOA-RequestLocationInformation*. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the DL-TDOA assistance data and location information request.

The beginning of the time interval T2 is not limited to PTW.

The general test parameters are listed in table A.6.10.1.2.1-2, and cell specific test parameters are listed in table A.6.10.1.2.1-3 and table A.6.10.1.2.1-4.

Table A.6.10.1.2.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	

SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Initial BWP configuration	Config 1,2,3		DLBWP.0.1 ULBWP.0.1	
Active UL BWP configuration	Config 1,2,3		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.2 FR1	
	Config 3		PRS.2.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2) mod 6 = 0 and (PCI of Cell 1 – PCI of Cell 3) mod 6 = 0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
CN and RAN eDRX configuration		s	eDRX length = 40.96 PTW length = 1.28	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			3	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to *NR-MutingPattern* defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		s	5	The length of the time interval that follows immediately after time interval T1.

Table A.6.10.1.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter	Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number		1	1	1
Positiong frequency layer		1	1	1

Correlation Matrix and Antenna Configuration			1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 19.08MHz	-56.54	-56.54	-56.54
	Config 2	dBm/ 19.08MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 47.88MHz	-52.56	-52.56	-52.56
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.6.10.1.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2.

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
Io Note 4	Config 1	dBm/ 19.08MHz	-65.43	-65.43	-65.43
	Config 2	dBm/ 96.48MHz	-65.43	-65.43	-65.43
	Config 3	dBm/ 47.88MHz	-61.44	-61.44	-61.44

PRS $\hat{E}_s/I_{ot}$	dB	-6	-13	-13
Propagation Condition		AWGN		
Note 1: OCNG shall be used such that active cells (all, except Cell 3 in T2) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.				
Note 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.				
Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

A.6.10.1.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 4.5.2.5. The test is considered complete after the UE reports the first set of positioning measurements based on the configured *reportingInterval.*

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 4.5.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during the repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in the clause 10.1.23.3, i.e., between RSTD_000000000 and RSTD_126083073.

A.6.10.1.3 NR RSTD measurement reporting delay test case for PRS aggregation in FR1 SA in RRC_IDLE state

A.6.10.1.3.1 Test purpose and environment

The purpose of the test is to verify that the RSTD measurement with PRS aggregation in RRC_IDLE state meets the requirements specified in clause 4.5.2.6 in AWGN propagation condition in FR1 in standalone scenario when two intra-band contiguous positioning frequency layers (PFLs) are configured.

The test environment and configurations reuse the test case for RRC_INACTIVE state defined in clause A.6.8.1.3 except that UE shall be in RRC_IDLE state and all 6 cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP during T2.

A.6.10.1.3.2 Test requirements

The RSTD measurement time with PRS aggregation in RRC_IDLE state fulfils the requirements specified in clause 4.5.2.6.

The UE shall perform and report the RSTD measurements by aggregating PRS resources from Cell 2 and Cell 5, Cell 3 and Cell 6 respectively with respect to the Cell 1 and Cell 4 from which the transmitted PRS resources are also aggregated, within the time duration specified in clause 4.5.2.6 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events observed during repeated tests shall be at least 90%, where the reported RSTD measurement with PRS aggregation for each correct event shall be within the RSTD reporting range specified in clause 10.1.23A.3.

A.6.10.2 PRS-RSRP Measurements

A.6.10.2.1 PRS-RSRP reporting delay test case for single positioning frequency layer in RRC_IDLE state for non-RedCap UE in FR1

A.6.10.2.1.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement in RRC_IDLE state meets the delay requirements specified in clause 4.5.3.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.10.2.1.1-1.

Table A.6.10.2.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

During T1 UE is in RRC_CONNECTED, the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34], shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_IDLE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.6.10.2.1.1-2, and cell specific test parameters are listed in table A.6.10.2.1.1-3.

Table A.6.10.2.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1	20: $N_{RB,c}$ = 106	
		2	20: $N_{RB,c}$ = 106	
		3	50: $N_{RB,c}$ = 133	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3	Normal	
DRX		1, 2, 3	1.28s	
Time offset between serving and neighbour cells	µs	1, 2, 3	3	Synchronous cells
Expected RSTD	µs	1, 2, 3	3	
Expected RSTD uncertainty	µs	1, 2, 3	5	
T1	s	1, 2, 3	2	
T2	s	1, 2, 3	6	

Table A.6.10.2.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3	OP.1		OP.1	
Initial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/19.08 MHz	1	N/A	-64.57	N/A	-64.57
	dBm/19.08 MHz	2		-64.57		-64.57
	dBm/47.88 MHz	3		-60.59		-60.59
Propagation Condition		1, 2, 3	AWGN			

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.10.2.1.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 4.5.3.5. The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in section 4.5.3.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1.24.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

A.6.10.2.2 PRS-RSRP reporting delay test case in RRC_IDLE state in FR1 when eDRX cycle > 10.24s

A.6.10.2.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement in RRC_IDLE with eDRX meets the delay requirements specified in clause 4.5.3.5 in an environment with AWGN propagation conditions.

The supported test configurations in table A.6.8.2.3.1-1 apply for this test.

The test procedure in clause A.6.8.2.3.1 apply for this test, except that during T2, UE is in RRC_IDLE state.

The general test parameters as specified in table A.6.8.2.3.1-2 apply for this test, except those specified in table A.6.10.2.2.1-1.

The cell specific test parameters as specified in table A.6.8.2.3.1-3 apply for this test.

Table A.6.10.2.2.1-1: General test parameters

Parameter	Unit	Test configuration	Value	Comment
eDRX cycle length (for CN eDRX)	s	1, 2, 3	40.96	

A.6.10.2.2.2 Test Requirements

The test requirements in clause A.6.8.2.3.2 apply for this test, except that the time limits are specified in clause 4.5.3.5.

A.6.10.3 RSCPD Measurements

A.6.10.3.1 DL RSCPD reported with RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA in RRC_IDLE state

A.6.10.3.1.1 Test Purpose and Environment

The purpose of the test is to verify that the DL RSCPD reported with RSTD measurement meets the requirements specified in clause 5.6.7.5 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The test environment is the same as in A.6.8.1.1 with the following additional configuration in table A.6. 10.3.1.1-1 and description.

In *NR-DL-TDOA-RequestLocationInformation,* the UE is configured to perform DL RSCPD measurement via *dl-PRS-RSCPD-Request*. The UE also is configured to perform both RSCPD and RSTD measurements within the time window indicated to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig*.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s) to be measured within the configured time window.

Table A.6.10.3.1.1-1: Time window configuration

Parameter		Unit	Value	Comment
Indicated time window configuration	Config 1,2,3		MTW.1	As specified in clause A.3.38

A.6.10.3.1.2 Test Requirements

The DL RSCPD reported with RSTD measurement time fulfils the requirements specified in clause 5.6.7.5.

The UE shall perform and report the DL RSCPD and DL RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6.7.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3 and the reported RSCPD measurement for each correct event shall be within the RSCPD reporting range specified in clause 10.1.43.3.

A.6.11 Measurement Performance Requirements in RRC_IDLE

A.6.11.1 RSTD Measurements

A.6.11.1.1 NR RSTD measurement accuracy test case for single positioning frequency layer in FR1 SA in RRC_IDLE state for non-RedCap UE

A.6.11.1.1.1 Test purpose and environment

The purpose of the test is to verify that the RSTD measurement in RRC_IDLE state without eDRX meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are listed in table A.6.11.1.1.1-1.

Table A.6.11.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The UE is configured with DRX cycle of 1.28s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34], shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 5.6.2.5.

The RSTD accuracy test parameters are listed in table A.6.11.1.1.1-2.

Table A.6.11.1.1.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN	1,2,3		freq1	Freq1	freq1	Freq1
$BW_{channel}$	1	MHz	20: $N_{RB,c}$ = 106		20: $N_{RB,c}$ = 106	
	2		20: $N_{RB,c}$ = 106		20: $N_{RB,c}$ = 106	
	3		50: $N_{RB,c}$ = 133		50: $N_{RB,c}$ = 133	
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
TDD configuration	1		N/A		N/A	
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1		SSB.1 FR1	
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1,2,3		OP.1		OP.1	
TRS configuration	1		TRS.1.1 FDD	-	TRS.1.1 FDD	
	2		TRS.1.1 TDD		TRS.1.1 TDD	
	3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration	1,2,3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Time offset with Cell 1	1	µs	-	3	-	3
	2,3		-	3	-	3
SMTC configuration	1		SMTC.2		SMTC.2	
	2,3		SMTC.1		SMTC.1	
PRS configuration	1		PRS.1.3 FR1		PRS.1.4 FR1	
	2		PRS.1.3 FR1		PRS.1.4 FR1	
	3		PRS.2.3 FR1		PRS.2.4 FR1	
PRS muting info	1,2,3		'10'	'01'	'10'	'01'
Expected RSTD	1, 2, 3	µs	N/A	3	N/A	3
Expected RSTD uncertainty	1, 2, 3	µs	N/A	5	N/A	5
EPRE ratio of PSS to SSS	1,2,3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS[Note 1]						

EPRE ratio of OCNG to OCNG DMRS Note 1						
N_{oc} Note2	1,2	dBm/ SCS	-98		-98	
	3		-95		-95	
$\hat{E}_s/I_{ot}$	1,2,3	dB	-6	-13	-6	-13
PRS-RSRP Note3	1,2	dBm/SC S	-103.7	-109.9	-103.7	-109.9
	3		-100.7	-106.9	-100.7	-106.9
Io Note3	1,2	dBm/ 19.08M Hz	-65.70	-65.70	-65.70	-65.70
	3	dBm/ 47.88M Hz	-61.72	-61.72	-61.72	-61.72
$\hat{E}_s/N_{oc}$	1,2,3	dB	-5.7	-11.9	-5.7	-11.9
Propagation condition	1,2,3	-	AWGN		AWGN	
Antenna configuration	1,2,3		1x2		1x2	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.11.1.1.2 Test requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.6.11.1.2 RSTD measurement accuracy test case for single positioning frequency layer in FR1 in RRC_IDLE state with eDRX>10.24s for non-RedCap UE

A.6.11.1.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement performed by UE in RRC_IDLE state with eDRX > 10.24s meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.6.11.1.2.1-1.

Table A.6.11.1.2.1-1: Supported test configurations.

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The UE is configured with eDRX cycle of 40.96s. The UE is configured to report positioning measurements every 20s by setting the value of *reportingInterval* to "*ri20*" in *nr-DL-TDOA-RequestLocationInformation.* The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34], shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 4.5.2.5.

Table A.6.11.1.2.1-2: RSTD accuracy test parameters.

Parameter	Config	Unit	Test 1	
			Cell 1	Cell 2
PRS ARFCN	1,2,3		freq1	Freq1
$BW_{channel}$	1	MHz	20: $N_{RB,c}$ = 106	
	2		20: $N_{RB,c}$ = 106	
	3		50: $N_{RB,c}$ = 133	
Duplex mode	1		FDD	
	2		TDD	
	3		TDD	
TDD configuration	1		N/A	
	2		TDDConf.1.1	
	3		TDDConf.2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-
	2		SR.1.1 TDD	
	3		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-
	2		CR.1.1 TDD	-
	3		CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1	
	2		SSB.1 FR1	
	3		SSB.2 FR1	
OCNG Patterns	1,2,3		OP.1	
TRS configuration	1		TRS.1.1 FDD	-
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
Initial BWP Configuration	1,2,3		DLBWP.0.1 ULBWP.0.1	
Time offset with Cell 1	1	µs	-	3
	2,3		-	3
SMTC configuration	1		SMTC.2	
	2,3		SMTC.1	
PRS configuration	1		PRS.1.3 FR1	
	2		PRS.1.3 FR1	
	3		PRS.2.4 FR1	
PRS muting info	1,2,3		'10'	'01'
Expected RSTD	1, 2, 3	µs	N/A	3
Expected RSTD uncertainty	1, 2, 3	µs	N/A	5
EPRE ratio of PSS to SSS	1,2,3	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	1,2	dBm/ SCS	-98	
	3		-95	
$\hat{E}_s / I_{ot}$	1,2,3	dB	-6	-13

PRS-RSRP[Note3]	1,2	dBm/SCS	-103.7	-109.9
	3		-100.7	-106.9
Io[Note3]	1,2	dBm/ 19.08MHz	-65.70	-65.70
	3	dBm/ 47.88MHz	-61.72	-61.72
$\hat{E}_s / N_{oc}$	1,2,3	dB	-5.7	-11.9
Propagation condition	1,2,3	-	AWGN	
Antenna configuration	1,2,3		1x2	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over sub-carriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.11.1.2.2 Test Requirements

The test is considered complete after the UE reports the first set of positioning measurements based on the configured *reportingInterval*. The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.6.11.1.3 NR RSTD measurement accuracy test case for PRS aggregation in FR1 SA in RRC_IDLE state

A.6.11.1.3.1 Test purpose and environment

The purpose of the test is to verify that the RSTD measurement results with PRS aggregation in RRC_IDLE state meets the requirements specified in clause 10.1.23A.2 in AWGN propagation condition in FR1 in standalone scenario when two intra-band contiguous positioning frequency layers (PFLs) are configured.

The test environment and configurations reuse the test case for RRC_INACTIVE state defined in clause A.6.9.1.3, except that UE shall be in RRC_IDLE state and all 4 cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP during T2.

A.6.11.1.3.2 Test requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23A.2.

A.6.11.2 PRS-RSRP measurements

A.6.11.2.1 PRS-RSRP measurement accuracy test case for non-RedCap UE in FR1 in RRC_IDLE state

A.6.11.2.1.1 Test Purpose and Environment

The purpose of this test is to verify accuracy of PRS-RSRP measurement performed by UE in RRC_IDLE mode in FR1.

A.6.11.2.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.11.2.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in A.6.11.2.1.2-2. In all test cases, Cell 1 is the PCell.

Table A.6.11.2.1.2-1: PRS-RSRP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.11.2.1.2-2: PRS-RSRP test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	20: $N_{RB,c}$ = 106			
	Config 2		20: $N_{RB,c}$ = 106			
	Config 3		50: $N_{RB,c}$ = 133			
BWP BW	Config 1		20: $N_{RB,c}$ = 106			
	Config 2		20: $N_{RB,c}$ = 106			
	Config 3		50: $N_{RB,c}$ = 133			
Downlink initial BWP configuration			DLBWP.0.1			
Uplink initial BWP configuration			ULBWP.0.1			
DRX Cycle		s	1.28			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD	
PRS configuration	Config 1		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 2		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.4 FR1	PRS.1.4 FR1
	Config 3		PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.4 FR1	PRS.2.4 FR1
PRS Resource slot offset (slot)	Config 1,2,3	slot	0	4	0	4
SSB configuration	Config 1		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1

	Config 2			SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3			SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1	Config 1		ms	-	3	-	3
	Config 2,3		µs	-	3	-	3
SMTC configuration	Config 1			SMTC.2			
	Config 2,3			SMTC.1			
OCNG Patterns				OCNG pattern 1			
PDSCH/PDCCH subcarrier spacing	Config 1,2		kHz	15 kHz			
	Config 3			30 kHz			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config 1,2		dBm/15kHZ	-98		-98	
	Config 3			-98		-98	
N_{oc} Note2	Config 1,2		dBm/SCS	-98		-98	
	Config 3			-95		-95	
$\hat{E}_s/I_{ot}$			dB	-2.41	-12.12	-2.41	-12.12
$\hat{E}_s/N_{oc}$			dB	-2	-10	-2	-10
PRS-RSRP Note3	Config 1, 2		dBm/SCS	-100	-108	-100	-108
	Config 3			-97	-105	-97	-105
Io Note3	Config 1,2		dBm/19.08MHz	-64.57		-64.57	
	Config 3		dBm/47.88MHz	-60.59		-60.59	
Propagation condition				AWGN			
Antenna configuration				1x2			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over sub-carriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.6.11.2.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.24.2.1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1.24.2.2.

A.6.11.2.2 PRS-RSRP measurement accuracy test case in RRC_IDLE state in FR1 when eDRX cycle > 10.24s

A.6.11.2.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement in RRC_IDLE with eDRX meets the accuracy requirements specified in clauses 10.1.24.2.1 and 10.1.24.2.2 in an environment with AWGN propagation conditions.

A.6.11.2.2.2 Test parameters

The supported test configurations in table A.6.9.2.1.2-1 apply for this test.

The test procedure in clause A.6.9.2.1.2 apply for this test, except that UE is in RRC_IDLE state.

The test parameters as specified in table A.6.9.2.1.2-2 apply for this test, except those additionally specified in table A.6.11.2.2.2-1.

Table A.6.11.2.2.2-1: PRS-RSRP test parameters

Parameter	Unit	Test configuration	Value	Comment
eDRX cycle length (for CN eDRX)	s	1, 2, 3	40.96	
PTW window length	s	1, 2, 3	1.28	

A.6.11.2.2.3 Test Requirements

The test requirements in clause A.6.9.2.1.3 apply for this test.

A.6.11.3 RSCPD Measurements

A.6.11.3.1 RSCPD with RSTD measurement accuracy in FR1 SA in RRC_IDLE

A.6.11.3.1.1 Test purpose and environment

The purpose of the test is to verify that the accuracy of RSCPD measurement reported with RSTD measurement in RRC_IDLE. This test will verify the requirements in clause 10.1.43.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.6.11.3.1.1-1.

Table A.6.11.3.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 50 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* with *dl-PRS-RSCPD-Request* from LMF via LPP as defined in TS 37.355 [34], clause 6.5.12, to enable UE to perform and report RSCPD in RRC_IDLE shall be provided to the UE before the start of the test. The UE is configured with DRX cycle of 1.28s.

A.6.11.3.1.2 Test parameters

The RSCPD with RSTD accuracy test parameters are given in table A.6.11.3.1.2.-1.

Table A.6.11.3.1.2-1: RSCPD with UE RSTD measurement accuracy test parameters

Parameter	Config	Unit	Test 1	
			Cell 1	Cell 2
PRS ARFCN	1,2,3		Freq1	Freq1
$BW_{channel}$	1	MHz	20: $N_{RB,c}$ = 106	
	2		20: $N_{RB,c}$ = 106	
	3		50: $N_{RB,c}$ = 133	
Duplex mode	1		FDD	
	2		TDD	
	3		TDD	
TDD configuration	1		N/A	
	2		TDDConf.1.1	
	3		TDDConf.2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-
	2		SR.1.1 TDD	
	3		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-
	2		CR.1.1 TDD	-
	3		CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1	
	2		SSB.1 FR1	
	3		SSB.2 FR1	
OCNG Patterns	1,2,3		OP.1	
TRS configuration	1		TRS.1.1 FDD	-
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
Initial BWP Configuration	1,2,3		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1,2,3		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1	µs	-	3
	2,3		-	3
SMTC configuration	1		SMTC.2	
	2,3		SMTC.1	
PRS configuration	1		PRS.1.1 FR1	
	2		PRS.1.1 FR1	
	3		PRS.2.1 FR1	
PRS Resource slot offset	1, 2, 3	slot	0	4
Expected RSTD	1, 2, 3	µs	N/A	3
Expected RSTD uncertainty	1, 2, 3	µs	N/A	5
EPRE ratio of PSS to SSS	1,2,3	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS[Note 1]				

EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS	1,2,3	dB	0	0
N_{oc} Note2	1,2	dBm/ SCS	-98	
	3		-95	
PRS $\hat{E}_s/I_{ot}$	1,2,3	dB	-6	-13
PRP Note3	1,2	dBm/ SCS	-103.7	-109.9
	3		-100.7	-106.9
Io Note3	1,2	dBm/ 19.08 MHz	-65.70	-65.70
	3	dBm/ 47.88 MHz	-61.72	-61.72
PRS $\hat{E}_s/N_{oc}$	1,2,3	dB	-5.7	-11.9
SSB $\hat{E}_s/N_{oc}$	1,2,3	dB	-5.7	
Propagation condition	1,2,3	-	AWGN	
Antenna configuration	1,2,3		1x2	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.

A.6. 11.3.1.3 Test requirements

The RSCPD reported together with RSTD fulfils RSCPD measurement accuracy specified in clause 10.1.43.2 for Cell 2.

A.7 NR standalone tests with one or more NR cells in FR2

A.7.1 SA: RRC_IDLE state mobility

A.7.1.1 Cell re-selection to NR

A.7.1.1.1 Cell reselection to FR2 intra-frequency NR case

A.7.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements specified in clause 4.2.2.3.

A.7.1.1.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.7.1.1.1.2-1, A.7.1.1.1.2-2 and A.7.1.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only cell 1 is already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing cell 2.

Table A.7.1.1.1.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.1.1.1.2-2: General test parameters for intra frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	
T2 end condition	Active cell		1, 2	Cell 2	
	Neighbour cell		1, 2	Cell 1	
Final condition	Active cell		1, 2	Cell 1	
	Neighbour cell		1, 2	Cell 2	
RF Channel Number			1, 2	1	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC.1	
DRX cycle length		s	1, 2	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2

Parameter		Unit	Test configuration	Value	Comment
T2	PC2/3/4	s	1, 2	135	T2 needs to be defined so that cell re-selection reaction time is taken into account.
	PC1			265	
T3	PC2/3/4	s	1, 2	35	T3 needs to be defined so that cell re-selection reaction time is taken into account.
	PC1			65	

Table A.7.1.1.1.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 2	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1	SR.3.1 TDD			SR.3.1 TDD		
		2	SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
		2	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
		2	CCR.3.1 TDD			CCR.3.1 TDD		
SSB configuration		1	SSB.3 FR2			SSB.7 FR2		
		2	SSB.4 FR2			SSB.8 FR2		
OCNG Pattern		1, 2	OP.4			OP.4		
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		1, 2	66			66		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-138			-138		
		2	-135			-135		
Pcompensation	dB	1, 2	0			0		
$Qhyst_s$	dB	1, 2	0			0		
$Qoffset_{s,n}$	dB	1, 2	0			0		
Cell_selection_and_reselection_quality_measurement		1, 2	SS-RSRP			SS-RSRP		
AoA setup		1, 2	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
Beam assumption Note 4		1,2	Rough			Rough		
$\hat{E}_s/I_{ot\,\mathrm{BB}}$ Note 5	dB	1	7.45	-3.55	0.95	-infinity	0.95	-3.55
		2						
N_{oc} Note2	dBm/SCS	1	-93					
		2	-90					
N_{oc} Note2	dBm/15 kHz	1	-102					
		2						
$\hat{E}_s/N_{oc}$	dB	1	8	-3	1.5	-infinity	1.5	-3
		2						
SS-RSRP Note3	dBm/SCS	1	-85	-96	-91.5	-infinity	-91.5	-96
		2	-82	-93	-88.5	-infinity	-88.5	-93
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-60.53	-67.40	-65.34	-69.17	-65.34	-67.40
		2	-57.52	-64.39	-62.33	-66.16	-62.33	-64.39
Treselection	s	1, 2	0	0	0	0	0	0
SintrasearchP	dB	1, 2	50			50		
Propagation Condition		1, 2	AWGN					

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation								
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.								

A.7.1.1.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 130 s for PC2/3/4 devices and less than 258 s for PC1 devices.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon cell 1.

The cell re-selection delay to an already detected cell shall be less than 27 s for PC2/3/4 devices and less than 53 s for PC1 devices.

The cell re-selection delay to an already detected cell shall be less than 27 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI\text{-}NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR_ intra} + T_{SI\text{-}NR}$,

Where:

T_{detect, NR_Intra} See table 4.2.2.3-1 in clause 4.2.2.3

$T_{evaluate, NR_ intra}$ See table 4.2.2.3-1 in clause 4.2.2.3

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

For the cell re-selection delay to a newly detectable in this test case, this gives:

- 129.28 s, allow 130 s, for PC2/3/4 devices
- 257.28 s, allow 258 s, for PC1 devices

For the cell re-selection delay to an already detected cell in this test case, this gives

- 26.88 s, allow 27 s, for PC2/3/4 devices
- 52.48 s, allow 53 s, for PC1 devices

A.7.1.1.2 Cell reselection to FR2 inter-frequency NR case

A.7.1.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2.2.4.

A.7.1.1.2.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.7.1.1.2.2-1, A.7.1.1.2.2-2 and A.7.1.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas and cell 2 is of higher priority than cell 1. Furthermore, UE has not registered with network for the tracking area containing cell 2.

Table A.7.1.1.2.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.7.1.1.2.2-2: General test parameters for FR2 inter frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 2	The UE camps on cell 2 in the initial phase and during T1 period the UE reselects to cell 1
	Neighbour cell		1, 2	Cell 1	
T1 end condition	Active cell		1, 2	Cell 1	The UE shall perform reselection to cell 1 during T1
	Neighbour cells		1, 2	Cell 2	
T3 end condition	Active cell		1, 2	Cell 2	The UE shall perform reselection to cell 2 with higher priority during T3
	Neighbour cell		1, 2	Cell 1	
RF Channel Number			1, 2	1, 2	
Time offset between cells			1, 2	3 µs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
			2	SSB.2 FR2	
SMTC configuration			1, 2	SMTC.1	
DRX cycle length		s	1, 2	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1	PC2/3/4	s	1, 2	35	T1 needs to be defined so that cell re-selection reaction time is taken into account.
	PC1			65	
T2		s	1, 2	>7	During T2, cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that cell 2 has not been detected by the UE prior to the start of period T3.
T3	PC2/3/4	s	1, 2	95	T3 needs to be defined so that cell re-selection reaction time is taken into account.
	PC1			125	

Table A.7.1.1.2.2-3: Cell specific test parameters for FR2 inter frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 2	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1, 2	SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET parameters		1, 2	CR.3.1 TDD			CR.3.1 TDD		
RMSI CORESET RMC configuration		1, 2	CCR.3.1 TDD			CCR.3.1 TDD		
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-140			-140		
		2	-137			-137		
Pcompensation	dB	1, 2	0			0		
$Qhyst_s$	dB	1, 2	0			0		
$Qoffset_{s,n}$	dB	1, 2	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2	SS-RSRP			SS-RSRP		
AoA setup		1, 2	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
Beam assumption Note 4		1,2	Rough			Rough		
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1	9.95	9.95	7.45	-11.05	-infinity	7.95
		2						
N_{oc} Note2	dBm/SCS	1	-93			-93		
		2	-90			-90		
N_{oc} Note2	dBm/15 kHz	1	-102			-102		
		2						
$\hat{E}_s/N_{oc}$	dB	1	10.5	10.5	8	-10.5	-infinity	8.5
		2						
SS-RSRP Note3	dBm/SCS	1	-82.5	-82.5	-85	-103.5	-infinity	-84.5
		2	-79.5	-79.5	-82	-100.5	-infinity	-81.5
Io	dBm/95.04 MHz	1, 2	-53.11	-53.11	-55.34	-63.61	-63.98	-54.91
Treselection	s	1, 2	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2	50			50		
$Thresh_{x,highP}$	dB	1, 2	48			48		
$Thresh_{serving,lowP}$	dB	1, 2	44			44		
$Thresh_{x,lowP}$	dB	1, 2	50			50		
Propagation Condition		1, 2	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.1.1.2.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon cell 2.

The cell re-selection delay to a higher priority cell shall be less than 87 s for PC2/3/4 devices and less than 113 s for PC1 devices.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon cell 1.

The cell re-selection delay to a lower priority cell shall be less than 27 s for PC2/3/4 devices and less than 53 s for PC1 devices.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate,\ NR_\ inter} + T_{SI\text{-}NR}$, and to a lower priority cell can be expressed as: $T_{evaluate,\ NR_\ inter} + T_{SI\text{-}NR}$,

Where:

$T_{higher_priority_search}$ See clause 4.2.2.7

$T_{evaluate,\ NR_\ inter}$ See table 4.2.2.4-1 in clause 4.2.2.4

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

For the cell re-selection delay to a higher priority cell in this test case, this gives:

- 86.88 s, allow 87 s, for PC2/3/4 devices
- 112.48 s, allow 113 s, for PC1 devices

For the cell re-selection delay to a lower priority cell in the test case, this gives

- 26.88 s, allow 27 s, for PC2/3/4 devices
- 52.48 s, allow 53 s, for PC1 devices

A.7.1.1.3 Cell reselection to FR2 intra-frequency NR case for UE fulfilling low mobility relaxed measurement criterion

A.7.1.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for UE configured with relaxed measurement criterion specified in clause 4.2.2.9.2.

A.7.1.1.3.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.7.1.1.3.2-1, A.7.1.1.3.2-2 and A.7.1.1.3.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. During T1 and T2, only criteria *lowMobilityEvalutation* is configured and fulfilled, where $(Srxlev_{Ref} - Srxlev) < S_{SearchDeltaP}$. UE has not registered with network for the tracking area containing Cell 2.

Table A.7.1.1.3.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.1.1.3.2-2: General test parameters for FR2 intra-frequency NR cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	The UE camps on cell 1 in the initial phase
	Neighbour cells		1, 2	Cell 2	
T1 end condition	Active cell		1, 2	Cell 2	The UE reselects to cell 2 during T1 period
	Neighbour cells		1, 2	Cell 1	
Final condition	Active cell		1, 2	Cell 1	The UE reselects to cell 1 during T2 period
	Neighbour cells		1,2	Cell 2	
RF Channel Number			1, 2	1	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC pattern 1	
DRX cycle length		s	1, 2	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	100	
T2		s	1, 2	100	

Table A.7.1.1.3.2-3: Cell specific test parameters for FR2 intra-frequency NR cell re-selection test case in AWGN for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		SR.3.1 TDD	
		2	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	
		2	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		CCR.3.1 TDD	
		2	CCR.3.1 TDD		CCR.3.1 TDD	
SSB configuration		1	SSB.3 FR2		SSB.7 FR2	
		2	SSB.4 FR2		SSB.8 FR2	
OCNG Pattern		1, 2	OP.4		OP.4	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1, 2	66		66	
Initial DL BWP configuration		1, 2	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-137		-137	
$S_{SearchDeltaP}$	dB	1, 2	6		6	
$T_{SearchDeltaP}$	s	1,2	5		5	
Pcompensation	dB	1, 2	0		0	
$Qhyst_s$	dB	1, 2	0		0	
$Qoffset_{s,n}$	dB	1, 2	0		0	
Cell_selection_and_ reselection_quality_measurement		1, 2	SS-RSRP		SS-RSRP	
AoA setup		1, 2	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption[Note 4]		1,2	Rough		Rough	
$\hat{E}_s/I_{ot\,\mathrm{BB}}$ [Note 5]	dB	1	-3.55	0.95	0.95	-3.55
		2				

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note2	dBm/SCS	1	-93			
		2	-90			
N_{oc} Note2	dBm/15 kHz	1	-102			
		2				
$\hat{E}_s / N_{oc}$	dB	1	-3	1.5	1.5	-3
		2				
SS-RSRP Note3	dBm/SCS	1	-96	-91.5	-91.5	-96
		2	-93	-88.5	-88.5	-93
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-67.40	-65.34	-65.34	-67.40
		2	-64.40	-62.34	-62.34	-64.40
Treselection	s	1, 2	0	0	0	0
SintrasearchP	dB	1, 2	50		50	
Propagation Condition		1, 2	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.1.1.3.3 Test Requirements

The cell reselection delay to an already detected cell for UE fulfilling low mobility relaxed criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected cell shall be less than 79 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to an already detectable cell can be expressed as: $T_{evaluate, NR_Intra} + T_{SI\text{-}NR}$,

Where:

$T_{evaluate, NR_Intra}$ See table 4.2.2.9.2-1 in clause 4.2.2.9,

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 78.08 s, allow 79 s for the cell re-selection delay to an already detected cell for UE fulfilling low mobility criterion in the test case.

A.7.1.1.4 Cell reselection to FR2 intra-frequency NR case for UE fulfilling not-at-cell edge relaxed measurement criterion

A.7.1.1.4.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for UE configured with relaxed measurement criterion specified in clause 4.2.2.9.3.

A.7.1.1.4.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.7.1.1.4.2-1, A.7.1.1.4.2-2 and A.7.1.1.4.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. During T1 and T2, only criteria *cellEdgeEvaluation* is configured and fulfilled, where Srxlev> $S_{SearchThresholdP}$. UE has not registered with network for the tracking area containing Cell 2.

Table A.7.1.1.4.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.1.1.4.2-2: General test parameters for FR2 intra-frequency NR cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	The UE camps on cell 1 in the initial phase
	Neighbour cells		1, 2	Cell 2	
T1 end condition	Active cell		1, 2	Cell 2	The UE reselects to cell 2 during T1 period
	Neighbour cells		1, 2	Cell 1	
Final condition	Active cell		1, 2	Cell 1	
	Neighbour cells		1,2	Cell 2	
RF Channel Number			1, 2	1	
Time offset between cells			1, 2	3 µs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC pattern 1	
DRX cycle length		s	1, 2	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	100	
T2		s	1, 2	100	

Table A.7.1.1.4.2-3: Cell specific test parameters for FR2 intra-frequency NR cell re-selection test case in AWGN for UE fulfilling not-at-cell edge criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		SR.3.1 TDD	
		2	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	
		2	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		CCR.3.1 TDD	
		2	CCR.3.1 TDD		CCR.3.1 TDD	
SSB configuration		1	SSB.3 FR2		SSB.7 FR2	
		2	SSB.4 FR2		SSB.8 FR2	
OCNG Pattern		1, 2	OP.4		OP.4	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1, 2	66		66	
Initial DL BWP configuration		1, 2	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1		ULBWP.0.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
RLM-RS		1, 2	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-137		-137	
Pcompensation	dB	1, 2	0		0	
$Qhyst_s$	dB	1, 2	0		0	
$Qoffset_{s,n}$	dB	1, 2	0		0	
Cell_selection_and_ reselection_quality_measurement		1, 2	SS-RSRP		SS-RSRP	
AoA setup		1, 2	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption Note 4		1,2	Rough		Rough	
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1	-3.55	0.95	0.95	-3.55
		2				
N_{oc} Note2	dBm/SCS	1	-93			
		2	-90			
N_{oc} Note2	dBm/15 kHz	1	-102			
		2				
$\hat{E}_s/N_{oc}$	dB	1	-3	1.5	1.5	-3
		2				
SS-RSRP Note3	dBm/SCS	1	-96	-91.5	-91.5	-96
		2	-93	-88.5	-88.5	-93
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-67.40	-65.34	-65.34	-67.40
		2	-64.40	-62.34	-62.34	-64.40
Treselection	s	1, 2	0	0	0	0
$S_{SearchThresholdP}$		1, 2	35	35	35	35
SintrasearchP	dB	1, 2	50		50	
Propagation Condition		1, 2	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.1.1.4.3 Test Requirements

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 79 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to an already detected cell can be expressed as: $T_{evaluate,\ NR_Intra} + T_{SI\text{-}NR}$,

Where:

$T_{evaluate,\ NR_Intra}$ See table 4.2.2.9.3-1 in clause 4.2.2.9,

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 78.08 s, allow 79 s for the cell re-selection delay to an already detected cell for UE fulfilling not-at-cell edge criterion in the test case.

A.7.1.1.5 Cell reselection to FR2 inter-frequency NR case for UE fulfilling low mobility relaxed measurement criterion

A.7.1.1.5.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements for UE fulfilling low mobility criterion specified in clause 4.2.2.10.2.

A.7.1.1.5.2 Test Parameters

The test scenario comprises of 2 cells (Cell 1 and Cell 2) on 2 different NR carriers respectively as given in tables A.7.1.1.5.2-1, A.7.1.1.5.2-2 and A.7.1.1.5.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. Cell 2 is of higher priority than Cell 1. The UE is configured with l*owMobilityEvalutation* criterion [2].

Table A.7.1.1.5.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.7.1.1.5.2-2: General test parameters for FR2 inter frequency NR cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 2	The UE camps on Cell 2 and fulfils low mobility (*lowMobilityEvalutation* [2]) criterion.
	Neighbour cell		1, 2	Cell 1	
T1 final condition	Active cell		1, 2	Cell 1	The UE reselects to low priority Cell 1 during T1
	Neighbour cell		1, 2	Cell 2	
T2 final condition	Active cell		1, 2	Cell 2	The UE reselects to high priority Cell 2 during T2
	Neighbour cell			Cell 1	
RF Channel Number			1, 2	1, 2	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
			2	SSB.2 FR2	
SMTC configuration			1, 2	SMTC pattern 1	
DRX cycle length		s	1, 2	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	85	T1 needs to be long enough to allow cell re-selection to already known Cell 1

Parameter	Unit	Test configuration	Value	Comment
T2	s	1, 2	85	T2 needs to be long enough to allow cell re-selection to already known Cell 2

Table A.7.1.1.5.2-3: Cell specific test parameters for FR2 inter frequency NR cell re-selection test case in AWGN for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1, 2	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET parameters		1, 2	CR.3.1 TDD		CR.3.1 TDD	
RMSI CORESET RMC configuration		1, 2	CCR.3.1 TDD		CCR.3.1 TDD	
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1, 2	66		66	
Initial DL BWP configuration		1, 2	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-137		-137	
Pcompensation	dB	1, 2	0		0	
$Qhyst_s$	dB	1, 2	0		0	
$Qoffset_{s,n}$	dB	1, 2	0		0	
Cell_selection_and_reselection_quality_measurement		1, 2	SS-RSRP		SS-RSRP	
AoA setup		1, 2	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption Note 4		1, 2	Rough		Rough	
$\hat{E}_s/I_{ot\ \mathrm{BB}}$ Note 5	dB	1, 2	9.95	7.45	-11.05	7.95
N_{oc} Note2	dBm/SCS	1	-93		-93	
		2	-90		-90	
N_{oc} Note2	dBm/15 kHz	1, 2	-102		-102	
$\hat{E}_s/N_{oc}$	dB	1, 2	10.5	8	-10.5	8.5
SS-RSRP Note3	dBm/SCS	1	-82.5	-85	-103.5	-84.5
		2	-79.5	-82	-100.5	-81.5
Io	dBm/95.04 MHz	1,2	-53.14	-55.37	-63.64	-54.94
TreselectionNR	s	1, 2	0		0	
SnonintrasearchP	dB	1, 2	50		Not sent	
$S_{SearchDeltaP}$	dB	1, 2	6		6	
$T_{SearchDeltaP}$	s	1, 2	5		5	
$Thresh_{x,highP}$	dB	1, 2	48		48	
$Thresh_{serving,lowP}$	dB	1, 2	44		44	
$Thresh_{x,lowP}$	dB	1, 2	50		50	
Propagation Condition		1, 2	AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.1.1.5.3 Test Requirements

The cell reselection delay to an already detected low priority cell (Cell 1) for UE fulfilling low mobility criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected low priority cell, Cell 1, shall be less than 79 s.

The cell reselection delay to an already detected high priority cell (Cell 2) for UE fulfilling low mobility criterion is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected high priority cell, Cell 2, shall be less than 79 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE 1: The cell re-selection delay to an already detected low priority cell can be expressed as: $T_{evaluate,\ NR_\ inter}$ + $T_{SI\text{-}NR}$

NOTE 2: The cell re-selection delay to an already detected higher priority cell can be expressed as: $T_{evaluate,\ NR_\ inter}$ + $T_{SI\text{-}NR}$

Where:

$T_{evaluate,\ NR_\ inter}$ See table 4.2.2.10.2-1 in clause 4.2.2.10.2

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 78.08 s, allow 79 s for the cell re-selection delay to an already detected low priority cell for UE fulfilling low mobility criterion in the test case.

This gives a total of 78.08 s, allow 79 s for the cell re-selection delay to an already detected high priority cell for UE fulfilling low mobility criterion in the test case.

A.7.1.1.6 Cell reselection to FR2 inter-frequency NR case for UE fulfilling not-at-cell edge relaxed measurement criterion

A.7.1.1.6.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements for UE fulfilling not-at-cell edge criterion specified in clause 4.2.2.10.3.

A.7.1.1.6.2 Test Parameters

The test scenario comprises of 2 cells (Cell 1 and Cell 2) on 2 different NR carriers respectively as given in tables A.7.1.1.6.2-1, A.7.1.1.6.2-2 and A.7.1.1.6.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. Cell 2 is of higher priority than Cell 1. The UE is configured with *cellEdgeEvaluation* criterion [2].

Table A.7.1.1.6.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.7.1.1.6.2-2: General test parameters for FR2 inter frequency NR cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 2	The UE camps on Cell 2 and fulfils not-at-cell edge (*cellEdgeEvaluation* [2]) criterion.
	Neighbour cell		1, 2	Cell 1	
T1 final condition	Active cell		1, 2	Cell 1	The UE reselects to low priority Cell 1 during T1
	Neighbour cell		1, 2	Cell 2	
T2 final condition	Active cell		1, 2	Cell 2	The UE reselects to high priority Cell 2 during T2
	Neighbour cell		1, 2	Cell 1	
RF Channel Number			1, 2	1, 2	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
			2	SSB.2 FR2	
SMTC configuration			1, 2	SMTC pattern 1	
DRX cycle length		s	1, 2	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	85	T1 needs to be long enough to allow cell re-selection to already known cell.
T2		s	1, 2	85	T2 needs to be long enough to allow cell re-selection to already known cell.

Table A.7.1.1.6.2-3: Cell specific test parameters for FR2 inter frequency NR cell re-selection test case in AWGN for UE fulfilling not-at-cell edge criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1, 2	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET parameters		1, 2	CR.3.1 TDD		CR.3.1 TDD	
RMSI CORESET RMC configuration		1, 2	CCR.3.1 TDD		CCR.3.1 TDD	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1, 2	66		66	
Initial DL BWP configuration		1, 2	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-137		-137	
Pcompensation	dB	1, 2	0		0	
$Qhyst_s$	dB	1, 2	0		0	
$Qoffset_{s,n}$	dB	1, 2	0		0	
Cell_selection_and_reselection_quality_measurement		1, 2	SS-RSRP		SS-RSRP	
AoA setup		1, 2	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption Note 4		1, 2	Rough		Rough	
$\hat{E}_s/I_{ot\,BB}$ Note 5	dB	1, 2	9.95	7.45	-11.05	7.95
N_{oc} Note2	dBm/SCS	1	-93		-93	
		2	-90		-90	
N_{oc} Note2	dBm/15 kHz	1, 2	-102		-102	
$\hat{E}_s/N_{oc}$	dB	1, 2	10.5	8	-10.5	8.5
SS-RSRP Note3	dBm/SCS	1	-82.5	-85	-103.5	-84.5
		2	-79.5	-82	-100.5	-81.5
Io	dBm/95.04 MHz	1,2	-53.14	-55.37	-63.64	-54.94
$S_{SearchThresholdP}$		1, 2	35	35	29	29
TreselectionNR	s	1, 2	0		0	
SnonintrasearchP	dB	1, 2	50		Not sent	
$Thresh_{x,highP}$	dB	1, 2	48		48	
$Thresh_{serving,lowP}$	dB	1, 2	44		44	
$Thresh_{x,lowP}$	dB	1, 2	50		50	
Propagation Condition		1, 2	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.1.1.6.3 Test Requirements

The cell reselection delay to an already detected low priority cell (Cell 1) for UE fulfilling not-at-cell edge criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected low priority cell, Cell 1, shall be less than 79 s.

The cell reselection delay to an already detected high priority cell (Cell 2) for UE fulfilling not-at-cell edge criterion is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected high priority cell, Cell 2, shall be less than 79 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE 1: The cell re-selection delay to an already detected low priority cell can be expressed as: $T_{evaluate, NR_ inter}$ + T_{SI-NR}

NOTE 2: The cell re-selection delay to an already detected higher priority cell can be expressed as: $T_{evaluate, NR_ inter}$ + T_{SI-NR}

Where:

$T_{evaluate, NR_ inter}$ See table 4.2.2.10.3-1 in clause 4.2.2.10.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 78.8 s, allow 79 s for the cell re-selection delay to an already detected low priority cell for UE fulfilling not-at-cell edge criterion in the test case.

This gives a total of 78.08 s, allow 79 s for the cell re-selection delay to an already detected high priority cell for UE fulfilling not-at-cell edge criterion in the test case.

A.7.1.1.7 Cell reselection to FR2 intra-frequency NR case for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*

A.7.1.1.7.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements specified in clause 4.2.2.3 for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*.

A.7.1.1.7.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.7.1.1.7.2-1, A.7.1.1.7.2-2 and A.7.1.1.7.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only cell 1 is already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing cell 2.

Table A.7.1.1.7.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.1.1.7.2-2: General test parameters for intra frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	
T2 end condition	Active cell		1, 2	Cell 2	
	Neighbour cell		1, 2	Cell 1	
Final condition	Active cell		1, 2	Cell 1	
	Neighbour cell		1, 2	Cell 2	
RF Channel Number			1, 2	1	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC.1	

Parameter	Unit	Test configuration	Value	Comment
DRX cycle length	s	1, 2	0.32	The value shall be used for all cells in the test.
PRACH configuration index		1, 2	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell		1, 2	Not configured	
highSpeedMeasFlagFR2-r17			Set 1	
T1	s	1, 2	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2	s	1, 2	10	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3	s	1, 2	5	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.7.1.1.7.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 2	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1	SR.3.1 TDD			SR.3.1 TDD		
		2	SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
		2	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
		2	CCR.3.1 TDD			CCR.3.1 TDD		
SSB configuration		1	SSB.3 FR2			SSB.7 FR2		
		2	SSB.4 FR2			SSB.8 FR2		
OCNG Pattern		1, 2	OP.4			OP.4		
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		1, 2	66			66		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-138			-138		
		2	-135			-135		
Pcompensation	dB	1, 2	0			0		
$Qhyst_s$	dB	1, 2	0			0		
$Qoffset_{s,n}$	dB	1, 2	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2	SS-RSRP			SS-RSRP		
AoA setup		1, 2	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
$\hat{E}_s/I_{ot}$	dB	1	8	-3	1.5	-infinity	1.5	-3
		2						
Beam assumption[Note 4]		1,2	Rough					
N_{oc} [Note2]	dBm/SCS	1	-93					
		2	-90					
N_{oc} [Note2]	dBm/15 kHz	1	-102					
		2						

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
$\hat{E}_s / N_{oc}$	dB	1	8	-3	1.5	-infinity	1.5	-3
		2						
SS-RSRP Note3	dBm/SCS	1	-85	-96	-91.5	-infinity	-91.5	-96
		2	-82	-93	-88.5	-infinity	-88.5	-93
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-59.37	-63.40	-62.47	-64.01	-62.47	-63.40
		2	-57.18	-62.86	-61.67	-64.01	-61.67	-62.86
Treselection	s	1, 2	0	0	0	0	0	0
SintrasearchP	dB	1, 2	50			50		
Propagation Condition		1,2	AWGN			AWGN 19444 Hz;		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.1.1.7.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 7 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon cell 1.

The cell re-selection delay to an already detected cell shall be less than 4 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI-NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR_ intra} + T_{SI-NR}$,

Where:

T_{detect, NR_Intra} See table 4.2.2.3-3 in clause 4.2.2.3

$T_{evaluate, NR_ intra}$ See table 4.2.2.3-3 in clause 4.2.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 6.4 s, allow 7 s for the cell re-selection delay to a newly detectable cell and 3.2 s for the cell re-selection delay to an already detected cell in the test case, which we allow 4 s.

A.7.1.1.8 Cell reselection to FR2 inter-frequency NR case for UE configured with *highSpeedMeasFlagFR2-r17*

A.7.1.1.8.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements for UE that supports *measEnhCAInterFreqFR2-r18* and configured with *highSpeedMeasFlagFR2-r17* specified in clause 4.2.2.4.

A.7.1.1.8.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.7.1.1.8.2-1, A.7.1.1.8.2-2 and A.7.1.1.8.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas and cell 2 is of higher priority than cell 1. Note that the value of configured *highSpeedMeasFlagFR2-r17* is set to *set2*.

Table A.7.1.1.8.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.7.1.1.8.2-2: General test parameters for FR2 inter frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 2	The UE camps on cell 2 in the initial phase and during T1 period the UE reselects to cell 1.
	Neighbour cell		1, 2	Cell 1	
T1 end condition	Active cell		1, 2	Cell 1	The UE shall perform reselection to cell 1 during T1.
	Neighbour cells		1, 2	Cell 2	
T3 end condition	Active cell		1, 2	Cell 2	The UE shall perform reselection to cell 2 with higher priority during T3.
	Neighbour cell		1, 2	Cell 1	
RF Channel Number			1, 2	1, 2	
Time offset between cells			1, 2	3 μs	Synchronous cells are assumed.
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
			2	SSB.2 FR2	
SMTC configuration			1, 2	SMTC.1	SMTC is set with 20 ms periodicity on both frequencies.
DRX cycle length		s	1, 2	0.32	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2.
rangeToBestCell			1, 2	Not configured	
highSpeedMeasFlagFR2-r17			1, 2	Set2	Set2 deployment is configured and the UE FR2 scaling factor is considered as N1 = 6.
T1		s	1, 2	10	T1 needs to be defined so that cell re-selection reaction time is taken into account.

Parameter	Unit	Test configuration	Value	Comment
T2	s	1, 2	>7	During T2, cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that cell 2 has not been detected by the UE prior to the start of period T3.
T3	s	1, 2	70	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.7.1.1.8.2-3: Cell specific test parameters for FR2 inter frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 2	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1, 2	SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET parameters		1, 2	CR.3.1 TDD			CR.3.1 TDD		
RMSI CORESET RMC configuration		1, 2	CCR.3.1 TDD			CCR.3.1 TDD		
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-140			-140		
		2	-137			-137		
Pcompensation	dB	1, 2	0			0		
$Qhyst_s$	dB	1, 2	0			0		
$Qoffset_{s,n}$	dB	1, 2	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2	SS-RSRP			SS-RSRP		
AoA setup		1, 2	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
Beam assumption Note 4		1,2	Rough			Rough		
$\hat{E}_s / I_{ot}$ BB Note 5	dB	1	9.95	9.95	7.45	-11.05	-infinity	7.95
		2						
N_{oc} Note2	dBm/SCS	1	-93			-93		
		2	-90			-90		
N_{oc} Note2	dBm/15 kHz	1	-102			-102		
		2						
$\hat{E}_s / N_{oc}$	dB	1	10.5	10.5	8	-10.5	-infinity	8.5
		2						
SS-RSRP Note3	dBm/SCS	1	-82.5	-82.5	-85	-103.5	-infinity	-84.5
		2	-79.5	-79.5	-82	-100.5	-infinity	-81.5
Io	dBm/95.04 MHz	1, 2	-53.11	-53.11	-55.34	-63.61	-63.98	-54.91
Treselection	s	1, 2	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2	50			50		
$Thresh_{x, highP}$	dB	1, 2	48			48		
$Thresh_{serving, lowP}$	dB	1, 2	44			44		
$Thresh_{x, lowP}$	dB	1, 2	50			50		
Propagation Condition		1, 2	AWGN			AWGN with 19444 Hz		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.								
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.								

A.7.1.1.8.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 2 and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 1 and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on cell 1.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate,\ NR_inter_HST} + T_{SI\text{-}NR}$, and to a lower priority cell can be expressed as: $T_{evaluate,\ NR_inter_HST} + T_{SI\text{-}NR}$,

Where:

$T_{higher_priority_search}$ See clause 4.2.2.7

$T_{evaluate,\ NR_inter_HST}$ See table 4.2.2.4-2a in clause 4.2.2.4

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.04 s, allow 68 s for the cell re-selection delay to a higher priority cell and 7.04 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 8 s.

A.7.2 SA: RRC_INACTIVE state mobility

A.7.2.1 Small Data Transmission

A.7.2.1.1 TA validation for CG-SDT in FR2

A.7.2.1.1.1 Test Purpose and Environment

The purpose of this test is to partly verify that the UE properly perform TA validation for CG-SDT transmission in clause 5.5.3. The test includes two sub-tests, Sub-test#1 for testing valid TA where UE can initiat CG-SDT transmission, and Sub-test#2 for testing invalid TA where UE does not initiate CG-SDT transmission. Subtest#2 is only tested if Sub-test#1 is passed. For each sub-test, UE is configured with CG-SDT configurations when entering RRC Inactive state. Sub-test#1 consists of four successive time periods, with time duration of T1, T2, T3 and T4 repectively. Sub-test#2 consists of two successive time periods, with time duration of T5 and T6 repectively. There is one cell,

which is the active NR cell in FR2. Figure A.7.2.1.1.1-1 shows the variation of the RSRP over the duration of Sub-test#1, and figure A.7.2.1.1.1-2 shows the variation of the RSRP over the duration of Sub-test#2.

In Sub-test#1:

- Prior to the time point TA, the UE shall be fully synchronized to PCell (Cell 1), be registered to the cell and have entered RRC connected mode.
- Before starting the test at time point TA, test equipment configures RSRP to P0. At time point TB, RSRP is changed from P0 to P1.
- At time point TC which is W1 after time point TB, UE expect to receive RRC release with CG SDT configuration and RRC status is changed to INACTIVE status.
- At time point TD, RSRP is changed from P1 to P0.
- At time point TE, RSRP is changed from P0 to P2. TE must be W2 before TF.
- Test equipment triggers UL data arrival at UE lower layer at time point TF. After time point TF, test equipment observes whether UE transmits with CG-SDT no later than TG which is W3 after TF.
- After time point TG, RRC status is changed from RRC INACTIVE to RRC CONNECTED.

In Sub-test#2:

- Prior to the time point TA, the UE shall pass Sub-test#1 and have entered RRC connected mode. Otherwise, Sub-test#2 shall not be executed.
- From time point TA to time point TD, RSRP is set to P2.
- At time point TC, which is W1 after time point TB, UE expect to receive RRC release with CG SDT configuration and RRC status is changed to INACTIVE status.
- At time point TD, RSRP is changed from P2 to P0.
- Test equipment triggers UL data arrival at UE lower layer at time point TF. TF is 3360 ms after TD. After time point TF, test equipment observes whether UE transmits with CG-SDT no later than TG which is W3 after TF.

W1 equals to 480 ms and W2 equals to 480 ms based on requirements in clause 5.5.3. W3 is 1060 ms.

Supported test configurations are shown in table A.7.2.1.1.1-1. The test parameters are given in tables A.7.2.1.1.1-2 and A.7.2.1.1.1-3.

Table A.7.2.1.1.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.7.2.1.1.1-2: General test parameters for TA validation for CG-SDT in FR2

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 66
DL initial BWP configuration	Config 1		DLBWP.0.1
UL initial BWP configuration	Config 1		ULBWP.0.1
TDD Configuration	Config 1		TDDConf.3.1
RMSI CORESET Reference Channel	Config 1		CR.3.1 DD
SSB Configuration	Config 1		SSB.3 FR2
SMTC Configuration	Config 1		SMTC.1

Parameter		Unit	Value
			Test 1
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	120
PRACH Configuration	Config 1		Table A.3.8.3.4
OCNG parameters			OP.5
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
DRX		s	0.64
cg-SDT-RSRP-ThresholdSSB		dBm	-110
cg-SDT-RSRP-ChangeThreshold		dB	8
cg-SDT-TimeAlignmentTime			infinity
CG-SDT resource period		ms	320
T1		s	0.8
T2		s	0.96
T3		s	3.04
T4		s	1.54
T5		s	1.76
T6		s	4.58

Table A.7.2.1.1.1-3: Cell specific test parameters TA validation for CG-SDT in FR2

Parameter		Unit	Test 1					
			T1	T2	T3	T4	T5	T6
AoA setup			Setup 1 defined in A.3.15					
Assumption for UE beams Note 4			Rough					
EPRE ratio of PDCCH DMRS to SSS		dB	4					
EPRE ratio of PDCCH to PDCCH DMRS		dB	0					
EPRE ratio of PBCH DMRS to SSS		dB	0					
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
N_{oc}	Config 1	dBm/15 kHz	-100					
N_{oc}	Config 1	dBm/SCS	-100					
$\hat{E}_s / I_{ot}$	Config 1	dB	0	13	0	24.5	24.5	0
$\hat{E}_s / N_{oc}$	Config 1	dB	0	13	0	24.5	24.5	0
SS-RSRP	Config 1	dBm/SCS	-100	-87	-100	-75.5	-75.5	-100
Io	Config 1	dBm/95.04 MHz	-68	-57.8	-68	-46.50	-46.50	-68
Propagation condition			AWGN					
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.								

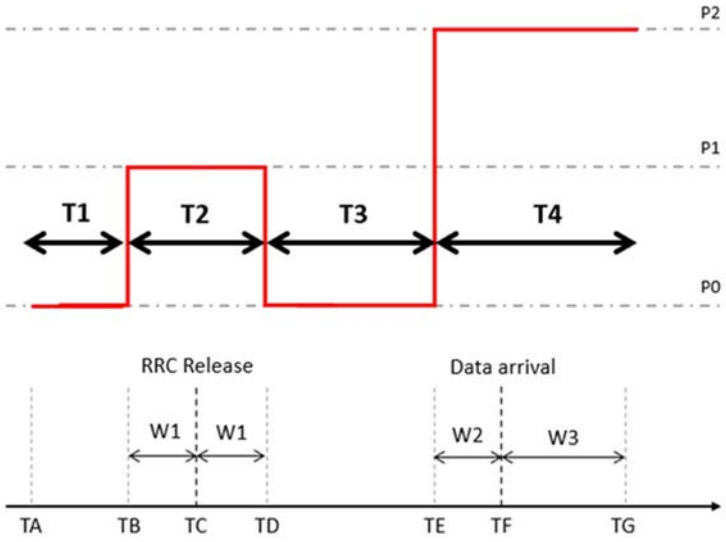


Figure A.7.2.1.1.1-1: RSRP variation for TA validation for CG-SDT Sub-test#1

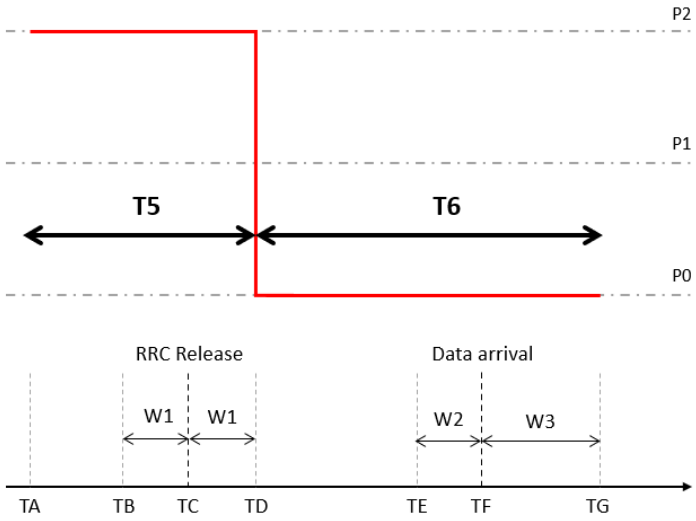


Figure A.7.2.1.1.1-2: RSRP variation for TA validation for CG-SDT Sub-test#2

A.7.2.1.1.2 Test Requirements

The UE behaviour in each test during time durations shall be as follows:

During Sub-test#1, UE shall transmit UL data with CG-SDT within 1060 ms after time point TF.

During Sub-test#2, after passing Sub-test#1, UE shall not transmit UL data with CG-SDT.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.2.2 Cell reselection for positioning

A.7.2.2.1 Cell reselection to FR2 intra-frequency NR case with RRC_ INACTIVE eDRX and positioning SRS

A.7.2.2.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell reselection requirements specified in clause 5.6.1A.2, when UE is in RRC_INACTIVE and configured with eDRX and to transmit SRS for positioning.

A.7.2.2.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.7.2.2.1.2-1, A.7.2.2.1.2-2 and A.7.2.2.1.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Only cell 1 is already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing cell 2. UE is configured with transmit SRS for positioning in cell 1.

Table A.7.2.2.1.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.2.2.1.2-2: General test parameters for intra frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell1	
T2 end condition	Active cell		1, 2	Cell2	
	Neighbour cell		1, 2	Cell1	
RF Channel Number			1, 2	1	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC.1	
DRX cycle length		s	1, 2	1.28	The value shall be used for all cells in the test.
CN and RAN eDRX configuration			Config 1	eDRX cycle = 40.96s PTW length = 1.28s	
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	1, 2	355	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.7.2.2.1.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case in AWGN

Parameter	Unit		Cell 1	Cell 2

		Test configuration	T1	T2	T3	T1	T2	T3
TDD configuration		1, 2	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1	SR.3.1 TDD			SR.3.1 TDD		
		2	SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
		2	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
		2	CCR.3.1 TDD			CCR.3.1 TDD		
SSB configuration		1	SSB.3 FR2			SSB.7 FR2		
		2	SSB.4 FR2			SSB.8 FR2		
OCNG Pattern		1, 2	OP.4			OP.4		
$BW_{channel}$	MHz	1, 2	100: $N_{RB,c}$ = 66			100: $N_{RB,c}$ = 66		
Data PRBs allocated		1, 2	66			66		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2	SSB			SSB		
Periodicity of SRS for positioning	s	1, 2	5.12			N/A		
Qrxlevmin	dBm/SCS	1	-138			-138		
		2	-135			-135		
Pcompensation	dB	1, 2	0			0		
$Qhyst_s$	dB	1, 2	0			0		
$Qoffset_{s,n}$	dB	1, 2	0			0		
Cell_selection_and_reselection_quality_measurement		1, 2	SS-RSRP			SS-RSRP		
AoA setup		1, 2	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
Beam assumption[Note 4]		1,2	Rough			Rough		
$\hat{E}_s/I_{ot\,\mathrm{BB}}$ [Note 5]	dB	1	7.45	-3.55	0.95	-infinity	0.95	-3.55
		2						
N_{oc} [Note2]	dBm/SCS	1	-93					
		2	-90					
N_{oc} [Note2]	dBm/15 kHz	1	-102					
		2						
$\hat{E}_s/N_{oc}$	dB	1	8	-3	1.5	-infinity	1.5	-3
		2						
SS-RSRP [Note3]	dBm/SCS	1	-85	-96	-91.5	-infinity	-91.5	-96
		2	-82	-93	-88.5	-infinity	-88.5	-93
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-60.53	-67.40	-65.34	-69.17	-65.34	-67.40
		2	-57.52	-64.39	-62.33	-66.16	-62.33	-64.39
Treselection	s	1, 2	0	0	0	0	0	0
SintrasearchP	dB	1, 2	50			50		
Propagation Condition		1, 2	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.7.2.2.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 355 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI-NR}$,

Where:

T_{detect, NR_Intra} See table 5.6.1A.2-2 in clause 5.6.1A.2

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 354.56 s, allow 355 s for the cell re-selection delay to a newly detectable cell.

A.7.3 RRC_CONNECTED state mobility

A.7.3.1 Handover

A.7.3.1.1 Inter-frequency handover from FR1 to FR2; unknown target cell

A.7.3.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR2 inter frequency handover requirements specified in clause 6.1.1.5.

A.7.3.1.1.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.1.2-2, and A.7.3.1.1.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.7.3.1.1.2-1: Inter-frequency handover from FR1 to FR2 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.1.2-2: General test parameters Inter-frequency handover from FR1 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	

Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.1.1.2-3: Cell specific test parameters for NR FR1-FR2 Inter frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]			N/A		Rough	
AoA setup			NA		Setup 1 as defined in A.3.15	
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD		TDD	
	Config 2,3		TDD		TDD	
TDD configuration	Config 1		Not Applicable		TDDConf.3.1	
	Config 2		TDDConf.1.1		TDDConf.3.1	
	Config 3		TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
	Config 2		10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
	Config 3		40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
	Config 2		10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
	Config 3		40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	Config 1		52		66	
	Config 2		52		66	
	Config 3		106		66	
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD		SR3.1 TDD	
	Config 2		SR.1.1 TDD		SR3.1 TDD	
	Config 3		SR2.1 TDD		SR3.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD		CR3.1 TDD	
	Config 2		CR.1.1 TDD		CR3.1 TDD	
	Config 3		CR2.1 TDD		CR3.1 TDD	
Control Channel RMC	Config 1		CCR.1.1 FDD		CCR.3.1 TDD	
	Config 2		CCR.1.1 TDD		CCR.3.1 TDD	
	Config 3		CCR.2.1 TDD		CCR.3.1 TDD	
OCNG Patterns			OP 1			
SSB configuration	Config 1,2		SSB.1 FR1		SSB. 3 FR2	
	Config 3		SSB.2 FR1		SSB. 3 FR2	
SMTC configuration	Config 1,2		SMTC.1		SMTC.1	
	Config 3		SMTC.2		SMTC.1	
SMTC configuration	Config 1,2		SMTC.1		SMTC.1	
	Config 3		SMTC.2		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz		120 kHz	
	Config 3		30 kHz		120 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz		120 kHz	
	Config 3		30 kHz		120 kHz	
PRACH configuration			FR1 PRACH configuration 1		FR2 PRACH configuration 1	
TRS configuration	Config 1		TRS.1.1 FDD		TRS.2.1 TDD	
	Config 2		TRS.1.1 TDD		TRS.2.1 TDD	
	Config 3		TRS.1.2 TDD		TRS.2.1 TDD	
PDSCH/PDCCH TCI state			N/A		TCI.State.2	
BWP configuraiton	Initial DL BWP		DLBWP.0.1		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0		0	

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	Link only, see clause A.3.7A		-104.7	
N_{oc} Note2	Config 1,2	dBm/SCS			-95.7	
	Config 3				-95.7	
$\hat{E}_s / I_{ot}$		dB			-Infinity	10
$\hat{E}_s / N_{oc}$		dB			-Infinity	10
Io Note3	Config 1,2	dBm/ BW			-66.7	-56.3
	Config 3	dBm/ BW			-66.7	-56.3
Propagation condition		-			AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.1.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 572 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 562 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.5.2.

This gives a total of 572 ms.

A.7.3.1.2 Intra-frequency handover from FR2 to FR2; unknown target cell

A.7.3.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 intra frequency handover requirements specified in clause 6.1.1.4.

A.7.3.1.2.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.2.2-2, and A.7.3.1.2.2-3.

The test scenario comprises of two cells on same carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the

UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.7.3.1.2.2-1: Intra-frequency handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.1.2.2-2: General test parameters Intra-frequency handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.1.2.2-3: Cell specific test parameters for NR FR2-FR2 Intra frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]			Rough		Rough	
AoA setup			Setup 1 as defined in A.3.15			
NR RF Channel Number			**1**		**1**	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
Data PRBs allocated			66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
RMSI CORESET Reference Channel			CR3.1 TDD			
Control Channel RMC			CCR.3.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB. 3 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
PDSCH/PDCCH TCI state			TCI.State.2			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} [Note2]		dBm/15 kHz	-104.7			
N_{oc} [Note2]		dBm/SCS	-95.7			

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
$\hat{E}_s / I_{ot}$	dB	6	-1.8	-Infinity	0
$\hat{E}_s / N_{oc}$	dB	6	6	-Infinity	7
Io[Note3]	dBm/ BW	-59.7	-56.7	-59.7	-56.7
Propagation condition	-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.1.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 232 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 222 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.4.2.

This gives a total of 232 ms.

A.7.3.1.3 Inter-frequency handover from FR2 to FR2; unknown target cell

A.7.3.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 inter frequency handover requirements specified in clause 6.1.1.4.

A.7.3.1.3.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.3.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.3.2-2, and A.7.3.1.3.2-3.

The test scenario comprises of carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.7.3.1.3.2-1: Inter-frequency handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.1.3.2-2: General test parameters Inter-frequency handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	

	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.1.3.2-3: Cell specific test parameters for NR FR2-FR2 Inter frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]			Rough		Rough	
AoA setup			Setup 1as defined in A.3.15			
NR RF Channel Number			1		2	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
Data PRBs allocated			66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
RMSI CORESET Reference Channel			CR3.1 TDD			
Control Channel RMC			CCR.3.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB. 3 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
PDSCH/PDCCH TCI state			TCI.State.2			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-104.7		-104.7	
N_{oc} Note2		dBm/SCS	-95.7		-95.7	
$\hat{E}_s / I_{ot}$		dB	5	5	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	5	5	-Infinity	5
Io[Note3]	Config 1,2	dBm/ BW	-60.5	-60.5	-66.7	-60.5
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.3.1.3.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 552 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 542 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.4.2.

This gives a total of 552 ms.

A.7.3.1.4 Inter-band inter-frequency synchronous DAPS handover from FR1 to FR2

A.7.3.1.4.1 Test Purpose and Environment

This test is to verify the requirement for the FR1-to-FR2 Inter-band inter-frequency synchronous DAPS handover requirements specified in clause 6.1.3.4.

A.7.3.1.4.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.4.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.4.2-2, A.7.3.1.4.2-3 and A.7.3.1.4.2-4.

The test scenario comprises of two bands each with one cell. The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively.

Before the start of T1, the UE is connected to Cell 1 (source PCell) on radio channel 1 but is not aware of Cell 2 (neighbour cell) on radio channel 2. The UE shall be configured with periodic CSI reporting for Cell 1. During T1, the UE shall not have any timing information of Cell 2.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event A4 is configured for neighbour cell (Cell 2), and the UE is configured with the measurement gaps (gap pattern ID # 0). Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A4. After receiving the Event A4, the test system shall send a RRC message implying DAPS handover to the UE.

The start of T3 is the instant when the test system receives the ACK of the PDSCH corresponding to the last TTI containing the RRC message implying DAPS handover to Cell 2 (target PCell) sent to the UE. During T3, the UE shall be able to perform random access to Cell 2. DL schedule and UL feedback to cell 1 shall be avoided when UE is required to perform DL reception or UL transmission in PRACH procedure in cell 2, except preamble transmission. After the RACH procedure is completed, the test system shall send a RRC message to the UE to release Cell 1 (source cell) on radio channel 1.

The start of T4 is the instant when the test system receives the ACK of the PDSCH corresponding to the last TTI containing the RRC message implying source cell release sent to the UE. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stop sending CSI report to the source cell.

Table A.7.3.1.4.2-1: Inter-band inter-frequency synchronous DAPS handover from FR1 to FR2 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode

	Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.4.2-2: General test parameters for Inter-band inter-frequency synchronous DAPS handover from FR1 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A4-Threshold		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells		µs	33	Synchronous cells
T1		s	5	
T2		s	<5	
T3		s	<0.5	
T4		ms	$10+T_{interrupt2}$	$T_{interrupt2}$ as defined in table 6.1.3.4.2-2 for synchronous DAPS HO
T5		ms	100	

Table A.7.3.1.4.2-3: Cell specific test parameters for Inter-band inter-frequency synchronous DAPS handover from FR1 to FR2 (Cell 1 in FR1)

Parameter		Unit	Cell 1	
			T1	T2 - T5
NR RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
OCNG Patterns			OP.1	
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
reportConfigType			periodic	
reportQuantity			cri-RI-PMI-CQI	
CSI reporting periodicity	Config 1,2	slot	5	
	Config 3		10	
CSI reporting offset	Config 1,2	slot	3	

Parameter		Unit	Cell 1	
			T1	T2 - T5
	Config 3		5	
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC Configuration	Config 1,2		SMTC.1	
	Config 3		SMTC.2	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz	
	Config 3		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz	
	Config 3		30 kHz	
PRACH configuration			FR1 PRACH configuration 2	
BWP	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.3	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.3	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	NA Link only, see clause A.3.7A	
N_{oc} Note2	Config 1,2	dBm/SCS		
	Config 3			
$\hat{E}_s / I_{ot}$		dB		
$\hat{E}_s / N_{oc}$		dB		
Io Note3	Config 1,2	dBm/ 9.36 MHz		
	Config 3	dBm/ 38.16 MHz		
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.3.1.4.2-4: Cell specific test parameters for Inter-band inter-frequency synchronous DAPS handover from FR1 to FR2 (Cell 2 in FR2)

Parameter		Unit	Cell 2	
			T1	T2 - T5
Assumption for UE beams Note 6			Rough	
AoA setup			Setup 1 as defined in A.3.15	
NR RF Channel Number			2	
Duplex mode	Config 1,2,3		TDD	
TDD configuration	Config 1,2,3		TDDConf.3.1	
$BW_{channel}$	Config 1,2,3	MHz	100: $N_{PRB,c}$ = 66	
BWP BW	Config 1,2,3	MHz	100: $N_{PRB,c}$ = 66	
TRS configuration	Config 1,2,3		TRS.2.1 TDD	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,2,3		SR3.1 TDD	
CORESET Reference Channel	Config 1,2,3		CR3.1 TDD	
OCNG Patterns			OCNG pattern 1	
CSI-RS configuration for CSI reporting	Config 1,2,3		CSI-RS.3.1 TDD	
SSB Configuration	Config 1,2,3		SSB.1 FR2	

SMTC Configuration			SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,3	kHz	120 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,3	kHz	120 kHz	
PRACH configuration			FR2 PRACH configuration 2	
TCI configuration			CSI-RS.Config.0	
BWP	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.3	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.3	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-104.7	-104.7
N_{oc} Note2		dBm/SCS	-95.7	-95.7
$\hat{E}_s / I_{ot}$		dB	-Infinity	10
$\hat{E}_s / N_{oc}$		dB	-Infinity	10
Io Note3		dBm/ 95.04 MHz	-66.7	-55.4
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.

A.7.3.1.4.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 92 ms from the beginning of time period T3. During $D_{handover1}$, the interruption on Cell 1 shall not exceed $T_{interrupt1}$ as defined in table 6.1.3.4.2-1 for synchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay $D_{handover1}$ can be expressed as: $T_{RRC_procedure} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 40 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 92 ms.

The UE shall complete to release Cell 1 less than (10 ms + $T_{interrupt2}$) from the beginning of time period T4. During $D_{handover2}$, the interruption on Cell 2 shall not exceed $T_{interrupt2}$ as defined in table 6.1.3.4.2-2 for synchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay $D_{handover2}$ can be expressed as: $T_{RRC_procedure} + T_{interrupt2}$, where:

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

A.7.3.1.5 Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR2

A.7.3.1.5.1 Test Purpose and Environment

This test is to verify the requirement for the FR1-to-FR2 Inter-band inter-frequency asynchronous DAPS handover requirements specified in clause 6.1.3.4.

A.7.3.1.5.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.5.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.5.2-2, A.7.3.1.5.2-3 and A.7.3.1.5.2-4.

The test scenario comprises of two bands each with one cell. The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively.

Before the start of T1, the UE is connected to Cell 1 (source PCell) on radio channel 1 but is not aware of Cell 2 (neighbour cell) on radio channel 2. The UE shall be configured with periodic CSI reporting for Cell 1. During T1, the UE shall not have any timing information of Cell 2.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event A4 is configured for neighbour cell (Cell 2), and the UE is configured with the measurement gaps (gap pattern ID # 0). Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A4. After receiving the Event A4, the test system shall send a RRC message implying DAPS handover to the UE.

The start of T3 is the instant when the test system receives the ACK of the PDSCH corresponding to the last TTI containing the RRC message implying DAPS handover to Cell 2 (target PCell) sent to the UE. During T3, the UE shall be able to perform random access to Cell 2. DL schedule and UL feedback to cell 1 shall be avoided when UE is required to perform DL reception or UL transmission in PRACH procedure in cell 2, except preamble transmission. After the RACH procedure is completed, the test system shall send a RRC message to the UE to release Cell 1 (source cell) on radio channel 1.

The start of T4 is the instant when the the test system receives the ACK of the PDSCH corresponding to last TTI containing the RRC message implying source cell release sent to the UE. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stop sending CSI report to the source cell.

Table A.7.3.1.5.2-1: Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR2 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.5.2-2: General test parameters for Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A4-Threshold		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used

Access Barring Information	-	Not Sent	No additional delays in random access procedure.
Time offset between cells	µs	62.5	Asynchronous cells
T1	s	5	
T2	s	<5	
T3	s	<0.5	
T4	ms	$10+T_{interrupt2}$	$T_{interrupt2}$ as defined in table 6.1.3.4.2-2 for asynchronous DAPS HO.
T5	ms	100	

Table A.7.3.1.5.2-3: Cell specific test parameters for Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR2 (Cell 1 in FR1)

Parameter		Unit	Cell 1	
			T1	T2 - T5
NR RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
OCNG Patterns			OP.1	
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
reportConfigType			periodic	
reportQuantity			cri-RI-PMI-CQI	
CSI reporting periodicity	Config 1,2	slot	5	
	Config 3		10	
CSI reporting offset	Config 1,2	slot	3	
	Config 3		5	
SSB Configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC Configuration	Config 1,2		SMTC.1	
	Config 3		SMTC.2	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz	
	Config 3		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz	
	Config 3		30 kHz	
PRACH configuration			FR1 PRACH configuration 2	
BWP	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.3	
	Initial UL BWP		ULBWP.0.1	

Parameter		Unit	Cell 1	
			T1	T2 - T5
	Dedicated UL BWP		ULBWP.1.3	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	NA Link only, see clause A.3.7A	
N_{oc} Note2	Config 1,2	dBm/SCS		
	Config 3			
$\hat{E}_s / I_{ot}$		dB		
$\hat{E}_s / N_{oc}$		dB		
Io Note3	Config 1,2	dBm/ 9.36 MHz		
	Config 3	dBm/ 38.16 MHz		
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.3.1.5.2-4: Cell specific test parameters for Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR2 (Cell 2 in FR2)

Parameter		Unit	Cell 2	
			T1	T2 - T5
Assumption for UE beams Note 6			Rough	
AoA setup			Setup 1 as defined in A.3.15	
NR RF Channel Number			2	
Duplex mode	Config 1,2,3		TDD	
TDD configuration	Config 1,2,3		TDDConf.3.1	
$BW_{channel}$	Config 1,2,3	MHz	100: $N_{PRB,c}$ = 66	
BWP BW	Config 1,2,3	MHz	100: $N_{PRB,c}$ = 66	
TRS configuration	Config 1,2,3		TRS.2.1 TDD	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,2,3		SR.3.1 TDD	
CORESET Reference Channel	Config 1,2,3		CR.3.1 TDD	
OCNG Patterns			OP.1	
CSI-RS configuration for CSI reporting	Config 1,2,3		CSI-RS.3.1 TDD	
SSB Configuration	Config 1,2,3		SSB.1 FR2	
SMTC Configuration			SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,3	kHz	120 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,3	kHz	120 kHz	
PRACH configuration			FR2 PRACH configuration 2	
TCI configuration			CSI-RS.Config.0	
BWP	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.3	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.3	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				

EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2	dBm/15 kHz	-104.7	-104.7
N_{oc} Note2	dBm/SCS	-95.7	-95.7
$\hat{E}_s / I_{ot}$	dB	-Infinity	10
$\hat{E}_s / N_{oc}$	dB	-Infinity	10
Io Note3	dBm/ 95.04 MHz	-66.7	-55.4
Propagation condition	-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.

A.7.3.1.5.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 92 ms from the beginning of time period T3. During $D_{handover1}$, the interruption on Cell 1 shall not exceed $T_{interrupt1}$ as defined in table 6.1.3.4.2-1 for asynchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay $D_{handover1}$ can be expressed as: $T_{RRC_procedure} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 40 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 792 ms.

The UE shall complete to release Cell 1 less than (10 ms + $T_{interrupt2}$) from the beginning of time period T4. During $D_{handover2}$, the interruption on Cell 2 shall not exceed $T_{interrupt2}$ as defined in table 6.1.3.4.2-2 for asynchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay $D_{handover2}$ can be expressed as: $T_{RRC_procedure} + T_{interrupt2}$, where:

$T_{RRC_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

A.7.3.1.6 Handover with PSCell from SA to EN-DC with unknown FR2 target PScell

A.7.3.1.6.1 Test Purpose and Environment

This test is to verify the PSCell addition delay requirements specified in clause 6.1.5.2 for handover with PSCell from NR SA to EN-DC with sequential processing when the SMTC of target unknown PSCell is present in RRCConnectionReconfiguration and the target PSCell is in FR2.

A.7.3.1.6.2 Test Parameters

The test scenario comprises of three carriers and one cell on each carrier. Cell 1 is the NR PCell, Cell 2 is an inter-RAT E-UTRAN neighbour cell and Cell 3 is an NR neighbour cell, on radio channel 1 in FR1, radio channel 2 in E-UTRAN in FR1 and radio channel 3 in FR2, respectively.

The test consists of three successive time periods, with time durations of T1, T2, T3 and T4 respectively. No gap patterns are configured in the test case.

At the start of time duration T1, the UE does not have any timing information of cell 2 and cell 3, and the UE is only monitoring Cell 1. During T1, only Cell 1 is known to the UE.

Starting T2, cell 2 and cell 3 become detectable. The RRC message implying handover with PSCell shall be sent to the UE during period T2 after the UE has reported Event B2 and Event B1. The start of T2 is the instant when the last TTI containing the RRC message implying handover with PSCell is sent to the UE. The handover with PSCell message shall contain Cell 2 as the target cell and Cell 3 as PSCell-to-be added. The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added.

The point in time at which the RRC message implying HO (Cell 2) with PSCell (Cell 3) is received at the UE antenna connector defines the start of period T3.

During T3, the UE shall carry out random access (i.e., transmit the PRACH) towards the Cell 2 and Cell 3. The test system shall observe the UE sends PRACH to E-UTRAN Cell 2 and PSCell (Cell 3) during period T3. Reception by the test system of the PRACH preambles defines the end of T3.

During T4, the UE shall send periodic CSI reports in PSCell and the test system shall observe the periodic reporting of CSI for PSCell.

Supported test configurations are shown in table A.7.3.1.6.2-1. General test parameters are provided in table A.6.3.1.14.1-2. Cell specific test parameters for NR Cell 1, E-UTRAN PCell Cell 2 and NR PScell Cell 3 are provided in tables A.6.3.1.14.1-3, A.6.3.1.14.1-4 and A.6.3.1.14.1-5 respectively.

Table A.7.3.1.6.2-1: Handover with PSCell from NR SA to EN-DC test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PCell: LTE FDD Target PSCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PCell: LTE TDD Target PSCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PCell: LTE FDD Target PSCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PCell: LTE TDD Target PSCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.6.2-2: General test parameters for handover with PSCell from NR SA to EN-DC

Parameter		Unit	Value	Comment
RF Channel Number			1, 2, 3	Three radio channels are used for this test. One for FR1 source PCell, second for E-UTRA target PCell and third for target NR PSCell
Initial Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell 2, Cell 3	Neighbour cell on RF channel number 2 and 3.
Final Condition	Active PCell		Cell 2	E-UTRA PCell on RF channel number 2.
	Active PSCell		Cell 3	PSCell on RF channel number 3.
	Neighbour Cell		Cell 1	RF channel number 1

NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
Event B2	Threshold1	dBm	As specified in table A.6.3.1.4-3	Absolute NR SS-RSRP threshold for event B2
	Threshold2EUTRAN	dBm	-98	Absolute E-UTRAN RSRP threshold for event B2
	Hysteresis	dB	0	
	TimeToTrigger	s	0	
Event B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	Threshold RSRP	dBm	-93	Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin.
	Time to Trigger	s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cell 1 and 2			3 ms	Asynchronous cells
Gap pattern configuration Id			0	As specified in table 9.1.2-1 started before T2 starts
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 3		dB	0	Individual offset for cells on carrier frequency of Cell 3.
T1		s	5	
T2		s	≤5	During this time the cell 2 and cell 3 shall be known.
T3		s	1	During this time the UE perform HO with PSCell addition.
T4		s	0.5	During this time the UE sends CSI reports for PSCell (Cell 3).

Table A.7.3.1.6.2-3: Cell specific test parameters for NR Cell 1

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3, 4	1		
Duplex mode			1, 2	FDD		
			3, 4	TDD		
$BW_{channel}$		MHz	1, 2, 3	10: $N_{PRB,c}$ = 52		
			4	40: $N_{PRB,c}$ = 106		
PDSCH reference measurement channel			1, 2	SR.1.1 FDD		
			3	SR.1.1 TDD		
			4	SR.2.1 TDD		
CORSET reference channel			1, 2	CR.1.1 FDD		
			3	CR.1.1 TDD		
			4	CR.2.1 TDD		
TRS configuration			1, 2	TRS.1.1 FDD		
			3	TRS.1.1 TDD		
			4	TRS.1.2 TDD		
OCNG pattern[Note1]			1, 2, 3, 4	OP.1		
BWP	Initial DL BWP		1, 2, 3, 4	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2, 3, 4	SMTC.1		
SSB configuration			1, 2, 3	SSB.1 FR1		
			4	SSB.2 FR1		
b2-Threshold1		dBm	1, 2, 3	-96		
			4	-93		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4	0		

EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc} Note2	dBm/15 KHz	1, 2, 3, 4	-100	-104	-100
N_{oc} Note2	dBm/SCS	1, 2, 3	-100	-104	-100
		4	-97	-101	-97
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4	12	0	-4
$\hat{E}_s/I_{ot}$ Note3	dB	1, 2, 3, 4	12	0	-4
SS-RSRP Note3	dBm/SCS	1, 2, 3	-88	-104	-104
		4	-85	-101	-101
Io Note3	dBm/9.36 MHz	1, 2, 3	-59.78	-73.04	-70.59
		4	-53.68	-66.9448	-64.49
Propagation condition		1, 2, 3, 4	AWGN		
Antenna Configuration and Correlation Matrix		1, 2, 3, 4	1x2 Low		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					

Table A.7.3.1.6.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2, 3, 4	2		
Duplex mode		1, 3	FDD		
		2, 4	TDD		
TDD special subframe configuration Note1		2, 4	6		
TDD uplink-downlink configuration Note1		2, 4	1		
$BW_{channel}$	MHz	1, 2, 3, 4	10 MHz: $N_{PRB,c}$ = 50		
PRACH Configuration Note2		1, 2	4		
		3, 4	53		
PDSCH parameters: DL Reference Measurement Channel Note3		1, 2	10 MHz: R.3 FDD		
		3, 4	10 MHz: R.0 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel Note3		1, 2, 3, 4	10 MHz: R.6 FDD		
OCNG Patterns Note3		1, 2	10 MHz: OP.10 FDD		
		3, 4	10 MHz: OP.1 TDD		
PBCH_RA	dB	1, 2, 3, 4	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					

PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA Note4					
OCNG_RB Note4					
N_{oc} Note5	dBm/15 kHz	1, 2, 3, 4	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4	-Infinity	8	78
$\hat{E}_s/I_{ot}$ Note6	dB	1, 2, 3, 4	-Infinity	78	78
RSRP Note6	dBm/15 kHz	1, 2, 3, 4	-Infinity	-90	-90
SCH_RP Note6	dBm/15 kHz	1, 2, 3, 4	-Infinity	-90	-90
Io Note6	dBm/9 MHz	1, 2, 3, 4	-67.21 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)
Propagation Condition		1, 2, 3, 4	AWGN		
Antenna Configuration and Correlation Matrix Note7		1, 2, 3, 4	1x2 Low		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.7.3.1.6.2-5: Cell specific test parameters for NR Cell 3

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
E-UTRA Channel Number		1,2, 3, 4	1			
NR Channel Number		1,2, 3, 4	2			
Duplex Mode		1,2, 3, 4	TDD			
TDD configuration		1,2, 3, 4	TDDConf.3.1			
$BW_{channel}$	MHz	1,2, 3, 4	100: NRB,c = 66			
Data PRBs allocated		1,2, 3, 4	48			
Initial BWP Configuration		1,2, 3, 4	DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2, 3, 4	DLBWP.1.1 ULBWP.1.1			
PRACH configuration on cell 3		FR2 PRACH configuration 2	Captured in A.3.8.3.2			
TRS Configuration		1,2, 3, 4	TRS.2.1 TDD			
PDSCH/PDCCH TCI state		1,2, 3, 4	TCI.State.2			
PDSCH Reference measurement channel		1,2, 3, 4	SR.3.3 TDD			
RMSI CORESET Reference Channel		1,2, 3, 4	CR.3.2 TDD			
Dedicated CORESET Reference Channel		1,2, 3, 4	CCR.3.7 TDD			
OCNG Patterns		1,2, 3, 4	OP.3			
SSB configuration		1,2, 3, 4	SSB.2 FR2			
SMTC configuration		1,2, 3, 4	SMTC.2			
PDSCH/PDCCH subcarrier spacing	kHz	1,2, 3, 4	120			
TRS Configuration		1,2, 3, 4	TRS.2.1 TDD			
CSI-RS configuration for CSI reporting		1,2, 3, 4	CSI-RS.3.1 TDD			
reportConfigType		1,2, 3, 4	periodic			
reportQuantity		1,2, 3, 4	cri-RI-PMI-CQI			
CSI reporting periodicity	slot	1,2, 3, 4	40			
CSI reporting offset	slot	1,2, 3, 4	4			
EPRE ratio of PSS to SSS	dB	1,2, 3, 4	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						

EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation condition		1,2, 3, 4	No external noise (Note 1)
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].			

Table A.7.3.1.6.2-6: OTA related test parameters

Parameter	Unit	Cell 3			
		T1	T2	T3	T4
Angle of arrival configuration		Setup 2a according to clause A.3.15.2.1			
Assumption for UE beams Note 6		Rough			
$\hat{E}s$	dBm/SCS	-Infinity	-81		
SSB_RP Note2, Note 4	dBm/SCS	-Infinity	-81		
$\hat{E}_s / I_{ot}$ BB Note 2, Note 7	dB	-Infinity	4.88		
Io Note 2, Note 4	dBm/95.04 MHz	N/A	-56.41		
NOTE 1: Void NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: Void NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.					

A.7.3.1.6.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 175 ms Note1 from the beginning of time period T3.

The UE shall start to transmit the PRACH to Cell 3 less than 692 ms Note2 from the beginning of time period T3.

The rate of correct PSCell addition observed during repeated tests shall be at least 90 %.

NOTE1: The handover delay can be expressed as specified in clause 6.1.5.2:

- $D_{HOwithPSCell_PCell}$ = RRC procedure delay + $T_{interrupt}$, where
- RRC procedure delay = 50 ms.
- $T_{interrupt}$ = 125 ms.

NOTE2: The PSCell addition delay can be expressed as follows as specified in clause 6.1.5.2.2:

RRC procedure delay = 50 ms and is specified in clause 12 in TS 38.331 [2].

$T_{processing}$ is as defined as 50 ms in the test.

T_{search_HO} is as defined as 80 ms in the test.

T_{search_PSCell} is as defined as 480 ms in the test.

T_{Δ} is defined as 20 ms in the test.

T_{PSCell_DU} is defined as 10 ms in the test.

This gives a total of 692 ms.

A.7.3.1.7 HO with PSCell from FR1 NR-SA to EN-DC with known E-UTRA PCell and known FR2 PSCell

A.7.3.1.7.1 Test purpose and environment

The purpose of this test is to verify that the delay of HO with PSCell from FR1 NR-SA to EN-DC with known E-UTRA PCell and known FR2 PSCell are within the requirements stated in clause 6.1.5.2.2 of TS 36.133 [15] for the case when the E-UTRA PCell and FR2 PSCell are known by the UE at the time of handover with PSCell.

The test consists of three successive time periods with duration of T1, T2, and T3. There are three carriers each with one cell. Before the test starts the UE is connected to Cell 1 (source FR1 PCell) on radio channel 1 (FR1 PCC) and is aware of Cell 2 (target E-UTRA PCell) on radio channel 2 and Cell 3 (FR2 target PSCell) on radio channel 3. The UE is monitoring both cell 2 and cell 3 before receives a RRC message implying handover with PSCell.

At the start of time duration T1, the UE does not have any timing information of Cell 2 and Cell 3. Starting T2, Cell 2 and Cell 3 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in table 9.1.2-1 is configured before T2 begins to enable inter-RAT frequency monitoring. The test system shall send a RRC message to the UE to trigger HO (Cell 2) with PSCell (Cell 3) during period T2, after UE has reported Event B2 and Event B1. The handover with PSCell message shall contain Cell 2 as the target cell and Cell 3 as PSCell-to-be added. The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added.

The point in time at which the RRC message implying HO (Cell 2) with PSCell (Cell 3) is received at the UE antenna connector defines the start of period T3. During T3, the UE shall carry out random access (i.e., transmit the PRACH) towards the Cell 2 and Cell 3. The test system shall observe the UE sends PRACH to Cell 2 and Cell 3 during period T3. Reception by the test system of the PRACH preambles defines the end of T3.

The test system shall observe the UE sends PRACH to E-UTRAN Cell 2 and PSCell (Cell 3) during period T3.

During T4, the UE shall send periodic CSI reports in PSCell and the test system shall observe the periodic reporting of CSI for PSCell.

Supported test configurations are shown in A.7.3.1.7.1-1. The test parameters for the E-UTRA cell are given in table A.3.7.2.2-1. The E-UTRA cell once set up is not changed across time. The test parameters for NR cell are given in tables A.7.3.1.7.1-2, cell-specific parameters in A.7.3.1.7.1-3, A.7.3.1.7.1-4, A.7.3.1.7.1-5 and OTA parameters in A.7.3.1.7.1-6 below.

Table A.7.3.1.7.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	Source FR1 PCell: NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, 10 MHz bandwidth Target PCell: LTE FDD, Target PSCell: NR TDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	Source FR1 PCell: NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, 10 MHz bandwidth Target PCell: LTE TDD, Target PSCell: NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.7.1-2: General Test Parameters for HO with PSCell

Parameter		Unit	Value	Comment
RF Channel Number			1, 2, 3	Three radio channels are used for this test. One for FR1 source PCell, second for E-UTRA target PCell and third for target NR PSCell
Initial Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Neighbour cell		Cell 2, Cell 3	Neighbour cell on RF channel number 2 and 3.
Final Condition	Active PCell		Cell 2	E-UTRA PCell on RF channel number 2.
	Active PSCell		Cell 3	PSCell on RF channel number 3.
	Neighbour Cell		Cell 1	RF channel number 1

Parameter		Unit	Value	Comment
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
Event B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	b1-Threshold RSRP	dBm	-93	Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin.
	Time to Trigger	s	0	
Event B2	b2-Threshold1	dBm	As specified in table A.6.3.1.4-3	Absolute NR SS-RSRP threshold for event B2
	b2-Threshold2EUTRAN	dBm	-98	Absolute E-UTRAN RSRP threshold for event B2
	Hysteresis	dB	0	
	TimeToTrigger	s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
PRACH configuration on Cell 3			FR2 configuration 2	Captured in A.3.8.3.2
Time offset between cell 1 and 2			3 ms	Asynchronous cells
Gap pattern configuration Id			0	As specified in table 9.1.2-1 started before T2 starts
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 3		dB	0	Individual offset for cells on carrier frequency of Cell 3.
T1		s	5	
T2		s	≤5	During this time the cell 2 and cell 3 shall be known.
T3		s	1	During this time the UE perform HO with PSCell addition.
T4		s	0.5	During this time the UE sends CSI reports for PSCell (Cell 3).

Table A.7.3.1.7.1-3: Cell specific test parameters for Cell 1

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2	1		
Duplex mode			1, 2	FDD		
$BW_{channel}$		MHz	1, 2	10: $N_{PRB,c}$ = 52 (FDD)		
PDSCH reference measurement channel			1, 2	SR.1.1 FDD		
CORSET reference channel			1, 2	CR.1.1 FDD		
TRS configuration			1, 2	TRS.1.1 FDD		
OCNG pattern[Note1]			1, 2	OP.1		
BWP	Initial DL BWP		1, 2	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2	SMTC.1		
SSB configuration			1, 2	SSB.1 FR1		
b2-Threshold1		dBm	1, 2	-96		
EPRE ratio of PSS to SSS		dB	1, 2	0		
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc} Note2	dBm/15 KHz	1, 2	-100	-104	-100
N_{oc} Note2	dBm/SCS	1, 2	-100	-104	-100
$\hat{E}_s/N_{oc}$	dB	1, 2	12	0	-4
$\hat{E}_s/I_{ot}$ Note3	dB	1, 2	12	0	-4
SS-RSRP Note3	dBm/SCS	1, 2	-88	-104	-104
Io Note3	dBm/9.36 MHz	1, 2	-59.78	-73.04	-70.59
Propagation condition		1, 2	AWGN		
Antenna Configuration and Correlation Matrix		1, 2	1x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.3.1.7.1-4: Cell specific test parameters for Cell 2

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2	2		
Duplex mode		1, 2	FDD		
TDD special subframe configuration Note1		4, 5, 6	6		
TDD uplink-downlink configuration Note1		4, 5, 6	1		
$BW_{channel}$	MHz	1, 2	10 MHz: $N_{PRB,c}$ = 50		
PRACH Configuration Note2		1, 2	4		
PDSCH parameters: DL Reference Measurement Channel Note3		1, 2	10 MHz: R.3 FDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel Note3		1, 2	10 MHz: R.6 FDD		
OCNG Patterns Note3		1, 2	10 MHz: OP.10 FDD		
PBCH_RA	dB	1, 2	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA Note4					
OCNG_RB Note4					
N_{oc} Note5	dBm/15 kHz	1, 2	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2	-Infinity	8	78

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
$\hat{E}_s/I_{ot}$ Note6	dB	1, 2	-Infinity	78	78
RSRP Note6	dBm/15 kHz	1, 2	-Infinity	-90	-90
SCH_RP Note6	dBm/15 kHz	1, 2	-Infinity	-90	-90
Io Note6	dBm/9 MHz	1, 2	-67.21 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)
Propagation Condition		1, 2	AWGN		
Antenna Configuration and Correlation Matrix Note7		1, 2	1x2 Low		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.7.3.1.7.1-5: Cell specific test parameters for Cell 3

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
E-UTRA Channel Number		1,2	1			
NR Channel Number		1,2	2			
Duplex Mode		1,2	TDD			
TDD configuration		1,2	TDDConf.3.1			
$BW_{channel}$	MHz	1,2	100: NRB,c = 66			
Data PRBs allocated		1,2	48			
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1			
TRS Configuration		1,2	TRS.2.1 TDD			
PDSCH/PDCCH TCI state		1,2	TCI.State.2			
PDSCH Reference measurement channel		1,2	SR.3.3 TDD			
RMSI CORESET Reference Channel		1,2	CR.3.2 TDD			
Dedicated CORESET Reference Channel		1,2	CCR.3.7 TDD			
OCNG Patterns		1,2	OP.3			
SSB configuration		1,2	SSB.2 FR2			
SMTC configuration		1,2	SMTC.2			
PDSCH/PDCCH subcarrier spacing	kHz	1,2	120			
TRS Configuration		1,2	TRS.2.1 TDD			
CSI-RS configuration for CSI reporting		1,2	CSI-RS.3.1 TDD			
reportConfigType		1,2	periodic			
reportQuantity		1,2	cri-RI-PMI-CQI			
CSI reporting periodicity	slot	1,2	40			
CSI reporting offset	slot	1,2	4			
EPRE ratio of PSS to SSS	dB	1,2	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
Propagation condition		1,2	No external noise (Note 1)			

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

Table A.7.3.1.7.1-6: OTA related test parameters

Parameter	Unit	Cell 3			
		T1	T2	T3	T4
Angle of arrival configuration		Setup 2a according to clause A.3.15.2.1			
Assumption for UE beams Note 6		Rough			
$\hat{E}s$	dBm/SCS	-Infinity	-81		
SSB_RP Note2, Note 4	dBm/SCS	-Infinity	-81		
$\hat{E}_s / I_{ot}$ BB Note 2, Note 7	dB	-Infinity	4.88		
Io Note 2, Note 4	dBm/95.04 MHz	N/A	-56.41		
NOTE 1: Void NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: Void NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.					

A.7.3.1.7.2 Test Requirements

In this test, the UE shall start to transmit the PRACH to E-UTRA Cell 2 less than 105 ms Note1 from the beginning of time period T3.

The UE shall transmit the PRACH to PSCell at latest 137 ms Note2 from the beginning of time period T3.

The rate of correct observed PSCell addition delay in HO with PSCell during repeated tests shall be at least 90 %.

NOTE1: The handover delay can be expressed as specified in clause 6.1.5.2:

$D_{HOwithPSCell_PCell}$ = RRC procedure delay + $T_{interrupt}$,

Where RRC procedure delay = 50 ms, $T_{interrupt} = T_{search_HO} + T_{IU} + T_{processing}$ is defined in clause 6.1.5.2.1, where

T_{search} = 0 ms,

T_{IU} = 10 ms,

$T_{processing}$ = 45 ms.

Note2: The PSCell addition delay can be expressed as follows as specified in clause 6.1.5.2:

$$D_{HOwithPSCell_PSCell} = T_{RRC_delay} + T_{processing} + T_{search_HO} + T_{search_PSCell} + T_{\Delta} + T_{PSCell_DU} + 2 \text{ ms}$$

Where:

T_{RRC_delay} = 50 ms

$T_{processing}$ = 45 ms

T_{search_HO} = 0 ms

T_{search_PSCell} = 0 ms

T_{Δ} = 20 ms

T_{PSCell_DU} = 1*10+10 = 20 ms

A.7.3.1.8 NR PSCell change delay in HO with PSCell from NR-DC to NR-DC

A.7.3.1.8.1 Test Purpose and Environment

The purpose of this test is to verify the PSCell change delay requirements in HO with PSCell from NR-DC to NR-DC defined in clauses 6.1.5.4.2. The requirements are applicable to NR FR1-FR1 inter-frequency PCell handover and NR FR2-FR2 intra-frequency PSCell change. Gap pattern ID gp0 is configured for PCell FR1-FR1 Inter frequency handover in the test case.

The supported test configurations are given in table A.7.3.1.8.1-1. The test scenario comprises four NR cells, source PCell(Cell 1) and source PSCell(Cell 2), target PCell(Cell 3), target PSCell(Cell 4).

Cell 1 and Cell 3 are on radio channel 1 in FR1.Cell 2 and Cell 4 are on radio channel 2 in FR2. Test parameters are given in tables A.7.3.1.8.1-2, A.7.3.1.8.1-3, A.7.3.1.8.1-4 and A.7.3.1.8.1-5 below. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of T1, the UE shall be connected to Cell 1 on radio channel 1 and Cell 2 on radio channel 2. UE is not aware of Cell 3 and Cell 4. Starting T2, cell 3 and Cell 4 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.7.3.1.8.1-1: Supported test configurations for HO with PSCell from NR-DC to NR-DC

Config	Description
1	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	Source PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.8.1-2: General test parameters for PCell FR1-FR1 Inter frequency handover

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 3	
Final condition	Active cell		Cell 3	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤5	

Table A.7.3.1.8.1-3: Cell specific test parameters for PCell FR1-FR1 Inter frequency handover

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
Gap pattern ID			gp0			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.3.1.8.1-4: General test parameters Intra-frequency FR2-FR2 PSCell change

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 2	
	Neighbouring cell		Cell 4	
Final condition	Active cell		Cell 4	
A4-Offset		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.1.8.1-5: Cell specific test parameters for Intra-frequency FR2-FR2 PSCell change

Parameter		Unit	Cell 2		Cell 4	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]			Rough		Rough	
AoA setup			Setup 1 as defined in A.3.15			
NR RF Channel Number			**1**		**1**	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
Data PRBs allocated			66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
RMSI CORESET Reference Channel			CR3.1 TDD			
Control Channel RMC			CCR.3.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB. 3 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
PDSCH/PDCCH TCI state			TCI.State.2			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} [Note2]		dBm/15 kHz	-104.7			
N_{oc} [Note2]		dBm/SCS	-95.7			
$\hat{E}_s / I_{ot}$		dB	6	-1.8	-Infinity	0
$\hat{E}_s / N_{oc}$		dB	6	6	-Infinity	7
Io[Note3]		dBm/ BW	-59.7	-56.7	-59.7	-56.7
Propagation condition		-	AWGN		AWGN	

Parameter	Unit	Cell 2		Cell 4	
		T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone					
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.3.1.8.2 Test Requirements

The UE shall start to transmit the PRACH to target PSCell (Cell 4) less than 83 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

A.7.3.1.9 Intra-frequency handover from FR2-2 to FR2-2; unknown target cell

A.7.3.1.9.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-2-NR FR2-2 intra frequency handover requirements specified in clause 6.1.1.4.

A.7.3.1.9.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.9.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.9.2-2 and A.7.3.1.9.2-3.

The test scenario comprises of carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.7.3.1.9.2-1: Intra-frequency handover from FR2-2 to FR2-2 test configurations

Configuration	Description
1	NR TDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NR TDD, SSB SCS 480 kHz, data SCS 480 kHz, BW 400 MHz
3	NR TDD, SSB SCS 960 kHz, data SCS 960 kHz, BW 400 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.9.2-2: General test parameters Intra-frequency handover from FR2-2 to FR2-2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A4-Offset		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.1.9.2-3: Cell specific test parameters for NR FR2-2-FR2-2 Intra frequency handover test case

Parameter		Unit	Config	Cell 1		Cell 2	
				T1	T2	T1	T2
Assumption for UE beams[Note 6]			1,2,3	Rough		Rough	
AoA setup			1,2,3	Setup 1 as defined in A.3.15			
NR RF Channel Number			1,2,3	**1**		**1**	
Duplex mode			1,2,3	TDD			
TDD configuration			1	TBD			
			2	TBD			
			3	TBD			
$BW_{channel}$		MHz	1	100: $N_{PRB,c}$ = 66			
			2	400: $N_{PRB,c}$ = 66			
			3	400: $N_{PRB,c}$ = 33			
Data PRBs allocated			1	66			
			2	66			
			3	33			
DRX Cycle		ms	1,2,3	Not Applicable			
PDSCH Reference measurement channel			1	SR3.1 TDD			
			2	TBD			
			3	TBD			
RMSI CORESET Reference Channel			1	CR3.1 TDD			
			2	TBD			
			3	TBD			
Control Channel RMC			1	CCR.3.1 TDD			
			2	TBD			
			3	TBD			
OCNG Patterns			1,2,3	OP.1			
SMTC Configuration			1,2,3	SMTC pattern 1			
SSB Configuration			1	SSB. 3 FR2			
			2	TBD			
			3	TBD			
PDSCH/PDCCH subcarrier spacing		kHz	1	120			
			2	480			
			3	960			
PUCCH/PUSCH subcarrier spacing		kHz	1	120			
			2	480			
			3	960			
PRACH configuration			1,2,3	FR2 PRACH configuration 1			
TRS configuration			1	TRS.2.1 TDD			
			2	TBD			
			3	TBD			
PDSCH/PDCCH TCI state			1,2,3	TCI.State.2			
BWP configuraiton	Initial DL BWP		1,2,3	DLBWP.0.1			
	Dedicated DL BWP		1,2,3	DLBWP.1.1			
	Initial UL BWP		1,2,3	ULBWP.0.1			
	Dedicated UL BWP		1,2,3	ULBWP.1.1			
EPRE ratio of PSS to SSS		dB		0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note2	dBm/15 kHz		-104.7			
N_{oc} Note2	dBm/SCS	1	-95.7			
		2	-89.7			
		3	-86.7			
$\hat{E}_s / I_{ot}$	dB		6	-1.8	-Infinity	0
$\hat{E}_s / N_{oc}$	dB		6	6	-Infinity	7
Io Note3	dBm/95.04 MHz Note4		-59.7	-56.7	-59.7	-56.7
	dBm/380.16 MHz Note4		-53.7	-50.7	-53.7	-50.7
Propagation condition	-		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.1.9.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 772 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 762 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.4.2.

This gives a total of 772 ms.

A.7.3.1.10 Inter-frequency handover from FR2-2 to FR2-2; unknown target cell

A.7.3.1.10.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-2-NR FR2-2 Inter frequency handover requirements specified in clause 6.1.1.4.

A.7.3.1.10.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.10.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.10.2-2 and A.7.3.1.10.2-3.

The test scenario comprises of carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.7.3.1.10.2-1: Inter-frequency handover from FR2-2 to FR2-2 test configurations

Configuration	Description
1	NR TDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NR TDD, SSB SCS 480 kHz, data SCS 480 kHz, BW 400 MHz
3	NR TDD, SSB SCS 960 kHz, data SCS 960 kHz, BW 400 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.10.2-2: General test parameters Inter-frequency handover from FR2-2 to FR2-2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A4-Offset		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.1.10.2-3: Cell specific test parameters for NR FR2-2-FR2-2 Inter frequency handover test case

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]		1,2,3	Rough		Rough	
AoA setup		1,2,3	Setup 1 as defined in A.3.15			
NR RF Channel Number		1,2,3	**1**		**2**	
Duplex mode		1,2,3	TDD			
TDD configuration		1	TBD			
		2	TBD			
		3	TBD			
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66			
		2	400: $N_{PRB,c}$ = 66			
		3	400: $N_{PRB,c}$ = 33			
Data PRBs allocated		1	66			
		2	66			
		3	33			
DRX Cycle	ms	1,2,3	Not Applicable			
PDSCH Reference measurement channel		1	SR3.1 TDD			
		2	TBD			
		3	TBD			
RMSI CORESET Reference Channel		1	CR3.1 TDD			
		2	TBD			
		3	TBD			
Control Channel RMC		1	CCR.3.1 TDD			
		2	TBD			
		3	TBD			
OCNG Patterns		1,2,3	OP.1			
SMTC Configuration		1,2,3	SMTC pattern 1			
SSB Configuration		1	SSB. 3 FR2			
		2	TBD			
		3	TBD			
PDSCH/PDCCH subcarrier spacing	kHz	1	120			
		2	480			
		3	960			
PUCCH/PUSCH subcarrier spacing	kHz	1	120			
		2	480			
		3	960			

Parameter		Unit	Config	Cell 1		Cell 2	
				T1	T2	T1	T2
PRACH configuration			1,2,3	FR2 PRACH configuration 1			
TRS configuration			1	TRS.2.1 TDD			
			2	TBD			
			3	TBD			
PDSCH/PDCCH TCI state			1,2,3	TCI.State.2			
BWP configuraiton	Initial DL BWP		1,2,3	DLBWP.0.1			
	Dedicated DL BWP		1,2,3	DLBWP.1.1			
	Initial UL BWP		1,2,3	ULBWP.0.1			
	Dedicated UL BWP		1,2,3	ULBWP.1.1			
EPRE ratio of PSS to SSS		dB		0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz		-104.7			
N_{oc} Note2		dBm/SCS	1	-95.7			
			2	-89.7			
			3	-86.7			
$\hat{E}_s / I_{ot}$		dB		6	6	-Infinity	7
$\hat{E}_s / N_{oc}$		dB		6	6	-Infinity	7
Io Note3		dBm/95.04 MHz Note4		-59.7	-59.7	-58.9	-58.9
		dBm/380.16 MHz Note4		-53.7	-53.7	-52.9	-52.9
Propagation condition		-		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.1.10.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 772 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 762 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.4.2.

This gives a total of 772 ms.

A.7.3.1.11 Inter-frequency handover from FR1 to FR2-2; unknown target cell

A.7.3.1.11.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR2-2 Inter frequency handover requirements specified in clause 6.1.1.4.

A.7.3.1.11.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.11.2-1 and A.7.3.1.11.2-1A, and the configuration for NR Cell 1 and NR Cell 2 are chosen independently. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.11.2-2 and A.7.3.1.11.2-3.

The test scenario comprises of carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.7.3.1.11.2-1: Inter-frequency handover from FR1 to FR2-2 test configurations for Cell 1

Configuration	Description
1	NR TDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NR TDD, SSB SCS 480 kHz, data SCS 480 kHz, BW 400 MHz
3	NR TDD, SSB SCS 960 kHz, data SCS 960 kHz, BW 400 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.11.2-1A: Inter-frequency handover from FR1 to FR2-2 test configurations for Cell 2

Configuration	Description
1	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, ≥10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, ≥40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: The UE is only required to be tested in one with smallest aggregated channel bandwidth from supported band combinations which is composed of CCs ≥ the bandwidth ($BW_{channel}$) defined in each test configuration	

Table A.7.3.1.11.2-2: General test parameters Inter-frequency handover from FR1 to FR2-2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A4-Offset		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.1.11.2-3: Cell specific test parameters for NR FR1-FR2-2 Inter frequency handover test case

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]		1,2,3	-		Rough	
AoA setup		1,2,3	-		Setup 1 as defined in A.3.15	
NR RF Channel Number		1,2,3	**1**		**2**	
Duplex mode		1	FDD		TDD	
		2,3	TDD		TDD	
TDD configuration		1	-		TBD	
		2	TDDConf.1.1		TBD	
		3	TDDConf.2.1		TBD	
$BW_{channel}$	MHz	1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		2	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
		3	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 33	
Data PRBs allocated		1	52		66	
		2	52		66	
		3	106		33	
DRX Cycle	ms	1,2,3	Not Applicable		Not Applicable	
PDSCH Reference measurement channel		1	SR.1.1 FDD		SR3.1 TDD	
		2	SR.1.1 TDD		TBD	
		3	SR2.1 TDD		TBD	
RMSI CORESET Reference Channel		1	CR.1.1 FDD		CR3.1 TDD	
		2	CR.1.1 TDD		TBD	
		3	CR2.1 TDD		TBD	
Control Channel RMC		1	CCR.1.1 FDD		CCR.3.1 TDD	
		2	CCR.1.1 TDD		TBD	
		3	CCR.2.1 TDD		TBD	
OCNG Patterns		1,2,3	OP.1		OP.1	
SMTC Configuration		1	SMTC.1		SMTC pattern 1	
		2,3	SMTC.2		SMTC pattern 1	
SSB Configuration		1	SSB.1 FR1		SSB. 3 FR2	
		2	SSB.2 FR1		TBD	
		3	SSB.2 FR1		TBD	
PDSCH/PDCCH subcarrier spacing	kHz	1	15		120	
		2	30		480	
		3	30		960	
PUCCH/PUSCH subcarrier spacing	kHz	1	15		120	
		2	30		480	
		3	30		960	
PRACH configuration		1,2,3	FR1 PRACH configuration 1		FR2 PRACH configuration 1	
TRS configuration		1	TRS.1.1 FDD		TRS.2.1 TDD	
		2	TRS.1.1 TDD		TBD	
		3	TRS.1.2 TDD		TBD	
PDSCH/PDCCH TCI state		1,2,3	-		TCI.State.2	
BWP configuraiton – Initial DL BWP		1,2,3	DLBWP.0.1		DLBWP.0.1	
BWP configuraiton – Dedicated DL BWP		1,2,3	LBWP.1.1		DLBWP.1.1	
BWP configuraiton – Initial UL BWP		1,2,3	ULBWP.0.1		ULBWP.0.1	
BWP configuraiton – Dedicated UL BWP		1,2,3	ULBWP.1.1		ULBWP.1.1	
EPRE ratio of PSS to SSS	dB		0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		Link only, see clause A.3.7A		-104.7	
N_{oc} Note2	dBm/SCS	1			-95.7	
		2			-89.7	
		3			-86.7	
$\hat{E}_s / I_{ot}$	dB				-Infinity	7
$\hat{E}_s / N_{oc}$	dB				-Infinity	7
Io Note3	dBm/95.04 MHz Note4				-58.9	-58.9
	dBm/380.16 MHz Note4				-52.9	-52.9
Propagation condition	-				AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.1.11.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 772 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 762 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.4.2.

This gives a total of 772 ms.

A.7.3.1.12 Intra-frequency handover from FR2 to FR2; known target cell configured with NCD-SSB

A.7.3.1.12.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 intra-frequency handover requirements specified in clause 6.1.1.4, when the target cell is configured with NCD-SSB.

A.7.3.1.12.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.12.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.12.2-2 and A.7.3.1.12.2-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of cell 2.

Before the test starts,

- UE is connected to Cell 1 with active DL BWP and active UL BWP;

- UE is configured with *nonCellDefiningSSB-r17* under *BWP-DownlinkDedicated*, and NCD-SSB serves as the reference SSB for the serving cell, and is contained in the active DL BWP.

During T2, Cell 2 is switched ON, and transmits two SSBs, i.e. CD-SSB at SSB frequency 1 and NCD-SSB at SSB frequency 2. Before the test, UE is configured to measure SSB frequency 2. The test equipment shall send an RRC message implying handover to Cell 2. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3.

The start of T3 is defined as the end of the last TTI containing the RRC message implying handover. The handover command indicates the UE to handover to Cell 2 with *firstActiveDownlinkBWP-Id* configured to BWP-1. The UE then performs handover from Cell 1's active DL-BWP associated with the NCD-SSB of Cell 1 to Cell 2's BWP-1 which is associated with NCD-SSB of Cell 2.

Table A.7.3.1.12.2-1: Intra-frequency handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.1.12.2-2: General test parameters Intra-frequency handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
SMTC configuration			SMTC.1 RedCap	For SSB frequency 2.
Measurement gap configuration			MG pattern #13, offset = 39	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.7.3.1.12.2-3: Cell specific test parameters for NR FR2-FR2 Intra frequency handover test case

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams[Note 6]			Rough			Rough		
AoA setup			Setup 1 as defined in A.3.15					
NR RF Channel Number			1			1		
Duplex mode			TDD					
TDD configuration			TDDConf.3.1					
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66					
BWP BW		MHz	100: $N_{PRB,c}$ = 66					
Data PRBs allocated			66					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel			SR3.1 TDD					
RMSI CORESET Reference Channel			CR3.1 TDD					
Control Channel RMC			CCR.3.1 TDD					
OCNG Patterns			OP. 1					
CD-SSB Configuration			SSB.3 FR2			SSB.3 FR2		
NCD-SSB Configuration			SSB.21 FR2			SSB.21 FR2		
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz					
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz					
PRACH configuration			FR2 PRACH configuration 1					
TRS configuration			TRS.2.1 TDD					
PDSCH/PDCCH TCI state			TCI.State.2					
BWP configuraiton	Initial DL BWP		DLBWP.0.1					

	Dedicated DL BWP		DLBWP.1.2 Note 7			DLBWP.1.2 Note 7			
	Initial UL BWP		ULBWP.0.1						
	Dedicated UL BWP		ULBWP.1.2			ULBWP.1.2			
EPRE ratio of PSS to SSS		dB	0			0			
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		dBm/15 kHz	-104.7			-104.7			
N_{oc} Note2		dBm/SCS	-95.7			-95.7			
$\hat{E}_s / I_{ot}$		dB	6	-1.8	-1.8	-Infinity	0	0	
$\hat{E}_s / N_{oc}$		dB	6	6	6	-Infinity	7	7	
Io Note3	Config 1,2	dBm/ BW	-59.7	-56.7	-56.7	-59.7	-56.7	-56.7	
Propagation condition		-	AWGN			AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 7: The starting PRB index for dedicated DL BWP is selected such that NCD-SSB is within the BWP BW.

A.7.3.1.12.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 92 ms from the beginning of time period T3.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 82 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.4.2.

This gives a total of 92 ms.

A.7.3.1.13 Inter-frequency handover from FR2 to FR2; known target cell configured with NCD-SSB

A.7.3.1.13.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 inter-frequency handover requirements specified in clause 6.1.1.4, when the target cell is configured with NCD-SSB.

A.7.3.1.13.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.13.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.13.2-2 and A.7.3.1.13.2-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of cell 2.

Before the test starts,

- UE is connected to Cell 1 with active DL BWP and active UL BWP;
- UE is not configured with *nonCellDefiningSSB-r17* under *BWP-DownlinkDedicated*, and CD-SSB serves as the reference SSB for the serving cell, and is contained in the active DL BWP.

During T2, Cell 2 is switched ON, and transmits two SSBs, i.e. CD-SSB at SSB frequency 1 and NCD-SSB at SSB frequency 2. Before the test, UE is configured to measure SSB frequency 1. The test equipment shall send an RRC message implying handover to Cell 2. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3.

The start of T3 is defined as the end of the last TTI containing the RRC message implying handover. The handover command indicates the UE to handover to Cell 2 with *firstActiveDownlinkBWP-Id* configured to BWP-1. The UE then performs handover from Cell 1's active DL-BWP associated with the CD-SSB of Cell 1 to Cell 2's BWP-1 which is associated with NCD-SSB of Cell 2.

Table A.7.3.1.13.2-1: Inter-frequency handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.1.13.2-2: General test parameters Inter-frequency handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
SMTC configuration			SMTC.1	For SSB frequency 1.
			SMTC.1 RedCap	For SSB frequency 2.
Measurement gap configuration			MG pattern #13, offset = 39	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.7.3.1.13.2-3: Cell specific test parameters for NR FR2-FR2 Inter frequency handover test case

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
Assumption for UE beams[Note 6]		Rough			Rough		
AoA setup		Setup 1as defined in A.3.15					
NR RF Channel Number		1			2		
Duplex mode		TDD					
TDD configuration		TDDConf.3.1					
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66					
BWP BW	MHz	100: $N_{PRB,c}$ = 66					
Data PRBs allocated		66					
DRX Cycle	ms	Not Applicable					
PDSCH Reference measurement channel		SR3.1 TDD					
RMSI CORESET Reference Channel		CR3.1 TDD					
Control Channel RMC		CCR.3.1 TDD					
OCNG Patterns		OP. 1					
CD-SSB Configuration		SSB.3 FR2			SSB.3 FR2		
NCD-SSB Configuration		N/A			SSB.21 FR2		
PDSCH/PDCCH subcarrier spacing	kHz	120 kHz					

PUCCH/PUSCH subcarrier spacing		kHz	120 kHz						
PRACH configuration			FR2 PRACH configuration 1						
TRS configuration			TRS.2.1 TDD						
PDSCH/PDCCH TCI state			TCI.State.2						
BWP configuraiton	Initial DL BWP		DLBWP.0.1						
	Dedicated DL BWP		DLBWP.1.3			DLBWP.1.2 Note 7			
	Initial UL BWP		ULBWP.0.1						
	Dedicated UL BWP		ULBWP.1.3			ULBWP.1.2			
EPRE ratio of PSS to SSS		dB	0			0			
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		dBm/15 kHz	-104.7			-104.7			
N_{oc} Note2		dBm/SCS	-95.7			-95.7			
$\hat{E}_s / I_{ot}$		dB	5	5	5	-Infinity	5	5	
$\hat{E}_s / N_{oc}$		dB	5	5	5	-Infinity	5	5	
Io Note3	Config 1,2	dBm/ BW	-60.5	-60.5	-60.5	-66.7	-60.5	-60.5	
Propagation condition		-	AWGN			AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 7: The starting PRB index for dedicated DL BWP is selected such that NCD-SSB is within the BWP BW.

A.7.3.1.13.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 132 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 122 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.4.2.

This gives a total of 132 ms.

A.7.3.1.14 Handover with PSCell from FR1-FR2 NR-DC to FR1-FR1 NR-DC with target PSCell in FR1

A.7.3.1.14.1 Test Purpose and Environment

The purpose of this test is to verify the PSCell change delay requirements in HO with PSCell in parellal processing from FR1-FR2 NR-DC to FR1-FR1 NR-DC defined in clauses 6.1.5.4.2. The requirements are applicable to NR FR1-FR2 inter-frequency PCell handover and NR FR1-FR1 inter-frequency PSCell change. Gap pattern ID gp0 is configured for PCell FR1-FR1 Inter frequency handover in the test case.

The supported test configurations are given in table A.7.3.1.14.1-1. The test scenario comprises four NR cells, source PCell (Cell 1) and source PSCell (Cell 2), target PCell (Cell 3), target PSCell (Cell 4).

Cell 1, Cell 3 and Cell 4 are on radio channel 1 in FR1.Cell 2 are on radio channel 2 in FR2. Test parameters are given in tables A.7.3.1.14.1-2, A.7.3.1.14.1-3, A.7.3.14.1-4 and A.7.3.1.14.1-5 below. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of T1, the UE shall be connected to Cell 1 on radio channel 1 and Cell 2 on radio channel 2. UE is not aware of Cell 3 and Cell 4. Starting T2, cell 3 and Cell 4 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.7.3.1.14.1-1: Supported test configurations for HO with PSCell from FR1-FR2 NR-DC to FR1-FR1 NR-DC

Config	Description
1	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.14.1-2: General test parameters for PCell FR1-FR1 Inter frequency handover

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 3	
Final condition	Active cell		Cell 3	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤5	

Table A.7.3.1.14.1-3: Cell specific test parameters for PCell FR1-FR1 Inter frequency handover

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
Gap pattern ID			gp0			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.3.1.14.1-4: General test parameters FR2-FR1 PSCell change

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 2	
	Neighbouring cell		Cell 4	
Final condition	Active cell		Cell 4	
A4-Offset		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used

Access Barring Information	-	Not Sent	No additional delays in random access procedure.
Time offset between cells		3 μs	Synchronous cells
T1	s	5	
T2	s	≤10	

Table A.7.3.1.14.1-5: Cell specific test parameters for FR2-FR1 PSCell change

Parameter		Unit	Cell 2		Cell 4	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]			Rough		N/A	
AoA setup			Setup 1 as defined in A.3.15		NA	
NR RF Channel Number			2		1	
Duplex mode	Config 1		TDD		FDD	
	Config 2,3		TDD		TDD	
TDD configuration	Config 1		TDDConf.3.1		Not Applicable	
	Config 2		TDDConf.3.1		TDDConf.1.1	
	Config 3		TDDConf.3.1		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 66		10: $N_{PRB,c}$ = 52	
	Config 2		100: $N_{PRB,c}$ = 66		10: $N_{PRB,c}$ = 52	
	Config 3		100: $N_{PRB,c}$ = 66		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1	MHz	100: $N_{PRB,c}$ = 66		10: $N_{PRB,c}$ = 52	
	Config 2		100: $N_{PRB,c}$ = 66		10: $N_{PRB,c}$ = 52	
	Config 3		100: $N_{PRB,c}$ = 66		40: $N_{PRB,c}$ = 106	
Data PRBs allocated	Config 1		66		52	
	Config 2		66		52	
	Config 3		66		106	
DRX Cycle		ms	Not Applicable		Not Applicable	
PDSCH Reference measurement channel	Config 1		SR3.1 TDD		SR.1.1 FDD	
	Config 2		SR3.1 TDD		SR.1.1 TDD	
	Config 3		SR3.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR3.1 TDD		CR.1.1 FDD	
	Config 2		CR3.1 TDD		CR.1.1 TDD	
	Config 3		CR3.1 TDD		CR2.1 TDD	
Control Channel RMC	Config 1		CCR.3.1 TDD		CCR.1.1 FDD	
	Config 2		CCR.3.1 TDD		CCR.1.1 TDD	
	Config 3		CCR.3.1 TDD		CCR.2.1 TDD	
OCNG Patterns			OP 1		OP 1	
SSB configuration	Config 1,2		SSB. 3 FR2		SSB.1 FR1	
	Config 3		SSB. 3 FR2		SSB.2 FR1	
SMTC configuration	Config 1,2		SMTC.1		SMTC.1	
	Config 3		SMTC.2		SMTC.2	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	120 kHz		15 kHz	
	Config 3		120 kHz		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	120 kHz		15 kHz	
	Config 3		120 kHz		30 kHz	
PRACH configuration			FR2 PRACH configuration 1		FR1 PRACH configuration 1	
TRS configuration	Config 1		TRS.2.1 TDD		TRS.1.1 FDD DD	
	Config 2		TRS.2.1 TDD		TRS.1.1 TDD	
	Config 3		TRS.2.1 TDD		TRS.1.2 TDD	
PDSCH/PDCCH TCI state			TCI.State.2		N/A	
BWP configuraiton	Initial DL BWP		DLBWP.0.1		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0		0	

Parameter		Unit	Cell 2		Cell 4	
			T1	T2	T1	T2
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-104.7		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-95.7		-98	
	Config 3				-95	
SSB_RP Note 3	Config 1,2	dBm/SCS Note5	-95.0	-95.0	-Infinity	-93
	Config 3				-Infinity	-90
$\hat{E}_s / N_{oc}$		dB	7	7	-Infinity	5
Io Note3	Config 1,2	dBm/ 9.36 MHz	N/A		-70.05	-63.85
	Config 3	dBm/ 38.16 MHz			-63.94	-57.75
	Config 1,2,3	dBm/95.04 MHz Note5	-66.7	-66.7	N/A	
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.1.14.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 3 less than 77 ms from the beginning of time period T2.

The UE shall transmit the PRACH preamble to Cell 4 less than 107 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

The rate of correct PSCell addition observed during repeated tests shall be at least 90 %.

NOTE: The handover requirements for handover with PSCell is defined in clause 6.1.5.4 in [15] as:

$D_{HOwithPSCel_PSCell} = T_{RRC_delay} + T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$

Where:

T_{RRC_delay} = 20 ms for 'RRC connection reconfiguration (NR SCG establishment/ /modification/release)'.

T_{search} = 0 ms for known cell.

T_{IU} = 15 ms in the test configuration.

$T_{processing}$ = 20 ms.

T_{Δ} = 20 ms.

T_{margin} = 2 ms.

This gives a total of 77 ms for handover delay.

NOTE: The PSCell change delay for handover with PSCell for NR-DC is defined in clause 6.1.5.4.2 in [15] as:

$D_{HOwithPSCel_PSCell} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell_DU} + T_{PCell_DU} + 2$ ms

Where:

T_{RRC_delay} = 20 ms for 'RRC connection reconfiguration (NR SCG establishment/ /modification/release)'.

$T_{processing}$ = 45 ms for source Cell and target Cell are in the different FR.

T_{search} = 0 ms for known cell.

T_{Δ} = 20 ms for fine time tracking and acquiring full timing information of the target cell.

T_{PSCell_DU} = 20 ms.

T_{PCell_DU} = 0 ms,.

This gives a total of 107 ms for handover delay.

A.7.3.1.15 HO with PSCell from FR1-FR1 NR-DC to FR1-FR2 NR-DC

A.7.3.1.15.1 Test Purpose and Environment

The purpose of this test is to verify the Handover with PSCell change delay requirements from FR1-FR1 NR-DC to FR1-FR2 NR-DC defined in clauses 6.1.5.4.2. The requirements are applicable to NR FR1-FR1 intra-frequency PCell handover and NR FR1-FR2 inter-frequency PSCell change. Gap pattern ID gp0 is configured for PCell FR1-FR1 Inter frequency handover in the test case.

The supported test configurations are given in table A.7.3.1.15.1-1. The test scenario comprises four NR cells, source PCell(Cell 1) and source PSCell(Cell 2), target PCell(Cell 3), target PSCell(Cell 4).

Cell 1 and Cell 3 are on radio channel 1 in FR1.Cell 2 is on radio channel 2 in FR1. Cell 4 is on radio channel 3 in FR2. Test parameters are given in tables A.7.3.1.15.1-2, A.7.3.1.15.1-3, A.7.3.1.15.1-4, A.7.3.1.15.1-5 and A.7.3.1.15.1-6 below. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of T1, the UE shall be connected to Cell 1 on radio channel 1 and Cell 2 on radio channel 2. UE is not aware of Cell 3 and Cell 4. Starting T2, cell 3 and Cell 4 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The SMTC of Cell 4 is provided in *targetcellSMTC-SCG-r16* but not configured in *reconfigurationWithSync*.

Table A.7.3.1.15.1-1: Supported test configurations for HO with PSCell from NR-DC to NR-DC

Config	Description
1	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Source PSCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Source PSCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	Source PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Source PSCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.15.1-2: General test parameters for PCell FR1-FR1 Inter frequency handover

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 3	

Final condition	Active cell		Cell 3	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤5	

Table A.7.3.1.15.1-3: Cell specific test parameters for PCell FR1-FR1 Inter frequency handover

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
Gap pattern ID			gp0			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
$\hat{E}_s/I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s/N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io[Note3]	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.3.1.15.1-4: General test parameters Inter-frequency FR1-FR2 PSCell change

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 2	
	Neighbouring cell		Cell 4	
Final condition	Active cell		Cell 4	
A4-Offset		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.1.15.1-5: Cell specific test parameters for Inter-frequency FR1-FR2 PSCell change (Cell 2)

Parameter		Unit	Cell 2	
			T1	T2
NR RF Channel Number			2	
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR2.1 TDD	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR2.1 TDD	
OCNG Patterns			OP.1	

SMTC Configuration			SMTC.1
SSB Configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz
	Config 3		30 kHz
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz
	Config 3		30 kHz
PRACH configuration			FR1 PRACH configuration 1
BWP	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2		dBm/15 kHz	N/A Link only, see clause A.3.7A
N_{oc} Note2	Config 1,2		
	Config 3		
$\hat{E}_s / I_{ot}$		dB	
$\hat{E}_s / N_{oc}$		dB	
SSB_RP	Config 1,2	dBm/SCS	
	Config 3	dBm/SCS	
Io Note3	Config 1,2	dBm/ 9.36 MHz	
	Config 3	dBm/ 38.16 MHz	
Propagation condition		-	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.3.1.15.1-6: Cell specific test parameters for Inter-frequency FR1-FR2 PSCell change (Cell 4)

Parameter	Unit	Cell 4	
		T1	T2
Assumption for UE beams Note 6		Rough	
AoA setup		Setup 1 as defined in A.3.15	
NR RF Channel Number		3	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66	
BWP BW	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated		66	
DRX Cycle	ms	Not Applicable	
PDSCH Reference measurement channel		SR3.1 TDD	
RMSI CORESET Reference Channel		CR3.1 TDD	
Control Channel RMC		CCR.3.1 TDD	
OCNG Patterns		OP.1	
SMTC Configuration		SMTC pattern 1	
SSB Configuration		SSB. 3 FR2	
PDSCH/PDCCH subcarrier spacing	kHz	120 kHz	

Parameter		Unit	Cell 4	
			T1	T2
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz	
PRACH configuration			FR2 PRACH configuration 1	
TRS configuration			TRS.2.1 TDD	
PDSCH/PDCCH TCI state			TCI.State.2	
BWP configuraiton	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-104.7	
N_{oc} Note2		dBm/SCS	-95.7	
$\hat{E}_s / I_{ot}$		dB	-Infinity	0
$\hat{E}_s / N_{oc}$		dB	-Infinity	7
Io Note3		-59.7	-59.7	-56.7
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.1.15.2 Test Requirements

The UE shall start to transmit the PRACH to target PSCell (Cell 4) less than 636 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover with PSCell delay can be expressed as: $D_{HOwithPSCell_PSCell} = T_{RRC_delay} + T_{processing} + T_{search_HO} + T_{search_PSCell} + T_{\Delta} + T_{PSCell_DU} + 2$ ms, where:

RRC procedure delay = 16 ms and is specified in clause 12 in TS 38.331 [2].

$T_{processing}$ is as defined as 50 ms in the test.

T_{search_HO} is as defined as 60 ms in the test.

T_{search_PSCell} is as defined as 480 ms in the test.

T_{Δ} is defined as 20 ms in the test.

T_{PSCell_DU} is defined as 10 ms in the test.

This gives a total of 636 ms.

A.7.3.2 RRC Connection Mobility Control

A.7.3.2.1 SA: RRC Re-establishment

A.7.3.2.1.1 Intra-frequency RRC Re-establishment in FR2

A.7.3.2.1.1.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR2 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.7.3.2.1.1.1-1, table A.7.3.2.1.1.1-2 and table A.7.3.2.1.1.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure.

Table A.7.3.2.1.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.1.1.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell 1	
	Neighbour cells		1	Cell 2	
Final condition	Active cell		1	Cell 2	
RF Channel Number			1	1	
Time offset between cells			1	3 µs	Synchronous cells
N310		-	1	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1	0	Radio link failure timer; T310 is disabled
T311		ms	1	5000	RRC re-establishment timer
Access Barring Information		-	1	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
SMTC configuration			1	SMTC pattern 1	
DRX cycle length		s	1	OFF	
PRACH configuration			1	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1		s	1	5	
T2		s	1	4.84	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133)
T3		s	1	5	

Table A.7.3.2.1.1.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 4			Rough			Rough		
TDD configuration		1	TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		1	24			24		
PDSCH RMC configuration		1	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration		1	TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI state		1	TCI.State.2			N/A		
OCNG Pattern		1	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1	SSB			SSB		
AoA setup		1	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
$\hat{E}_s / I_{ot}$	dB	1	-0.12	-infinity	-infinity	-3.46	2	2
N_{oc} Note2	dBm/15 kHz	1	-104.7					
N_{oc} Note2	dBm/SCS	1	-95.7					
$\hat{E}_s / N_{oc}$	dB	1	4	-infinity	-infinity	2	2	2
SS-RSRP Note3	dBm/SCS	1	-91.7	-infinity	-infinity	-93.7	-93.7	-93.7
Io	dBm/95.04 MHz	1	-59.64	-62.59	-62.59	-59.94	-62.59	-62.59
Propagation Condition		1	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.2.1.1.2 Test Requirements

The RRC re-establishment delay is defined as the time from the moment UE declares RLF, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to an unknown NR intra frequency cell shall be less than 5 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$

$N_{freq} = 1$

$T_{identify_intra_NR} = 3520$ ms

$T_{SI} = 1280$ ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target intra-frequency NR cell.

$T_{PRACH} = 15$ ms; it is the additional delay caused by the random access procedure.

This gives a total of 4865 ms for RRC re-establishment delay, allow 9.84 s (4.84 s + 5 s) from the beginning of T2 in the test case.

A.7.3.2.1.2 Inter-frequency RRC Re-establishment in FR2

A.7.3.2.1.2.1 Test Purpose and Environment

The purpose is to verify that the NR inter-frequency RRC re-establishment delay in FR2 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.7.3.2.1.2.1-1, table A.7.3.2.1.2.1-2 and table A.7.3.2.1.2.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of cell 2 by the end of T1.

Table A.7.3.2.1.2.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.1.2.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case in FR2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell 1	
	Neighbour cells		1	Cell 2	
Final condition	Active cell		1	Cell 2	
RF Channel Number			1	1, 2	
Time offset between cells			1	3 µs	Synchronous cells
N310		-	1	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1	0	Radio link failure timer; T310 is disabled
T311		ms	1	5000	RRC re-establishment timer
Access Barring Information		-	1	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
SMTC configuration			1	SMTC pattern 1	
DRX cycle length		s	1	OFF	
PRACH configuration			1	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1		s	1	5	

T2	s	1	4.84	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133)
T3	s	1	6	

Table A.7.3.2.1.2.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case in FR2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 4			Rough			Rough		
AoA setup		1	Setup 3 as specified in clause A.3.15					
			AoA1			AoA2		
TDD configuration		1	TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		1	24			24		
PDSCH RMC configuration		1	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration		1	TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI state		1	TCI.State.2			N/A		
OCNG Pattern		1	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1	SSB			SSB		
N_{oc} Note2	dBm/15 kHz	1	-92.1			-92.1		
N_{oc} Note2	dBm/SCS	1	-83.1			-83.1		
$\hat{E}_s / N_{oc}$	dB	1	0	-infinity	-infinity	-infinity	-infinity	0
$\hat{E}_s / I_{ot}$ BB Note 5	dB	1	-1.01	-infinity	-infinity	-infinity	-infinity	-1.01
SSB_RP Note3	dBm/SCS	1	-83.1	-infinity	-infinity	-infinity	-infinity	-83.1
Io	dBm/95.04 MHz	1	-55.46	-58.51	-58.51	-58.51	-58.51	-55.46
Propagation Condition		1	AWGN			AWGN		

NOTE 1: OCNG shall be used such that a constant total transmitted power is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.3.2.1.2.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to an unknown NR inter frequency cell shall be less than 6 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 2$

$T_{identify_intra_NR}$ = 1600 ms

$T_{identify_inter_NR}$ = 2080 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target inter-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 5025 ms, allow 6 s in the test case.

A.7.3.2.1.3 Intra-frequency RRC Re-establishment in FR2 without serving cell timing

A.7.3.2.1.3.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR2 without serving cell timing is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.7.3.2.1.3.1-1, table A.7.3.2.1.3.1-2 and table A.7.3.2.1.3.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.7.3.2.1.3.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.1.3.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell 1	
	Neighbour cells		1	Cell 2	
Final condition	Active cell		1	Cell 2	
RF Channel Number			1	1	
Time offset between cells			1	3 µs	Synchronous cells
N310		-	1	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1	6000	Radio link failure timer configured by *RLF-TimersAndConstants*
T311		ms	1	5000	RRC re-establishment timer

Access Barring Information	-	1	Not Sent	No additional delays in random access procedure.
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC pattern 1	
DRX cycle length	s	1	OFF	
PRACH configuration		1	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1	s	1	5	
T2	s	1	10.84	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133)
T3	s	1	5	

Table A.7.3.2.1.3.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 4			Rough			Rough		
TDD configuration		1	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1	CR.3.1 FDD			CR.3.1 FDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 FDD			CCR.3.1 FDD		
TRS configuration		1	TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI state		1	TCI.State.2			N/A		
OCNG Pattern		1	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1	SSB			SSB		
AoA setup		1	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
$\hat{E}_s / I_{ot}$	dB	1	5	-infinity	-infinity	-infinity	-infinity	5
N_{oc} Note2	dBm/15 kHz	1	-104.7					
N_{oc} Note2	dBm/SCS	1	-95.7					
$\hat{E}_s / N_{oc}$	dB	1	5	-infinity	-infinity	-infinity	-infinity	5
SS-RSRP Note3	dBm/SCS	1	-90.7	-infinity	-infinity	-infinity	-infinity	-90.7
Io	dBm/95.04 MHz	1	-60.52	-66.71	-60.52	-60.52	-66.71	-60.52
Propagation Condition		1	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.2.1.3.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to an unknown NR intra frequency cell without serving cell timing shall be less than 5 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 1$

$T_{identify_intra_NR}$ = 3520 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 [2] for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 4865 ms, allow 5 s in the test case.

A.7.3.2.1.4 Intra-frequency RRC Re-establishment in FR2-2

A.7.3.2.1.4.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR2-2 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.7.3.2.1.4.1-1, table A.7.3.2.1.4.1-2 and table A.7.3.2.1.4.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure.

Table A.7.3.2.1.4.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	NR 960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.2.1.4.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR2-2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1,2,3	Cell 1	
	Neighbour cells		1,2,3	Cell 2	
Final condition	Active cell		1,2,3	Cell 2	

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		1,2,3	1	
Time offset between cells		1,2,3	3 μs	Synchronous cells
N310	-	1,2,3	1	Maximum consecutive out-of-sync indications from lower layers
N311	-	1,2,3	1	Minimum consecutive in-sync indications from lower layers
T310	ms	1,2,3	0	Radio link failure timer; T310 is disabled
T311	ms	1,2,3	5000	RRC re-establishment timer
Access Barring Information	-	1,2,3	Not Sent	No additional delays in random access procedure.
SSB configuration		1,2,3	SSB.1 FR2	
SMTC configuration		1,2,3	SMTC pattern 1	
DRX cycle length	s	1,2,3	OFF	
PRACH configuration		1,2,3	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1	s	1,2,3	5	
T2	s	1,2,3	4.84	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133)
T3	s	1,2,3	5	

Table A.7.3.2.1.4.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR2-2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 4		1,2,3	Rough			Rough		
TDD configuration		1,2,3	TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		1	24			24		
PDSCH RMC configuration		1,2,3	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1,2,3	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1,2,3	CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration		1,2,3	TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI state		1,2,3	TCI.State.2			N/A		
OCNG Pattern		1,2,3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1,2,3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1,2,3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1,2,3	SSB			SSB		
AoA setup		1,2,3	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
$\hat{E}_s / I_{ot}$	dB	1,2,3	-0.12	-infinity	-infinity	-3.46	2	2
N_{oc} Note2	dBm/15 kHz	1,2,3	-104.7					
N_{oc} Note2	dBm/SCS	1	-95.7					
		2	-89.7					
		3	-86.7					
$\hat{E}_s / N_{oc}$	dB	1,2,3	4	-infinity	-infinity	2	2	2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
SS-RSRP Note3	dBm/SCS	1	-91.7	-infinity	-infinity	-93.7	-93.7	-93.7
		2	-85.7	-infinity	-infinity	-87.7	-87.7	-87.7
Io	dBm/95.04 MHz	1	-59.64	-62.59	-62.59	-59.94	-62.59	-62.59
	dBm/380.16 MHz	2, 3	-53.65	-56.60	-56.60	-53.65	-56.60	-56.60
Propagation Condition		1,2,3	AWGN					
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation								

A.7.3.2.1.4.2 Test Requirements

he RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to an unknown NR intra frequency cell shall be less than 5 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 1$

$T_{identify_intra_NR} = 3520$ ms

$T_{SI} = 1280$ ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target intra-frequency NR cell.

$T_{PRACH} = 15$ ms; it is the additional delay caused by the random access procedure.

This gives a total of 4865 ms, allow 5 s in the test case.

A.7.3.2.1.5 Inter-frequency RRC Re-establishment in FR2-2

A.7.3.2.1.5.1 Test Purpose and Environment

The purpose is to verify that the NR inter-frequency RRC re-establishment delay in FR2-2 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.7.3.2.1.5.1-1, table A.7.3.2.1.5.1-2 and table A.7.3.2.1.5.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of cell 2 by the end of T1.

Table A.7.3.2.1.5.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	NR 960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.2.1.5.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case in FR2-2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1,2,3	Cell 1	
	Neighbour cells		1,2,3	Cell 2	
Final condition	Active cell		1,2,3	Cell 2	
RF Channel Number			1,2,3	1, 2	
Time offset between cells			1,2,3	3 μs	Synchronous cells
N310		-	1,2,3	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1,2,3	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1,2,3	0	Radio link failure timer; T310 is disabled
T311		ms	1,2,3	5000	RRC re-establishment timer
Access Barring Information		-	1,2,3	Not Sent	No additional delays in random access procedure.
SSB configuration			1,2,3	SSB.1 FR2	
SMTC configuration			1,2,3	SMTC pattern 1	
DRX cycle length		s	1,2,3	OFF	
PRACH configuration			1,2,3	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1		s	1,2,3	5	
T2		s	1,2,3	4.84	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133)
T3		s	1,2,3	6	

Table A.7.3.2.1.5.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case in FR2-2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams[Note 4]			Rough			Rough		
AoA setup		1,2,3	Setup 3 as specified in clause A.3.15					
			AoA1			AoA2		
TDD configuration		1,2,3	TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		1	24			24		
PDSCH RMC configuration		1,2,3	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1,2,3	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1,2,3	CCR.3.1 TDD			CCR.3.1 TDD		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TRS configuration		1,2,3	TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI state		1,2,3	TCI.State.2			N/A		
OCNG Pattern		1,2,3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1,2,3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1,2,3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1,2,3	SSB			SSB		
N_{oc} Note2	dBm/15 kHz	1,2,3	-92.1			-92.1		
N_{oc} Note2	dBm/SCS	1	-83.1			-83.1		
		2	-77.05			-77.05		
		3	-74.04			-74.04		
$\hat{E}_s / N_{oc}$	dB	1,2,3	0	-infinity	-infinity	-infinity	-infinity	0
$\hat{E}_s / I_{ot}$ BB Note 5	dB	1,2,3	-1.01	-infinity	-infinity	-infinity	-infinity	-1.01
SSB_RP Note3	dBm/SCS	1	-83.1	-infinity	-infinity	-infinity	-infinity	-83.1
		2	-77.05	-infinity	-infinity	-infinity	-infinity	-77.05
		3	-74.04	-infinity	-infinity	-infinity	-infinity	-74.04
Io	dBm/95.04 MHz	1	-55.46	-58.51	-58.51	-58.51	-58.51	-55.46
Propagation Condition		1 ,2,3	AWGN			AWGN		

NOTE 1: OCNG shall be used such that a constant total transmitted power is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.3.2.1.5.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to an unknown NR inter frequency cell shall be less than 6 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 2$

$T_{identify_intra_NR} = 1600$ ms

$T_{identify_inter_NR} = 2080$ ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target inter-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 5025 ms, allow 6 s in the test case.

A.7.3.2.1.6 Intra-frequency RRC Re-establishment in FR2-2 without serving cell timing

A.7.3.2.1.6.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR2-2 without serving cell timing is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.7.3.2.1.6.1-1, table A.7.3.2.1.6.1-2 and table A.7.3.2.1.6.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.7.3.2.1.6.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	NR 960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.2.1.6.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR2-2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1,2,3	Cell 1	
	Neighbour cells		1,2,3	Cell 2	
Final condition	Active cell		1,2,3	Cell 2	
RF Channel Number			1,2,3	1	
Time offset between cells			1,2,3	3 µs	Synchronous cells
N310		-	1,2,3	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1,2,3	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1,2,3	6000	Radio link failure timer configured by *RLF-TimersAndConstants*
T311		ms	1,2,3	5000	RRC re-establishment timer
Access Barring Information		-	1,2,3	Not Sent	No additional delays in random access procedure.
SSB configuration			1,2,3	SSB.1 FR2	
SMTC configuration			1,2,3	SMTC pattern 1	
DRX cycle length		s	1,2,3	OFF	
PRACH configuration			1,2,3	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1		s	1,2,3	5	
T2		s	1,2,3	10.84	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133)
T3		s	1,2,3	5	

Table A.7.3.2.1.6.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR2-2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 4			Rough			Rough		
TDD configuration		1,2,3	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1,2,3	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1,2,3	CR.3.1 FDD			CR.3.1 FDD		
Dedicated CORESET RMC configuration		1,2,3	CCR.3.1 FDD			CCR.3.1 FDD		
TRS configuration		1,2,3	TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI state		1,2,3	TCI.State.2			N/A		
OCNG Pattern		1,2,3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1,2,3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1,2,3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1,2,3	SSB			SSB		
AoA setup		1,2,3	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
$\hat{E}_s/I_{ot}$	dB	1,2,3	5	-infinity	-infinity	-infinity	-infinity	5
N_{oc} Note2	dBm/15 kHz	1,2,3	-104.7					
N_{oc} Note2	dBm/SCS	1	-95.7					
		2	-89.7					
		3	-86.7					
$\hat{E}_s/N_{oc}$	dB	1,2,3	5	-infinity	-infinity	-infinity	-infinity	5
SS-RSRP Note3	dBm/SCS	1	-90.7	-infinity	-infinity	-infinity	-infinity	-90.7
		2	-84.7	-infinity	-infinity	-infinity	-infinity	-84.7
		3	-81.7	-infinity	-infinity	-infinity	-infinity	-81.7
Io	dBm/95.04 MHz	1	-60.52	-66.71	-60.52	-60.52	-66.71	-60.52
	dBm/380.16 MHz	2	-54.52	-60.71	-54.52	-54.52	-60.71	-54.52
	dBm/380.16 MHz	3	-54.53	-60.72	-54.54	-54.53	-60.72	-54.53
Propagation Condition		1,2,3	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.2.1.6.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to an unknown NR intra frequency cell without serving cell timing shall be less than 5 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}$.

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$

$N_{freq} = 1$

$T_{identify_intra_NR}$ = 3520 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 [2] for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 4865 ms, allow 5 s in the test case.

A.7.3.2.2 Random Access

A.7.3.2.2.1 4-step RA type c ontention based random access test in FR2 for NR Standalone

A.7.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in table A.7.3.2.2.1.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in table A.7.3.2.2.1.1-2 and table A.7.3.2.2.1.1-3.

Table A.7.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR2 for NR Standalone

Config	Description
1	NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.2.1.1-2: General test parameters for contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.1 FR2	As defined in A.3.10
CSI-RS for tracking	Config 1		TRS.2.1 TDD	
Duplex Mode for Cell 1	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	As defined in A.3.1.4
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated	Config 1		24	
OCNG Pattern Note 1			OCNG pattern 1	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR.3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD	As defined in A.3.1.2
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		

Parameter	Unit	Test-1	Comments
EPRE ratio of PDSCH to PDSCH_DMRS	dB		
ss-PBCH-BlockPower	dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)	dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
PRACH Configuration		FR2 PRACH configuration 1	As defined in A.3.8.3, with exceptions as defined below
rsrp-ThresholdSSB	dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88 dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower	dBm	-100	As defined in TS 38.331 [2]

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 3: The Δ_{UL} value is calculated as -ROUND(P_{PRACH0} -1), where P_{PRACH0} is the measured first PRACH power with -80.6 dBm/SCS applied, *preambleReceivedTargetPower* = -100 dBm and *ss-PBCH-BlockPower* = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.
NOTE 4: The Δ_{DL} value is calculated as ($RSRP_{REP}$ – RSRP_76), where $RSRP_{REP}$ is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.7.3.2.2.1.1-3: OTA-related test parameters for contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 3			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	No external noise (Note 4)	

NOTE 1: No articial noise is applied in this test.
NOTE 2: Void.
NOTE 3: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 4: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.7.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.7.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in Clause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in Clause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2.2.1.4 the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.7.3.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in Clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

A.7.3.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in Clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

A.7.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in Clause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.7.3.2.2.2 4-step RA type n on-contention based random access test in FR2 for NR Standalone

A.7.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in table A.7.3.2.2.2.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in table A.7.3.2.2.2.1-2 and table A.7.3.2.2.2.1-3 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports csi-RSRP-AndRSRQ-MeasWithSSB or csi-RSRP-AndRSRQ-MeasWithoutSSB.

Table A.7.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR2 for NR Standalone

Config	Description
1	NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Test-2	Comments
SSB Configuration	Config 1		SSB.1 FR2	SSB.1 FR2	As defined in A.3.10
CSI-RS for tracking	Config 1		TRS.2.1 TDD	TRS.2.1 TDD	
CSI-RS Configuration	Config 1		N/A	CSI-RS.3.1 TDD	As defined in A.3.1.4
Duplex Mode for Cell 2	Config 1		TDD	TDD	
TDD Configuration	Config 1		TDDConf.3.1	TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66	
Data PRBs allocated	Config 1		24	24	

Parameter		Unit	Test-1	Test-2	Comments
OCNG Pattern Note 1			OP.3	OP.3	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR3.1 TDD	SR3.1 TDD	As defined in A.3.1.1.
NR RF Channel Number			1	1	
EPRE ratio of PSS to SSS		dB	0	0	
EPRE ratio of PBCH_DMRS to SSS		dB			
EPRE ratio of PBCH to PBCH_DMRS		dB			
EPRE ratio of PDCCH_DMRS to SSS		dB			
EPRE ratio of PDCCH to PDCCH_DMRS		dB			
EPRE ratio of PDSCH_DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH_DMRS		dB			
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)		dBm	maximum value configurable for certain power class	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
PRACH Configuration			FR2 PRACH configuration 2	FR2 PRACH configuration 3	As defined in A.3.8.3, with exceptions as defined below.
rsrp-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88 dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower		dBm	-100	-100	As defined in TS 38.331 [2]

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 3: The Δ_{UL} value is calculated as -ROUND(P_{PRACH0} -1), where P_{PRACH0} is the measured first PRACH power with -80.6 dBm/SCS applied, *preambleReceivedTargetPower* = -100 dBm and *ss-PBCH-BlockPower* = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.
NOTE 4: The Δ_{DL} value is calculated as ($RSRP_{REP}$ – RSRP_76), where $RSRP_{REP}$ is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.7.3.2.2.2.1-3: OTA-related test parameters for non-contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Test-2	Comments
AoA setup			Setup 1	Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 3			Rough	Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	-80.6	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	-80.6	
	Es/Iot_{BB}	dB	21.09	21.09	
	Io	dBm/95.04 MHz	-56.01	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	-95.0	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	-95.0	

Parameter		Unit	Test-1	Test-2	Comments
	Es/Iot_{BB}	dB	6.69	6.69	
	Io	dBm/95.04 MHz	-70.41	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	No external noise (Note 4)	No external noise (Note 4)	
NOTE 1: No articial noise is applied in this test. NOTE 2: void. NOTE 3: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation. NOTE 4: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].					

A.7.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.7.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.2.2.1 for SSB-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in Clause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.3 2-step RA type contention based random access test in FR2 for NR Standalone

A.7.3.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the 2-step RA type random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.3 and Clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in table A.7.3.2.2.3.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in table A.7.3.2.2.3.1-2 and table A.7.3.2.2.3.1-3.

Table A.7.3.2.2.3.1-1: Supported test configurations for 2-step RA type contention based random access test in FR2 for NR Standalone

Config	Description
1	NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.2.3.1-2: General test parameters for 2-step RA type contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.1 FR2	As defined in A.3.10
Duplex Mode for Cell 1	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	As defined in A.3.1.4
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 24	
OCNG Pattern Note 1			OCNG pattern 1	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR.3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD	As defined in A.3.1.2

NR RF Channel Number		1	
EPRE ratio of PSS to SSS	dB	0	
EPRE ratio of PBCH_DMRS to SSS	dB		
EPRE ratio of PBCH to PBCH_DMRS	dB		
EPRE ratio of PDCCH_DMRS to SSS	dB		
EPRE ratio of PDCCH to PDCCH_DMRS	dB		
EPRE ratio of PDSCH_DMRS to SSS	dB		
EPRE ratio of PDSCH to PDSCH_DMRS	dB		
ss-PBCH-BlockPower	dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)	dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
MsgA Configuration		FR2 MsgA configuration 1	As defined in A.3.20.3, with exceptions as defined below
msgA-RSRP-ThresholdSSB	dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88 dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower	dBm	-100	As defined in TS 38.331 [2]

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 3: The Δ_{UL} value is calculated as -ROUND(PMsgA0 -1), where PMsgA0 is the measured first MsgA PRACH power with -80.6 dBm/SCS applied, *msgA-PreambleReceivedTargetPower* = -100 dBm and *ss-PBCH-BlockPower* = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send MsgA.
NOTE 4: The Δ_{DL} value is calculated as (RSRP_$_{REP}$ – RSRP_76), where RSRP_$_{REP}$ is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.7.3.2.2.3.1-3: OTA-related test parameters for 2-step RA type contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
AoA setup			Setup 2b	As defined in A.3.15.1
Assumption for UE beams Note 2			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot$_{BB}$	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot$_{BB}$	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	No external noise (Note 3)	

NOTE 1: No articial noise is applied in this test.
NOTE 2: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 3: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.7.3.2.2.3.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.7.3.2.2.3.2.1 MsgA Transmission

To test the UE behavior specified in Clause 6.2.2.3.1.1 the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB.*

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first MsgA preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.3.2.2 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.1.2 the System Simulator shall transmit a MsgB containing a fallbackRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit MsgA with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB's contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first MsgA PRACH shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.3.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.3 the System Simulator shall transmit a MsgB containing a fallbackRAR message and Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first MsgA PRACH shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.4 2-step RA type n on-contention based random access test in FR2 for NR Standalone

A.7.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.3 and Clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in table A.7.3.2.2.4.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in table A.7.3.2.2.4.1-2 and table A.7.3.2.2.4.1-3.

Table A.7.3.2.2.4.1-1: Supported test configurations for non-contention based random access test for 2-step RA type in FR2 for NR Standalone

Config	Description
1	NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.2.4.1-2: General test parameters for non-contention based random access test for 2-step RA type in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.1 FR2	As defined in A.3.10
Duplex Mode for Cell 2	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 24	
OCNG Pattern Note 1			OP.3	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR3.1 TDD	As defined in A.3.1.1.
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,f,c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
MsgA Configuration			FR2 MsgA configuration 2	As defined in A.3.20.3, with exceptions as defined below.
msgA-RSRP-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88 dBm. Δ_{DL} is derived from the downlink calibration process Note 4
msgA-PreambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 3: The Δ_{UL} value is calculated as -ROUND(P_{MsgA0} -1), where P_{MsgA0} is the measured first MsgA PRACH power with -80.6 dBm/SCS applied, *msgA-PreambleReceivedTargetPower* = -100 dBm and *ss-PBCH-*

Parameter	Unit	Test-1	Comments
BlockPower = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send MsgA. NOTE 4: The Δ_{DL} value is calculated as (RSRP_$_{REP}$ – RSRP_76), where RSRP_$_{REP}$ is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.			

Table A.7.3.2.2.4.1-3: OTA-related test parameters for non-contention based random access test for 2-step RA type in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 2			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	No external noise (Note 3)	
NOTE 1: No artificial noise is applied in this test. NOTE 2: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 3: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].				

A.7.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.7.3.2.2.4.2.1 MsgA Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.3.2.1 for MsgA transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.4.2.2 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble after 3 MsgA transmissions

have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB if the MsgB contains a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power if all received Random Access Response Reception has not been considered as successful.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA*.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA PRACH power with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.3 SA: RRC Connection Release with Redirection

A.7.3.2.3.1 Redirection from NR in FR2 to NR in FR2

A.7.3.2.3.1.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to NR requirements specified in clause 6.2.3.2.1.

A.7.3.2.3.1.2 Test Parameters

Supported test configurations are shown in table A.7.3.2.3.1.2-1. The time delay is tested by using the parameters in table A.7.3.2.3.1.2-2, and A.7.3.2.3.1.2-3.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2.

Table A.7.3.2.3.1.2-1: Redirection from NR to NR test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.3.1.2-2: General test parameters for Redirection from NR to NR test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	3.2	

Table A.7.3.2.3.1.2-3: Cell specific test parameters for Redirection from NR to NR test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]			Rough		Rough	
AoA setup			Setup 1as defined in A.3.15			
NR RF Channel Number			1		2	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
Data PRBs allocated			66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
RMSI CORESET Reference Channel			CR3.1 TDD			
Control Channel RMC			CCR.3.1 TDD			
OCNG Patterns			OP.1			
SMTC configuration			SMTC.1			
SSB Configuration			SSB.3 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
PDSCH/PDCCH TCI state			TCI.State.2			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-104.7		-104.7	
N_{oc} Note2		dBm/SCS	-95.7		-95.7	
$\hat{E}_s / I_{ot}$		dB	5	5	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	5	5	-Infinity	5
Io[Note3]		dBm/ BW	-60.5	-60.5	-66.7	-60.5
Propagation condition		-	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone					
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.3.2.3.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 3160 ms from the beginning of time period T2.

The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_NR} = T_{RRC_procedure_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH},$$

where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}NR}$ = 1760 ms in the test.

$T_{SI\text{-}NR}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target NR cell.

T_{RACH} = 10 ms in the test.

This gives a total of 3160 ms.

A.7.3.2.4 LTM PDCCH-order Random Access

A.7.3.2.4.1 PDCCH-order RACH on neighbor cell in FR2 when RACH BW is within active BWP

A.7.3.2.4.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 PDCCH-ordered RACH to an intra-frequency candidate cell in FR2 for LTM. The interruption requirements specified in clause 8.2.2.2.20. This test is for UE supporting PDCCH-ordered RACH to an intra-frequency candidate cell, whose SSB is within active BWPs of the UE.

A.7.3.2.4.1.2 Test Parameters

Two cells are deployed in the test, which are FR2 PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. Test configurations are given in table A.7.3.2.4.1.2-1. Both PDCCH order RACH delay and transmit timing requirement are tested by using the parameters in table A.7.3.2.4.1.2-2, and A.7.3.2.4.1.2-3.

There are two tests in the test case, test 1 and test 2:

- In test 1, joint TCI state configuration as defined in table A.7.3.2.4.1.2-2 is provided for UE that supports *ltm-BeamIndicationJointTCI-r18*.
- In test 2, separate TCI state configuration as defined in table A.7.3.2.4.1.2-2 for test 2 is provided for UE that supports *ltm-BeamIndicationSeparateTCI-r18* and does not support *ltm-BeamIndicationJointTCI-r18*.

If a UE supports *ltm-BeamIndicationSeparateTCI-r18* and does not support *ltm-BeamIndicationJointTCI-r18*, it is only required to pass test 2. Otherwise, it is only required to pass test 1.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. No gap patterns are configured in the test case.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- A measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.
- The UE has performed L3 measurement and SSB based L1-RSRP measurement on Cell 2.

T1 starts from UE transmitting a valid L1 report on Cell 2. After receiving the first L1 report on Cell 2 during T1, the network sends TCI state activation MAC CE to active TCI state of Cell 2 in no later than 100 ms.

- In test 1, CandidateTCI-State#1 is activated.
- In test 2, CandidateTCI-State#1 and CandidateTCI-UL-State#1 are activated.
- For UE incapable of early TCI state activation, network shall not send TCI state activation MAC CE to active TCI state of Cell 2.

The start of T2 is the instant when PDCCH order to trigger PRACH transmission on Cell 2 is sent to the UE.

Table A.7.3.2.4.1.2-1: PDCCH order RACH on Neighbor cell in FR1 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.4..2.2-2: General test parameters for PDCCH order RACH in FR2

Parameter		Unit	Value		Comment
			Test 1	Test 2	
Initial conditions	Active cell		Cell 1		
	Neighbouring cell		Cell 2		Cell 2 is the candidate cell
Final condition	Active cell		Cell 1		After transmitting PRACH on Cell 2, UE shall be back to Cell 1.
A3-Offset		dB	0		
Hysteresis		dB	0		
Time To Trigger		s	0		
Filter coefficient			0		L3 filtering is not used
DRX			OFF		DRX is not used
Time offset between cells			0.3 μs		RTD between cells is less than CP
deriveSSB-IndexFromCell			Enabled		
EarlyUL-SyncConfig	frequencyInfoUL		NR RF Channel Number 1		Same as Cell 1
	PRACH configuration		FR2 PRACH configuration 5		RACH bandwidth is within active UL BWP of Cell 1
	bwp-GenericParameters		ULBWP.0.1		
	n-TimingAdvanceOffset	Tc	N/A		
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	320		Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1		Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1		
	spCellInclusion		N/A		

ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DLorJoint TCI.State.0	DLorJoint TCI.State.2	As specified in clause A.3.16B. Configured for early TCI state activation.
ltm-UL-TCI-StatesToAddModList	CandidateTCI-UL-State#1		N/A	UL TCI.State.0	As specified in clause A.3.16B. Configured for early TCI state activation.
ltm-ConfigComplete			True		Candidate cell's configuration is complete configuration
T1		s	0.3		
T2		s	≤0.5		

Table A.7.3.2.4..2.2-3: Cell specific test parameters for PDCCH order RACH test case in FR2

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]			Rough		Rough	
AoA setup			Setup 1 as defined in A.3.15			
NR RF Channel Number			**1**		**1**	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
Data PRBs allocated			66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
RMSI CORESET Reference Channel			CR3.1 TDD			
Control Channel RMC			CCR.3.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB.3 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120			
PUCCH/PUSCH subcarrier spacing		kHz	120			
PRACH configuration			FR2 PRACH configuration 6			
TRS configuration			TRS.2.1 TDD			
PDSCH/PDCCH TCI state			TCI.State.2			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} [Note2]		dBm/15 kHz	-104.7		-104.7	
N_{oc} [Note2]		dBm/SCS	-95.7		-95.7	
$\hat{E}_s / I_{ot}$		dB	-1.8		0	
$\hat{E}_s / N_{oc}$		dB	6		7	
SSB_RP		dBm/SCS	-89.7		-88.7	
Io[Note3]		dBm/ 95.04 MHz	-56.7		-56.7	
Propagation condition		-	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone					
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.3.2.4.1.3 Test Requirements

The UE shall transmit the PRACH to Cell 2 in the first available PRACH occasion after $N_{T,2}$ + 0.25 ms + T_{SSB} from the beginning of time period T2. After transmitting PRACH on Cell 2, UE shall be back to Cell 1.

NOTE: The PDCCH order RACH delay can be expressed as: $N_{T,2} + T_{\mathrm{BWPswitchDelay}} + \Delta_{\mathrm{Delay}} + T_{\mathrm{switch}} + T_{\mathrm{SSB}} + \Delta_{\mathrm{RF/BB\ preparation}}$, where:

- $N_{T,2}$ is a time duration of N_2 symbols corresponding to a PUSCH preparation time for UE processing capability 1 assuming μ corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH order and the SCS configuration of the corresponding PRACH transmission and is specified in table 6.4-1 in 38.214 [26].
- $T_{\mathrm{BWPswitchDelay}}$= 0, T_{switch}= 0, $\Delta_{\mathrm{RF/BB\ preparation}}$= 0
- Δ_{Delay}= 0.25 ms
- $T_{\mathrm{SSB}} = T_{\mathrm{first-SSB_RACH}} + T_{\mathrm{SSB-proc}}$, where $T_{\mathrm{first-SSB_RACH}}$ is first SSB occasion, after 1 slot from the end of the slot of the PDCCH, and $T_{\mathrm{SSB-proc}}$ = 2 ms, which is the time for SSB processing.

During T2, interruption on Cell 1 UL shall not happen outside the overlapped slot to transmit PRACH and *N* symbols from the last or first symbol of PRACH occasion as defined in clause 8.1 in 38.213 [3], where N=4. During T2, interruption on Cell 1 DL shall not occur outside the overlapped slot to transmit PRACH.

The test equipment will verify that the timing of PRACH transmission on Cell 2 is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB of Cell 2.

- The N_{TA_offset} value (in T_c units) is 13792.
- The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.3.2.4.2 PDCCH-order RACH on inter-frequency neighbor cell in FR2

A.7.3.2.4.2.1 Test Purpose and Environment

This test is to verify the requirement for PDCCH-order RACH on neighbour cell in FR2 when RACH bandwidth is outside any configured UL BWP specified in clause 8.1 in 38.213 [3], UE transmit timing in clause 7.1 and interruption in clause 8.2.2.2.20 for UE supporting *rach-EarlyTA-Measurement-r18*, *pdcch-RACH-PrepTimeList-r18* and *pdcch-RACH-SwitchingTimeList-r18*.

A.7.3.2.4.2.2 Test Parameters

In this test, there are two cells: NR Cell 1 as PCell in FR2 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR2 on NR RF channel 2. Test configurations are given in table A.7.3.2.4.2.2-1. Both PDCCH order RACH delay, transmit timing requirement and the interruption requirements are tested by using the parameters in table A.7.3.2.4.2.2-2, and A.7.3.2.4.2.2-3.

The test consists of two successive time periods, with time durations of T1 and T2 respectively.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- A measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A4 is used.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.
- The UE has reported L3 measurement results and performed SSB based L1-RSRP measurement on Cell 2.

T1 starts from UE transmitting a valid L1 report on Cell 2. After T1, test equipment sends PDCCH order to trigger RACH transmission. The start of T2 is the instant when PDCCH order to trigger PRACH transmission on Cell 2 is received.

Table A.7.3.2.4.2.2-1: PDCCH order RACH on inter-frequency neighbor cell in FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Candidate cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.4.2.2-2: General test parameters for PDCCH order RACH in FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	Cell 2 is the candidate cell
Final condition	Active cell		Cell 1	After transmitting PRACH on Cell 2, UE shall be back to Cell 1.
a4-Threshold		dBm	-110	Cell 2
Hysteresis		dB	0	
Time To Trigger		ms	0	
Filter coefficient			0	L3 filtering is not used
includeBeamMeasurements			True	
Gap Pattern Id			13	As specified in table 9.1.2-1.
Measurement gap offset			39	
DRX			OFF	DRX is not used
Time offset between cells			0.3 μs	
deriveSSB-IndexFromCell			Enabled	
EarlyUL-SyncConfig	frequencyInfoUL		NR RF Channel Number 2	Cell 2
	PRACH configuration		FR2 PRACH configuration 5	
	bwp-GenericParameters		ULBWP.0.1	
	n-TimingAdvanceOffset	Tc	N/A	
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	320	Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1	Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1	
	spCellInclusion		N/A	
ltm-ConfigComplete			True	Candidate cell's configuration is complete configuration
T1		s	0.3	
T2		s	≤0.5	

Table A.7.3.2.4.2.2-3: Cell specific test parameters for PDCCH order RACH test case

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		N/A	
RMSI CORESET Reference Channel			Config 1	CR.3.1 TDD		N/A	
Control Channel RMC			Config 1	CCR.3.1 TDD		N/A	
SMTC configuration			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PUCCH/PUSCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		TRS.2.1 TDD	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
$\hat{E}_s / I_{ot}$ Note 3		dB	Config 1	5	5	5	5
N_{oc} Note2		dBm/15 kHz	Config 1	-104.7	-104.7	-104.7	-104.7
N_{oc} Note2		dBm/SCS	Config 1	-95.7	-95.7	-95.7	-95.7
SSB_RP Note 3		dBm/SCS Note5	Config 1	-90.7	-90.7	-90.7	-90.7
Io Note3		dBm/95.04 MHz Note5	Config 1	-60.5	-60.5	-60.5	-60.5
Propagation Condition			Config 1	AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.3.2.4.2.3 Test Requirements

The UE shall transmit the PRACH to Cell 2 in the first available PRACH occasion after $N_{T,2}$ + 0.25 ms + T_{SSB} + $\Delta_{\mathrm{RF/BB\ preparation}}$ from the beginning of time period T2. After transmitting PRACH on Cell 2, UE shall be back to Cell 1.

NOTE: The PDCCH order RACH delay can be expressed as: $N_{T,2} + T_{\mathrm{BWPswitchDelay}} + \Delta_{\mathrm{Delay}} + T_{\mathrm{switch}} + T_{\mathrm{SSB}} + \Delta_{\mathrm{RF/BB\ preparation}}$, where:

- $N_{T,2}$ is a time duration of N_2 symbols corresponding to a PUSCH preparation time for UE processing capability 1 assuming μ corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH order and the SCS configuration of the corresponding PRACH transmission and is specified in table 6.4-1 in 38.214 [26].
- $T_{\mathrm{BWPswitchDelay}}$= 0, T_{switch}= 0
- $\Delta_{\mathrm{RF/BB\ preparation}}$ is reported in *pdcch-RACH-PrepTimeList-r18*
- Δ_{Delay}= 0.25 ms
- $T_{\mathrm{SSB}} = T_{\mathrm{first-SSB_RACH}} + T_{\mathrm{SSB-proc}}$, where $T_{\mathrm{first-SSB_RACH}}$is the time to first SSB occasion overlapped with MGL after 2 ms and 1 slot from the end of the slot that UE receives PDCCH-order, and $T_{\mathrm{SSB-proc}}$ = 2 ms, which is the time for SSB processing.

During T2, interruption on Cell 1 shall not happen outside ceil (Y/NR Slot length) +1 slots before and after PRACH transmission and the same slot of PRACH, where Y as reported in *pdcch-RACH-SwitchingTimeList-r18*,

The test equipment will verify that the timing of PRACH transmission on Cell 2 is within (N_{TA} + N_{TA_offset}) ×T_c ± T_e of the first detected path of DL SSB of Cell 2.

- The N_{TA_offset} value (in T_c units) is 13792.
- The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.3.3 Conditional Handover

A.7.3.3.1 Intra-frequency conditional handover from FR2 to FR2

A.7.3.3.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 intra frequency conditional handover requirements specified in clause 6.1.4.4.

A.7.3.3.1.2 Test Parameters

Supported test configurations are shown in table A.7.3.3.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.3.2.2-2, and A.7.3.3.2.2-3.

The test scenario comprises of two cells. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. NR shall configure a condition implying handover to cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2. Starting T2, cell 2 becomes detectable.

Table A.7.3.3.1.2-1: Intra-frequency conditional handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.3.1.2-2: General test parameters for conditional Intra-frequency handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset for condition		dBm	-1	Trigger HO to cell which may be measured as -1 dB relative to cell 1. Actual SS-RSRP is 5 dB stronger.
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤2	

Table A.7.3.3.1.2-3: Cell specific test parameters for NR FR2-FR2 conditional Intra frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
AoA setup			Setup 1 as defined in A.3.15			
Assumption for UE beams[Note 6]			Rough			
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
CORESET Reference Channel			CR3.1 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB.1 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
TCI configuration			CSI-RS.Config.0			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						

EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-104.7		-104.7	
N_{oc} Note2	Config 1	dBm/SCS	-95.7		-95.7	
$\hat{E}_s/I_{otBB}$ Note 8		dB	5.03	-5.41	-Infinity	3.81
$\hat{E}_s/N_{oc}$		dB	6	6	-Infinity	11
Io Note3	Config 1	dBm/ BW	-59.7	-54.2	-59.7	-54.2
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 7: Es/Iot, SSB_RP and Io levels have been derived from other parameters for infomation purposes. They are not settable parameters themseleves.
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated REFSENS requirement in TS 38.101-2 [19] clause 7.3.2, and an allowance of 1 dB for UE multi-band relaxation factor Δ_{MBS} specified in TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.3.3.1.2.3 Test Requirements

$T_{RRC} + T_{Event_DU}$ occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure} + T_{interrupt} + T_{CHO_execution}$ =1600+62+10=1672 ms (power class 1) or 1080+62+10 =1152 ms (power classes 2,3 and 4) from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}=T_{processing} + T_{IU} + T_{\Delta} + T_{margin}$ =40+20+2 = 62 ms excluding any transmissions which do not occur due to scheduling restrictions.

A.7.3.3.2 Inter-frequency conditional handover from FR2 to FR2; unknown target cell

A.7.3.3.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 inter frequency conditional handover requirements specified in clause 6.1.4.4.

A.7.3.3.2.2 Test Parameters

Supported test configurations are shown in table A.7.3.3.3.2-1. Both conditional handover delay and interruption length are tested by using the parameters in table A.7.3.3.3.2-2, and A.7.3.3.3.2-3.

The test scenario comprises of two carriers and one cell on each carrier. Gap pattern ID gp0 is configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. NR shall configure a condition implying handover to cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2. At the start of T2, cell 2 becomes detectable and meets the handover condition.

Table A.7.3.3.2.2-1: Inter-frequency conditional handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.3.2.2-2: General test parameters Inter-frequency conditional handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset for handovercondition		dB	FFS	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤7	

Table A.7.3.3.2.2-3: Cell specific test parameters for NR FR2-FR2 Inter frequency conditional handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
AoA setup			Setup 1 as defined in A.3.15			
Assumption for UE beams[Note 6]			Rough			
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
DRX Cycle		ms	Not Applicable			
Gap pattern ID			gp0			
PDSCH Reference measurement channel			SR3.1 TDD			
CORESET Reference Channel			CR3.1 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB.1 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
TCI configuration			CSI-RS.Config.0			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} [Note2]		dBm/15 kHz	-104.7		-104.7	
N_{oc} [Note2]	Config 1,2	dBm/SCS	-95.7		-95.7	

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Config 3		-95.7		-95.7	
$\hat{E}_s / I_{ot}$		dB	5	5	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	5	5	-Infinity	5
Io[Note3]	Config 1,2	dBm/ BW	-60.5	-60.5	-66.7	-60.5
	Config 3	dBm/ BW	-60.5	-60.5	-66.7	-60.5
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.3.2.3Test Requirements

$T_{RRC} + T_{Event_DU}$ occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure} + T_{interrupt} + T_{CHO_execution}$ = 6720+62+10 ms=6792 ms (power class 1) or 4160+62+10 ms =4232 ms (power classes 2,3 and 4) from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}=T_{processing} + T_{IU} + T_{\Delta} + T_{margin}$ =40+20+2 = 62 ms excluding any transmissions which do not occur due to scheduling restrictions. excluding any transmissions which do not occur due to scheduling restrictions.

A.7.3.3.3 NES triggering intra-frequency target CHO delay From FR2 to FR2

A.7.3.3.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 intra frequency NES triggering conditional handover requirements specified in clause 6.1.4.4.

A.7.3.3.3.2 Test Parameters

Supported test configurations are shown in table A.7.3.3.3.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.3.3.2-2 and A.7.3.3.3.2-3.

The test scenario comprises of two cells. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. NR shall configure a condition implying NES triggering handover to cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2.

Starting T2, cell 2 becomes detectable and DCI-2-9 command with including NES-mode indication as ‘1’ is sent at a time earlier than UE realizes the RSRP condition of CHO is met

Table A.7.3.3.3.2-1: Intra-frequency NES triggering conditional handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.3.3.2-2: General test parameters for NES triggering conditional Intra-frequency handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset for condition		dBm	-1	Trigger HO to cell which may be measured as -1 dB relative to cell 1. Actual SS-RSRP is 5 dB stronger.
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤2	

Table A.7.3.3.3.2-3: Cell specific test parameters for NR FR2-FR2 NES triggering conditional Intra frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
AoA setup			Setup 1 as defined in A.3.15			
Assumption for UE beams[Note 6]			Rough			
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
CORESET Reference Channel			CR3.1 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB.1 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
TCI configuration			CSI-RS.Config.0			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} [Note2]		dBm/15 kHz	-104.7		-104.7	
N_{oc} [Note2]	Config 1	dBm/SCS	-95.7		-95.7	
$\hat{E}_s/I_{otBB}$ [Note 8]		dB	5.03	-5.41	-Infinity	3.81
$\hat{E}_s/N_{oc}$		dB	6	6	-Infinity	11
Io[Note3]	Config 1	dBm/	-59.7	-54.2	-59.7	-54.2

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
		BW				
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 7: Es/Iot, SSB_RP and Io levels have been derived from other parameters for infomation purposes. They are not settable parameters themseleves.
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated REFSENS requirement in TS 38.101-2 [19] clause 7.3.2, and an allowance of 1 dB for UE multi-band relaxation factor Δ_{MBS} specified in TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.3.3.3.2.3 Test Requirements

$T_{RRC} + T_{Event_DU}$ occurs during T1 as the NES triggering handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.
The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure} + T_{interrupt} + T_{CHO_execution}$ =1600+62+10=1672 ms (power class 1) or 1080+62+10 =1152 (PC2/3/4) 62 ms=1152 ms (power classes 2,3 and 4) from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}=T_{processing} + T_{IU} + T_{\Delta} + T_{margin}$ =40+20+2 = 62 ms excluding any transmissions which do not occur due to scheduling restrictions.

A.7.3.3.4 NES triggering inter-frequency conditional handover from FR2 to FR1

A.7.3.3.4.1 Test Purpose and Environment

This test is to verify the requirement for the NES triggering NR FR2-NR FR1 inter frequency conditional handover requirements specified in clause 6.1.4.3.

A.7.3.3.4.2 Test Parameters

Supported test configurations are shown in table A.7.3.3.4.2-1. Both conditional handover delay and interruption length are tested by using the parameters in table A.7.3.3.4.2-2, A.7.3.3.4.2-3 and A.7.3.3.4.2-4.

The test scenario comprises of two carriers and one cell on each carrier. Measurement gap is configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. NR shall configure a NES based CHO condition implying handover to cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2. At the start of T2, cell 2 becomes detectable and meets the NES-based handover condition. In this test, UE is not indicated to report SSB based RRM measurement result with the associated SSB index for carrier of cell 2, and DCI 2-9 command of '1' value for indicating NES-specific CHO execution condition is transmitted to UE at 950 ms from the start of T2, i.e. UE is expected to decode the DCI command 2-9 later than the time when the NES condition is considered met.

Table A.7.3.3.4.2-1: Inter-frequency conditional handover from FR2 to FR1 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

Table A.7.3.3.4.2-2: General test parameters Inter-frequency conditional handover from FR2 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	

	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset in condition		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	3	

Table A.7.3.3.4.2-3: Cell specific test parameters for NR FR2-FR1 Inter frequency conditional handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
AoA setup			Setup 1 as defined in A.3.15		NA	
Assumption for UE beams[Note 6]			Rough		NA	
Duplex mode			TDD		FDD	
TDD configuration			TDDConf.3.1		NA	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
DRX Cycle		ms	Not Configured		Not Configured	
Gap pattern ID			gp0		NA	
PDSCH Reference measurement channel			SR3.1 TDD		SR.1.1 FDD	
CORESET Reference Channel			CR3.1 TDD		CR.1.1 FDD	
OCNG Patterns			OCNG pattern 1		OCNG pattern 1	
SMTC Configuration			SMTC pattern 1		SMTC pattern 1	
SSB Configuration			SSB.1 FR2		SSB.1 FR1	
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz		15 kHz	
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz		15 kHz	
PRACH configuration			FR2 PRACH configuration 1		FR1 PRACH configuration 1	
TRS configuration			TRS.2.1 TDD		NA	
TCI configuration			CSI-RS.Config.0		NA	
BWP configuraiton	Initial DL BWP		DLBWP.0.1		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
Propagation condition		-	AWGN		N/A Link only, see clause A.3.7A	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						

Table A.7.3.3.4.2-4: OTA related test parameters for NR FR2-FR1 Inter frequency conditional handover test case

Parameter		Unit	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
Angle of arrival configuration			According to clause A.3.15.1				N/A			
Assumption for UE beams Note 7			Rough				N/A			
N_{oc} Note 1	Config 1,2,3	dBm/15 kHz	-104.7				Link only, see clause A.3.7A			
N_{oc} Note 1	Config 1,2,3	dBm/SCS	-95.7							
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB	7							
$\hat{E}_s / I_{ot}$	Config 1,2,3	dB	7							
SSB_RP Note 2, Note 4	Config 1,2,3	dBm/SCS	-88.7							
Io Note 2, Note 4	Config 1,2,3	dBm/95.04 MHz	-58.92							

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.

A.7.3.3.4.3 Test Requirements

$T_{RRC} + T_{Event_DU}$ occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure} + T_{interrupt} + T_{CHO_execution}$ = 1022 ms from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}=T_{processing} + T_{IU} + T_{\Delta} + T_{margin}$ = 62 ms excluding any transmissions which do not occur due to measurement gaps.

A.7.3.3.5 NR conditional handover including target MCG and target SCG from FR1-FR2 NR-DC to FR1-FR2 NR-DC

A.7.3.3.5.1 Test Purpose and Environment

This test is to verify the requirement for the requirements of CHO including target MCG and target SCG in NR-DC requirements specified in clause 6.1.6.2. inter-frequency conditional handover from NR FR1 to NR FR1 and intra-frequency PSCell change from NR-FR2 to NR FR2 are tested independently in the same test, with different end points.

The supported test configurations are given in table A.7.3.3.5.1-1. The test scenario comprises four NR cells, source PCell(Cell 1) and source PSCell(Cell 2), target PCell(Cell 3), target PSCell(Cell 4).

Cell 1 and Cell 3 are on radio channel 1 in FR1.Cell 2 and Cell 4 are on radio channel 2 in FR2. Test parameters are given in tables A.7.3.3.5.1-2, A.7.3.3.5.1-3, A.7.3.3.5.1-4 and A.7.3.3.5.1-5 below. Gap pattern ID gp0 is configured for PCell FR1-FR1 Inter frequency conditional handover in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. NR shall configure a message implying conditional handover including target MCG in FR1 and target SCG in FR2 to Cell 3 during T1, at a time earlier than T_{RRC} before the beginning of T2. At the start of T2, cell 2 becomes detectable and meets the handover condition.

Table A.7.3.3.5.1-1: Supported test configurations for CHO with PSCell change from NR-DC to NR-DC

Config	Description
1	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	Source PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.3.5.1-2: General test parameters for PCell FR1-FR1 Inter frequency conditional handover

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 3	
Final condition	Active cell		Cell 3	
A3-Offset in handover condition		dBm	-4	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤5	

Table A.7.3.3.5.1-3: Cell specific test parameters for PCell FR1-FR1 Inter frequency conditional handover

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
Gap pattern ID			gp0			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			

Parameter		Unit	Cell 1		Cell 3	
			T1	T2	T1	T2
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.3.3.5.1-4: General test parameters Intra-frequency FR2-FR2 PSCell change (known cell)

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 2	
	Neighbouring cell		Cell 4	
Final condition	Active cell		Cell 4	
A4-Offset		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.3.5.1-5: Cell specific test parameters for Intra-frequency FR2-FR2 PSCell change (known cell)

Parameter	Unit	Cell 2	Cell 4

			T1	T2	T1	T2
Assumption for UE beams[Note 6]			Rough		Rough	
AoA setup			Setup 1 as defined in A.3.15			
NR RF Channel Number			1		1	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
Data PRBs allocated			66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
RMSI CORESET Reference Channel			CR3.1 TDD			
Control Channel RMC			CCR.3.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB. 3 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
PDSCH/PDCCH TCI state			TCI.State.2			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} [Note2]		dBm/15 kHz	-104.7			
N_{oc} [Note2]		dBm/SCS	-95.7			
$\hat{E}_s / I_{ot}$		dB	6	-1.8	-Infinity	0
$\hat{E}_s / N_{oc}$		dB	6	6	-Infinity	7
Io[Note3]		dBm/ BW	-59.7	-56.7	-59.7	-56.7
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.3.5.2 Test Requirements

A.7.3.3.5.2.1 Test Requirements for NR conditional handover

$T_{RRC} + T_{Event_DU}$ occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 3 less than $T_{measure} + T_{interrupt} + T_{CHO_execution}$ = 1040+67+10 ms=1117 ms from the start of T2 and the interruption during T2 shall not exceed $T_{interrupt}=T_{processing} + T_{IU} + T_{\Delta} + T_{margin}$ =25+20+20+2 = 67 ms excluding any transmissions which do not occur due to scheduling restrictions. excluding any transmissions which do not occur due to scheduling restrictions.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

A.7.3.3.5.2.2 Test Requirements for NR PSCell change

The UE shall start to transmit the PRACH to Cell 4 less than $T_{measure} + T_{CHO_execution} + T_{processing} + T_{search_PCell_Conditional} + T_{search_PSCell} + T_{\Delta_PSCell} + T_{PSCell_DU}$ + 2 =1040+10+25+20+20 +2ms=1117 msfrom the start of T2.

A.7.3.3.6 NR conditional Handover including target MCG and candidate SCG from FR1-FR2 NR-DC to FR1-FR2 NR-DC

A.7.3.3.6.1 Test Purpose and Environment

This test is to verify the requirements for conditional handover including target MCG and candidate SCG in NR-DC: from FR1-FR2 NR-DC to FR1-FR2 NR-DC specified in clause 6.1.7.2. This test verifies the requirements for inter-frequency FR1-FR1 conditional handover and intra-frequency FR2-FR2 conditional PSCell change.

A.7.3.3.6.2 Test Parameters

The supported test configurations are given in table A.7.3.3.6.1-1. The test scenario comprises four NR cells, source PCell (Cell 1) and source PSCell (Cell 2), target PCell (Cell 3), and target PSCell (Cell 4).

Cell 1 is on radio channel 1 in FR1. Cell 3 is on radio channel 2 in FR1, Cell 2 and Cell 4 are on radio channel 3 in FR2. The event-triggered reporting with Event A3 is used for handover condition. Test parameters are given in tables A.7.3.3.6.1-2, A.7.3.3.6.1-3, and A.7.3.3.6.1-4 below. Gap pattern ID gp0 is configured for PCell FR1-FR1 Inter frequency conditional handover in the test case. The test consists of three successive time periods, with time durations of T1, T2 and T3, respectively.

At the start of T1, the UE shall be connected to Cell 1 on radio channel 1 and Cell 2 on radio channel 3. UE is not aware of Cell 3 and Cell 4. TE shall configure a condition implying conditional handover to Cell 3 with a condition implying conditional PSCell change to cell 4 during T1, at a time earlier than T_{RRC} before the beginning of T2.

At the start of T2, cell 3 becomes detectable. At the start of T3, cell 4 becomes detectable. The condition for conditional handover and the condition for conditional PSCell change is met during T3.

Table A.7.3.3.6.1-1: Supported test configurations for Conditional Handover including target MCG and candidate SCG from NR-DC to NR-DC

Config	Description
1	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	Source PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	Source PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Source PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target PSCell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.3.6.1-2: General test parameters for FR1-FR1 inter frequency conditional handover with target MCG and FR2-FR2 intra-frequency conditional PSCell change with candidate SCG

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1, 2	

	Target cell		Cell 3, 4	
Final condition	Active cell		Cell 3, 4	
A3-Offset in condition for PCell		dBm	-4	
A4-Offset in condition for PSCell		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	1	
T2		s	2	It is the time gap between target PCell and target PScell become detectable
T3		s	≤2	

Table A.7.3.3.6.1-3: Cell specific test parameters for PCell FR1-FR1 Inter frequency handover with target MCG

Parameter		Unit	Cell 1			Cell 3		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			2		
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		40: $N_{PRB,c}$ = 106					
TRS configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
DRX Cycle		ms	Not Applicable					
Gap pattern ID			gp0					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD					
	Config 2		SR.1.1 TDD					
	Config 3		SR2.1 TDD					
CORESET Reference Channel	Config 1		CR.1.1 FDD					
	Config 2		CR.1.1 TDD					
	Config 3		CR2.1 TDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					
BWP	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								

Parameter		Unit	Cell 1			Cell 3		
			T1	T2	T3	T1	T2	T3
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15 kHz	-98			-98		
N_{oc} Note2	Config 1,2	dBm/SCS	-98			-98		
	Config 3		-95			-95		
$\hat{E}_s / I_{ot}$		dB	4	4	4	-Infinity	5	5
$\hat{E}_s / N_{oc}$		dB	4	4	4	-Infinity	5	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-94	-Infinity	-93	-93
	Config 3	dBm/SCS	-91	-91	-91	-Infinity	-90	-90
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59	-64.59	-64.59	-70.05	-63.85	-63.85
	Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-58.49	-63.94	-57.75	-57.75
Propagation condition		-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.3.3.6.1-4: Cell specific test parameters for conditionaly intra-frequency FR2-FR2 PSCell change with candidate SCG

Parameter		Unit	Cell 2			Cell 4		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 6			Rough			Rough		
AoA setup			Setup 1 as defined in A.3.15					
NR RF Channel Number			3			3		
Duplex mode			TDD					
TDD configuration			TDDConf.3.1					
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66					
BWP BW		MHz	100: $N_{PRB,c}$ = 66					
Data PRBs allocated			66					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel			SR3.1 TDD					
RMSI CORESET Reference Channel			CR3.1 TDD					
Control Channel RMC			CCR.3.1 TDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
SSB Configuration			SSB. 3 FR2					
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz					
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz					
PRACH configuration			FR2 PRACH configuration 1					
TRS configuration			TRS.2.1 TDD					
PDSCH/PDCCH TCI state			TCI.State.2					
BWP configuraiton	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					

Dedicated UL BWP			ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0			0		
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15 kHz	-104.7					
N_{oc} Note2		dBm/SCS	-95.7					
$\hat{E}_s / I_{ot}$		dB	5.03	5.03	-5.41	-Infinity	-Infinity	3.81
$\hat{E}_s / N_{oc}$		dB	6	6	6	-Infinity	-Infinity	11
Io Note3		dBm/ BW	-59.7	-59.7	-54.2	-59.7	-59.7	-54.2
Propagation condition		-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.3.6.3 Test Requirements

$T_{RRC} + T_{Event_DU}$ occurs during T1 and T2, as the conditional handover condition for cell 3 becomes satisfied from the start of T2, and the conditional PSCell change condition for cell 4 becomes satisfied from the start of T3. The test shall verify that there are no interruptions during T1 and T2. The UE shall not start the transmission of the new uplink PRACH channel of the target PCell before T3.

In this test, the UE shall start to transmit the PRACH to Cell 3 less than 1677 ms (power class 1) or 1157 ms (power classes 2,3 and 4)[Note1] from the beginning of time period T3.

The UE shall transmit the PRACH to Cell 4 at latest 1677 ms (power class 1) or 1157 ms (power classes 2,3 and 4)[Note2] from the beginning of time period T3.

The rate of correct observed delay in conditional handover including target MCG and candidate SCG during repeated tests shall be at least 90 %.

NOTE 1: The PCell conditional handover delay can be expressed as specified in clause 6.1.7.2.1:

$D_{CHOwithCPC_PCell} = T_{RRC_delay} + T_{Event_DU} + \max(T_{measure_PCell}, T_{measure_PSCell}) + T_{UE_preparation} + T_{processing} + T_{\Delta_PCell} + T_{PCell_DU} + 2$ ms,

Where:

$\max(T_{measure_PCell}, T_{measure_PSCell})$ = 1600 ms (power class 1) or 1080 ms (power classes 2, 3 and 4)

$T_{UE_preparation}$ = 10 ms

$T_{processing}$ = 25 ms

T_{Δ_PSCell} = 20 ms

T_{PCell_DU} = 20 ms

NOTE 2: The PSCell conditional change delay can be expressed as follows as specified in clause 6.1.7.2.2:

DCHOwithCPC_PSCell = TRRC_delay + TEvent_DU + max (Tmeasure_PCell, Tmeasure_PSCell) + TUE_preparation + Tprocessing + TΔ_PSCell + TPSCell_DU + 2 ms

Where:

max ($T_{measure_PCell}$, $T_{measure_PSCell}$) = 1600 ms (power class 1) or 1080 ms (power classes 2, 3 and 4)

$T_{UE_preparation}$ = 10 ms

$T_{processing}$ = 25 ms

T_{Δ_PSCell} = 20 msT_{PSCell_DU} = 20 ms

A.7.3.4 LTM PCell Switch

A.7.3.4.1 RACH based Intra-frequency PCell switch from FR2 to FR2

A.7.3.4.1.1 Test Purpose and Environment

This test is to verify the intra frequency RACH based LTM PCell switch requirements from NR FR2 to NR FR2 specified in clause 6.3.1 for both with and without early TCI state activation.

A.7.3.4.1.2 Test Parameters

Two cells are deployed in the test, which are FR2 PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. Test configurations are given in table A.7.3.4.1.2-1. Both cell switch delay and interruption length are tested by using the parameters in table A.7.3.4.1.2-2 and A.7.3.4.1.2-3.

The test consists of 4 tests, and UE is required to pass one among Test 1A, Test 1B, Test 2A and Test 2B.

- Test 1: for a UE supporting *ltm-MAC-CE-JointTCI-r18* and/or *ltm-MAC-CE-SeparateTCI-r18*
  - Test 1A: for a UE supporting *ltm-MAC-CE-JointTCI-r18*.
  - Test 1B: for a UE supporting *ltm-MAC-CE-SeparateTCI-r18* and does not support *ltm-MAC-CE-JointTCI-r18*.
- Test 2: for a UE not supporting *ltm-MAC-CE-JointTCI-r18* and *ltm-MAC-CE-SeparateTCI-r18*
  - Test 2A: for a UE supporting *ltm-BeamIndicationJointTCI-r18*.
  - Test 2B: for a UE supporting *ltm-BeamIndicationSeparateTCI-r18* and does not support *ltm-BeamIndicationJointTCI-r18*.

The test consists of four successive time periods, with time durations of T1, T2, T3 and T4, respectively. No gap patterns are configured in the test case.

During T1, for Test 1A, 1B, 2A and 2B:

- A measurement object is configured for the frequency of the Cell 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used.
- T1 ends with UE reporting an L3 measurement result of Cell 2 to Cell 1.

During T2, for Test 1A, 1B, 2A and 2B:

- At the start of T2, UE is provided with *LTM-Candidate-r18* for Cell 2
  - Joint TCI state configuration as defined in table A.7.3.4.1.2-2 for Test 1A and Test 2A are provided.
  - Separate TCI state configuration as defined in table A.7.3.4.1.2-2 for Test 1B and Test 2B are provided.

- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.

- T2 ends with UE reporting a valid L1-RSRP result of Cell 2.

During T3, for Test 1A and 1B:

- At the start of T3, UE receives candidate cell TCI state activation MAC CE for Cell 2.

  - In Test 1A, *CandidateTCI-State#1* is activated.

  - In Test 1B, *CandidateTCI-State#1* and *CandidateTCI-UL-State#1* is activated.

- T3 ends 50 ms after the candidate cell TCI state activation MAC CE transmission.

- In Test 2A and 2B, T3 is skipped.

During T4, for Test 1A, 1B, 2A and 2B:

- The start of T4 is the instant when the last TTI containing LTM cell switch command MAC CE is sent by Cell 1 to the UE.

- In the cell switch command, Cell 2 is the target cell. Contention-Free Random-Access Resources are indicated. The field of Timing Advance Command is set to FFF.

  - In test 1A, CandidateTCI-State#2 is indicated.

  - In test 1B, CandidateTCI-State#2 and CandidateTCI-UL-State#1 are indicated.

  - In test 2A, CandidateTCI-State#1 is indicated.

  - In test 2B, CandidateTCI-State#1 and CandidateTCI-UL-State#1 are indicated.

- T4 ends upon the reception of PRACH at Cell 2.

Table A.7.3.4.1.2-1: Intra-frequency cell switch from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.4.1.2-2: General test parameters for Intra-frequency cell switch from FR2 to FR2

Parameter		Unit	Value				Comment
			Test 1A	Test 1B	Test 2A	Test 2B	
Initial conditions	Active cell		Cell 1				
	Neighbouring cell		Cell 2				Cell 2 is the candidate cell
Final condition	Active cell		Cell 2				
A3-Offset		dB	-15				
Hysteresis		dB	0				
Time To Trigger		s	0				
Filter coefficient			0				L3 filtering is not used
DRX			OFF				DRX is not used
Access Barring Information		-	Not Sent				No additional delays in random access procedure.
Time offset between cells			0.3 μs				RTD between cells is less than CP
deriveSSB-IndexFromCell			Enabled				
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	320				Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1				Report candidate cell's (Cell 2) L1-

Parameter		Unit	Value				Comment
			Test 1A	Test 1B	Test 2A	Test 2B	
	nrOfReportedRS-PerCell		n1				RSRP measurement results.
	spCellInclusion		N/A				
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DlorJoint TCI.State.0	DlorJoint TCI.State.2	DlorJoint TCI.State.1	DlorJoint TCI.State.3	As specified in clause A.3.16B. In test 1A and 1B, CandidateTCI-State#1 and/or CandidateTCI-UL-State#1 are configured for early TCI state activation. CandidateTCI-State#2 and/or CandidateTCI-UL-State#1 are configured for TCI state indication in cell switch command. In test 2A and 2B, CandidateTCI-State#1 and/or CandidateTCI-UL-State#1 are configured for TCI state indication in cell switch command.
	CandidateTCI-State#2		DlorJoint TCI.State.1	DlorJoint TCI.State.3	N/A	N/A	
ltm-UL-TCI-StatesToAddModList	CandidateTCI-UL-State#1		N/A	UL TCI.State.0	N/A	UL TCI.State.0	
ltm-ConfigComplete			True				Candidate cell's configuration is complete configuration
T1		s	<3				
T2		s	≤0.2				
T3		s	≤0.1				
T4		s	≤0.2				

Table A.7.3.4.1.2-3: Cell specific test parameters for NR FR2-FR2 Intra frequency cell switch test case

Parameter		Unit	Cell 1	Cell 2
			T1 ~ T4	T1 ~ T4
NR RF Channel Number			1	1
Assumption for UE beams[Note 6]			Rough	Rough
AoA setup			Setup 1 as defined in A.3.15	
Duplex mode			TDD	
TDD configuration			TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66	
BWP BW		MHz	100: $N_{PRB,c}$ = 66	
PDSCH Reference			SR3.1 TDD	
CORESET Reference Channel			CR3.1 TDD	
Control Channel RMC			CCR.3.1 TDD	
CP length			Normal	
TRS configuration			TRS.2.1 TDD	
OCNG Patterns			OP.1	
SMTC Configuration			SMTC.1	
SSB Configuration			SSB.3 FR2	
PDSCH/PDCCH subcarrier spacing		kHz	120	
PUCCH/PUSCH subcarrier spacing		kHz	120	
PRACH configuration			FR2 PRACH configuration 6	
PDSCH/PDCCH TCI state			TCI.State.2	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	

Parameter	Unit	Cell 1	Cell 2
		T1 ~ T4	T1 ~ T4
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2	dBm/15 kHz	-104.7	
N_{oc} Note2	dBm/SCS	-95.7	
$\hat{E}_s / I_{ot}$	dB	-1.8	0
$\hat{E}_s / N_{oc}$	dB	6	7
SSB_RP	dBm/SCS	-89.7	-88.7
Io Note3	dBm/ 95.04 MHz	-56.7	-56.7
Propagation condition	-	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.7.3.4.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 in no later than D_{LTM} from the beginning of time period T4.

The rate of correct cell switches observed during repeated tests shall be at least 90 %.

NOTE: The cell switch delay can be expressed as D_{LTM} (= T_{cmd} + $T_{LTM\text{-}interrupt}$), where:

T_{cmd} = T_{HARQ} + 3 ms and is specified in clause 6.3.1.2,

$T_{LTM\text{-}interrupt}$ = $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$ + $T_{LTM\text{-}IU}$ ms, as stated in clause 6.3.1.3

- $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 0 ms for Test 1A and 1B, $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 22 ms for Test 2A and 2B
- $T_{LTM\text{-}IU}$ = 20 ms
- $T_{LTM\text{-}RRC\text{-}processing}$ = 10 ms if UE does not support *ltm-FastProcessingConfig-r18*, otherwise $T_{LTM\text{-}RRC\text{-}processing}$ =0 ms
- $T_{LTM\text{-}processing}$ = 10 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 10 ms for FR2-to-FR2 cell switch in the capability
- $T_{LTM\text{-}processing}$ = 15 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 15 ms for FR2-to-FR2 cell switch in the capability
- $T_{LTM\text{-}processing}$ = 20 ms if the UE does not support *ltm-FastUE-Processing-r18* capability.

A.7.3.4.2 RACH-less Intra-frequency PCell switch from FR2 to FR2

A.7.3.4.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 RACH-less intra frequency PCell switch specified in clause 6.3.1 for both with and without early TCI state activation.

A.7.3.4.2.2 Test Parameters

Two cells are deployed in the test, which are FR2 PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. Test configurations are given in table A.7.3.4.2.2-1. Both cell switch delay and interruption length are tested by using the parameters in table A.7.3.4.2.2-2 and A.7.3.4.2.2-3.

The test consists of 4 tests, and UE is required to pass one among Test 1A, Test 1B, Test 2A and Test 2B.

- Test 1: for a UE supporting *ltm-MAC-CE-JointTCI-r18* and/or *ltm-MAC-CE-SeparateTCI-r18*
  - Test 1A: for a UE supporting *ltm-MAC-CE-JointTCI-r18*.
  - Test 1B: for a UE supporting *ltm-MAC-CE-SeparateTCI-r18* and does not support *ltm-MAC-CE-JointTCI-r18*.
- Test 2: for a UE not supporting *ltm-MAC-CE-JointTCI-r18* and *ltm-MAC-CE-SeparateTCI-r18*
  - Test 2A: for a UE supporting *ltm-BeamIndicationJointTCI-r18*.
  - Test 2B: for a UE supporting *ltm-BeamIndicationSeparateTCI-r18* and does not support *ltm-BeamIndicationJointTCI-r18*.

The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5, respectively. No gap patterns are configured in the test case.

During T1, for Test 1A, 1B, 2A and 2B:

- A measurement object is configured for the frequency of the Cell 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used.
- T1 ends with UE reporting an L3 measurement result of Cell 2 to Cell 1.

During T2, for Test 1A, 1B, 2A and 2B:

- At the start of T2, UE is provided with *LTM-Candidate-r18* for Cell 2
- Joint TCI state configuration as defined in table A.7.3.4.2.2-2 for Test 1A and Test 2A are provided.
- Separate TCI state configuration as defined in table A.7.3.4.2.2-2 for Test 1B and Test 2B are provided.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.
- T2 ends with UE reporting a valid L1-RSRP result of Cell 2.

During T3, for Test 1A and 1B:

- At the start of T3, UE receives candidate cell TCI state activation MAC CE for Cell 2.
  - In Test 1A, *CandidateTCI-State#1* is activated.
  - In Test 1B, *CandidateTCI-State#1* and *CandidateTCI-UL-State#1* is activated.
- T3 ends 50 ms after the candidate cell TCI state activation MAC CE transmission.
- In Test 2A and 2B, T3 is skipped.

During T4, for Test 1A, 1B, 2A and 2B:

- At the start of T4, UE receives PDCCH order to trigger PRACH transmission on Cell 2.
- T4 ends 5 ms after the UE transmits the PRACH to Cell 2.
- For UE incapable of *rach-EarlyTA-Measurement-r18*, T4 is skipped.

During T5, for Test 1A, 1B, 2A and 2B:

- The start of T5 is the last TTI containing LTM cell switch command MAC CE is sent by Cell 1 to the UE.
- In the cell switch command, Cell 2 is the target cell and the field of Timing Advance Command is set to 0.

- In test 1A, CandidateTCI-State#2 is indicated.
- In test 1B, CandidateTCI-State#2 and CandidateTCI-UL-State#1 are indicated.
- In test 2A, CandidateTCI-State#1 is indicated.
- In test 2B, CandidateTCI-State#1 and CandidateTCI-UL-State#1 are indicated.

- Cell 2 continuously schedules PUSCH for the UE.
- T5 ends either at the UL slot of PUSCH scheduled by Cell 2 at the fist DL slot not earlier than (T_{cmd} + $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$) after the beginning of T5 or upon the reception of PUSCH at Cell 2, whichever is earlier.
  - The values of T_{cmd}, $T_{LTM\text{-}RRC\text{-}processing}$ $T_{LTM\text{-}processing}$, $T_{first\text{-}RS}$ and $T_{RS\text{-}proc}$ are specified in A.7.3.4.2.3.

Table A.7.3.4.2.2-1: Intra-frequency cell switch from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.4.2.2-2: General test parameters for Intra-frequency cell switch from FR2 to FR2

Parameter		Unit	Value				Comment
			Test 1A	Test 1B	Test 2A	Test 2B	
Initial conditions	Active cell		Cell 1				
	Neighbouring cell		Cell 2				Cell 2 is the candidate cell
Final condition	Active cell		Cell 2				
A3-Offset		dB	-15				
Hysteresis		dB	0				
Time To Trigger		s	0				
Filter coefficient			0				L3 filtering is not used
DRX			OFF				DRX is not used
Access Barring Information		-	Not Sent				No additional delays in random access procedure.
Time offset between cells			0.3 μs				RTD between cells is less than CP
deriveSSB-IndexFromCell			Enabled				
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	320				Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1				Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1				
	spCellInclusion		N/A				
EarlyUL-SyncConfig	frequencyInfoUL		NR RF Channel Number 1				Same as Cell 1
	PRACH configuration		FR2 PRACH configuration 5				RACH bandwidth is within active UL BWP of Cell 1
	bwp-GenericParameters		ULBWP.0.1				
	n-TimingAdvanceOffset	Tc	N/A				

Parameter		Unit	Value				Comment
			Test 1A	Test 1B	Test 2A	Test 2B	
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DlorJoint TCI.State. 0	DlorJoint TCI.State. 2	DlorJoint TCI.State. 1	DlorJoint TCI.State. 3	As specified in clause A.3.16B. In test 1A and 1B, CandidateTCI-State#1 and/or CandidateTCI-UL-State#1 are configured for early TCI state activation. CandidateTCI-State#2 and/or CandidateTCI-UL-State#1 are configured for TCI state indication in cell switch command. In test 2A and 2B, CandidateTCI-State#1 and/or CandidateTCI-UL-State#1 are configured for TCI state indication in cell switch command.
	CandidateTCI-State#2		DlorJoint TCI.State. 1	DlorJoint TCI.State. 3	N/A	N/A	
ltm-UL-TCI-StatesToAddModList	CandidateTCI-UL-State#1		N/A	UL TCI.State. 0	N/A	UL TCI.State. 0	
ltm-ConfigComplete			True				Candidate cell's configuration is complete configuration
T1		s	<3				
T2		s	≤0.2				
T3		s	≤0.1				
T4		s	≤0.2				
T5		s	≤0.1				

Table A.7.3.4.2.2-3: Cell specific test parameters for NR FR2-FR2 Intra frequency cell switch test case

Parameter	Unit	Cell 1	Cell 2
		T1 ~ T5	T1 ~ T5
NR RF Channel Number		1	1
Assumption for UE beams[Note 6]		Rough	Rough
AoA setup		Setup 1 as defined in A.3.15	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66	
BWP BW	MHz	100: $N_{PRB,c}$ = 66	
PDSCH Reference		SR3.1 TDD	
CORESET Reference Channel		CR3.1 TDD	
Control Channel RMC		CCR.3.1 TDD	
CP length		Normal	

Parameter		Unit	Cell 1	Cell 2
			T1 ~ T5	T1 ~ T5
TRS configuration			TRS.2.1 TDD	
OCNG Patterns			OP.1	
SMTC Configuration			SMTC.1	
SSB Configuration			SSB.3 FR2	
PDSCH/PDCCH subcarrier spacing		kHz	120	
PUCCH/PUSCH subcarrier spacing		kHz	120	
PRACH configuration			FR2 PRACH configuration 6	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-104.7	
N_{oc} Note2		dBm/SCS	-95.7	
$\hat{E}_s / I_{ot}$		dB	-1.8	0
$\hat{E}_s / N_{oc}$		dB	6	7
SSB_RP		dBm/SCS	-89.7	-88.7
Io Note3		dBm/ 95.04 MHz	-56.7	-56.7
Propagation condition		-	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.7.3.4.2.3 Test Requirements

The UE shall start to transmit PUSCH to Cell 2 in no later than D_{LTM} from the beginning of time period T5.
The rate of correct cell switches observed during repeated tests shall be at least 90 %.

NOTE: The cell switch delay can be expressed as D_{LTM} (= T_{cmd} + $T_{LTM\text{-}interrupt}$), where:

T_{cmd} = T_{HARQ} + 3 ms and is specified in clause 6.3.1.2, $T_{LTM\text{-}interrupt}$ is defined in clause 6.3.1.3 as $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$ + $T_{LTM\text{-}IU}$,

- $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 0 ms for Test 1A and 1B, $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 22 ms for Test 2A and 2B,
- $T_{LTM\text{-}IU}$ is the uncertainty on transmitting the first uplink transmission on Cell 2.
- $T_{LTM\text{-}RRC\text{-}processing}$ = 10 ms if UE does not support *ltm-FastProcessingConfig-r18*, otherwise $T_{LTM\text{-}RRC\text{-}processing}$ =0 ms
- $T_{LTM\text{-}processing}$ = 10 ms if the UE supports *ltm-FastProcessingConfig-r18* capability and UE reports 10 ms for FR2-to-FR2 cell switch in the capability
- $T_{LTM\text{-}processing}$ = 15 ms if the UE supports *ltm-FastProcessingConfig-r18* capability and UE reports 15 ms for FR2-to-FR2 cell switch in the capability
- $T_{LTM\text{-}processing}$ = 20 ms if the UE does not support *ltm-FastProcessingConfig-r18* capability.

A.7.3.4.3 RACH-based Inter-frequency LTM PCell switch from FR2 to FR2

A.7.3.4.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 RACH-based inter-frequency PCell switch specified in clause 6.3.1 for both with and without early TCI state activation.

A.7.3.4.3.2 Test Parameters

Two cells are deployed in the test, which are FR2 PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on a different frequency than the PCell. Test configurations are given in table A.7.3.4.3.2-1. Both cell switch delay and interruption length are tested by using the parameters in table A.7.3.4.3.2-2 and A.7.3.4.3.2-3.

The test consists of 4 tests, and UE is required to pass one among Test 1A, Test 1B, Test 2A and Test 2B.

- Test 1: for a UE supporting *ltm-MAC-CE-JointTCI-r18* and/or *ltm-MAC-CE-SeparateTCI-r18*
  - Test 1A: for a UE supporting *ltm-MAC-CE-JointTCI-r18*.
  - Test 1B: for a UE supporting *ltm-MAC-CE-SeparateTCI-r18* and does not support *ltm-MAC-CE-JointTCI-r18*.
- Test 2: for a UE not supporting *ltm-MAC-CE-JointTCI-r18* and *ltm-MAC-CE-SeparateTCI-r18*
  - Test 2A: for a UE supporting *ltm-BeamIndicationJointTCI-r18*.
  - Test 2B: for a UE supporting *ltm-BeamIndicationSeparateTCI-r18* and does not support *ltm-BeamIndicationJointTCI-r18*.

The test consists of five successive time periods, with time durations of T1, T2, T3, and T4, respectively. Measurement gap pattern gp0 is configured.

During T1, for Test 1A, 1B,2A and 2B:

- A measurement object is configured for the frequency of the Cell 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used.
- T1 ends with UE reporting an L3 measurement result of Cell 2 to Cell 1.

During T2, for Test 1A, 1B, 2A and 2B:

- At the start of T2, UE is provided with *LTM-Candidate-r18* for Cell 2
- Joint TCI state configuration as defined in table A.7.3.4.3.2-2 for Test 1A and Test 2A are provided.
- Separate TCI state configuration as defined in table A.7.3.4.3.2-2 for Test 1B and Test 2B are provided.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.
- T2 ends with UE reporting a valid L1-RSRP result of Cell 2.

During T3, for Test 1A and 1B:

- At the start of T3, UE receives candidate cell TCI state activation MAC CE for Cell 2.
  - In Test 1A, *CandidateTCI-State#1* is activated.
  - In Test 1B, *CandidateTCI-State#1* and *CandidateTCI-UL-State#1* is activated.
- T3 ends 100 ms after the candidate cell TCI state activation MAC CE transmission.
- In Test 2A and 2B, T3 is skipped.

During T4, for Test 1A, 1B, 2A and 2B:

- The start of T4 is the last TTI containing LTM cell switch command MAC CE is sent by Cell 1 to the UE.
- In the cell switch command, Cell 2 is the target cell and the field of Timing Advance Command is set to FFF.
  - In test 1A, CandidateTCI-State#2 is indicated.
  - In test 1B, CandidateTCI-State#2 and CandidateTCI-UL-State#1 are indicated.
  - In test 2A, CandidateTCI-State#1 is indicated.
  - In test 2B, CandidateTCI-State#1 and CandidateTCI-UL-State#1 are indicated.
- T4 ends upon the reception of PRACH at Cell 2.

Table A.7.3.4.3.2-1: Inter-frequency cell switch from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.4.3.2-2: General test parameters for Inter-frequency cell switch from FR2 to FR2

Parameter		Unit	Value				Comment
			Test 1A	Test 1B	Test 2A	Test 2B	
Initial conditions	Active cell		Cell 1				
	Neighbouring cell		Cell 2				Cell 2 is the candidate cell
Final condition	Active cell		Cell 2				
A3-Offset		dB	-15				
Hysteresis		dB	0				
Time To Trigger		s	0				
Filter coefficient			0				L3 filtering is not used
includeBeamMeasurements			True				
DRX			OFF				DRX is not used
Measurement gap pattern ID			gp0				As specified in table 9.1.2-1
Measurement gap offset			39				
Access Barring Information		-	Not Sent				No additional delays in random access procedure.
Time offset between cells			0.3 μs				
deriveSSB-IndexFromCell			Enabled				
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	320				Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1				Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1				
	spCellInclusion		N/A				
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DlorJoint TCI.State.0	DlorJoint TCI.State.2	DlorJoint TCI.State.1	DlorJoint TCI.State.3	As specified in clause A.3.16B. In test 1A and 1B, CandidateTCI-State#1 and/or CandidateTCI-
	CandidateTCI-State#2		DlorJoint TCI.State.1	DlorJoint TCI.State.3	N/A	N/A	

Parameter		Unit	Value				Comment
			Test 1A	Test 1B	Test 2A	Test 2B	
ltm-UL-TCI-StatesToAddModList	CandidateTCI-UL-State#1		N/A	UL TCI.State.0	N/A	UL TCI.State.0	UL-State#1 are configured for early TCI state activation. CandidateTCI-State#2 and/or CandidateTCI-UL-State#1 are configured for TCI state indication in cell switch command. In test 2A and 2B, CandidateTCI-State#1 and/or CandidateTCI-UL-State#1 are configured for TCI state indication in cell switch command.
ltm-ConfigComplete			True				Candidate cell's configuration is complete configuration
T1		s	<3				
T2		s	≤0.2				
T3		s	≤0.2				
T4		s	≤0.1				

Table A.7.3.4.3.2-3: Cell specific test parameters for NR FR2-FR2 Inter frequency cell switch test case

Parameter		Unit	Cell 1	Cell 2
			T1 ~ T4	T1 ~ T4
NR RF Channel Number			1	2
Assumption for UE beams[Note 6]			Rough	Rough
AoA setup			Setup 1 as defined in A.3.15	
Duplex mode			TDD	
TDD configuration			TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66	
BWP BW		MHz	100: $N_{PRB,c}$ = 66	
PDSCH Reference			SR3.1 TDD	
CORESET Reference Channel			CR3.1 TDD	
Control Channel RMC			CCR.3.1 TDD	
CP length			Normal	
TRS configuration			TRS.2.1 TDD	
OCNG Patterns			OP.1	
SMTC Configuration			SMTC.1	
SSB Configuration			SSB.3 FR2	
PDSCH/PDCCH subcarrier spacing		kHz	120	
PUCCH/PUSCH subcarrier spacing		kHz	120	
PRACH configuration			FR2 PRACH configuration 6	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				

Parameter	Unit	Cell 1	Cell 2
		T1 ~ T4	T1 ~ T4
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2	dBm/15 kHz	-104.7	
N_{oc} Note2	dBm/SCS	-95.7	
$\hat{E}_s / I_{ot}$	dB	5	5
$\hat{E}_s / N_{oc}$	dB	5	5
SSB_RP	dBm/SCS	-90.7	-90.7
Io Note3	dBm/ 95.04 MHz	-60.5	-60.5
Propagation condition	-	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.7.3.4.3.3 Test Requirements

The UE shall start to transmit RACH to Cell 2 in no later than D_{LTM} from the beginning of time period T4.
The rate of correct cell switches observed during repeated tests shall be at least 90 %.

NOTE: The cell switch delay can be expressed as D_{LTM} (= T_{cmd} + $T_{LTM\text{-}interrupt}$), where:

T_{cmd} = T_{HARQ} + 3 ms and is specified in clause 6.3.1.2, $T_{LTM\text{-}interrupt}$ is defined in clause 6.3.1.3 as $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$ + $T_{LTM\text{-}IU}$,

- $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 0 ms for Test 1A and 1B, $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 22 ms for Test 2A and 2B,
- $T_{LTM\text{-}IU}$ = 20 ms.
- $T_{LTM\text{-}RRC\text{-}processing}$ = 10 ms if UE does not support *ltm-FastProcessingConfig-r18*, otherwise $T_{LTM\text{-}RRC\text{-}processing}$ =0 ms
- $T_{LTM\text{-}processing}$ = 10 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 10 ms for FR2-to-FR2 cell switch in the capability
- $T_{LTM\text{-}processing}$ = 15 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 15 ms for FR2-to-FR2 cell switch in the capability
- $T_{LTM\text{-}processing}$ = 20 ms if the UE does not support *ltm-FastUE-Processing-r18* capability.

A.7.3.5 LTM PSCell Switch

A.7.3.5.1 RACH-based Intra-frequency LTM PSCell switch from FR2 to FR2

A.7.3.5.1.1 Test Purpose and Environment

This test is to verify RACH-based LTM PSCell Switch requirements for the NR FR2-NR FR2 intra frequency cell switch specified in clause 8.20 for both with and without early TCI state activation.

A.7.3.5.1.2 Test Parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1), source FR2 PSCell (Cell 2) and target FR2 PSCell (Cell 3) on the same frequency as the PSCell. Test configurations are given in table A.7.3.5.1.2-1. Both PSCell switch delay and interruption length are tested by using the parameters in table A.7.3.5.1.2-2, A.7.3.5.1.2-3 and A.7.3.5.1.2-4.

The test consists of 4 tests, and UE is required to pass one among Test 1A, Test 1B, Test 2A and Test 2B.

- Test 1: for a UE supporting *ltm-MAC-CE-JointTCI-r18* and/or *ltm-MAC-CE-SeparateTCI-r18*
  - Test 1A: for a UE supporting *ltm-MAC-CE-JointTCI-r18*.
  - Test 1B: for a UE supporting *ltm-MAC-CE-SeparateTCI-r18* and does not support *ltm-MAC-CE-JointTCI-r18*.
- Test 2: for a UE not supporting *ltm-MAC-CE-JointTCI-r18* and *ltm-MAC-CE-SeparateTCI-r18*
  - Test 2A: for a UE supporting *ltm-BeamIndicationJointTCI-r18*.
  - Test 2B: for a UE supporting *ltm-BeamIndicationSeparateTCI-r18* and does not support *ltm-BeamIndicationJointTCI-r18*.

The test consists of four successive time periods, with time durations of T1, T2, T3 and T4, respectively. No gap patterns are configured in the test case.

During T1, for Test 1A, 1B, 2A and 2B:

- A measurement object is configured for the frequency of the Cell 3, and it is indicated to the UE that event-triggered reporting with Event A3 is used.
- T1 ends with UE reporting an L3 measurement result of Cell 3 to Cell 1.

During T2, for Test 1A, 1B, 2A and 2B:

- At the start of T2, UE is provided with *LTM-Candidate-r18* for Cell 3
  - Joint TCI state configuration as defined in table A.7.3.5.1.2-2 for Test 1A and Test 2A are provided.
  - Separate TCI state configuration as defined in table A.7.3.5.1.2-2 for Test 1B and Test 2B are provided.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 3) in PUCCH format 2.
- T2 ends with UE reporting a valid L1-RSRP result of Cell 3.

During T3, for Test 1A and 1B:

- At the start of T3, UE receives candidate cell TCI state activation MAC CE for Cell 3.
  - In Test 1A, *CandidateTCI-State#1* is activated.
  - In Test 1B, *CandidateTCI-State#1* and *CandidateTCI-UL-State#1* is activated.
- T3 ends 50 ms after the candidate cell TCI state activation MAC CE transmission.
- In Test 2A and 2B, T3 is skipped.

During T4, for Test 1A, 1B, 2A and 2B:

- The start of T4 is the instant when the last TTI containing LTM cell switch command MAC CE is sent by Cell 2 to the UE.
- In the cell switch command, Cell 3 is the target cell for PSCell switch. Contention-Free Random-Access Resources are indicated and the field of Timing Advance Command is set to FFF.
  - In test 1A, CandidateTCI-State#2 is indicated.
  - In test 1B, CandidateTCI-State#2 and CandidateTCI-UL-State#1 are indicated.

- In test 2A, CandidateTCI-State#1 is indicated.
- In test 2B, CandidateTCI-State#1 and CandidateTCI-UL-State#1 are indicated.

- T4 ends upon the reception of PRACH at Cell 3.

Table A.7.3.5.1.2-1: Intra-frequency PSCell switch from FR2 to FR2 test configurations

Config	Description
1	PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Source Pscell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target Pscell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: FR1 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Source Pscell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target Pscell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: FR1 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Source Pscell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target Pscell: FR2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.7.3.5.1.2-2: General test parameters for Intra-frequency cell switch from FR2 to FR2

Parameter		Unit	Value				Comment
			Test 1A	Test 1B	Test 2A	Test 2B	
Initial conditions	Active cell		Cell 1, Cell 2				
	Neighbouring cell		Cell 3				Cell 3 is the candidate cell
Final condition	Active cell		Cell 1, Cell 3				
A3-Offset		dB	-15				
Hysteresis		dB	0				
Time To Trigger		s	0				
Filter coefficient			0				L3 filtering is not used
DRX			OFF				DRX is not used
Access Barring Information		-	Not Sent				No additional delays in random access procedure.
Time offset between Cell 2 and Cell 3			0.3 μs				RTD between Cell 2 and Cell 3 is less than CP
deriveSSB-IndexFromCell			Enabled				
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	320				Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1				Report candidate cell's (Cell 3) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1				
	spCellInclusion		N/A				
ltm-DL-OrJointTCI-StateToAddModList	CandidateTCI-State#1		DlorJoint TCI.State.0	DLorJoint TCI.State.2	DLorJoint TCI.State.1	DLorJoint TCI.State.3	As specified in clause A.3.16B. In test 1A and 1B, CandidateTCI-State#1 and/or CandidateTCI-
	CandidateTCI-State#2		DLorJoint TCI.State.1	DLorJoint TCI.State.3	N/A	N/A	

Parameter		Unit	Value				Comment
			Test 1A	Test 1B	Test 2A	Test 2B	
ltm-UL-TCI-StatesToAddModList	CandidateTCI-UL-State#1		N/A	UL TCI.State.0	N/A	UL TCI.State.0	UL-State#1 are configured for early TCI state activation. CandidateTCI-State#2 and/or CandidateTCI-UL-State#1 are configured for TCI state indication in cell switch command. In test 2A and 2B, CandidateTCI-State#1 and/or CandidateTCI-UL-State#1 are configured for TCI state indication in cell switch command.
ltm-ConfigComplete			True				Candidate cell's configuration is complete configuration
T1		s	<3				
T2		s	≤0.2				
T3		s	≤0.1				
T4		s	≤0.1				

Table A.7.3.5.1.2-3: Cell specific test parameters for PCell (Cell 1)

Parameter		Unit	Cell 1
			T1~T4
NR RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
DRX Cycle		ms	Not Applicable
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
SSB Configuration	Config 1,2		SSB.1 FR1

Parameter		Unit	Cell 1
			T1~T4
	Config 3		SSB.2 FR1
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15
	Config 3		30
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15
	Config 3		30
PRACH configuration			FR1 PRACH configuration 6
BWP	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2		dBm/15 kHz	-98
N_{oc} Note2	Config 1,2	dBm/SCS	-98
	Config 3		
$\hat{E}_s / I_{ot}$		dB	4
$\hat{E}_s / N_{oc}$		dB	4
SSB_RP	Config 1,2	dBm/SCS	-94
	Config 3		-91
Io Note3	Config 1,2	dBm/ 9.36 MHz	-64.59
	Config 3	dBm/ 38.16 MHz	-58.49
Propagation condition		-	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.3.5.1.2-4: Cell specific test parameters for NR FR2-FR2 Intra frequency cell switch test case

Parameter	Unit	Cell 2	Cell 3
		T1 ~ T4	T1 ~ T4
NR RF Channel Number		2	2
Assumption for UE beams Note 6		Rough	Rough
AoA setup		Setup 1 as defined in A.3.15	
Duplex mode		TDD	
TDD configuration		TDDConf.2.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66	
BWP BW	MHz	100: $N_{PRB,c}$ = 66	
PDSCH Reference		SR3.1 TDD	
CORESET Reference Channel		CR3.1 TDD	
Control Channel RMC		CCR.3.1 TDD	
CP length		Normal	
TRS configuration		TRS.2.1 TDD	
OCNG Patterns		OP.1	
SMTC Configuration		SMTC.1	
SSB Configuration		SSB.3 FR2	
PDSCH/PDCCH subcarrier spacing	kHz	120	
PUCCH/PUSCH subcarrier spacing	kHz	120	
PRACH configuration		FR2 PRACH configuration 6	

Parameter		Unit	Cell 2	Cell 3
			T1 ~ T4	T1 ~ T4
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-104.7	
N_{oc} Note2		dBm/SCS	-95.7	
$\hat{E}_s / I_{ot}$		dB	-1.8	0
$\hat{E}_s / N_{oc}$		dB	6	7
SSB_RP		dBm/SCS	-88.7	-89.7
Io Note3		dBm/ 95.04 MHz	-56.7	-56.7
Propagation condition		-	AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.7.3.5.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 3 in no later than D_{LTM} from the beginning of time period T4.

The rate of correct cell switches observed during repeated tests shall be at least 90 %.

NOTE: The cell switch delay can be expressed as D_{LTM} (= T_{cmd} + $T_{LTM\text{-}interrupt}$), where:

T_{cmd} = T_{HARQ} + 3 ms and is specified in clause 6.3.1.2, $T_{LTM\text{-}interrupt}$ is defined in clause 8.20.3 as $T_{LTM\text{-}interrupt}$ = $T_{LTM\text{-}RRC\text{-}processing}$ + $T_{LTM\text{-}processing}$ + $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$ + $T_{LTM\text{-}IU}$ ms.

- $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 0 ms for Test 1A and 1B, $T_{first\text{-}RS}$ + $T_{RS\text{-}proc}$= 22 ms for Test 2A and 2B
- $T_{LTM\text{-}IU}$=20 ms,
- $T_{LTM\text{-}RRC\text{-}processing}$ = 10 ms if UE does not support *ltm-FastProcessingConfig-r18*, otherwise $T_{LTM\text{-}RRC\text{-}processing}$ =0 ms
- $T_{LTM\text{-}processing}$ = 10 ms if the UE supports *ltm-FastUE-Processing-r18* capability and UE reports 10 ms for FR2-to-FR2 cell switch in the capability
- $T_{LTM\text{-}processing}$ = 15 ms if the UE supports *ltm-FastUE-Processing-r18*] capability and UE reports 15 ms for FR2-to-FR2 cell switch in the capability
- $T_{LTM\text{-}processing}$ = 20 ms if the UE does not support *ltm-FastUE-Processing-r18* capability.

A.7.4 Timing

A.7.4.1 UE transmit timing

A.7.4.1.1 NR UE Transmit Timing Test for FR2

A.7.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. *highSpeedMeasFlagFR2-r17* is broadcast to UE supporting power class 6. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in table 7.4.1.1.1-1.

Table A.7.4.1.1.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz

For this test a single NR cell is used. Tables A.7.4.1.1.1-2 and A.7.4.1.1.1-2A define the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.7.4.1.1.1-3.

Table A.7.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2
SSB ARFCN		1	Freq1	Freq1
TDD configuration		1	TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	66	
Initial BWP Configuration		1	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1	DLBWP.1.1 ULBWP.1.1	
TRS Configuration		1	TRS.2.1 TDD	
PDSCH/PDCCH TCI state		1	TCI.State.2	
DRX Cycle	ms	1	N/A	DRX.8[Note5]
PDSCH Reference measurement channel		1	SR.3. 3 TDD	
RMSI CORESET Reference Channel		1	CR.3. 2 TDD	
Dedicated CORESET Reference Channel		1	CCR.3. 7 TDD	
OCNG Patterns		1	OP.1	
SSB Configuration		1	SSB.4 FR2	
SMTC Configuration		1	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1	120	
EPRE ratio of PSS to SSS	dB	1	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation condition		1	AWGN	
SRS Config		1	SRSConf.1[Note6]	SRSConf.2[Note6]

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.7.4.1.1.1-3

Table A.7.4.1.1.1-2A: OTA related test parameters

Parameter	Unit	Test 1	Test 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams[Note 6]		Fine	
N_{oc} [Note1]	dBm/15 kHz[Note4]	-112	
N_{oc} [Note1]	dBm/SCS[Note3]	-100	
$\hat{E}_s / N_{oc}$	dB	4	
SS-RSRP[Note2]	dBm/SCS [Note4]	-96	
$\hat{E}_s / I_{ot}$	dB	4	
Io[Note2]	dBm/95.04 MHz [Note4]	-68.5	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.4.1.1.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	17	17	Matches $N_{PRB,c}$
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	

	periodicityAndOffset-p	sl1, 0	sl2560, 4	Offset to align with DRX periodicity
	sequenceId	0	0	Any 10 bit number

Table A.7.4.1.1.1-4: Void

A.7.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test:

1) Setup NR PCell according to parameters given in table A.7.4.1.1.1-1.
2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.
   a. The N_{TA} offset value (in T_c units) is 13792
   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1
3) The test system shall adjust the timing of the DL path by values given in table A.7.4.1.1.2-1

Table A.7.4.1.1.2-1 Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
240	$+8*64T_c$	$+4*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna. Skip this step for test 2 with DRX confiured.
5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

A.7.4.1.2 NR UE Transmit Timing Test for FR2-2

A.7.4.1.2.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in table A.7.4.1.2.1-1.

Table A.7.4.1.2.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	NR TDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NR TDD, SSB SCS 480 kHz, data SCS 480 kHz, BW 400 MHz
3	NR TDD, SSB SCS 960 kHz, data SCS 960 kHz, BW 400 MHz
NOTE: The UE is required to be tested in the configuration with the largest supported SCS	

For this test a single NR cell is used. Tables A.7.4.1.2.1-2 and A.7.4.1.2.1-2A define the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.7.4.1.2.1-3.

Table A.7.4.1.2.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2
SSB ARFCN		1	Freq1	Freq1
TDD configuration		1	TBD	
		2	TBD	
		3	TBD	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66	
		2	400: $N_{PRB,c}$ = 66	
		3	400: $N_{PRB,c}$ = 33	
Data PRBs allocated		1	66	
		2	66	
		3	33	
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1	
TRS Configuration		1	TRS.2.1 TDD	
		2	TBD	
		3	TBD	
PDSCH/PDCCH TCI state		1,2,3	TCI.State.2	
DRX Cycle	ms	1,2,3	N/A	DRX.8[Note5]
PDSCH Reference measurement channel		1	SR.3. 3 TDD	
		2	TBD	
		3	TBD	
RMSI CORESET Reference Channel		1	CR.3. 2 TDD	
		2	TBD	
		3	TBD	
Dedicated CORESET Reference Channel		1	CCR.3. 7 TDD	
		2	TBD	
		3	TBD	
OCNG Patterns		1,2,3	OP.1	
SSB Configuration		1	SSB.4 FR2	
		2	TBD	
		3	TBD	
SMTC Configuration		1,2,3	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1	120	
		2	480	
		3	960	
EPRE ratio of PSS to SSS	dB	1	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation condition		1	AWGN	
SRS Config		1	SRSConf.1[Note6]	SRSConf.2[Note6]

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.7.4.1.2.1-3

Table A.7.4.1.2.1-2A: OTA related test parameters

Parameter	Unit	Config	Test 1	Test 2
Angle of arrival configuration		1,2,3	Setup 1 according to clause A.3.15.1	
Assumption for UE beams[Note 6]		1,2,3	Fine	
N_{oc}[Note1]	dBm/15 kHz[Note4]		-112	
N_{oc}[Note1]	dBm/SCS[Note3]	1	-100	
		2	-94	
		3	-91	
$\hat{E}_s / N_{oc}$	dB	1,2,3	4	
SS-RSRP[Note2]	dBm/SCS [Note4]	1	-96	
		2	-90	
		3	-87	
$\hat{E}_s / I_{ot}$	dB	1,2,3	4	
Io[Note2]	dBm/95.04 MHz [Note4]	1	-68.5	
	dBm/380.16 MHz [Note4]	2,3	-62.5	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 3: Void

NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone

NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.4.1.2.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	17	17	Matches $N_{PRB,c}$
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl2560, 4	Offset to align with DRX periodicity
	sequenceId	0	0	Any 10 bit number

A.7.4.1.2.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test:

1) Setup NR PCell according to parameters given in table A.7.4.1.2.2-1.
2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.
   a. The N_{TA} offset value (in T_c units) is 13792
   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1
3) The test system shall adjust the timing of the DL path by values given in table A.7.4.1.2.2-1

Table A.7.4.1.2.2-1 Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
120	$+8*64T_c$	$+4*64T_c$
480	$+4*64T_c$	$+2*64T_c$
960	$+4*64T_c$	$+2*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX configured.
5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

The rate of correct transmit timing observed during repeated tests shall be at least 90 %.

A.7.4.1.3 NR UE Transmit Timing Test with 2-TA for FR2 UE supporting *multiDCI-IntraCellMultiTRP-TwoTA-r18*

A.7.4.1.3.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits, for UE supporting *multiDCI-IntraCellMultiTRP-TwoTA-r18* and is configured with 2 TAGs for multi-DCI multi-TRP operation. UE is also configured with *dl-OrJointTCI-StateList* or *ul-TCI-State-List*. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in table A.7.4.1.3.1-1.

Table A.7.4.1.3.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz

For this test a single NR cell is used. Tables A.7.4.1.3.1-2 and A.7.4.1.3.1-2A define the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.7.4.1.3.1-3.

For UE not support the capability of “rxTimingDiff-r18”, the UE is only required to be tested in Test1 and Test3.

For UE supports the capability of “rxTimingDiff-r18”, the UE is only required to be tested in Test2 and Test4.

Table A.7.4.1.3.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1		Test2		Test3		Test4		Band Group
			TRP #1	TRP #2	TRP #1	TRP #2	TRP #1	TRP #2	TRP #1	TRP #2	
SSB ARFCN		1,2	Freq1								
Duplex Mode		1,2	TDD								
TDD configuration		1,2	TDDConf.3.1								
$BW_{channel}$	MHz	1,2	100: $N_{PRB,c}$ = 66								
Data PRBs allocated		1,2	66								
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1								
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1								
TRS Configuration		1,2	TRS.2.1 TDD TRS.2.2 TDD								
DRX Cycle	ms	1,2	N/A				DRX.8[Note5]				
PDSCH Reference measurement channel		1,2	SR.3. 3 TDD								
RMSI CORESET Reference Channel		1,2	CR.3.2 TDD								
coresetPoolIndex for dedicated CORESET Reference Channel		1,2	0	1	0	1	0	1	0	1	
Dedicated CORESET Reference Channel		1,2	CCR.3.4 TDD	CCR.3.6 TDD	CCR.3.4 TDD	CCR.3.6 TDD	CCR.3.4 TDD	CCR.3.6 TDD	CCR.3.4 TDD	CCR.3.6 TDD	
TCI configuration		1,2	DLorJoint TCI.State.0 with tag-Id-ptr-r18 = n0	DLorJoint TCI.State.1 with tag-Id-ptr-r18 = n1	DLorJoint TCI.State.0 with tag-Id-ptr-r18 = n0	DLorJoint TCI.State.1 with tag-Id-ptr-r18 = n1	DLorJoint TCI.State.0 with tag-Id-ptr-r18 = n0	DLorJoint TCI.State.1 with tag-Id-ptr-r18 = n1	DLorJoint TCI.State.0 with tag-Id-ptr-r18 = n0	DLorJoint TCI.State.1 with tag-Id-ptr-r18 = n1	
Timing difference compared to TRP#1	us	1,2	0	0.1	0	7	0	0.1	0	7	
OCNG Patterns		1,2	OP.1								
SSB Configuration		1,2	SSB.1 FR2								
SMTC Configuration		1,2	SMTC.1								
PDSCH/PDCCH	kHz	1,2	120								

Parameter	Unit	Config	Test1		Test2		Test3		Test4		Band Group
			TRP #1	TRP #2	TRP #1	TRP #2	TRP #1	TRP #2	TRP #1	TRP #2	
subcarrier spacing											
EPRE ratio of PSS to SSS	dB	1,2	0				0				
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of PDCCH DMRS to SSS											
EPRE ratio of PDCCH to PDCCH DMRS											
EPRE ratio of PDSCH DMRS to SSS											
EPRE ratio of PDSCH to PDSCH											
EPRE ratio of OCNG DMRS to SSS(Note 1)											
EPRE ratio of OCNG to OCNG DMRS (Note 1)											
Propagation condition		1,2	AWGN								
SRS Config		1,2	SRSConf.1[Note6]				SRSConf.2[Note6]				

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: VoidNOTE 4: Void
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.5.4.1.x.1-3

Table A.7.4.1.3.1-2A: OTA related test parameters

Parameter	Unit	Test 1	Test 2	Test 3	Test 4
Angle of arrival configuration		Setup 3 as specified in clause A.3.15 [Note 7]			
Assumption for UE beams[Note 6]		Fine			
N_{oc} [Note1]	dBm/15 kHz[Note4]	-112			
N_{oc} [Note1]	dBm/SCS[Note3]	-100			
$\hat{E}_s/N_{oc}$	dB	4			
SS-RSRP[Note2]	dBm/SCS [Note4]	-96			

Parameter	Unit	Test 1	Test 2	Test 3	Test 4
$\hat{E}_s / I_{ot}$	dB	4			
Io Note2	dBm/95.04 MHz Note4	-68.5			

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 7: AoA1 for TRP1 and AoA2 for TRP2

Table A.7.4.1.3.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1		SRSConf.2		Comments
SRS-ResourceSet	srs-ResourceSetId	0	1	0	1	
	srs-ResourceIdList	0	1	0	1	
	resourceType	Periodic	Periodic	Periodic	Periodic	
	Usage	Codebook	Codebook	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	1	0	0	
	nrofSRS-Ports	Port1	Port1	Port1	Port1	
	transmissionComb	n2	n2	n2	n2	
	combOffset-n2	0	0	0	0	
	cyclicShift-n2	0	0	0	0	
	resourceMapping startPosition	0	0	0	0	
	resourceMapping nrofSymbols	n1	n1	n1	n1	
	resourceMapping repetitionFactor	n1	n1	n1	n1	
	freqDomainPosition	0	0	0	0	
	freqDomainShift	0	0	0	0	
	freqHopping c-SRS	17	17	17	17	Matches $N_{PRB,c}$
	freqHopping b-SRS	0	0	0	0	
	freqHopping b-hop	0	0	0	0	
	groupOrSequenceHopping	Neither	Neither	Neither	Neither	
	resourceType	Periodic	Periodic	Periodic	Periodic	
	periodicityAndOffset-p	sl2, 0	sl2, 1	sl2560, 4	sl2560, 9	Offset to align with DRX periodicity
	sequenceId	0	0	0	0	Any 10 bit number
	TCI state	DLorJoint TCI.State.0	DLorJoint TCI.State.1	DLorJoint TCI.State.0	DLorJoint TCI.State. 1	

Table A.7.4.1.3.1-4: Void

A.7.4.1.3.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test:

1) Setup NR PCell according to parameters given in table A.7.4.1.3.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB for each TAG.

   a. The N_{TA} offset value (in T_c units) is 13792

   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in table A.7.4.1.3.2-1 for only TRP#1. The timing of the DL path of TRP#2 is not changed.

Table A.7.4.1.3.2-1 Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1&Test2	Test3&Test4
240	$+8*64T_c$	$+4*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first path (in time) of DL SSB of each TAG used by the UE to determine downlink timing is received from the reference cell at the UE antenna. For TRP#2, the test system shall verify there is no adjustment. Skip this step for Test 3 and Test 4 with DRX confiured.

5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna. For Test 3 and Test 4 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

A.7.4.2 UE timer accuracy

A.7.4.3 Timing advance

A.7.4.3.1 SA FR2 timing advance adjustment accuracy

A.7.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.7.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.7.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.7.4.3.1.2-2, A.7.4.3.1.2-3 and A.7.4.3.1.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.7.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.7.4.3.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in Clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k+1 for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.7.4.3.1.2-1: Timing advance supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.4.3.1.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		1	
Initial DL BWP		DLBWP.0.1	As specified in table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	*For 120 kHz SCS* $N_{TA_new} = N_{TA_old}$ + *1024*Tc* (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.7.4.3.1.2-3: Cell specific test parameters for timing advance

Parameter	Unit	Test1	
		T1	T2
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66	
BWP BW	MHz	100: $N_{PRB,c}$ = 66	
DRX Cycle	ms	Not Applicable	
PDSCH Reference measurement channel		SR.3.1 TDD	
CORESET Reference Channel		CR.3.1 TDD	
OCNG Patterns		OCNG pattern 1	
TRS configuration		TRS.2.1 TDD	
PDSCH/PDCCH TCI state		TCI.State.2	
SMTC configuration		SMTC.1	
SSB Configuration		SSB.3 FR2	
PDSCH/PDCCH subcarrier spacing	kHz	120 kHz	
PUCCH/PUSCH subcarrier spacing	kHz	120 kHz	
EPRE ratio of PSS to SSS	dB	0	
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation condition	-	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone

Table A.7.4.3.1.2-3A: OTA related test parameters

Parameter	Unit	Test 1	
		T1	T2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams[Note 6]		Fine	
N_{oc} [Note1]	dBm/15 kHz[Note4]	-112	
N_{oc} [Note1]	dBm/SCS[Note3]	-103	
$\hat{E}_s/N_{oc}$	dB	4	
SS-RSRP[Note2]	dBm/SCS [Note4]	-99	
$\hat{E}_s/I_{ot}$	dB	4	
Io[Note2]	dBm/95.04 MHz [Note4]	-68.5	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance

Field	Value	Comment
c-SRS	16	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=4	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission

NOTE: For further information see clause 6.3.2 in TS 38.331 [2].

A.7.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where *k* = 11.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.7.4.3.2 SA FR2-2 timing advance adjustment accuracy

A.7.4.3.2.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.7.4.3.2.2 Test Parameters

Supported test configurations are shown in table A.7.4.3.2.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.7.4.3.2.2-2, A.7.4.3.2.2-3 and A.7.4.3.2.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.7.4.3.2.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.7.4.3.2.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in Clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.7.4.3.2.2-1: Timing advance supported test configurations

Configuration	Description
1	NR TDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NR TDD, SSB SCS 480 kHz, data SCS 480 kHz, BW 400 MHz
3	NR TDD, SSB SCS 960 kHz, data SCS 960 kHz, BW 400 MHz
NOTE: The UE is required to be tested in the configuration with the largest supported SCS	

Table A.7.4.3.2.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		1	
Initial DL BWP		DLBWP.0.1	As specified in table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	*For 120 kHz SCS* $N_{TA_new} = N_{TA_old} + 1024*T_c$ *For 480 kHz SCS* $N_{TA_new} = N_{TA_old} + 256*T_c$ *For 960 kHz SCS* $N_{TA_new} = N_{TA_old} + 128*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	

T2	s	5	

Table A.7.4.3.2.2-3: Cell specific test parameters for timing advance

Parameter	Unit	Config	T1	T2
TDD configuration		1	TBD	
		2	TBD	
		3	TBD	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66	
		2	400: $N_{PRB,c}$ = 66	
		3	400: $N_{PRB,c}$ = 33	
Data PRBs allocated		1	66	
		2	66	
		3	33	
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1	
TRS Configuration		1	TRS.2.1 TDD	
		2	TBD	
		3	TBD	
PDSCH/PDCCH TCI state		1,2,3	TCI.State.2	
DRX Cycle	ms	1,2,3	N/A	DRX.8[Note5]
PDSCH Reference measurement channel		1	SR.3. 3 TDD	
		2	TBD	
		3	TBD	
RMSI CORESET Reference Channel		1	CR.3. 2 TDD	
		2	TBD	
		3	TBD	
Dedicated CORESET Reference Channel		1	CCR.3. 7 TDD	
		2	TBD	
		3	TBD	
OCNG Patterns		1,2,3	OP.1	
SSB Configuration		1	SSB.4 FR2	
		2	TBD	
		3	TBD	
SMTC Configuration		1,2,3	SMTC.1	

Table A.7.4.3.2.2-3A: OTA related test parameters

Parameter	Unit	Config	T1	T2
Angle of arrival configuration		1,2,3	Setup 1 according to clause A.3.15.1	
Assumption for UE beams[Note 6]		1,2,3	Fine	
N_{oc} [Note1]	dBm/15 kHz[Note4]		-112	
N_{oc} [Note1]	dBm/SCS[Note3]	1	-100	
		2	-94	
		3	-91	
$\hat{E}_s / N_{oc}$	dB	1,2,3	4	
SS-RSRP[Note2]	dBm/SCS [Note4]	1	-96	
		2	-90	
		3	-87	
$\hat{E}_s / I_{ot}$	dB	1,2,3	4	
Io[Note2]	dBm/95.04 MHz [Note4]	1	-68.5	
	dBm/380.16 MHz [Note4]	2,3	-62.5	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.4.3.2.2-4: Sounding Reference Symbol Configuration for timing advance

Field	Value	Comment
c-SRS	16	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=0	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.7.4.3.2.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.7.5 Signaling characteristics

A.7.5.1 Radio link Monitoring

In the following clause, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

Editor note: The metric for the detection of the UE UL transmitted signal by the TE is FFS.

A.7.5.1.1 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with SSB-based RLM RS in non-DRX mode

A.7.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.7.5.1.1.1-1. The test parameters are given in Tables A.7.5.1.1.1-2, A.7.5.1.1.1-3, and A.7.5.1.1.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.7.5.1.1.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In addition to RLM-RS radio link monitoring using SSB index 0 and SSB index 1, the UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

Table A.7.5.1.1.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.7.5.1.1.1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		TDD
$BW_{channel}$		Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1		24
DL initial BWP configuration		Config 1		DLBWP.0.1
DL dedicated BWP configuration		Config 1		DLBWP.1.1
UL initial BWP configuration		Config 1		ULBWP.0.1
UL dedicated BWP configuration		Config 1		ULBWP.1.1
TDD Configuration		Config 1		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1		CCR.3.4 TDD
SSB Configuration		Config 1		SSB.1 FR2
SMTC Configuration		Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1		120 KHz
PRACH Configuration		Config 1		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1		0,1
OCNG parameters				OP.5
CP length				Normal
	DCI format			1-0
	Number of Control OFDM symbols			2

Parameter			Unit	Value
				Test 1
Out of sync transmission parameters	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				*gp0*
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1		TRS.2.1 TDD
T1			s	0.2
T2			s	9.68
T3			s	9.68
D1			s	9.64
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.1.1.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
AoA setup			Setup 3 defined in A.3.15					
			AoA1			AoA2		
Assumption for UE beams Note 5			Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4			Not sent		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0					
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15			
ssb-Index 1 SNR	Config 1		Not sent			2 Note 6	-15	-15
N_{oc}	Config 1	dBm/ 15kHz	-92.1			-92.1		
Time multiplexing of the downlink transmissions from each AoA			Defined in Figure A.7.5.1.1.1-2					
Propagation condition			TDL-A 30 ns 75 Hz			TDL-A 30 ns 75 Hz		
NOTE 1: OCNG shall be used such a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. NOTE 5: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation. NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband								

Table A.7.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0

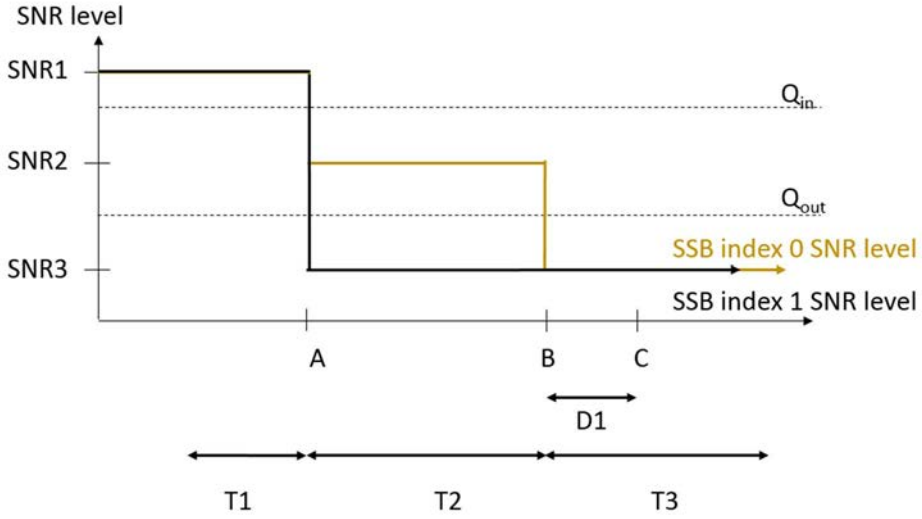


Figure A.7.5.1.1.1-1: SNR variation for out-of-sync testing

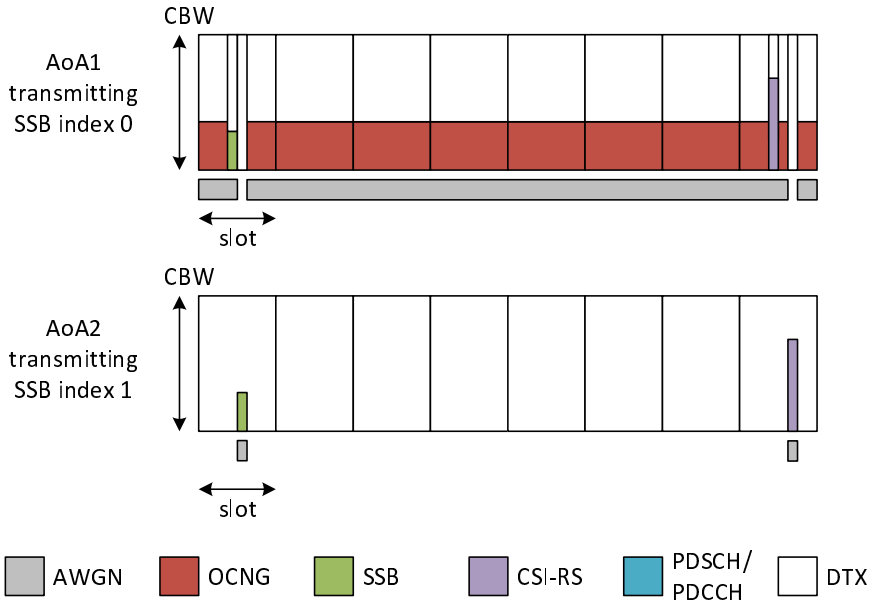


Figure A.7.5.1.1.1-2: Time multiplexed downlink transmissions

A.7.5.1.1.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.1.2 Radio Link Monitoring In-sync Test for FR2 PCell configured with SSB-based RLM RS in non-DRX mode

A.7.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.7.5.1.2.1-1.The test parameters are given in Tables A.7.5.1.2.1-2, and A.7.5.1.2.1-3 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.7.5.1.2.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Table A.7.5.1.2.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.7.5.1.2.1-2: General test parameters for FR2 in-sync testing in non-DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		TDD
$BW_{channel}$		Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1		24
DL initial BWP configuration		Config 1		DLBWP.0.1
DL dedicated BWP configuration		Config 1		DLBWP.1.1
UL initial BWP configuration		Config 1		ULBWP.0.1
UL dedicated BWP configuration		Config 1		ULBWP.1.1
TDD Configuration		Config 1		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1		CCR.3.1 TDD
SSB Configuration		Config 1		SSB.1 FR2
SMTC Configuration		Config 1		SMTC.3
PDSCH/PDCCH subcarrier spacing		Config 1		120 KHz
PRACH Configuration		Config 1		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1		0,1
OCNG parameters				OP.5
CP length				Normal
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	0
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4

Parameter			Unit	Value
				Test 1
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				N/A
Layer 3 filtering				*Enabled*
T310 timer			ms	4000
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1		TRS.2.1 TDD
T1			s	0.2
T2			s	0.2
T3			s	1.88
T4			s	0.2
T5			s	3.84
D1			s	3.8
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.1.2.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1									
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
AoA setup			Setup 3 defined in A.3.15									
			AoA1					AoA2				
Assumption for UE beams Note 5			Rough					Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0					Not sent				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0									
EPRE ratio of PBCH DMRS to SSS		dB										
EPRE ratio of PBCH to PBCH DMRS		dB										
EPRE ratio of PSS to SSS		dB										
EPRE ratio of PDSCH DMRS to SSS		dB										
EPRE ratio of PDSCH to PDSCH DMRS		dB										
EPRE ratio of OCNG DMRS to SSS		dB										
EPRE ratio of OCNG to OCNG DMRS		dB										
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15	-15	-15					
ssb-Index 1 SNR	Config 1		Not sent					2 Note 6	-15	-15	-4.5	2 Note 6
N_{oc}	Config 1	dBm/ 15kHz	-92.1					-92.1				
Time multiplexing of the downlink transmissions from each AoA			Defined in Figure A.7.5.1.2.1-2									
Propagation condition			TDL-A 30 ns 75 Hz					TDL-A 30 ns 75 Hz				

Parameter	Unit	Test 1									
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.											
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.											
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.											
NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.											
NOTE 5: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.											
NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband											

Table A.7.5.1.2.1-4: Void

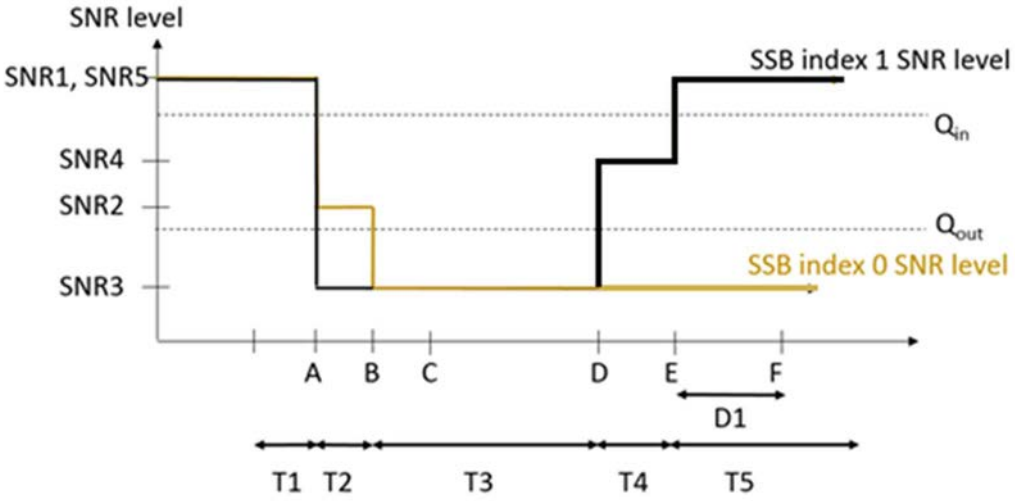


Figure A.7.5.1.2.1-1: SNR variation for in-sync testing

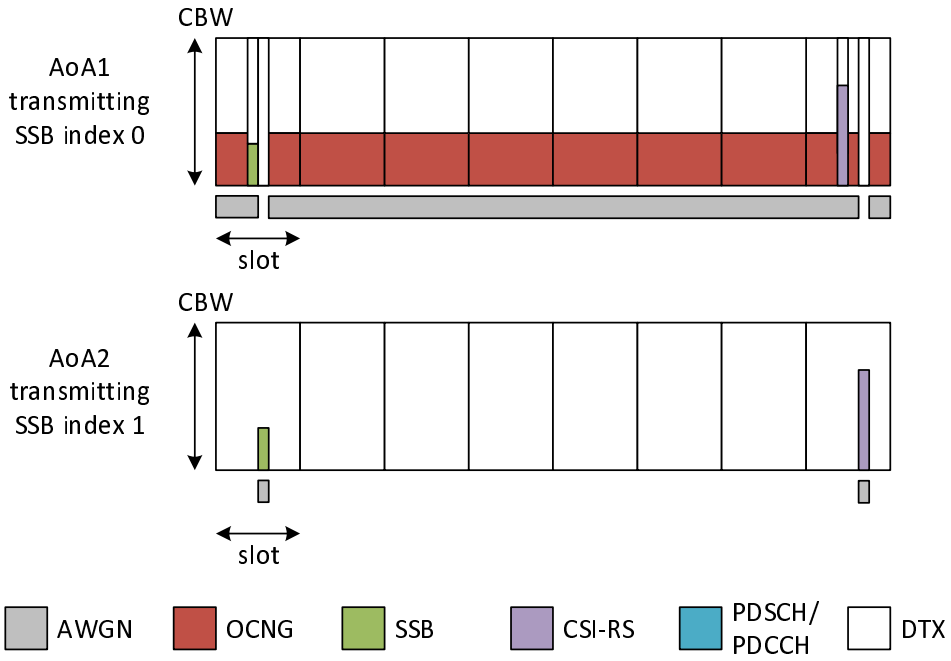


Figure A.7.5.1.2.1-2: Time multiplexed downlink transmissions

A.7.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.1.3 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with SSB-based RLM RS in DRX mode

A.7.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.7.5.1.3.1-1. The test parameters are given in Tables A.7.5.1.3.1-2, and A.7.5.1.3.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.7.5.1.3.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.7.5.1.3.1-2: General test parameters for FR2 out-of-sync testing in DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		TDD
$BW_{channel}$		Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1		66
DL initial BWP configuration		Config 1		DLBWP.0.1
DL dedicated BWP configuration		Config 1		DLBWP.1.1
UL initial BWP configuration		Config 1		ULBWP.0.1
UL dedicated BWP configuration		Config 1		ULBWP.1.1
TDD Configuration		Config 1		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1		CCR.3.4 TDD
SSB Configuration		Config 1		SSB.1 FR2
SMTC Configuration		Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1		120 KHz
PRACH Configuration		Config 1		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1		0,1
OCNG parameters				OP.1
CP length				Normal
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4

Parameter			Unit	Value
				Test 1
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX Configuration				DRX.3
Gap pattern ID				N/A
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1		TRS.2.1 TDD
T1			s	0.2
T2			s	14.48
T3			s	14.48
D1			s	14.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.1.3.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for out-of-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
AoA setup			Setup 1 defined in A.3.15		
Assumption for UE beams Note 5			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15
ssb-Index 1 SNR	Config 1		2 Note 6	-15	-15
N_{oc}	Config 1	dBm/15KHz	-104.7 dBm		
Propagation condition			TDL-A 30 ns 75 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. NOTE 5: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation. NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband.					

Table A.7.5.1.3.1-4: Void

Table A.7.5.1.3.1-5: Void

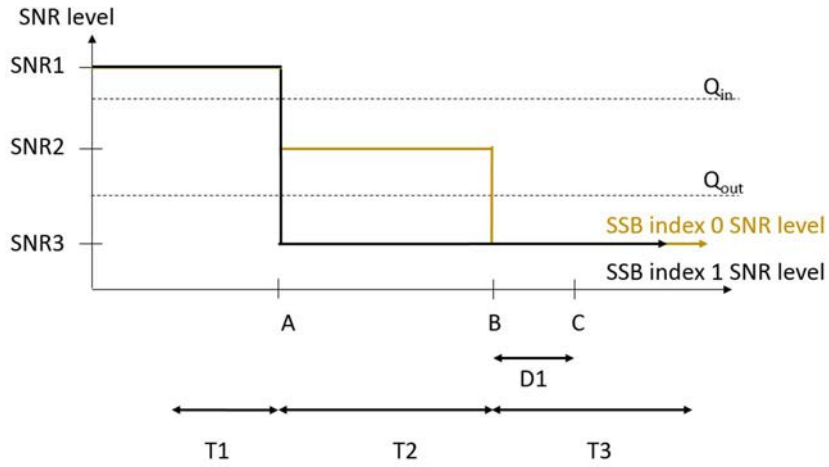


Figure A.7.5.1.3.1-1: SNR variation for out-of-sync testing

A.7.5.1.3.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.1.4 Radio Link Monitoring In-sync Test for FR2 PCell configured with SSB-based RLM RS in DRX mode

A.7.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.7.5.1.4.1-1. The test parameters are given in Tables A.7.5.1.4.1-2, and A.7.5.1.4.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.7.5.1.4.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.7.5.1.4.1-2: General test parameters for FR2 in-sync testing in DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		TDD
$BW_{channel}$		Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1		66
DL initial BWP configuration		Config 1		DLBWP.0.1
DL dedicated BWP configuration		Config 1		DLBWP.1.1
UL initial BWP configuration		Config 1		ULBWP.0.1
UL dedicated BWP configuration		Config 1		ULBWP.1.1
TDD Configuration		Config 1		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1		CCR.3.1 TDD
SSB Configuration		Config 1		SSB.1 FR2
SMTC Configuration		Config 1		SMTC.3
PDSCH/PDCCH subcarrier spacing		Config 1		120 KHz
PRACH Configuration		Config 1		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1		0,1
OCNG parameters				OP.1
CP length				Normal
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	0
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX Configuration				DRX.11
Gap pattern ID				N/A
Layer 3 filtering				*Enabled*
T310 timer			ms	4000
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1		TRS.2.1 TDD
T1			s	0.2
T2			s	0.2
T3			s	2.8
T4			s	0.2
T5			s	3.88
D1			s	3.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.1.4.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for in-sync radio link monitoring test in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams Note 5			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15	-4.5	2 Note 6
ssb-Index 1 SNR	Config 1		2 Note 6	-15	-15	-15	-15
N_{oc}	Config 1	dBm/15KHz	-104.7 dBm				
Propagation condition			TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.3
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
NOTE 5: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband.

Table A.7.5.1.4.1-4: Void

Table A.7.5.1.4.1-5: Void

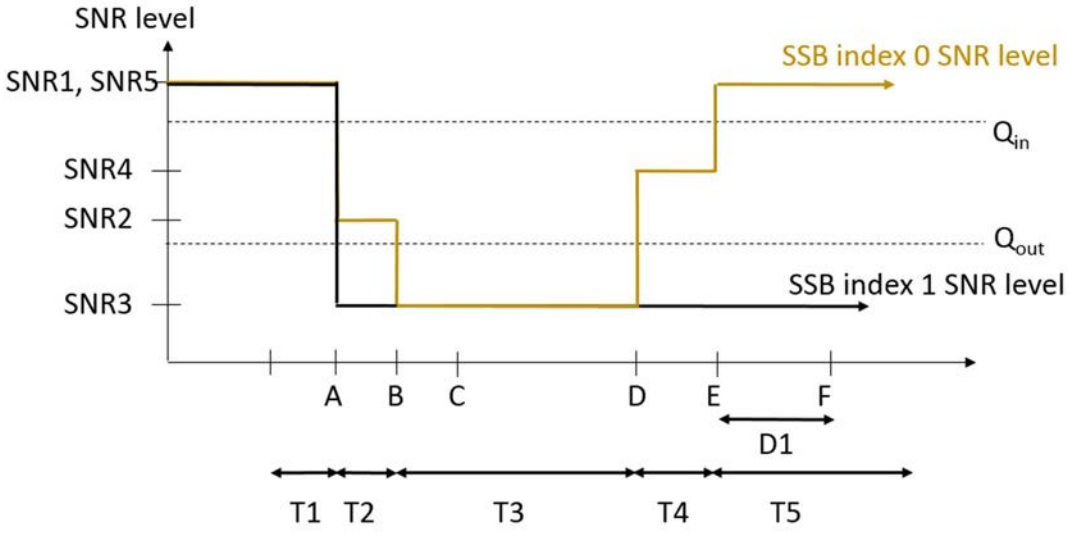


Figure A.7.5.1.4.1-1: SNR variation for in-sync testing

A.7.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.1.5 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with CSI-RS-based RLM in non-DRX mode

A.7.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR2 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.5.1-1, A.7.5.1.5.1-2, A.7.5.1.5.1-3 and A.7.5.1.5.1-4 below. There is one cell, cell 1 which is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.5.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 10 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test. In the test, SSB0 and SSB1 are configured as BFD-RS and are not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.7.5.1.5.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.1.5.1-2: General test parameters for FR2 PCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
TDD Configuration	Config 1		TDDConf.3.1
$BW_{channel}$	Config 1		100: $N_{RB,c}$ = 66
Data RBs allocated	Config 1		24
$BW_{occupied}$	Config 1		24
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.4
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.4
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.4 TDD CCR.3.6 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
SSB index for BFD-RS	Config 1		0, 1

TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.5
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			*gp0
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	0.35
T3		s	0.35
D1		s	0.31
Note 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.7.5.1.5.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
AoA setup			Setup 3 defined in A.3.15					
			AoA1			AoA2		
Assumption for UE beams Note 10			Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4			Not sent		
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB	0					
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR on RLM-RS1	Config 1	dB	2 Note 11	-6 Note 11	-15			
SNR on RLM-RS2	Config 1	dB	Not sent			2 Note 11	-15	-15
N_{oc}	Config 1	dBm/ 15kHz	-92.1			-92.1		
Propagation condition			TDL-A 30ns 75Hz			TDL-A 30ns 75Hz		

Parameter	Unit	Test 1					
		T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.							
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.							
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.							
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.1.5.1-1.							
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.							
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.							
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband							

Table A.7.5.1.5.1-4: Measurement gap configuration for FR2 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: RLM RS is partially overlapped with measurement gap	

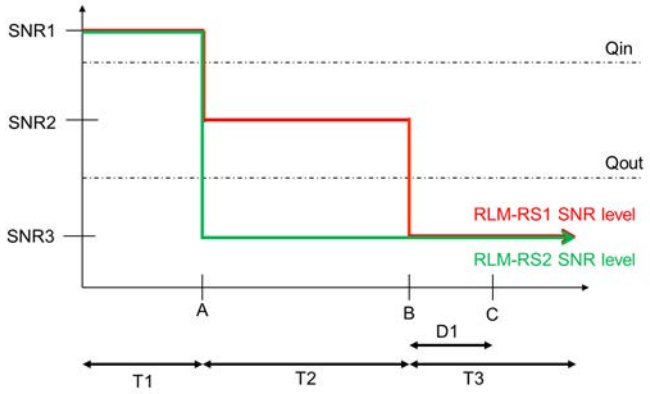


Figure A.7.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing

A.7.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 no later than time point C (D_1 second after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.1.6 Radio Link Monitoring In-sync Test for FR2 PCell configured with CSI-RS-based RLM in non-DRX mode

A.7.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR2 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.6.1-1, A.7.5.1.6.1-2 and A.7.5.1.6.1-3 below. There is one cells, cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.6.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 10 ms. In the test, DRX configuration is not enabled. In the test, SSB0 and SSB1 are configured as BFD-RS and are not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.7.5.1.6.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.1.6.1-2: General test parameters for FR2 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
TDD Configuration	Config 1		TDDConf.3.1
$BW_{channel}$	Config 1		100: $N_{RB,c}$ = 66
Data RBs allocated	Config 1		24
$BW_{occupied}$	Config 1		24
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.4
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.4
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
SSB index for BFD-RS	Config 1		0, 1
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.5
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4

	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
Note 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.7.5.1.6.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1									
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
AoA setup			Setup 3 defined in A.3.15									
			AoA1					AoA2				
Assumption for UE beams Note 10			Rough					Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	4					Not sent				
EPRE ratio of PDCCH to PDCCH DMRS		dB										
EPRE ratio of PBCH DMRS to SSS		dB	0									
EPRE ratio of PBCH to PBCH DMRS		dB										
EPRE ratio of PSS to SSS		dB										
EPRE ratio of PDSCH DMRS to SSS		dB										
EPRE ratio of PDSCH to PDSCH DMRS		dB										
EPRE ratio of OCNG DMRS to SSS		dB										
EPRE ratio of OCNG to OCNG DMRS		dB										
SNR on RLM-RS1	Config 1	dB	2 Note 11	-6 Note 11	-15	-15	-15					
SNR on RLM-RS2	Config 1	dB	Not sent					2 Note 11	-15	-15	-4.5	2 Note 11
N_{oc}	Config 1	dBm/ 15KHz	-92.1					-92.1				

Parameter	Unit	Test 1									
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
Propagation condition		TDL-A 30ns 75Hz					TDL-A 30ns 75Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.7.5.1.6.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband.

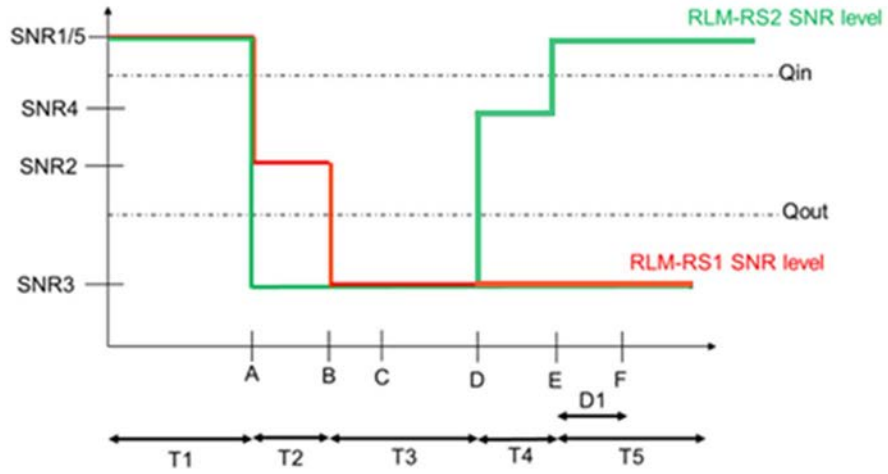


Figure A.7.5.1.6.1-1: SNR variation for CSI-RS in-sync testing

A.7.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.1.7 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with CSI-RS-based RLM in DRX mode

A.7.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR2 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.7.1-1, A.7.5.1.7.1-2, and A.7.5.1.7.1-3 below. There is one cell, cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.7.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be

configured for periodic CSI reporting with a reporting periodicity of 10 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. In the test, SSB0 and SSB1 are configured as BFD-RS and are not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.7.5.1.7.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.1.7.1-2: General test parameters for FR2 PCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
TDD Configuration	Config 1		TDDConf.3.1
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.4 TDD CCR.3.6 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
SSB index for BFD-RS	Config 1		0, 1
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1

CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
Note 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.7.5.1.7.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
AoA setup		dB	Setup 1 defined in A.3.15		
Assumption for UE beams Note 10			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB			
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS1	Config 1	dB	2 Note 11	-6 Note 11	-15
SNR on RLM-RS2	Config 1	dB	2 Note 11	-15	-15
N_{oc}	Config 1	dBm/15KHz	-104.7		
Propagation condition			TDL-A 30ns 75Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.1.7.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband.

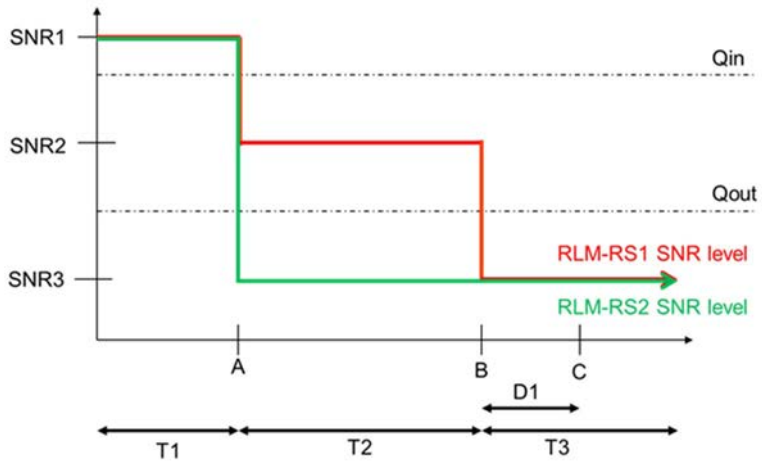


Figure A.7.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing

A.7.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C (D_1 secondafter the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.1.8 Radio Link Monitoring In-sync Test for FR2 PCell configured with CSI-RS-based RLM in DRX mode

A.7.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR2 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.8.1-1, A.7.5.1.8.1-2, A.7.5.1.8.1-3 and A.7.5.1.8.1-4 below. There is one cells, cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.8.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 10 ms. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test. In the test, SSB0 and SSB1 are configured as BFD-RS and are not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.7.5.1.8.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.1.8.1-2: General test parameters for FR2 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter	Unit	Value
		Test 1
Active PCell		Cell 1

RF Channel Number			1
Duplex mode	Config 1		TDD
TDD Configuration	Config 1		TDDConf.3.1
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
SSB index for BFD-RS	Config 1		0, 1
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			*gp0
Layer 3 filtering			*Enabled*
T310 timer		ms	*2000*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2

T2	s	0.2
T3	s	1.64
T4	s	0.2
T5	s	1.88
D1	s	1.84
Note 1: UE-specific PDCCH is not transmitted after T1 starts.		

Table A.7.5.1.8.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup		dB	Setup 1 defined in A.3.15				
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	4				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS							
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS1	Config 1	dB	2 Note 11	-6 Note 11	-15	-4.5	2 Note 11
SNR on RLM-RS2	Config 1	dB	2 Note 11	-15	-15	-15	-15
N_{oc}	Config 1	dBm/15KHz	-104.7				
Propagation condition			TDL-A 30ns 75Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.7.5.1.8.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband.

Table A.7.5.1.8.1-4: Measurement gap configuration for FR2 CSI-RS in-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: RLM RS is partially overlapped with measurement gap	

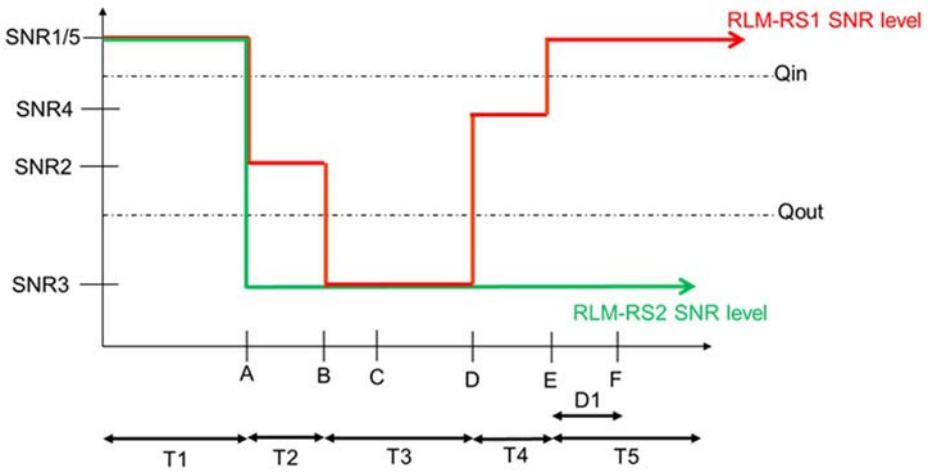


Figure A.7.5.1.8.1-1: SNR variation for CSI-RS in-sync testing

A.7.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.1.9 UE Radio Link Monitoring Scheduling Restrictions on FR2

A.7.5.1.9.1 Test Purpose and Environment

The purpose is to verify that the NR UE correctly follows the RLM scheduling restrictions requirements defined in clause 8.1.7. This test verifies that the UE correctly receive the PDCCH scheduled on the symbols right before the RLM SSB symbols without overlap so that it sends ACK/NACK correctly. The test case is only applicable to UE which supports pdcch-MonitoringAnyOccasions or pdcch-MonitoringAnyOccasionsWithSpanGap.

The test parameters are given in table A.7.5.1.9.1-1, table A.7.5.1.9.1-2 and table A.7.5.1.9.1-3 below. The UE is required during time period T1 to transmit ACK/NACK correctly upon scheduling of PDSCH.

Table A.7.5.1.9.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 120 kHz RMC SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.1.9.1-2: General test parameters for NR RLM scheduling restriction test case in FR2

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		1	1	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC.3	
DRX cycle length	s	1	OFF	
T1	s	1	5	During T1 the UE is required to correctly transmit ACK/NACK

Table A.7.5.1.9.1-3: Cell specific test parameters for NR RLM scheduling restriction test case in FR2

Parameter	Unit	Test configuration	Cell 1	
AoA setup		1	Setup 3 defined in A.3.15.3	
			AoA1	AoA2
Assumption for UE beams Note 1			Rough	Rough
TDD configuration		1	TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24	
PDSCH Reference measurement channel		1	SR.3.2 TDD	Not sent
RMSI CORESET RMC configuration		1	CR.3.1 TDD	Not sent
Dedicated CORESET RMC configuration		1	CCR.3.2 TDD	Not sent
TRS configuration		1	TRS.2.1 TDD	TRS.2.2 TDD
PDCCH/PDSCH TCI state		1	TCI.State.2	N/A
OCNG Pattern		1	OP.5 defined in A.3.2.1	Not sent
Initial DL BWP configuration		1	DLBWP.0.1	
Initial UL BWP configuration		1	ULBWP.0.1	
RLM-RS		1	SSB with index 0	SSB with index 1
N_{oc}	dBm/15kHz	1	-92.1	-92.1
N_{oc} Note2	dBm/SCS	1	-83.1	-83.1
$\hat{E}_s / N_{oc}$	dB	1	2	2
$\hat{E}_s / I_{ot}$ BB Note 4	dB	1	1	1
SSB_RP Note3	dBm/SCS	1	-81.1	-81.1
Io	dBm/95.04 MHz	1	-54.35	-54.35
Time multiplexing of the downlink transmissions from each AoA		1	Defined in Figure A.7.5.1.9.1-1	
Propagation Condition		1	AWGN	AWGN

NOTE 1: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

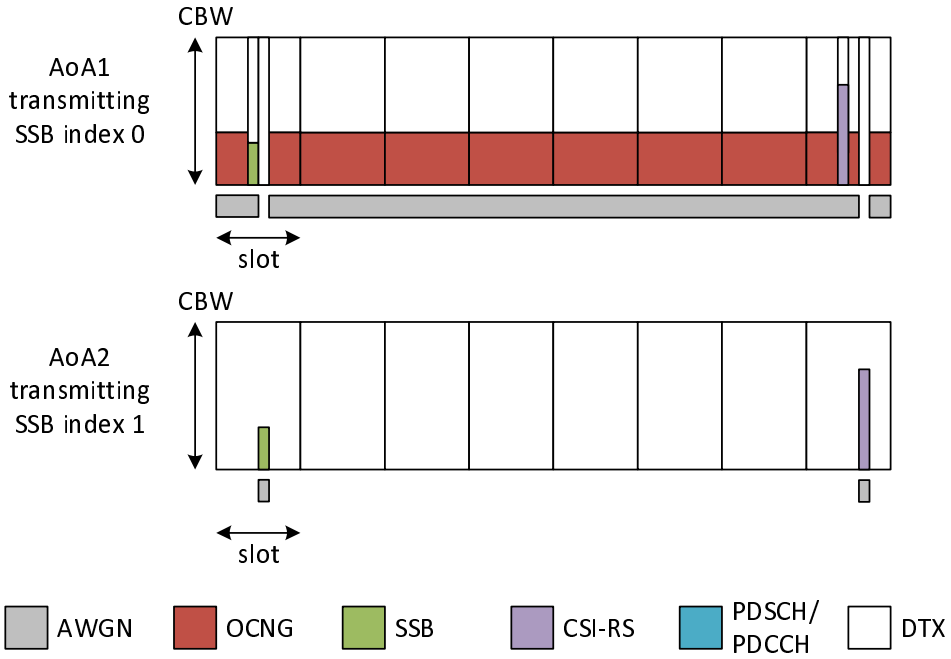


Figure A.7.5.1.9.1-1: Time multiplexed downlink transmissions

A.7.5.1.9.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.1.7.3.

The UE shall be continuously scheduled by PDCCH on the symbols right before each SSB which is not covered by SMTC during the entire length of T1. The UE shall transmit ACK/NACK for every scheduled PDCCH during the time duration T1.

A.7.5.1.10 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with SSB-based RLM RS in non-DRX mode for UE supporting fast beam sweeping in multi-Rx

A.7.5.1.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.7.5.1.10.1-1. The test parameters are given in Tables A.7.5.1.10.1-2, and A.7.5.1.10.1-3below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.10.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.7.5.1.10.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In addition to RLM-RS radio link monitoring using SSB index 0 and SSB index 1.

Table A.7.5.1.10.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.7.5.1.10.1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		TDD
$BW_{channel}$		Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1		24
DL initial BWP configuration		Config 1		DLBWP.0.1
DL dedicated BWP configuration		Config 1		DLBWP.1.1
UL initial BWP configuration		Config 1		ULBWP.0.1
UL dedicated BWP configuration		Config 1		ULBWP.1.1
TDD Configuration		Config 1		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1		CCR.3.4 TDD
SSB Configuration		Config 1		SSB.1 FR2
SMTC Configuration		Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1		120 KHz
PRACH Configuration		Config 1		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1		0,1
OCNG parameters				OP.5
CP length				Normal
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				*NA*
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1		TRS.2.1 TDD
T1			s	0.2
T2			s	1.2*N +0.08 Note 3
T3			s	1.2*N +0.08 Note 3
D1			s	1.2*N +0.04 Note 3

NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.
NOTE 3: N is the value indicated by UE for *fastBeamSweepingMultiRx-r18*.

Table A.7.5.1.10.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter	Unit	Test 1					
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 5 defined in A.3.15					
		AoA1			AoA2		
Assumption for UE beams Note 5		Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS	dB	4			Not sent		

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
EPRE ratio of PDCCH to PDCCH DMRS		dB	0					
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15			
ssb-Index 1 SNR	Config 1		Not sent			2 Note 6	-15	-15
N_{oc}	Config 1	dBm/ 15kHz	-92.1			-92.1		
Time multiplexing of the downlink transmissions from each AoA			Defined in Figure A.7.5.1.10.1-2					
Propagation condition			TDL-A 30 ns 75 Hz			TDL-A 30 ns 75 Hz		
NOTE 1: OCNG shall be used such a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. NOTE 5: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation. NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband								

Table A.7.5.1.10.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0

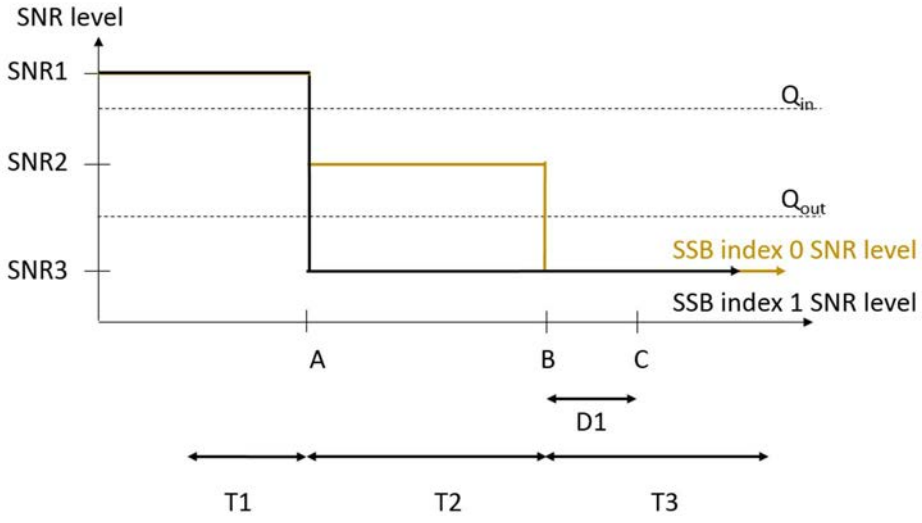


Figure A.7.5.1.10.1-1: SNR variation for out-of-sync testing

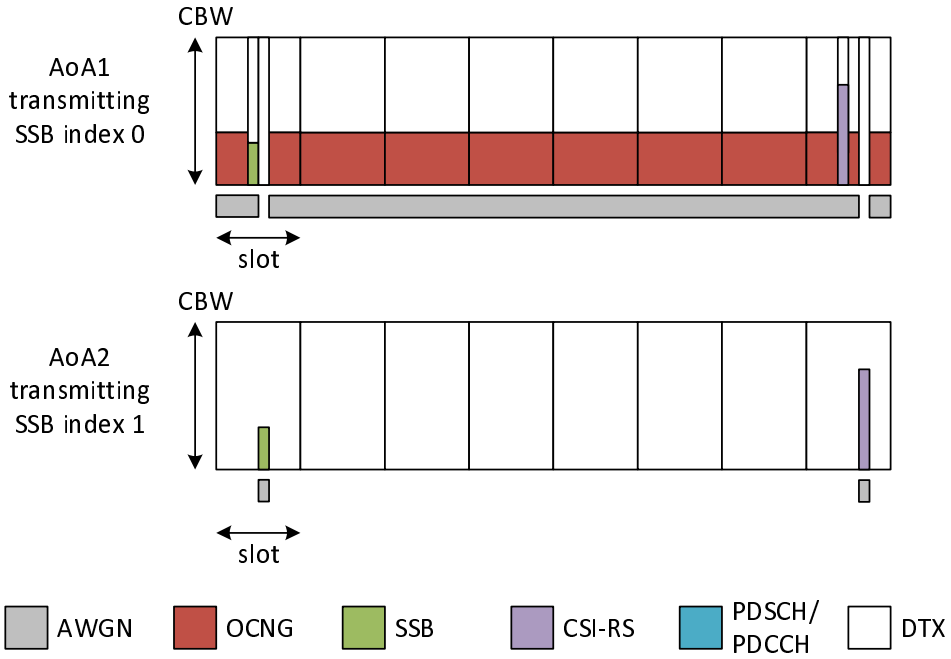


Figure A.7.5.1.10.1-2: Time multiplexed downlink transmissions

A.7.5.1.10.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.1.11 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with CSI-RS-based RLM in non-DRX mode when CD-SSB is outside active BWP

A.7.5.1.11.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used and when CD-SSB is outside active BWP. This test will partly verify the FR2 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test is for UE supporting *rlm-BM-BFD-CSI-RS-OutsideActiveBWP-r18* and the UE is not required past legacy test in A.7.5.1.5.

The test environment is the same as in A.7.5.1.5.

NOTE: The starting PRB index of the SSB can be any possible PRB index of the RF channel BW occurring after the last PRB of the DL active BWP.

The test requirements are the same as in A.7.5.1.5.2.

A.7.5.1.12 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with SSB-based RLM RS in non-DRX mode when CD-SSB is outside active BWP

A.7.5.1.12.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when CD-SSB is outside active BWP. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

The test environment is the same as in A.7.5.1.1 with following exceptions in Table A.7.5.1.1.1-2.

Parameter		Unit	Value
			Test 1
DL dedicated BWP configuration	Config 1		DLBWP.1.5
UL dedicated BWP configuration	Config 1		ULBWP.1.5

A.7.5.1.12.2 Test Requirements

The test requirements are the same as in A.7.5.1.1.2.

A.7.5.1.13 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with SSB-based RLM RS in non-DRX mode for UE supporting NCD-SSB based measurement outside active BWP

A.7.5.1.13.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.7.5.1.13 .1-1. The test parameters are given in Tables A.7.5.1.13 .1-2, A.7.5.1.13 .1-3, and A.7.5.1.13 .1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.13 .1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.7.5.1.13 .1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In addition to RLM-RS radio link monitoring using SSB index 0 and SSB index 1, the UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

Table A.7.5.1.13 .1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.7.5.1.13 .1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
$BW_{channel}$	Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1		24
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
TDD Configuration	Config 1		TDDConf.3.1
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.4 TDD
CD-SSB Configuration	Config 1		SSB.1 FR2
NCD-SSB Configuration	Config 1		SSB.19 FR2
SMTC Configuration	Config 1		SMTC pattern 1 for RedCap

Parameter			Unit	Value
				Test 1
PDSCH/PDCCH subcarrier spacing		Config 1		120 KHz
PRACH Configuration		Config 1		Table A.3.8.3.4
SSB index assigned as RLM RS		Config 1		0,1
OCNG parameters				OP.5
CP length				Normal
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				*gp0*
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1		TRS.2.1 TDD
T1			s	0.2
T2			s	9.68
T3			s	9.68
D1			s	9.64
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.1.13 .1-3: OTA related cell specific test parameters for FR2 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
AoA setup			Setup 3 defined in A.3.15					
			AoA1			AoA2		
Assumption for UE beams [Note 5]			Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4			Not sent		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0					
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
ssb-Index 0 SNR	Config 1	dB	2[Note 6]	-6[Note 6]	-15			
ssb-Index 1 SNR	Config 1		Not sent			2[Note 6]	-15	-15
N_{oc}	Config 1	dBm/ 15kHz	-92.1			-92.1		
Time multiplexing of the downlink transmissions from each AoA			Defined in Figure A.7.5.1.13 .1-2					
Propagation condition			TDL-A 30 ns 75 Hz			TDL-A 30 ns 75 Hz		

Parameter	Unit	Test 1					
		T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.							
NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band..							
NOTE 5: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.							
NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband							

Table A.7.5.1.13 .1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0

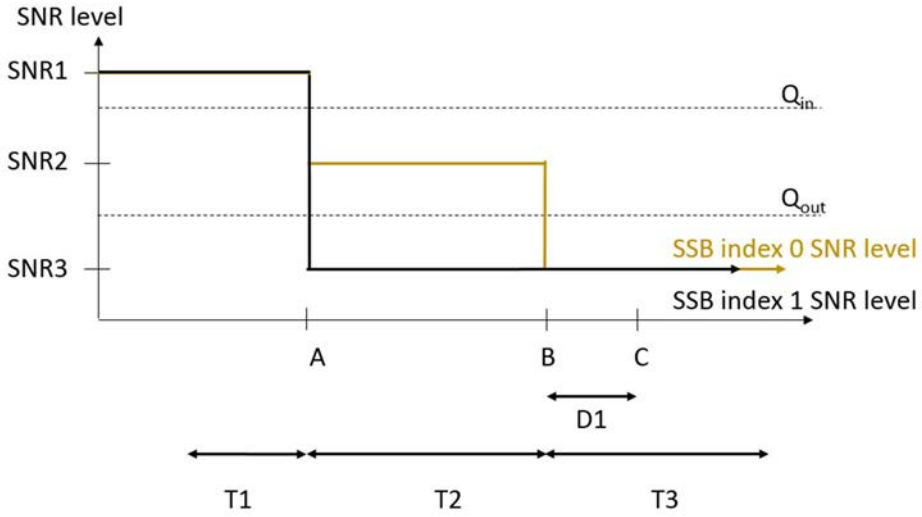


Figure A.7.5.1.13 .1-1: SNR variation for out-of-sync testing

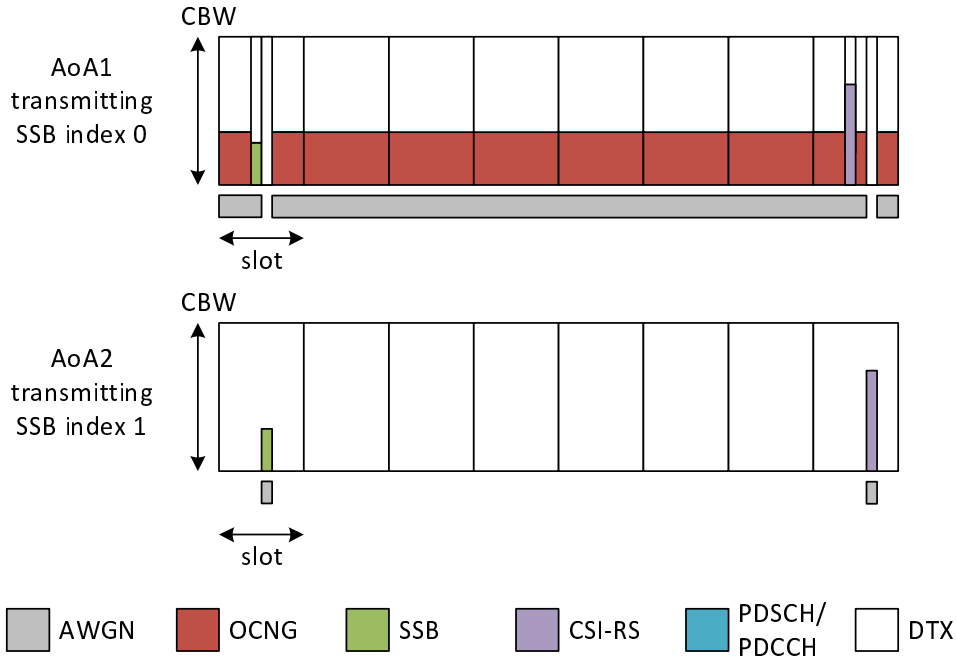


Figure A.7.5.1.13 .1-2: Time multiplexed downlink transmissions

A.7.5.1.13.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.2 Interruption

A.7.5.2.1 Interruptions during measurements on deactivated NR SCC in FR2

A.7.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE missed ACK/NACK rate does not exceed the limits at NR PSCell interruptions during the measurement on the deactivated NR SCC. This test will verify the missed ACK/NACK rate for PCell in standalone NR specified in clause 8.2.2.2. Supported test configurations are shown in table A.7.5.2.1.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.7.5.2.1.1-2 and A.7.5.2.1.1-3 below. In the test there are two cells: Cell 1 and Cell 2. Cell 1 is PCell, Cell 2 is an NR deactivated SCell. Cell 1 shall be configured as PCell and Cell 2 shall be configured as SCell.

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell 1 and Cell 2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector, defines the start of time period T1. During T1, PCell is continuously scheduled in DL.

Table A.7.5.2.1.1-1: Interruptions during measurements on deactivated NR SCC supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD – TDD duplex mode

Table A.7.5.2.1.1-2: General test parameters for interruptions during measurements on deactivated NR SCC in standalone NR

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two NR RF channels
Active PCell		Cell 1	PCell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Deactivated SCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell 1 and Cell 2
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.7.5.2.1.1-3: NR cell specific test parameters for interruptions during measurements on deactivated NR SCC in standalone NR

Parameter		Unit	Cell 1	Cell 2
Frequency Range			FR2	
Duplex mode			TDD	

Parameter		Unit	Cell 1	Cell 2
TDD configuration			TDDConf.3.1	
$BW_{channel}$			100 MHz: $N_{PRB,c}$ = 66	
Data PRBs allocated			66	
Initial DL BWP Configuration			DLBWP.0.2 Note4	
Initial UL BWP Configuration			ULBWP.0.2 Note6	
Downlink dedicated BWP Configuration			DLBWP.1.1	
Uplink dedicated BWP configuration			ULBWP.1.1	
PDSCH Reference measurement channel			SR.3.1 TDD	
RMSI CORESET parameters			CR.3.1 TDD	
Dedicated CORESET parameters			CCR.3.1 TDD	
OCNG Patterns			OP.1	
SMTC Configuration			SMTC.1	
SSB Configuration			SSB.1 FR2	
TCI State			TCI.State.0	
TRS Configuration			TRS.2.1 TDD	
Correlation Matrix and Antenna Configuration			1x2 Low	
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Time offset to Cell 1 Note 3		µs	-	3
Propagation Condition			AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in clause 12 of of TS 38.213 [3].

Table A.7.5.2.1.1-4: OTA related test parameters for interruptions during measurements on deactivated NR SCC in standalone NR

Parameter		Unit	Cell 1	Cell 2
Angle of arrival configuration			Setup1 according to table A.3.15.1	Setup 1according to table A.3.15.1
Assumption for UE beams Note 6			Rough	Rough
N_{OC} Note1	NR_TDD_FR2_A	dBm/15kHz	-104.7	-104.7
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
N_{OC} Note1	NR_TDD_FR2_A	dBm/SCS	-95.7	-95.7
	NR_TDD_FR2_B			

Parameter		Unit	Cell 1	Cell 2
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
SSB_RP[Note2]	NR_TDD_FR2_A	dBm/120KHz Note3	-88.7	-88.7
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
$\hat{E}_s/N_{oc}$		dB	7	7
$\hat{E}_s/I_{ot}$		dB	7	7
Io[Note2]	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-58.92	-58.92
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.2.1.2 Test Requirements

The UE shall be continuously scheduled on PCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5 % of ACK/NACK on PCell.

If the NR PCell is not in the same band as the deactivated SCell, the UE is only allowed to cause interruptions on NR PCell immediately before and immediately after an SMTC. Each interruption on NR PCell shall not exceed the value defined in Table A.7.5.2.1.2-1.

If the NR PCell is in the same band as the deactivated SCell, the UE is only allowed to cause an interruption on PCell no earlier than 4 slots before an SMTC and no later than 4 slots after the SMTC. the interruption on NR PCell shall not exceed the value defined in Table A.7.5.2.1.2-2.

Table A.7.5.2.1.2-1: Interruption duration if the PCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	4

Table A.7.5.2.1.2-2: Interruption duration if the PCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	8 + SMTC duration

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.2.2 SA interruptions at NR SRS carrier-based switching

A.7.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that when a UE needs to transmit aperiodic SRS, the UE can perform SRS carrier-based switching to a carrier not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission. The test will partly verify the interruption requirements on PCell in clause 8.2.2.2.9.

A.7.5.2.2.2 Test Parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the FR2 PCell. Cell 2 is an activated FR2 SCell on the TDD SCC which operats in downlink without PUCCH/PUSCH. The UE is configured with the SRS switching between PCell and SCell.The test parameters for PCell and SCell are given in Tables A.7.5.2.2.2-2, A.7.5.2.2.2-3, and A.7.5.2.2.2-4 below. The test consists of two successive time periods, with duration of T1 and T2, respectively. Immediately at the beginning of T2, the UE is triggered for SRS switching by DCI 2_3 scheduling. After T2, the UE is expected to transmit aperiodic SRS on a special slot in the configured TDD UL/DL configuration, as scheduled by DCI 2_3. The UE shall be scheduled on PCell continuously throughout the test.

The test equipment verifies that potential interruption is carried out correctly by monitoring ACK/NACK sent in PCell.

Table A.7.5.2.2.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.5.2.2.2-2: General test parameters for SA interruptions at NR SRS carrier-based switching

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1
Configured SCell		Cell 2	Activated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of PCell
T1	s	5	
T2	ms	100	UE shall perform SRS switching during T2

Table A.7.5.2.2.2-3: Cell-specific test parameters for SA interruptions at NR SRS carrier-based switching

Parameter		Unit	Cell 1	Cell 2
Frequency Range			FR2	
Duplex mode	Config 1		TDD	
TDD configuration	Config 1		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 66	
Downlink initial BWP Configuration	Config 1		DLBWP.0.1	
Downlink dedicated BWP Configuration	Config 1		DLBWP.1.1	
Uplink initial BWP configuration	Config 1		ULBWP.0.1	
Uplink dedicated BWP configuration	Config 1		ULBWP.1.1	
SRS configuration	Config 1		SRS.6 TDD	
TRS configuration	Config 1		TRS.2.1 TDD	
TCI state	Config 1		TCI.State.0	
PDSCH Reference measurement channel	Config 1		SR.3.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD	

Parameter		Unit	Cell 1	Cell 2
RMC CORESET Reference Channel	Config 1		CCR.3.1 TDD	
OCNG Patterns			OP.1	
SSB Configuration			SSB.1 FR2	
SMTC Configuration	Config 1		SMTC.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
$\hat{E}_s/N_{oc}$		dB	17	
Propagation Condition			AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Table A.7.5.2.2.2-4: OTA related test parameters

Parameter	Unit	Test 1	
		T1	T2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 6		Fine	
N_{oc} Note 1	dBm/15kHz Note 4	-112	
N_{oc} Note 1	dBm/SCS Note 3	-103	
$\hat{E}_s / N_{oc}$	dB	4	
SS-RSRP Note 2	dBm/SCS Note 4	-99	
$\hat{E}_s / I_{ot}$	dB	4	
Io Note2	dBm/95.04 MHz Note 4	-68.5	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.2.2.3 Test Requirements

During T2, interruption on PCell due to SRS carrier-based switching between Cell 1 and Cell 2 shall not exceed the required values specified in clause 8.2.2.2.9.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.3 SCell Activation and Deactivation Delay

A.7.5.3.1 SCell Activation and deactivation for SCell in FR2 intra-band in non-DRX

A.7.5.3.1.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.6.5.3.1.1 except the PCell and SCell are in FR2 intra-band.

The supported test configurations are shown in table A.7.5.3.1.1-1 below. The general test parameters are the same as defined in Table A.6.5.3.1.1-2 except those described in Tables A.7.5.3.1.1-2, and cell specific test parameters are described in Tables A.7.5.3.1.1-3. OTA related test parameters are shown in table A.7.5.3.1.1-4 below.

Table A.7.5.3.1.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.3.1.1-2: General test parameters for FR2 SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channels are used for this test, cell 1 and cell2 use RF channel 1 and 2, respectively.

Table A.7.5.3.1.1-3: Cell specific test parameters for FR2 SCell activation case

Parameter[Note 5]	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
SSB ARFCN		freq1			freq2		
Duplex mode		TDD					
TDD configuration		TDDConf.3.1					
Downlink initial BWP Configuration		DLBWP.0.1					
Downlink dedicated BWP Configuration		DLBWP.1.1					
Uplink initial BWP configuration		ULBWP.0.1					
Uplink dedicated BWP configuration		ULBWP.1.1					
TRS configuration		TRS.2.1 TDD					
TCI state		TCI.State.0					
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66					
Data PRBs allocated		66	66		66		
PDSCH Reference measurement channel		SR.3.1 TDD			-		
RMSI CORESET Parameters		CR.3.1 TDD			-		
Dedicated CORESET Parameters		CCR.3.1 TDD			-		
OCNG Patterns		OP.1					
SSB Configuration		SSB.1 FR2					
SMTC Configuration		SMTC.1					
CSI-RS configuration for CSI reporting		CSI-RS.3.1 TDD					
reportConfigType		periodic			N/A		
reportQuantity		cri-RI-PMI-CQI			N/A		
CSI reporting periodicity	slot	40			N/A		
CSI reporting offset	slot	4			N/A		
EPRE ratio of PSS to SSS	dB	0					
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS[Note 1]							
EPRE ratio of OCNG to OCNG DMRS [Note 1]							
Propagation conditions		AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void

Table A.7.5.3.1.1-4: OTA related test parameters for FR2 SCell activation case

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to table A.3.15.1			Setup 1 according to table A.3.15.1		
Assumption for UE beams Note 7		Rough			Rough		
N_{oc} Note1	dBm/15kHz Note4	-104.7			-104.7		
N_{oc} Note1	dBm/SCS Note3	-95.7			-95.7		
$\hat{E}_s / N_{oc}$	dB	7			7		
SSB_RP Note2	dBm/SCS Note4	-88.7			-88.7		
$\hat{E}_s / I_{ot}$	dB	7			7		
Io Note2	dBm/95.04 MHz Note4	-58.92			-58.92		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.3.1.2 Test Requirements

The test requirements defined in clause A.6.5.3.1.2 shall apply to this test case, except $T_{activation_time}$ will be replaced with the value $T_{FirstSSB}$ + 5 ms as defined in clause 8.3.

A.7.5.3.2 SCell Activation and deactivation for FR1+FR2 inter-band with target SCell in FR2

A.7.5.3.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.7.5.3.1.1 except the PCell is in FR1 and SCell is in FR2.

The supported test configurations are defined in Table A.7.5.3.2.1-1. The general test parameters are the same as defined in Table A.6.5.3.1.1-2 except that the length of T2 is 2 s. And cell specific test parameters are described in Tables A.7.5.3.2.1-2. OTA related test parameters are defined in Table A.7.5.3.2.1-3.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment 100 ms after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2.

During T2, the test equipment monitors the L1-RSRP measurement reporting for the SCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot $m+T_{L1\text{-}RSRP}$. In the next DL slot after slot $m+T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PCell during activation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell 1 deactivation command is sent until CSI reporting for SCell 1 is discontinued.

Table A.7.5.3.2.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.7.5.3.2.1-2: Cell specific test parameters for FR2 SCell activation case

Parameter[Note 5]		Unit	Cell 1			Cell 2		
			T1	T2			T1	T2
SSB ARFCN			Freq1				Freq2	
Duplex mode	Config 1		FDD				TDD	
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable			TDDConf.3.1		
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1					
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1					
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1					
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1					
TRS configuration	Config 1,2,3		N/A				TRS.2.1 TDD	
TCI state	Config 1,2,3		TCI.State.0					
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 3		40: $N_{PRB,c}$ = 106					
Data PRBs allocated	Config 1,2		52	66	52	66	52	66
	Config 3		106		106		106	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			-		
	Config 2		SR.1.1 TDD					
	Config 3		SR.2.1 TDD					
RMSI CORESET Parameters	Config 1		CR.1.1 FDD			-		
	Config 2		CR.1.1 TDD					
	Config 3		CR.2.1 TDD					
Dedicated CORESET Parameters	Config 1		CCR.1.1 FDD			-		
	Config 2		CCR.1.1 TDD					
	Config 3		CCR.2.1 TDD					
OCNG Patterns			OP.1					
SSB configuration	Config 1,2		SSB.1 FR1			SSB.3 FR2		
	Config 3		SSB.2 FR1					
CSI-RS configuration for CSI reporting	Config 1~3		N/A			N/A	CSI-RS.3.1 TDD [Note 6]	CSI-RS.3.1 TDD
reportConfigType for CSI reporting			periodic			N/A		
reportConfigType for L1-RSRP			periodic			N/A		

Parameter[Note 5]		Unit	Cell 1			Cell 2		
			T1	T2			T1	T2
reportQuantity for CSI reporting			cri-RI-PMI-CQI				N/A	
reportQuantity for L1-RSRP			ssb-Index-RSRP				N/A	
CSI reporting periodicity	Config 1,2	slot	5				N/A	
	Config 3		10					
L1-RSRP reporting periodicity [Note 7]	Config 1,2	slot	5				N/A	
	Config 3		10					
CSI reporting offset	Config 1,2	slot	2				N/A	
	Config 3		4					
L1-RSRP reporting offset	Config 1,2	slot	2				N/A	
	Config 3		4					
SMTC configuration			SMTC.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH_DMRS to SSS								
EPRE ratio of PBCH to PBCH_DMRS								
EPRE ratio of PDCCH_DMRS to SSS								
EPRE ratio of PDCCH to PDCCH_DMRS								
EPRE ratio of PDSCH_DMRS to SSS								
EPRE ratio of PDSCH to PDSCH_DMRS								
EPRE ratio of OCNG DMRS to SSS[Note 1]								
EPRE ratio of OCNG to OCNG DMRS [Note 1]								
Propagation conditions			N/A Link only, see clause A.3.7A			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: All parameters apply for configuration 1, 2 and 3
NOTE 6: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot $m+T_{L1\text{-}RSRP}$ during T2.
NOTE 7: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.3.2.1-3: OTA related test parameters for FR1 PCell activation case with FR2 SCell

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			N/A			According to clause A.3.15.1		
Assumption for UE beams [Note 7]			N/A			Rough		
N_{oc} [Note 1]	Config 1,2,3	dBm/15kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} [Note 1]	Config 1,2,3	dBm/SCS				-95.7		
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB				-∞	7	7
	Config 1,2,3	dB				-∞	7	7
SSB_RP[Note 2, Note 4]	Config 1,2,3	dBm/SCS				-∞	-88.7	-88.7
Io[Note 2, Note 4]	Config 1,2,3	dBm/95.04 MHz				-66.68	-58.92	-58.92

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.

A.7.5.3.2.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after at least one CSI-RS transmission occasion for channel measurement plus n_{CSI_ref} slots, as defined in 5.2.2.5 in [26], and reporting after slot (m+k). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PCell in the slot.

During T2 the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than

3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$

as defined in clause 8.3.2. For this test case, $T_{FirstSSB_MAX}$=T_{SMTC_MAX}=T_{rs}=20 ms; $T_{L1\text{-}RSRP,\ measure}$=160 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ 680 ms.

During T2 the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in Table A.5.5.3.1.1-2

- $T_{activation_time}$ = 3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows 710 ms

- $T_{CSI_Reporting}$ = 10 ms

- NR slot length is 0.125 ms for this test case.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, as defined in clause 8.3, where T_X =20 ms.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption of PCell due to activation of SCell shall not be more than the values specified for SA in Clause 8.2.2.2.7.

A.7.5.3.3 SCell Activation and deactivation for SCell in FR2 inter-band in non-DRX

A.7.5.3.3.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.7.5.3.1.1 except the PCell and SCell are in FR2 inter-band.

The supported test configurations are shown in table A.7.5.3.3.1-1 below. The general test parameters are described in Tables A.7.5.3.3.1-2, and cell specific test parameters are described in Tables A.7.5.3.3.1-3. OTA related test parameters are shown in table A.7.5.3.3.1-4 below.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell. A MAC message for activation of SCell is sent by the test equipment 100 ms after the RRC message, in a slot # denoted m.

The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2. Immediately at beginning of T2 the transmission power of Cell 2 is increased to same level as for PCell. During T2, the test equipment monitors the L1-RSRP measurement reporting for the SCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot m+$T_{L1\text{-}RSRP}$. In the next DL slot after slot m+$T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell 1 deactivation command is sent until CSI reporting for SCell is discontinued.

Table A.7.5.3.3.1-1: Supported test configurations for FR2 SCell activation in FR2 inter-band

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.3.3.1-2: General test parameters for FR2 SCell activation in FR2 inter-band

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channels are used for this test. RF channel number 1 is in band 1 and RF channel number 2 is in band 2, where bands 1 and 2 are inter-band CA operating bands in FR2 as specified in Table 5.2A.2-1 in TS 38.101-2 [19].
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2.
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every second subframe
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	μs	≤8	A random value from 0μs to 8μs
T1	s	7	During this time the PCell shall be known and the SCell configured and detected.
T2	s	2	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI_Reporting}$	ms	2	the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.7.5.3.3.1-3: Cell specific test parameters for FR2 SCell activation in FR2 inter-band

Parameter[Note 5]	Unit	T1		T2		T3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
Downlink initial BWP Configuration		DLBWP.0.1		DLBWP.0.1		DLBWP.0.1	
Downlink dedicated BWP Configuration		DLBWP.1.1		DLBWP.1.1		DLBWP.1.1	
Uplink initial BWP configuration		ULBWP.0.1		ULBWP.0.1		ULBWP.0.1	

Parameter[Note 5]	Unit	T1		T2		T3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Uplink dedicated BWP configuration		ULBWP.1.1		ULBWP.1.1		ULBWP.1.1	
TRS configuration		TRS.2.1 TDD		TRS.2.1 TDD		TRS.2.1 TDD	
TCI state		TCI.State.0		TCI.State.0		TCI.State.0	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Parameters		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Parameters		CCR.3.1 TDD	-	CCR.3.1 TDD	-	CCR.3.1 TDD	-
CSI-RS configuration		NA	NA	NA	CSI-RS.3.1 TDD Note 2	NA	CSI-RS.3.1 TDD
CSI reporting periodicity [Note 3]		NA	5	NA	5	NA	5
OCNG Patterns		OP.1					
SSB Configuration		SSB.1 FR2					
SMTC Configuration		SMTC.1					
EPRE ratio of PSS to SSS	dB	0					
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS[Note 1]							
EPRE ratio of OCNG to OCNG DMRS [Note 1]							
Propagation conditions		AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
NOTE 3: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.3.3.1-4: OTA related test parameters for FR2 SCell activation in FR2 inter-band

Parameter[Note 6]	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 3 as specified in clause A.3.15					
		AoA1			AoA2		
Assumption for UE beams [Note 7]		Rough			Rough		
N_{oc} [Note1]	dBm/15kHz[Note4]	-92.1			-92.1		
N_{oc} [Note1]	dBm/SCS[Note3]	-83.1			-83.1		
$\hat{E}_s / N_{oc}$	dB	0			0		
SS-RSRP[Note2]	dBm/SCS [Note4]	-83.1			-83.1		
$\hat{E}_s / I_{ot}$	dB	0			0		
Io[Note2]	dBm/95.04 MHz [Note4]	-51.1			-51.1		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: All parameters apply for configuration 1
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.3.3.2 Test Requirements

During T2 the UE shall start sending CSI report for the SCell in the configured slots for CSI reporting after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k). UE shall send the first CSI report for SCell after receiving at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k), or in the next available uplink resource for CSI reporting if the slot was subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PCell in the slot.

During T2, the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than 3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ as defined in clause 8.3.2. For this test case, $T_{FirstSSB_MAX}$=T_{SMTC_MAX}=T_{rs}=20 ms; $T_{L1\text{-}RSRP,\ measure}$=480 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ =1000 ms.

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in Table A.7.5.3.3.1-2
- $T_{activation_time}$ = 3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows 1030 ms
- $T_{CSI_Reporting}$ = 10 ms
- NR slot length is 0.125 ms for this test case.

During T2, the interruption of PCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, where T_X =20 ms.

During T3, the UE shall stop sending CSI reports for SCell no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T3, the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$ as defined in clause 8.3.

A.7.5.3.4 Direct SCell activation at SCell addition of known SCell in FR2

A.7.5.3.4.1 Test Purpose and Environment

The purpose of this test is to verify that the delay and interruption for direct SCell activation delay at SCell addition are within the requirements stated in clause 8.3.4.

The supported test configurations are shown in Table A.7.5.3.4.1-1 below. The general test parameters are given in Table A.7.5.3.4.1-2 and cell-specific test parameters in Table A.7.5.3.4.1-3. OTA related test parameters are shown in Table A.7.5.3.4.1-4.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two FR2 carriers and two NR cells. Before the test starts the UE is connected to Cell 1 (PCell) on carrier #1, but is not aware of Cell 2 on NR carrier #2. Cell 1 and Cell 2 have constant signal levels throughout the test. The UE is monitoring the PCell. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the Cell 2 is monitored by the UE. During T1, Cell 2 should be detected and measured by the UE such that it meets the condition for known cell defined in clause 8.3.4 for direct SCell activation.

Time period T2 starts when the *RRCReconfiguration* message for the configuration and activation of Cell 2 (the SCell), which is sent from the test equipment, is received at the UE antenna connector in a slot # denoted m. The test equipment shall set the parameter *sCellState* to *activated* for the SCell, which causes Cell 2 to become configured and activated.

Time period T3 starts at (m + N_{direct}), at which point UE shall be reporting a valid CQI for both PCell and SCell.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during the activation of SCell. The test equipment verifies the activation time by counting the slots from the time when the SCell activation message is sent until a CQI report with other than CQI index 0 is received.

Table A.7.5.3.4.1-1: Supported test configurations

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.3.4.1-2: General test parameters

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channels (1,2) in FR2 are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured and activated SCell		Cell 2	Configured and activated SCell on NR RF channel number 2.
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
SCell measurement cycle (measCycleSCell)	ms	160	
T1	s	7	During this time the measurement for Cell 2 is configured, and Cell 2 is detected.
T2	s	N_{direct}	During this time the UE shall configure and activate Cell 2 as SCell.
T3	ms	100	During this time the UE shall report valid CQI for both PCell and SCell.
A3-offset	dB	-15	
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
k	slot	$k_1 + 3 \cdot N_{slot}^{subframe,\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.7.5.3.4.1-3: Cell specific test parameters

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2		
Duplex mode	Config 1		TDD					
TDD configuration	Config 1		TDDConf.3.1					
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 66					
DL initial BWP configuration	Config 1		DLBWP.0.1					
DL dedicated BWP configuration	Config 1		DLBWP.1.1					
UL initial BWP configuration	Config 1		ULBWP.0.1					
UL dedicated BWP configuration	Config 1		ULBWP.1.1					
Timing offset to Cell 1		ms	Not Applicable			0		
PDSCH Reference measurement channel	Config 1		SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD			CR.3.1 TDD		
RMC CORESET Reference Channel	Config 1		CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration	Config 1		TRS.2.1 TDD			TRS.2.1 TDD		
CSI-RS configuration	Config 1		CSI-RS.3.1 TDD			CSI-RS.3.1 TDD		
CSI reporting periodicity	Config 1	ms	5			5		
OCNG Patterns			OP.1					
SMTC configuration			SMTC.1					
SSB configuration	Config 1		SSB.1 FR2			SSB.1 FR2		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
Propagation condition	-	AWGN					
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							

Table A.7.5.3.4.1-4: OTA related test parameters

Parameter[Note 6]	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to A.3.15.1					
Assumption for UE beams[Note 7]		Rough			Rough		
N_{oc} [Note1]	dBm/15kHz[Note4]	-112			-112		
N_{oc} [Note1]	dBm/SCS[Note3]	-102.97			-102.97		
$\hat{E}_s / N_{oc}$	dB	14			14		
SS-RSRP[Note2]	dBm/SCS [Note4]	-88.97			-88.97		
$\hat{E}_s / I_{ot}$	dB	14			14		
Io[Note2]	dBm/95.04 MHz [Note4]	-59.81			-59.81		
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone							
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone							
NOTE 6: All parameters apply for configuration 1							
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation							

A.7.5.3.4.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PCell in the slot.

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{N_{direct}}{NR\ slot\ length}$, where

$$N_{direct} = T_{RRC_Process} + T_1 + T_{activation_time} + T_{CSI_Reporting} - 3 \text{ ms},$$

- $T_{RRC_Process}$ = 16 ms, which is the RRC procedure delay defined for SCell addition in clause 12 of TS 38.331 [2],

- T_1 is the delay from slot m + $T_{RRC_Process}$ until the transmission of *RRCReconfigurationComplete* message,

- $T_{activation_time} = T_{FirstSSB}$ + 5 ms = 25 ms,

- $T_{CSI_Reporting}$ = 10 ms

This gives a total of $N_{direct} = 16 + T_1 + 25 + 10 - 3 = (48 + T_1)$ ms, and NR slot length is 0.125 ms.

During T3 the UE shall send CSI reports for SCell with non-zero CQI index and continue to send CSI reports for SCell with non-zero CQI index until the end of T3.

During T2 interruption of PSCell during SCell activation shall not happen outside the window from slot *m*+1 to slot $m+1+\frac{T_{RRC_Process}+T_1+T_X}{NR\,slot\,length}$ as defined in clause 8.3.4, where T_X =20 ms.

The interruption of PCell due to activation of SCell shall not be more than the values specified for NR SA in clause 8.2.2.2.11.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot m + $\frac{N_{direct}}{NR\,slot\,length}$ as defined in clause 8.3.4 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.7.5.3.5 Direct SCell activation at handover with known SCell in FR2

A.7.5.3.5.1 Test Purpose and Environment

This test is to verify the requirements specified in sub clause 8.3.5 for the FR2 intra-frequency handover with direct SCell activation.

The test scenario comprises of three FR2 cells, one source PCell (Cell 1), one target PCell (Cell 2) and one SCell (Cell 3). The test consists of three successive time periods, with time durations of T1, T2, and T3 respectively.

At the start of time duration T1, the UE is in connected mode with PCell (Cell 1). Both Cell 2 and Cell 3 are known to UE and UE is reporting CQI for all Cell 1.

Time period T2 starts when UE receives a handover command that initiate handover of UE to Cell 2 and also activates Cell 3. This is done using an *RRCConnectionReconfiguration* message with parameter *sCellState* set to *activated* for the Cell 3. The message is sent from the test equipment to the UE and is received in a slot number n at the UE antenna connector. The UE shall accomplish the handover, addition and activation of the SCell no later than slot (n $+\frac{N_{direct}}{NR\,slot\,length}$).

Time period T3 starts at (n $+\frac{N_{direct}}{NR\,slot\,length}$), at which point UE shall be reporting a valid CSI for both Cell 2 and Cell 3 as given in tables A.7.5.3.5.1-1 and A.7.5.3.5.1-2.

Table A.7.5.3.5.1-1: Supported test configurations for FR2 handover with direct SCell activation case

Configuration	Description
1	SCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.3.5.1-2: General test parameters for FR2 handover with direct SCell activation case

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two NR radio channels are used for this test, Cell 1 and Cell 2 use RF channel 1 and Cell 3 use RF channel 2 respectively.
A4-Offset		dB	-15	
Time offset between cells			3 µs	Synchronous cells
Initial conditions	Source cell		Cell 1	Source Cell
	Target cell		Cell 2	Neighbour cell
	SCell		Cell 3	SCell is not added and activated
Final condition	Source cell		Cell 2	Cell 2 is Source cell after handover
	Neighbour cell		Cell 1	Neighbour cell
	SCell		Cell 3	SCell is added and activated

Table A.7.5.3.5.1-3: Cell specific test parameters for FR2 SCell activation case

Parameter[Note 5]	Unit	T1			T2			T3		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3
SSB ARFCN		freq1	freq1	freq 2	freq1	freq1	freq 2	freq1	freq1	freq2
Duplex mode		TDD			TDD			TDD		
TDD configuration		TDDConf.3.1			TDDConf.3.1			TDDConf.3.1		
Downlink initial BWP Configuration		DLBWP.0.1			DLBWP.0.1			DLBWP.0.1		
Downlink dedicated BWP Configuration		DLBWP.1.1			DLBWP.1.1			DLBWP.1.1		
Uplink initial BWP configuration		ULBWP.0.1			ULBWP.0.1			ULBWP.0.1		
Uplink dedicated BWP configuration		ULBWP.1.1			ULBWP.1.1			ULBWP.1.1		
TRS configuration		TRS.2.1 TDD			TRS.2.1 TDD			TRS.2.1 TDD		
TCI state		TCI.State.0			TCI.State.0			TCI.State.0		
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
PDSCH Reference measurement channel		SR.3.1 TDD		-	SR.3.1 TDD		-	SR.3.1 TDD		
RMSI CORESET Parameters		CR.3.1 TDD		-	CR.3.1 TDD		-	CR.3.1 TDD		
Dedicated CORESET Parameters		CCR.3.1 TDD		-	CCR.3.1 TDD		-	CCR.3.1 TDD		
OCNG Patterns		OP.1								
SSB Configuration		SSB.1 FR2								
SMTC Configuration		SMTC.1								
PRACH configuration		FR2 PRACH configuration 1								
CSI-RS configuration for CSI reporting		CSI-RS.3.1 TDD								
reportConfigType		periodic		-	periodic		-	periodic		-
reportQuantity		cri-RI-PMI-CQI		-	cri-RI-PMI-CQI		-	cri-RI-PMI-CQI		-
CSI reporting periodicity	slot	40		-	40		-	40		-
CSI reporting offset	slot	4		-	4		-	4		-
EPRE ratio of PSS to SSS	dB	0								
EPRE ratio of PBCH_DMRS to SSS										
EPRE ratio of PBCH to PBCH_DMRS										
EPRE ratio of PDCCH_DMRS to SSS										
EPRE ratio of PDCCH to PDCCH_DMRS										
EPRE ratio of PDSCH_DMRS to SSS										
EPRE ratio of PDSCH to PDSCH_DMRS										
EPRE ratio of OCNG DMRS to SSS[Note 1]										
EPRE ratio of OCNG to OCNG DMRS[Note 1]										
Propagation conditions		AWGN								

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: Void

Table A.7.5.3.5.1-4: OTA related test parameters for FR2 SCell activation case

Parameter Note 6	Unit	Cell 1			Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to table A.3.15.1			Setup 1 according to table A.3.15.1			Setup 1 according to table A.3.15.1		
Assumption for UE beams Note 7		Rough			Rough			Rough		
N_{oc} Note1	dBm/15kHz Note4	-112			-112			-112		
N_{oc} Note1	dBm/SCS Note3	-102.97			-102.97			-102.97		
$\hat{E}_s / N_{oc}$	dB	14			14			14		
SS-RSRP Note2	dBm/SCS Note4	-88.97			-88.97			-88.97		
$\hat{E}_s / I_{ot}$	dB	14			14			14		
Io Note2	dBm/95.04 MHz Note4	-56.89			-56.89			-59.81		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.3.5.2 Test Requirements

The UE shall be capable to transmit valid CSI report for PCell (Cell 2) and to the directly activated SCell 1 no later than in slot n+ N_{direct}.

The SCell activation delay, N_{direct}, can be expressed as: $N_{direct} = T_{RRC_process} + T_{interrupt} + T_2 + T_3 + T_{activation_time} + T_{CSI_Reporting}$ - 3 ms; Where:

- $T_{RRC_Process}$: RRC procedure delay defined in clause 12 of TS 38.331 and it is equal to 16 ms,
- $T_{interrupt}$: Interruption time during handover as specified in clause 6.1.1. The value to be verified in the test is 52 ms ($T_{interrupt}$ = 0 ms for T_{search} + 10 ms for T_{IU} + 20 ms for $T_{processing}$ + 20 ms for T_{Δ} + 2 ms for T_{margin} ms) by assuming known SCell and SMTC.1 configuration.
- T_2: Delay from slot $n + \frac{T_{RRC_Process} + T_{interrupt}}{\text{NR slot length}}$ until UE has obtained a valid TA command for the target PCell,
- T_3: Delay for applying the received TA for uplink transmission in the target PCell, and greater than or equal to k+1 slot, where k is defined in clause 4.2 in TS 38.213,
- $T_{activation_time}$ and $T_{CSI_Reporting}$ are specified in clause 8.3.2, where the following definitions of $T_{FirstSSB}$ and $T_{FirstSSB_MAX}$ as defined in clause 8.3.5 shall apply:

During time period T2 of the test, the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot n + $\frac{T_{HARQ} + T_{activtion_time} + T_{CSI_Reporting}}{NR\ slot\ length}$, $T_{activation_time} = T_{SMTC_SCell}$ + 5 ms, as defined in clause 8.3.

During time period T3 of the test, the UE shall stop sending CSI reports for SCell at latest in a slot m + $\frac{T_{HARQ} + 3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During time period T2 of the test, interruption of PCell / PSCell during SCell activation shall not happen outside the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ} + 3\ ms + T_X}{\text{NR slot length}} + N_{interruption}$, as defined in clause 8.3.

During time period T3 of the test, the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot m + 1 + $\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to m + 1 + $\frac{\mathrm{T_{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During time period T2 of the test, if there are no uplink resources for reporting the valid CSI in a slot $\frac{\mathrm{T_{HARQ}}+T_{\mathrm{activtion_time}}+T_{\mathrm{CSI_Reporting}}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.7.5.3.6 PUCCH SCell activation and deactivation for FR1+FR2 inter-band with target SCell in FR2 and known

A.7.5.3.6.1 Test Purpose and Environment

The purpose of this test is to verify that the PUCCH SCell activation and deactivation times are within the requirements stated in clause 8.3.12 and 8.3.14, when the PUCCH SCell in FR2 is known by the UE at the time of activation.

The supported test configurations are shown in table A.7.5.3.6.1-1 below. The test parameters are given in Tables A.7.5.3.6.1-2 and cell-specific parameters in A.7.5.3.6.1-3 below. The test consists of four successive time periods, with duration of T1, T2 T3, and T4 respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 but is not aware of Cell 2. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the PUCCH SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI for the activated PUCCH SCell at latest in slot n+ $\frac{T_{HARQ}+T_{delay_\mathrm{multiple_SCells_PUCCH_SCell}}}{NR\ slot\ length}$, and report valid CSI for the activated DL SCell at latest in slot n+$\frac{T_{HARQ}+T_{delay_\mathrm{multiple_SCells_other_SCell}}}{NR\ slot\ length}$, as defined in clause 8.3.13. In this test case, both valid TA and invalid TA cases shall be tested.

Test for case when UE has valid TA: the *TimeAlignmentTimer* [2] associated with the TAG containing the PUCCH SCell is running, and $T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + [X]*T_{target_PL_RS} + T_{CSI_Reporting}$.

Test for case when UE do not have valid TA: $T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + \max((T_{First_available_CSI} + T_{CSI_processing}), [X]*T_{target_PL_RS}, (T1+T2+T3)) + T_{CSI_reporting_after}$

$T_{activation_time_multiple_scells}$ is the target SCell activation delay in millisecond in multiple SCell activation scenario as specified in clause 8.3.7

Any PCell interruption due to activation of PUCCH SCell shall occur in the slot $n + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2

Time period T3 starts when a MAC message for deactivation of PUCCH SCell abd DL SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot m + $\frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3.14and the starting point of any PCell interruption due to the deactivation shall occur in the slot m + 1 + $\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to m + 1 + $\frac{\mathrm{T_{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.14.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of PUCCH SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.7.5.3.6.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.7.5.3.6.1-2: Cell specific test parameters for FR2 SCell activation case

Parameter Note 5		Unit	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
SSB ARFCN			Freq1				Freq2			
Duplex mode	Config 1		FDD				TDD			
	Config 2,3		TDD							
TDD configuration	Config 1		Not Applicable				TDDConf.3.1			
	Config 2		TDDConf.1.1							
	Config 3		TDDConf.2.1							
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1							
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1							
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1							
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1							
TRS configuration	Config 1,2,3		N/A				TRS.2.1 TDD			
TCI state	Config 1,2,3		TCI.State.0							
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52				100: $N_{PRB,c}$ = 66			
	Config 3		40: $N_{PRB,c}$ = 106							
Data PRBs allocated	Config 1,2		52	66	52		66	52	66	
	Config 3		106		106			106		
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD				-			
	Config 2		SR.1.1 TDD							
	Config 3		SR.2.1 TDD							
RMSI CORESET Parameters	Config 1		CR.1.1 FDD				-			
	Config 2		CR.1.1 TDD							
	Config 3		CR.2.1 TDD							
Dedicated CORESET Parameters	Config 1		CCR.1.1 FDD				-			
	Config 2		CCR.1.1 TDD							
	Config 3		CCR.2.1 TDD							
OCNG Patterns			OP.1							
SSB configuration	Config 1,2		SSB.1 FR1				SSB.3 FR2			
	Config 3		SSB.2 FR1							
CSI-RS configuration for CSI reporting	Config 3		N/A				CSI-RS.3.1 TDD			
reportConfigType for CSI reporting							periodic			
reportQuantity for CSI reporting							cri-RI-PMI-CQI			
CSI reporting periodicity	Config 3	slot					40			
CSI reporting offset	Config 3	slot					8			
SMTC configuration			SMTC.1							
EPRE ratio of PSS to SSS		dB	0							

Parameter Note 5	Unit	Cell 1				Cell 2			
		T1	T2	T3	T4	T1	T2	T3	T4
EPRE ratio of PBCH_DMRS to SSS									
EPRE ratio of PBCH to PBCH_DMRS									
EPRE ratio of PDCCH_DMRS to SSS									
EPRE ratio of PDCCH to PDCCH_DMRS									
EPRE ratio of PDSCH_DMRS to SSS									
EPRE ratio of PDSCH to PDSCH_DMRS									
EPRE ratio of OCNG DMRS to SSS Note 1									
EPRE ratio of OCNG to OCNG DMRS Note 1									
Propagation conditions		N/A Link only, see clause A.3.7A				AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: All parameters apply for configuration 1, 2 and 3

Table A.7.5.3.6.1-3: OTA related test parameters for FR2 SCell with FR1 PCell

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			N/A			According to clause A.3.15.1		
Assumption for UE beams Note 7			N/A			Rough		
N_{oc} Note 1	Config 1,2,3	dBm/15kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} Note 1	Config 1,2,3	dBm/SCS				-95.7		
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB				-∞	7	7
[illegible]	Config 1,2,3	dB				-∞	7	7
SSB_RP Note 2, Note 4	Config 1,2,3	dBm/SCS				-∞	-88.7	-88.7
Io Note 2, Note 4	Config 1,2,3	dBm/95.04 MHz				-66.68	-58.92	-58.92

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.

A.7.5.3.6.2 Test Requirements

By end of T2 the UE shall finish the DL activation for the PUCCH SCell. Assuming the periodic CSI reporting is used and assuming periodic CSI activation and TCI state is sent along with SCell activation MAC CE, UE shall finish the DL activation by slot n+ 10 ms + T_{HARQ} + $T_{FineTiming}$

With SSB periodicity of 20 ms, UE shall complete DL activation of PUCCH SCell with in 30 ms after transmitting HARQ message for SCell activation command.

During T2 the UE shall start sending PRACH preamble to TE and shall obtain the TA command from TA and shall be ready to send valid CSI report to the TE. CSI report shall be transmitted within 30 ms + [X=0] + max (($T_{First_available_CSI}$ + $T_{CSI_processing}$), (T1+T2+T3)) + $T_{CSI_reporting_after}$ from the transmission of HARQ feedback of SCell activation command as specified in the 8.3.12.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot n + $\frac{\mathrm{T_{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $m + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}}$, as defined in clause 8.3, where T_X =20 ms.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot n + 1 + $\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to n + 1 + $\frac{\mathrm{T_{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption of PCell due to activation of SCell shall not be more than the values specified for SA in Clause 8.2.2.2.7.

A.7.5.3.7 PUCCH SCell activation and deactivation delay requirements of FR2 unknown cell with FR1 PCell

A.7.5.3.7.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.7.5.3.7.1 except the PUCCH SCell in FR2 is unknown.

The supported test configurations and the general test parameters are defined in Table A.7.5.3.7.1-1 and Table A.7.5.3.7.1-2, respectively. And cell specific test parameters are described in Tables A.7.5.3.7.1-3. OTA related test parameters are defined in Table A.7.5.3.7.1-4. In all test cases, two cells are used. Cell 1 is the FR1 PCell in the primary Timing Advance Group (pTAG) and cell 2 is the FR2 PUCCH SCell in the secondary Timing Advance Group (sTAG).

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment T1 after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2. At the time of T2, the UE does not have a valid TA for the SCell in sTAG. Immediately at the beginning of T2 the transmission power of Cell 2 is increased to same level as for cell 2

During T2, the test equipment monitors the L1-RSRP measurement result for the SCell reported on the PCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot m+$T_{L1\text{-}RSRP}$. In the next DL slot after slot m+$T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCell and PUCCH-SpatialRelation of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell. T_{HARQ} + $T_{activation_time}$ after slot m, the UE shall be able to monitor PDCCH on the SCell that triggers PDCCH order-based contention-free PRACH. The test equipment receives the PRACH and sends random access response with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value estimated from the PRACH. The UE shall start reporting CSI of the SCell with non-zero CQI index via PUCCH on the SCell no later than slot m + (T_{HARQ} + $T_{delay_PUCCH_SCell}$)/NR slot length. Here, $T_{activation_time}$ is the SCell activation delay defined in 8.3.2 for FR2 unknown SCell with periodic CSI-RS used for CSI reporting, and $T_{delay_PUCCH_SCell}$ is the PUCCH SCell activation delay defined in 8.3.12 for an invalid TA scenario.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during the activation of the SCell.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting on the SCell is discontinued.

Table A.7.5.3.7.11: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

	Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.7.5.3.7.1-2: General test parameters for unknown FR2 PUCCH SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated PUCCH SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	μs	≤25	A random value from 0μs to 25μs
T1	s	7	During this time the PCell shall be known and the SCell configured and detected.
T2	s	2	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2] and TS 38.213 [3].

Table A.7.5.3.7.1-3: Cell specific test parameters for FR2 PUCCH SCell activation case

Parameter[Note 5]		Unit	Cell 1			Cell 2		
			T1	T2			T1	T2
SSB ARFCN			Freq1			Freq2		
Duplex mode	Config 1		FDD			TDD		
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable		TDDConf.3.1			
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1					
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1					
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1					

Parameter[Note 5]		Unit	Cell 1			Cell 2		
			T1	T2			T1	T2
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1					
TRS configuration	Config 1,2,3		N/A			TRS.2.1 TDD		
TCI state	Config 1,2,3		TCI.State.0					
PUCCH Spatial Relation	Config 1,2,3		N/A			PUCCH.SRI.0		
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 3		40: $N_{PRB,c}$ = 106					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			SR.3.1 TDD		
	Config 2		SR.1.1 TDD					
	Config 3		SR.2.1 TDD					
RMSI CORESET Parameters	Config 1		CR.1.1 FDD			-		
	Config 2		CR.1.1 TDD					
	Config 3		CR.2.1 TDD					
Dedicated CORESET Parameters	Config 1		CCR.1.1 FDD			CCR.3.1 TDD		
	Config 2		CCR.1.1 TDD					
	Config 3		CCR.2.1 TDD					
OCNG Patterns			OP.1					
SSB configuration	Config 1,2		SSB.1 FR1			SSB.3 FR2		
	Config 3		SSB.2 FR1					
CSI-RS configuration for CSI reporting	Config 1,2,3		N/A			N/A	CSI-RS.3.1 TDD [Note 6]	CSI-RS.3.1 TDD
TimeAlignmentTimer for pTAG	Config 1,2,3		ms500			N/A		
TimeAlignmentTimer for sTAG	Config 1,2,3		N/A			ms500		
reportConfigType for CSI reporting			-			Periodic		
reportConfigType for L1-RSRP			periodic			-		
reportQuantity for CSI reporting			-			cri-RI-PMI-CQI		
reportQuantity for L1-RSRP			ssb-Index-RSRP			-		
CSI reporting periodicity	Config 1,2	slot	-			40		
	Config 3		-					
L1-RSRP reporting periodicity [Note 7]	Config 1,2	slot	5			-		
	Config 3		10					
CSI reporting offset	Config 1,2	slot	-			4		
	Config 3		-					
L1-RSRP reporting offset	Config 1,2	slot	2			-		
	Config 3		4					
SMTC configuration			SMTC.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH_DMRS to SSS								
EPRE ratio of PBCH to PBCH_DMRS								
EPRE ratio of PDCCH_DMRS to SSS								
EPRE ratio of PDCCH to PDCCH_DMRS								
EPRE ratio of PDSCH_DMRS to SSS								
EPRE ratio of PDSCH to PDSCH_DMRS								
EPRE ratio of OCNG DMRS to SSS[Note 1]								
EPRE ratio of OCNG to OCNG DMRS [Note 1]								
Propagation conditions			N/A Link only, see clause A.3.7A			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void
NOTE 6: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.

Parameter[Note 5]	Unit	Cell 1			Cell 2		
		T1	T2			T1	T2
NOTE 7: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.							

Table A.7.5.3.7.1-4: OTA related test parameters for FR2 PUCCH SCell activation

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			N/A			According to clause A.3.15.1		
Assumption for UE beams [Note 7]			N/A			Rough		
N_{oc} [Note 1]	Config 1,2,3	dBm/15kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} [Note 1]	Config 1,2,3	dBm/SCS				-95.7		
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB				-∞	7	7
$\hat{E}_s / I_{ot}$	Config 1,2,3	dB				-∞	7	7
SSB_RP[Note 2, Note 4]	Config 1,2,3	dBm/SCS				-∞	-88.7	-88.7
Io[Note 2, Note 4]	Config 1,2,3	dBm/95.04 MHz				-66.68	-58.92	-58.92

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.

A.7.5.3.7.2 Test Requirements

During T2 the UE shall start sending a valid L1-RSRP report of the SCell to the PCell in the configured slots for CSI reporting after slot ($m+T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than 3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ as defined in clause 8.3.2.

During T2 the UE shall start sending CSI reports of the SCell with non-zero CQI index via PUCCH on the SCell in the configured slots for CSI reporting no later than slot $m + \frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$ as defined in clause 8.3.12.

During T3 the UE shall stop sending CSI reports on the SCell no later than slot $n + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.14.

During T2 interruption of PCell during the SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, as defined in clause 8.3, where T_X =20 ms. If the UE is not capable of parallelTxPRACH-SRS-PUCCH-PUSCH additional interruption can be allowed as defined in Clause 8.2.2.2.18.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot $n + 1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to $n + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.14.

The interruption of PCell due to activation of SCell shall not be more than the values specified for SA in Clause 8.2.2.2.18.

A.7.5.3.8 SCell Activation and deactivation for known PUCCH SCell in FR2 inter-band in non-DRX

A.7.5.3.8.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements specified in clause 8.3, when PUCCH for a being activated SCell is configured on the SCell. The PCell and SCell are inter-band in FR2 and the SCell is known by a UE. The test shall be performed for the cases respectively where UE has valid TA and where UE does not have valid TA for an sTAG which the SCell belongs to at the time of activation.

The supported test configurations are shown in table A.7.5.3.8.11-1 below. The general test parameters are described in Tables A.7.5.3.8.1-2, and cell specific test parameters are described in Tables A.7.5.3.8.1-3. OTA related test parameters are shown in table A.7.5.3.8.1-4 below.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. The UE shall be continuously scheduled in the PCell (Cell 1) throughout the whole test.

Before the test starts, the UE is connected to the Cell 1 (PCell) on radio channel 1 but is not aware of Cell 2 (SCell) on radio channel 2. The PCell is in the pTAG and the SCell is in an sTAG. The UE is only monitoring the PCell.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured with PUCCH on radio channel 2. The UE now starts monitoring the Cell 2. During T1, Cell 2 should be detected and measured by the UE such that it meets the condition for known cell defined in clause 8.3.2 for SCell activation.

A MAC message for activation of SCell is sent by the test equipment in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2.

During T2,

- When the UE has a valid TA, the UE shall be able to report valid CSI for the activated SCell no later than in slot n+$\frac{T_{HARQ}+T_{activation_time}+[X]*T_{target_PL-RS}+T_{CSI_Reporting}}{NR\ slot\ length}$, as defined in clause 8.3.12.
- When the UE does not have a valid TA, the test equipment should send a PDCCH order to the UE to initiate RA procedure on the PUCCH SCell no later than in slot n+$\frac{T_{HARQ}+T_{activation_time}}{NR\ slot\ length}$, and the UE shall be able to report valid CSI for the activated SCell no later than in slot n + $\frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$, as defined in clause 8.3.12.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot n + $\frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3, and the starting point of any PCell interruption due to the deactivation shall occur in the slot m + 1 + $\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to m + 1 + $\frac{\mathrm{T_{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and the deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received from the PUCCH SCell.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting from the PUCCH SCell is discontinued.

Table A.7.5.3.8.1-1: Supported test configurations for FR2 PUCCH SCell activation in FR2 inter-band

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.3.8.1-2: General test parameters for known PUCCH SCell activation in FR2 inter-band

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two NR radio channels are used for this test. RF channel number 1 is in band 1 and RF channel number 2 is in band 2, where bands 1 and 2 are inter-band CA operating bands in FR2 as specified in Table 5.2A.2-1 in TS 38.101-2 [19].

Parameter	Unit	Value	Comment
Active PCell		Cell 1	PCell on NR RF channel number 1.
Configured PUCCH SCell		Cell 2	Configured PUCCH SCell on NR RF channel number 2.
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every second subframe
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	µs	≤8	A random value from 0µs to 8µs
Filter coefficient		0	L3 filtering is not used
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI_Reporting}$	ms	2	the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
T1	s	7	During this time the PUCCH SCell shall be configured and detected.
T2	s	2	During this time the UE shall activate the PUCCH SCell.
T3	s	1	During this time the UE shall deactivate the PUCCH SCell.
TimeAlignmentTimer	ms	1280	Cell 1 in pTAG.
TimeAlignmentTimerSTAG	ms	[1280]	Cell 2 in sTAG.

Table A.7.5.3.8.1-3: Cell specific test parameters for FR2 PUCCH SCell activation in FR2 inter-band

Parameter[Note 5]	Unit	T1		T2		T3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
Downlink initial BWP Configuration		DLBWP.0.1		DLBWP.0.1		DLBWP.0.1	
Downlink dedicated BWP Configuration		DLBWP.1.1		DLBWP.1.1		DLBWP.1.1	
Uplink initial BWP configuration		ULBWP.0.1		ULBWP.0.1		ULBWP.0.1	
Uplink dedicated BWP configuration		ULBWP.1.1		ULBWP.1.1		ULBWP.1.1	
TRS configuration		TRS.2.1 TDD		TRS.2.1 TDD		TRS.2.1 TDD	
TCI state		TCI.State.0		TCI.State.0		TCI.State.0	
Spatial Relation Configuration		PUCCH.SRI.0		PUCCH.SRI.0		PUCCH.SRI.0	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Parameters		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Parameters		CCR.3.1 TDD	-	CCR.3.1 TDD	-	CCR.3.1 TDD	-
CSI-RS configuration		NA	NA	NA	CSI-RS.3.1 TDD [Note 2]	NA	CSI-RS.3.1 TDD
CSI reporting periodicity [Note 3]		NA	5	NA	5	NA	5
PRACH configuration		-	-	-	FR2 PRACH configuration 2	-	FR2 PRACH configuration 2
OCNG Patterns		OP.1					
SSB Configuration		SSB.1 FR2					
SMTC Configuration		SMTC.1					
EPRE ratio of PSS to SSS	dB	0					
EPRE ratio of PBCH_DMRS to SSS							

Parameter[Note 5]	Unit	T1		T2		T3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS[Note 1]							
EPRE ratio of OCNG to OCNG DMRS [Note 1]							
Propagation conditions		AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
NOTE 3: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.3.8.1-4: OTA related test parameters for FR2 SCell activation in FR2 inter-band

Parameter[Note 6]	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 3 as specified in clause A.3.15					
		AoA1			AoA2		
Assumption for UE beams [Note 7]		Rough			Rough		
N_{oc} [Note1]	dBm/15kHz[Note4]	-92.1			-92.1		
N_{oc} [Note1]	dBm/SCS[Note3]	-83.1			-83.1		
$\hat{E}_s / N_{oc}$	dB	0			0		
SS-RSRP[Note2]	dBm/SCS [Note4]	-83.1			-83.1		
$\hat{E}_s / I_{ot}$	dB	0			0		
Io[Note2]	dBm/95.04 MHz [Note4]	-51.1			-51.1		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: All parameters apply for configuration 1
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.3.8.2 Test Requirements

During T2, when the UE has valid TA, the UE shall start sending CSI report for the SCell with non-zero CQI index on the PUCCH SCell no later than in slot n+$\frac{T_{HARQ}+T_{activation_time}+\lceil X \rceil * T_{target_PL-RS}+T_{CSI_Reporting}}{NR\ slot\ length}$, where $T_{activation_time}$ is max($T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}-T_{HARQ}) as defined in clause 8.3.2, which allows 5 ms.

If the UE has a valid TA for transmitting on the SCell, during T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting on PUCCH SCell no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+[X]*T_{target_PL-RS}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in Table A.4.5.3.1.1-2
- $T_{activation_time}$ = max($T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}-T_{HARQ}), which allows 5 ms
- $T_{CSI_Reporting}$ = 10 ms
- NR slot length is 0.125 ms for this test case.

If the UE does not have a valid TA for transmitting on the SCell, during T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in Table A.4.5.3.1.1-2
- $T_{delay_PUCCH_SCell}$ = $T_{activation_time}$ + max (($T_{First_available_CSI}$ + $T_{CSI_processing}$), (T1+T2+T3), [X]*T_{target_PL-RS}) + $T_{CSI_reporting_after}$
- FFS the value of T1+T2+T3 and $T_{CSI_reporting_after}$
- NR slot length is 0.125 ms for this test case.

During T2 interruption of PCell / PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{interruption}$, as defined in clause 8.3.

During T3 the UE shall stop sending CSI reports for SCell at latest in a slot n+ $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

A.7.5.3.9 PUCCH SCell Activation and deactivation of unknown SCell in FR2

A.7.5.3.9.1 Test Purpose and Environment

The purpose of this test is to verify that SCell activation and deactivation are done within the required time period defined in clause 8.3.12, when PUCCH for a being activated SCell is configured on the NR FR2 SCell. The PCell and SCell are in different FR2 band. The SCell is unknown by the UE and the UE does not have valid TA for a sTAG which the SCell belongs to at the time of activation. Supported test configurations are shown in table A.7.5.3.9.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.7.5.3.9.1-2 and A.7.5.3.9.1-3 below. OTA related test parameters are shown in table A.7.5.3.9.1-4 below.

In the test there are two cells: Cell 1 and Cell 2. Cell 1 is PCell, Cell 2 is the PUCCH SCell being activated and deactivated. The test consists of three successive time periods with duration of T1, T2 and T3, respectively. The UE shall be continuously scheduled in Cell 1 (PCell) throughout the test.

Before the test starts, the UE is connected to the PCell (Cell 1) on NR radio channel 1 (PCC), but is not aware of SCell (Cell 2) on NR radio channel 2 (SCC). The PCell is in the pTAGs and the SCell is in a sTAG. The UE is only monitoring the PCC.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) gets configured with PUCCH on NR radio channel 2 (SCC). The UE now starts monitoring the SCC2 also. Test equipment sends a MAC message for activation of the SCell. The MAC message for the activation is received at the UE antenna connector at slot # denoted m, which is defined as the start of time period T2.

Immediately at beginning of T2 the transmission power of Cell 2 is increased to same level as for Cell 1. During T2, the test equipment monitors the L1-RSRP measurement reporting for the SCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot m+$T_{L1-RSRP}$. In the next DL slot after slot m+$T_{L1-RSRP}$, the test equipment sends a

MAC message for the activation of the TCI state of the RMC CORESET of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell. During T2, the test equipment should send a PDCCH order to the UE to initiate RA procedure on the PUCCH SCell at slot $(m+\frac{T_{HARQ}+T_{activation_time}}{NR\ slot\ length})$ after UE report on PCell.

Time period T3 starts when a MAC message for deactivation of the PUCCH SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for SCell is discontinued.

Table A.7.5.3.9.1-1: PUCCH SCell Activation and deactivation test configurations in FR2 inter-band

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.3.9.1-2: General test parameters for PUCCH SCell activation and deactivation in FR2 inter-band

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two NR radio channels are used for this test. RF channel number 1 is in band 1 and RF channel number 2 is in band 2, where bands 1 and 2 are inter-band CA operating bands in FR2 as specified in Table 5.2A.2-1 in TS 38.101-2 [19].
Active PCell		Cell 1	PCell on NR RF channel number 1.
Configured PUCCH SCell		Cell 2	Configured PUCCH SCell on NR RF channel number 2.
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every second subframe
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
TimeAlignmentTimer for sTAG	ms	5120	Set for UE has not valid TA at start of T2 based on T1 = 7 s.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to Cell 1	µs	≤ 8	A random value from 0µs to 8µs
Filter coefficient		0	L3 filtering is not used
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k_1 should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI_Reporting}$	ms	2	the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
T1	s	7	During this time the PUCCH SCell shall be configured and detected.
T2	s	2	During this time the UE shall activate the PUCCH SCell.
T3	s	1	During this time the UE shall deactivate the PUCCH SCell.

Table A.7.5.3.9.1-3: NR Cell specific test parameters for PUCCH SCell activation and deactivation in FR2 inter-band

Parameter[Note 5]	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
SSB ARFCN		freq1			freq2		
Duplex mode		TDD					
TDD configuration		TDDConf.3.1					
Downlink initial BWP Configuration		DLBWP.0.1					
Downlink dedicated BWP Configuration		DLBWP.1.1					
Uplink initial BWP configuration		ULBWP.0.1					
Uplink dedicated BWP configuration		ULBWP.1.1					
TRS configuration		TRS.2.1 TDD					
TCI state		TCI.State.0					
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
PDSCH Reference measurement channel		SR.3.1 TDD			-		
RMSI CORESET Parameters		CR.3.1 TDD			-		
Dedicated CORESET Parameters		CCR.3.1 TDD			-		
CSI-RS configuration		NA			NA	CSI-RS.3.1 TDD Note 2	
CSI reporting periodicity Note 3		NA			NA	5	
OCNG Patterns		OP.1					
SSB Configuration		SSB.1 FR2					
SMTC Configuration		SMTC.1					
EPRE ratio of PSS to SSS	dB	0					
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS[Note 1]							
EPRE ratio of OCNG to OCNG DMRS Note 1							
Propagation conditions		AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
NOTE 3: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.3.9.1-4: OTA related test parameters for PUCCH SCell activation and deactivation in FR2 inter-band

Parameter[Note 6]	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 3 as specified in clause A.3.15					
		AoA1			**AoA2**		
Assumption for UE beams Note 7		Rough			Rough		
N_{oc} Note1	dBm/15kHz[Note4]	-92.1			-92.1		
N_{oc} Note1	dBm/SCS[Note3]	-83.1			-83.1		
$\hat{E}_s / N_{oc}$	dB	0			-infinite	0	
SS-RSRP[Note2]	dBm/SCS Note4	-83.1			-infinite	-83.1	
$\hat{E}_s / I_{ot}$	dB	0			-infinite	0	
Io[Note2]	dBm/ 95.04 MHz Note4	-51.1			-54.1	-51.1	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

Parameter[Note 6]	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone NOTE 6: All parameters apply for configuration 1 NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.							

A.7.5.3.9.2 Test Requirements

During T2, the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than 3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ as defined in clause 8.3.12. For this test case, $T_{FirstSSB_MAX}$=T_{SMTC_MAX}=T_{rs}=20 ms; $T_{L1\text{-}RSRP,\ measure}$=480 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ =1000 ms.

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in Table A.7.5.3.3.1-2
- $T_{delay_PUCCH_SCell}$ = $T_{activation_time}$ + max (($T_{First_available_CSI}$ + $T_{CSI_processing}$), (T1+T2+T3), T_{meas}) + $T_{CSI_reporting_after}$
- $T_{activation_time}$ = 3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows 1030 ms
- T_{meas} = 5* T_{rs} = 100 ms
- NR slot length is 0.125 ms for this test case.

During T2, the interruption of PCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $m + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}}$, where T_X =20 ms.

During T3, the UE shall stop sending CSI reports for SCell no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.14.

During T3, the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$ as defined in clause 8.3.14.

A.7.5.3.10 SCell Activation and deactivation of FR2 known PUCCH SCell and one FR2 unknown SCell with FR2 PCell

A.7.5.3.10.1 Test Purpose and Environment

The purpose of this test is to verify that when a PUCCH SCell and DL SCell are activated using the same MAC CE command, the PUCCH SCell, and DL SCell activation and deactivation delays are within the requirements stated in clause 8.3.13 and 8.3.15. When UE receive the MAC CE activation command, PUCCH SCell in FR2 is known to UE and DL SCell in FR2 is unknown to the UE.

The supported test configurations are provided in table A.7.5.3.10.1-1 below. The general test parameters are given in Tables A.7.5.3.10.1-2 and cell-specific test parameters are given in A.7.5.3.10.1-3. OTA related test parameters are given in A.7.5.3.10.1-4.

The test consists of two sub tests, one with valid timing advance (TA), and other with invalid TA. The test consists of six successive time periods, with duration of T1, T2, and T3 respectively. There are two NR carriers, and PCC has two cell and SCC has one cells. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 but is not aware of Cell 2 (PUCCH SCell) and Cell 3 (DL SCell). Cell 1 and Cell 3 are configured on primary timing advance group (pTAG). Cell 2 is on different band than Cell 1 and Cell 3. For valid TA case, Cell 1, Cell 2 and Cell 3 are on same TAG. For invalid TA case Cell 2 is on different TAG than Cell 1 and Cell 3. At the start of the test, the UE is monitoring PCC and not SCC.

At the beginning of T1, the UE receives an RRC message by which the PUCCH SCell (Cell 2) and DL SCell (Cell 3) becomes configured on radio channel 2 and 1 respectively. In T1, the UE starts measuring PUCCH SCell 1 and DL SCell is not detectable. During the duration of T1, the time alignment timer is running on and pTAG, and the TA is maintained on PCell. At the end of T1, the test equipment sends a MAC CE message for activation of the PUCCH SCell and DL SCell simultaneously.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI for the activated PUCCH SCell at latest in slot $n1+\frac{T_{HARQ}+T_{delay_\text{multiple}_SCells_PUCCH_SCell}}{NR\ slot\ length}$, and report valid CSI for the activated DL SCell at latest in slot $n1+\frac{T_{HARQ}+T_{delay_\text{multiple}_SCells_other_SCell}}{NR\ slot\ length}$, as defined in clause 8.3.13. In this test case, both valid TA and invalid TA cases shall be tested.

Test for case when UE has valid TA (i.e., the *TimeAlignmentTimer* [2] associated with the TAG containing the PUCCH SCell is running), $T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + [X]*T_{target_PL_RS} + T_{CSI_Reporting}$.

Test for case when UE do not have valid TA: $T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + \max((T_{First_available_CSI} + T_{CSI_processing}), [X]*T_{target_PL_RS}, (T1+T2+T3)) + T_{CSI_reporting_after}$

$T_{activation_time_multiple_scells}$ is the target SCell activation delay in millisecond in multiple SCell activation scenario as specified in clause 8.3.7

In case of valid TA, for Cell 2 activation, the UE shall start reporting CSI in PUCCH SCell in slot $n1 + \frac{T_{\text{HARQ}}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the PUCCH SCell activation has been completed.

For Cell 3 activation, the UE shall start reporting CSI in PCell in slot $n1 + \frac{T_{\text{HARQ}}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the DL SCell activation has been completed.

Any PCell interruption due to activation of PUCCH SCell or DL SCell shall occur in the slot $n1 + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n1 + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3.13, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.2.2.7.

Time period T3 starts when a MAC message for deactivation of PUCCH SCell and DL SCell, sent from the test equipment to the UE in a slot # denoted n2, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot $n2 + \frac{T_{\text{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3.15, and the starting point of any PCell interruption due to the deactivation shall occur in the slot $n2 + 1 + \frac{T_{\text{HARQ}}}{NR\ slot\ length}$ to $n2 + 1 + \frac{T_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.15.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of PUCCH SCell and DL SCell, respectively.

The test equipment verifies the PUCCH SCell activation time by counting the slots from the time when the PUCCH SCell activation command is sent until a CSI report with other than CQI index 0 is received. The test equipment verifies the DL SCell activation time by counting the slots from the time when the DL SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the PUCCH SCell deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for PUCCH SCell is discontinued. The test equipment verifies the DL SCell deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for DL SCell is discontinued.

Table A.7.5.3.10.1-1: Supported test configurations for FR2 SCell activation in FR2 inter-band

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode for PCell NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode for PUCCH SCell and DL SCell

Table A.7.5.3.10.1-2: General test parameters for FR2 SCell activation in FR2 inter-band

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channels are used for this test. RF channel number 1 is in band 1 and RF channel number 2 is in band 2, where bands 1 and 2 are inter-band CA operating bands in FR2 as specified in Table 5.2A.2-1 in TS 38.101-2 [19].
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated PUCCH SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 2.
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every second subframe
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 and Cell 3 timing offset to cell1	µs	≤8	A random value from 0µs to 8µs
T1	s	6	During this time the PUCCH SCell shall be known and the DL SCell configured and detected.
T2	s	2	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T4	s	6	During this time the PUCCH SCell shall be known and the DL SCell configured and detected.
T5	s	2	During this time the UE shall activate the PUCCH SCell and DL SCell.
T6	s	1	During this time the UE shall deactivate the PUCCH SCell and DL SCell.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI_Reporting}$	ms	2	the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.7.5.3.10.1-3: Cell specific test parameters for FR2 SCell activation in FR2 inter-band

Parameter[Note 5]	Unit	T1			T2			T3		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3
SSB ARFCN		freq1	freq2		freq1	freq2		freq1	freq2	
Duplex mode		TDD			TDD			TDD		
TDD configuration		TDDConf.3.1			TDDConf.3.1			TDDConf.3.1		
Downlink initial BWP Configuration		DLBWP.0.1			DLBWP.0.1			DLBWP.0.1		
Downlink dedicated BWP Configuration		DLBWP.1.1			DLBWP.1.1			DLBWP.1.1		
Uplink initial BWP configuration		ULBWP.0.1			ULBWP.0.1			ULBWP.0.1		
Uplink dedicated BWP configuration		ULBWP.1.1			ULBWP.1.1			ULBWP.1.1		
TRS configuration		TRS.2.1 TDD			TRS.2.1 TDD			TRS.2.1 TDD		
TCI state		TCI.State.0			TCI.State.0			TCI.State.0		
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		

Parameter[Note 5]	Unit	T1			T2			T3		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3
PDSCH Reference measurement channel		SR.3.1 TDD	-		SR.3.1 TDD	-		SR.3.1 TDD	-	
RMSI CORESET Parameters		CR.3.1 TDD	-		CR.3.1 TDD	-		CR.3.1 TDD	-	
Dedicated CORESET Parameters		CCR.3.1 TDD	-		CCR.3.1 TDD	-		CCR.3.1 TDD	-	
CSI-RS configuration		CSI-RS.3.1 TDD	NA		CSI-RS.3.1 TDD	CSI-RS.3.1 TDD [Note 2]		CSI-RS.3.1 TDD	CSI-RS.3.1 TDD	
CSI reporting periodicity [Note 3]		NA	5		NA	5		NA	5	
OCNG Patterns		OP.1								
SSB Configuration		SSB.1 FR2								
SMTC Configuration		SMTC.1								
EPRE ratio of PSS to SSS	dB	0								
EPRE ratio of PBCH_DMRS to SSS										
EPRE ratio of PBCH to PBCH_DMRS										
EPRE ratio of PDCCH_DMRS to SSS										
EPRE ratio of PDCCH to PDCCH_DMRS										
EPRE ratio of PDSCH_DMRS to SSS										
EPRE ratio of PDSCH to PDSCH_DMRS										
EPRE ratio of OCNG DMRS to SSS[Note 1]										
EPRE ratio of OCNG to OCNG DMRS [Note 1]										
Propagation conditions		AWGN								

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
NOTE 3: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.3.10.1-4: OTA related test parameters for FR2 SCell activation in FR2 inter-band

Parameter[Note 6]	Unit	Cell 1		Cell 3		Cell 2		
		T1	T2	T3	T1	T2	T3	
AoA setup		Setup 3 as specified in clause A.3.15						
		AoA1			AoA2			
Assumption for UE beams [Note 7]		Rough			Rough			
N_{oc} [Note1]	dBm/15kHz[Note4]	-92.1			-92.1			
N_{oc} [Note1]	dBm/SCS[Note3]	-83.1			-83.1			
$\hat{E}_s / N_{oc}$	dB	0			-∞			
SS-RSRP[Note2]	dBm/SCS [Note4]	-83.1			-83.1			
$\hat{E}_s / I_{ot}$	dB	0			0			
Io[Note2]	dBm/95.04 MHz [Note4]	-51.1			-51.1			

Parameter[Note 6]	Unit	Cell 1		Cell 3	Cell 2		
		T1	T2	T3	T1	T2	T3
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone							
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone							
NOTE 6: All parameters apply for configuration 1							
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.							

A.7.5.3.10.2 Test Requirements

When UE receive SCell activation command at slot n1, during T2 the UE shall start sending CSI reports for SCell 2 with non-zero CQI index in the configured slots for CSI reporting no later than slot n1 + $\frac{T_{HARQ}+T_{delay_multiple_SCells_PUCCH_SCell}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in Table A.5.5.3.x6.1-2

- $T_{delay_multiple_SCells_PUCCH_SCell}$ is defined in clause 8.13.13.1. In this test case, both valid TA and invalid TA cases shall be tested.

  - Test for case when UE has valid TA: the *TimeAlignmentTimer* [2] associated with the TAG containing the PUCCH SCell is running, and $T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + [X]*T_{target_PL_RS} + T_{CSI_Reporting}$.

    - Test for case when UE do not have valid TA: $T_{delay_multiple_SCells_PUCCH_SCell} = T_{activation_time_multiple_scells} + \max((T_{First_available_CSI} + T_{CSI_processing}), [X]*T_{target_PL_RS}, (T1+T2+T3)) + T_{CSI_reporting_after.}$

    - $T_{activation_time_multiple_scells}$ is the target SCell activation delay in millisecond in multiple SCell activation scenario as specified in clause 8.3.7.

- $T_{CSI_Reporting}$ = 10 ms

- NR slot length is 0.125 ms.

During T2 the UE shall start sending CSI reports for SCell 3 with non-zero CQI index in the configured slots for CSI reporting no later than slot n1 + $\frac{T_{HARQ}+T_{delay_multiple_SCells_other_SCell}}{NR\ slot\ length}$where

- T_{HARQ} is defined in Table A.5.5.3.x6.1-2

- $T_{delay_multiple_SCells_other_SCell} = T_{activation_time_multiple_scells} + T_{CSI_Reporting}$.

  - $T_{activation_time_multiple_scells}$ is the target SCell activation delay in millisecond in multiple SCell activation scenario as specified in clause 8.3.7

- $T_{CSI_Reporting}$ = 10 ms

- NR slot length is 0.125 ms.

Any PCell interruption due to activation of PUCCH SCell or DL SCell shall occur in the slot $n1 + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n1 + 1 + \frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3.13, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2.2.2.7.

During T3, when UE receives deactivation MAC CE at n2 slot, the UE shall stop sending CSI reports for both PUCCH SCell and DL SCell no later than slot n2 + $\frac{T_{\mathrm{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3. The starting point of any PCell

interruption due to the deactivation shall occur in the slot $n2 + 1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to $n2 + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.15.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $n1 + \frac{T_{HARQ}+T_{delay_multiple_SCells_PUCCH_SCell}}{NR\ slot\ length}$, as defined in clause 8.3.13 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.7.5.3.11 PUCCH SCell activation and deactivation delay requirements of FR2 unknown cell with FR2 PCell

A.7.5.3.11.1 PUCCH SCell activation with non-PUCCH SCell in a secondary PUCCH Group

A.7.5.3.11.1.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.7.5.3.11 except the PUCCH SCell in FR2 is unknown and another to-be-activated FR2 non-PUCCH SCell in parallel with the PUCCH SCell belongs to the secondary PUCCH group.

The supported test configurations and the general test parameters are defined in Table A.7.5.3.11.1.1-1 and Table A.7.5.3.11.1.1-2, respectively. And cell specific test parameters are described in Tables A.7.5.3.11.1.1-3. OTA related test parameters are defined in Table A.7.5.3.11.1.1-4. In all test cases, three cells are used. Cell 1 is the FR2 PCell, and Cell 2 and Cell 3 are SCells in a different band from Cell 1. Cell 2 is PUCCH SCell and Cell 3 is non-PUCCH SCell belonging to the secondary PUCCH group.

In the test configuration 1, the UE is configured with a single Timingi Advance Group (TAG) for all cells, whereas UE is configured with a primary TAG (pTAG) for Cell 1 and a secondary TAG (sTAG) for Cell 2 and Cell 3 in the test configuration 2. The test configuration 1 and 2 are to verify the UE performance for the case where the UE has a valid TA for the PUCCH SCell and the case where the UE does not have a valid TA for the PUCCH SCell, respectively.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell (Cell) and the non-PUCCH SCell (Cell 3) become configured on NR. During T1 the SCells are powered off and UE is not aware of the SCells.

A MAC message for activation of SCells is sent by the test equipment T1 after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCells is received at the UE antenna connector defines the start of time period T2. Immediately at the beginning of T2 the transmission power of Cell 2 is increased to same level as for cell 2 At the time of T2, the UE has a valid TA in the test configuration 1 while the UE does not have a valid TA for the SCell in sTAG in the test configuration 2. During the test for the test configuration 1, the UE needs to be provided with a new Timing Advance Command MAC control element at least once during each time alignment timer period.

During T2, the test equipment monitors the L1-RSRP measurement result for the PUCCH SCell reported on the PCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot $m+T_{L1\text{-}RSRP}$. In the next DL slot after slot $m+T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCells and PUCCH-SpatialRelation of the PUCCH SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for the SCells.

During the test for the test configuration 1, the UE shall start reporting CSI of the PUCCH SCell (Cell 2) and the non-PUCCH SCell (Cell 3) with non-zero CQI index via PUCCH on the SCell no later than slot m + (T_{HARQ} + $T_{delay_multiple_SCells_PUCCH_SCell}$)/NR slot length and slot m + (T_{HARQ} + $T_{delay_multiple_SCells_other_SCell}$)/NR slot length, respectively. Here, $T_{delay_multiple_SCells_PUCCH_SCell}$ and $T_{delay_multiple_SCells_other_SCell}$ are the PUCCH SCell activation delay and other SCell activation delay defined in 8.3.13 for a valid TA scenario.

During the test for the test configuration 2, T_{HARQ} + $T_{activation_time}$ after slot m, the UE shall be able to monitor PDCCH on the PUCCH SCell that triggers PDCCH order-based contention-free PRACH. The test equipment receives the PRACH and sends random access response with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value estimated from the PRACH. The UE shall start reporting CSI of the PUCCH SCell (Cell 2) and the non-PUCCH SCell (Cell 3) with non-zero CQI index via PUCCH on the SCell no later than slot m + (T_{HARQ} + $T_{delay_multiple_SCells_PUCCH_SCell}$)/NR slot length and slot m + (T_{HARQ} + $T_{delay_multiple_SCells_other_SCell}$)/NR slot length, respectively.

Here, $T_{activation_time}$ is the SCell activation delay defined in 8.3.2 for FR2 unknown SCell with periodic CSI-RS used for CSI reporting, and $T_{delay_multiple_SCells_PUCCH_SCell}$ and $T_{delay_multiple_SCells_other_SCell}$ are the PUCCH SCell activation delay and other SCell activation delay defined in 8.3.13 for an invalid TA scenario.

Time period T3 starts when a MAC message for deactivation of the SCells, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during the activation of the SCells.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting on the PUCCH SCell is discontinued.

Table A.7.5.3.11.1.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	PCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target SCells: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target SCells: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is required to pass both of the supported test configurations. The UE will be configured with a single Timing Advance Group (TAG) in the test configuration 1 whearas two TAGs are used in the test configuration 2.	

Table A.7.5.3.11.1.1-2: General test parameters for unknown FR2 PUCCH SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	Three NR radio channel (1, 2, 3) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated PUCCH SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2. The cell is in a different FR2 band from Cell 1.
Configured deactivated non-PUCCH SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3. The cell is intra-band contiguous to Cell 2.
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	µs	≤25	A random value from 0µs to 25µs
Cell 3 timing offset to cell1	µs	≤25	A random value from 0µs to 25µs
Cell 3 timing offset to cell2	µs	0	
T1	s	7	During this time the PCell (Cell 1) shall be known and the SCells (Cell 2 and Cell 3) configured and detected.
T2	s	2	During this time the UE shall activate the SCells.
T3	s	1	During this time the UE shall deactivate the SCells.

Parameter	Unit	Value	Comment
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2] and TS 38.213 [3].

Table A.7.5.3.11.1.1-3: Cell specific test parameters for FR2 PUCCH SCell activation case

Parameter		Unit	Cell 1			Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2			freq3		
Duplex mode	Config 1,2		TDD								
TDD configuration	Config 1,2		TDDConf.3.1								
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1								
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1								
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1								
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1								
TRS configuration	Config 1,2		TRS.2.1 TDD								
TCI state	Config 1,2		TCI.State.0								
PUCCH Spatial Relation	Config 1,2		PUCCH.SRI.0			PUCCH.SRI.0			N/A		
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66								
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD			SR.3.1 TDD			-		
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD			-			-		
Dedicated CORESET Parameters	Config 1,2		CCR.3.1 TDD			CCR.3.1 TDD			-		
TimeAlignmentTimer for pTAG	Config 1,2		ms500			N/A			N/A		
TimeAlignmentTimer for sTAG	Config 1		N/A			N/A			N/A		
	Config 2		N/A			ms500			N/A		
CSI-RS configuration for CSI reporting	Config 1,2		-			N/A	CSI-RS.3.1 TDD Note 6		N/A	CSI-RS.3.1 TDD Note 6	
SSB configuration	Config 1,2		SSB.3 FR2			N/A	SSB.3 FR2		N/A	SSB.3 FR2	
CSI reporting periodicity	Config 1,2	ms	5			5			N/A		
reportConfigType for CSI reporting	Config 1,2		-			Periodic			N/A		
reportConfigType for L1-RSRP	Config 1,2		periodic			-			N/A		
reportQuantity for CSI reporting	Config 1,2		-			cri-RI-PMI-CQI			-		
reportQuantity for L1-RSRP	Config 1,2		ssb-Index-RSRP			-			N/A		
CSI reporting periodicity	Config 1,2		-			40			40		
L1-RSRP reporting periodicity Note 7	Config 1,2		40			-			N/A		
CSI reporting offset	Config 1,2		-			4			4		
L1-RSRP reporting offset	Config 1,2		4			-			N/A		
OCNG Patterns			OP.1								
SMTC configuration			SMTC.1								

Parameter	Unit	Cell 1			Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3	T1	T2	T3
EPRE ratio of PSS to SSS	dB	0								
EPRE ratio of PBCH DMRS to SSS										
EPRE ratio of PBCH to PBCH DMRS										
EPRE ratio of PDCCH DMRS to SSS										
EPRE ratio of PDCCH to PDCCH DMRS										
EPRE ratio of PDSCH DMRS to SSS										
EPRE ratio of PDSCH to PDSCH										
EPRE ratio of OCNG DMRS to SSS(Note 1)										
EPRE ratio of OCNG to OCNG DMRS (Note 1)										
Propagation condition	-	AWGN								

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void
NOTE 6: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot $m+T_{L1\text{-}RSRP}$ during T2.
NOTE 7: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.3.11.1.1-4: OTA related test parameters for FR2 PUCCH SCell activation

Parameter[Note 6]	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to A.3.15.1					
Assumption for UE beams[Note 7]		Rough			Rough		
N_{oc} [Note1]	dBm/15kHz[Note4]	-112			-112		
N_{oc} [Note1]	dBm/SCS[Note3]	-102.97			-102.97		
$\hat{E}_s / N_{oc}$	dB	-∞	14	14	-∞	14	14
SS-RSRP[Note2]	dBm/SCS [Note4]	-∞	-88.97	-88.97	-∞	-88.97	-88.97
$\hat{E}_s / I_{ot}$	dB	-∞	14	14	-∞	14	14
Io[Note2]	dBm/95.04 MHz [Note4]	-73.98	-59.81	-59.81	-73.98	-59.81	-59.81

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: All parameters apply for configuration 1 and 2
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.5.3.11.1.2 Test Requirements

During T2 the UE shall start sending a valid L1-RSRP report of the SCell to the PCell in the configured slots for CSI reporting after slot $(m+T_{L1\text{-}RSRP})$, where $T_{L1\text{-}RSRP}$ is no larger than 3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ as defined in clause 8.3.2.

During T2, if the test is based on the test configuration 1, the UE shall start sending CSI reports of the PUCCH SCell (Cell 2) and the non-PUCCH SCell (Cell 3) with non-zero CQI index via PUCCH on the SCell no later than slot m + (T_{HARQ} + $T_{delay_multiple_SCells_PUCCH_SCell}$)/NR slot length and slot m + (T_{HARQ} + $T_{delay_multiple_SCells_other_SCell}$)/NR slot length, respectively. Here, $T_{delay_multiple_SCells_PUCCH_SCell}$ and $T_{delay_multiple_SCells_other_SCell}$ are the PUCCH SCell activation delay and other SCell activation delay defined in 8.3.13 for a valid TA scenario.

During T2, if the test is based on the test configuration 2, the UE shall start sending CSI reports of the PUCCH SCell (Cell 2) and the non-PUCCH SCell (Cell 3) with non-zero CQI index via PUCCH on the SCell (Cell 2) no later than slot m + (T_{HARQ} + $T_{delay_multiple_SCells_PUCCH_SCell}$)/NR slot length and slot m + (T_{HARQ} + $T_{delay_multiple_SCells_other_SCell}$)/NR slot length, respectively. Here, $T_{delay_multiple_SCells_PUCCH_SCell}$ and $T_{delay_multiple_SCells_other_SCell}$ are the PUCCH SCell activation delay and other SCell activation delay defined in 8.3.13 for an invalid TA scenario.

During T3 the UE shall stop sending CSI reports on the PUCCH SCell no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.15.

During T2 interruption of PCell during the SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, as defined in clause 8.3, where T_X =20 ms. If the UE is not capable of parallelTxPRACH-SRS-PUCCH-PUSCH additional interruption can be allowed as defined in Clause 8.2.2.2.18.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.15.

The interruption of PCell due to activation of SCells shall not be more than the values specified for SA in Clause 8.2.2.2.18.

A.7.5.3.11.2 PUCCH SCell activation with non-PUCCH SCell in a primary PUCCH Group

A.7.5.3.11.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.7.5.3.11 except the PUCCH SCell in FR2 is unknown and another to-be-activated FR2 non-PUCCH SCell in parallel with the PUCCH SCell belongs to the primary PUCCH group.

The supported test configurations and the general test parameters are defined in Table A.7.5.3.11.2.1-1 and Table A.7.5.3.11.2.1-2, respectively. And cell specific test parameters are described in Tables A.7.5.3.11.2.1-3. OTA related test parameters are defined in Table A.7.5.3.11.2.1-4. In all test cases, three cells are used. Cell 1 and Cell 3 are FR2 PCell and FR2 non-PUCCH SCell in the same band, respectively, and Cell 2 is PUCCH SCells in a different band from Cell 1 and Cell 3. Cell 3 belongs to the primary PUCCH group.

In the test configuration 1, the UE is configured with a single Timingi Advance Group (TAG) for all cells, whereas UE is configured with a primary TAG (pTAG) for Cell 1 and a secondary TAG (sTAG) for Cell 2 and Cell 3 in the test configuration 2. The test configuration 1 and 2 are to verify the UE performance for the case where the UE has a valid TA for the PUCCH SCell and the case where the UE does not have a valid TA for the PUCCH SCell, respectively.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell (Cell) and the non-PUCCH SCell (Cell 3) become configured on NR. During T1 the SCells are powered off and UE is not aware of the SCells.

A MAC message for activation of SCells is sent by the test equipment T1 after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCells is received at the UE antenna connector defines the start of time period T2. Immediately at the beginning of T2 the transmission power of Cell 2 is increased to same level as for cell 2 At the time of T2, the UE has a valid TA in the test configuration 1 while the UE does not have a valid TA for the SCell in sTAG in the test configuration 2. During the test for the test configuration 1, the UE needs to be provided with a new Timing Advance Command MAC control element at least once during each time alignment timer period.

During T2, the test equipment monitors the L1-RSRP measurement result for the PUCCH SCell reported on the PCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot m+$T_{L1\text{-}RSRP}$. In the next DL slot after slot m+$T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCells and PUCCH-SpatialRelation of the PUCCH SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for the SCells.

During the test for the test configuration 1, the UE shall start reporting CSI of the PUCCH SCell (Cell 2) and the non-PUCCH SCell (Cell 3) with non-zero CQI index via PUCCH on the PUCCH SCell (Cell 2) and PCell (Cell 1), respectively, no later than slot m + (T_{HARQ} + $T_{delay_multiple_SCells_PUCCH_SCell}$)/NR slot length and slot m + (T_{HARQ} + $T_{delay_multiple_SCells_other_SCell}$)/NR slot length, respectively. Here, $T_{delay_multiple_SCells_PUCCH_SCell}$ and $T_{delay_multiple_SCells_other_SCell}$ are the PUCCH SCell activation delay and other SCell activation delay defined in 8.3.13 for a valid TA scenario.

During the test for the test configuration 2, T_{HARQ} + $T_{activation_time}$ after slot m, the UE shall be able to monitor PDCCH on the PUCCH SCell that triggers PDCCH order-based contention-free PRACH. The test equipment receives the PRACH and sends random access response with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value estimated from the PRACH. The UE shall start reporting CSI of the PUCCH SCell (Cell 2) and the non-PUCCH SCell (Cell 3) with non-zero CQI index via PUCCH on the PUCCH SCell (Cell 2) and PCell (Cell 1), respectively, no later than slot m + (T_{HARQ} + $T_{delay_multiple_SCells_PUCCH_SCell}$)/NR slot length and slot m + (T_{HARQ} + $T_{delay_multiple_SCells_other_SCell}$)/NR slot length, respectively. Here, $T_{activation_time}$ is the SCell activation delay defined in 8.3.2 for FR2 unknown SCell with periodic CSI-RS used for CSI reporting, and $T_{delay_multiple_SCells_PUCCH_SCell}$ and $T_{delay_multiple_SCells_other_SCell}$ are the PUCCH SCell activation delay and other SCell activation delay defined in 8.3.13 for an invalid TA scenario.

Time period T3 starts when a MAC message for deactivation of the SCells, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during the activation of the SCells.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting on the PUCCH SCell is discontinued.

Table A.7.5.3.11.2.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	PCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target SCells: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target SCells: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is required to pass both of the supported test configurations. The UE will be configured with a single Timing Advance Group (TAG) in the test configuration 1 whearas two TAGs are used in the test configuration 2.	

Table A.7.5.3.11.2.1-2: General test parameters for unknown FR2 PUCCH SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	Three NR radio channel (1, 2, 3) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated PUCCH SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2. The cell is in a different FR2 band from Cell 1.
Configured deactivated non-PUCCH SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3. The cell is intra-band contiguous to Cell 1.
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	µs	≤25	A random value from 0µs to 25µs
Cell 3 timing offset to cell1	µs	≤25	A random value from 0µs to 25µs
Cell 3 timing offset to cell2	µs	0	

Parameter	Unit	Value	Comment
T1	s	7	During this time the PCell (Cell 1) shall be known and the SCells (Cell 2 and Cell 3) configured and detected.
T2	s	2	During this time the UE shall activate the SCells.
T3	s	1	During this time the UE shall deactivate the SCells.
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2] and TS 38.213 [3].

Table A.7.5.3.11.2.1-3: Cell specific test parameters for FR2 PUCCH SCell activation case

Parameter		Unit	Cell 1			Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2			freq3		
Duplex mode	Config 1,2		TDD								
TDD configuration	Config 1,2		TDDConf.3.1								
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1								
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1								
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1								
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1								
TRS configuration	Config 1,2		TRS.2.1 TDD								
TCI state	Config 1,2		TCI.State.0								
PUCCH Spatial Relation	Config 1,2		PUCCH.SRI.0			PUCCH.SRI.0			N/A		
$BW_{channel}$	Config 1,2	MHz	100: $N_{PRB,c}$ = 66								
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD			SR.3.1 TDD			-		
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD			-			-		
Dedicated CORESET Parameters	Config 1,2		CCR.3.1 TDD			CCR.3.1 TDD			-		
TimeAlignmentTimer for pTAG	Config 1,2		ms500			N/A			N/A		
TimeAlignmentTimer for sTAG	Config 1		N/A			N/A			N/A		
	Config 2		N/A			ms500			N/A		
CSI-RS configuration for CSI reporting	Config 1,2		-			N/A	CSI-RS.3.1 TDD Note 6		N/A	CSI-RS.3.1 TDD Note 6	
SSB configuration	Config 1,2		SSB.3 FR2			N/A	SSB.3 FR2		N/A	SSB.3 FR2	
CSI reporting periodicity	Config 1,2	ms	5			5			N/A		
reportConfigType for CSI reporting	Config 1,2		-			Periodic			N/A		
reportConfigType for L1-RSRP	Config 1,2		periodic			-			N/A		
reportQuantity for CSI reporting	Config 1,2		-			cri-RI-PMI-CQI			-		
reportQuantity for L1-RSRP	Config 1,2		ssb-Index-RSRP			-			N/A		

Parameter		Unit	Cell 1			Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
CSI reporting periodicity	Config 1,2		-			40			40		
L1-RSRP reporting periodicity Note 7	Config 1,2		40			-			N/A		
CSI reporting offset	Config 1,2		-			4			4		
L1-RSRP reporting offset	Config 1,2		4			-			N/A		
OCNG Patterns			OP.1								
SMTC configuration			SMTC.1								
EPRE ratio of PSS to SSS		dB	0								
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of PDCCH DMRS to SSS											
EPRE ratio of PDCCH to PDCCH DMRS											
EPRE ratio of PDSCH DMRS to SSS											
EPRE ratio of PDSCH to PDSCH											
EPRE ratio of OCNG DMRS to SSS(Note 1)											
EPRE ratio of OCNG to OCNG DMRS (Note 1)											
Propagation condition		-	AWGN								

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void
NOTE 6: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
NOTE 7: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.3.11.2.1-4: OTA related test parameters for FR2 PUCCH SCell activation

Parameter Note 6	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to A.3.15.1					
Assumption for UE beams Note 7		Rough			Rough		
N_{oc} Note1	dBm/15kHz Note4	-112			-112		
N_{oc} Note1	dBm/SCS Note3	-102.97			-102.97		
$\hat{E}_s / N_{oc}$	dB	-∞	14	14	-∞	14	14
SS-RSRP Note2	dBm/SCS Note4	-∞	-88.97	-88.97	-∞	-88.97	-88.97
$\hat{E}_s / I_{ot}$	dB	-∞	14	14	-∞	14	14
Io Note2	dBm/95.04 MHz Note4	-73.98	-59.81	-59.81	-73.98	-59.81	-59.81

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: All parameters apply for configuration 1 and 2
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.5.3.11.2.2 Test Requirements

During T2 the UE shall start sending a valid L1-RSRP report of the SCell to the PCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than 3 ms + $T_{FirstSSB_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ as defined in clause 8.3.2.

During T2, if the test is based on the test configuration 1, the UE shall start sending CSI reports of the PUCCH SCell (Cell 2) and the non-PUCCH SCell (Cell 3) with non-zero CQI index via PUCCH on the PUCCH SCell (Cell 2) and PCell (Cell 1), respectively, no later than slot m + (T_{HARQ} + $T_{delay_multiple_SCells_PUCCH_SCell}$)/NR slot length and slot m + (T_{HARQ} + $T_{delay_multiple_SCells_other_SCell}$)/NR slot length, respectively. Here, $T_{delay_multiple_SCells_PUCCH_SCell}$ and $T_{delay_multiple_SCells_other_SCell}$ are the PUCCH SCell activation delay and other SCell activation delay defined in 8.3.13 for a valid TA scenario.

During T2, if the test is based on the test configuration 2, the UE shall start sending CSI reports of the PUCCH SCell (Cell 2) and the non-PUCCH SCell (Cell 3) with non-zero CQI index via PUCCH on the PUCCH SCell (Cell 2) and PCell (Cell 1), respectively, no later than slot m + (T_{HARQ} + $T_{delay_multiple_SCells_PUCCH_SCell}$)/NR slot length and slot m + (T_{HARQ} + $T_{delay_multiple_SCells_other_SCell}$)/NR slot length, respectively. Here, $T_{delay_multiple_SCells_PUCCH_SCell}$ and $T_{delay_multiple_SCells_other_SCell}$ are the PUCCH SCell activation delay and other SCell activation delay defined in 8.3.13 for an invalid TA scenario.

During T3 the UE shall stop sending CSI reports on the PUCCH SCell no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.15.

During T2 interruption of PCell during the SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, as defined in clause 8.3, where T_X =20 ms. If the UE is not capable of parallelTxPRACH-SRS-PUCCH-PUSCH additional interruption can be allowed as defined in Clause 8.2.2.2.18.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.15.

The interruption of PCell due to activation of SCells shall not be more than the values specified for SA in Clause 8.2.2.2.18.

A.7.5.3.12 Void

A.7.5.3.13 SCell Activation for SCell in FR2 intra-band in non-DRX

A.7.5.3.13.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.5.5.3.8.1, PCell and SCell are in FR2 intra-band.

The supported test configurations are shown in table A.5.5.3.8.1-1 below. The general test parameters are the same as defined in Table A.5.5.3.8.1-2 except those described in Tables A.7.5.3.13.1-2, and cell specific test parameters are described in Tables A.7.5.3.13.1-3. OTA related test parameters are shown in table A.7.5.3.13.1-4 below.

Table A.7.5.3.13.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.3.13.1-2: General test parameters for FR2 SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channels are used for this test, cell 1 and cell2 use RF channel 1 and 2, respectively.

Table A.7.5.3.13.1-3: Cell specific test parameters for FR2 SCell activation case

Parameter[Note 5]	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
SSB ARFCN		freq1		freq2	
Duplex mode		TDD			
TDD configuration		TDDConf.3.1			

Parameter[Note 5]	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
Downlink initial BWP Configuration		DLBWP.0.1			
Downlink dedicated BWP Configuration		DLBWP.1.1			
Uplink initial BWP configuration		ULBWP.0.1			
Uplink dedicated BWP configuration		ULBWP.1.1			
TRS configuration		TRS.2.1 TDD			
TCI state		TCI.State.0			
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66			
Data PRBs allocated		66	66		66
PDSCH Reference measurement channel		SR.3.1 TDD		-	
RMSI CORESET Parameters		CR.3.1 TDD		-	
Dedicated CORESET Parameters		CCR.3.1 TDD		-	
OCNG Patterns		OP.1			
SSB Configuration		SSB.1 FR2			
Aperiodic CSI-RS for SCell activation		TRS.2.3 TDD			
gapBetweenBursts	Slot	N/A			
SMTC Configuration		SMTC.1			
CSI-RS configuration for CSI reporting		CSI-RS.3.1 TDD			
reportConfigType		periodic		N/A	
reportQuantity		cri-RI-PMI-CQI		N/A	
CSI reporting periodicity	slot	40		N/A	
CSI reporting offset	slot	4		N/A	
EPRE ratio of PSS to SSS	dB	0			
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS[Note 1]					
EPRE ratio of OCNG to OCNG DMRS [Note 1]					
Propagation conditions		AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void

Table A.7.5.3.13.1-4: OTA related test parameters for FR2 SCell activation case

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 1 according to table A.3.15.1		Setup 1 according to table A.3.15.1	
Assumption for UE beams [Note 7]		Rough		Rough	
N_{oc} [Note1]	dBm/15kHz[Note4]	-104.7		-104.7	
N_{oc} [Note1]	dBm/SCS[Note3]	-95.7		-95.7	
$\hat{E}_s / N_{oc}$	dB	7		7	
SSB_RP[Note2]	dBm/SCS [Note4]	-88.7		N/A	
CSI_RP[Note2]	dBm/SCS [Note4]	N/A		-88.7	
$\hat{E}_s / I_{ot}$	dB	7		7	

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
Io[Note2]	dBm/95.04 MHz [Note4]	-58.92		-58.92	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP, CSI_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.3.13.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $(n + 1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length})$. UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot $n + \frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, $T_{activation_time} = T_{FirstATRS} + 5$ ms, as defined in TS 38.133 [6] clause 8.3.16.

During T2 interruption of PCell / PSCell during SCell activation shall not happen outside the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in TS 38.133 [6] clause 8.3.16.

The interruption on any activated serving cell shall not be more than the values specified for SA in TS 38.133 [6] clause 8.2.2.2.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in TS 38.133 [6] clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.7.5.3.14 SCell Activation for known SCell in FR2 inter-band

A.7.5.3.14.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.7.5.3.13.1 except the PCell and SCell are in FR2 inter-band, when the SCell in FR2 is known by the UE at the time of activation.

The supported test configurations are shown in table A.7.5.3.14.1-1 below. The general test parameters are described in Tables A.7.5.3.14.1-2, and cell specific test parameters are described in Tables A.7.5.3.14.1-3. OTA related test parameters A.7.5.3.14.1 are shown in table A.7.5.3.14.1-4 below.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on NR. The UE now starts monitoring the SCell. The test equipment sends a MAC message for activation of the SCell triggering the aperiodic CSI-RS for fast SCell activation.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m (where m mode 20=1), defines the start of time period T2. The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot $m + \frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{\text{NR slot length}}$, as defined in clause 8.3.6. The UE shall start reporting CSI in PSCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption due to

activation of SCell shall occur in the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to slot $m + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during activation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

Table A.7.5.3.14.1-1: Supported test configurations for FR2 SCell activation in FR2 inter-band

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.3.14.1-2: General test parameters for FR2 SCell activation in FR2 inter-band

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channels are used for this test. RF channel number 1 is in band 1 and RF channel number 2 is in band 2, where bands 1 and 2 are inter-band CA operating bands in FR2 as specified in Table 5.2A.2-1 in TS 38.101-2 [19].
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2.
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every second subframe
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	µs	≤8	A random value from 0µs to 8µs
A3-offset	dB	-15	
T1	s	7	During this time the PCell shall be known and the SCell configured and detected.
T2	s	2	During this time the UE shall activate the SCell.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI_Reporting}$	ms	2	the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.7.5.3.14.1-3: Cell specific test parameters for FR2 SCell activation in FR2 inter-band

Parameter[Note 5]	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		freq1	freq2	freq1	freq2
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
Downlink initial BWP Configuration		DLBWP.0.1		DLBWP.0.1	
Downlink dedicated BWP Configuration		DLBWP.1.1		DLBWP.1.1	
Uplink initial BWP configuration		ULBWP.0.1		ULBWP.0.1	
Uplink dedicated BWP configuration		ULBWP.1.1		ULBWP.1.1	
TRS configuration		TRS.2.1 TDD		TRS.2.1 TDD	
TCI state		TCI.State.0		TCI.State.0	

Parameter[Note 5]	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Parameters		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Parameters		CCR.3.1 TDD	-	CCR.3.1 TDD	-
CSI-RS configuration		NA	NA	NA	CSI-RS.3.1 TDD [Note 2]
CSI reporting periodicity [Note 3]		NA	5	NA	5
OCNG Patterns		OP.1			
SSB Configuration		SSB.1 FR2			
SMTC Configuration		SMTC.1			
Aperiodic CSI-RS for SCell activation		-	-	-	TRS.2.3 TDD
gapBetweenBursts	Slot	N/A		0	
cellIndividualOffset	dB	N/A		16	
EPRE ratio of PSS to SSS	dB	0			
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS[Note 1]					
EPRE ratio of OCNG to OCNG DMRS [Note 1]					
Propagation conditions		AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
NOTE 3: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.3.14.1-4: OTA related test parameters for FR2 SCell activation in FR2 inter-band

Parameter[Note 6]	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
AoA setup		Setup 3 as specified in clause A.3.15			
		AoA1		AoA2	
Assumption for UE beams [Note 7]		Rough		Rough	
N_{oc} [Note1]	dBm/15kHz[Note4]	-92.1		-92.1	
N_{oc} [Note1]	dBm/SCS[Note3]	-83.1		-83.1	
$\hat{E}_s / N_{OC}$	dB	0		0	
SS-RSRP[Note2]	dBm/SCS [Note4]	-83.1		N/A	
CSI-RSRP[Note2]	dBm/SCS [Note4]	N/A		-83.1	
$\hat{E}_s / I_{ot}$	dB	0		0	
Io[Note2]	dBm/95.04 MHz [Note4]	-51.1		-51.1	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: All parameters apply for configuration 1
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.3.14.2 Test Requirements

During T2 the UE shall start sending CSI report for the SCell in the configured slots for CSI reporting after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k). UE shall send the first CSI report for SCell after receiving at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k), or in the next available uplink resource for CSI reporting if the slot was subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PCell in the slot.

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in Table A.7.5.3.14.1-2
- $T_{activation_time}$ = max($T_{FirstATRS}$ + 5 ms, $T_{uncertainty_RRC}$ + T_{RRC_delay}-T_{HARQ})
- $T_{CSI_Reporting}$ = 10 ms
- NR slot length is 0.125 ms for this test case.

During T2, the interruption of PCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, where T_X =4 ms.

A.7.5.3.15 PUCCH SCell activation and deactivation with FR1 PCell based on L3 reporting after SCell activation command

A.7.5.3.15.1 Test Purpose and Environment

The purpose of this test is to verify that the PUCCH SCell activation and deactivation times are within the requirements stated in clause 8.3.12 for UE capable of l3-MeasUnknownSCellActivation-r18.

The supported test configurations are shown in table A.7.5.3.15.1-1 below. The test parameters are given in Tables A.7.5.3.15.1-2 and cell-specific parameters in A.7.5.3.15.1-3 and A.7.5.3.15.1-4 below. The test consists of Three successive time periods, with duration of T1, T2 and T3 respectively. There are three NR carriers, each with one cell. Before the test starts the UE is connected to Cell 1 and Cell 2 but is not aware of Cell 3, and UE is configured with MeasObjectNR on carriers of Cell 1 and Cell 2. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell (Cell 3) becomes configured on radio channel 3, and one measID is associated with *reportOnActivation*. The UE now starts monitoring the Cell 3. The test equipment sends a MAC message for activation of the PUCCH SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI for the activated PUCCH SCell at latest in slot n+ $\frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$, as defined in clause 8.3.12.

There are two sub-tests in the test. In sub-test 1, TE shall transmit DCI 0-1 to PSCell at slot $n + \frac{T_{HARQ}+7\ ms}{\text{NR slot length}}$, and the UE shall be able to send L3 measurements report of the SCell at slot $n + \frac{T_{HARQ}+7\ ms+k2}{\text{NR slot length}}$, where k2 =1. In sub-test 2, TE shall transmit DCI 0-1 to PSCell at slot $n + \frac{T_{HARQ}+7\ ms+M-k2}{\text{NR slot length}}$, where k2=1 and M is defined in 8.3.12. The UE shall be able to send L3 measurements report of the SCell at+ $\frac{T_{HARQ}+7\ ms+M}{\text{NR slot length}}$.

Any PCell interruption due to activation of PUCCH SCell shall occur in the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2

Time period T3 starts when a MAC message for deactivation of PUCCH SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot m + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, as defined in clause 8.3.14and the starting point of any PCell interruption due to the deactivation shall occur in the slot m + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to m + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.14.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of PUCCH SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.7.5.3.15.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode FR1 SCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode FR2 Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode FR1 SCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode FR2 Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode FR1 SCell: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode FR2 Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to pass in one of the supported test configurations Note 2: A UE which passes the requirements in test case A.7.5.3.15 can skip the test cases in A.7.5.3.19	

Table A. A.7.5.3.15.1-2: General test parameters for FR2 SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	Three NR radio channel (1, 2, 3) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Active SCell		Cell 2	Active Secondary cell on NR RF channel number 2
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	µs	0	
Time alignment error between cell3 and cell1	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	26	During this time the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell. PUSCH for L3 reporting is scheduled at the first UL slot after slot n + T_{HARQ} + 7 ms
T3	s	1	During this time the UE shall deactivate the SCell.
A4-offset	dB	-15	
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.

Parameter	Unit	Value	Comment
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.7.5.3.15.1-3: Cell specific test parameters for FR2 SCell activation case: Cell 1 and Cell 2

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			Freq1			Freq2		
Duplex mode	Config 1		FDD			FDD		
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable			Not Applicable		
	Config 2		TDDConf.1.1			TDDConf.1.1		
	Config 3		TDDConf.2.1			TDDConf.2.1		
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1					
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1					
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1					
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1					
TRS configuration	Config 1,2,3		N/A			N/A		
TCI state	Config 1,2,3		TCI.State.0					
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52		
	Config 3		40: $N_{PRB,c}$ = 106			40: $N_{PRB,c}$ = 106		
Data PRBs allocated	Config 1,2		52	52	52	52	52	52
	Config 3		106	106	106	106	106	106
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			SR.1.1 FDD		
	Config 2		SR.1.1 TDD			SR.1.1 TDD		
	Config 3		SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET Parameters	Config 1		CR.1.1 FDD			CR.1.1 FDD		
	Config 2		CR.1.1 TDD			CR.1.1 TDD		
	Config 3		CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET Parameters	Config 1		CCR.1.1 FDD			CCR.1.1 FDD		
	Config 2		CCR.1.1 TDD			CCR.1.1 TDD		
	Config 3		CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Patterns			OP.1					
SSB configuration	Config 1,2		SSB.1 FR1			SSB.1 FR1		
	Config 3		SSB.2 FR1			SSB.2 FR1		
SMTC configuration			SMTC.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH_DMRS to SSS								
EPRE ratio of PBCH to PBCH_DMRS								
EPRE ratio of PDCCH_DMRS to SSS								
EPRE ratio of PDCCH to PDCCH_DMRS								
EPRE ratio of PDSCH_DMRS to SSS								
EPRE ratio of PDSCH to PDSCH_DMRS								
EPRE ratio of OCNG DMRS to SSS Note 1								
EPRE ratio of OCNG to OCNG DMRS Note 1								
Propagation conditions			N/A Link only, see clause A.3.7A			N/A Link only, see clause A.3.7A		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								

Table A.7.5.3.15.1-4: Cell specific test parameters for FR2 SCell activation case: Cell 3

Parameter Note 5		Unit	Cell 3		
			T1	T2	T3
SSB ARFCN			Freq3		
Duplex mode	Config 1,2,3		TDD		
TDD configuration	Config 1,2,3		TDDConf.3.1		
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1		
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1		
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1		
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1		
TRS configuration	Config 1,2,3		TRS.2.1 TDD		
TCI state	Config 1,2,3		TCI.State.0		
$BW_{channel}$	Config 1,2,3	MHz	100: NRB,c = 66		
Data PRBs allocated	Config 1,2,3		66		
PDSCH Reference measurement channel	Config 1,2,3		SR.3.1 TDD		
RMSI CORESET Parameters	Config 1,2,3		CR.3.1 TDD		
Dedicated CORESET Parameters	Config 1,2,3		CCR.3.1 TDD		
OCNG Patterns	Config 1,2,3		OP.1		
SSB configuration	Config 1,2,3		SSB.1 FR2		
CSI-RS configuration for CSI reporting	Config 1,2,3		CSI-RS.3.1 TDD		
reportConfigType for CSI reporting	Config 1,2,3		periodic		
reportQuantity for CSI reporting	Config 1,2,3		cri-RI-PMI-CQI		
CSI reporting periodicity	Config 1,2,3	slot	40		
CSI reporting offset	Config 1,2,3	slot	4		
SMTC configuration	Config 1,2,3		SMTC.1		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions			AWGN		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.7.5.3.15.1-4: OTA related test parameters for FR2 SCell with FR1 PCell

Parameter		Unit	Cell 1 and Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			N/A			According to clause A.3.15.1		
Assumption for UE beams Note 7			N/A			Rough		
N_{oc} Note 1	Config 1,2,3	dBm/15kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} Note 1	Config 1,2,3	dBm/SCS				-95.7		
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB				-∞	7	7
$\hat{E}_s / I_{ot}$	Config 1,2,3	dB				-∞	7	7
SSB_RP Note 2, Note 4	Config 1,2,3	dBm/SCS				-∞	-88.7	-88.7

Parameter		Unit	Cell 1 and Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Io Note 2, Note 4	Config 1,2,3	dBm/95.04 MHz				-66.68	-58.92	-58.92
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 3: Void								
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone								
NOTE 5: Void								
NOTE 6: Void								
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.								

A.7.5.3.15.2 Test Requirements

By end of T2 the UE shall finish the DL activation for the PUCCH SCell. Assuming the periodic CSI reporting is used and assuming periodic CSI activation and TCI state is sent along with SCell activation MAC CE, UE shall finish the DL activation by slot n+ $\frac{T_{HARQ}+T_{activation_time}}{NR\ slot\ length}$ as defined in clause 8.3.12.

During T2 the UE shall start sending PRACH preamble to TE and shall obtain the TA command from TE and shall be ready to send valid CSI report to the TE. CSI report shall be transmitted within $T_{activation_time}$ + Max (($T_{First_available_CSI}$ + $T_{CSI_processing}$), (T1+T2+T3)) + $T_{CSI_reporting_after}$ from the transmission of HARQ feedback of SCell activation command as specified in the 8.3.12.

In sub-test 1, $T_{activation_time}$ = 7 ms + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.12.

In sub-test 2, $T_{activation_time}$ = 7 ms + M+ max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.12.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot m + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell during SCell activation shall not happen outside the slot $n + 1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to $n + 1 + \frac{T_{HARQ}+3\ ms+T_X}{NR\ slot\ length}$, as defined in clause 8.3, where T_X =20 ms.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot m + $1 + \frac{T_{HARQ}}{NR\ slot\ length}$ to m + $1 + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption of PCell due to activation of SCell shall not be more than the values specified for SA in Clause 8.2.2.2.7.

A.7.5.3.16 PUCCH SCell activation and deactivation with FR2 PCell based on L3 reporting after SCell activation command

A.7.5.3.16.1 Test Purpose and Environment

The purpose of this test is to verify that the PUCCH SCell activation and deactivation times are within the requirements stated in clause 8.3.12 for UE capable of l3-MeasUnknownSCellActivation-r18.

The supported test configurations are shown in table A.7.5.3.16.1-1 below. The test parameters are given in Tables A.7.5.3.16.1-2 and cell-specific parameters in A.7.5.3.16.1-3 below. The test consists of Three successive time periods, with duration of T1, T2 and T2 respectively. There are two NR carriers, each with one cell. Before the test starts the UE is connected to Cell 1 but is not aware of Cell 2, and UE is configured with MeasObjectNR on carrier of Cell 1 and Cell 2. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the PUCCH SCell (Cell 2) becomes configured on radio channel 2, and one measID is associated with *reportOnActivation*. The UE now starts monitoring the Cell 2. The test equipment sends a MAC message for activation of the PUCCH SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI for the activated PUCCH SCell at latest in slot $n+\frac{T_{HARQ}+T_{delay_PUCCH_SCell}}{NR\ slot\ length}$, as defined in clause 8.3.12.

There are two sub-tests in the test. In sub-test 1, TE shall transmit DCI 0-1 to PSCell at slot $n+\frac{T_{\mathrm{HARQ}}+7\ ms}{\mathrm{NR\ slot\ length}}$, and the UE shall be able to send L3 measurements report of the SCell at slot $n+\frac{T_{\mathrm{HARQ}}+7\ ms+\mathrm{k2}}{\mathrm{NR\ slot\ length}}$, where k2 =1. In sub-test 2, TE shall transmit DCI 0-1 to PSCell at slot $n+\frac{T_{\mathrm{HARQ}}+7\ ms+\mathrm{M}-\mathrm{k2}}{\mathrm{NR\ slot\ length}}$, where k2=1 and M is defined in 8.3.12. The UE shall be able to send L3 measurements report of the SCell at$+\frac{T_{\mathrm{HARQ}}+7\ ms+\mathrm{M}}{\mathrm{NR\ slot\ length}}$.

Any PCell interruption due to activation of PUCCH SCell shall occur in the slot $n+1+\frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n+1+\frac{T_{\mathrm{HARQ}}+3\ ms+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}}+N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2

Time period T3 starts when a MAC message for deactivation of PUCCH SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot $\mathrm{m}+\frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3.14and the starting point of any PCell interruption due to the deactivation shall occur in the slot $\mathrm{m}+1+\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to $\mathrm{m}+1+\frac{\mathrm{T_{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.14.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of PUCCH SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.7.5.3.16.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	PCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: A UE which passes the requirements in test case A.7.5.3.16 can skip the test cases in A.7.5.3.20.	

Table A. A.7.5.3.16.1-2: General test parameters for FR2 SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Three NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	µs	0	
Time alignment error between cell3 and cell1	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	26	During this time the SCell configured and detected.

Parameter	Unit	Value	Comment
T2	s	1	During this time the UE shall activate the SCell. PUSCH for L3 reporting is scheduled at the first UL slot after slot n + T_{HARQ} + 7 ms
T3	s	1	During this time the UE shall deactivate the SCell.
A4-offset	dB	-15	
T_{HARQ}	ms	2	k_1×NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.7.5.3.16.1-2: Cell specific test parameters for FR2 SCell activation case: Cell 1 and Cell 2

Parameter Note 5		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			Freq1			Freq2		
Duplex mode	Config 1		TDD			TDD		
TDD configuration	Config 1		TDDConf.3.1			TDDConf.3.1		
Downlink initial BWP Configuration	Config 1		DLBWP.0.1			DLBWP.0.1		
Downlink dedicated BWP Configuration	Config 1		DLBWP.1.1			DLBWP.1.1		
Uplink initial BWP configuration	Config 1		ULBWP.0.1			ULBWP.0.1		
Uplink dedicated BWP configuration	Config 1		ULBWP.1.1			ULBWP.1.1		
TRS configuration	Config 1		TRS.2.1 TDD			TRS.2.1 TDD		
TCI state	Config 1		TCI.State.0			TCI.State.0		
$BW_{channel}$	Config 1	MHz	100: NRB,c = 66			100: NRB,c = 66		
Data PRBs allocated	Config 1		66			66		
PDSCH Reference measurement channel	Config 1		SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET Parameters	Config 1		CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET Parameters	Config 1		CCR.3.1 TDD			CCR.3.1 TDD		
OCNG Patterns	Config 1		OP.1			OP.1		
SSB configuration	Config 1		SSB.1 FR2			SSB.1 FR2		
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.3.1 TDD			CSI-RS.3.1 TDD		
reportConfigType for CSI reporting	Config 1		periodic			periodic		
reportQuantity for CSI reporting	Config 1		cri-RI-PMI-CQI			cri-RI-PMI-CQI		
CSI reporting periodicity	Config 1	slot	40			40		

Parameter Note 5		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
CSI reporting offset	Config 1	slot	4			4		
SMTC configuration	Config 1		SMTC.1			SMTC.1		
EPRE ratio of PSS to SSS		dB	0			0		
EPRE ratio of PBCH_DMRS to SSS								
EPRE ratio of PBCH to PBCH_DMRS								
EPRE ratio of PDCCH_DMRS to SSS								
EPRE ratio of PDCCH to PDCCH_DMRS								
EPRE ratio of PDSCH_DMRS to SSS								
EPRE ratio of PDSCH to PDSCH_DMRS								
EPRE ratio of OCNG DMRS to SSS Note 1								
EPRE ratio of OCNG to OCNG DMRS Note 1								
Propagation conditions			AWGN			WGN		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								

Table A.7.5.3.16.1-4: OTA related test parameters for FR2 SCell with FR2 PCell

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			According to clause A.3.15.1			According to clause A.3.15.1		
Assumption for UE beams Note 7			Rough			Rough		
N_{oc} Note 1	Config 1	dBm/15kHz	-104.7			-104.7		
N_{oc} Note 1	Config 1	dBm/SCS	-95.7			-95.7		
$\hat{E}_s / N_{oc}$	Config 1	dB	7	7	7	-∞	7	7
$\hat{E}_s / I_{ot}$	Config 1	dB	7	7	7	-∞	7	7
SSB_RP Note 2, Note 4	Config 1	dBm/SCS	-88.7	-88.7	-88.7	-∞	-88.7	-88.7
Io Note 2, Note 4	Config 1	dBm/95.04 MHz	-58.92	-58.92	-58.92	-66.68	-58.92	-58.92
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 3: Void								
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone								
NOTE 5: Void								
NOTE 6: Void								
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.								

A.7.5.3.16.2 Test Requirements

By end of T2 the UE shall finish the DL activation for the PUCCH SCell. Assuming the periodic CSI reporting is used and assuming periodic CSI activation and TCI state is sent along with SCell activation MAC CE, UE shall finish the DL activation by slot n+ $\frac{T_{HARQ}+T_{activation_time}}{NR\ slot\ length}$ as defined in clause 8.3.12.

During T2 the UE shall start sending PRACH preamble to TE and shall obtain the TA command from TE and shall be ready to send valid CSI report to the TE. CSI report shall be transmitted within $T_{activation_time}$ + Max (($T_{First_available_CSI}$ + $T_{CSI_processing}$), (T1+T2+T3)) + $T_{CSI_reporting_after}$ from the transmission of HARQ feedback of SCell activation command as specified in the 8.3.12.

In sub-test 1, $T_{activation_time}$ = 7 ms + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.12.

In sub-test 2, $T_{activation_time}$ = 7 ms + M+ max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}) as defined in clause 8.3.12.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, as defined in clause 8.3, where T_X =20 ms.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption of PCell due to activation of SCell shall not be more than the values specified for SA in Clause 8.2.2.2.7.

A.7.5.3.17 SCell Activation and deactivation for SCell in FR2 inter-band in DRX for UE capable of small beam sweeping factors and/or short measurement interval

A.7.5.3.17.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.7.5.3.1.1 except the PCell (Cell 1) and SCell (Cell 2) are in FR2 inter-band. The test will also verify that the SSB-based L1-RSRP measurement accuracy is within the specified limits as stated in clause 10.1.20.1.

The supported test configurations are shown in table A.7.5.3.17.1-1 below. The general test parameters are described in Tables A.7.5.3.17.1-2, and cell specific test parameters are described in Tables A.7.5.3.17.1-3. OTA related test parameters are shown in table A.7.5.3.17.1-4 below.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell. A MAC message for activation of SCell is sent by the test equipment 100 ms after the RRC message, in a slot # denoted m. The UE shall be continuously scheduled within on-duration based on DRX configuration in the PCell throughout the whole test. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2. Immediately at beginning of T2 the transmission power of Cell 2 is increased to same level as for Cell 1. During T2, the test equipment monitors the L1-RSRP measurement reporting for the SCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot m+$T_{L1\text{-}RSRP}$. In the next DL slot after slot m+$T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received. In this test the allowed time for SCell activation depends on the UE reported capabilities regarding small beam sweeping factors (beamSweepingFactorReduction-r18) and short measurement intervals (shortMeasInterval-r18).

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for SCell is discontinued.

The test equipment verifies the absolute accuracy of SSB-based L1-RSRP measurements during T2 by using the parameters in Table A.7.5.3.17.1-3 and Table A.7.5.3.17.1-4.

Table A.7.5.3.17.1-1: Supported test configurations for FR2 SCell activation in FR2 inter-band

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.3.17.1-2: General test parameters for FR2 SCell activation in FR2 inter-band

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channels are used for this test. RF channel number 1 is in band 1 and RF channel number 2 is in band 2, where bands 1 and 2 are inter-band CA operating bands in FR2 as specified in Table 5.2A.2-1 in TS 38.101-2 [19].
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2.
CP length		Normal	
DRX		DRX.8	DRX Configuration 8: DRX cycle = 320 ms and TAT = infinity as specified in A.3.3.8
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every second subframe
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	ms	≤8	A random value from 0 ms to 8 ms
T1	ms	100	During this time the PCell shall be known and the SCell is configured but not detected.
T2	s	2 or 12	During this time the UE shall activate the SCell. Depends on the UE capability, T2= 2 s for the case where DRX is not applicable. T2= 12 s for the case where DRX is applicable.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
X1		1,2,4,6 (Default 8)	Optionally signaled by the UE capabilities as part of beamSweepingFactorReduction-r18:
X2		0,1,2,3,4,5,6,7 (Default 8)	Optionally signaled by the UE capabilities as part of beamSweepingFactorReduction-r18:

Table A.7.5.3.17.1-3: Cell specific test parameters for FR2 SCell activation in FR2 inter-band

Parameter[Note 5]	Unit	T1		T2		T3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
Downlink initial BWP Configuration		DLBWP.0.1		DLBWP.0.1		DLBWP.0.1	
Downlink dedicated BWP Configuration		DLBWP.1.1		DLBWP.1.1		DLBWP.1.1	
Uplink initial BWP configuration		ULBWP.0.1		ULBWP.0.1		ULBWP.0.1	
Uplink dedicated BWP configuration		ULBWP.1.1		ULBWP.1.1		ULBWP.1.1	
TRS configuration		TRS.2.1 TDD		TRS.2.1 TDD		TRS.2.1 TDD	
TCI state		TCI.State.0		TCI.State.0		TCI.State.0	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Parameters		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Parameters		CCR.3.1 TDD	-	CCR.3.1 TDD	-	CCR.3.1 TDD	-

Parameter[Note 5]	Unit	T1		T2		T3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
CSI-RS configuration		NA	NA	NA	CSI-RS.3.1 TDD Note 2	NA	CSI-RS.3.1 TDD
CSI reporting periodicity Note 3		NA	5	NA	5	NA	5
OCNG Patterns		OP.1					
SSB Configuration		SSB.1 FR2					
SMTC Configuration		SMTC.3					
EPRE ratio of PSS to SSS	dB	0					
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
Propagation conditions		AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot $m+T_{L1\text{-}RSRP}$ during T2.
NOTE 3: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.3.17.1-4: OTA related test parameters for FR2 SCell activation in FR2 inter-band

Parameter[Note 6]	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 3 as specified in clause A.3.15					
		AoA1			**AoA2**		
Assumption for UE beams Note 7		Rough			Rough		
N_{oc} Note1	dBm/15kHz Note4	-92.1			-92.1		
N_{oc} Note1	dBm/SCS Note3	-83.1			-83.1		
$\hat{E}_s / N_{oc}$	dB	0			0		
SS-RSRP Note2	dBm/SCS Note4	-83.1			-83.1		
$\hat{E}_s / I_{ot}$	dB	0			0		
Io Note2	dBm/95.04 MHz Note4	-51.1			-51.1		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: All parameters apply for configuration 1
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.3.17.2 Test Requirements

During T2 the UE shall start sending CSI report for the SCell in the configured slots for CSI reporting after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k). UE shall send the first CSI report for SCell after receiving at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k), or in the next available uplink resource for CSI reporting if the slot was subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PCell in the slot.

For UE capable of *beamSweepingFactorReduction-r18* and *shortMeasInterval-r18* capabilities:

During T2, the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than:

3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$

as defined in clause 8.3.2. For this test case, UE supports short measurement interval hence $T_{FirstSSB_MAX,\ enhanced}$ =$T_{SMTC_MAX,\ enhanced}$ =$T_{rs,\ enhanced}$ =T_{SSB}=20 ms; $T_{L1\text{-}RSRP,\ enhanced\ measure}$=X2/8 *480 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ according to table A.7.5.17.2-1. $T_{L1\text{-}RSRP}$ =968 ms if X1 and X2 use the default value and a minimum of 348 ms for the case with X1=1, X2=0 (for other values of X1/X2 capability corresponding value of $_{TL1\text{-}RSRP}$ shall be adopted from table A.7.5.17.2-1:

Table A.7.5.3.17.2-1: $T_{L1\text{-}RSRP}$ for different X1/X2 capabilities (ms)

	X1=1	X1=2	X1=4	X1=6
X2=0	348	368	408	448
X2=1	408	428	468	508
X2=2	468	488	528	568
X2=3	528	548	588	628
X2=4	588	608	648	688
X2=5	648	668	708	748
X2=6	708	728	768	808
X2=7	768	788	828	868

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{3719ctivation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in table A.7.5.3.3.1-2
- $T_{activation_time}$ = 3 ms $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows 1000 ms in case of no X1/X2 capability and a minimum of 380 ms for the case with X1=1, X2=0 (for other values of X1/X2 capability corresponding value of $_{TL1\text{-}RSRP}$ shall be adopted.

For UE capable of *beamSweepingFactorReduction-r18* but not *shortMeasInterval-r18* capabilities, the cell specific test parameters are described in table A.7.5.3.17.1-3 except that SMTC value is SMTC.1:

During T2, the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than:

3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$

as defined in clause 8.3.2. For this test case, UE supports short measurement interval hence $T_{FirstSSB_MAX,\ enhanced}$ =$T_{SMTC_MAX,\ enhanced}$ =$T_{rs,\ enhanced}$ =20 ms; $T_{L1\text{-}RSRP,\ enhanced\ measure}$=X2/8 *11520 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ = 12008 ms if X1 and X2 are absent. Value of $T_{L1\text{-}RSRP}$ for various X1/X2 capabilities is obtained from table A.7.53.17.2-2.

Table A.7.5.3.17.2-2: $T_{L1\text{-}RSRP}$ for different X1/X2 capabilities (ms)

	X1=1	X1=2	X1=4	X1=6
X2=0	348	368	408	448
X2=1	1788	1808	1848	1888
X2=2	3228	3248	3288	3328
X2=3	4668	4688	4728	4768
X2=4	6108	6128	6168	6208
X2=5	7548	7568	7608	7648
X2=6	8988	9008	9048	9088
X2=7	10428	10448	10488	10528

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in table A.7.5.3.3.1-2

- $T_{activation_time}$ = 3 ms $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows 12040 ms in case of no X1/X2 capability and a minimum of 380 ms for the case with X1=1, X2=0 (for other values of X1/X2 capability corresponding value of $T_{L1\text{-}RSRP}$ shall be adopted.

For UE capable of *shortMeasInterval-r18* but not *beamSweepingFactorReduction-r18* capabilities, the general test parameters are described in table A.7.5.3.17.1-2, except that the default value for X1=X2=8 is chosen.

During T2, the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than:

3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + 8*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$

as defined in clause 8.3.2. For this test case, UE supports short measurement interval hence $T_{FirstSSB_MAX,\ enhanced}$ =$T_{SMTC_MAX,\ enhanced}$ =$T_{rs,\ enhanced}$ =T_{SSB}=20 ms; $T_{L1\text{-}RSRP,\ enhanced\ measure}$=480 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ =968 ms.

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

-T_{HARQ} is defined in table A.7.5.3.3.1-2

-$T_{activation_time}$ = 3 ms $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + 8*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows 1000 ms.

-$T_{CSI_Reporting}$ = 10 ms

-NR slot length is 0.125 ms for this test case.

The L1-RSRP measurement accuracy for SSB resource reported by UE in L1-RSRP report (SSB#0 or SSB#1) of Cell 3 shall fulfil the accuracy requirements in clauses 10.1.20.1 provided the side condition is -2 dB as defined in clause 8.3.2.

During T3, the UE shall stop sending CSI reports for SCell no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

A.7.5.3.18 SCell Activation and deactivation for FR1+FR2 inter-band with target SCell in FR2, in DRX, for UE capable of small beam sweeping factors and/or short measurement interval

A.7.5.3.18.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.7.5.3.1.1 except the PCell is in FR1 and SCell is in FR2.

The supported test configurations are defined in table A.7.5.3.18.1-1. The general test parameters are the same as defined in table A.7.5.3.18.1-2. And cell specific test parameters are described in Tables A.7.5.3.18.1-2. OTA related test parameters are defined in table A.7.5.3.18.1-3. The test will also verify that the SSB-based L1-RSRP measurement accuracy is within the specified limits as stated in clause 10.1.20.1.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment 100 ms after the RRC message, in a slot # denoted m. The UE shall be continuously scheduled within on-duration based on DRX configuration in the PCell throughout the whole test. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2.

During T2, the test equipment monitors the L1-RSRP measurement reporting for the SCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot m+$T_{L1\text{-}RSRP}$. In the next DL slot after slot m+$T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell 1 deactivation command is sent until CSI reporting for SCell 1 is discontinued.

The test equipment verifies the absolute accuracy of SSB-based L1-RSRP measurements during T2 by using the parameters in table A.7.5.3.18.1-3 and table A.7.5.3.18.1-4.

Table A.7.5.3.18.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.7.5.3.18.1-2: General test parameters for FR2 SCell activation in FR2 inter-band

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		DRX.8	DRX Configuration 8: DRX cycle = 320 ms and TAT = infinity as specified in A.3.3.8
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to cell1	µs	0	
Time alignment error between cell2 and cell1	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	ms	100	During this time the PSCell shall be known and the SCell configured and detected.
T2	s	5	During this time the UE shall activate the SCell. Depends on the UE capability, T2= 2 s for the case where DRX is not applicable.
T3	s	1	During this time the UE shall deactivate the SCell.
A3-offset	dB	-15	
T_{HARQ}	ms	Config 1: 2 Config 2: 3 Config 3: 2.5	$k_1 \times$ NR slot length k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] that will meet the timing constraints of this test case.

Table A.7.5.3.18.1-3: Cell specific test parameters for FR2 SCell activation case

Parameter[Note 5]		Unit	Cell 1			Cell 2		
			T1	T2			T1	T2
SSB ARFCN			Freq1			Freq2		
Duplex mode	Config 1		FDD			TDD		
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable			TDDConf.3.1		
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1					
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1					
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1					
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1					
TRS configuration	Config 1,2,3		N/A			TRS.2.1 TDD		
TCI state	Config 1,2,3		TCI.State.0					
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 3		40: $N_{PRB,c}$ = 106					
Data PRBs allocated	Config 1,2		52	66	52	66	52	66
	Config 3		106		106		106	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			-		
	Config 2		SR.1.1 TDD					
	Config 3		SR.2.1 TDD					
RMSI CORESET Parameters	Config 1		CR.1.1 FDD			-		
	Config 2		CR.1.1 TDD					
	Config 3		CR.2.1 TDD					
Dedicated CORESET Parameters	Config 1		CCR.1.1 FDD			-		
	Config 2		CCR.1.1 TDD					
	Config 3		CCR.2.1 TDD					
OCNG Patterns			OP.1					
SSB configuration	Config 1,2		SSB.1 FR1			SSB.3 FR2		
	Config 3		SSB.2 FR1					
CSI-RS configuration for CSI reporting	Config 1~3		N/A			N/A	CSI-RS.3.1 TDD [Note 6]	CSI-RS.3.1 TDD
reportConfigType for CSI reporting			periodic			N/A		
reportConfigType for L1-RSRP			periodic			N/A		
reportQuantity for CSI reporting			cri-RI-PMI-CQI			N/A		
reportQuantity for L1-RSRP			ssb-Index-RSRP			N/A		
CSI reporting periodicity	Config 1,2	slot	5			N/A		
	Config 3		10					
L1-RSRP reporting periodicity [Note 7]	Config 1,2	slot	5			N/A		
	Config 3		10					
CSI reporting offset	Config 1,2	slot	2			N/A		
	Config 3		4					
L1-RSRP reporting offset	Config 1,2	slot	2			N/A		
	Config 3		4					
SMTC configuration			SMTC.3					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH_DMRS to SSS								
EPRE ratio of PBCH to PBCH_DMRS								
EPRE ratio of PDCCH_DMRS to SSS								
EPRE ratio of PDCCH to PDCCH_DMRS								
EPRE ratio of PDSCH_DMRS to SSS								
EPRE ratio of PDSCH to PDSCH_DMRS								
EPRE ratio of OCNG DMRS to SSS[Note 1]								

Parameter[Note 5]	Unit	Cell 1			Cell 2		
		T1	T2			T1	T2
EPRE ratio of OCNG to OCNG DMRS [Note 1]							
Propagation conditions		N/A Link only, see clause A.3.7A			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: All parameters apply for configuration 1, 2 and 3
NOTE 6: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot $m+T_{L1\text{-}RSRP}$ during T2.
NOTE 7: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.3.18.1-4: OTA related test parameters for FR2 SCell activation case with FR1 PCell

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			N/A			According to clause A.3.15.1		
Assumption for UE beams [Note 7]			N/A			Rough		
N_{oc} [Note 1]	Config 1,2,3	dBm/15kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} [Note 1]	Config 1,2,3	dBm/SCS				-95.7		
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB				-∞	7	7
$\hat{E}_s / I_{ot}$	Config 1,2,3	dB				-∞	7	7
SSB_RP[Note 2, Note 4]	Config 1,2,3	dBm/SCS				-∞	-88.7	-88.7
Io[Note 2, Note 4]	Config 1,2,3	dBm/95.04 MHz				-66.68	-58.92	-58.92

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.

A.7.5.3.18.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PCell in the slot.

For UE capable of *beamSweepingFactorReduction-r18* and *shortMeasInterval-r18* capabilities:

During T2 the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot ($m+T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than

$3\text{ ms} + T_{FirstSSB_MAX,\ enhanced} + 15*T_{SMTC_MAX,\ enhanced} + X1*T_{rs,\ enhanced} + T_{L1\text{-}RSRP,\ enhanced_measure} + T_{L1\text{-}RSRP,\ report}$

as defined in clause 8.3.2. For this test case, $T_{FirstSSB_MAX,\ enhanced} = T_{SMTC_MAX,\ enhanced} = T_{rs,\ enhanced} = T_{SSB} = 20$ ms; $T_{L1\text{-}RSRP,\ enhanced_measure} = (X2/8)*160$ ms and $T_{L1\text{-}RSRP,reprt} = 5$ ms, which allows $T_{L1\text{-}RSRP} = 680$ ms if X1 and X2 use the default value. Value of $T_{L1\text{-}RSRP}$ for various X1/X2 capabilities is obtained from table A.7.5.3.18.2-1.

During T2 the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in table A.7.5.3.18.1-2

- $T_{activation_time}$ = 3 ms $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows 710 ms in case of no X1/X2 capability and a minimum of 380 ms for the case with X1=1, X2=0 (for other values of X1/X2 capability corresponding value of $T_{L1\text{-}RSRP}$ shall be adopted from table A.7.5.3.18.2-1.

Table A.7.5.3.18.2-1: $T_{L1\text{-}RSRP}$ for different X1/X2 capabilities (ms)

	X1=1	X1=2	X1=4	X1=6
X2=0	348	368	408	448
X2=1	368	388	428	468
X2=2	388	408	448	488
X2=3	408	428	468	508
X2=4	428	448	488	528
X2=5	448	468	508	548
X2=6	468	488	528	568
X2=7	488	508	548	588

For UE capable of beamSweepingFactorReduction-r18 but not shortMeasInterval-r18 capabilities, the cell specific test parameters are described in table A.7.5.3.18.1-3 except that SMTC value is SMTC.1:

During T2 the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than

3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$

as defined in clause 8.3.2. For this test case, $T_{FirstSSB_MAX,\ enhanced}$ =$T_{SMTC_MAX,\ enhanced}$ =$T_{rs,\ enhanced}$ = T_{SSB}=20 ms; $T_{L1\text{-}RSRP,\ enhanced_measure}$= (X2/8)*3840 ms and $T_{L1\text{-}RSRP,3724ctiva}$=5 ms, which allows $T_{L1\text{-}RSRP}$ = 4328 ms if X1 and X2 use the default value. Value of $T_{L1\text{-}RSRP}$ for various X1/X2 capabilities is obtained from table A.7.5.3.18.2-2.

During T2 the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{3724ctivation_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in table A.5.5.3.1.1-2

- $T_{activation_time}$ = 3 ms $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + X1*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows 4360 ms in case of no X1/X2 capability and a minimum of 380 ms for the case with X1=1, X2=0 (for other values of X1/X2 capability corresponding value of $T_{L1\text{-}RSRP}$ shall be adopted from table A.7.5.3.18.2-2.

Table A.7.5.3.18.2-2: $T_{L1\text{-}RSRP}$ for different X1/X2 capabilities (ms)

	X1=1	X1=2	X1=4	X1=6
X2=0	348	368	408	448
X2=1	828	848	888	928
X2=2	1308	1328	1368	1408
X2=3	1788	1808	1848	1888
X2=4	2268	2288	2328	2368
X2=5	2748	2768	2808	2848
X2=6	3228	3248	3288	3328
X2=7	3708	3728	3768	3808

For UE capable of *shortMeasInterval-r18* but not *beamSweepingFactorReduction-r18* capabilities, the general test parameters are described in table A.7.5.3.18.1-2, except that the default value for X1=X2=8 is chosen.

During T2, the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than:

3 ms + $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + 8*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$

as defined in clause 8.3.2. For this test case, UE supports short measurement interval hence $T_{FirstSSB_MAX,\ enhanced}$ =$T_{SMTC_MAX,\ enhanced}$ =$T_{rs,\ enhanced}$ =T_{SSB}=20 ms; $T_{L1\text{-}RSRP,\ enhanced\ measure}$=160 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ =680 ms.

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

-T_{HARQ} is defined in table A.7.5.3.3.1-2

-$T_{activation_time}$ = 3 ms $T_{FirstSSB_MAX,\ enhanced}$ + 15*$T_{SMTC_MAX,\ enhanced}$ + 8*$T_{rs,\ enhanced}$ + $T_{L1\text{-}RSRP,\ enhanced_measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows 710 ms.

- $T_{CSI_Reporting}$ = 10 ms

- NR slot length is 0.125 ms for this test case.

The L1-RSRP measurement accuracy for SSB resource reported by UE in L1-RSRP report (SSB#0 or SSB#1) of Cell 3 shall fulfil the accuracy requirements in clauses 10.1.20.1 provided the side condition is -2 dB as defined in clause 8.3.2.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

A.7.5.3.19 SCell Activation and deactivation of FR2 unknown SCell with FR1 PCell in non-DRX with L3 reporting during activation

A.7.5.3.19.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3.17, when the SCell is unknown in FR2 by the UE at the time of activation. In this test, UE shall perform two sub-tests where two different UL resource locations are configured.

The supported test configurations are shown in table A.7.5.3.19.1-1 below. The test parameters are the same as in clause A.4.5.3.3.1 except those described in the following clause. The general test parameters are given in table A.7.5.3.19.1-2 and cell-specific test parameters in table A.7.5.3.19.1-3 below. In this case, OTA related test parameters are shown in table A.7.5.3.19.1-4 below.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two carriers, PCell (Cell 1) in FR1 and SCell (Cell 2) in FR2. Cell 1 have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) but is not aware of Cell 2 (SCell). The UE is monitoring the PCell. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. In the measurement control information for Cell 2, it is indicated to the UE that event-triggered reporting with Event A2 and reportOnActivation is used. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the SCell activation.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n (where n mode 20=1), defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot n + $\frac{T_{HARQ}+T_{activation_time}+T_{CSI_Reporting}}{\text{NR slot length}}$, as defined in clause 8.3.

In sub-test1, TE shall transmit DCI 0-1 to PCell at slot $n + \frac{T_{HARQ}+7\ ms}{\text{NR slot length}}$. The UE shall be able to send L3 measurements report of the SCell at slot $n + \frac{T_{HARQ}+7\ ms+0.125\ \text{ms}}{\text{NR slot length}}$ for sub-test 1.

In sub-test2, TE shall transmit DCI 0-1 to PCell at slot $n + \frac{T_{HARQ}+3\ ms+\text{M}-0.125\ \text{ms}}{\text{NR slot length}}$. The UE shall be able to send L3 measurements report of the SCell at slot $n + \frac{T_{HARQ}+7\ ms+\text{M}}{\text{NR slot length}}$ for sub-test 2. TE will send TCI activation command after receiving L3 measurement report of the SCell.

The UE shall start reporting CSI in PCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $n + \frac{T_{\text{HARQ}}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for SCell is discontinued.

Table A.7.5.3.19.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.7.5.3.19.1-2: General test parameters for FR2 SCell activation case with FR1 PSCell

Parameter	Unit	Value	Comment
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
T1	s	16	During this time the PCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
Hysteresis	dB	0	
a2-Threshold	dBm	-100	
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.7.5.3.19.1-3: Cell specific test parameters for FR2 SCell activation case with FR1 active PCell

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			Freq1			Freq2		
Duplex mode	Config 1		FDD			FDD		

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable			Not Applicable		
	Config 2		TDDConf.1.1			TDDConf.1.1		
	Config 3		TDDConf.2.1			TDDConf.2.1		
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1					
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1					
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1					
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1					
TRS configuration	Config 1,2,3		N/A			N/A		
TCI state	Config 1,2,3		TCI.State.0					
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52		
	Config 3		40: $N_{PRB,c}$ = 106			40: $N_{PRB,c}$ = 106		
Data PRBs allocated	Config 1,2		52	52	52	52	52	52
	Config 3		106	106	106	106	106	106
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			SR.1.1 FDD		
	Config 2		SR.1.1 TDD			SR.1.1 TDD		
	Config 3		SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET Parameters	Config 1		CR.1.1 FDD			CR.1.1 FDD		
	Config 2		CR.1.1 TDD			CR.1.1 TDD		
	Config 3		CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET Parameters	Config 1		CCR.1.1 FDD			CCR.1.1 FDD		
	Config 2		CCR.1.1 TDD			CCR.1.1 TDD		
	Config 3		CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Patterns			OP.1					
SSB configuration	Config 1,2		SSB.1 FR1			SSB.1 FR1		
	Config 3		SSB.2 FR1			SSB.2 FR1		
SMTC configuration			SMTC.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH_DMRS to SSS								
EPRE ratio of PBCH to PBCH_DMRS								
EPRE ratio of PDCCH_DMRS to SSS								
EPRE ratio of PDCCH to PDCCH_DMRS								
EPRE ratio of PDSCH_DMRS to SSS								
EPRE ratio of PDSCH to PDSCH_DMRS								
EPRE ratio of OCNG DMRS to SSS Note 1								
EPRE ratio of OCNG to OCNG DMRS Note 1								
Propagation conditions			N/A Link only, see clause A.3.7A			N/A Link only, see clause A.3.7A		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								

Table A.7.5.3.19.1-4: OTA related test parameters for FR2 SCell activation case with FR1 PCell

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			N/A			According to clause A.3.15.1		
Assumption for UE beams Note 7			N/A			Rough		
N_{oc} Note 1	Config 1,2,3	dBm/15kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} Note 1	Config 1,2,3	dBm/SCS				-95.7		
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB				-∞	7	7
$\hat{E}_s / I_{ot}$	Config 1,2,3	dB				-∞	7	7
SSB_RP Note 2, Note 4	Config 1,2,3	dBm/SCS				-∞	-88.7	-88.7

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Io Note 2, Note 4	Config 1,2,3	dBm/95.04 MHz				-66.68	-58.92	-58.92
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 3: Void								
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone								
NOTE 5: Void								
NOTE 6: Void								
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.								

A.7.5.3.19.2 Test Requirements

During T2, the UE shall be able to send a valid L3-RSRP report for the SCell in the configured slots for CSI reporting at slot n + $\frac{T_{HARQ}+7ms+0.125ms}{NR\ slot\ length}$ for sub-test 1. For sub-test2, the UE shall be able to send a valid L3-RSRP for the SCell at slot n + $\frac{T_{HARQ}+7ms+M}{NR\ slot\ length}$. The UE is not required to send L3-RSRP report after slot n + $\frac{T_{HARQ}+3ms+M}{NR\ slot\ length}$, where M is defined in 8.3.17.

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot n + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} and $T_{CSI_Reporting}$ are defined in table A.7.5.3.16.1-2.
- In this case, T_{SSB}=T_{SMTC} = 20 ms and $T_{L1\text{-}RSRP,report}$ = 5 ms.
- For sub-test1, $T_{activation_time}$ = 7 ms + 0.125 ms + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}).
- For sub-test2, $T_{activation_time}$ = 3 ms + M + max (T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay})
- NR slot length is 0.125 ms for this test case.

During T3 the UE shall stop sending CSI reports for SCell no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell / PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, as defined in clause 8.3, where T_X =20 ms.

During T3 interruption of PCell / PSCell during SCell activation shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.7.5.3.20 SCell Activation and Deactivation of FR2 unkown SCell with FR2 PCell in non-DRX with L3 reporting during activation

A.7.5.3.20.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3.17, when the SCell is unknown in FR2 by the UE at the time of activation. In this test, UE shall perform two sub-tests where two different UL resource locations are configured.

The supported test configurations are shown in table A.7.5.3.20.1-1 below. The test parameters are the same as in clause A.4.5.3.3.1 except those described in the following clause. The general test parameters are given in table A.7.5.3.20.1-2 and cell-specific test parameters in table A.7.5.3.20.1-3 below. In this case, OTA related test parameters are shown in table A.7.5.3.20.1-4 below.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two carriers, PCell (Cell 1) in FR2 and SCell (Cell 2) in FR2. Cell 1 has constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) but is not aware of Cell 2 (SCell). The UE is monitoring the PCell. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. In the measurement control information for Cell 2, it is indicated to the UE that event-triggered reporting with Event A2 and reportOnActivation is used. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the SCell activation.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n (where n mode 20=1), defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot n + $\frac{T_{\text{HARQ}}+T_{\text{activation_time}}+T_{\text{CSI_Reporting}}}{\text{NR slot length}}$, as defined in clause 8.3.

In sub-test1, TE shall transmit DCI 0-1 to PCell at slot $n + \frac{T_{\text{HARQ}}+7\ ms}{\text{NR slot length}}$. The UE shall be able to send L3 measurements report of the SCell at slot $n + \frac{T_{\text{HARQ}}+7\ ms+0.125\ \text{ms}}{\text{NR slot length}}$ for sub-test 1.
In sub-test2, TE shall transmit DCI 0-1 to PCell at slot $n + \frac{T_{\text{HARQ}}+3\ ms+\text{M}-0.125\ \text{ms}}{\text{NR slot length}}$. The UE shall be able to send L3 measurements report of the SCell at slot $n + \frac{T_{\text{HARQ}}+7\ ms+\text{M}}{\text{NR slot length}}$ for sub-test 2. TE will send TCI activation command after receiving L3 measurement report of the SCell.

The UE shall start reporting CSI in PCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $n + \frac{T_{\text{HARQ}}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot $n + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}} + N_{\text{interruption}}$, as defined in clause 8.3, where $N_{\text{interruption}}$ is the interruption length given in clause 8.2.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for SCell is discontinued.

Table A.7.5.3.20.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	PCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.3.20.1-2: General test parameters for FR2 SCell activation case with FR2 PCell

Parameter	Unit	Value	Comment
Active PCell		Cell 1	Primary cell on NR RF channel number 1.

Parameter	Unit	Value	Comment
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
T1	s	16	During this time the PCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
Hysteresis	dB	0	
a2-Threshold	dBm	-100	
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI_Reporting}$	ms	15	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.7.5.3.20.1-3: Cell specific test parameters for FR2 SCell activation case with FR2 active PCell

Parameter Note 5		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			Freq1			Freq2		
Duplex mode	Config 1		TDD			TDD		
TDD configuration	Config 1		TDDConf.3.1			TDDConf.3.1		
Downlink initial BWP Configuration	Config 1		DLBWP.0.1			DLBWP.0.1		
Downlink dedicated BWP Configuration	Config 1		DLBWP.1.1			DLBWP.1.1		
Uplink initial BWP configuration	Config 1		ULBWP.0.1			ULBWP.0.1		
Uplink dedicated BWP configuration	Config 1		ULBWP.1.1			ULBWP.1.1		
TRS configuration	Config 1		TRS.2.1 TDD			TRS.2.1 TDD		
TCI state	Config 1		TCI.State.0			TCI.State.0		
$BW_{channel}$	Config 1	MHz	100: NRB,c = 66			100: NRB,c = 66		
Data PRBs allocated	Config 1		66			66		
PDSCH Reference measurement channel	Config 1		SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET Parameters	Config 1		CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET Parameters	Config 1		CCR.3.1 TDD			CCR.3.1 TDD		
OCNG Patterns	Config 1		OP.1			OP.1		
SSB configuration	Config 1		SSB.1 FR2			SSB.1 FR2		
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.3.1 TDD			CSI-RS.3.1 TDD		
reportConfigType for CSI reporting	Config 1		periodic			periodic		
reportQuantity for CSI reporting	Config 1		cri-RI-PMI-CQI			cri-RI-PMI-CQI		
CSI reporting periodicity	Config 1	slot	40			40		

Parameter Note 5		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
CSI reporting offset	Config 1	slot	4			4		
SMTC configuration	Config 1		SMTC.1			SMTC.1		
EPRE ratio of PSS to SSS		dB	0			0		
EPRE ratio of PBCH_DMRS to SSS								
EPRE ratio of PBCH to PBCH_DMRS								
EPRE ratio of PDCCH_DMRS to SSS								
EPRE ratio of PDCCH to PDCCH_DMRS								
EPRE ratio of PDSCH_DMRS to SSS								
EPRE ratio of PDSCH to PDSCH_DMRS								
EPRE ratio of OCNG DMRS to SSS Note 1								
EPRE ratio of OCNG to OCNG DMRS Note 1								
Propagation conditions			AWGN			WGN		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								

Table A.7.5.3.20.1-4: OTA related test parameters for FR2 SCell activation case with FR2 PCell

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			According to clause A.3.15.1			According to clause A.3.15.1		
Assumption for UE beams Note 7			Rough			Rough		
N_{oc} Note 1	Config 1	dBm/15kHz	-104.7			-104.7		
N_{oc} Note 1	Config 1	dBm/SCS	-95.7			-95.7		
$\hat{E}_s / N_{oc}$	Config 1	dB	7	7	7	-∞	7	7
$\hat{E}_s / I_{ot}$	Config 1	dB	7	7	7	-∞	7	7
SSB_RP Note 2, Note 4	Config 1	dBm/SCS	-88.7	-88.7	-88.7	-∞	-88.7	-88.7
Io Note 2, Note 4	Config 1	dBm/95.04 MHz	-58.92	-58.92	-58.92	-66.68	-58.92	-58.92
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 3: Void								
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone								
NOTE 5: Void								
NOTE 6: Void								
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.								

A.7.5.3.20.2 Test Requirements

During T2, the UE shall be able to send a valid L3-RSRP report for the SCell in the configured slots for CSI reporting at slot n + $\frac{T_{HARQ}+7ms+0.125ms}{NR\ slot\ length}$ for sub-test 1. For sub-test2, the UE shall be able to send a valid L3-RSRP for the SCell at slot n + $\frac{T_{HARQ}+7ms+M}{NR\ slot\ length}$. The UE is not required to send L3-RSRP report after slot n + $\frac{T_{HARQ}+3ms+M}{NR\ slot\ length}$, where M is defined in 8.3.17.

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot n + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} and $T_{CSI_Reporting}$ are defined in table A.7.5.3.16.1-2.
- In this case, T_{SSB}=T_{SMTC} = 20 ms and $T_{L1\text{-}RSRP,report}$ = 5 ms.
- For sub-test1, $T_{activation_time}$ = 7 ms + 0.125 ms + max(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay}).
- For sub-test2, $T_{activation_time}$ = 3 ms + M + max (T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$, $T_{uncertainty_RRC}$ + T_{RRC_delay})
- NR slot length is 0.125 ms for this test case.

During T3 the UE shall stop sending CSI reports for SCell no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell / PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, as defined in clause 8.3, where T_X =20 ms.

During T3 interruption of PCell / PSCell during SCell activation shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.7.5.4 Void

A.7.5.5 Beam Failure Detection and Link recovery procedures

A.7.5.5.1 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with SSB-based BFD and LR in non-DRX mode

A.7.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.1.1-1, A.7.5.5.1.1-2, A.7.5.5.1.1-3 and A.7.5.5.1.1-4 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.1.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.7.5.5.1.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test 1.

Table A.7.5.5.1.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

2	TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.7.5.5.1.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Active PCell		1-2		Cell 1	
RF Channel Number		1-2		1	
Duplex mode		1-2		TDD	
TDD Configuration		1-2		TDDConf.3.1	
$BW_{channel}$		1-2		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1-2		66	
PDSCH/PDCCH subcarrier spacing		1-2	kHz	120	
DL initial BWP configuration		1-2		DLBWP.0.1	
DL dedicated BWP configuration		1-2		DLBWP.1.1	
UL initial BWP configuration		1-2		ULBWP.0.1	
UL dedicated BWP configuration		1-2		ULBWP.1.1	
PDSCH Reference Channel		1		SR.3.2 TDD	
		2		SR.3.3 TDD	
RMSI CORESET Reference Channel		1		CR.3.1 TDD	
		2		CR.3.2 TDD	
Dedicated CORESET Reference Channel		1		CCR.3.1 TDD	
		2		CCR.3.7 TDD	
OCNG parameters		1-2		OP.1	
CP length		1-2		Normal	
PDSCH/PDCCH TCI state		1-2		TCI.State.0	
CSI-RS for tracking		1-2		TRS.2.1 TDD	
SSB Configuration		1		SSB.1 FR2	
		2		SSB.2 FR2	
SMTC Configuration		1-2		SMTC.3	
PRACH Configuration		1-2		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration		1-2		OFF	
SSB index assigned as BFD RS (q_0)		1-2		0	
SSB index assigned as CBD RS (q_1)		1-2		1	
SSB index assigned as RLM RS		1-2		0,1	
Beam failure detection transmission parameters	DCI format	1-2		1-0	
	Number of Control OFDM symbols	1-2		2	
	Aggregation level	1-2	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0	
	DMRS precoder granularity	1-2		REG bundle size	
	REG bundle size	1-2		6	
Gap pattern ID		1-2		gp0	
gapOffset		1-2	ms	0	
rlmInSyncOutOfSyncThreshold		1-2		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
		2		-92	
powerControlOffsetSS		1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1-2		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1-2		pbfd4	see TS 38.321 [7], clause 5.17

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
CSI-RS configuration for CSI reporting	1-2		CSI-RS.3.1 TDD	
reportConfigType	1-2		periodic	
reportQuantity	1-2		cri-RI-PMI-CQI	
CSI reporting periodicity	1-2	slot	40	
CSI reporting offset	1-2	slot	4	
T310	1-2	ms	1000	
N310	1-2		2	
T1	1-2	s	1	The UE shall be fully synchronized to cell 1 during T1
T2	1-2	s	2.61	
T3	1-2	s	1.64	
T4	1-2	s	0	
T5	1-2	s	1.01	
D1	1-2	s	0.97	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.5.1.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	**T2**	**T3**	**T4**	**T5**
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1-2	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_SSB of set q_1	Config 1-2	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	Config 1	dBm/ SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 2		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1,2	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1. NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1. NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1. NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.1.1-1. NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6. NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation. NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband							

Table A.7.5.5.1.1-4: Void

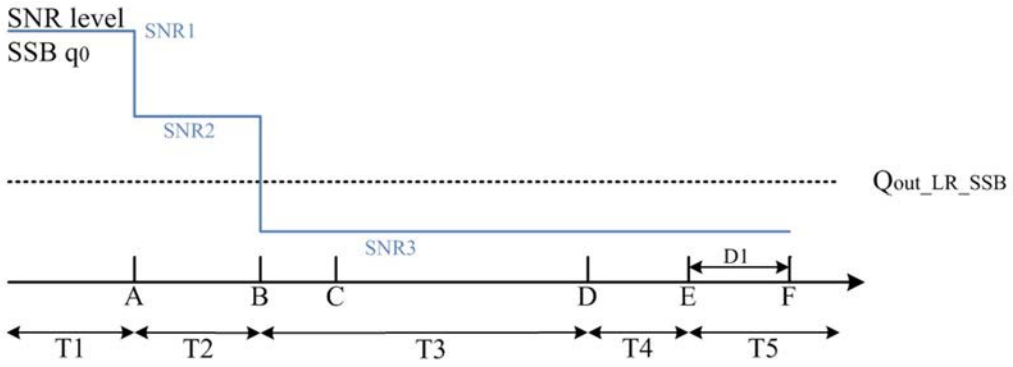


Figure A.7.5.5.1.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

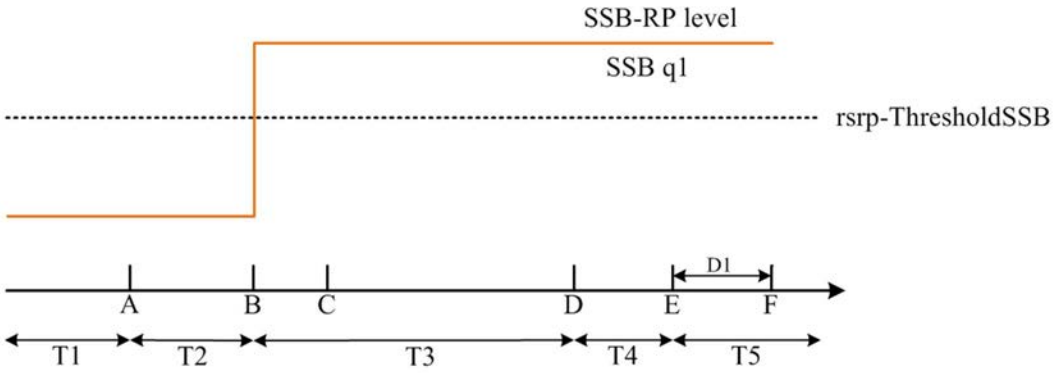


Figure A.7.5.5.1.1-2: SSB_RP level variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.7.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 960+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.5.2 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with SSB-based BFD and LR in DRX mode

A.7.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.2.1-1, A.7.5.5.2.1-2, A.7.5.5.2.1-3, A.7.5.5.2.1-4 and A.7.5.5.2.1-5 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.2.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.7.5.5.2.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.7.5.5.2.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.7.5.5.2.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active PCell	1-2		Cell 1	
RF Channel Number	1-2		1	
Duplex mode	1-2		TDD	
TDD Configuration	1-2		TDDConf.3.1	
$BW_{channel}$	1-2		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1-2		66	
PDSCH/PDCCH subcarrier spacing	1-2	kHz	120	
DL initial BWP configuration	1-2		DLBWP.0.1	
DL dedicated BWP configuration	1-2		DLBWP.1.1	
UL initial BWP configuration	1-2		ULBWP.0.1	
UL dedicated BWP configuration	1-2		ULBWP.1.1	
PDSCH Reference Channel	1		SR.3.2 TDD	
	2		SR.3.3 TDD	
RMSI CORESET Reference Channel	1		CR.3.1 TDD	
	2		CR.3.2 TDD	
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	
	2		CCR.3.7 TDD	
OCNG parameters	1-2		OP.1	
CP length	1-2		Normal	
PDSCH/PDCCH TCI state	1-2		TCI.State.0	
CSI-RS for tracking	1-2		TRS.2.1 TDD	
SSB Configuration	1		SSB.1 FR2	
	2		SSB.2 FR2	
SMTC Configuration	1-2		SMTC.3	
PRACH Configuration	1-2		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration	1-2		DRX.3	A.3.3.3
SSB index assigned as BFD RS (q_0)	1-2		0	
SSB index assigned as CBD RS (q_1)	1-2		1	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
SSB index assigned as RLM RS		1-2		0,1	
Beam failure detection transmission parameters	DCI format	1-2		1-0	
	Number of Control OFDM symbols	1-2		2	
	Aggregation level	1-2	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0	
	DMRS precoder granularity	1-2		REG bundle size	
	REG bundle size	1-2		6	
Gap pattern ID		1-2		N/A	
rlmInSyncOutOfSyncThreshold		1-2		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
		2		-92	
powerControlOffsetSS		1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1-2		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1-2		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1-2		CSI-RS.3.1 TDD	
reportConfigType		1-2		periodic	
reportQuantity		1-2		cri-RI-PMI-CQI	
CSI reporting periodicity		1-2	slot	40	
CSI reporting offset		1-2	slot	4	
T310		1-2	ms	1000	
N310		1-2		2	
T1		1-2	s	1	The UE shall be fully synchronized to cell 1 during T1
T2		1-2	s	3.37	
T3		1-2	s	2.8	
T4		1-2	s	0	
T5		1-2	s	0.61	
D1		1-2	s	0.57	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.7.5.5.2.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1,2	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_SSB of set q_1	Config 1-2	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	Config 1	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
	Config 2		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1-2	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband.

Table A.7.5.5.2.1-4: Void

Table A.7.5.5.2.1-5: Void

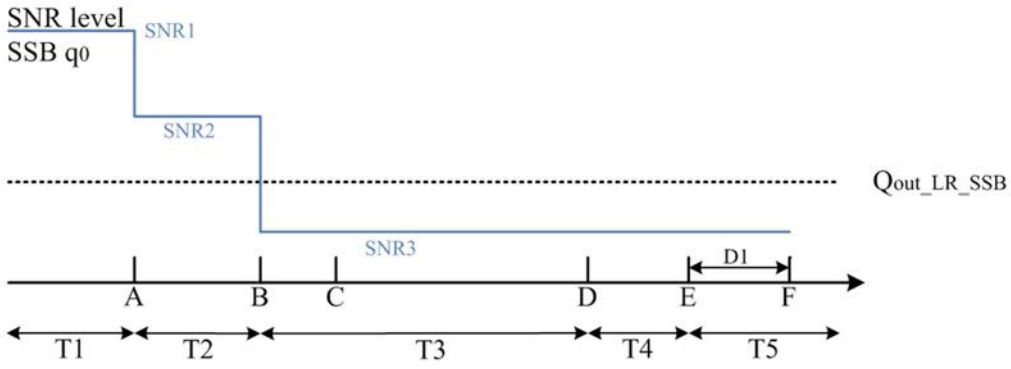


Figure A.7.5.5.2.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in DRX mode

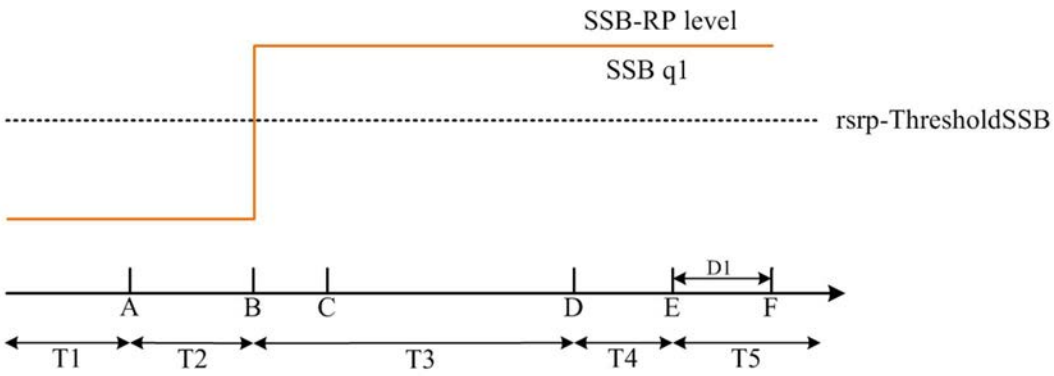


Figure A.7.5.5.2.1-2: SSB_RP level variation for SSB-based beam failure detection and link recovery testing in DRX mode

A.7.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 560+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.5.3 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.7.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.3.1-1, A.7.5.5.3.1-2, and A.7.5.5.3.1-3 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.3.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.7.5.5.3.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.7.5.5.3.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.5.3.1-2: General test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active PCell	1		Cell 1	
RF Channel Number	1		1	
Duplex mode	1		TDD	
TDD Configuration	1		TDDConf.3.1	
$BW_{channel}$	1		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1		66	
PDSCH/PDCCH subcarrier spacing	1	kHz	120	
DL initial BWP configuration	1		DLBWP.0.1	
DL dedicated BWP configuration	1		DLBWP.1.1	
UL initial BWP configuration	1		ULBWP.0.1	
UL dedicated BWP configuration	1		ULBWP.1.1	
PDSCH Reference Channel	1		SR.3.2 TDD	
RMSI CORESET Reference Channel	1		CR.3.1 TDD	
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
OCNG parameters		1		OP.1	
CP length		1		Normal	
PDSCH/PDCCH TCI state		1		TCI.State.0	
CSI-RS for tracking		1		TRS.2.1 TDD	
SSB Configuration		1		SSB.1 FR2	
SMTC Configuration		1		SMTC.3	
PRACH Configuration		1		FR2 PRACH configuration 4	A.3.8.3.4
DRX configuration		1		OFF	
CSI-RS configuration for BFD/CBD/RLM		1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0)		1		0	
CSI-RS index assigned as CBD RS (q_1)		1		1	
CSI-RS index assigned as RLM RS		1		0,1	
Beam failure detection transmission parameters	DCI format	1		1-0	
	Number of Control OFDM symbols	1		2	
	Aggregation level	1	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1	dB	0	
	DMRS precoder granularity	1		REG bundle size	
	REG bundle size	1		6	
Gap pattern ID		1		N/A	
rlmInSyncOutOfSyncThreshold		1		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType		1		periodic	
reportQuantity		1		cri-RI-PMI-CQI	
CSI reporting periodicity		1	slot	40	
CSI reporting offset		1	slot	4	
T310		1	ms	1000	
N310		1		2	
T1		1	s	1	The UE shall be fully synchronized to cell 1 during T1
T2		1	s	1.17	
T3		1	s	0.9	
T4		1	s	0	
T5		1	s	0.31	
D1		1	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.7.5.5.3.1-3: Cell specific test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Unit	Test 1				
		T1	**T2**	**T3**	**T4**	**T5**
AoA setup		Setup 1 defined in A.3.15				
Assumptpion for UE beams Note 10		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.3.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.7.5.5.3.1-4: Void

Table A.7.5.5.3.1-5: Void

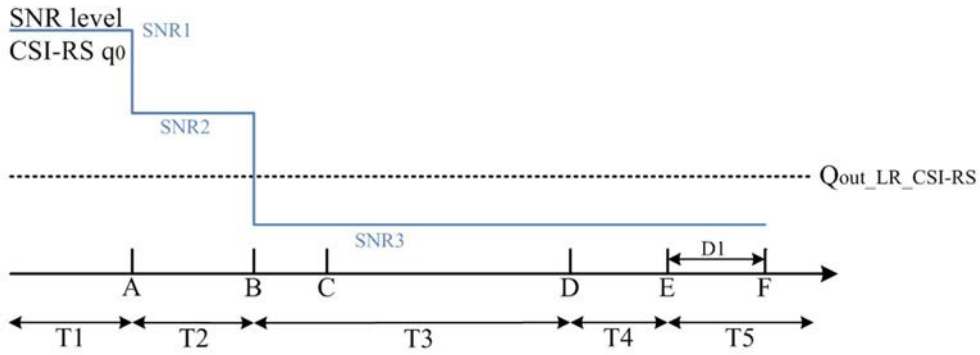


Figure A.7.5.5.3.1-1: SNR variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

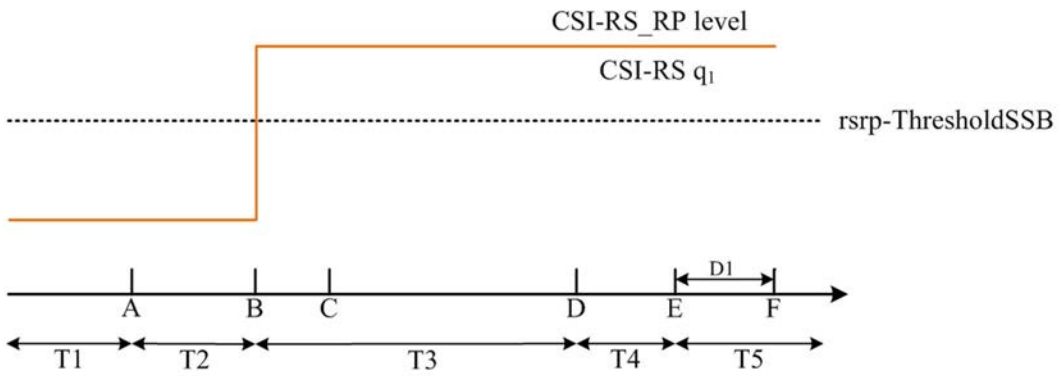


Figure A.7.5.5.3.1-2: CSI-RS_RP level variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

A.7.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.5.4 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with CSI-RS-based BFD and LR in DRX mode

A.7.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.4.1-1, A.7.5.5.4.1-2, A.7.5.5.4.1-3, and A.7.5.5.4.1-4 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.4.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.7.5.5.4.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.7.5.5.4.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.5.4.1-2: General test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Active PCell		1		Cell 1	
RF Channel Number		1		1	
Duplex mode		1		TDD	
TDD Configuration		1		TDDConf.3.1	
$BW_{channel}$		1		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1		66	
PDSCH/PDCCH subcarrier spacing		1	kHz	120	
DL initial BWP configuration		1		DLBWP.0.1	
DL dedicated BWP configuration		1		DLBWP.1.1	
UL initial BWP configuration		1		ULBWP.0.1	
UL dedicated BWP configuration		1		ULBWP.1.1	
PDSCH Reference Channel		1		SR.3.2 TDD	
RMSI CORESET Reference Channel		1		CR.3.1 TDD	
Dedicated CORESET Reference Channel		1		CCR.3.1 TDD	
OCNG parameters		1		OP.1	
CP length		1		Normal	
PDSCH/PDCCH TCI state		1		TCI.State.0	
CSI-RS for tracking		1		TRS.2.1 TDD	
SSB Configuration		1		SSB.1 FR2	
SMTC Configuration		1		SMTC.3	
PRACH Configuration		1		FR2 PRACH configuration 4	A.3.8.3.4
DRX configuration		1		DRX.3	A.3.3.3
CSI-RS configuration for BFD/CBD/RLM		1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0)		1		0	
CSI-RS index assigned as CBD RS (q_1)		1		1	
CSI-RS index assigned as RLM RS		1		0,1	
Beam failure detection transmission parameters	DCI format	1		1-0	
	Number of Control OFDM symbols	1		2	
	Aggregation level	1	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1	dB	0	
	DMRS precoder granularity	1		REG bundle size	
	REG bundle size	1		6	
Gap pattern ID		1		N/A	
rlmInSyncOutOfSyncThreshold		1		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType		1		periodic	
reportQuantity		1		cri-RI-PMI-CQI	
CSI reporting periodicity		1	slot	40	
CSI reporting offset		1	slot	4	
T310		1	ms	1000	
N310		1		2	

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
T1	1	s	1	The UE shall be fully synchronized to cell 1 during T1
T2	1	s	5.43	
T3	1	s	5.16	
T4	1	s	0	
T5	1	s	0.31	
D1	1	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.5.4.1-3: Cell specific test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.4.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.7.5.5.4.1-4: Void

Table A.7.5.5.4.1-5: Void

Table A.7.5.5.4.1-6: Void

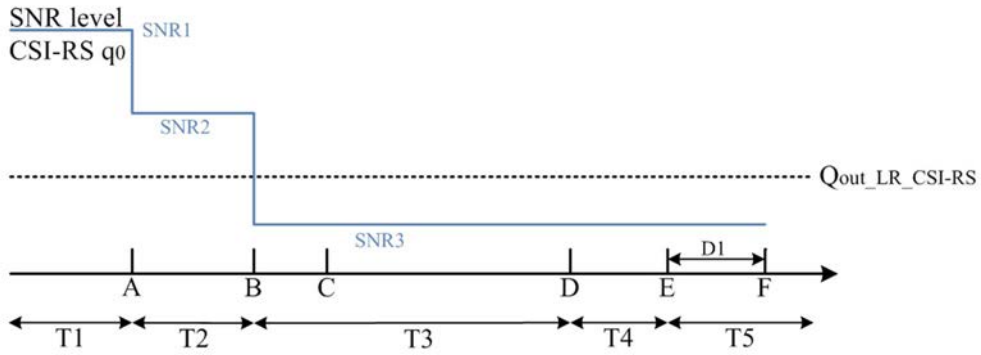


Figure A.7.5.5.4.1-1: SNR variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

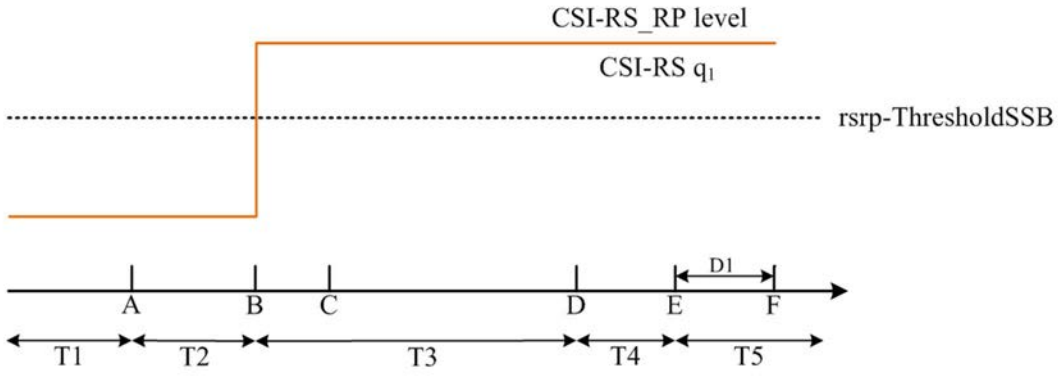


Figure A.7.5.5.4.1-2: CSI-RS_RP level variation for CSI-RS based beam failure detection and link recovery testing in DRX mode

A.7.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.5.5 Scheduling availability restriction during Beam Failure Detection and Link Recovery for FR2 PCell configured with SSB-based BFD and LR in non-DRX mode

A.7.5.5.5.1 Test Purpose and Environment

The purpose is to test scheduling availability restrictions when the UE is performing beam failure detection or when the UE is performing L1-RSRP measurement for candidate beam detection, when no DRX is used. This test will verify the scheduling availability restriction requirements in clause 8.5.7 and 8.5.8.

The test parameters are given in Tables A.7.5.5.5.1-1, A.7.5.5.5.1-2 and A.7.5.5.5.1-3 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.5.1-1 shows the variation of the downlink SNR of the SSB index 0 in the active cell to emulate SSB based beam failure. Figure A.7.5.5.5.1-2 shows the variation of the downlink L1-RSRP of the SSB index 1 used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. This test will focus on the scheduling availability during beam failure detection) and candidate beam detection. In the test, DRX configuration is not enabled. Test is to test the scheduling availability restriction of UE performing beam failure detection and candidate beam detection when SSB RS configured for Beam failure detection and candidate beam detection. During the test the UE is scheduled to transmit continuously in UL.

Table A.7.5.5.5.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.5.5.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Active PCell		1-2		Cell 1	
RF Channel Number		1-2		1	
Duplex mode		1-2		TDD	
TDD Configuration		1-2		TDDConf.3.1	
$BW_{channel}$		1-2		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1-2		66	
PDSCH/PDCCH subcarrier spacing		1-2	kHz	120	
DL initial BWP configuration		1-2		DLBWP.0.1	
DL dedicated BWP configuration		1-2		DLBWP.1.1	
UL initial BWP configuration		1-2		ULBWP.0.1	
UL dedicated BWP configuration		1-2		ULBWP.1.1	
PDSCH Reference Channel		1		SR.3.2 TDD	
		2		SR.3.3 TDD	
RMSI CORESET Reference Channel		1		CR.3.1 TDD	
		2		CR.3.2 TDD	
Dedicated CORESET Reference Channel		1		CCR.3.1 TDD	
		2		CCR.3.7 TDD	
OCNG parameters		1-2		OP.1	
CP length		1-2		Normal	
PDSCH/PDCCH TCI state		1-2		TCI.State.0	
CSI-RS for tracking		1-2		TRS.2.1 TDD	
SSB Configuration		1		SSB.1 FR2	
		2		SSB.2 FR2	
SMTC Configuration		1-2		SMTC.1	
PRACH Configuration		1-2		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration		1-2		OFF	
	DCI format	1-2		1-0	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Beam failure detection transmission parameters	Number of Control OFDM symbols	1-2		2	
	Aggregation level	1-2	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0	
	DMRS precoder granularity	1-2		REG bundle size	
	REG bundle size	1-2		6	
Gap pattern ID		1-2		N/A	
rlmInSyncOutOfSyncThreshold		1-2		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
		2		-92	
powerControlOffsetSS		1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1-2		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1-2		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1-2		CSI-RS.3.1 TDD	
reportConfigType		1-2		periodic	
reportQuantity		1-2		cri-RI-PMI-CQI	
CSI reporting periodicity		1-2	slot	40	
CSI reporting offset		1-2	slot	4	
T310		1-2	ms	1000	
N310		1-2		2	
T1		1-2	s	1	The UE shall be fully synchronized to cell 1 during T1
T2		1-2	s	2.6	
T3		1-2	s	1.64	
T4		1-2	s	0	
T5		1-2	s	1.01	
D1		1-2	s	0.97	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.7.5.5.5.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA Setup			Setup1 defined in A.3.15.1				
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SSB index assigned as BFD RS (q_0)	Config 1-4		0	0	Note 12		
SSB index assigned as CBD RS (q_1)	Config 1-4		1	1	1	1	1
SNR of SSB index 0	Config 1-2	dB	5 Note 11	-3 Note 11	-12	-12	-12

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
SNR of SSB index 1	Config 1-2	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of SSB index 1	Config 1	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 2		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1-2	dBm/120 kHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.5.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam given in clause B.2.1.3 and does not limit UE implementation or test system implementation
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband.
NOTE 12: BFD RS (q_0) is configured as SSB index 0 at the start of T3, and it is reconfigured by RRC as SSB index 1 after the UE transmits the preamble on a beam associated with the candidate beam set q_1.

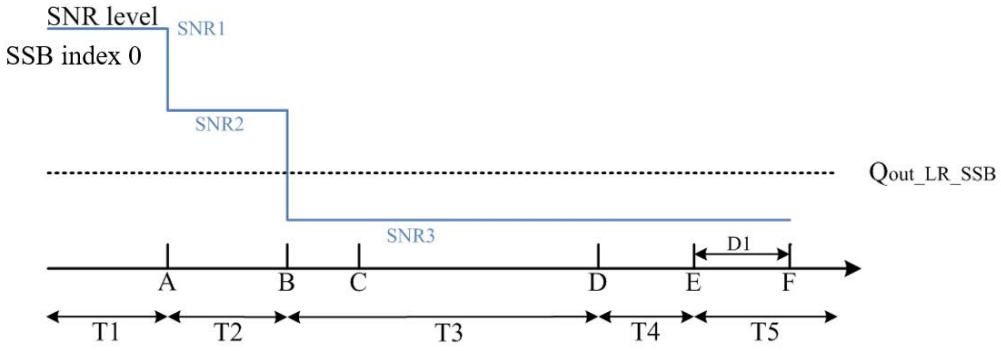


Figure A.7.5.5.5.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

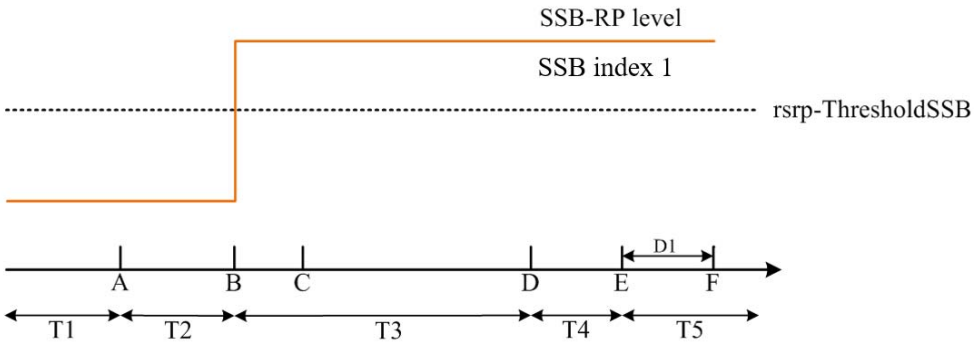


Figure A.7.5.5.5.1-2: SSB_RP level variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.7.5.5.5.2 Test Requirements

The UE behaviour during time duration T3 follows the requirements defined in clause 8.5.7.3:

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on BFD-RS symbols to be measured for beam failure detection.

The UE behaviour during time durations T4 and T5 follows the requirements defined in clause 8.5.8.3:

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on reference symbols to be measured for candidate beam detection.

A.7.5.5.6 Beam Failure Detection and Link Recovery Test for FR2 SCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.7.5.5.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for an active SCell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the SCell with *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 SCell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.6.1-1, A.7.5.5.6.1-2 and A.7.5.5.6.1-3. There are two cells, cell 1 is the active PCell and cell 2 is the active SCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.6.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active SCell to emulate CSI-RS based beam failure. Figure A.7.5.5.6.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.7.5.5.6.1-1: Supported test configurations for FR2 PCell and SCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.5.6.1-2: General test parameters for FR2 SCell for beam failure detection and link recovery testing in non-DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active PCell	1		Cell 1	
RF Channel Number for PCell	1		1	
Active SCell	1		Cell 2	
RF Channel Number for SCell	1		2	
Duplex mode	1		TDD	
TDD Configuration	1		TDDConf.3.1	
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1		66	
PDSCH/PDCCH subcarrier spacing	1	kHz	120	
DL initial BWP configuration	1		DLBWP.0.1	
DL dedicated BWP configuration	1		DLBWP.1.1	
UL initial BWP configuration	1		ULBWP.0.1	
UL dedicated BWP configuration	1		ULBWP.1.1	
PDSCH Reference Channel	1		SR.3.2 TDD	
RMSI CORESET Reference Channel	1		CR.3.1 TDD	A.3.1.2
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	
OCNG parameters	1		OP.1	A.3.2.1
CP length	1		Normal	
PDSCH/PDCCH TCI state	1		TCI.State.0	
CSI-RS for tracking	1		TRS.2.1 TDD	
SSB Configuration	1		SSB.3 FR2	A.3.10
SMTC Configuration	1		SMTC.3	A.3.11

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
PRACH Configuration		1		FR2 PRACH configuration 4	Table A.3.8.3.4-1
DRX configuration		1		OFF	
CSI-RS configuration for BFD/CBD on SCell		1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0)		1		0	
CSI-RS index assigned as CBD RS (q_1)		1		1	
CSI-RS configuration for RLM on PCell		1		CSI-RS.3.2 TDD	A.3.14.2
Beam failure detection transmission parameters	DCI format	1		1-0	
	Number of Control OFDM symbols	1		2	
	Aggregation level	1	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1	dB	0	
	DMRS precoder granularity	1		REG bundle size	
	REG bundle size	1		6	
Gap pattern ID		1		N/A	
schedulingRequestID-BFR-SCell-r16		1		Configured	
Periodicity of PUCCH for SR configuration for BFR on SCell		1	slot	40	5 ms
Offset of PUCCH for SR configuration for BFR on SCell		1	slot	4	
PUCCH parameters for SR configuration for BFR on SCell		1		Table 8.3.3.1.2-1 in [13]	
rlmInSyncOutOfSyncThreshold		1		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType		1		periodic	
reportQuantity		1		cri-RI-PMI-CQI	
CSI reporting periodicity		1	slot	40	
CSI reporting offset		1	slot	4	
T310		1	ms	1000	
N310		1		2	
T1		1	s	1	The UE shall be fully synchronized to cell 1 during T1
T2		1	s	1.17	
T3		1	s	0.9	
T4		1	s	0	
T5		1	s	0.31	
D1		1	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.7.5.5.6.1-3: Cell specific test parameters for FR2 SCell for beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Cell 1	Cell 2 Test 1				
			T1 to T5	T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15	Setup 1 defined in A.3.15				
Assumptpion for UE beams Note 10			Rough	Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR_CSI-RS of set q_0	Config 1	dB	5	5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1	dBm/SCS kHz	-104.5	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/ 120kHz	-104.7	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz	TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.6.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

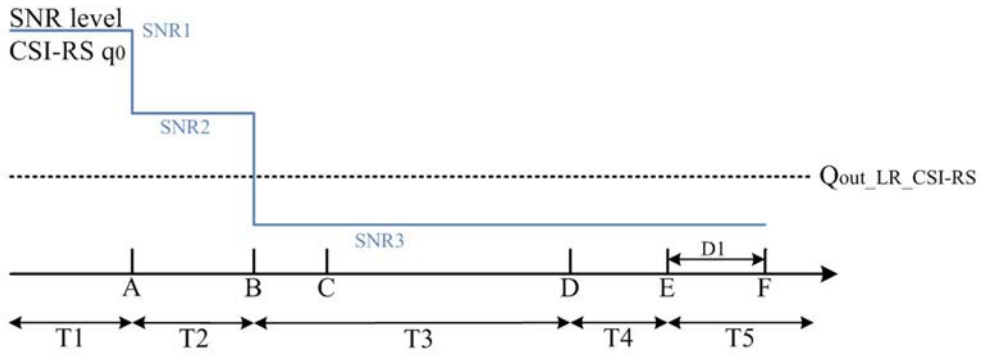


Figure A.7.5.5.6.1-1: SNR variation for beam failure detection and link recovery testing for SCell in non-DRX mode

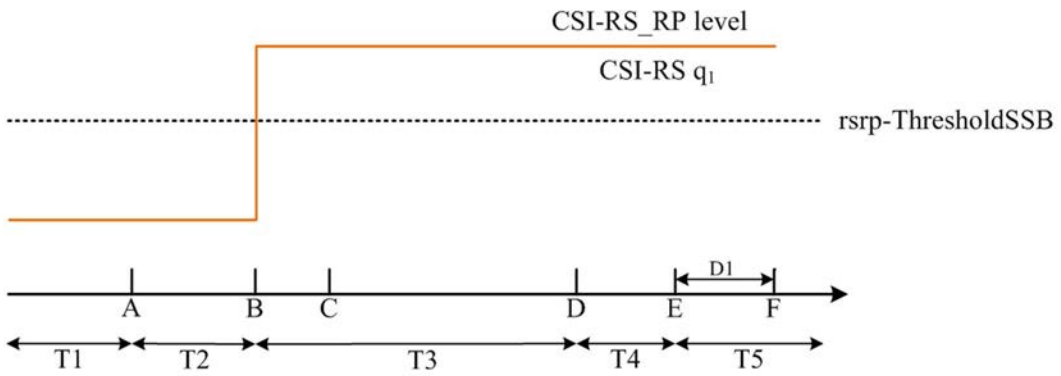


Figure A.7.5.5.6.1-2: CSI-RS_RP level variation for CSI-RS based beam failure detection and link recovery testing for SCell in non-DRX mode

A.7.5.5.6.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 in A.7.5.5.6.1 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initial link recovery. During T4 and T5 the UE measures and evaluates beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q_1. The UE shall not transmit PUCCH with an LRR with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.5.7 Beam Failure Detection and Link Recovery Test for FR2 SCell configured with CSI-RS-based BFD and LR in DRX mode

A.7.5.5.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for an active SCell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the SCell with *schedulingRequestID-BFR-SCell-r16* configuration, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 SCell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.7.1-1, A.7.5.5.7.1-2 and A.7.5.5.7.1-3. There are two cell, cell 1 is the active PCell and cell 2 is the active SCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.7.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active SCell to emulate CSI-RS based beam failure. Figure A.7.5.5.7.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.7.5.5.7.1-1: Supported test configurations for FR2 PCell and SCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.5.7.1-2: General test parameters for FR2 SCell for beam failure detection and link recovery testing in DRX mode

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Active PCell		1		Cell 1	
RF Channel Number for PCell		1		1	
Active SCell		1		Cell 2	
RF Channel Number for SCell		1		2	
Duplex mode		1		TDD	
TDD Configuration		1		TDDConf.3.1	
$BW_{channel}$		1	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1		66	
PDSCH/PDCCH subcarrier spacing		1	kHz	120	
DL initial BWP configuration		1		DLBWP.0.1	
DL dedicated BWP configuration		1		DLBWP.1.1	
UL initial BWP configuration		1		ULBWP.0.1	
UL dedicated BWP configuration		1		ULBWP.1.1	
PDSCH Reference Channel		1		SR.3.2 TDD	
RMSI CORESET Reference Channel		1		CR.3.1 TDD	A.3.1.2
Dedicated CORESET Reference Channel		1		CCR.3.1 TDD	
OCNG parameters		1		OP.1	A.3.2.1
CP length		1		Normal	
PDSCH/PDCCH TCI state		1		TCI.State.0	
CSI-RS for tracking		1		TRS.2.1 TDD	
SSB Configuration		1		SSB.3 FR2	A.3.10
SMTC Configuration		1		SMTC.3	A.3.11
PRACH Configuration		1		FR2 PRACH configuration 4	Table A.3.8.3.4-1
DRX configuration		1		DRX.3	A.3.3.3
CSI-RS configuration for BFD/CBD on SCell		1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0)		1		0	
CSI-RS index assigned as CBD RS (q_1)		1		1	
CSI-RS configuration for RLM on PCell		1		CSI-RS.3.2 TDD	A.3.14.2
Beam failure detection transmission parameters	DCI format	1		1-0	
	Number of Control OFDM symbols	1		2	
	Aggregation level	1	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1	dB	0	
	DMRS precoder granularity	1		REG bundle size	
	REG bundle size	1		6	
Gap pattern ID		1		N/A	
schedulingRequestID-BFR-SCell-r16		1		Configured	
Periodicity of PUCCH for SR configuration for BFR on SCell		1	slot	40	5 ms
Offset of PUCCH for SR configuration for BFR on SCell		1	slot	4	
PUCCH parameters for SR configuration for BFR on SCell		1		Table 8.3.3.1.2-1 in [13]	
rlmInSyncOutOfSyncThreshold		1		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
powerControlOffsetSS	1		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount	1		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer	1		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	1		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType	1		periodic	
reportQuantity	1		cri-RI-PMI-CQI	
CSI reporting periodicity	1	slot	40	
CSI reporting offset	1	slot	4	
T310	1	ms	1000	
N310	1		2	
T1	1	s	1	The UE shall be fully synchronized to cell 1 during T1
T2	1	s	5.43	
T3	1	s	5.16	
T4	1	s	0	
T5	1	s	0.31	
D1	1	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.5.7.1-3: Cell specific test parameters for FR2 SCell for beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Cell 1	Test 1 Cell 2				
			T1 to T5	T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15	Setup 1 defined in A.3.15				
Assumption for UE beams Note 10			Rough	Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR_CSI-RS of set q_0	Config 1	dB	5	5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1	dBm/ SCS kHz	-104.5	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/120 kHz	-104.7	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz	TDL-A 30 ns 75 Hz				

Parameter	Unit	Cell 1	Test 1 Cell 2				
		T1 to T5	T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 4: Void							
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.							
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.							
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.7.1-1.							
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.							
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.							

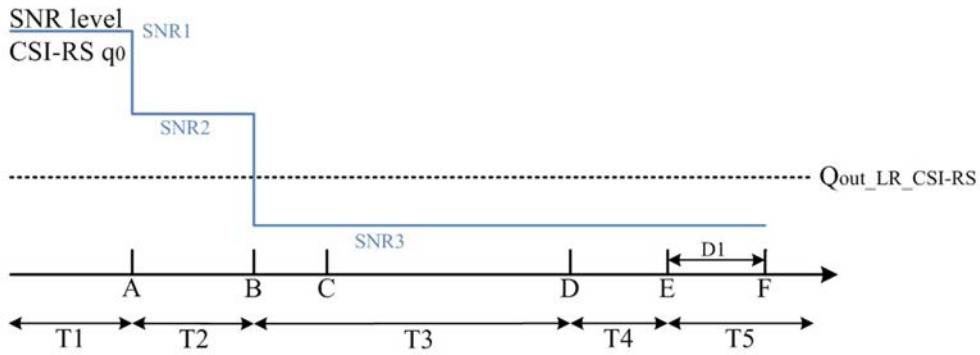


Figure A.7.5.5.7.1-1: SNR variation for beam failure detection and link recovery testing for SCell in DRX mode

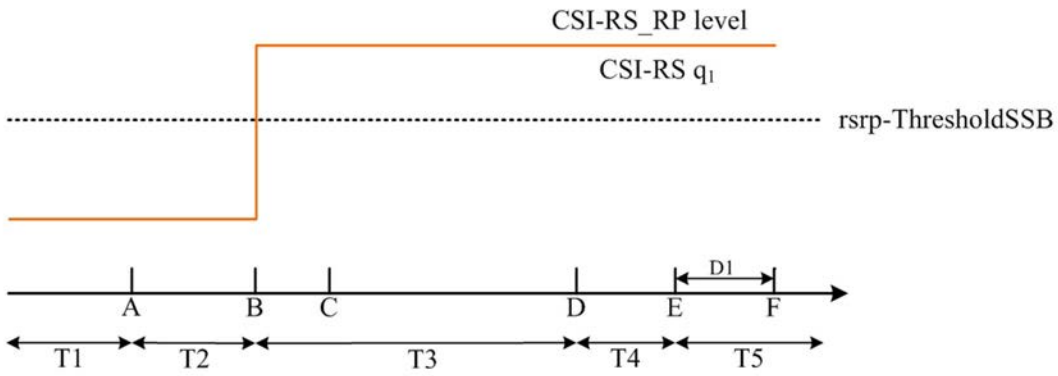


Figure A.7.5.5.7.1-2: CSI-RS_RP level variation for CSI-RS based beam failure detection and link recovery testing for SCell in DRX mode

A.7.5.5.7.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 in A.7.5.5.7.1 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initial link recovery. During T4 and T5 the UE measures and evaluates beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set q_1. The UE shall not transmit PUCCH with an LRR with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.5.8 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with CSI-RS-based BFD and LR in DRX mode for UE fulfilling relaxed measurement criterion

A.7.5.5.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.3.4 for UE fulfilling good serving cell quality relaxed measurement criteria. The test parameters are given in Tables A.7.5.5.8.1-1, A.7.5.5.8.1-2, A.7.5.5.8.1-3, and A.7.5.5.8.1-4 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.8.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.7.5.5.8.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

As specified in the Test Purpose, the UE is configured with the relaxed measurement criterion for both low mobility and good serving cell quality defined in clause 5.7.13.2 in TS 38.331 [2]. At the beginning of T1, the UE has fulfilled the good serving cell quality relaxation measurements criterion and is performing relaxed measurements for beam failure detection.

- *goodServingCellEvaluationBFD* [2] criterion is configured according to the parameters listed in table A.7.5.5.8.1-2;
- *lowMobilityEvalutationcConnected* [2] criterion is configured according to the parameters listed in table A.7.5.5.8.1-2.

Table A.7.5.5.8.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.5.8.1-2: General test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active PCell	1		Cell 1	
RF Channel Number	1		1	
Duplex mode	1		TDD	
TDD Configuration	1		TDDConf.3.1	
$BW_{channel}$	1		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1		66	
PDSCH/PDCCH subcarrier spacing	1	kHz	120	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
DL initial BWP configuration		1		DLBWP.0.1	
DL dedicated BWP configuration		1		DLBWP.1.1	
UL initial BWP configuration		1		ULBWP.0.1	
UL dedicated BWP configuration		1		ULBWP.1.1	
PDSCH Reference Channel		1		SR.3.2 TDD	
RMSI CORESET Reference Channel		1		CR.3.1 TDD	
Dedicated CORESET Reference Channel		1		CCR.3.1 TDD	
OCNG parameters		1		OP.1	
CP length		1		Normal	
PDSCH/PDCCH TCI state		1		TCI.State.0	
CSI-RS for tracking		1		TRS.2.1 TDD	
SSB Configuration		1		SSB.1 FR2	
SMTC Configuration		1		SMTC.3	
PRACH Configuration		1		FR2 PRACH configuration 4	A.3.8.3.4
DRX configuration		1		DRX.3	A.3.3.3
CSI-RS configuration for BFD/CBD/RLM		1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0)		1		0	
CSI-RS index assigned as CBD RS (q_1)		1		1	
CSI-RS index assigned as RLM RS		1		0,1	
Beam failure detection transmission parameters	DCI format	1		1-0	
	Number of Control OFDM symbols	1		2	
	Aggregation level	1	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1	dB	0	
	DMRS precoder granularity	1		REG bundle size	
	REG bundle size	1		6	
Gap pattern ID		1		N/A	
rlmInSyncOutOfSyncThreshold		1		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType		1		periodic	
reportQuantity		1		cri-RI-PMI-CQI	
CSI reporting periodicity		1	slot	40	
CSI reporting offset		1	slot	4	
T310		1	ms	1000	
N310		1		1	
offset		4	dB	N/A	*offset* in goodServingCellEvaluationBFD
s-SearchDeltaP-Connected		1	dB	6	Used to determine if low mobility relaxed criterion is fulfilled
t-SearchDeltaP-Connected		1	s	5	Used to determine if low mobility relaxed criterion is fulfilled

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
T1	1	s	-6-	The UE shall be fully synchronized to cell 1 during T1. UE is performing relaxed measurements for BFD.
T2	1	s	-3.6-	
T3	1	s	-9.64-	
T4	1	s	0	
T5	1	s	0.31	
D1	1	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.5.8.1-3: Cell specific test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	**T2**	**T3**	**T4**	**T5**
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5 Note 11	5 Note 11	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.4.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

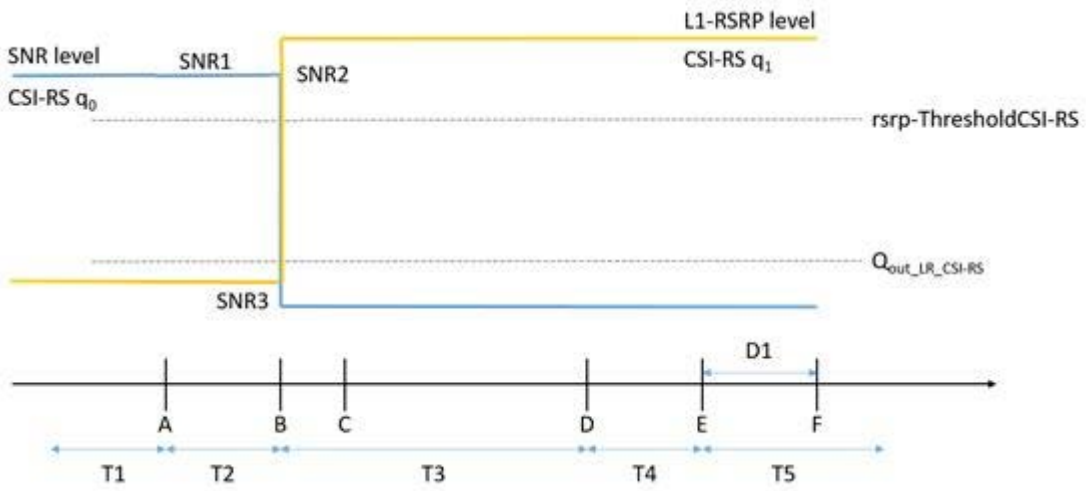


Figure A.7.5.5.8.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

A.7.5.5.8.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery, and exit from relaxed measurements. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.5.9 TRP specific Beam Failure Detection and Link Recovery Test for FR2 SCell configured with CSI-RS-based BFD and LR in DRX mode

A.7.5.5.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects TRP specific CSI-RS-based beam failure and link recovery in the sets $\bar{q}_{0,0}$ and $\bar{q}_{1,0}$ for TRP0 when DRX is used for an FR2 active SCell requirements in clause 8.18.

The test parameters are given in Tables A.7.5.5.9.1-1, A.7.5.5.9.1-2 and A.7.5.5.9.1-3. There are two cell, cell 1 is the active PCell and cell 2 is the active SCell, in the test. SCell is configured with two TRPs. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.9.1-1 shows the variation of the downlink SNR of the CSI-RS in set $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ in the active SCell for TRP0 and TRP1 respectively. Figure A.7.5.5.9.11-1additionally shows the variation of the downlink L1-RSRP of the CSI-RS in $\bar{q}_{1,0}$ for TPR0. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.7.5.5.9.1-1: Supported test configurations for FR2 PCell and SCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.5.9.1-2: General test parameters for FR2 SCell for beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number for PCell			1	
Active SCell			Cell 2	
RF Channel Number for SCell			2	
Duplex mode	Config 1		TDD	
BW channel	Config 1		100: $N_{PRB,c}$ = 66	
DL initial BWP configuration	Config 1		DLBWP.0.1	
DL dedicated BWP configuration	Config 1		DLBWP.1.1	
UL initial BWP configuration	Config 1		ULBWP.0.1	
UL dedicated BWP configuration	Config 1		ULBWP.1.1	
TDD Configuration	Config 1		TDDConf.3.1	
CORESET Reference Channel	Config 1		CR.3.1 TDD	A.3.1.2
SSB Configuration	Config 1		SSB.3 FR2	A.3.11
SMTC Configuration	Config 1		SMTC.3	A.3.10
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz	
PRACH Configuration	Config 1		Table A.3.8.3.1-1	
CSI-RS configuration for TRP0	Config 1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS configuration for TRP1	Config 1		CSI-RS.3.6 TDD	A.3.14.2
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.3.1 TDD	A.3.14.2
TRS configuration	Config 1		TRS.2.1 TDD	
TCI configuration	Config 1		CSI-RS.Config.0	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.3	
Gap pattern ID			N/A	
schedulingRequestID-BFR-SCell-r16			Configured	

Parameter		Unit	Value	Comment
			Test 1	
Periodicity of PUCCH for SR configuration for BFR on SCell		Slot	40	5 ms
Offset of PUCCH for SR configuration for BFR on SCell		Slot	5	
PUCCH parameters for SR configuration for BFR on SCell			Table 8.3.3.1.2-1 in [13]	
csi-RS-Index assigned as BFD RS in set (q00)			0	
csi-RS-Index assigned as BFD RS in set (q01)			2	
CSI-RS index assigned as RLM RS			0, 1	
CSI-RS Index assigned as CBD RS in set (q10)			1	
CSI-RS Index assigned as CBD RS in set (q11)			3	
SSB index assigned as RLM RS			0, 1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdCSI-RS	Config 1	dBm/SCS	-95	Threshold used for $Q_{in_LR_CSI-RS}$
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	10.81	
T3		s	10.28	
T4		s	0	
T5		s	0.57	
D1		s	0.53	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.5.9.1-3: Cell specific test parameters for FR2 SCell for beam failure detection and link recovery testing in DRX mode

Parameter	Unit	Cell 1	Cell 2				
		T1 to T5	T1	T2	T3	T4	T5
AoA setup		Setup 3 as specified in clause A.3.15 Note 11					
Assumption for UE beams Note 10		Rough	Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB						
EPRE ratio of PBCH DMRS to SSS	dB						
EPRE ratio of PBCH to PBCH DMRS	dB						
EPRE ratio of PSS to SSS	dB						
EPRE ratio of PDSCH DMRS to SSS	dB						
EPRE ratio of PDSCH to PDSCH DMRS	dB						
EPRE ratio of OCNG DMRS to SSS	dB						
EPRE ratio of OCNG to OCNG DMRS	dB						
SNR_CSI-RS of set $q_{0,0}$	dB	5	5	-3	-12	-12	-12
SNR_CSI-RS of set $q_{0,1}$	dB	5	5	5	5	5	5
SNR_CSI-RS of set $q_{1,0}$	dB	0.2	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set $q_{1,0}$	dBm/ SCS kHz	-104.5	-104.5	-104.5	-84.5	-84.5	-84.5

Parameter	Unit	Cell 1	Cell 2				
		T1 to T5	T1	T2	T3	T4	T5
N_{oc}	dBm/120 kHz	-104.7	-104.7				
Propagation condition		TDL-A 30 ns 75 Hz	TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.7.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: AoA1 for PCell and TRP1 of SCell , AoA2 for TRP2 of SCell

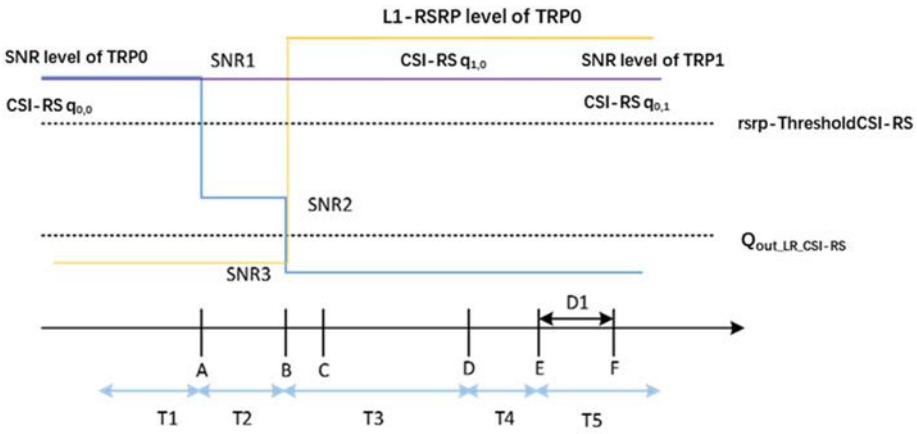


Figure A.7.5.5.9.1-1: SNR and L1-RSRP variation for beam failure detection and link recovery testing for SCell in DRX mode

A.7.5.5.9.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 in A.7.5.5.9.1 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1 for TRP1 and TRP2.

During the period from time point A to time point B the UE shall transmit uplink signal in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3, T4, T5, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1 for TRP2.

During T3 the UE shall detect beam failure and initiate link recovery for TRP1. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_{0,1}$.

No later than time point F occurring no later than D1 = [520]+10 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set $q_{0,1}$. The UE shall not transmit PUCCH with an LRR with the candidate beam set $q_{0,1}$ earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.5.10 TRP specific Beam Failure Detection and Link Recovery Test for FR2 PCell configured with SSB-based BFD and LR in non-DRX mode

A.7.5.5.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects TRP specific SSB-based beam failure and link recovery in the sets $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ for TRP1 with *schedulingRequestID-BFR-r17* configured, when no DRX is used for an FR2 serving cell requirements in clause 8.18.

The test parameters are given in Tables A.7.5.5.10.1-1, A.7.5.5.10.1-2, A.7.5.5.10.1-3 and A.7.5.5.10.1-4 below. There is one active serving cell configured with two TRPs in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.10.1-1 shows the variation of the downlink SNR of the SSB in set $\bar{q}_{0,0}$ and $\bar{q}_{1,0}$ for TRP1 and TRP2 respectively. Figure A.7.5.5.10.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set $\bar{q}_{0,1}$ for TPR1.

Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test 1.

Table A.7.5.5.10.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.7.5.5.10.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	Same configuration for both TRP whereever applicbale
Active PCell			Cell 1	
RF Channel Number for PCell			1	
Duplex mode	Config 1,2		TDD	
TDD Configuration	Config 1,2		TDDConf.3.1	
BW channel	Config 1,2		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	Config 1,2		66	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	120	
DL initial BWP configuration	Config 1,2		DLBWP.0.1	
DL dedicated BWP configuration	Config 1,2		DLBWP.1.1	
UL initial BWP configuration	Config 1,2		ULBWP.0.1	
UL dedicated BWP configuration	Config 1,2		ULBWP.1.1	
PDSCH Reference Channel	Config 1		SR.3.2 TDD	
	Config 2		SR.3.3 TDD	
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD	
	Config 2		CR.3.2 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.3.1 TDD	A.3.1.2
	Config 2		CCR.3.7 TDD	
OCNG parameters	Config 1,2		OP.1	
CP length	Config 1,2		Normal	
PDSCH/PDCCH TCI state	Config 1,2		TCI.State.0	
CSI-RS for tracking	Config 1,2		TRS.2.1 TDD	

Parameter		Unit	Value Test 1	Comment Same configuration for both TRP whereever applicbale
CSI-RS configuration for CSI reporting	Config 1,2		CSI-RS.3.1 TDD	
reportConfigType	Config 1,2		periodic	
reportQuantity	Config 1,2		cri-RI-PMI-CQI	
CSI reporting periodicity	Config 1,2	slot	40	
CSI reporting offset	Config 1,2	slot	4	
SSB Configuration for TRP0	Config 1		SSB.1 FR2	
	Config 2		SSB.2 FR2	
SSB Configuration for TRP1	Config 1		SSB.9 FR2	
	Config 2		SSB.10 FR2	
SMTC Configuration	Config 1,2		SMTC.3	A.3.10
PRACH Configuration	Config 1,2		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration	Config 1,2		OFF	
SSB Index assigned as BFD RS (q0,0)	Config 1,2		0	
SSB Index assigned as CBD RS (q1,0)	Config 1,2		1	
SSB Index assigned as BFD RS (q0,1)	Config 1,2		2	
SSB Index assigned as CBD RS (q1,1)	Config 1,2		3	
SSB Index assigned as RLM RS	Config 1,2		0,1,2,3	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
Gap pattern ID			gp0	
gapOffset			0	
schedulingRequestID-BFR- r17			Configured	
Periodicity of PUCCH for SR configuration for BFR on PCell		slot	40	5 ms
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
	Config 2		-92	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	2.61	
T3		s	1.64	
T4		s	0	
T5		s	1.01	
D1		s	0.97	

Parameter	Unit	Value	Comment
		Test 1	Same configuration for both TRP whereever applicbale
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.			
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.7.5.5.10.13: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 3 as specified in clause A.3.15 Note 12				
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set $q_{0,0}$	Config 1-2	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_SSB of set $q_{0,1}$	Config 1-2	dB	5 Note 11	5 Note 11	5 Note 11	5 Note 11	5 Note 11
SNR_SSB of set $q_{1,0}$	Config 1-2	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of set $q_{1,0}$	Config 1	dBm/ SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 2		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1,2	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.							
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.							
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.							
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.1.1-1.							
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.							
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.							
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband							
NOTE 12: AoA1 for TRP1 and AoA2 for TRP2							

Table A.7.5.5.10.1-4: Void

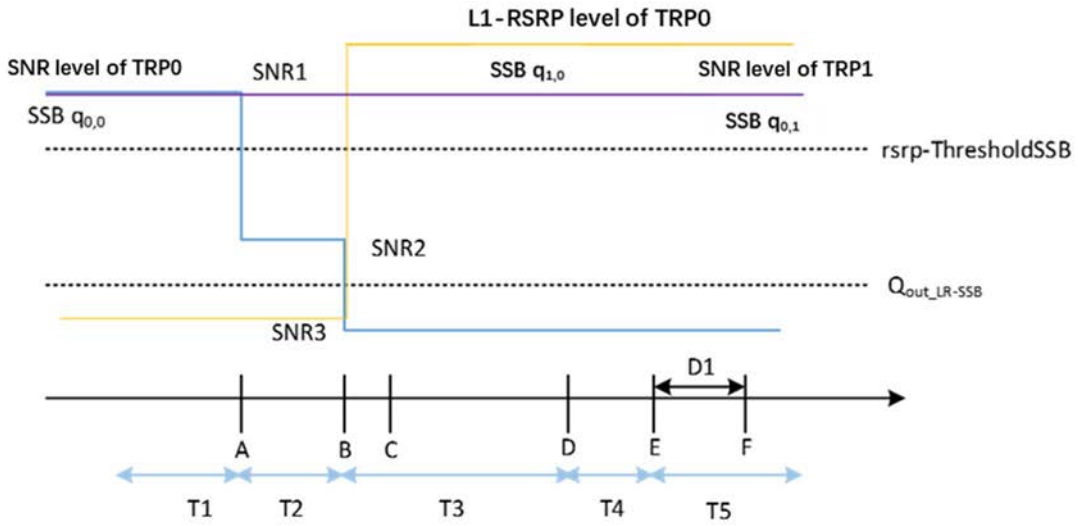


Figure A.7.5.5.10.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.7.5.5.10.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1 for TRP 0 and TRP1.

During the period from time point A to time point B the UE shall transmit uplink signal for TRP 0 and TRP1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3, T4, T5, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission for TRP 1.

During T3 the UE shall detect beam failure and initiate link recovery for TRP 0. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_{1,0}$.

No later than time point F occurring no later than D1 = 960+10 ms after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing a beam associated with the candidate beam set $q_{1,0}$. The UE shall not transmit PUCCH with an LRR with the candidate beam set $q_{1,0}$ earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.5.11 Beam Failure Detection and Link Recovery Test for FR2-2 PCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.7.5.5.11.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2-2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.11.1-1, A.7.5.5.11.1-2, and A.7.5.5.11.1-3 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.11.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.7.5.5.11.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time

duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.7.5.5.11.1-1: Supported test configurations for FR2-2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	TDD duplex mode, 480 kHz SSB SCS, 400 MHz bandwidth
3	TDD duplex mode, 960 kHz SSB SCS, 400 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR2-2	

Table A.7.5.5.11.1-2: General test parameters for FR2-2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
Active PCell		1,2,3		Cell 1	
RF Channel Number		1,2,3		1	
Duplex mode		1,2,3		TDD	
TDD Configuration		1,2,3		TDDConf.3.1	
$BW_{channel}$		1		100: $N_{PRB,c}$ = 66	
		2		400: $N_{PRB,c}$ = 66	
		3		400: $N_{PRB,c}$ = 33	
Data PRBs allocated		1		66	
		2		66	
		3		33	
PDSCH/PDCCH subcarrier spacing		1	kHz	120	
		2	kHz	480	
		3	kHz	960	
DL initial BWP configuration		1,2,3		DLBWP.0.1	
DL dedicated BWP configuration		1,2,3		DLBWP.1.1	
UL initial BWP configuration		1,2,3		ULBWP.0.1	
UL dedicated BWP configuration		1,2,3		ULBWP.1.1	
PDSCH Reference Channel		1,2,3		SR.3.2 TDD	
RMSI CORESET Reference Channel		1,2,3		CR.3.1 TDD	
Dedicated CORESET Reference Channel		1,2,3		CCR.3.1 TDD	
OCNG parameters		1,2,3		OP.1	
CP length		1,2,3		Normal	
PDSCH/PDCCH TCI state		1,2,3		TCI.State.0	
CSI-RS for tracking		1,2,3		TRS.2.1 TDD	
SSB Configuration		1,2,3		SSB.1 FR2	
SMTC Configuration		1,2,3		SMTC.3	
PRACH Configuration		1,2,3		FR2 PRACH configuration 4	A.3.8.3.4
DRX configuration		1,2,3		OFF	
CSI-RS configuration for BFD/CBD/RLM		1,2,3		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0)		1,2,3		0	
CSI-RS index assigned as CBD RS (q_1)		1,2,3		1	
CSI-RS index assigned as RLM RS		1,2,3		0,1	
Beam failure detection transmission parameters	DCI format	1,2,3		1-0	
	Number of Control OFDM symbols	1,2,3		2	
	Aggregation level	1,2,3	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1,2,3	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1,2,3	dB	0	
	DMRS precoder granularity	1,2,3		REG bundle size	
	REG bundle size	1,2,3		6	
Gap pattern ID		1,2,3		N/A	

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
rlmInSyncOutOfSyncThreshold	1,2,3		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB	1,2,3	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS	1,2,3		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount	1,2,3		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer	1,2,3		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	1,2,3		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType	1,2,3		periodic	
reportQuantity	1,2,3		cri-RI-PMI-CQI	
CSI reporting periodicity	1,2,3	slot	40	
CSI reporting offset	1,2,3	slot	4	
T310	1,2,3	ms	1000	
N310	1,2,3		2	
T1	1,2,3	s	1	The UE shall be fully synchronized to cell 1 during T1
T2	1,2,3	s	1.17	
T3	1,2,3	s	0.9	
T4	1,2,3	s	0	
T5	1,2,3	s	0.31	
D1	1,2,3	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.5.11.1-3: Cell specific test parameters for FR2-2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumptpion for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1,2,3	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1,2,3	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1,2,3	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1,2,3	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Void						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.11.1-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.						
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.						
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband						

Table A.7.5.5.11.1-4: Void

Table A.7.5.5.11.1-5: Void

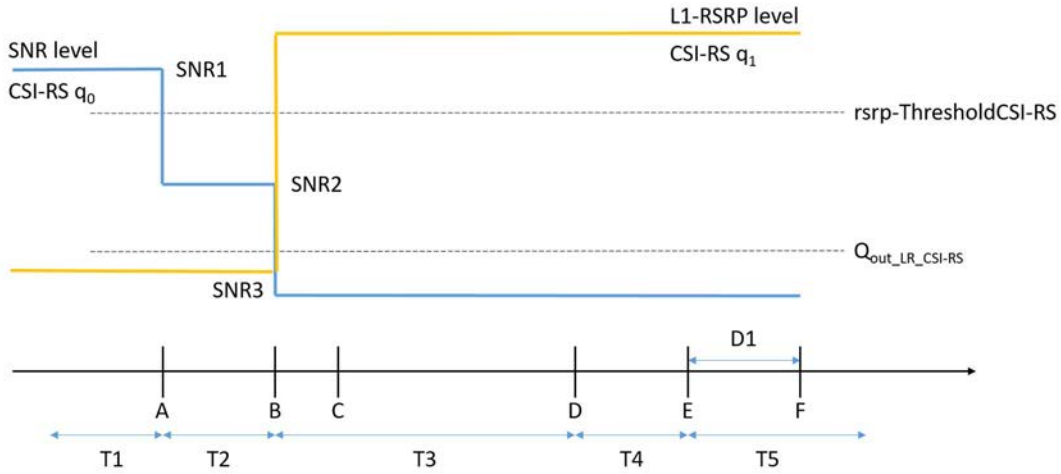


Figure A.7.5.5.11.1-1: SNR and L1-RSRP variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

A.7.5.5.11.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.5.12 Beam Failure Detection and Link Recovery Test for FR2-2 PCell configured with CSI-RS-based BFD and LR in DRX mode

A.7.5.5.12.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2-2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.12.1-1, A.7.5.5.12.1-2, A.7.5.5.12.1-3, and A.7.5.5.12.1-4 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.12.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.7.5.5.12.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.7.5.5.12.1-1: Supported test configurations for FR2-2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	TDD duplex mode, 480 kHz SSB SCS, 400 MHz bandwidth
3	TDD duplex mode, 960 kHz SSB SCS, 400 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR2-2	

Table A.7.5.5.12.1-2: General test parameters for FR2-2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active PCell	1,2,3		Cell 1	
RF Channel Number	1,2,3		1	
Duplex mode	1,2,3		TDD	
TDD Configuration	1,2,3		TDDConf.3.1	
$BW_{channel}$	1		100: $N_{PRB,c}$ = 66	
	2		400: $N_{PRB,c}$ = 66	
	3		400: $N_{PRB,c}$ = 33	
Data PRBs allocated	1		66	
	2		66	
	3		33	
PDSCH/PDCCH subcarrier spacing	1	kHz	120	
	2	kHz	480	
	3	kHz	960	
DL initial BWP configuration	1,2,3		DLBWP.0.1	
DL dedicated BWP configuration	1,2,3		DLBWP.1.1	
UL initial BWP configuration	1,2,3		ULBWP.0.1	
UL dedicated BWP configuration	1,2,3		ULBWP.1.1	
PDSCH Reference Channel	1,2,3		SR.3.2 TDD	
RMSI CORESET Reference Channel	1,2,3		CR.3.1 TDD	
Dedicated CORESET Reference Channel	1,2,3		CCR.3.1 TDD	
OCNG parameters	1,2,3		OP.1	
CP length	1,2,3		Normal	
PDSCH/PDCCH TCI state	1,2,3		TCI.State.0	
CSI-RS for tracking	1,2,3		TRS.2.1 TDD	
SSB Configuration	1,2,3		SSB.1 FR2	
SMTC Configuration	1,2,3		SMTC.3	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
PRACH Configuration		1,2,3		FR2 PRACH configuration 4	A.3.8.3.4
DRX configuration		1,2,3		DRX.3	A.3.3.3
CSI-RS configuration for BFD/CBD/RLM		1,2,3		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0)		1,2,3		0	
CSI-RS index assigned as CBD RS (q_1)		1,2,3		1	
CSI-RS index assigned as RLM RS		1,2,3		0,1	
Beam failure detection transmission parameters	DCI format	1,2,3		1-0	
	Number of Control OFDM symbols	1,2,3		2	
	Aggregation level	1,2,3	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1,2,3	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1,2,3	dB	0	
	DMRS precoder granularity	1,2,3		REG bundle size	
	REG bundle size	1,2,3		6	
Gap pattern ID		1,2,3		N/A	
rlmInSyncOutOfSyncThreshold		1,2,3		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1,2,3	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1,2,3		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1,2,3		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1,2,3		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1,2,3		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType		1,2,3		periodic	
reportQuantity		1,2,3		cri-RI-PMI-CQI	
CSI reporting periodicity		1,2,3	slot	40	
CSI reporting offset		1,2,3	slot	4	
T310		1,2,3	ms	1000	
N310		1,2,3		2	
T1		1,2,3	s	1	The UE shall be fully synchronized to cell 1 during T1
T2		1,2,3	s	5.43	
T3		1,2,3	s	5.16	
T4		1,2,3	s	0	
T5		1,2,3	s	0.31	
D1		1,2,3	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.7.5.5.12.1-3: Cell specific test parameters for FR2-2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter	Unit	Test 1				
		T1	**T2**	**T3**	**T4**	**T5**
AoA setup		Setup 1 defined in A.3.15				
Assumption for UE beams Note 10		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					
EPRE ratio of PSS to SSS	dB					
EPRE ratio of PDSCH DMRS to SSS	dB					
EPRE ratio of PDSCH to PDSCH DMRS	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1,2,3	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1,2,3	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1,2,3	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1,2,3	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.12.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.7.5.5.12.1-4: Void

Table A.7.5.5.12.1-5: Void

Table A.7.5.5.12.1-6: Void

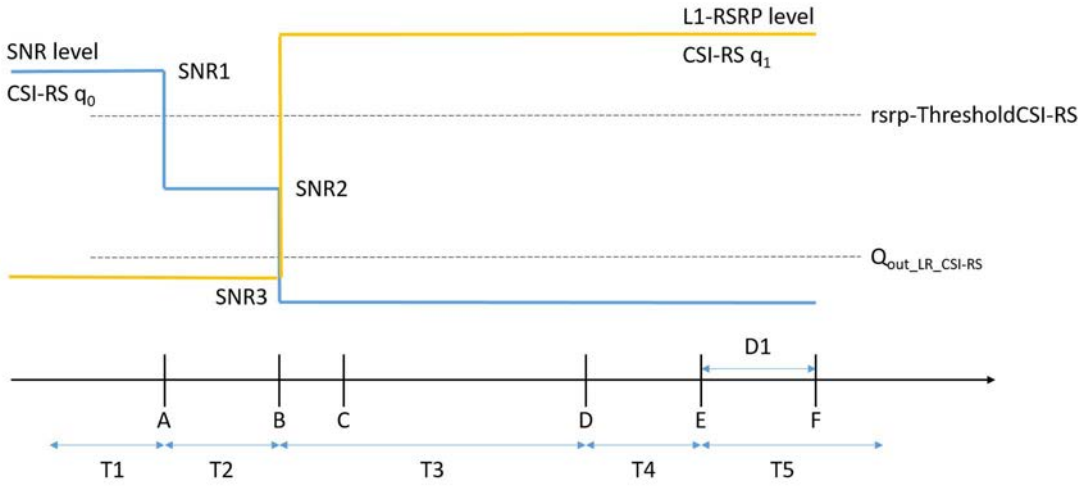


Figure A.7.5.5.12.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

A.7.5.5.12.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.5.13 Scheduling availability restriction during Beam Failure Detection and Link Recovery for FR2-2 PCell configured with SSB-based BFD and LR in non-DRX mode

A.7.5.5.13.1 Test Purpose and Environment

The purpose is to test scheduling availability restrictions when the UE is performing beam failure detection or when the UE is performing L1-RSRP measurement for candidate beam detection, when no DRX is used. This test will verify the scheduling availability restriction requirements in clause 8.5.7 and 8.5.8.

The test parameters are given in Tables A.7.5.5.13.1-1, A.7.5.5.13.1-2 and A.7.5.5.13.1-3 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.13.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.7.5.5.13.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. This test will focus on the scheduling availability during beam failure detection) and candidate beam detection. In the test, DRX configuration is not enabled. Test is to test the scheduling availability restriction of UE performing beam failure detection and candidate beam detection when SSB RS configured for Beam failure detection and candidate beam detection. During the test the UE is scheduled to transmit continuously in UL.

Table A.7.5.513.1-1: Supported test configurations for FR2-2 PCell

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.5.13.1-2: General test parameters for FR2-2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active PCell	1-2		Cell 1	
RF Channel Number	1-2		1	
Duplex mode	1-2		TDD	
TDD Configuration	1-2		TDDConf.3.1	
$BW_{channel}$	1-2		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1-2		66	
PDSCH/PDCCH subcarrier spacing	1-2	kHz	120	
DL initial BWP configuration	1-2		DLBWP.0.1	
DL dedicated BWP configuration	1-2		DLBWP.1.1	
UL initial BWP configuration	1-2		ULBWP.0.1	
UL dedicated BWP configuration	1-2		ULBWP.1.1	
PDSCH Reference Channel	1		SR.3.2 TDD	
	2		SR.3.3 TDD	
RMSI CORESET Reference Channel	1		CR.3.1 TDD	
	2		CR.3.2 TDD	
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	
	2		CCR.3.7 TDD	
OCNG parameters	1-2		OP.1	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
CP length		1-2		Normal	
PDSCH/PDCCH TCI state		1-2		TCI.State.0	
CSI-RS for tracking		1-2		TRS.2.1 TDD	
SSB Configuration		1		SSB.1 FR2	
		2		SSB.2 FR2	
SMTC Configuration		1-2		SMTC.1	
PRACH Configuration		1-2		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration		1-2		OFF	
SSB index assigned as BFD RS (q_0)		1-2		0	
SSB index assigned as CBD RS (q_1)		1-2		1	
Beam failure detection transmission parameters	DCI format	1-2		1-0	
	Number of Control OFDM symbols	1-2		2	
	Aggregation level	1-2	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0	
	DMRS precoder granularity	1-2		REG bundle size	
	REG bundle size	1-2		6	
Gap pattern ID		1-2		N/A	
rlmInSyncOutOfSyncThreshold		1-2		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
		2		-92	
powerControlOffsetSS		1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1-2		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1-2		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1-2		CSI-RS.3.1 TDD	
reportConfigType		1-2		periodic	
reportQuantity		1-2		cri-RI-PMI-CQI	
CSI reporting periodicity		1-2	slot	40	
CSI reporting offset		1-2	slot	4	
T310		1-2	ms	1000	
N310		1-2		2	
T1		1-2	s	1	The UE shall be fully synchronized to cell 1 during T1
T2		1-2	s	2.6	
T3		1-2	s	1.64	
T4		1-2	s	0	
T5		1-2	s	1.01	
D1		1-2	s	0.97	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.7.5.5.13.1-3: Cell specific test parameters for FR2-2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
AoA Setup		Setup1 defined in A.3.15.1				
Assumption for UE beams Note 10		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1-2	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_SSB of set q_1	Config 1-2	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	Config 1	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 2		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1-2	dBm/120 kHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.13.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam given in clause B.2.1.3 and does not limit UE implementation or test system implementation
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband.

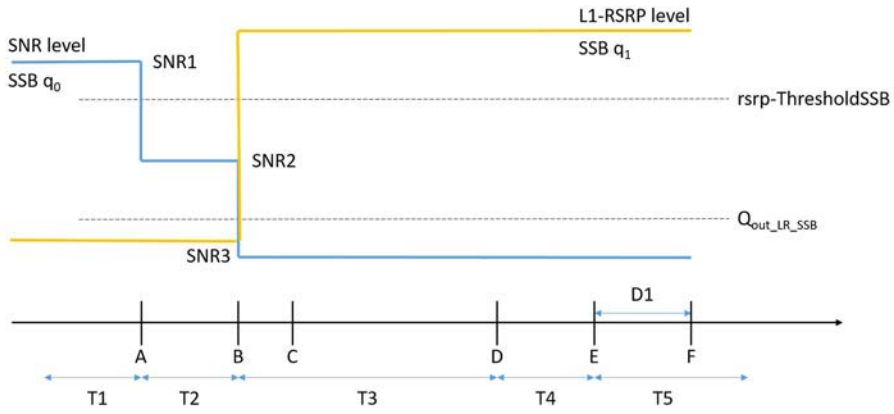


Figure A.7.5.5.13.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.7.5.5.13.2 Test Requirements

The UE behaviour during time duration T3 follows the requirements defined in clause 8.5.7.3:

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on BFD-RS symbols to be measured for beam failure detection.

The UE behaviour during time durations T4 and T5 follows the requirements defined in clause 8.5.8.3:

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on reference symbols to be measured for candidate beam detection.

A.7.5.5.14 TRP specific Beam Failure Detection and Link Recovery for FR2 PCell configured with CSI-RS-based BFD and LR and multi-Rx operation in DRX mode

A.7.5.5.14.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects TRP specific CSI-RS-based beam failure and link recovery in the sets $\bar{q}_{0,0}$ and $\bar{q}_{1,0}$ for TRP0 and sets $\bar{q}_{0,1}$ and $\bar{q}_{1,1}$ for TRP1 when DRX is used for an FR2 PCell requirements in clause 8.18.

The test parameters are given in Tables A.7.5.5.14.1-1, A.7.5.5.14.1-2 and A.7.5.5.14.1-3. Cell 1 is the active PCell in the test. PCell is configured with two TRPs. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.14.1-3 shows the variation of the downlink SNR of the CSI-RS in set $\bar{q}_{0,0}$ and $\bar{q}_{0,1}$ in the PCell for TRP0 and TRP1 respectively. Figure A.7.5.5.14.1-3 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in $\bar{q}_{1,0}$ for TPR0. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms.

In the test, UE is capable of multi-Rx operation and configured with group-based beam reporting (GBBR) on the cell 1. During T1, UE shall be able to report via beam pair associated with sets $\bar{q}_{0,0}$ for TRP0 and $\bar{q}_{0,1}$ for TRP1. After T5, UE shall be able to report via new beam pair associated with sets $\bar{q}_{1,0}$ for TRP0 and $\bar{q}_{0,1}$ for TRP1

During T2 and T3, for beam failure detection, CSI-RS resources in the two sets $\bar{q}_{0,0}$ for TRP0 and $\bar{q}_{0,1}$ for TRP1 are overlapped on the same OFDM symbol according to CSI-RS configuration in table A.7.5.5.14.1-2 and A.3.14.2-3, and the conditions in clause 8.18.3.2 are met, at least including:

- Both CSI-RSs are not in any CSI-RS resource set with repetition ON
- The CSI-RS in set $\bar{q}_{0,0}$ has same QCL source as the active TCI state of one PDSCH, and the CSI-RS in set $\bar{q}_{0,1}$ has same QCL source as the active TCI state of the other PDSCH
- Resources of the active TCI states for the two PDSCHs have been reported as a resource group in Rel-17 group-based RSRP report.

During T4 and T5, for candidate beam detection, CSI-RS resources in the two sets $\bar{q}_{1,0}$ for TRP0 and $\bar{q}_{0,1}$ for TRP1 are also overlapped according to CSI-RS configuration in table A.7.5.5.14.1-2 and and A.3.14.2-3.

In addition, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.7.5.5.14.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.5.14.1-2: General test parameters for FR2 PCell for beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number for PCell			1	
Duplex mode	Config 1		TDD	
BW channel	Config 1		100: $N_{PRB,c}$ = 66	
DL initial BWP configuration	Config 1		DLBWP.0.1	
DL dedicated BWP configuration	Config 1		DLBWP.1.1	
UL initial BWP configuration	Config 1		ULBWP.0.1	
UL dedicated BWP configuration	Config 1		ULBWP.1.1	

Parameter		Unit	Value	Comment
			Test 1	
TDD Configuration	Config 1		TDDConf.3.1	
CORESET Reference Channel	Config 1		CR.3.1 TDD	A.3.1.2
SSB Configuration	Config 1		SSB.3 FR2	A.3.11
SMTC Configuration	Config 1		SMTC.3	A.3.10
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz	
PRACH Configuration	Config 1		Table A.3.8.3.1-1	
CSI-RS configuration for TRP0	Config 1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS configuration for TRP1	Config 1		CSI-RS.3.6 TDD	A.3.14.2
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.3.1 TDD	A.3.14.2
TRS configuration	Config 1		TRS.2.1 TDD	
TCI configuration	Config 1		CSI-RS.Config.0	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.3	
Gap pattern ID			N/A	
schedulingRequestID-BFR-r17			Configured	
Periodicity of PUCCH for SR configuration for BFR on PCell		Slot	40	5 ms
CSI-RS Index assigned as BFD RS in set ($q_{0,0}$)			0	
CSI-RS Index assigned as CBD RS in set ($q_{1,0}$)			1	
CSI-RS Index assigned as BFD RS in set ($q_{0,1}$)			2	
CSI-RS Index assigned as CBD RS in set ($q_{1,1}$)			3	
CSI-RS index assigned as RLM RS			0, 1	
SSB index assigned as RLM RS			0, 1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdCSI-RS	Config 1	dBm/SCS	-95	Threshold used for $Q_{in_LR_CSI-RS}$
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
T310 Timer		ms	1000	
N310			2	

Parameter	Unit	Value	Comment
		Test 1	
T1	s	1	During this time the the UE shall be fully synchronized to cell 1
T2 (BFD time +CBD time +margin)	s	5.69	
T3 (BFD time +margin)	s	5.16	
T4	s	0	
T5 (CBD time +margin)	s	0.57	
D1 (CBD time +margin)	s	0.53	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.7.5.5.14.1-3: Cell specific test parameters for FR2 PCell for beam failure detection and link recovery testing in DRX mode

Parameter	Unit	Cell 1				
		T1	T2	T3	T4	T5
AoA setup		Setup 6 as specified in clause A.3.15 Note 11				
Assumption for UE beams Note 10		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					
EPRE ratio of PSS to SSS	dB					
EPRE ratio of PDSCH DMRS to SSS	dB					
EPRE ratio of PDSCH to PDSCH DMRS	dB					
EPRE ratio of OCNG DMRS to SSS	dB					
EPRE ratio of OCNG to OCNG DMRS	dB					
SNR_CSI-RS of set $q_{0,0}$	dB	5	-3	-12	-12	-12
SNR_CSI-RS of set $q_{0,1}$	dB	5	5	5	5	5
SNR_CSI-RS of set $q_{1,0}$	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set $q_{1,0}$	dBm/ SCS kHz	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	dBm/120 kHz	-104.7				
Propagation condition		TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.7.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
NOTE 10: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: AoA1 and AoA3 are for TRP0 of PCell, AoA2 is for TRP1 of PCell. AoA1 and A0A2 are from the set of qualified AoA pairs according to A.3.15.6.

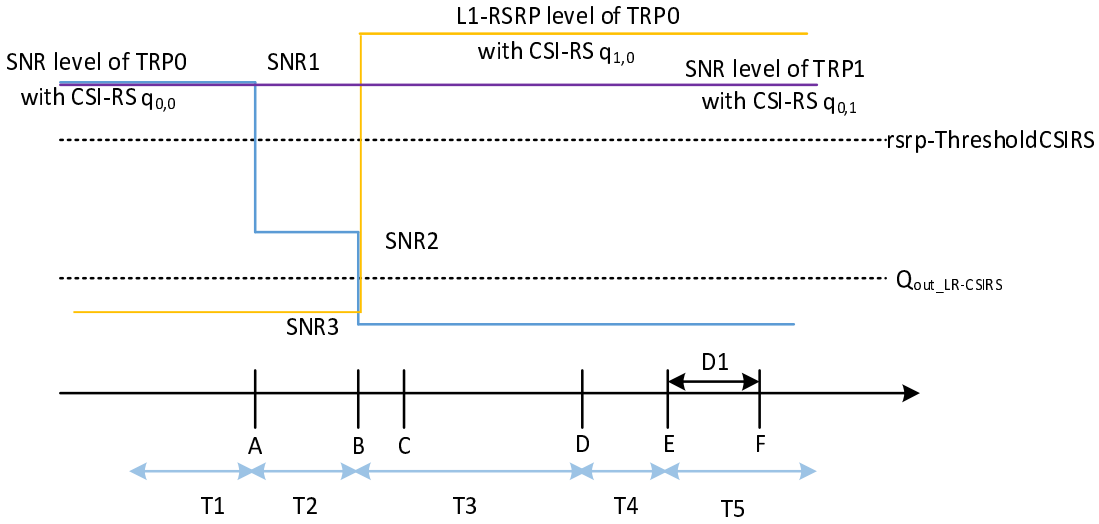


Figure A.7.5.5.14.1-1: SNR and L1-RSRP variation for beam failure detection and link recovery testing for PCell in DRX mode

A.7.5.5.14.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 in A.7.5.5.14.1 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1 with sets $\bar{q}_{0,0}$ for TRP0 and sets $\bar{q}_{0,1}$ for TRP1. During T1, UE reports via beam pair assoiated with sets $\bar{q}_{0,0}$ for TRP0 and $\bar{q}_{0,1}$ for TRP1.

During the period from time point A to time point B the UE shall transmit uplink signal in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3, T4, T5, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1 with sets $\bar{q}_{0,1}$ for TRP1.

During T3 the UE shall detect beam failure and initiate link recovery for TRP0. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate sets $\bar{q}_{1,0}$ for TRP0 and $\bar{q}_{0,1}$ for TRP1.

No later than time point F occurring no later than D1 after the start of T5, the UE shall transmit PUCCH with LRR, followed by BFR MAC CE containing beam associated with the candidate beam with sets $\bar{q}_{1,0}$ for TRP0. The UE shall not transmit PUCCH with an LRR with candidate beam set $\bar{q}_{1,0}$ for TRP0 earlier than time point B.

After T5, UE shall be able to report via new beam pair associated with sets $\bar{q}_{1,0}$ for TRP0 and $\bar{q}_{0,1}$ for TRP1.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.6 Active BWP switch

A.7.5.6.1 DCI-based and Timer-based Active BWP Switch

A.7.5.6.1.1 NR FR2- NR FR2 DL active BWP switch of SCell with non-DRX in SA

A.7.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6, and interruption requirement on other active serving cell defined in clause 8.2.2.2.5.

The supported test configurations are shown in table A.7.5.6.1.1.1-1 below. The test scenario comprises of one PCell (Cell 1) and one SCell (Cell 2) as given in table A.7.5.6.1.1.1-2. NR Cell-specific parameters are specified in table A.7.5.6.1.1.1-3 below. OTA related test parameters are shown in table A.7.5.6.1.1.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).

UE is configured with 2 different UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.

UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for PSCell, BWP-0 in Cell 1 before starting the test.

UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-1 in SCell.

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in PCell.

UE is configured with a bwp-InactivityTimer timer value for SCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for SCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in SCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of SCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell on PCell no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-2 no later than the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

The starting time of PCell (Cell 1) interruption due to BWP switch on SCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on SCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the half subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of SCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell on PCell at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-1 no later than the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The starting time of PCell (Cell 1) interruption due to BWP switch of SCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in SCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

The test equipment verifies that potential interruption to PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of SCell, respectively.

Table A.7.5.6.1.1.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD -TDD duplex mode
NOTE 1: Void	

Table A.7.5.6.1.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2	Two NR radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2	SCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and SCell
bwp-InactivityTimer	ms	200	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell 2 timing offset to cell1	µs	3	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.7.5.6.1.1.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter	Unit	Cell 1	Cell 2
Frequency Range		FR2	FR2
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66	
Active BWP ID		0	0
Downlink initial BWP Configuration		DLBWP.0.2	
Uplink initial BWP Configuration		ULBWP.0.2	N/A
Downlink active BWP-0 Configuration		DLBWP.0.2	N/A
Downlink active BWP-1 Configuration		N/A	DLBWP.1.1
Downlink active BWP-2 Configuration		N/A	DLBWP.1.3
Uplink active BWP-0 Configuration		ULBWP.0.2	N/A
Uplink active BWP-1 Configuration		N/A	N/A
Uplink active BWP-2 Configuration		N/A	N/A
PDSCH Reference measurement channel		SR.3.1 TDD	
TRS configuration		TRS.2.1 TDD	
TCI state		TCI.State.0	
RMSI CORESET parameters		CR.3.1 TDD	
Dedicated CORESET parameters		CCR.3.1 TDD	
OCNG Patterns		OP.1	
SSB Configuration		SSB.1 FR2	
SMTC Configuration		SMTC.1	
Correlation Matrix and Antenna Configuration		1x2 Low	
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation Condition		AWGN	AWGN

Parameter	Unit	Cell 1	Cell 2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.5.6.1.1.1-4: OTA related test parameters for BWP switching test case

Parameter	Unit	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 defined in clause A.3.15.1	Setup 1 defined in clause A.3.15.1
Assumtion for UE beams Note 6		Fine	Fine
N_{oc} Note1	dBm/15kHz	-112	-112
N_{oc} Note1	dBm/SCS	-103	-103
SS-RSRP Note2	dBm/SCS Note3	-85	-85
$\hat{E}_s / I_{ot}$	dB	18	18
Io Note4	dBm/95.04 MHz Note4	-56	-56
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone. NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.			

A.7.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for SCell on PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for SCell on PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, $k1$ is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed SCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T1 and T3, the start time of PCell interruption during SCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the first UL slot that occurs after the beginning of DL slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.7.5.6.1.2 NR FR1- NR FR2 DL active BWP switch of SCell with non-DRX in SA

A.7.5.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6, and interruption requirement on other active serving cell defined in clause 8.2.2.2.5.

The supported test configurations are shown in table A.7.5.6.1.2.1-1 below. The test scenario comprises of one NR PCell (Cell 1) and one NR SCell (Cell 2). The general parameters are given in table A.7.5.6.1.2.1-2. NR Cell-specific parameters are specified in table A.7.5.6.1.2.1-3 below. OTA related test parameters are shown in table A.7.5.6.1.2.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).

UE is configured with 2 different UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.

UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for PCell, BWP-0 in Cell 1 before starting the test.

UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-1 in SCell.

UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-0 in PCell.

UE is configured with a bwp-InactivityTimer timer value for SCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for SCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in SCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of SCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell on PCell no later than the first UL slot that occurs after the begining of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-2 no later than the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

The starting time of PCell (Cell 1) interruption due to BWP switch on SCell shall occur within the BWP switch delay if the UE doesn't support per-FR gap, otherwise no interruption due to BWP switch on PCell is allowed.

During T2, the test equipment won't transmit DCI format for PDSCH reception on SCell (Cell 2).

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the half subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of SCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell on PCell at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-1 no later than the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The starting time of PCell (Cell 1) interruption due to BWP switch of SCell shall occur within the BWP switch delay if the UE doesn't support per-FR gap, otherwise no interruption due to BWP switch on PCell is allowed.

The test equipment verifies the DL BWP switch time in SCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

The test equipment verifies that potential interruption to PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of SCell, respectively.

Table A.7.5.6.1.2.1-1: DL BWP switch supported test configurations

Config	Description
1	PCell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode SCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode SCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: NR 30 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode SCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.6.1.2.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		2	Two NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2	SCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and SCell
bwp-InactivityTimer	ms	200	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on SCC.
Cell 2 timing offset to cell1	µs	3	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.7.5.6.1.2.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1	Cell 2
Frequency Range			FR1	FR2
Duplex mode	Config 1		FDD	TDD
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	TDDConf.3.1
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,2	MHz	10 MHz: $N_{PRB,c}$ = 52	100 MHz: $N_{PRB,c}$ = 66
	Config 3		40 MHz: $N_{PRB,c}$ = 106	
Active BWP ID			0	1, 2
Downlink initial BWP Configuration			DLBWP.0.2	
Uplink initial BWP Configuration			ULBWP.0.2	N/A
Downlink active BWP-0 Configuration			DLBWP.0.2	N/A
Downlink active BWP-1 Configuration			N/A	DLBWP.1.1
Downlink active BWP-2 Configuration			N/A	DLBWP.1.3
Uplink active BWP-0 Configuration			ULBWP.0.2	N/A
Uplink active BWP-1 Configuration			N/A	N/A
Uplink active BWP-2 Configuration			N/A	N/A
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.3.1 TDD
	Config 2		SR.1.1 TDD	

Parameter		Unit	Cell 1	Cell 2
	Config 3		SR.2.1 TDD	
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.3.1 TDD
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.3.1 TDD
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
OCNG Patterns			OP.1	
SSB Configuration	Config 1,2		SSB.1 FR1	SSB.1 FR2
	Config 3		SSB.2 FR1	
TRS configuration	Config 1,2,3		-	TRS.2.1 TDD
TCI state	Config 1,2,3		TCI.State.0	TCI.State.0
SMTC Configuration			SMTC.1	
Correlation Matrix and Antenna Configuration			NA Link only, see clause A.3.7A	1x2 Low
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation Condition			NA Link only, see clause A.3.7A	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.5.6.1.2.1-4: OTA related test parameters for BWP switching test case

Parameter	Unit	Cell 1	Cell 2
Angle of arrival configuration		-NA Link only, see clause A.3.7A	Setup 1 defined in clause A.3.15.1
Assumption for UE beams Note 6			Fine
N_{oc} Note1	dBm/15kHz		-112
N_{oc} Note1	dBm/SCS		-103
SS-RSRP Note2	dBm/SCS Note3		-85
$\hat{E}_s/I_{ot}$	dB		18
Io Note4	dBm/95.04 MHz Note4		-56

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.

Parameter	Unit	Cell 1	Cell 2
NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.			

A.7.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

If the UE doesn't support per-FR gap,

- During T1 and T3, the start time of SCell interruption during PCell active BWP switch shall not happen outside the BWP switch delay.
- The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.2.2.2.5.

Otherwise no interruption due to BWP switch on SCell is allowed.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after the beginning of DL slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.7.5.6.1.3 NR FR2 DL active BWP switch with non-DRX in SA

A.7.5.6.1.3.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6. Supported test configurations are shown in table A.7.5.6.1.3.1-1.

The test scenario comprises of one cell (Cell 1) as given in table A.7.5.6.1.3.1-2. Cell-specific parameters of NR PCell is specified in table A.7.5.6.1.3.1-3 below. The OTA related test parameters for FR2 is shown in table A.7.5.6.1.3.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with 2 different UE-specific downlink bandwidth parts, BWP-1 and BWP-2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1.
- UE is configured with a *bwp-InactivityTimer* timer value for Cell 1.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for DL BWP switch, sent from the test equipment to the UE, is received at the UE side in Cell 1's slot # denoted *i*. The UE should switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell 1 no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-2 starting from the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

During T2, the test equipment won't transmit DCI format for PDSCH reception on Cell 1.

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the half subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell 1 at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-1 starting from the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The test equipment verifies the DL BWP switch time by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

Table A.7.5.6.1.3.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void. NOTE 2: A UE which fulfils the requirements in test case A.7.5.6.1.1 or A.7.5.6.1.2 can skip the test cases in A.7.5.6.1.3.	

Table A.7.5.6.1.3.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
bwp-InactivityTimer	ms	-200-	
T1	s	-0.2-	
T2	s	-0.2-	
T3	s	-0.2-	

Table A.7.5.6.1.3.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Active BWP ID		1, 2
Initial DL BWP Configuration		DLBWP.0.2 Note 2
Active DL BWP-1 Configuration		DLBWP.1.1 Note 2
Active DL BWP-2 Configuration		DLBWP.1.3 Note 2
Initial UL BWP Configuration		ULBWP.0.2 Note 2

Parameter	Unit	Cell 1
Active UL BWP-1 Configuration		ULBWP.1.1 Note 2
Active UL BWP-2 Configuration		ULBWP.1.3 Note 2
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State		TCI.State.0
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.7.5.6.1.3.1-4: OTA related test parameters for DL BWP switch in SA

Parameter	Unit	Cell 2
Angle of arrival configuration		Setup 1 defined in clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note 1	dBm/15 kHz	-112
N_{oc} Note 1	dBm/SCS	-103
SS-RSRP Note 2	dBm/120 kHz Note3	-85
$\hat{E}_s/I_{ot}$	dB	18
$\hat{E}_s/N_{oc}$ Note 5	dB	18
Io Note2	dBm/95.04 MHz Note4	-56

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.6.1.3.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, $k1$ is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after the beginning of DL slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.7.5.6.1.4 NR FR2-2- NR FR2-2 DL active BWP switch of SCell with non-DRX in SA

A.7.5.6.1.4.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6, and interruption requirement on other active serving cell defined in clause 8.2.2.2.5.

The supported test configurations are shown in table A.7.5.6.1.4.1-1 below. The test scenario comprises of one PCell (Cell 1) and one SCell (Cell 2) as given in table A.7.5.6.1.4.1-2. NR Cell-specific parameters are specified in table A.7.5.6.1.4.1-3 below. OTA related test parameters are shown in table A.7.5.6.1.4.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).

UE is configured with 2 different UE-specific downlink bandwidth parts for SCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.

UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for PSCell, BWP-0 in Cell 1 before starting the test.

UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-1 in SCell.

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in PCell.

UE is configured with a bwp-InactivityTimer timer value for SCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for SCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in SCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of SCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell on PCell no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-2 no later than the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

The starting time of PCell (Cell 1) interruption due to BWP switch on SCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on SCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the half subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of SCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell on PCell at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-1 no later than the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The starting time of PCell (Cell 1) interruption due to BWP switch of SCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in SCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

The test equipment verifies that potential interruption to PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of SCell, respectively.

Table A.7.5.6.1.4.1-1: DL BWP switch supported test configurations

Configuration	Description
1	NR TDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NR TDD, SSB SCS 480 kHz, data SCS 480 kHz, BW 400 MHz
3	NR TDD, SSB SCS 960 kHz, data SCS 960 kHz, BW 400 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.6.1.4.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2	Two NR radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2	SCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and SCell
bwp-InactivityTimer	ms	200	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell 2 timing offset to cell1	µs	3	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.7.5.6.1.4.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter	Unit	Config	Cell 1	Cell 2
Frequency Range		1,2,3	FR2-2	FR2-2
Duplex mode		1,2,3	TDD	
TDD configuration		1	TDDConf.3.1	
		2	TBD	
		3	TBD	
$BW_{channel}$		1	100 MHz: $N_{PRB,c}$ = 66	
		2	400 MHz: $N_{PRB,c}$ = 66	
		3	400 MHz: $N_{PRB,c}$ = 33	
Active BWP ID		1,2,3	0	0
Downlink initial BWP Configuration		1,2,3	DLBWP.0.2	
Uplink initial BWP Configuration		1,2,3	ULBWP.0.2	N/A

Parameter	Unit	Config	Cell 1	Cell 2
Downlink active BWP-0 Configuration		1,2,3	DLBWP.0.2	N/A
Downlink active BWP-1 Configuration		1,2,3	N/A	DLBWP.1.1
Downlink active BWP-2 Configuration		1,2,3	N/A	DLBWP.1.3
Uplink active BWP-0 Configuration		1,2,3	ULBWP.0.2	N/A
Uplink active BWP-1 Configuration		1,2,3	N/A	N/A
Uplink active BWP-2 Configuration		1,2,3	N/A	N/A
PDSCH Reference measurement channel		1	SR.3.1 TDD	
		2	TBD	
		3	TBD	
TRS configuration		1	TRS.2.1 TDD	
		2	TBD	
		3	TBD	
TCI state		1,2,3	TCI.State.0	
RMSI CORESET parameters		1	CR.3.1 TDD	
		2	TBD	
		3	TBD	
Dedicated CORESET parameters		1	CCR.3.1 TDD	
		2	TBD	
		3	TBD	
OCNG Patterns		1,2,3	OP.1	
SSB Configuration		1	SSB.1 FR2	
		2	TBD	
		3	TBD	
SMTC Configuration		1,2,3	SMTC.1	
Correlation Matrix and Antenna Configuration			1x2 Low	
EPRE ratio of PSS to SSS	dB		0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation Condition			AWGN	AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Table A.7.5.6.1.4.1-4: OTA related test parameters for BWP switching test case

Parameter	Unit	Config	Cell 1	Cell 2
Angle of arrival configuration		1,2,3	Setup 1 defined in clause A.3.15.1	Setup 1 defined in clause A.3.15.1
Assumtion for UE beams Note 6		1,2,3	Fine	Fine
N_{oc} Note1	dBm/15kHz		-112	-112
N_{oc} Note1	dBm/SCS	1	-103	-103
		2	-97	-97
		3	-94	-94

Parameter	Unit	Config	Cell 1	Cell 2
SS-RSRP Note2	dBm/SCS Note3	1	-85	-85
		2	-79	-79
		3	-76	-76
$\hat{E}_s/I_{ot}$	dB		18	18
Io Note4	dBm/95.04 MHz Note4	1	-56	-56
	dBm/380.16 MHz Note4	2,3	-50.0	-50.0

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.6.1.4.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for SCell on PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for SCell on PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed SCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T1 and T3, the start time of PCell interruption during SCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.7.5.6.2 RRC-based Active BWP Switch

A.7.5.6.2.1 NR FR2 DL active BWP switch of PCell with non-DRX in SA

A.7.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6.3. Supported test configurations are shown in table A.7.5.6.2.1.1-1.

The test scenario comprises of one PCell (Cell 1) as given in table A.7.5.6.2.1.1-2. Cell-specific parameters of PCell are specified in table A.7.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to completely receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ as defined in clause 8.6.3 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1. The UE shall be continuously scheduled on PCell's BWP-1 starting from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$.

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in PCell by counting the time from the time when the RRC Reconfiguration message including updated BWP configurationis sent till the time when RRC Reconfiguration Complete message is received.

Table A.7.5.6.2.1.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.6.2.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
T1	s	0.2	

Table A.7.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Active BWP ID		1
Initial DL BWP Configuration		DLBWP.0.2
Initial UL BWP Configuration		ULBWP.0.2

Parameter		Unit	Cell 1
Initial Condition	Active DL BWP-1 Configuration		DLBWP.1.3
	Active UL BWP-1 Configuration		ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration		DLBWP.1.1
	Active UL BWP-1 Configuration		ULBWP.1.1
'PDSCH Reference measurement channel			SR.3.1 TDD
RMSI CORESET parameters			CR.3.1 TDD
Dedicated CORESET parameters			CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.1 FR2
SMTC Configuration			SMTC.1
TCI State			TCI.State.0
TRS Configuration			TRS.2.1 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.7.5.6.2.1.1-4: OTA related test parameters for BWP switching test case

Parameter		Unit	Cell 1
Angle of arrival configuration			Setup 1 according to table A.3.15
Assumption for UE beams Note 5			Fine
N_{oc} Note1	NR_TDD_FR2_A	dBm/15kHz	-112
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS	-103
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
SS-RSRP Note2	NR_TDD_FR2_A	dBm/SCS Note3	-85
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
$\hat{E}_s/I_{ot}$		dB	18

Parameter		Unit	Cell 1
Io[Note2]	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-56
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone			
NOTE 5: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.			

A.7.5.6.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PCell from the first DL slot that occurs after the beginning of slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.6.2.2 NR FR2-2 DL active BWP switch of PCell with non-DRX in SA

A.7.5.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6.3. Supported test configurations are shown in table A.7.5.6.2.2.1-1.

The test scenario comprises of one PCell (Cell 1) as given in table A.7.5.6.2.2.1-2. Cell-specific parameters of PCell are specified in table A.7.5.6.2.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to completely receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ as defined in clause 8.6.3 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1. The UE shall be continuously scheduled on PSCell's BWP-1 starting from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$.

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in PSCell by counting the time from the time when the RRC Reconfiguration message including updated BWP configurationis sent till the time when RRC Reconfiguration Complete message is received.

Table A.7.5.6.2.2.1-1: DL BWP switch supported test configurations

Configuration	Description
1	NR TDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NR TDD, SSB SCS 480 kHz, data SCS 480 kHz, BW 400 MHz
3	NR TDD, SSB SCS 960 kHz, data SCS 960 kHz, BW 400 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.6.2.2.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
T1	s	[0.2]	

Table A.7.5.6.2.2.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter	Unit	Config	Cell 1	Cell 2
Frequency Range		1,2,3	FR2-2	FR2-2
Duplex mode		1,2,3	TDD	
TDD configuration		1	TDDConf.3.1	
		2	TBD	
		3	TBD	
$BW_{channel}$		1	100 MHz: $N_{PRB,c}$ = 66	
		2	400 MHz: $N_{PRB,c}$ = 66	
		3	400 MHz: $N_{PRB,c}$ = 33	
Active BWP ID		1,2,3	0	0
Downlink initial BWP Configuration		1,2,3	DLBWP.0.2	
Uplink initial BWP Configuration		1,2,3	ULBWP.0.2	N/A
Downlink active BWP-0 Configuration		1,2,3	DLBWP.0.2	N/A
Downlink active BWP-1 Configuration		1,2,3	N/A	DLBWP.1.1
Downlink active BWP-2 Configuration		1,2,3	N/A	DLBWP.1.3
Uplink active BWP-0 Configuration		1,2,3	ULBWP.0.2	N/A
Uplink active BWP-1 Configuration		1,2,3	N/A	N/A
Uplink active BWP-2 Configuration		1,2,3	N/A	N/A
PDSCH Reference measurement channel		1	SR.3.1 TDD	
		2	TBD	

Parameter	Unit	Config	Cell 1	Cell 2
		3	TBD	
TRS configuration		1	TRS.2.1 TDD	
		2	TBD	
		3	TBD	
TCI state		1,2,3	TCI.State.0	
RMSI CORESET parameters		1	CR.3.1 TDD	
		2	TBD	
		3	TBD	
Dedicated CORESET parameters		1	CCR.3.1 TDD	
		2	TBD	
		3	TBD	
OCNG Patterns		1,2,3	OP.1	
SSB Configuration		1	SSB.1 FR2	
		2	TBD	
		3	TBD	
SMTC Configuration		1,2,3	SMTC.1	
Correlation Matrix and Antenna Configuration			1x2 Low	
EPRE ratio of PSS to SSS	dB		0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation Condition			AWGN	AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Table A.7.5.6.2.2.1-4: OTA related test parameters for BWP switching test case

Parameter	Unit	Config	Cell 1	Cell 2
Angle of arrival configuration		1,2,3	Setup 1 defined in clause A.3.15.1	Setup 1 defined in clause A.3.15.1
Assumtion for UE beams Note 6		1,2,3	Fine	Fine
N_{oc} Note1	dBm/15kHz		-112	-112
N_{oc} Note1	dBm/SCS	1	-103	-103
		2	-97	-97
		3	-94	-94
SS-RSRP Note2	dBm/SCS Note3	1	-85	-85
		2	-79	-79
		3	-76	-76
$\hat{E}_s / I_{ot}$	dB		18	18
Io Note4	dBm/95.04 MHz Note4	1	-56	-56
	dBm/380.16 MHz Note4	2,3	-50.0	-50.0
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

NOTE 3:	SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4:	Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5:	As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 6:	Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.6.2.2.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PCell from the first DL slot that occurs after the beginning of slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.6.3 Simultaneous DCI-based and Timer-based Active BWP Switch on multiple CCs

A.7.5.6.3.1 Active BWP switch on multiple SCells with non-DRX in SA

A.7.5.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify fulfillment of DL BWP switch delay requirement defined in clauses 8.6.2A.1 and 8.6.2B.1, and interruption requirement on other active serving cell defined in clause 8.2.2.2.5.

The supported test configurations are shown in table A.7.5.6.3.1.1-1 below. The test scenario comprises one PCell (Cell 1) and two SCells (Cell 2 and Cell 3) as given in table A.7.5.6.3.1.1-2. NR cell-specific parameters are provided in table A.7.5.6.3.1.1-3, and OTA related test parameters in table A.7.5.6.3.1.1-4 below.

The test consists of three consecutive time periods with durations T1, T2 and T3, respectively.

PDCCHs indicating new transmissions shall be transmitted in PCell, SCell 1 and SCell 2 throughout time periods T1 and T3 to ensure that UE sends ACK/NACKs for PDSCH reception in PCell, SCell 1 and SCell 2. During T2, there shall be scheduling on PDSCH in PCell only.

Before the test starts,

UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (SCell 1) on radio channel 2 (SCC1), and Cell 3 (SCell 2) on radio channel 3 (SCC2).

UE is configured with a single UE-specific downlink bandwidth part, BWP-0, for Cell 1 (PCell). BWP-0 includes the bandwidth of the initial DL BWP and SSB.

UE is configured with two different UE-specific downlink bandwidth parts, BWP-1 and BWP-2, for Cell 2 (SCell 1). BWP-1 and BWP-2 include the bandwidth of the initial DL BWP and SSB.

UE is configured with two different UE-specific downlink bandwidth parts, BWP-3 and BWP-4, for Cell 3 (SCell 2). BWP-3 and BWP-4 include the bandwidth of the initial DL BWP and SSB.

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in PCell.

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in SCell 1.

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-3 in SCell 2.

UE is configured with a *bwp-InactivityTimer* timer value for SCell 1 and SCell 2, respectively.

All cells have constant signal levels throughout the test.

Time period T1 starts when the UE simultaneously receives DCI format 1_1 commands for DL BWP switch in SCell 1 and SCell 2, respectively, in a slot # denoted *m*. The UE shall switch its SCell 1 bandwidth part from BWP-1 to BWP-2, and its SCell 2 bandwidth part from BWP-3 to BWP-4. The UE shall be able to receive PDSCH in SCell 1 and SCell 2 starting from the first DL slot that occurs after slot ($m+T_{MultipleBWPswitchDelay}$) as defined in clause 8.6.2A.1, and to transmit ACK/NACKs in SCell 1 and SCell 2 from the first UL slot that occurs after ($m+T_{BWPswitchDelay}+k1$) where *k1* is specified in [7]. The UE shall be continuously scheduled in SCell 1 BWP-2 and SCell 2 BWP-4 no later than in the first DL slot that occurs after slot ($m+T_{MultipleBWPswitchDelay}$). The starting time of any interruption on PCell due to DL BWP switching of SCell 1 and SCell 2 shall occur within the BWP switching delay. The length of any interruption on PCell due to DL BWP switching of SCell 1 and SCell 2 shall fulfill requirements in clause 8.2.2.2.5.

Time period T2 starts when the test equipment ceases to schedule the UE on PDSCH in SCell 1 and SCell 2, thereby causing the *bwp-InactivityTimer* timers for SCell 1 and SCell 2 to be running until expiry.

Time period T3 starts at the beginning of the first DL half-subframe immediately after the earliest of the *bwp-InactivityTimer* timers expires, in a slot # denoted *n*. The UE shall switch its SCell 1 bandwidth part from BWP-2 to BWP-1, and its SCell 2 bandwidth part from BWP-4 to BWP-3. The UE shall be able to receive PDSCH in SCell 1 and SCell 2 starting from the first DL slot that occurs after slot ($n+T_{MultipleBWPswitchDelay}$) as defined in clause 8.6.2B.1, and to transmit ACK/NACKs in SCell 1 and SCell 2 from the first UL slot that occurs after slot ($n+T_{MultipleBWPswitchDelay}+k1$). The UE shall be continuously scheduled in SCell 1 BWP-1 and SCell 2 BWP-3 no later than in the first DL slot that occurs after slot ($n+T_{MultipleBWPswitchDelay}$). The starting time of any interruption on PCell due to DL BWP switching of SCell 1 and SCell 2 shall occur within the BWP switching delay. The length of any interruption on PCell due to DL BWP switching of SCell 1 and SCell 2 shall fulfill requirements in clause 8.2.2.2.5.

The test equipment verifies the DL BWP switch time by counting the slots from the time when the BWP switch commands are received or *bwp-InactivityTimer* timers expire until ACK/NACKs are sent in SCell 1 and SCell 2, respectively.

The test equipment verifies that potential interruptions of PCell due to DL BWP switching on SCell 1 and SCell 2 are carried out within the correct time span, and are within the correct length, by monitoring ACK/NACKs sent in PCell for PCell.

Table A.7.5.6.3.1.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD -TDD duplex mode

Table A.7.5.6.3.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2, 3	Three NR radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell 1		Cell 2	SCell 1 on RF channel number 2.
Active SCell 2		Cell 3	SCell 2 on RF channel number 3.
CP length		Normal	
DRX		OFF	
sCellDeactivationTimer	ms	---	Same value applies for SCell 1 and SCell 2. The value infinity is applied.
bwp-InactivityTimer	ms	200	Same value applies for SCell 1 and SCell 2.
Cell 2 timing offset to Cell 1	µs	0	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
Cell 3 timing offset to Cell 1	µs	0	
T1	s	0.2	During T1, DCI-based simultaneous BWP switching of SCell 1 and SCell 2 is carried out.
T2	s	0.2	During T2 bwp-InactivityTimer timers shall run to expiry.
T3	s	0.2	During T3, timer-based simultaneous BWP switching of SCell 1 and SCell 2 is carried out.

Table A.7.5.6.3.1.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter	Unit	Cell 1	Cell 2	Cell 3
Frequency Range		FR2		
NR RF channel		1	2	3
Duplex mode		TDD		
TDD configuration		TDDConf.3.1		
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		
Active Downlink BWP ID		0	1, 2	3, 4
Downlink initial BWP Configuration		DLBWP.0.2	DLBWP.0.2	DLBWP.0.2
Uplink initial BWP Configuration		ULBWP.0.2	ULBWP.0.2	ULBWP.0.2
Downlink active BWP-0 Configuration		DLBWP.1.1	---	---
Downlink active BWP-1 Configuration		---	DLBWP.1.1	---
Downlink active BWP-2 Configuration		---	DLBWP.1.3	---
Downlink active BWP-3 Configuration		---	---	DLBWP.1.1
Downlink active BWP-4 Configuration		---	---	DLBWP.1.3
Uplink active BWP-0 Configuration		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD		
TRS configuration		TRS.2.1 TDD		
TCI state		TCI.State.0		
RMSI CORESET parameters		CR.3.1 TDD		
Dedicated CORESET parameters		CCR.3.1 TDD		
OCNG Patterns		OP.1		
SSB Configuration		SSB.3 FR2		
SMTC Configuration		SMTC.1		
EPRE ratio of PSS to SSS	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS Note1				
EPRE ratio of OCNG to OCNG DMRS Note1				
Propagation Condition		AWGN	AWGN	AWGN
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low

NOTE 1: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.7.5.6.3.1.1-4: OTA related test parameters for BWP switching test case

Parameter	Unit	Cell 1	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 defined in clause A.3.15.1		
Assumtion for UE beams Note4		Fine	Fine	Fine
Noc Note1	dBm/15kHz	-111.7	-111.7	-111.7
Noc Note1	dBm/SCS	-102.7	-102.7	-102.7
Ês/Noc	dB	7	7	7
SSB-RP Note2	dBm/SCS	-95.7	-95.7	-95.7
Ês/Iot	dB	7	7	7
Io Note3	dBm/95.04 MHz	-65.9	[65.9	-65.9

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB-RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 4: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.6.3.1.2 Test Requirements

During T1, the UE shall start to send ACK/NACKs in SCell 1 and SCell 2 from the first UL slot that occurs after the beginning of DL slot ($m+T_{MultipleBWPswitchDelay}+k1$).

During T3, the UE shall start to send ACK/NACKs in SCell 1 and SCell 2 from the first UL slot that occurs after the beginning of DL slot ($n+T_{MultipleBWPswitchDelay}+k1$).

During T1 and T3, the start of any interruption on PCell due to active BWP switching on SCell 1 and SCell 2 shall not happen outside the BWP switching delay $T_{MultipleBWPswitchDelay}$, and the length of any interruption shall not exceed the length specified in clause 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed active BWP switch delays in SCell 1 and SCell 2 to be considered correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.6.4 SCell dormancy switch

A.7.5.6.4.1 NR FR2 PCell SCell dormancy switch of single FR2 SCell inside active time

A.7.5.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the Dormant SCell BWP switch delay requirements are within the requirements stated in clause 8.6 for UE configured with a single downlink SCell, when the dormancy indication is received in any of the first 3 OFDM symbols or is received after the first 3 OFDM symbols.

The Supported test configurations are given in table A.7.5.6.4.1.1-1. The test parameters are given in Tables A.7.5.6.4.1.1-2 and cell-specific parameters in A.7.5.6.4.1.1-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A6 is used The test consists of four successive time periods, with duration of T1, T2, T3 and T4, respectively. There are two carriers both in FR2, with one cell on the PCC and 2 cells on SCC. Cell 1, Cell 2 and Cell 3 operate in either FDD or TDD duplex mode according to test configuration. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) with configured and activated SCell (SCell 1) on radio channel 2 (SCC1). The UE is not aware of Cell 3 on radio channel 2 (SCC1). The UE is reporting CSI and shall not report CQI index 0 (out-of-range) in the available uplink resources to report CQI for the SCell. The UE shall be continuously scheduled in the PCell throughout the whole test.

The UE receives a DCI-based BWP switch command by which the SCell 1 (Cell 2) is requested to switch the active BWP to the dormant BWP.

The point in time at which the DCI message is received at the UE antenna connector, in a subframe # denoted n, defines the start of time period T1. The UE shall accomplish the BWP switch to the dormant BWP latest in subframe (n + $T_{BWPswitchDelay}$ + X). The UE shall continue to shall report valid CQI if the UE has available uplink resources to report CQI for the dormant SCell. The UE shall continue to shall report L1-RSRP if the UE has available uplink resources to report L1-RSRP for the Dormant SCell. Any PCell interruption due to BWP switch on the SCell shall occur in the subframes n to (n+ $T_{BWPswitchDelay}$ + X).

Time T2 start at T1 + ($T_{BWPswitchDelay}$ + X). During T2 the UE shall continue to measure and report CQI and L1-RSRP in the available uplink resources to report CQI and L1-RSRP for the SCell.

Time T3 starts at T2 + 500 ms. During T3 the UE shall continue to measure and report CQI and L1-RSRP in the available uplink resources to report CQI and L1-RSRP for the SCell.

Starting at T4 = T3 + 500 ms, Cell 3 becomes detectable. During T3 the UE shall continue to measure and report CQI and L1-RSRP in the available uplink resources to report CQI and L1-RSRP for the SCell. The UE shall send one Event A6 triggered measurement report, with a measurement reporting delay less than 1000 ms from the beginning of time period T4. The UE is not required to read the neighbour cell SSB index in this test.

At time T5 starting at T4 + 1500 ms a a DCI-based BWP switch command by which the SCell 1 (Cell 2) is requested to switch the active BWP to the non-dormant BWP.

The point in time at which the DCI message is received at the UE antenna connector, in a subframe # denoted n, defines the start of time period T6. The UE shall accomplish the BWP switch to the non-dormant BWP latest in subframe (n + $T_{BWPswitchDelay}$ + X). The UE shall continue to shall report valid CQI if the UE has available uplink resources to report CQI for the non-dormant SCell. The UE shall continue to shall report L1-RSRP if the UE has available uplink resources to report L1-RSRP for the non-dormant SCell. Any PCell interruption due to BWP switch on the SCell shall occur in the subframes n to (n+ $T_{BWPswitchDelay}$ + X).

During T2, T3 and T4 the total rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements and RRM measurements, clause 8.2.2.2.12.3, on dormant SCells, shall not exceed [0.5]%.

During T2, T3 and T4 the total rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from L1-RSRP measurements and RRM measurements, clause 8.2.2.2.12.3, on dormant SCells, shall not exceed [0.5]%.

During T2, T3 and T4 the total rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements and RRM measurements, clause 8.2.2.2.12.3, on dormant SCells, shall not exceed [0.5]%

During T1, T2, T3, T4, T5 and T6, the UE shall be continuously scheduled in the SCell 1.

Table A.7.5.6.4.1.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.6.4.1.1-2: General test parameters for dormancy SCell in NR SA with PCell and SCell in FR2

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
PCell		1	Cell 1				
SCell		1	Cell 2				
Neighbour cell		1	Cell 3				Cell to be identified.
RF Channel Number		1	1				cell 1
RF Channel Number		1	2				Cell 2 and Cell 3
Measurement gap type		1					No measurement gaps configured
SSB configuration		1	SSB.1 FR2				for all cells
SMTC configuration		1	SMTC.1				all cells
CSI-RS parameters		1	CSI-RS.3.2 FDD				
CSI reporting periodicity, Non-dormant BWP	ms		2				
CSI reporting periodicity, Dormant BWP	ms		40				
Timing offset between the cells	ms		0				
Triggering DCI format			1_1	0_1	1_1	0_1	Triggering DCI format
OFDM symbol range in slot for transmission of DCI with dormancy indication			0 – 2		3 – 11		Test1 and Test3 are based on that triggering DCI is received within the first three OFDM symbols of a slot. Test2 and Test4 are based on that the triggering DCI is received after the first three OFDM symbols of a slot
A3-Offset	dB	1	-4.5				
CP length		1	Normal				
Hysteresis	dB	1	0				
Time To Trigger	s	1	0				
Filter coefficient		1	0				L3 filtering is not used
DRX		1	OFF				
T1	s	1	5				
T2	s	1	5				

Table A.7.5.6.4.1.1-3: NR Cell specific test parameters for dormancy SCell in NR SA with PCell and SCell in FR2

Parameter	Unit	Test configuration	Cell 1, Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	

Parameter	Unit	Test configuration	Cell 1, Cell 2		Cell 3	
			T1	T2	T1	T2
Dedicated CORESET RMC configuration, Test 1,2		1	CCR.3.1 TDD		CCR.3.1 TDD	
Dedicated CORESET RMC configuration, Test 3,4			CCR.3.2 TDD		CCR.3.1 TDD	
OCNG Patterns		1	OP.1		OP.1	
TRS configuration		1	TRS.2.1 TDD		N/A	
Downlink initial BWP configuration		1	DLBWP.0.1		N/A	
Uplink initial BWP configuration		1	ULBWP.0.1	N/A	N/A	
Downlink active non-dormant BWP configuration		1	N/A	DLBWP.1.2	N/A	
Downlink active dormant BWP configuration		1	DLBWP.1.2		N/A	
Active UL BWP configuration		1	ULBWP.1.1	N/A	N/A	
RLM-RS		1	CSI-RS		N/A	
EPRE ratio of PSS to SSS	dB		0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS Note 4						
EPRE ratio of OCNG to OCNG DMRS Note 4						
N_{oc} Note 2	dBm/SCS	1	-98			
N_{oc} Note 2	dBm/15 kHz	1	-98			
$\hat{E}_s / I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
$\hat{E}_s / N_{oc}$	dB	1	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: OCNG shall be used such that the cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols

A.7.5.6.4.1.2 Test Requirements

During T1 the UE shall switch to the dormant BWP.

During T2, T3, T4 and T5 the UE shall not send ACK/NACK for the PDSCH data scheduled on the SCell.

During T2, T3, T4 and T5 the UE shall continue to send CSI reports for SCell 1 with non-zero CQI index.

During T2, T3, T4 and T5 the UE shall continue to send L1-RSRP reports for SCell.

During T4 the UE shall send one Event A6 triggered measurement report, with a measurement reporting delay less than 1000 ms from the beginning of time period T4.

During T2, T3, T4 and T5, the missing ACK/NACK sent in PCell shall be less than 1.5 % of the total number of the expected ACK/NACK.

During T6, the UE shall send ACK/NACK for the PDSCH data scheduled after subframe (n+ $T_{BWPswitchDelay}$ + X) for the SCell 1.

All of the above test requirements shall be fulfilled in order for the observed SCell 1 BWP switch delays, PCell interruption rate, correct CSI and L1-RSRP reporting and event triggeres reporting. The rate of correct observed SCell 1 hibernation delay, activation delay and SCell 1 deactivation delay during repeated tests shall be at least 90 %.

A.7.5.6.4.2 NR FR1 PCell SCell dormancy switch of two FR2 SCells outside active time

A.7.5.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify fulfillment of SCell dormancy switching delay requirements in clause 8.6.2A when the UE is triggered to switch between non-dormancy and dormancy outside DRX active time. In the tested scenario, the UE is connected to PCell in FR1and two SCells in FR2, and the SCells are switched from non-dormancy to dormancy, and vice versa, at a point in time before start of *onDuration*. The UE is configured to monitor PDCCH for DCI format 2_6 at *ps-Offset* before the start of *onDuration*. Two tests are specified, where a UE that only supports triggering within the first three OFDM symbols of a slot shall undergo Test1 only, and a UE that supports triggering also in remaining OFDM symbols of a slot shall undergo both Test1 and Test2. In the tested scenario, *ps-Offset* is selected to correspond to the dormancy switching time specified in clause 8.6.2A.

The supported test configurations are provided in table A.7.5.6.4.2.1-1 below. General test parameters are provided in table A.7.5.6.4.2.1-2, and cell-specific parameters are provided in table A.7.5.6.4.2.1-3 below. OTA-related test parameters are provided in table A.7.5.6.4.2.1-4.

The tests consist of four consecutive time periods, T1, T2, T3 and T4, respectively.

Three carriers are used in the test. Cell 1 (PCell) is on RF channel 1 (PCC) in FR1, and Cell 2 (SCell 1) and Cell 3 (SCell 2) are on RF channels 2 (SCC1) and 3 (SCC2) in FR2, respectively. All three cells have constant signal levels throughout the test.

Before the test starts,

- UE is connected to Cell 1 (PCell), Cell 2 (SCell 1) and Cell 3 (SCell 2).
- UE is configured with a single UE-specific downlink bandwidth part, BWP-0, for Cell 1. BWP-0 includes the bandwidth of the initial DL BWP and SSB.
- UE is configured with one non-dormant and one dormant UE-specific downlink bandwidth part, BWP-0 and BWP-1, respectively, for Cell 2 and Cell 3. BWP-0 includes the bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP in Cell 1 is BWP-0.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP in Cell 2 is BWP-0.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP in Cell 3 is BWP-0.
- UE is configured with DRX.
- UE is configured to monitor DCI format 2_6, and to be active during *onDuration* even when no DCI format 2_6 is detected (*ps-WakeUp*).

Time period T1 starts when the UE at *ps-Offset* before *onDuration* detects a DCI format 2_6 carrying dormancy indication that indicates that SCell 1 and SCell 2 are to be switched from non-dormancy to dormancy. The UE shall switch active bandwidth parts for SCell 1 and SCell 2, respectively, from non-dormant BWP-0 to dormant BWP-1. The UE shall complete the switching before the start of *onDuration*. The test equipment schedules the UE continuously with new data indications in PCell starting from beginning of *onDuration*. The test equipment verifies that the UE is transmitting HARQ feedback for PCell from the beginning of *onDuration* and thus verifies that the UE has completed interruptions due to dormancy switching before the start of *onDuration.*

Time period T2 starts when T1 is completed. The test equipment continues to schedule the UE continuously in PCell. The UE shall carry out CSI and RRM measurements on the dormant SCells. The UE shall report ACK/NACK in PCell in response to scheduled PDSCH, with the maximum loss of transmitted ACK/NACKs fulfilling the requirement in clause 8.2.2.2.12. The test equipment verifies that the loss of ACK/NACKs is no larger than 1.5 %.

Time period T3 starts when T2 is completed. During T3, the test equipment does not schedule the UE, by which the inactivity timer expires and the UE stops monitoring PDCCH except for signalling using DCI format 2_6 at wake-up signalling occasions.

Time period T4 starts when the UE at *ps-Offset* before *onDuration* detects a DCI format 2_6 carrying dormancy indication that indicates that SCell 1 and SCell 2 are to be switched from dormancy to non-dormancy. The UE shall switch active bandwidth parts for SCell 1 and SCell 2, respectively, from dormant BWP-1 to non-dormant BWP-0. The UE shall complete the switching before the start of *onDuration*. The test equipment schedules the UE with new data indication in PCell, SCell 1 and SCell 2 during *onDuration*. The UE shall receive in PCell, SCell 1 and SCell 2 and send HARQ feedback for PCell, SCell 1 and SCell 2 via PCell. The test equipment verifies that the UE is transmitting HARQ feedback for PCell, SCell 1 and SCell 2 from the beginning of *onDuration*, and thus verifies that the UE has completed interruptions due to dormancy switching before the start of *onDuration*.

Table A.7.5.6.4.2.1-1: Supported test configurations

Config	Description
1	PCell: 15kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode SCells: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 15kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode SCells: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode SCells: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to undergo test for one of the supported test configurations.	

Table A.7.5.6.4.2.1-2: General test parameters

Parameter	Unit	Value		Comment
		Test1	Test2	
NR RF Channel Number		1, 2, 3		Three NR radio channels are used for this test
Active PCell		Cell 1		PCell on RF channel number 1 in FR1
Active SCell 1		Cell 2		SCell 1 on RF channel number 2 in FR2
Active SCell 2		Cell 3		SCell 2 on RF channel number 3 in FR2
CSI reporting periodicity, Non-dormant BWP	ms	2		CSI reporting periodicity for periodic reporting of CQI for PCell and non-dormant SCells
CSI reporting periodicity, Dormant BWP	ms	40		CSI reporting periodicity for periodic reporting of CQI for dormant SCells
CP length		Normal		
DRX		DRX.8		For both PCell and SCells. See clause A.3.3.8.
ps-Offset		Depending on UE capability		Monitoring of DCI 2_6 ahead of start of drx-onDurationTimer. Value of ps-Offset shall correspond to SCell dormancy switching time for switching of two SCells, as specified in clause 8.6.2A. Actual value depends on reported UE capabilities.
ps-WakeUp		true		Wake up for onDuration in case DCI format 2_6 is not detected.
Cell 2 timing offset to Cell 1	µs	<24		Timing offset shall be less than MRTD for FR1-FR2 CA, and leave margin for timing difference between Cell 2 and Cell 3.
Cell 3 timing offset to Cell 2	ns	<260		Timing offset shall be less than MRTD for FR2 intra-band non-contiguous CA.
OFDM symbol range in slot for transmission of DCI with dormancy indication		0 – 2	3 – 11	Test1 is based on that triggering DCI is received within the first three OFDM symbols of a slot.Test2 is based on that the triggering DCI is received later than within the first three OFDM symbols of a slot.

Parameter	Unit	Value		Comment
		Test1	Test2	
T1	s	0.2		During this time the SCells are switched from non-dormancy to dormancy.
T2	s	10		During this time the SCells are dormant.
T3	s	0.2		During this time the UE is not scheduled in PCell.
T4	s	0.2		During this time the SCells are switched from dormancy to non-dormancy.

Table A.7.5.6.4.2.1-3: Cell specific test parameters

Parameter		Unit	Cell 1	Cell 2	Cell 3
Frequency Range			FR1	FR2	FR2
NR RF channel			1	2	3
Duplex mode	Config 1		FDD	TDD	TDD
	Config 2,3		TDD		
TDD configuration	Config 1		---	TDDConf.3.1	TDDConf.3.1
	Config 2		TDDConf.1.1		
	Config 3		TDDConf.2.1		
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
	Config 3		40: $N_{PRB,c}$ = 106		
Downlink initial BWP Configuration			DLBWP.0.2	DLBWP.0.2	DLBWP.0.2
Uplink initial BWP Configuration			ULBWP.0.2	---	---
Downlink active non-dormant BWP-0 Configuration			DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
Downlink active dormant BWP-1 Configuration			---	DLBWP.1.1	DLBWP.1.1
Uplink active BWP-0 Configuration			ULBWP.0.2	---	---
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.3.1 TDD	SR.3.1 TDD
	Config 2		SR.1.1 TDD		
	Config 3		SR.2.1 TDD		
CSI-RS configuration for CSI reporting, Non-dormant BWP	Config 1		CSI-RS.1.1 FDD	CSI-RS.3.1 TDD	CSI-RS.3.1 TDD
	Config 2		CSI-RS.1.1 TDD		
	Config 3		CSI-RS.2.1 TDD		
CSI-RS configuration for CSI reporting, Dormant BWP			---	CSI-RS.3.5 TDD	CSI-RS.3.5 TDD
TRS configuration	Config 1		TRS.1.1 FDD	TRS.2.1 TDD	TRS.2.1 TDD
	Config 2		TRS.1.1 TDD		
	Config 3		TRS.1.2 TDD		
TCI state			TCI.State.0	TCI.State.0	TCI.State.0
RMSI CORESET parameters	Config 1		CR.1.1 FDD	---	---
	Config 2		CR.1.1 TDD		
	Config 3		CR.2.1 TDD		
Dedicated CORESET parameters, Test 1,2	Config 1		CCR.1.1 FDD	CCR.3.1 TDD	CCR.3.1 TDD
	Config 2		CCR.1.1 TDD		
	Config 3		CCR.2.1 TDD		
Dedicated CORESET parameters, Test 3,4	Config 1		CCR.1.5 FDD	CCR.3.1 TDD	CCR.3.1 TDD
	Config 2		CCR.1.5 TDD		
	Config 3		CCR.2.3 TDD		
OCNG Patterns			OP.1	OP.1	OP.1
SSB Configuration	Config 1,2		SSB.1 FR1	SSB.1 FR2	SSB.1 FR2
	Config 3		SSB.2 FR1		
SMTC Configuration			SMTC.1	SMTC.1	SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low		
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS[Note1]					
EPRE ratio of OCNG to OCNG DMRS[Note1]					

Parameter	Unit	Cell 1	Cell 2	Cell 3
Propagation Condition		N/A Link only, see clause A.3.7A	AWGN	AWGN
NOTE 1: OCNG shall be used such that the cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Table A.7.5.6.4.2.1: OTA related test parameters

Parameter	Unit	Cell 1	Cell 2	Cell 3
Angle of arrival configuration		N/A Link only, see clause A.3.7A	Setup 1 defined in clause A.3.15.1	
Assumtion for UE beams Note6			Fine	Fine
N_{oc} Note1	dBm/15kHz		-112	-112
N_{oc} Note1	dBm/SCS		-103	-103
SS-RSRP Note2	dBm/SCS Note3		-85	-85
Ês/Iot	dB		18	18
Io Note4	dBm/95.04 MHz Note4		-56	-56
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.				

A.7.5.6.4.2.2 Test Requirements

Starting from *onDuration* in time period T1, the UE shall transmit ACK/NACK in response to scheduling in PCell. There shall be no loss of ACK/NACK.

During time period T2, the UE shall transmit ACK/NACKs in response to scheduling in PCell and the rate of missed ACK/NACKs shall be no more than 1.5 %.

Starting from *onDuration* in time period T4, the UE shall transmit ACK/NACK in response to scheduling in PCell, SCell 1 and SCell 2. There shall be no loss of ACK/NACK.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.6.5 Simultaneous RRC-based Active BWP Switch on multiple CCs

A.7.5.6.5.1 Active BWP switch on multiple SCells with non-DRX in SA

A.7.5.6.5.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for simultaneous RRC-based BWP switch on multiple CCs defined in clause 8.6.3A.

The supported test configurations are shown in table A.7.5.6.5.1.1-1. The test scenario comprises one PCell (Cell 1) and one SCell (Cell 2) as given in table A.7.5.6.5.1.1-2. NR cell-specific parameters are provided in table A.7.5.6.5.1.1-3, and OTA related test parameters in table A.7.5.6.5.1.1-4.

PDCCHs indicating new transmissions shall be transmitted in PCell and SCell throughout to ensure that UE sends ACK/NACKs for PDSCH reception in PCell, SCell.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), to Cell 2 (SCell) on radio channel 2 (SCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell), Cell 2 (SCell).

- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition on Cell 1 (PCell), Cell 2 (SCell).

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration in Cell 1 and Cell 2, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition in Cell 1 and Cell 2.

The UE shall be able to receive PDSCH on Cell 1 and Cell 2 at the beginning of the DL slot right after PCell's DL slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$) as defined in clause 8.6.3A and be ready for the reception of uplink grant for the PCell no later than at the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$). The UE shall be continuously scheduled on Cell 1's BWP-1and Cell 2's BWP-1 starting from the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$).

$T_{RRCprocessingDelay}$, $T_{BWPswitchDelayRRC}$ and D_{RRC} are defined in clause 8.6.3A.

The test equipment verifies the DL BWP switch time in Cell 1 and Cell 2 by counting the time from the time when the RRC Reconfiguration message including updated BWP configuration is sent till the time when RRC Reconfiguration Complete message is received.

Table A.7.5.6.5.1.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD -TDD duplex mode

Table A.7.5.6.5.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2, 3	Three NR radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2	SCell on RF channel number 2.
CP length		Normal	
DRX		OFF	
Cell 2 timing offset to Cell 1	µs	0	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	During T1, RRC-based simultaneous BWP switching of PCell and SCell is carried out.

Table A.7.5.6.5.1.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1	Cell 2
Frequency Range			FR2	
NR RF channel			1	2
Duplex mode			TDD	
TDD configuration			TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66	
Active Downlink BWP ID			0	1
Downlink initial BWP Configuration			DLBWP.0.2	DLBWP.0.2
Uplink initial BWP Configuration			ULBWP.0.2	ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration		DLBWP.1.3	DLBWP.1.3
	Active UL BWP-1 Configuration		ULBWP.1.3	ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration		DLBWP.1.1	DLBWP.1.1
	Active UL BWP-1 Configuration		ULBWP.1.1	ULBWP.1.1
PDSCH Reference measurement channel			SR.3.1 TDD	
TRS configuration			TRS.2.1 TDD	
TCI state			TCI.State.0	

Parameter	Unit	Cell 1	Cell 2
RMSI CORESET parameters		CR.3.1 TDD	
Dedicated CORESET parameters		CCR.3.1 TDD	
OCNG Patterns		OP.1	
SSB Configuration		SSB.3 FR2	
SMTC Configuration		SMTC.1	
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS Note1			
EPRE ratio of OCNG to OCNG DMRS Note1			
Propagation Condition		AWGN	AWGN
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low

NOTE 1: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.7.5.6.5.1.1-4: OTA related test parameters for BWP switching test case

Parameter	Unit	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 defined in clause A.3.15.1	
Assumtion for UE beams Note4		Fine	Fine
Noc Note1	dBm/15kHz	-111.7-	-111.7
Noc Note1	dBm/SCS	-102.7-	-102.7
Ês/Noc	dB	7-	7
SSB-RP Note2	dBm/SCS	-85-	-85
Ês/Iot	dB	-18-	18
Io Note3	dBm/95.04 MHz	-56	-56

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB-RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the center of the quiet zone
NOTE 4: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.6.5.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PCell and SCell in the beginning of the DL slot right after slot $(i+\frac{T_{RRC processing Delay}+T_{BWP switch Delay RRC}+D_{RRC}}{NR\ slot\ length})$.

All of the above test requirements shall be fulfilled in order for the observed PCell and SCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.6.5.2 NR FR2-2 Active BWP switch on multiple SCells with non-DRX in SA

A.7.5.6.5.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for simultaneous RRC-based BWP switch on multiple CCs defined in clause 8.6.3A.

The supported test configurations are shown in table A.7.5.6.5.2.1-1. The test scenario comprises one PCell (Cell 1) and one SCell (Cell 2) as given in table A.7.5.6.5.2.1-2. NR cell-specific parameters are provided in table A.7.5.6.5.2.1-3, and OTA related test parameters in table A.7.5.6.5.2.1-4.

PDCCHs indicating new transmissions shall be transmitted in PCell and SCell throughout to ensure that UE sends ACK/NACKs for PDSCH reception in PCell, SCell.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), to Cell 2 (SCell) on radio channel 2 (SCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell), Cell 2 (SCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition on Cell 1 (PCell), Cell 2 (SCell).

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration in Cell 1 and Cell 2, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition in Cell 1 and Cell 2.

The UE shall be able to receive PDSCH on Cell 1 and Cell 2 at the beginning of the DL slot right after PCell's DL slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$) as defined in clause 8.6.3A and be ready for the reception of uplink grant for the PCell no later than at the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$). The UE shall be continuously scheduled on Cell 1's BWP-1and Cell 2's BWP-1 starting from the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$).

$T_{RRCprocessingDelay}$, $T_{BWPswitchDelayRRC}$ and D_{RRC} are defined in clause 8.6.3A.

The test equipment verifies the DL BWP switch time in Cell 1 and Cell 2 by counting the time from the time when the RRC Reconfiguration message including updated BWP configuration is sent till the time when RRC Reconfiguration Complete message is received.

Table A.7.5.6.5.2.1-1: DL BWP switch supported test configurations

Configuration	Description
1	NR TDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NR TDD, SSB SCS 480 kHz, data SCS 480 kHz, BW 400 MHz
3	NR TDD, SSB SCS 960 kHz, data SCS 960 kHz, BW 400 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.5.6.5.2.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2	Two NR radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2	SCell on RF channel number 2.
CP length		Normal	
DRX		OFF	
Cell 2 timing offset to Cell 1	µs	0	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	During T1, RRC-based simultaneous BWP switching of PCell and SCell is carried out.

Table A.7.5.6.5.2.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter	Unit	Config	Cell 1	Cell 2
Frequency Range		1,2,3	FR2-2	FR2-2
Duplex mode		1,2,3	TDD	
TDD configuration		1	TDDConf.3.1	
		2	TBD	
		3	TBD	
$BW_{channel}$		1	100 MHz: $N_{PRB,c}$ = 66	
		2	400 MHz: $N_{PRB,c}$ = 66	
		3	400 MHz: $N_{PRB,c}$ = 33	
Active BWP ID		1,2,3	0	0
Downlink initial BWP Configuration		1,2,3	DLBWP.0.2	
Uplink initial BWP Configuration		1,2,3	ULBWP.0.2	N/A
Downlink active BWP-0 Configuration		1,2,3	DLBWP.0.2	N/A
Downlink active BWP-1 Configuration		1,2,3	N/A	DLBWP.1.1
Downlink active BWP-2 Configuration		1,2,3	N/A	DLBWP.1.3
Uplink active BWP-0 Configuration		1,2,3	ULBWP.0.2	N/A
Uplink active BWP-1 Configuration		1,2,3	N/A	N/A
Uplink active BWP-2 Configuration		1,2,3	N/A	N/A
PDSCH Reference measurement channel		1	SR.3.1 TDD	
		2	TBD	
		3	TBD	
TRS configuration		1	TRS.2.1 TDD	
		2	TBD	
		3	TBD	
TCI state		1,2,3	TCI.State.0	
RMSI CORESET parameters		1	CR.3.1 TDD	
		2	TBD	
		3	TBD	
Dedicated CORESET parameters		1	CCR.3.1 TDD	
		2	TBD	
		3	TBD	
OCNG Patterns		1,2,3	OP.1	
SSB Configuration		1	SSB.1 FR2	
		2	TBD	
		3	TBD	
SMTC Configuration		1,2,3	SMTC.1	
Correlation Matrix and Antenna Configuration			1x2 Low	
EPRE ratio of PSS to SSS	dB		0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation Condition			AWGN	AWGN

Parameter	Unit	Config	Cell 1	Cell 2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Table A.7.5.6.5.2.1-4: OTA related test parameters for BWP switching test case

Parameter	Unit	Config	Cell 1	Cell 2
Angle of arrival configuration		1,2,3	Setup 1 defined in clause A.3.15.1	Setup 1 defined in clause A.3.15.1
Assumtion for UE beams Note 6		1,2,3	Fine	Fine
N_{oc} Note1	dBm/15kHz		-112	-112
N_{oc} Note1	dBm/SCS	1	-103	-103
		2	-97	-97
		3	-94	-94
SS-RSRP Note2	dBm/SCS Note3	1	-85	-85
		2	-79	-79
		3	-76	-76
$\hat{E}_s / I_{ot}$	dB		18	18
Io Note4	dBm/95.04 MHz Note4	1	-56	-56
	dBm/380.16 MHz Note4	2,3	-50.0	-50.0
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone. NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.				

A.7.5.6.5.2.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PCell and SCell in the beginning of the DL slot right after slot ($i+\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}}{NR\ slot\ length}$).

All of the above test requirements shall be fulfilled in order for the observed PCell and SCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.7 PSCell addition and release delay

A.7.5.7.1 Addition and Release Delay of known NR PSCell

A.7.5.7.1.1 Test Purpose and Environment

The purpose of this test is to verify the PSCell addition and release delay requirements defined in clauses 8.9.2 and 8.9.3, respectively, for the case where the PSCell is known to the UE at the time of addition.

The supported test configurations are given in table A.7.5.7.1.1-1. The test scenario comprises two NR cells, Cell 1 and Cell 2, on radio channel 1 in FR1 and radio channel 2 in FR2, respectively. Test parameters are given in Tables A.7.5.7.1.1-2, A.7.5.7.1.1-3 and A.7.5.7.1.1-4 below. The test consists of six time periods with durations T1, T2, T3, T4, T5 and T6, respectively.

At the start of T1, the UE shall be connected to Cell 1 (PCell) on radio channel 1 (PCC) and shall only monitor PCC and hence be unaware of Cell 2 (PSCell-to-be) on radio channel 2. Before the start of T2, the test system shall send

measurement control information including measurement gap configuration and event-triggered reporting configuration for measurements on radio channel 2.

During T2, the Cell 2 becomes known to the UE. Therefore, during T2 the UE shall report Event triggered report.

The point in time at which the RRC message to release measurement gap is transmitted from the test system defines the start of period T3. During T3, after measurement gap is released, the test system transmits the RRC message to the UE to add PSCell on radio channel 2. The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added.

The point in time at which the RRC message to add PSCell (Cell 2) is received at the UE antenna connector defines the start of period T4.

During T4, the UE shall carry out random access towards the PSCell. Reception by the test system of the PRACH preamble defines the start of T5.

During T5, the UE shall send periodic CSI reports in PSCell. After having received at least one such report, the test system shall send a RRC message instructing the UE to release the PSCell. Reception by the UE of the RRC message defines the start of T6.

During T6, the UE shall release the PSCell.

Table A.7.5.7.1.1-1: Supported test configurations for FR2 PSCell

Config	Description
1	FR1 FDD SSB SCS 15kHz BW 10 MHz – FR2 TDD SSB SCS 240kHz BW 100 MHz
2	FR1 TDD SSB SCS 15kHz BW 10 MHz – FR2 TDD SSB SCS 240kHz BW 100 MHz
3	FR1 TDD SSB SCS 30kHz BW 40 MHz – FR2 TDD SSB SCS 240kHz BW 100 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.7.1.1-2: General test parameters for PSCell addition and release delay

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test
Active PCell			Cell 1	PCell on RF channel number 1 in FR1
Neighbour cell			Cell 2	Neighbour cell (PSCell-to-be) on RF channel number 2 in FR2
A4	Hysteresis	dB	0	Hysteresis for event A4
	Threshold RSRP	dBm	-118	Threshold for event A4
	Time to Trigger	s	0	Time to trigger for event A4
DRX			OFF	For both PCell and PSCell once activated
Measurement gap pattern ID			0	Gaps are configured before T2 and released before T3.
PRACH configuration in Cell 2			FR2 PRACH configuration 2	PRACH configuration as specified in Clause A.3.8.3.2.
CSI reporting periodicity and offset configuration for Cell 2		ms	2	
T1		s	5	During this time the PCell is known and Cell 2 is unknown.
T2		s	1	During this time the UE shall identify neighbour cell 2 and report event B1.
T3		s	3.5	During this time the test system transmits the RRC messages to release measurement gap and add PSCell.
T4		s	1	During this time the UE adds the PSCell.
T5		s	1	During this time the UE sends CSI reports for PSCell.
T6		s	1	During this time the UE releases the PSCell.

Table A.7.5.7.1.1-3: NR Cell specific test parameters for PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell 2					
				T1	T2	T3	T4	T5	T6
Frequency Range		1,2,3	FR1	FR2					
Duplex mode		1	FDD	TDD					
		2,3	TDD						
TDD configuration		1	–	TDDConf.3.1					
		2	TDDConf.1.1						
		3	TDDConf.2.1						
$BW_{channel}$	MHz	1,2	10: $N_{PRB,c}$ = 52	100: $N_{PRB,c}$ = 66					
		3	40: $N_{PRB,c}$ = 106						
Data PRBs allocated		1,2	52	48					
		3	106						
Initial Downlink BWP configuration		1,2,3	DLBWP.0.1	DLBWP.0.1					
Initial Uplink BWP configuration		1,2,3	ULBWP.0.1	ULBWP.0.1					
Dedicated Downlink BWP configuration		1,2,3	DLBWP.1.1	DLBWP.1.1					
Dedicated Uplink BWP configuration		1,2,3	ULBWP.1.1	ULBWP.1.1					
PDSCH Reference Measurement Channel		1	SR.1.1 FDD	SR.3.3 TDD					
		2	SR.1.1 TDD						
		3	SR.2.1 TDD						
TRS configuration		1,2,3	–	TRS.2.1 TDD					
TCI state		1,2,3	–	TCI.State.0					
RMSI CORESET parameters		1	CR.1.1 FDD	CR.3.2 TDD					
		2	CR.1.1 TDD						
		3	CR.2.1 TDD						
Dedicated CORESET parameters		1	CCR.1.1 FDD	CCR.3.7 TDD					
		2	CCR.1.1 TDD						
		3	CCR.2.1 TDD						
OCNG Patterns[Note1]		1,2,3	OP.1	OP.3					
SSB configuration		1,2	SSB.1 FR1	SSB.2 FR2					
		3	SSB.2 FR1						
SMTC configuration		1,2,3	SMTC.2	SMTC.1					
PDSCH/PDCCH subcarrier spacing	kHz	1,2	15	120					
		3	30						
EPRE ratio of PSS to SSS	dB	1,2,3	0	0					
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS									
EPRE ratio of OCNG to OCNG DMRS									
Propagation Condition		1,2,3	N/A	No external noise (Note 6)					

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void
NOTE 6: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

Table A.7.5.7.1.1-4: OTA related test parameters for PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell 2					
				T1	T2	T3	T4	T5	T6
Angle of arrival configuration		1,2,3	Link only, see clause A.3.7A	Setup 2a according to clause A.3.15.2.1					
Assumption for UE beams [Note 3]				Rough					
$\hat{E}s$	dBm/SCS	1,2,3		-∞	-81				
SSB_RP [Note1, Note2]	dBm/SCS	1,2,3		-∞	-81				

Parameter	Unit	Config	Cell 1	Cell 2					
				T1	T2	T3	T4	T5	T6
$\hat{E}_s/I_{ot}$ BB Note1, Note 4	dB	1,2,3		-∞	4.88				
Io Note 1, Note2	dBm/95.04 MHz	1,2,3		N/A	-56.41				

NOTE 1: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 2: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 3: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.5.7.1.2 Test Requirements

The UE shall transmit the PRACH preamble to PSCell at latest 112 ms into T4.

The UE shall transmit at least one periodic CSI report for PSCell during T5.

The UE shall stop transmitting CSI reports for PSCell at latest 20 ms into T6.

All of the above test requirements shall be fulfilled in order for the observed PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.7.2 Addition and Release Delay of unknown NR PSCell in

A.7.5.7.2.1 Test Purpose and Environment

The purpose of this test is to verify the PSCell addition and release delay requirements defined in clauses 8.9.2 and 8.9.3, respectively, for the case where the PSCell is unknown to the UE at the time of addition.

The supported test configurations are given in table A.7.5.7.2.1-1. The test scenario comprises two NR cells, Cell 1 and Cell 2, on radio channel 1 in FR1 and radio channel 2 in FR2, respectively. Test parameters are given in Tables A.7.5.7.2.1-2, A.7.5.7.2.1-3 and A.7.5.7.2.1-4 below. The test consists of four time periods with durations T1, T2, T3 and T4, respectively.

At the start of T1, the UE shall be connected to Cell 1 (PCell) on radio channel 1 (PCC) and shall only monitor PCC and hence be unaware of Cell 2 (PSCell-to-be) on radio channel 2. At the end of T1, the test system shall send a RRC message instructing the UE to add PSCell (Cell 2), and further instructing the UE to report CSI periodically in the PSCell once it has been added. Reception by the UE of this RRC message defines the start of T2.

During T2, the UE shall identify PSCell and carry out random access towards the PSCell. Reception by the test system of the PRACH preamble defines the start of T3.

During T3, the UE shall send periodic CSI reports in PSCell. After having received at least one such report, the test system shall send a RRC message instructing the UE to release the PSCell. Reception by the UE of the RRC message defines the start of T4.

During T4, the UE shall release the PSCell.

Table A.7.5.7.2.1-1: Supported test configurations for FR2 PSCell

Config	Description
1	FR1 FDD SSB SCS 15kHz BW 10 MHz – FR2 TDD SSB SCS 240kHz BW 100 MHz
2	FR1 TDD SSB SCS 15kHz BW 10 MHz – FR2 TDD SSB SCS 240kHz BW 100 MHz
3	FR1 TDD SSB SCS 30kHz BW 40 MHz – FR2 TDD SSB SCS 240kHz BW 100 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.7.2.1-2: General test parameters for PSCell addition and release delay

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1 in FR1
Neighbour cell		Cell 2	Neighbour cell (PSCell-to-be) on RF channel number 2 in FR2
DRX		OFF	For both PCell and PSCell once activated
PRACH configuration in Cell 2		FR2 PRACH configuration 2	PRACH configuration as specified in Clause A.3.8.3.2.
CSI reporting periodicity and offset configuration for Cell 2	ms	2	
T1	s	5	During this time the PCell is known and Cell 2 is unknown.
T2	s	1	During this time the UE adds the PSCell.
T3	s	1	During this time the UE sends CSI reports for PSCell.
T4	s	1	During this time the UE releases the PSCell.

Table A.7.5.7.2.1-3: NR Cell specific test parameters for PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
Frequency Range		1,2,3	FR1	FR2			
Duplex mode		1	FDD	TDD			
		2,3	TDD				
TDD configuration		1	–	TDDConf.3.1			
		2	TDDConf.1.1				
		3	TDDConf.2.1				
$BW_{channel}$	MHz	1,2	10: $N_{PRB,c}$ = 52	100: $N_{PRB,c}$ = 66			
		3	40: $N_{PRB,c}$ = 106				
Data PRBs allocated		1,2	52	48			
		3	106				
Initial Downlink BWP configuration		1,2,3	DLBWP.0.1	DLBWP.0.1			
Initial Uplink BWP configuration		1,2,3	ULBWP.0.1	ULBWP.0.1			
Dedicated Downlink BWP configuration		1,2,3	DLBWP.1.1	DLBWP.1.1			
Dedicated Uplink BWP configuration		1,2,3	ULBWP.1.1	ULBWP.1.1			
PDSCH Reference Measurement Channel		1	SR.1.1 FDD	SR.3.3 TDD			
		2	SR.1.1 TDD				
		3	SR.2.1 TDD				
TRS configuration		1,2,3	–	TRS.2.1 TDD			
TCI state		1,2,3	–	TCI.State.0			
RMSI CORESET parameters		1	CR.1.1 FDD	CR.3.2 TDD			
		2	CR.1.1 TDD				
		3	CR.2.1 TDD				
Dedicated CORESET parameters		1	CCR.1.1 FDD	CCR.3.7 TDD			
		2	CCR.1.1 TDD				
		3	CCR.2.1 TDD				
OCNG Patterns[Note1]		1,2,3	OP.1	OP.3			
SSB configuration		1,2	SSB.1 FR1	SSB.2 FR2			
		3	SSB.2 FR1				
SMTC configuration		1,2,3	SMTC.2	SMTC.1			
PDSCH/PDCCH subcarrier spacing	kHz	1,2	15	120			
		3	30				
EPRE ratio of PSS to SSS	dB	1,2,3	0	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS							

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
EPRE ratio of OCNG to OCNG DMRS							
Propagation Condition		1,2,3	AWGN	No external noise (Note 6)			
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Void NOTE 3: Void NOTE 4: Void NOTE 5: Void NOTE 6: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].							

Table A.7.5.7.2.1-4: OTA related test parameters for PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
Angle of arrival configuration		1,2,3	Link only, see clause A.3.7A	Setup 2a according to clause A.3.15.2.1			
Assumption for UE beams Note 3				Rough			
$\hat{E}s$	dBm/SCS	1,2,3		-∞	-81		
SSB_RP Note1, Note 2	dBm/SCS	1,2,3		-∞	-81		
$\hat{E}_s/I_{ot}$ BB Note1, Note 4	dB	1,2,3		-∞	4.88		
Io Note 1, Note 2	dBm/95.04 MHz	1,2,3		N/A	-56.41		
NOTE 1: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 2: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone. NOTE 3: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation. NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.							

A.7.5.7.2.2 Test Requirements

The UE shall transmit the PRACH preamble to PSCell at latest 572 ms into T2.

The UE shall transmit at least one periodic CSI report for PSCell during T3.

The UE shall stop transmitting CSI reports for PSCell at latest 20 ms into T4.

All of the above test requirements shall be fulfilled in order for the observed PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.7.3 Addition and Release Delay of known NR PSCell in FR2-2

A.7.5.7.3.1 Test Purpose and Environment

The purpose of this test is to verify the PSCell addition and release delay requirements defined in clauses 8.9.2 and 8.9.3, respectively, for the case where the PSCell is known to the UE at the time of addition.

The supported test configurations are given in table A.7.5.7.3.1-1. The test scenario comprises two NR cells, Cell 1 and Cell 2, on radio channel 1 in FR1 and radio channel 2 in FR2-2, respectively. Test parameters are given in Tables A.7.5.7.3.1-2, A.7.5.7.3.1-3 and A.7.5.7.3.1-4 below. The test consists of five time periods with durations T1, T2, T3, T4 and T5, respectively.

At the start of T1, the UE shall be connected to Cell 1 (PCell) on radio channel 1 (PCC) and shall only monitor PCC and hence be unaware of Cell 2 (PSCell-to-be) on radio channel 2. Before the start of T2, the test system shall send measurement control information including measurement gap configuration and event-triggered reporting configuration for measurements on radio channel 2.

During T2, the Cell 2 becomes known to the UE. Therefore, during T2 the UE shall report Event triggered report.

The point in time at which the RRC message to release measurement gap is transmitted from the test system defines the start of period T3. During T3, after measurement gap is released, the test system transmits the RRC message to the UE to add PSCell on radio channel 2. The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added.

The point in time at which the RRC message to add PSCell (Cell 2) is received at the UE antenna connector defines the start of period T4.

During T4, the UE shall carry out random access towards the PSCell. Reception by the test system of the PRACH preamble defines the start of T4.

During T5, the UE shall send periodic CSI reports in PSCell. After having received at least one such report, the test system shall send a RRC message instructing the UE to release the PSCell. Reception by the UE of the RRC message defines the start of T6

During T6, the UE shall release the PSCell.

Table A.7.5.7.3.1-1: Supported test configurations for FR2-2 PSCell

Config	Description
1	FR1 FDD SSB SCS 15kHz BW 10 MHz – FR2-2 TDD SSB SCS 120kHz BW 100 MHz
2	FR1 TDD SSB SCS 15kHz BW 10 MHz – FR2-2 TDD SSB SCS 120kHz BW 100 MHz
3	FR1 TDD SSB SCS 30kHz BW 40 MHz – FR2-2 TDD SSB SCS 120kHz BW 100 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.7.3.1-2: General test parameters for PSCell addition and release delay

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test
Active PCell			Cell 1	PCell on RF channel number 1 in FR1
Neighbour cell			Cell 2	Neighbour cell (PSCell-to-be) on RF channel number 2 in FR2-2
A4	Hysteresis	dB	0	Hysteresis for event A4
	Threshold RSRP	dBm	-118	Threshold for event A4
	Time to Trigger	s	0	Time to trigger for event A4
DRX			OFF	For both PCell and PSCell once activated
Measurement gap pattern ID			0	Gaps are configured before T2 and released before T3.
PRACH configuration in Cell 2			FR2 PRACH configuration 2	PRACH configuration as specified in Clause A.3.8.3.2.
CSI reporting periodicity and offset configuration for Cell 2		ms	2	
T1		s	5	During this time the PCell is known and Cell 2 is unknown.
T2		s	1	During this time the UE shall identify neighbour cell 2 and report event B1.
T3		s	3.5	During this time the test system transmits the RRC messages to release measurement gap and add PSCell.
T4			1	During this time the UE adds the PSCell.
T5		s	1	During this time the UE sends CSI reports for PSCell.
T6		s	1	During this time the UE releases the PSCell.

Table A.7.5.7.3.1-3: NR Cell specific test parameters for PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell 2				
				T1	T2	T3	T4	T5
Frequency Range		1,2,3	FR1	FR2-2				
Duplex mode		1	FDD	TDD				
		2,3	TDD					

Parameter	Unit	Config	Cell 1	Cell 2				
				T1	T2	T3	T4	T5
TDD configuration		1	–	TDDConf.3.1				
		2	TDDConf.1.1					
		3	TDDConf.2.1					
$BW_{channel}$	MHz	1,2	10: $N_{PRB,c}$ = 52	100: $N_{PRB,c}$ = 66				
		3	40: $N_{PRB,c}$ = 106					
Data PRBs allocated		1,2	52	48				
		3	106					
Initial Downlink BWP configuration		1,2,3	DLBWP.0.1	DLBWP.0.1				
Initial Uplink BWP configuration		1,2,3	ULBWP.0.1	ULBWP.0.1				
Dedicated Downlink BWP configuration		1,2,3	DLBWP.1.1	DLBWP.1.1				
Dedicated Uplink BWP configuration		1,2,3	ULBWP.1.1	ULBWP.1.1				
PDSCH Reference Measurement Channel		1	SR.1.1 FDD	SR.3.3 TDD				
		2	SR.1.1 TDD					
		3	SR.2.1 TDD					
TRS configuration		1,2,3	–	TRS.2.1 TDD				
TCI state		1,2,3	–	TCI.State.0				
RMSI CORESET parameters		1	CR.1.1 FDD	CR.3.2 TDD				
		2	CR.1.1 TDD					
		3	CR.2.1 TDD					
Dedicated CORESET parameters		1	CCR.1.1 FDD	CCR.3.7 TDD				
		2	CCR.1.1 TDD					
		3	CCR.2.1 TDD					
OCNG Patterns[Note1]		1,2,3	OP.1	OP.3				
SSB configuration		1,2	SSB.1 FR1	SSB.2 FR2				
		3	SSB.2 FR1					
SMTC configuration		1,2,3	SMTC.2	SMTC.1				
PDSCH/PDCCH subcarrier spacing	kHz	1,2	15	120				
		3	30					
EPRE ratio of PSS to SSS	dB	1,2,3	0	0				
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS								
EPRE ratio of OCNG to OCNG DMRS								
Propagation Condition		1,2,3	N/A	No external noise (Note 2)				

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

Table A.7.5.7.3.1-4: OTA related test parameters for PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell 2				
				T1	T2	T3	T4	T5
Angle of arrival configuration		1,2,3	Link only, see clause A.3.7A	Setup 2a according to clause A.3.15.2.1				
Assumption for UE beams [Note 3]				Rough				
$\hat{E}_s$	dBm/SCS	1,2,3		-∞	-81			
SSB_RP [Note1, Note2]	dBm/SCS	1,2,3		-∞	-81			
$\hat{E}_s / I_{ot}$ BB [Note1, Note 4]	dB	1,2,3		-∞	4.88			
Io [Note 1, Note2]	dBm/95.04 MHz	1,2,3		N/A	-56.41			

Parameter	Unit	Config	Cell 1	Cell 2				
				T1	T2	T3	T4	T5
NOTE 1: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 2: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.								
NOTE 3: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.								
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.								

A.7.5.7.3.2 Test Requirements

The UE shall transmit the PRACH preamble to PSCell at latest TBD ms into T3.

The UE shall transmit at least one periodic CSI report for PSCell during T4.

The UE shall stop transmitting CSI reports for PSCell at latest 20 ms into T5.

All of the above test requirements shall be fulfilled in order for the observed PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.7.4 Addition and Release Delay of unknown NR PSCell in FR2-2

A.7.5.7.4.1 Test Purpose and Environment

The purpose of this test is to verify the PSCell addition and release delay requirements defined in clauses 8.9.2 and 8.9.3, respectively, for the case where the PSCell is unknown to the UE at the time of addition.

The supported test configurations are given in table A.7.5.7.4.1-1. The test scenario comprises two NR cells, Cell 1 and Cell 2, on radio channel 1 in FR1 and radio channel 2 in FR2-2, respectively. Test parameters are given in Tables A.7.5.7.4.1-2, A.7.5.7.4.1-3 and A.7.5.7.4.1-4 below. The test consists of four time periods with durations T1, T2, T3 and T4, respectively.

At the start of T1, the UE shall be connected to Cell 1 (PCell) on radio channel 1 (PCC) and shall only monitor PCC and hence be unaware of Cell 2 (PSCell-to-be) on radio channel 2. At the end of T1, the test system shall send a RRC message instructing the UE to add PSCell (Cell 2), and further instructing the UE to report CSI periodically in the PSCell once it has been added. Reception by the UE of this RRC message defines the start of T2.

During T2, the UE shall identify PSCell and carry out random access towards the PSCell. Reception by the test system of the PRACH preamble defines the start of T3.

During T3, the UE shall send periodic CSI reports in PSCell. After having received at least one such report, the test system shall send a RRC message instructing the UE to release the PSCell. Reception by the UE of the RRC message defines the start of T4.

During T4, the UE shall release the PSCell.

Table A.7.5.7.4.1-1: Supported test configurations for FR2-2 PSCell

Config	Description
1	FR1 FDD SSB SCS 15kHz BW 10 MHz – FR2-2 TDD SSB SCS 120kHz BW 100 MHz
2	FR1 TDD SSB SCS 15kHz BW 10 MHz – FR2-2 TDD SSB SCS 120kHz BW 100 MHz
3	FR1 TDD SSB SCS 30kHz BW 40 MHz – FR2-2 TDD SSB SCS 120kHz BW 100 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.7.4.1-2: General test parameters for PSCell addition and release delay

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1 in FR1

Parameter	Unit	Value	Comment
Neighbour cell		Cell 2	Neighbour cell (PSCell-to-be) on RF channel number 2 in FR2-2
DRX		OFF	For both PCell and PSCell once activated
PRACH configuration in Cell 2		FR2 PRACH configuration 2	PRACH configuration as specified in Clause A.3.8.3.2.
CSI reporting periodicity and offset configuration for Cell 2	ms	2	
T1	s	5	During this time the PCell is known and Cell 2 is unknown.
T2	s	1	During this time the UE adds the PSCell.
T3	s	1	During this time the UE sends CSI reports for PSCell.
T4	s	1	During this time the UE releases the PSCell.

Table A.7.5.7.4.1-3: NR Cell specific test parameters for PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
Frequency Range		1,2,3	FR1	FR2-2			
Duplex mode		1	FDD	TDD			
		2,3	TDD				
TDD configuration		1	–	TDDConf.3.1			
		2	TDDConf.1.1				
		3	TDDConf.2.1				
$BW_{channel}$	MHz	1,2	10: $N_{PRB,c}$ = 52	100: $N_{PRB,c}$ = 66			
		3	40: $N_{PRB,c}$ = 106				
Data PRBs allocated		1,2	52	48			
		3	106				
Initial Downlink BWP configuration		1,2,3	DLBWP.0.1	DLBWP.0.1			
Initial Uplink BWP configuration		1,2,3	ULBWP.0.1	ULBWP.0.1			
Dedicated Downlink BWP configuration		1,2,3	DLBWP.1.1	DLBWP.1.1			
Dedicated Uplink BWP configuration		1,2,3	ULBWP.1.1	ULBWP.1.1			
PDSCH Reference Measurement Channel		1	SR.1.1 FDD	SR.3.3 TDD			
		2	SR.1.1 TDD				
		3	SR.2.1 TDD				
TRS configuration		1,2,3	–	TRS.2.1 TDD			
TCI state		1,2,3	–	TCI.State.0			
RMSI CORESET parameters		1	CR.1.1 FDD	CR.3.2 TDD			
		2	CR.1.1 TDD				
		3	CR.2.1 TDD				
Dedicated CORESET parameters		1	CCR.1.1 FDD	CCR.3.7 TDD			
		2	CCR.1.1 TDD				
		3	CCR.2.1 TDD				
OCNG Patterns[Note1]		1,2,3	OP.1	OP.3			
SSB configuration		1,2	SSB.1 FR1	SSB.2 FR2			
		3	SSB.2 FR1				
SMTC configuration		1,2,3	SMTC.2	SMTC.1			
PDSCH/PDCCH subcarrier spacing	kHz	1,2	15	120			
		3	30				
EPRE ratio of PSS to SSS	dB	1,2,3	0	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS							
EPRE ratio of OCNG to OCNG DMRS							
Propagation Condition		1,2,3	No external noise (Note 2)	No external noise (Note 2)			

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].							

Table A.7.5.7.4.1-4: OTA related test parameters for PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
Angle of arrival configuration		1,2,3	Link only, see clause A.3.7A	Setup 2a according to clause A.3.15.2.1			
Assumption for UE beams Note 3				Rough			
$\hat{E}s$	dBm/SCS	1,2,3		-∞	-81		
SSB_RP Note1, Note 2	dBm/SCS	1,2,3		-∞	-81		
$\hat{E}_s/I_{ot}$ BB Note1, Note 4	dB	1,2,3		-∞	4.88		
Io Note 1, Note 2	dBm/95.04 MHz	1,2,3		N/A	-56.41		
NOTE 1: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 2: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.							
NOTE 3: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.							
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.							

A.7.5.7.4.2 Test Requirements

The UE shall transmit the PRACH preamble to PSCell at latest TBD ms into T2.

The UE shall transmit at least one periodic CSI report for PSCell during T3.

The UE shall stop transmitting CSI reports for PSCell at latest 20 ms into T4.

All of the above test requirements shall be fulfilled in order for the observed PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.8 Active TCI state switch delay

A.7.5.8.1 MAC-CE based active TCI state switch

A.7.5.8.1.1 NR PCell FR2 active TCI state switch for a known TCI state

A.7.5.8.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10.3. Supported test configuration is shown in table A.7.5.8.1.1.1-1.

The test scenario comprises of one NR PCell (Cell 1) as given in table A.7.5.8.1.1.1-2. Cell-specific parameters of NR PCell are specified in table A.7.5.8.1.1.1-3 below. The OTA related test parameters for FR2 are shown in table A.7.5.8.1.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).

- UE is configured with 2 different TCI states for PCell, PDCCH TCI state 0 (QCL'd to SSB0) and TCIstate 1 (QCL'd to SSB1), in Cell 1 before starting the test.
- UE is indicated in TCI state 0 as the active PDCCH TCI state
- Target TCI state is not in the active TCI state list.

The test consists of two time periods, T1 and T2. Figure A.7.5.8.1.1.1-1 and Figure A.7.5.8.1.1.1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which PDCCH-TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies that UE can be scheduled on PCell on TCI state 0 till slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$. The test equipment also verifies the TCI state switch time in PCell by scheduling the UE on TCI state 1 after slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$ + ($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$)/*NR slot length*.

Table A.7.5.8.1.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.8.1.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	
T2	s	0.2	

Table A.7.5.8.1.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TC. State.2
TCI State 1		TCI.State.3
TRS Configuration		TRS.2.1 TDD TRS.2.2 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		

Parameter	Unit	Cell 1
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		No external noise (Note 2)
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].		

Table A.7.5.8.1.1.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
$\hat{E}_s$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	-Infinity	-80.6
$\hat{E}_s / I_{ot}$ BB Note 7	dB	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-55.41	-55.41	- Infinity	-55.41
NOTE 1: Void					
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Void					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.					
NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.					
NOTE 7: Calculation of Es/Iot$_{BB}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					

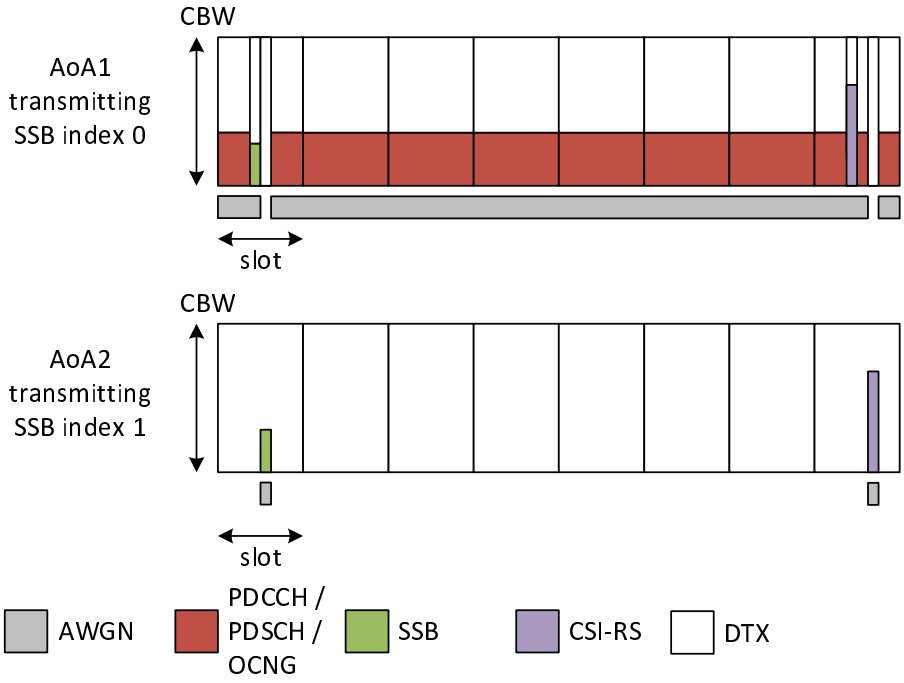


Figure A.7.5.8.1.1.1-1: Time multiplexed downlink transmissions during T1

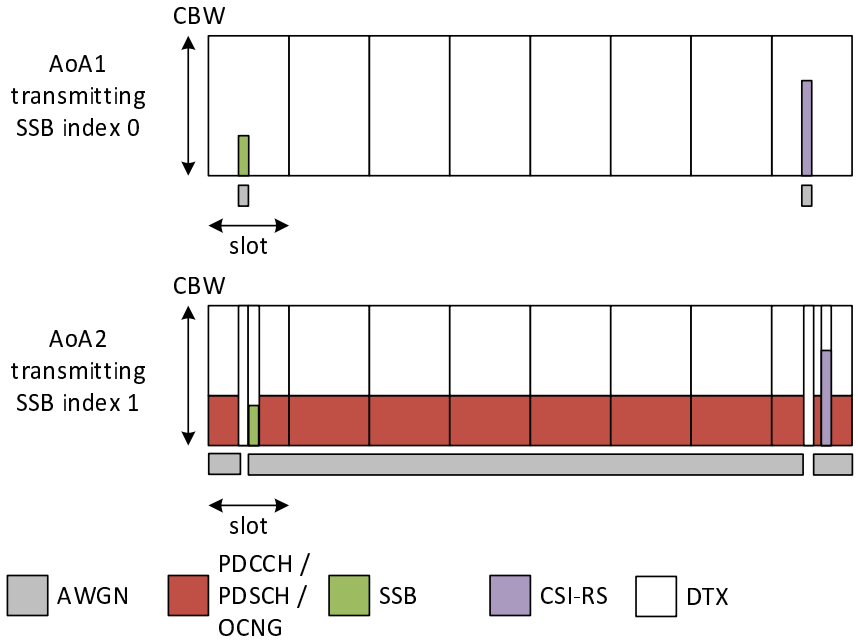


Figure A.7.5.8.1.1.1-2: Time multiplexed downlink transmissions during T2

A.7.5.8.1.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on TCI state 0 till slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$
- be able to start receiving on TCI state 1 after slot n+ T_{HARQ} +5$N_{slot}^{subframe,\mu}$ + $T_{first\text{-}SSB}$/*NR slot length*

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.8.2 RRC based active TCI state switch

A.7.5.8.2.1 NR PCell FR2 active TCI state switch for a known TCI state

A.7.5.8.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10.3. Supported test configuration is shown in table A.7.5.8.2.1.1-1.

The test scenario comprises of one NR PCell as given in table A.7.5.8.2.1.1-2. Cell-specific parameters of NR PCell is specified in table A.7.5.8.2.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.7.5.8.2.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is configured with 1 TCI state for PCell, PDCCH-TCI-state0 (QCL'd to SSB0)
- UE is indicated in TCI state0 as the active TCI state

The test consists of two time periods, T1 and T2. Figure A.7.5.8.2.1.1-1 and Figure A.7.5.8.2.1.1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI-state1 starts

transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a RRC command indicating a switch to TCI-state1.

The test equipment verifies the TCI state switch time in PCell by scheduling the UE on TCI state 1 after slot n+ $(T_{RRC_processing} + T_{first\text{-}SSB})/NR\ slot\ length + 2N_{slot}^{subframe,\mu}$.

Table A.7.5.8.2.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.8.2.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	
T2	s	2	

Table A.7.5.8.2.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TC. State.2
TCI State 1		TCI.State.3
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
Number of reported RS		2
L1-RSRP reporting period	slot	640
timeRestrictionForChannelMeasurements		configured
TRS Configuration		TRS.2.1 TDD TRS.2.2 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		No external noise (Note 2)

Parameter	Unit	Cell 1
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].		

Table A.7.5.8.2.1.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
$\hat{E}_S$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	-Infinity	-80.6
$\hat{E}_s/I_{ot\ BB}$ Note 7	dB	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-55.41	-55.41	- Infinity	-55.41
NOTE 1: Void NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone. NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation. NOTE 7: Calculation of Es/Iot$_{BB}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					

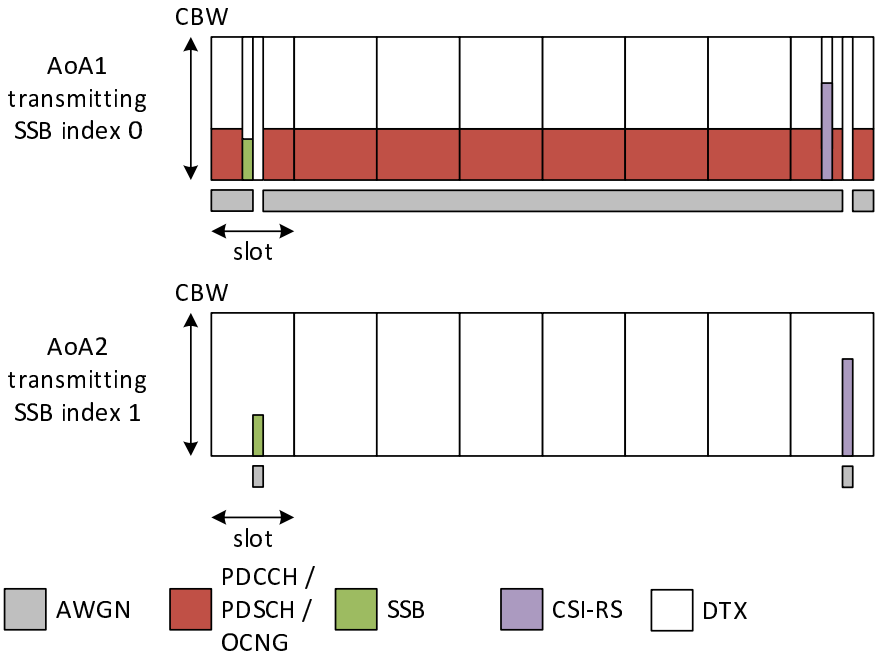


Figure A.7.5.8.2.1.1-1: Time multiplexed downlink transmissions during T1

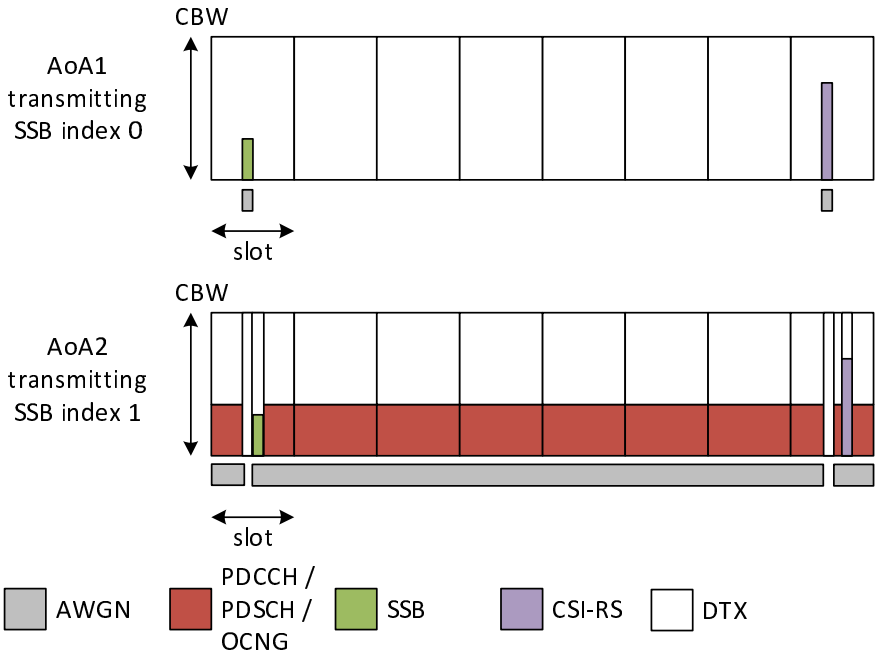


Figure A.7.5.8.2.1.1-2: Time multiplexed downlink transmissions during T2

A.7.5.8.2.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with both SSB0 and SSB1.

After receiving RRC command in slot n, UE shall be able to start receiving on TCI state 1 after slot n+ ($T_{RRC_processing}$ + $T_{first\text{-}SSB}$) / *NR slot length* + $2N_{slot}^{subframe,\mu}$.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.8.3 MAC-CE based active TCI state switch for HST FR2 scenario

A.7.5.8.3.1 NR PCell FR2 HST active TCI state switch for a known TCI state

A.7.5.8.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10.3A for FR2 power class 6 UE. Supported test configuration is shown in table A.7.5.8.3.1.1-1. Furthermore, the purpose of this test is also to verify the one shot large timing adjustment requirement specified in clause 7.1.2.3 provided *highSpeedMeasFlagFR2-r17* is configured and *highSpeedLargeOneStepUL-TimingFR2-r17* is enabled for UE supporting FR2 power class 6 and *largeOneStepUL-timingFR2-r17* capability.

The test scenario comprises of one NR PCell (Cell 1) as given in table A.7.5.8.3.1.1-2. Cell-specific parameters of NR PCell are specified in table A.7.5.8.3.1.1-3 below. The OTA related test parameters for FR2 are shown in table A.7.5.8.3.1.1-4. During the test, *highSpeedMeasFlagFR2-r17* is configured to be *set2* and broadcast to UE.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is configured with 2 different TCI states for PCell, PDCCH TCI state 0 (QCL'd to SSB0) and TCI state 1 (QCL'd to SSB1), in Cell 1 before starting the test.
- UE is indicated in TCI state 0 as the active PDCCH TCI state

The test consists of two time periods, T1 and T2. Figure A.7.5.8.3.1.1-1 and Figure A.7.5.8.3.1.1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which PDCCH-TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting, which has the relative timing delay compared to TCI state 0 by the absolute value of the one-way differential propagation time $|T_{old} - T_{new}| = 2.33\ \mu s$. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state. After the TCI state switch, the UE transmit timing accuracy shall be measured by the test equipment by using the SRS defined in table A.7.5.8.3.1-5.

The test equipment verifies that

- UE can be scheduled on PCell on TCI state 0 till n+ T_{HARQ} +3 ms.
- the TCI state switch time in PCell by scheduling the UE on TCI state 1 after slot n + T_{HARQ} + 3 ms + $T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$ + T_{rs} + $T_{rs\text{-}proc}$.
- the UE transmission timing immediately after TCI state switch shall follow the requirements as specified in clause 7.1.2.3.

Table A.7.5.8.3.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.8.3.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	
T2	s	0.2	

Table A.7.5.8.3.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TCI.State.0
TCI State 1		TCI.State.1
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		

EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AOA1: No external noise (Note 2) AOA2: No external noise (Note 2) with 9722 Hz frequency offset
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].		

Table A.7.5.8.3.1.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
$\hat{E}_s$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	-Infinity	-80.6
$\hat{E}_s/I_{ot}$ BB Note 7	dB	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-55.41	-55.41	- Infinity	-55.41
NOTE 1: Void NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone. NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation. NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.6-4.					

Table A.7.5.8.3.1.1-5: Sounding Reference Symbol Configuration

Field	Value	Comment
c-SRS	16	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=0	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

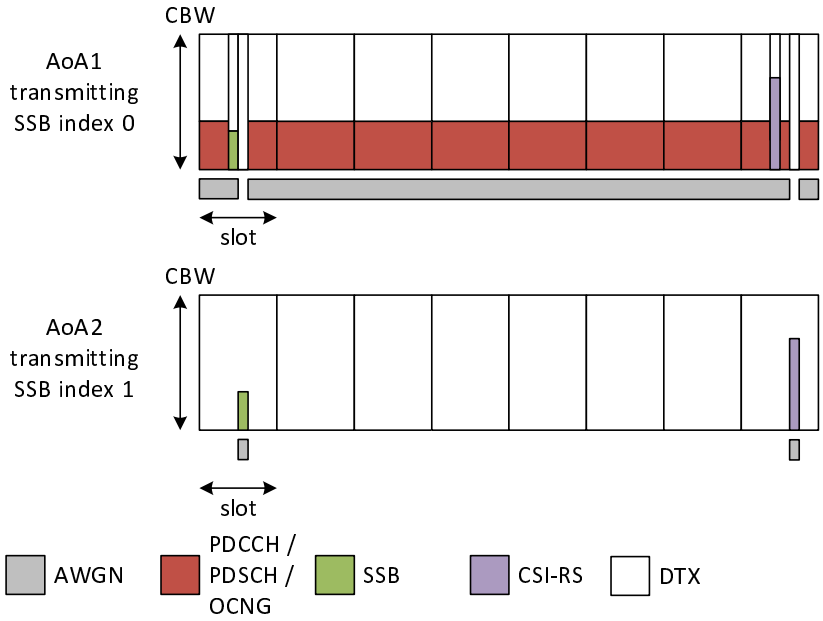


Figure A.7.5.8.3.1.1-1: Time multiplexed downlink transmissions during T1

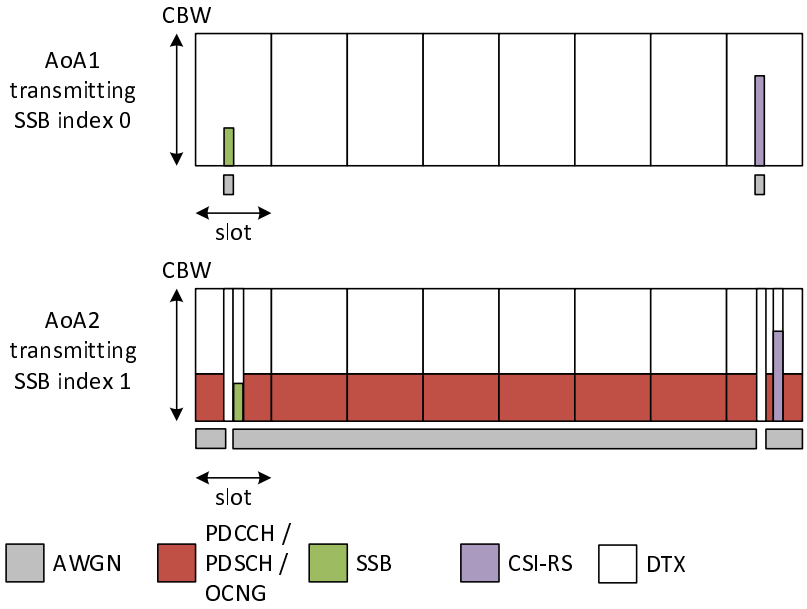


Figure A.7.5.8.3.1.1-2: Time multiplexed downlink transmissions during T2

A.7.5.8.3.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After the TCI state switch, the UE transmission timing immediately after TCI state switch shall follow the requirements as specified in clause 7.1.2.3.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on TCI state 0 till n + T_{HARQ} + 3 ms
- be able to start receiving on TCI state 1 after n + T_{HARQ} + 7 ms + $T_{first-SSB}$ + T_{rs}

A.7.5.8.3.2 NR PCell FR2 HST active TCI state switch for PC6 UE supporting *tci-StateSwitchInd-r18* for a known TCI state

A.7.5.8.3.2.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10.3 applicable for FR2 power class 6 UE. Supported test configuration is shown in table A.7.5.8.3.2.1-1. Furthermore, the purpose of this test is also to verify the timing adjustment requirement specified in clause 7.1.2.3. In the test, *highSpeedMeasFlagFR2-r17* is configured and cross-RRH TCI state indicator for UE-specific PDCCH MAC *CE* as specified in Clause 6.1.3.77 of TS 38.321 [7] is set to '0' for the TCI state switch for FR2 power class 6 UE supporting *tci-StateSwitchInd-r18* capability.

The test scenario comprises of one NR PCell (Cell 1) and the general test parameters are specified in table A.7.5.8.3.2.1-2. Cell-specific parameters of NR PCell are specified in table A.7.5.8.3.2.1-3 below. The OTA related test parameters for FR2 are specified in table A.7.5.8.3.2.1-4. During the test, *highSpeedMeasFlagFR2-r17* is configured to be *set2*.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is configured with 2 different TCI states for PCell: PDCCH TCI state 0 (QCL'd to SSB0) and TCI state 1 (QCL'd to SSB1), and TCI state 0 is indicated as the active PDCCH TCI state.

The test consists of two time periods: T1 and T2. Figure A.7.5.8.3.2.1-1 and A.7.5.8.3.2.1-2 show the time multiplexed (allocation in frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which PDCCH-TCI-state0 is QCL'd is transmitted. From the beginning of T2, the SSB corresponding to TCI state 1 is transmitted. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a MAC-CE command indicating a switch to TCI state 1 with cross-RRH TCI state indicator for UE-specific PDCCH *MAC CE* set as '0'. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state. After the TCI state switch, the UE transmit timing accuracy shall be measured by the test equipment by using the SRS defined in table A.7.5.8.3.2-5. TCI state 1 has relative timing delay of $4*64*T_c$ compared to TCI state 0.

The test equipment verifies that

- UE can be scheduled on PCell on TCI state 0 till n+ T_{HARQ} +3 ms.
- the TCI state switch time in PCell by scheduling the UE on TCI state 1 after slot n + T_{HARQ} + 3 ms + $T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$.
- the UE transmission timing immediately after TCI state switch shall follow the requirements as specified in clause 7.1.2.3.

Table A.7.5.8.3.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.8.3.2.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	
T2	s	0.2	

Table A.7.5.8.3.2.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TCI.State.0
TCI State 1		TCI.State.1
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.7.5.8.3.2.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 4		Rough			
$\hat{E}_s$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 1	dBm/ SCS	-80.6	-80.6	-Infinity	-80.6
$\hat{E}_s/I_{ot\,BB}$ Note 5	dB	8.3	8.3	-Infinity	8.3
Io Note1	dBm/95.04 MHz Note4	-56.0	-56.0	- Infinity	-56.0
NOTE 1: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 2: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 3: As observed with 0 dBi gain antenna at the center of the quiet zone.					
NOTE 4: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.					
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.6-4.					

Table A.7.5.8.3.2.1-5: Sounding Reference Symbol Configuration

Field	Value	Comment
c-SRS	16	Frequency hopping is disabled

b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=0	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

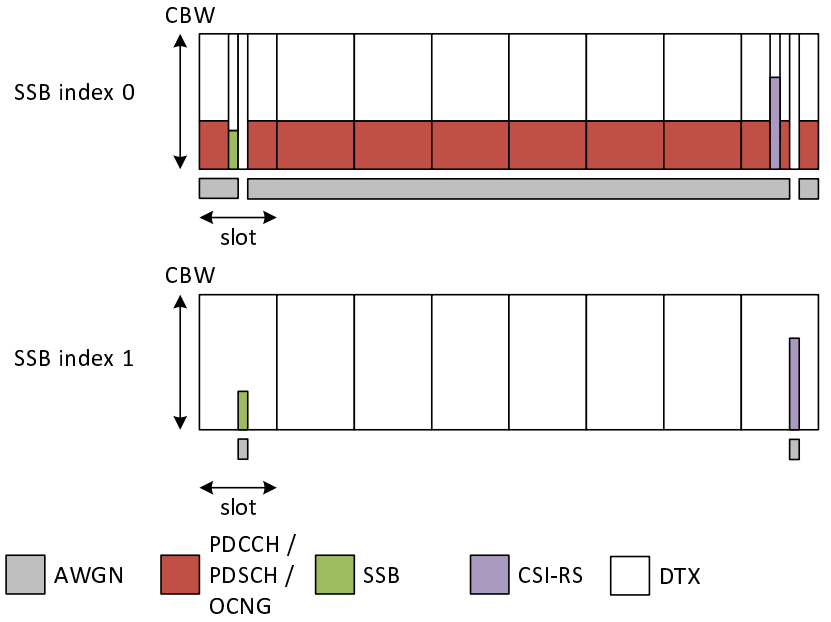


Figure A.7.5.8.3.2.1-1: Time multiplexed downlink transmissions during T1

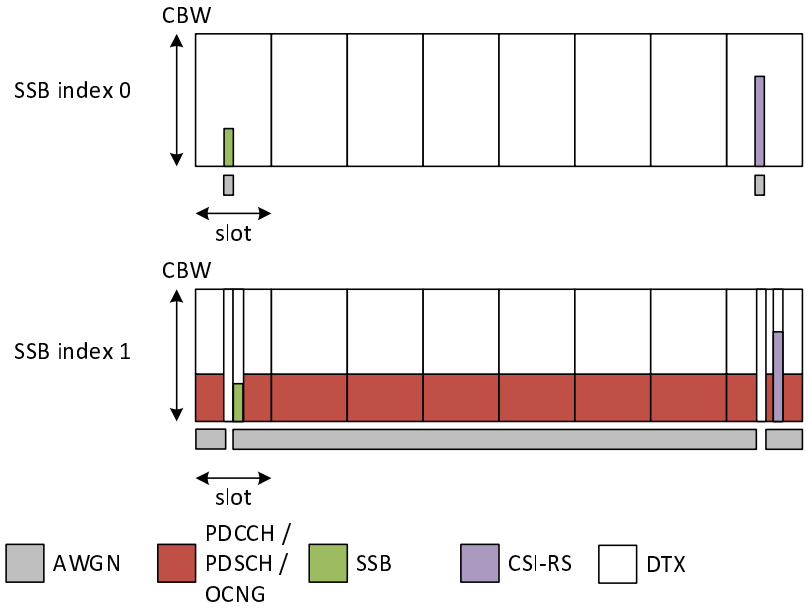


Figure A.7.5.8.3.2.1-2: Time multiplexed downlink transmissions during T2

A.7.5.8.3.2.2 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After the TCI state switch, the UE transmission timing immediately after TCI state switch shall follow the requirements as specified in clause 7.1.2.3.

After receiving TCI state switch command with cross-RRH TCI state indicator for UE-specific PDCCH MAC CE set to '0' in slot n, UE shall:

- be able to continue to receive on TCI state 0 till n+ T_{HARQ} +3 ms
- be able to start receiving on TCI state 1 after n+ T_{HARQ} +5 ms + $T_{first\text{-}SSB.}$

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.8.4 DCI based active TCI state switch with m-DCI for simultaneous reception

A.7.5.8.4.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10E.4.2. Supported test configuration is shown in table A.7.5.8.4.1-1.

The test scenario comprises of one NR PCell (Cell 1) as given in table A.7.5.8.4.1-2. Cell-specific parameters of NR PCell are specified in table A.7.5.8.4.1-3 below. The OTA related test parameters for FR2 are shown in table A.7.5.8.4.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- The UE is configured with the following TCI states: TCI state 0 (QCL'd to SSB0), TCI state 1 (QCL'd to SSB1), TCI state 2 (QCL'd to SSB2) and TCI state 3 (QCL'd to SSB3).
- UE is indicated with the following TCI states for Cell 1 (PCell):
  - PDCCH TCI state 0 (QCL'd to SSB0), PDSCH TCI state 0 (QCL'd to SSB0) for CORESETPoolIndex 0, and
  - PDCCH TCIstate 1 (QCL'd to SSB1), PDSCH TCI state 1 (QCL'd to SSB1) for CORESETPoolIndex 1.
- UE is configured with groupBasedBeamReporting-r17 for SSB index 2 and SSB index 3.
- tci-PresentInDCI is configured in the PDSCH configuration.

The test consists of two time periods, T1 and T2. During T1, the time multiplexed (allocation in Frequency is symbolic) downlink transmissions are scheduled from each Angle of Arrival (AoA1, AoA2 and AoA3) as shown in Figure A.7.5.8.4.1-1. UE is configured to transmit periodic L1-RSRP group-based beam reports on SSB index 2 and SSB index 3. After UE transmits the first L1-RSRP group-based beam report with SSB index 2 and SSB index 3 as a beam pair, TE sends TCI state activation MAC-CEs to activate TCI state 2 and TCI state 3 for PDSCHs.

T2 starts at a time that is not earlier than active TCI state list update delay (as defined in section 8.10E.6.2) from the time UE has received the TCI state activation MAC-CEs. At the beginning of T2, at slot n, UE receives DCI to switch PDSCH TCI state on CORESETPoolIndex 0 for indicating the TCI state switch of PDSCH to TCI state 3. At slot n+1, UE receives DCI to switch PDSCH TCI state on CORESETPoolIndex 1 for indicating the TCI state switch of PDSCH to TCI state 2. During T2, the time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival is shown in Figure A.7.5.8.4.1-2.

The test equipment verifies the TCI state switch time in PCell by scheduling the UE on TCI state 2 and TCI state 3 simultaneously after slot n + 1 + timeDurationForQCL

Table A.7.5.8.4.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.8.4.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.8	
T2	s	0.2	

Table A.7.5.8.4.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration		SSB.25 FR2
SMTC Configuration		SMTC.1
TCI State 0		TCI. State.2
TCI State 1		TCI.State.3
TCI State 2		TCI. State.2
TCI State 3		TCI.State.3
TRS Configuration		TRS.2.1 TDD TRS.2.2 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		No external noise (Note 2)
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].		

Table A.7.5.8.4.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 1							
		SSB0		SSB1		SSB2		SSB3	
		T1	T2	T1	T2	T1	T2	T1	T2
Angle of arrival configuration		Setup 6 according to clause A.3.15.3							
		AoA1		AoA2		AoA3		AoA1	
Assumption for UE beams Note 6		Rough							
$\hat{E}_s$	dBm/SCS	-80.6	-80.6	-80.6	-80.6	-80.6	-80.6	-85.60	-85.60
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	-80.6	-80.6	-80.6	-80.6	-85.60	-85.60
$\hat{E}_s/I_{ot}$ BB Note 7	dB	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
Io Note2	dBm/95.04 MHz Note4	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-60.41	-60.41
Time offset (t)	µs	0	0	0	0	0	0	0.35	0.35

NOTE 1: Void
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.
NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 8: Three probes are used to test dual to dual TCI state switch. One probe shall be used to emulate two different SSBs i.e SSB0 and SSB3. SSB3 is transmitted with same AoA as SSB0 with a time offset (x) and a different power from SSB0.

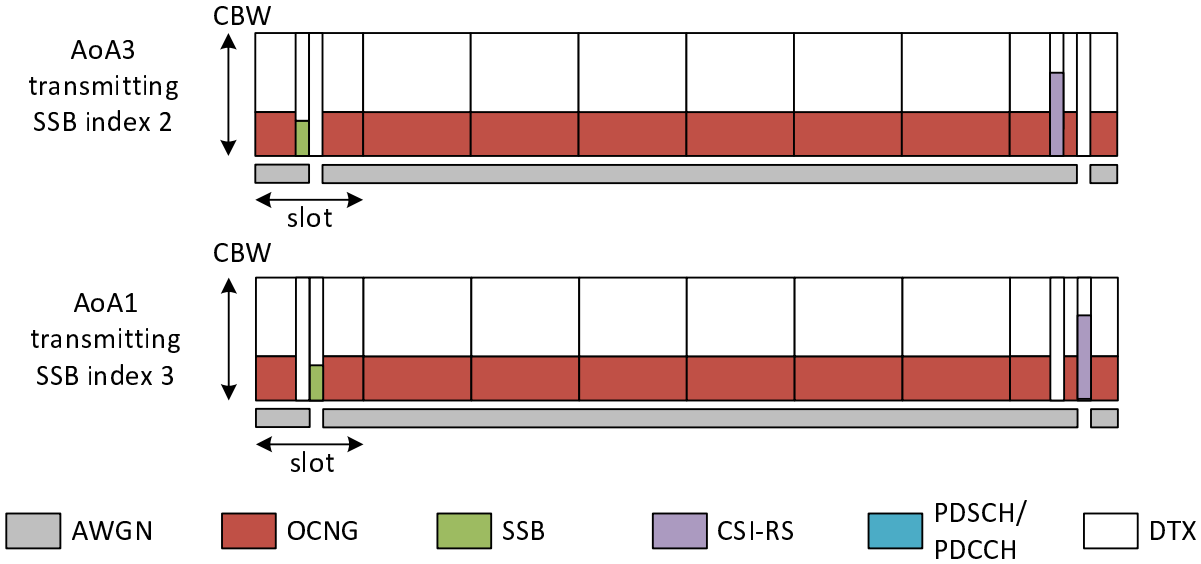


Figure A.7.5.8.4.1-1: Time multiplexed downlink transmissions during T1

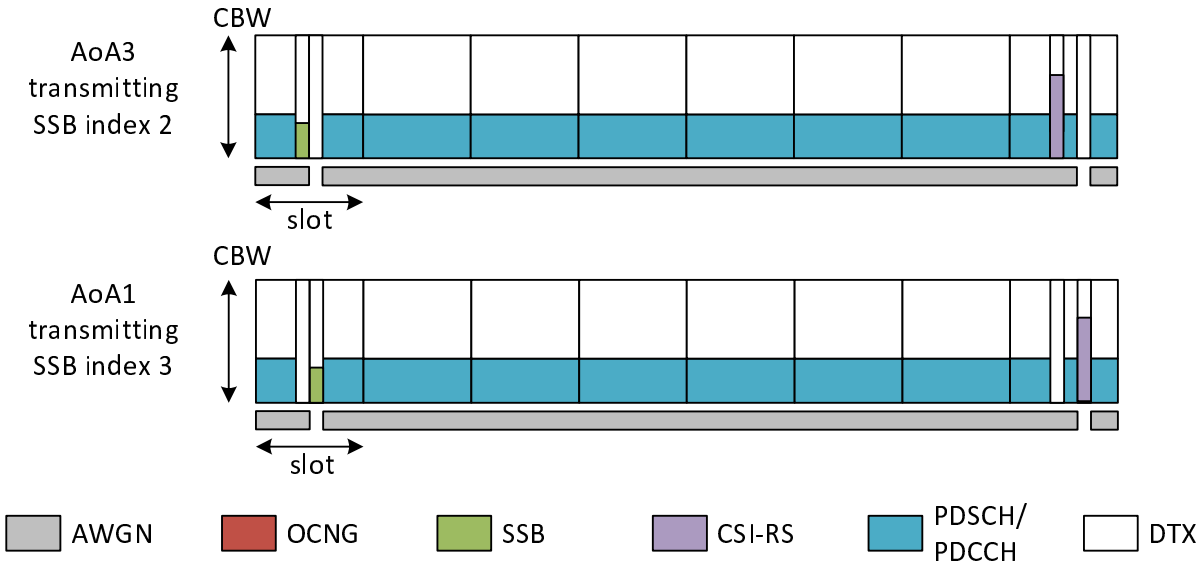


Figure A.7.5.8.4.1-2: Time multiplexed downlink transmissions during T2

A.7.5.8.4.2 Test Requirements

After receiving two DCIs in slot n and slot n+1 during T2, UE shall:

- be able to start receiving on TCI state 2 and TCI state 3 simultaneously after slot n + *timeDurationForQCL*

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.8.5 Single-DCI FR2 DCI based active TCI state switch with known target TCI states for simultaneous reception

A.7.5.8.5.1 Test Purpose and Environment

The purpose of this test is to verify the DCI based active TCI state switch delay requirement defined for sDCI in clause 8.10E.4.1 for simultaneous reception in DL, while also verifying that the UE can complete active TCI state list update within the delay requirement defined in 8.10E.6.1. Supported test configuration is shown in table A.7.5.8.5.1-1.

The test scenario comprises of one NR PCell (Cell 1) in FR2-1 as given in table A.7.5.8.5.1-2. Cell-specific parameters of NR PCell are specified in table A.7.5.8.5.1-3 below. The OTA related test parameters for FR2 are shown in table A.7.5.8.5.1-4.

PDCCH indicating new transmissions shall be sent continuously on PCell to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is configured with *groupBasedBeamReporting-r17* for SSB index 0 and SSB index 1
- UE is configured with 3 different TCI states for PCell in Cell 1 before starting the test:
  - PDCCH TCI state 0 (QCL'd to SSB0),
  - PDSCH TCI state 0 (QCL'd to SSB0),
  - PDSCH TCI state 1 (QCL'd to SSB1)
- UE is indicated TCI state 0 as the active PDCCH and PDSCH TCI state at the beginning of the test.
  - TCI state 1, which is one of the target TCI states, is not in the active TCI state list.

The test consists of two time periods, T1 and T2.

During T1, only SSBs to which PDCCH TCI state 0 and PDSCH TCI state 0 are QCL'd is transmitted (SSB0). During T1, SSB0 is transmitted on AoA1.

At the beginning of T2, the SSB corresponding to PDSCH TCI state 1 starts transmitting on AoA2. The UE is configured with *groupBasedBeamReporting-r17* to provide periodic group-based L1-RSRP reports for SSB0 and SSB1. In slot n, which is within 1280 ms of UE providing group-based L1-RSRP report with results for SSB0 and SSB1 as a beam pair, UE receives a MAC-CE command indicating activation of TCI state 0 and TCI state 1 in a single codepoint. *Tci-PresentInDCI* is configured as enabled in the PDSCH configuration.

After a time that equals to the active TCI state list update delay defined in section 8.10F.6.1 for sDCI, UE receives a DCI indicating TCI state 0 and TCI state 1 for PDSCH scheduling. The TE verifies that the UE can start receiving PDSCH with TCI state 0 (in AoA1) and TCI state 1 (in AoA2) simultaneously after *timeDurationForQCL* from receiving the DCI.

Table A.7.5.8.5.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.8.5.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	
T2	s	2	

Table A.7.5.8.5.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TCI. State.2
TCI State 1		TCI.State.3
TRS Configuration		TRS.2.1 TDD TRS.2.2 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		

Parameter	Unit	Cell 1
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.7.5.8.5.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 5 according to clause A.3.15.5			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
$\hat{E}_s$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	-Infinity	-80.6
$\hat{E}_s / I_{ot}$ BB Note 7	dB	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-55.41	-55.41	- Infinity	-55.41
NOTE 1: Void NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone. NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation. NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					

A.7.5.8.5.1.2 Test Requirements

During T2, UE shall send group-based L1-RSRP report with results for SSB0 and SSB1.

After receiving DCI indicating TCI state 0 and TCI state 1 for PDSCH in slot n, UE shall be able to start receiving TCI state 0 and TCI state 1 simultaneously after n + *timeDurationForQCL*.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.9 Uplink spatial relation switch delay

A.7.5.9.1 MAC-CE based Spatial Relation switch

A.7.5.9.1.1 NR PCell FR2 spatial relation associated with known DL-RS

A.7.5.9.1.1.1 Test Purpose and Environment

The purpose of this test is to verify fulfillment of the uplink spatial relation switch delay requirement defined in clause 8.12.3 by a UE capable of beam correspondence without the need for UL beam sweeping. The supported test configurations are shown in table A.7.5.9.1.1.1-1.

The test scenario comprises one PCell (Cell 1) as outlined in table A.7.5.9.1.1.1-2. Cell-specific parameters are provided in table A.7.5.9.1.1.1-3. OTA-related test parameters are provided in table A.7.5.9.1.1.1-4.

Throughout the test, PDCCH indicating new transmissions shall ge sent continuously on PCell to ensure that the UE will send ACK/NACKs on PUCCH.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with a single TCI state, TCI State-0, which is QCLed with SSB0.

- UE is configured with two spatial relation information configurations Spatial Relation Info-0 and Spatial Relation Info-1 for PUCCH, each associated with SSB0 and SSB1, respectively.

- UE is indicated via MAC-CE activation of *PUCCH-SpatialRelationInfoId* corresponding to Spatial Relation Info-0

- UE is configured with a CSI measurement configuration indicating L1-RSRP measurements on SSB0 and SSB1 with periodic reporting. The L1-RSRP measurement period is influenced by the following: the higher layer parameter *timeRestrictionForChannelMeasurement* is configured, measured SSBs are fully overlapping with SMTC window, and there are no conflicts with measurement gaps.

The test consists of two time periods, T1 and T2. During T1 only the SSB associated with PDCCH TCI state-0 and PUCCH Spatial Relation Info-0 is transmitted. At the beginning of T2, transmission of the SSB associated with PUCCH Spatial Relation Info-1 starts. The UE conducts periodic L1-RSRP measurements and *SSB-Index-RSRP* reporting for SSB0 and SSB1. In slot *n*, which is within 1280 ms after UE receiving both SSB0 and SSB1, and after reporting valid results for both the SSB0 and the SSB1, the UE receives a MAC-CE indicating a switch of spatial relation to PUCCH Spatial Relation Info 1.

The test equipment verifies that the UE transmits according to PUCCH Spatial Relation Info 0 up until slot n + T_{HARQ}/NR slot length + $3N_{slot}^{subframe,\mu}$, and according to PUCCH Spatial Relation Info 1 from slot n + T_{HARQ}/NR slot length + $3N_{slot}^{subframe,\mu}$ + 1 and onwards.

Table A.7.5.9.1.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.9.1.1.1-2: General test parameters

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
L1-RSRP reporting period	slot	160	Periodic L1-RSRP reporting configured
L1-RSRP measured RS		SSB0, SSB1	L1-RSRP measurements of SSB0 and SSB1.
Number of reported RS		2	L1-RSRP reporting of measurements on SSB0 and SSB1.
T1	s	[0.2]	
T2	s	[2]	

Table A.7.5.9.1.1.1-3: NR Cell specific test parameters

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State-0 Configuration		TCI.State.0
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
timeRestrictionForChannelMeasurements		configured
TRS Configuration		TRS.2.1 TDD

Parameter	Unit	Cell 1
Spatial Relation Info-0 Configuration		PUCCH.SRI.0
Spatial Relation Info-1 Configuration		PUCCH.SRI.1
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS Note 1		
EPRE ratio of OCNG to OCNG DMRS Note 1		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.7.5.9.1.1.1-4: OTA related test parameters

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
N_{oc} Note 1	dBm/15 kHz	-92.1			
N_{oc} Note 1	dBm/SCS	-83.1			
$\hat{E}_s/N_{oc}$	dB	1		-infinity	1
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1		-infinity	-82.1
Io Note2	dBm/95.04 MHz Note4	-50.6		-54.1	-50.6
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.					
NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.					

A.7.5.9.1.1.2 Test Requirements

During T2, the UE shall send L1-RSRP report with results for SSB0 and SSB1.

After receiving MAC-CE command in slot *n*, the UE shall:

- Continue transmitting using PUCCH spatial relation associated with SSB0 up to and including slot *n* + T_{HARQ}/NR slot length + $3N_{slot}^{subframe,\mu}$
- Start transmitting using PUCCH spatial relation associated with SSB1 from slot *n* + T_{HARQ}/NR slot length + $3N_{slot}^{subframe,\mu}$ + 1 and onwards.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.9.2 RRC based spatial relation switch

A.7.5.9.2.1 NR PCell FR2 spatial relation switch associated with a known DL-RS

A.7.5.9.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the RRC based spatial relation switch delay requirement defined in clause 8.12.5 by a UE capable of beam correspondence without the need for UL beam sweeping. In the test the higher layer parameter *timeRestrictionForChannelMeasurements* is configured. Supported test configuration is shown in table A.7.5.9.2.1.1-1.

The test scenario comprises of one PCell (Cell 1) as given in table A.7.5.9.2.1.1-2. Cell-specific parameters of PCell is specified in table A.7.5.9.2.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.7.5.9.2.1.1-4.

Periodic SRS is transmitted on PCell (Cell 1), and the SRS configuration is SRSConf.1 given in table A.5.4.1.1.1-3.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is configured with 1 SRS-SpatialRelation0 associated with SSB0.
- UE is indicated SRS-SpatialRelation0 as the active SRS spatial relation.

The test consists of two time periods, T1 and T2. During T1 only SSB0 to which SRS-SpatialRelation0 associated is transmitted. UE shall transmit periodic SRS with SRS-SpatialRelation0 on the UL of the PCell.

T2 start when the tester initiates transmission of SSB1 corresponding to SRS-SpatialRelation1. The UE is configured to transmit periodic L1-RSRP reports.

In slot n, which is within 1280ms of UE providing the L1-RSRP report with results for both SSB0 and SSB1, the UE receives an RRC command indicating a switch to transmit periodic SRS with target SRS-SpatialRelation1. The UE shall be able to transmit periodic SRS with target spatial relation (SRS-SpatialRelation1) on PCell in slot n + $T_{RRC_processing}$/NR slot length +1.

Table A.7.5.9.2.1.1-1: Supported test configurations

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.9.2.1.1-2: General test parameters for spatial relation switch associated with a known DL-RS

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
timeRestrictionForChannelMeasurements		configured	Time domain measurement restriction for the channel (signal) measurements (see TS 38.214 [19], clause 5.2.1.1)
T1	s	0.5	
T2	s	1.5	

Table A.7.5.9.2.1.1-3: NR Cell specific test parameters for spatial relation switch associated with a known DL-RS

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD

Parameter	Unit	Cell 1
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
SRS-SpatialRelation0		SRS.SRI0
SRS-SpatialRelation1		SRS.SRI1
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
Number of reported RS		2
L1-RSRP reporting period	slot	160
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS (Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.7.5.9.2.1.1-4: OTA related test parameters for spatial relation switch associated with a known DL-RS

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams[Note 6]		Rough		Rough	
N_{oc}[Note 1]	dBm/15 kHz	-92.1			
N_{oc}[Note 1]	dBm/SCS	-83.1			
$\hat{E}_s/N_{oc}$	dB	1	1	-Infinity	1
SS-RSRP[Note 2]	dBm/120 kHz[Note3]	-82.1	-82.1	-Infinity	-82.1
Io[Note2,Note6]	dBm/95.04 MHz[Note4]	-50.6	-50.6	-54.1	-50.6
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone. NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.5.9.2.1.2 Test Requirements

During T1 UE shall send L1-RSRP report with SSB0 to which SRS-SpatialRelation0 is associated. During T2, UE shall send L1-RSRP report with SSB1 to which SRS-SpatialRelation1 is associated.

After receiving RRC command in slot n, UE shall be able to transmit target periodic SRS with SRS-SpatialRelation1 on the PCell in the slot $n + T_{RRC_processing}/NR\ slot\ length + 1$.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.10 UE specific CBW change

A.7.5.10.1 NR FR2 UE specific CBW change of PCell with non-DRX in SA

A.7.5.10.1.1 Test Purpose and Environment

The purpose of this test is to verify the UE specific CBW change delay requirement defined in clause 8.13. Supported test configurations are shown in table A.7.5.10.1.1-1.

The test scenario comprises of one PCell (Cell 1) as given in table A.7.5.10.1.1-2. Cell-specific parameters of PCell are specified in table A.7.5.10.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK transmission.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell).
- UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-1 of initial condition in PCell.
- UE has been configured with UE-specific CBW (CBW-1)
- UE is indicated in SCS-SpecificCarrier [2] that the UE-specific CBW is CBW-1 as the initial condition in Cell 1 (PCell).

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated CBW configuration, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its CBW with the updated CBW of final condition (CBW-2).

The UE shall be able to completely receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{CBWchangeDelayRRC}}}{\text{NR Slot length}}$ as defined in clause 8.13.2 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{CBWchangeDelayRRC}}}{\text{NR Slot length}}$ + k1. The UE shall be continuously scheduled on PCell's BWP-1 on CBW-2 starting from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{CBWchangeDelayRRC}}}{\text{NR Slot length}}$.

$T_{RRCprocessingDelay}$ and $T_{CBWchangeDelayRRC}$ are defined in clause 8.13.

The test equipment verifies the UE specific CBW switch time in PCell by counting the time from the time when the RRC Reconfiguration message including updated CBW configurations sent till the time when RRC Reconfiguration Complete message is received.

Table A.7.5.10.1.1-1: UE specific CBW change supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.10.1.1-2: General test parameters for UE specific CBW change in NR SA

Parameter	Unit	Value	Comment

NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
T1	s	0.2	

Table A.7.5.10.1.1-3: NR Cell specific test parameters for UE specific CBW change in NR SA

Parameter		Unit	Cell 1
Frequency Range			FR2
Duplex mode			TDD
TDD configuration			TDDConf.3.1
$BW_{channel}$			100 MHz: $N_{PRB,c}$ = 66
Active DL BWP ID			0
Initial DL BWP Configuration (BWP-1)			DLBWP.0.2
Initial UL BWP Configuration (BWP-1)			ULBWP.0.2
Initial Condition	Active DL CBW Configuration (CBW-1)		DLCBW.1.1
	Active UL CBW Configuration (CBW-1)		ULCBW.1.1
Final Condition	Active DL CBW Configuration (CBW-2)		DLCBW.1.2
	Active UL CBW Configuration (CBW-2)		ULCBW.1.2
'PDSCH Reference measurement channel			SR.3.1 TDD
RMSI CORESET parameters			CR.3.1 TDD
Dedicated CORESET parameters			CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.1 FR2
SMTC Configuration			SMTC.1
TCI State			TCI.State.0
TRS Configuration			TRS.2.1 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.5.10.1.1-4: OTA related test parameters for UE specific CBW change test case

Parameter		Unit	Cell 2
Angle of arrival configuration			Setup 1 according to table A.3.15
Assumption for UE beams Note 5			Fine
N_{oc} Note1	NR_TDD_FR2_A	dBm/15kHz	-112
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS	-103
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		

Parameter		Unit	Cell 2
	NR_TDD_FR2_Y		
SS-RSRP Note2	NR_TDD_FR2_A	dBm/SCS Note3	-85
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
$\hat{E}_s/I_{ot}$		dB	18
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-56
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.10.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PCell from the first DL slot that occurs after the beginning of slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{CBWchangeDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{CBWchangeDelayRRC}}}{\text{NR Slot length}}$ + k1.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed PCell UE specific CBW change delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.11 UE UL carrier RRC reconfiguration Delay

A.7.5.11.1 UE UL carrier RRC reconfiguration Delay

A.7.5.11.1.1 Test Purpose and Environment

The purpose of this test is to verify that when the UE receives a RRC message implying NR UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within the time limits specified in clause 8.4.2 and 8.4.3 for configuring and deconfiguring, respectively. The test will also verify the interruption at UL carrier configuration requirements on PCell in clause 8.2.2.2.4.

There are two cells: FR2 PCell (Cell 1) on NR RF channel 1 and FR2 SCell (Cell 2) on NR RF channel 2. NR uplink is broadcast by *ServingCellConfigCommonSIB.* The test parameters for PCell and SCell are given in table A.7.5.11.1.1-1, table A.7.5.11.1.1-2 and table A.7.5.11.1.1-3 below. The test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, NR uplink of Cell 2 is not configured to UE. At the start of T2, a NR uplink of Cell 2 is configured to UE through *RRCReconfiguration*, then UE shall start transmission on the NR uplink of Cell 2. At the start of T3, the NR uplink is released through *RRCReconfiguration*.

The test equipment also verifies that potential interruption of PCell due to UL carrier configuration on SCell is carried out within the correct time span and within the correct length by monitoring ACK/NACK sent in PCell.

Table A.7.5.11.1.1-1: Supported test configurations

Configuration	PCell (Cell 1)	SCell (Cell 2)
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	DL and UL: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.11.1.1-2: General test parameters for SA UE UL carrier RRC reconfiguration Delay for FR2

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2	Two NR RF channels
Active cell		Config 1	Cell 1: FR2 PCell Cell 2: FR2 SCell	PCell on RF channel number 1 FR2 SCell on RF channel number 2
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern ID		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
Cell 2 timing offset to Cell 1	μs	Config 1	3	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	5	
T3	s	Config 1	5	

Table A.7.5.11.1.1-3: NR Cell specific test parameters for SA UE UL carrier RRC reconfiguration Delay for FR2

Parameter		Unit	Test configuration	Cell 1			Cell 2		
				T1	T2	T3	T1	T2	T3
AoA setup			Config 1	Setup 1 as specified in clause A.3.15					
Beam Assumption[Note 7]			Config 1	Rough			Rough		
Frequency Range			Config 1	FR2			FR2		
NR RF Channel Number			Config 1	1			2		
Duplex mode			Config 1	TDD			TDD		
TDD configuration			Config 1	TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated			Config 1	66			66		
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1			DLBWP.0.1		
	Initial UL BWP			ULBWP.0.1			ULBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1			DLBWP.1.1		
	Dedicated UL BWP			ULBWP.1.1			ULBWP.1.1		
OCNG Patterns			Config 1	OP.1			OP.1		
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD			SR.3.1 TDD		
CORESET Reference Channel			Config 1	CR.3.1 TDD			CR.3.1 TDD		
SSB configuration			Config 1	SSB.1 FR2			SSB.1 FR2		
SMTC configuration			Config 1	SMTC.1			SMTC.1		
TRS configuration			Config 1	TRS.2.1 TDD			TRS.2.1 TDD		
TCI state			Config 1	TCI.State.0			TCI.State.0		
PUSCH parameters for NR UL carrier			Config 1	N/A			N/A	G-FR2-A3-4 in [13]	N/A
PUCCH parameters for NR UL carriers			Config 1	N/A			N/A	Table 11.3.2.3.1.2-2 in [13]	N/A
EPRE ratio of PSS to SSS			Config 1	0			0		
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15kHz Note5	Config 1	-104.7			-104.7		
N_{oc} Note2	dBm/SCS Note4	Config 1	-95.7			-95.7		
SS-RSRP Note 3	dBm/SCS Note5	Config 1	-88.7			-88.7		
$\hat{E}_s/I_{ot}$	dB	Config 1	7			7		
$\hat{E}_s/N_{oc}$	dB	Config 1	7			7		
Io Note3	dBm/95.04 MHz Note5	Config 1	-58.92			-58.92		
Propagation Condition		Config 1	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.5.11.1.2 Test Requirements

The UE shall be ready to start transmission on the NR uplink carrier on SCell within 20 ms from the start of T2.

The UE shall stop the transmission on the NR uplink carrier on SCell within 20 ms from the start of T3.

During T2 and T3, the start of interruption of PCell due to UL carrier configuration or de-configuration on SCell shall not happen outside the UL carrier configuration delay which is 20 ms in this test, and the length of interruption shall not exceed the length specified in clause 8.2.2.2.4.

All of the above test requirements shall be fulfilled in order for the observed UE UL carrier configuration delay and UE UL carrier release delay to be counted as correct. The rate of correct observed UE UL carrier configuration delay and UE UL carrier release delay during repeated tests shall be at least 90 %.

A.7.5.12 Conditional PSCell addition and release delay (FR2 SA)

A.7.5.12.1 Addition and Release Delay of PSCell

A.7.5.12.1.1 Test purpose and environment

The purpose of this test is to verify that the conditional PSCell addition and release delays under SA are within the requirements stated in clause 8.9A.2.

A.7.5.12.1.2 Test Parameters

The supported test configurations are given in table A.7.5.12.1.2-1. The test scenario comprises two NR cells, Cell 1 and Cell 2, on radio channel 1 in FR1 and radio channel 2 in FR2, respectively. Test parameters are given in Tables A.7.5.12.1.2-2 and A.7.5.12.1.2-3 below. The test consists of four successive time periods, with time durations of T1, T2, T3, T4, respectively.

At the start of time duration T1, the UE does not have any timing information of cell 2. NR shall configure a condition implying addition to cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2.

At the start of T2, cell 2 becomes detectable and meets the addition condition. Reception by the test system of the PRACH preamble defines the start of T3.

During T3, the UE shall send periodic CSI reports in PSCell. After having received at least one such report, the test system shall send an RRC message instructing the UE to release the PSCell. Reception by the UE of the RRC message defines the start of T4.

During T4, the UE shall release the PSCell.

Table A.7.5.12.1.2-1: Supported test configurations for FR2 PSCell

Config	Description
1	FR1 FDD SSB SCS 15kHz BW 10 MHz – FR2 TDD SSB SCS 240kHz BW 100 MHz
2	FR1 TDD SSB SCS 15kHz BW 10 MHz – FR2 TDD SSB SCS 240kHz BW 100 MHz
3	FR1 TDD SSB SCS 30kHz BW 40 MHz – FR2 TDD SSB SCS 240kHz BW 100 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.12.1.2-2: General test parameters for conditional PSCell addition and release delay

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test
Active PCell			Cell 1	PCell on RF channel number 1 in FR1
Neighbour cell			Cell 2	Neighbour cell (PSCell-to-be) on RF channel number 2 in FR2
A4	Hysteresis	dB	0	Hysteresis for event A4
	Threshold RSRP	dBm	-118	Threshold for event A4
	Time to Trigger	s	0	Time to trigger for event A4
DRX			OFF	For both PCell and PSCell once activated
Measurement gap pattern ID			0	Gaps are configured before T2 and released before T3.
PRACH configuration in Cell 2			FR2 PRACH configuration 2	PRACH configuration as specified in Clause A.3.8.3.2.
CSI reporting periodicity and offset configuration for Cell 2		ms	2	
T1		s	5	During this time the PCell is known and Cell 2 is unknown.
T2		s	≤7	During this time Cell 2 meets the addition condition and UE adds this PSCell.
T3		s	1	During this time the UE sends CSI reports for Cell 2.
T4		s	1	During this time the UE releases the Cell 2.

Table A.7.5.12.1.2-3: NR Cell specific test parameters for conditional PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
Frequency Range		1,2,3	FR1	FR2			
Duplex mode		1	FDD	TDD			
		2,3	TDD				
TDD configuration		1	–	TDDConf.3.1			
		2	TDDConf.1.1				

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
		3	TDDConf.2.1				
$BW_{channel}$	MHz	1,2	10: $N_{PRB,c}$ = 52	100: $N_{PRB,c}$ = 66			
		3	40: $N_{PRB,c}$ = 106				
Data PRBs allocated		1,2	52	48			
		3	106				
Initial Downlink BWP configuration		1,2,3	DLBWP.0.1	DLBWP.0.1			
Initial Uplink BWP configuration		1,2,3	ULBWP.0.1	ULBWP.0.1			
Dedicated Downlink BWP configuration		1,2,3	DLBWP.1.1	DLBWP.1.1			
Dedicated Uplink BWP configuration		1,2,3	ULBWP.1.1	ULBWP.1.1			
PDSCH Reference Measurement Channel		1	SR.1.1 FDD	SR.3.3 TDD			
		2	SR.1.1 TDD				
		3	SR.2.1 TDD				
TRS configuration		1,2,3	–	TRS.2.1 TDD			
TCI state		1,2,3	–	TCI.State.0			
RMSI CORESET parameters		1	CR.1.1 FDD	CR.3.2 TDD			
		2	CR.1.1 TDD				
		3	CR.2.1 TDD				
Dedicated CORESET parameters		1	CCR.1.1 FDD	CCR.3.7 TDD			
		2	CCR.1.1 TDD				
		3	CCR.2.1 TDD				
OCNG Patterns[Note1]		1,2,3	OP.1	OP.3			
SSB configuration		1,2	SSB.1 FR1	SSB.2 FR2			
		3	SSB.2 FR1				
SMTC configuration		1,2,3	SMTC.2	SMTC.1			
PDSCH/PDCCH subcarrier spacing	kHz	1,2	15	120			
		3	30				
EPRE ratio of PSS to SSS	dB	1,2,3	0	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS							
EPRE ratio of OCNG to OCNG DMRS							
Propagation Condition		1,2,3	N/A	No external noise (Note 2)			

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

Table A.7.5.12.1.2-4: OTA related test parameters for conditional PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
Angle of arrival configuration		1,2,3	Link only, see clause A.3.7A	Setup 2a according to clause A.3.15.2.1			
Assumption for UE beams [Note 3]				Rough			
$\hat{E}s$	dBm/SCS	1,2,3		-∞	-81		
SSB_RP [Note1, Note2]	dBm/SCS	1,2,3		-∞	-81		
$\hat{E}_s/I_{ot}$ BB [Note1, Note 4]	dB	1,2,3		-∞	4.88		
Io [Note 1, Note2]	dBm/95.04 MHz	1,2,3		N/A	-56.41		

Parameter	Unit	Config	Cell 1	Cell 2			
				T1	T2	T3	T4
NOTE 1: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 2: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.							
NOTE 3: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.							
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.							

A.7.5.12.1.3 Test Requirements

$T_{RRC_delay} + T_{Event_DU}$ occurs during T1 as the addition condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure} + T_{UE_preparation} + T_{processing} + T_{\Delta} + T_{PSCell_DU}$ + 2 ms = 6720+10+62 ms=6792 ms (power class 1) or 4160+10+62 ms =4232 ms (power classes 2,3 and 4) from the start of T2.

The UE shall transmit at least one periodic CSI report for PSCell during T3.

The UE shall stop transmitting CSI reports for PSCell at latest 20 ms into T4.

All of the above test requirements shall be fulfilled in order for the observed conditional PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.13 Unified TCI state switching delay

A.7.5.13.1 MAC-CE based active joint TCI state switching

A.7.5.13.1.1 NR PCell FR2 active joint TCI state switch for a known TCI state

A.7.5.13.1.1.1 Test Purpose and Environment

The purpose of this test is to verify both active downlink and uplinke TCI state switch delay requirement defined in clause 8.15 and 8.16, respectively, by using joint TCI state of unified TCI state switch framework. In this test, the target TCI state is not in the active TCI state list for PDSCH/PDCCH, and UE is capable of beam correspondence without the need for UL beam sweeping, i.e. *beamCorrespondenceWithoutUL-BeamSweeping* is set to 1. Supported test configuration is shown in table A.7.5.13.1.1.1-1.

The test scenario comprises of one NR PCell (Cell 1) as given in table A.7.5.13.1.1.1-2. Cell-specific parameters of NR PCell are specified in table A.7.5.13.1.1.1-1 below. The OTA related test parameters for FR2 are shown in table A.7.5.13.1.1.1-2.

Table A.7.5.13.1.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.13.1.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
L1-RSRP reporting period	slot	160	Periodic L1-RSRP reporting configured
Number of RS for L1-RSRP reporting		2	Two source RSs in TCI state 0 and 1.

T1	s	0.2	
T2	s	2	

A.7.5.13.1.1.2 Test parameters

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.
- UE is provided with *dl-OrJoint-TCIStateList-r17* and UE's higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *joint*;
- UE is configured with 2 different joint TCI states for PCell, TCI state 0 (QCL'd to SSB0) and TCI state 1 (QCL'd to SSB1), and the TCI state 1 is not in the active TCI state list for PDSCH/PDCCH.
- UE is indicated TCI state 0 as the active PDCCH TCI state

The test consists of two time periods, T1 and T2. During T1 only source RS in TCI state 0 is transmitted. At the beginning of T2, source RS in TCI state 1 start transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms after the slot in which UE provides L1-RSRP report with results for both source RSs in TCI state 0 and 1, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies the following UE behavior for joint TCI state switch:

- UE shall be able to receive and transmit with TCI state 0 until slot slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu}$, and
- receive and transmit with TCI state 1 from slot $n+T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{first_target\text{-}PL\text{-}RS} + 4*T_{target_PL\text{-}RS} + 2$ ms) / *NR slot length*

Table A.7.5.13.1.1.2-1: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
PL-RS Configuration (CSI-RS#1)		Resource #4 in TRS.2.1 TDD for DLorJoint TCI.State.2 and DLorJoint TCI.State.3
TCI State 0		DLorJoint TCI.State.2
TCI State 1		DLorJoint TCI.State.3
TRS Configuration		TRS.2.1 TDD for DLorJoint TCI.State.2 TRS 2.2 TDD for DLorJoint TCI.State.3
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		

Parameter	Unit	Cell 1
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		No external noise (Note 2)
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].		

Table A.7.5.13.1.1.2-2: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 1			
		Source RS in TCI state 0		Source RS in TCI state 1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
$\hat{E}_s$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	-Infinity	-80.6
$\hat{E}_s/I_{ot\ BB}$ Note 7	dB	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-56.0	-56.0	- Infinity	-56.0
NOTE 1: Void NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone. NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation. NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					

A.7.5.13.1.1.3 Test Requirements

The test verifies that UE can be scheduled by PCell on TCI state 0 and TCI state 1.

During T2, UE shall send L1-RSRP report with results for source RSs in both TCI state 0 and 1.

After receiving MAC-CE command in slot n, UE shall:

- be able to receive and transmit with TCI state 0 until slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu}$
- be able to start receiving and transmitting with TCI state 1 after slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{first_target\text{-}PL\text{-}RS} + 4*T_{target_PL\text{-}RS} + 2\ ms)$ / *NR slot length*

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.13.2 MAC-CE based active uplink TCI state switch

A.7.5.13.2.1 NR FR2 PCell uplink TCI state switch for a known TCI state

A.7.5.13.2.1.1 Test Purpose and Environment

The purpose of this test is to verify fulfillment of the uplink TCI switch delay requirement defined in clause 8.16.3 by a UE capable of beam correspondence without the need for UL beam sweeping. The test scenario comprises one PCell (Cell 1).

Throughout the test, PDCCH indicating new transmissions shall be sent continuously on PCell to ensure that the UE will send ACK/NACKs on PUCCH.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with a unified DL TCI state, TCI State-0, and SSB0 is configured as QCL source for the TCI state. At the start of test UE is connected to DL TCI state 0.
- UE is configured with 2 UL TCI states, UL TCI state 0 and UL TCI state 1. QCL info to UL TCI state 0 and 1 is provided by SSB0 and SSB1, respectively. Initially only UL TCI 0 is in the active TCI states.
- PL-RS is configured for each of the UL TCI states. CSI-RS 0 and CSI-RS 1 are associated with UL TCI state 0 and 1 respectively as PL-RS.
- AT the start of the test UE connected to DL TCI state 0 and UL TCI state 0.

Index of CSI-RS#1 is configured for UE as PUSCH-PathlossReferenceRS-Id-r17 which is indicated in TCI-UL-State-r17 of uplink TCI state 1. CSI-RS#1 is QCLed typeD with SSB#1. UE does not maintain CSI-RS#1 as pathloss RS before the uplink TCI state switching.

The test consists of two time periods, T1 and T2. During T1, only the SSB associated with DL TCI state-0 and UL TCI state 0 is transmitted. At the beginning of T2, transmission of the SSB 1 associated with UL TCI state 1 starts. The UE conducts periodic L1-RSRP (i.e., *SSB-Index-RSRP)* reporting for SSB0 and SSB1. In slot *n*, which is within 1280 ms after UE receiving both SSB0 and SSB1, and after reporting valid results for both the SSB0 and the SSB1, the UE receives a MAC-CE indicating a TCI state switch to UL TCI state 1.

The test equipment verifies that the UE transmits according to UL TCI state 0 up until slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu}$, and according to UL TCI state 1 from slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + NM^*$ ($T_{first_target\text{-}PL\text{-}RS} + 4^*T_{target_PL\text{-}RS} + 2$ ms) / *NR slot length* and onwards. NM is equal to 1. Where, T_{HARQ} (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].

A.7.5.13.2.1.2 Test parameters

The supported test configurations are provided in table A.7.5.13.2.1.2-1.

General test parameters are provided in table A.7.5.13.2.1.2-2.

Cell-specific parameters are provided in table A.7.5.13.2.1.2-3.

OTA-related test parameters are provided in table A.7.5.13.2.1.2-4.

Table A.7.5.13.2.1.2-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.13.2.1.2-2: General test parameters

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
L1-RSRP reporting period	slot	160	Periodic L1-RSRP reporting configured
L1-RSRP measured RS		SSB0, SSB1	L1-RSRP measurements of SSB0 and SSB1.
Number of reported RS		2	L1-RSRP reporting of measurements on SSB0 and SSB1.

T1	s	0.2	
T2	s	2	

Table A.7.5.13.2.1.2-3: NR Cell specific test parameters

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
DL TCI State		DLorJoint TCI.State.0
PL-RS Configuration for CSI-RS#0		Resource #4 in TRS.2.1 TDD for UL TCI.State.2
PL-RS Configuration for CSI-RS#1		Resource #4 in TRS.2.2 TDD for UL TCI.State.3
UL TCI State-0 Configuration		UL TCI.State.2
UL TCI State-1 Configuration		UL TCI.State.3
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
timeRestrictionForChannelMeasurements		configured
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS Note 1		
EPRE ratio of OCNG to OCNG DMRS Note 1		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.7.5.13.2.1.2-4: OTA related test parameters

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
N_{oc} Note 1	dBm/15 kHz	-92.1			
N_{oc} Note 1	dBm/SCS	-83.1			
$\hat{E}_s/N_{oc}$	dB	1		-infinity	1
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1		-infinity	-82.1
Io Note2	dBm/95.04 MHz Note4	-55.0		-58.5	-55.0

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.					
NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.					

A.7.5.13.2.1.3 Test Requirements

During T2, the UE shall send L1-RSRP report with results for SSB0 and SSB1.

After receiving MAC-CE command in slot *n*, the UE shall:

- Continue transmitting using UL TCI state 0 up to and including slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu}$
- Start transmitting using UL TCI state 1, from slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + (T_{first_target\text{-}PL\text{-}RS} + 4*T_{target_PL\text{-}RS} + 2$ ms) / *NR slot length* and onwards.

The rate of correct events observed during repeated tests shall be at least 90 %

A.7.5.13.3 MAC-CE based active downlink TCI state switch

A.7.5.13.3.1 NR PCell FR2 active downlink TCI state switch to cell with additional PCI for a known TCI state

A.7.5.13.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the MAC-CE based active downlink TCI state switch delay requirement defined in clause 8.15.3. Supported test configuration is shown in table A.7.5.13.3.1.1-1.

Table A.7.5.13.3.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

A.7.5.13.3.1.2 Test Parameters

The test scenario comprises of one NR PCell (Cell 1) and one NR cell as the cell with additional PCI (Cell 2), as given in table A.7.5.13.3.1.2-1. Cell-specific parameters of NR PCell and the cell with additional PCI are specified in table A.7.5.13.3.1.2-2 below. The OTA related test parameters for FR2 are shown in table A.7.5.13.3.1.2-3.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is provided with *dl-OrJoint-TCIStateList-r17* and UE's higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *separate*.
- UE is configured with SSB-based L1-RSRP measurements on cell with additional PCI (Cell 2)
- UE is configured with 2 different TCI states for PCell, TCI state 0 (QCL'd to TRS resource set 1, TCI state of which is QCLed to SSB0 of Cell 1) and TCI state 1 (QCL'd to TRS resource set 2, TCI state of which is QCLed to SSB1 of Cell 2), in Cell 1 before starting the test.

- UE is indicated in TCI state 0 as the active TCI state

The test consists of two time periods, T1 and T2. Figure A.7.5.13.3.1.2-1 and Figure A.7.5.13.3.1.2-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 of Cell 1 and SSB1 of Cell 2, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies that UE can be scheduled on PCell on TCI state 0 till slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$. The test equipment also verifies the TCI state switch time in PCell by scheduling the UE on TCI state 1 after slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$ + ($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$)/*NR slot length*.

Table A.7.5.13.3.1.2-1: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Cell with additional PCI		Cell 2	Neighbour cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
L1-RSRP reporting period	slot	160	Periodic L1-RSRP reporting configured
L1-RSRP measured RS		SSB0 of Cell 1, SSB1 of Cell 2	L1-RSRP measurements of SSB0 and SSB1.
Number of RS for L1-RSRP reporting		2	Two source RSs in TCI state 0 and 1.
Cell 2 timing offset to cell1	us	<CP	
T1	s	0.2	
T2	s	2	

Table A.7.5.13.3.1.2-2: NR Cell specific test parameters for TCI state switch to a cell with additional PCI

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration		SSB.1 FR2 for SSB0 of Cell 1 and SSB1 of Cell 2
SMTC Configuration		SMTC.1
DL TCI State 0		DLorJoint TCI.State.0
DL TCI State 1		DLorJoint TCI.State.1
TRS Configuration		TRS.2.1 TDD for DLorJoint TCI.State.0 TRS.2.2 TDD for DLorJoint TCI.State.1
Pathloss RS Configuration		Resource #4 in TRS.2.1 TDD
reportQuantity for SSB		ssb-Index-RSRP-Index-r17
reportConfigType for SSB		periodic
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		

Parameter	Unit	Cell 1
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		No external noise (Note 2)
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].		

Table A.7.5.13.3.1.2-3: OTA related test parameters for TCI state switch to a cell with additional PCI

Parameter	Unit	Cell 1		Cell 2	
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
$\hat{E}_s$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	-Infinity	-80.6
$\hat{E}_s / I_{ot}$ BB Note 7	dB	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-56.0	-56.0	- Infinity	-56.0
NOTE 1: Void					
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Void					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.					
NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.					
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					

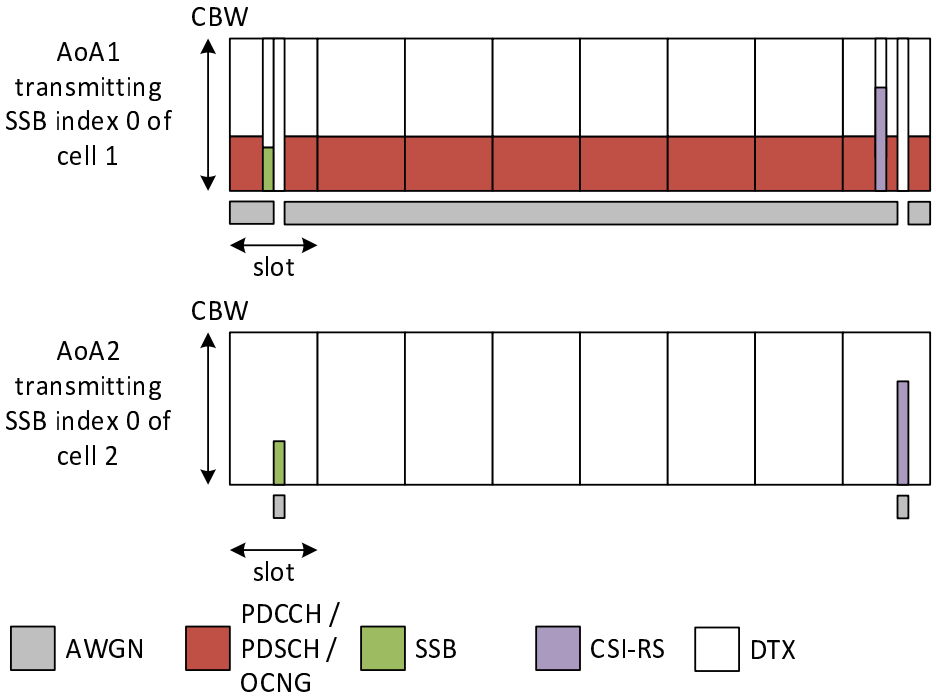


Figure A.7.5.13.3.1.2-1: Time multiplexed downlink transmissions during T1

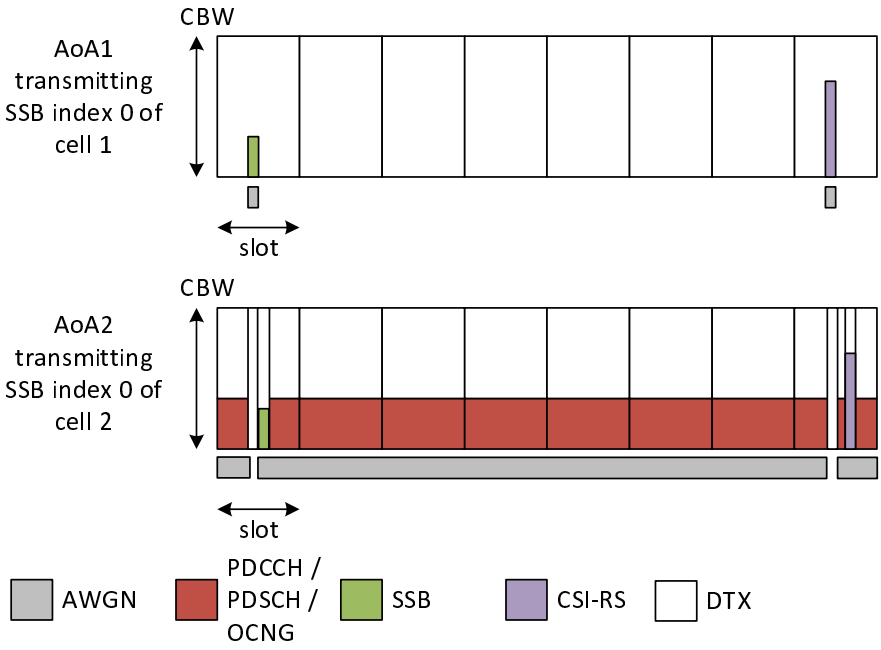


Figure A.7.5.13.3.1.2-2: Time multiplexed downlink transmissions during T2

A.7.5.13.3.1.3 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 of Cell 1 and SSB1 of Cell 2.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on DL TCI state 0 till slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$
- be able to start receiving on DL TCI state 1 after slot n+ T_{HARQ} + (5 ms + $T_{first\text{-}SSB}$) / *NR slot length*

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.13.4 sDCI MAC-CE based joint TCI state switching

A.7.5.13.4.1 NR PCell FR2 dual downlink and uplink TCI state switch in sDCI for known case

A.7.5.13.4.1.1 Test Purpose and Environment

The purpose of this test is to verify both active downlink and uplink TCI state switch delay requirement defined in clause 8.21 and 8.23, respectively, by using joint TCI state of unified TCI state switch framework when *tci-JointTCI-UpdateSingleActiveTCI-PerCC-r18* is supported and when *tci-SeparateTCI-UpdateSingleActiveTCI-PerCC-r18* is not supported. Supported test configuration is shown in table A.7.5.13.4.1.1-1.

Table A.7.5.13.4.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.13.4.1.1-2: General test parameters for dual TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
L1-RSRP reporting period	slot	320	Periodic L1-RSRP reporting configured

L1-RSRP measured RS		SSB0 and SSB1 of TRP0, SSB2 and SSB3 of TRP1	L1-RSRP measurements of SSB0, SSB1 SSB2 and SSB3.
Number of RS for L1-RSRP reporting		4	SSB0, SSB1, SSB2 and SSB3 in Joint TCI state 0, 1, 2, and 3.
TRP0 timing offset to TRP1	us	<CP	
T1	s	0.2	
T2	s	1	UE is required to activate dual joint TCI states (TCI state 2 and TCI state 3).

A.7.5.13.4.1.2 Test parameters

The test scenario comprises of one NR PCell (Cell 1) as given in table A.7.5.13.4.1.2-1. Cell-specific parameters of NR PCell are specified in table A.7.5.13.4.1.2-2 below. The OTA related test parameters for FR2 are shown in table A.7.5.13.4.1.2-3.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- PDCCHs indicating new transmissions shall be sent continuously on Pcell to ensure that the UE would have ACK/NACK sending.
- UE is provided with *dl-OrJoint-TCIStateList-r17* and UE's higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *joint*.
- applyIndicatedTCI-State-r18 is set as {first} for TRP0 (CORESET index p associated with Joint TCI state 0 and Joint TCI state 1) and as {second} for TRP1 (CORESET index q associated with Joint TCI state 2 and Joint TCI state 3).
- tci-SelectionPresentInDCI-r18 is configured in the BWP configuration, i.e. TCI state for the PDSCH is indicated by DCI format 1_1 and PDSCHs on two TRPs are scheduled in TDM manner.
- UE is configured with two joint TCI states (TCI state 0 and TCI state 1) for TRP0 and two joint TCI states (TCI state 2 and TCI state 3) for TRP1. QCL info to Joint TCI state 0,1,2 and 3 are provided by SSB0, SSB1, SSB2 and SSB3, respectively.
- UE is indicated in TCI state 0 and TCI state 2 as the active TCI state for TRP0 and TRP1.

The test consists of two time periods, T1 and T2. During T1, SSB0 in joint TCI state 0 and SSB2 in joint TCI state 2 are transmitted.

At the beginning of T2, SSB1 in joint TCI state 1 and SSB3 in joint TCI state 3 start transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms after the slot in which UE provides L1-RSRP report with results for SSB1 and SSB3 in joint TCI state 1 and joint TCI state 3, UE receives a MAC-CE command indicating a switch to dual joint TCI state 1 and TCI state 3 for two TRPs.

The test equipment verifies that UE can be scheduled by two TRPs on joint TCI state 0 and joint TCI state 2 till slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$. The test equipment also verifies the TCI state switch time for two TRPs by scheduling the UE on joint TCI state 1 and joint TCI state 3 after slot n+T_{HARQ} + 3$N_{slot}^{subframe,\mu}$ + max{NM1* ($T_{first_target\text{-}PL\text{-}RS1}$ + 4*$T_{target_PL\text{-}RS1}$ + 2 ms), NM2* ($T_{first_target\text{-}PL\text{-}RS2}$ + 4*$T_{target_PL\text{-}RS\ 2}$+ 2 ms) }/ *NR slot length*.

Table A.7.5.13.4.1.2-1: Void

Table A.7.5.13.4.1.2-2: NR Cell specific test parameters for dual TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		66
Initial BWP Configuration		DLBWP.0.2 ULBWP.0.2

Parameter	Unit	Cell 1
Dedicated BWP Configuration		DLBWP.1.1 ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters (CORESET index p)		CCR.3.1 TDD
Dedicated CORESET parameters (CORESET index q)		CCR.3.2 TDD
OCNG Patterns		OP.5 defined in A.3.2.1
SSB Configuration for TRP0		SSB.1 FR2
SSB Configuration for TRP1		SSB.5 FR2
SMTC Configuration		SMTC.1
Joint TCI State 0		DLorJoint TCI.State.2
Joint TCI State 1		DLorJoint TCI.State.6
Joint TCI State 2		DLorJoint TCI.State.7
Joint TCI State 3		DLorJoint TCI.State.8
TRS Configuration		TRS.2.1 TDD for DLorJoint TCI.State.2 TRS.2.4 TDD for DLorJoint TCI.State.6 TRS.2.5 TDD for DLorJoint TCI.State.7 TRS.2.6 TDD for DLorJoint TCI.State.8
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.7.5.13.4.1.2-3: OTA related test parameters for dual TCI state switch

Parameter	Units	TRP0				TRP1			
		SSB0		SSB2		SSB1		SSB3	
		T1	T2	T1	T2	T1	T2	T1	T2
Angle of arrival configuration		Setup 7 according to clause A.3.15.7							
		AoA1		AoA2		AoA2		AoA3	
Assumption for UE beams Note 6		Rough							
$\hat{E}_S$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	-Infinity	-80.6	-80.6	-80.6	-Infinity	-80.6
$\hat{E}_s/I_{ot}$ BB Note 7	dB	8.3	8.3	-Infinity	8.3	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-56.0	-56.0	- Infinity	-56.0	-56.0	-56.0	- Infinity	-56.0
NOTE 1: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 2: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 3: As observed with 0 dBi gain antenna at the center of the quiet zone. NOTE 4: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation. NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.									

A.7.5.13.4.1.3 Test Requirements

During T2, the test verifies that UE can be scheduled by two TRPs on joint TCI state 1 and joint TCI state 3.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive and transmit with joint TCI state 0 and joint TCI state 2 till slot n+ T_{HARQ} +$3N_{slot}^{subframe,\mu}$
- be able to start receiving and transmitting with joint TCI state 1 and joint TCI state 3 after slot n+T_{HARQ} + $3N_{slot}^{subframe,\mu}$ + max{NM1* ($T_{first_target\text{-}PL\text{-}RS1}$ + 4*$T_{target_PL\text{-}RS1}$ + 2 ms), NM2* ($T_{first_target\text{-}PL\text{-}RS2}$ + 4*$T_{target_PL\text{-}RS\ 2}$+ 2 ms) }/ *NR slot length*.
  - where NM1=1, NM2=1.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.13.5 MAC-CE based dual downlink TCI state switching delay for unified TCI for single-DCI mTRP

A.7.5.13.5.1 NR PCell FR2 dual downlink TCI state switch in sDCI for known case

A.7.5.13.5.1.1 Test Purpose and Environment

The purpose of this test is to verify the MAC-CE based dual downlink TCI state switch delay requirement defined in clause 8.21.3 when *tci-SeparateTCI-UpdateSingleActiveTCI-PerCC-r18* is supported. Supported test configuration is shown in table A.7.5.13.5.1.1-1.

Table A.7.5.13.5.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

A.7.5.13.5.1.2 Test Parameters

There is one active serving cell (Cell 1) configured with two TRPs in the test. Cell-specific parameters of Cell 1 are specified in table A.7.5.13.5.1.2-2 below. The OTA related test parameters for FR2 are shown in table A.7.5.13.5.1.2-3.

PDCCHs indicating new transmissions shall be sent continuously on TRP0 to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1 (PCC).
- UE is provided with *dl-OrJoint-TCIStateList-r17* and UE's higher layer signalling *unifiedTCI-StateType-r17* in IE *MIMOParam-r17* is set to *separate.*
- UE is configured with SSB-based L1-RSRP measurements on Cell 1
- applyIndicatedTCI-State-r18 is set as {first} for TRP0 (CORESET index p associated with Joint TCI state 0 and Joint TCI state 1) and as {second} for TRP1 (CORESET index q associated with Joint TCI state 2 and Joint TCI state 3).
- tci-SelectionPresentInDCI-r18 is configured in the BWP configuration, i.e. TCI state for the PDSCH is indicated by DCI format 1_1 and PDSCHs on two TRPs are scheduled in TDM manner.
- UE is configured with two TCI states (TCI state 0 and TCI state 1) for TRP0 and two TCI states(TCI state 2 and TCI state 3) for TRP1. QCL info to DL TCI state 0, 1 , 2 and 3 are provided by SSB0, SSB1, SSB2 and SSB3, respectively.
- UE is indicated in TCI state 0 and TCI state 1 as the active TCI state for TRP0 and TRP1

The test consists of two time periods, T1 and T2. During T1, source RS in TCI state 0 and TCI state 2 are transmitted. At the beginning of T2, source RS in TCI state 1 and source RS in TCI state 3 start transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms after the slot in which UE provides L1-RSRP

report with results for source RSs in TCI state 1 and 3, UE receives a MAC-CE command indicating a switch to TCI state 1 and 3 for two TRPs. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies that UE can be scheduled by two TRPs on TCI state 0 and TCI state 2 till slot n+ T_{HARQ} +3$N_{slot}^{subframe,\mu}$. The test equipment also verifies the TCI state switch time for two TRPs by scheduling the UE on TCI state 1 and TCI state 3 after slot after slot n+ T_{HARQ} + 3$N_{slot}^{subframe,\mu}$+ max{TO_{k1}*($T_{first\text{-}SSB1}$ + AD_1*T_{SSB1} + $T_{SSB\text{-}proc}$), TO_{k2}*($T_{first\text{-}SSB2}$ + AD_2*T_{SSB2} + $T_{SSB\text{-}proc}$)} / NR slot length.

Table A.7.5.13.5.1.2-1: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
L1-RSRP reporting period	slot	160	Periodic L1-RSRP reporting configured
L1-RSRP measured RS		SSB0 and SSB1 of TRP0, SSB2 and SSB3 of TRP1	L1-RSRP measurements of SSB0, SSB1 SSB2 and SSB3.
Number of RS for L1-RSRP reporting		4	four source RSs in TCI state 0,1, 2,3.
Cell 2 timing offset to cell1	us	<CP	
T1	s	0.2	
T2	s	1	

Table A.7.5.13.5.1.2-2: NR Cell specific test parameters

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3. 2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP. 5
SSB Configuration for TRP 0		SSB.1 FR2
SSB Configuration for TRP 1		SSB.5 FR2
SMTC Configuration		SMTC.1
DL TCI State 0		DLorJoint TCI.State.2
DL TCI State 1		DLorJoint TCI.State.6
DL TCI State 2		DLorJoint TCI.State.7
DL TCI State 3		DLorJoint TCI.State.8
TRS Configuration		TRS.2.1 TDD for DLorJoint TCI.State.2 TRS.2.2 TDD for DLorJoint TCI.State.6 TRS.2.4 TDD for DLorJoint TCI.State.7 TRS.2.5 TDD for DLorJoint TCI.State.8
Pathloss RS Configuration		Resource #4 in TRS.2.1 TDD
reportQuantity for SSB		ssb-Index-RSRP-Index-r17
reportConfigType for SSB		periodic
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		

Parameter	Unit	Cell 1
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.7.5.13.5.1.2-3: OTA related test parameters for TCI state switch

Parameter	Units	TRP0				TRP1			
		SSB0		SSB2		SSB1		SSB3	
		T1	T2	T1	T2	T1	T2	T1	T2
Angle of arrival configuration		Setup 7 according to clause A.3.15.7							
		AoA1		AoA2		AoA2		AoA3	
Assumption for UE beams Note 6		Rough							
$\hat{E}_s$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	-Infinity	-80.6	-80.6	-80.6	-Infinity	-80.6
$\hat{E}_s / I_{ot\ BB}$ Note 7	dB	8.3	8.3	-Infinity	8.3	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-56.0	-56.0	- Infinity	-56.0	-56.0	-56.0	- Infinity	-56.0
NOTE 1: Void NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone. NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation. NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.									

A.7.5.13.5.1.3 Test Requirements

During T2, the test verifies that UE can be scheduled by two TRPs on TCI state 1 and TCI state 3.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on DL TCI state 0 and DL TCI state 2 till slot n+ T_{HARQ} +$3N_{slot}^{subframe,\mu}$
- be able to start receiving on DL TCI state 1 and DL TCI state 3 after slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ max{TO_{k1}*($T_{first\text{-}SSB1}$ + AD_1*T_{SSB1} + $T_{SSB\text{-}proc}$), TO_{k2}*($T_{first\text{-}SSB2}$ + AD_2*T_{SSB2} + $T_{SSB\text{-}proc}$)} / NR slot length

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.13.6 MAC-CE based active uplink TCI state switch for single-DCI mTRP

A.7.5.13.6.1 NR FR2 PCell uplink TCI state switch for two known TCI states

A.7.5.13.6.1.1 Test Purpose and Environment

The purpose of this test is to verify fulfillment of the uplink TCI switch delay requirement defined in clause 8.23.3 by a UE capable of beam correspondence without the need for UL beam sweeping when *tci-SeparateTCI-UpdateSingleActiveTCI-PerCC-r18* is supported. The test scenario comprises one PCell (Cell 1) with two TRPs.

Throughout the test, PDCCH indicating new transmissions shall be sent continuously on PCell to ensure that the UE will send ACK/NACKs on PUCCH.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with a unified DL TCI state, TCI State-0, and SSB0 is configured as QCL source for the TCI state. At the start of test UE is connected to DL TCI state 0.
- UE is configured with 4 UL TCI states, UL TCI state 0, UL TCI state 1, UL TCI state 2, and UL TCI state 3. QCL info to UL TCI state 0, 1, 2, and 3 is provided by SSB0, SSB1, SSB2, and SSB3, respectively. Initially only UL TCI 0 is in the active TCI state list.
- PL-RS is configured for each of the UL TCI states. CSI-RS 0, CSI-RS 1, CSI-RS 2, and CSI-RS 3 are associated with UL TCI state 0, 1, 2, and 3 respectively as PL-RS.
- At the start of the test UE is connected to DL TCI state 0, UL TCI state 0, and UL TCI state 1.

Index of CSI-RS#1 is configured for UE as PUSCH-PathlossReferenceRS-Id-r17 which is indicated in TCI-UL-State-r17 of uplink TCI state 1. CSI-RS#1 is QCLed typeD with SSB#1. UE does not maintain CSI-RS#1 as pathloss RS before the uplink TCI state switching.

Index of CSI-RS#2 is configured for UE as PUSCH-PathlossReferenceRS-Id-r17 which is indicated in TCI-UL-State-r17 of uplink TCI state 2. CSI-RS#2 is QCLed typeD with SSB#2. UE does not maintain CSI-RS#2 as pathloss RS before the uplink TCI state switching.

The test consists of two time periods, T1 and T2. During T1, only the SSBs associated with DL TCI state-0, UL TCI state 0, and UL TCI state 1 are transmitted. At the beginning of T2, transmission of the SSB 2 associated with UL TCI state 2 and transmission of the SSB 3 associated with UL TCI state 3 start. The UE conducts periodic L1-RSRP (i.e., *SSB-Index-RSRP)* reporting for SSB0, SSB1, SSB2, and SSB3. In slot *n*, which is within 1280 ms after UE receiving SSB0, SSB1, SSB2, and SSB3, and after reporting valid results for the SSB0, the SSB1, the SSB2 and the SSB3, the UE receives a MAC-CE indicating a TCI state switch to UL TCI state 2 and to UL TCI state 3.

The test equipment verifies that the UE transmits according to UL TCI state 0 and UL TCI state 1 up until slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu}$, and according to UL TCI state 2 and to UL TCI state 3 from slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + \max\{NM1^* (T_{first_target\text{-}PL\text{-}RS1} + 4^*T_{target_PL\text{-}RS1} + 2 \text{ ms}), NM2^* (T_{first_target\text{-}PL\text{-}RS2} + 4^*T_{target_PL\text{-}RS2} + 2 \text{ ms})\}$ / *NR slot length* and onwards. NM1 is equal to 1. NM2 is equal to 1. Where, T_{HARQ} (in slot) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].

A.7.5.13.6.1.2 Test parameters

The supported test configurations are provided in table A.7.5.13.6.1.2-1.

General test parameters are provided in table A.7.5.13.6.1.2-2.

Cell-specific parameters are provided in table A.7.5.13.6.1.2-3.

OTA-related test parameters are provided in table A.7.5.13.6.1.2-4.

Table A.7.5.13.6.1.2-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.13.6.1.2-2: General test parameters

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
L1-RSRP reporting period	slot	160	Periodic L1-RSRP reporting configured
L1-RSRP measured RS		SSB0, SSB1, SSB2, SSB3	L1-RSRP measurements of SSB0, SSB1, SSB2 and SSB3.
Number of reported RS		3	L1-RSRP reporting of measurements on SSB0, SSB1, SSB2, and SSB3.
T1	s	0.2	
T2	s	2	

Table A.7.5.13.6.1.2-3: NR Cell specific test parameters

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
DL TCI State		DLorJoint TCI.State.0
PL-RS Configuration for CSI-RS#0		Resource #4 in TRS.2.1 TDD for UL TCI.State.2
PL-RS Configuration for CSI-RS#1		Resource #4 in TRS.2.2 TDD for UL TCI.State.3
PL-RS Configuration for CSI-RS#2		Resource #4 in TRS.2.4 TDD for UL TCI.State.4
PL-RS Configuration for CSI-RS#3		Resource #4 in TRS.2.5 TDD for UL TCI.State.5
UL TCI State-0 Configuration		UL TCI.State.2
UL TCI State-1 Configuration		UL TCI.State.3
UL TCI State-2 Configuration		UL TCI.State.4
UL TCI State-3 Configuration		UL TCI.State.5
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
timeRestrictionForChannelMeasurements		configured
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS Note 1		
EPRE ratio of OCNG to OCNG DMRS Note 1		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.7.5.13.6.1.2-4: OTA related test parameters

Parameter	Unit	Cell 1							
		SSB0		SSB1		SSB2		SSB3	
		T1	T2	T1	T2	T1	T2	T1	T2
Angle of arrival configuration		Setup 7 according to clause A.3.15.7							
		AoA1		AoA2		AoA1		AoA3	
Assumption for UE beams Note 6		Rough							
N_{oc} Note 1	dBm/15 kHz	-92.1							
N_{oc} Note 1	dBm/SCS	-83.1							
$\hat{E}_s/N_{oc}$	dB	1		-infinity	1	-infinity	1	-infinity	1
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1		-infinity	-82.1	-infinity	-82.1	-infinity	-82.1
Io Note2	dBm/95.04 MHz Note4	-55.0		-58.5	-55.0	-58.5	-55.0	-58.5	-55.0

Parameter	Unit	Cell 1							
		SSB0		SSB1		SSB2		SSB3	
		T1	T2	T1	T2	T1	T2	T1	T2
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.									
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.									
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.									
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.									
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.									
NOTE 6: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.									

A.7.5.13.6.1.3 Test Requirements

During T2, the UE shall send L1-RSRP report with results for SSB0 and SSB1.

After receiving MAC-CE command in slot *n*, the UE shall:

- Continue transmitting using UL TCI state 0 and UL TCI state 1 up to and including slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu}$

- Start transmitting using UL TCI state 2 and UL TCI state 3, from slot $n + T_{HARQ} + 3N_{slot}^{subframe,\mu} + \max\{T_{first_target\text{-}PL\text{-}RS1} + 4*T_{target_PL\text{-}RS1} + 2\text{ ms}, T_{first_target\text{-}PL\text{-}RS2} + 4*T_{target_PL\text{-}RS2} + 2\text{ ms}\}$ / *NR slot length* and onwards.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.5.14 PSCell RACH-less based Activation and deactivation for FR1+FR2 inter-band with target PSCell in FR2

A.7.5.14.1 Test Purpose and Environment

The purpose of this test case is to test the activation PSCell delay for a UE configured with one deactivated SCG in NR-DC and when PSCell in one SCG is being activated. The test also tests the deactivation delay. The test case tests the requirements within which the UE shall be able to activate the deactivated SCG in clause 8.17.2 for RACH-less based conditions when PSCell and TCI state are known. The PCell is in NR FR1 and the PSCell is in NR FR2.

The supported test configurations are defined in table A.7.5.14.1-1. The test parameters for NR cell are given in Tables A.7.5.14.1-2. And cell specific test parameters are described in Tables A.7.5.14.1-3. OTA related test parameters are defined in table A.7.5.14.1-4.

At the beginning of T1 the UE is configured with a PSCell which is activated. At T1 the PSCell is deactivated. PSCell is configured with *bfd-and-RLM* with value *true*.

An RRC message for activation of PSCell is sent by the test equipment 1 s after the RRC message deactivating the PSCell, in a slot # denoted m. The point in time at which the RRC message for activation of PSCell is received at the UE defines the start of time period T2.

During T2, the test equipment monitors for SR from the UE on the PSCell. The time when test equipment receives a scheduling request from the UE is denoted as slot T3.

Time period T4 starts when a RRC message for deactivation of the PSCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of the PSCell, respectively.

The test equipment verifies the activation time by when the SR from the UE is received in the activated PSCell.

The test equipment verifies the deactivation time by counting the slots from the time when the PSCell deactivation command is sent until UL transmission from the PSCell is discontinued.

Table A.7.5.14.1-1: Supported test configurations for FR2 PSCell activation case

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target PSCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PSCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PSCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.7.5.14.1-2: General Test Parameters for FR2 PSCell activation and deactivation

TBD

Table A.7.5.14.1-3: Cell specific test parameters for FR2 PSCell activation case

Parameter[Note 5]		Unit	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
SSB ARFCN			Freq1				Freq2			
Duplex mode	Config 1		FDD				TDD			
	Config 2,3		TDD							
TDD configuration	Config 1		Not Applicable				TDDConf.3.1			
	Config 2		TDDConf.1.1							
	Config 3		TDDConf.2.1							
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1							
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1							
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1							
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1							
TRS configuration	Config 1,2,3		N/A				TRS.2.1 TDD			
TCI state	Config 1,2,3		TCI.State.0							
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52				100: $N_{PRB,c}$ = 66			
	Config 3		40: $N_{PRB,c}$ = 106							
Data PRBs allocated	Config 1,2		52	66	66	52	66	52	52	66
	Config 3		106			106		106	106	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD				-			
	Config 2		SR.1.1 TDD							
	Config 3		SR.2.1 TDD							
RMSI CORESET Parameters	Config 1		CR.1.1 FDD				-			
	Config 2		CR.1.1 TDD							
	Config 3		CR.2.1 TDD							
Dedicated CORESET Parameters	Config 1		CCR.1.1 FDD				-			
	Config 2		CCR.1.1 TDD							
	Config 3		CCR.2.1 TDD							
OCNG Patterns			OP.1							
SSB configuration	Config 1,2		SSB.1 FR1				SSB.3 FR2			
	Config 3		SSB.2 FR1							
CSI-RS configuration for CSI reporting	Config 1~3		N/A				CSI-RS.3.1 TDD			
reportConfigType for CSI reporting			periodic				N/A			
reportConfigType for L1-RSRP			periodic				N/A			
reportQuantity for CSI reporting			cri-RI-PMI-CQI				N/A			
reportQuantity for L1-RSRP			ssb-Index-RSRP				N/A			
CSI reporting periodicity	Config 1,2	slot	5				N/A			
	Config 3		10							
	Config 1,2	slot	5				N/A			

Parameter[Note 5]		Unit	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
L1-RSRP reporting periodicity [Note 7]	Config 3		10							
CSI reporting offset	Config 1,2	slot	2				N/A			
	Config 3		4							
L1-RSRP reporting offset	Config 1,2	slot	2				N/A			
	Config 3		4							
SMTC configuration			SMTC.1							
EPRE ratio of PSS to SSS		dB	0							
EPRE ratio of PBCH_DMRS to SSS										
EPRE ratio of PBCH to PBCH_DMRS										
EPRE ratio of PDCCH_DMRS to SSS										
EPRE ratio of PDCCH to PDCCH_DMRS										
EPRE ratio of PDSCH_DMRS to SSS										
EPRE ratio of PDSCH to PDSCH_DMRS										
EPRE ratio of OCNG DMRS to SSS[Note 1]										
EPRE ratio of OCNG to OCNG DMRS [Note 1]										
Propagation conditions			N/A Link only, see clause A.3.7A				AWGN			
Scheduling request resource priodicity		ms	N/A				20			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: All parameters apply for configuration 1, 2 and 3
NOTE 6: Void.
NOTE 7: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.14.1-4: OTA related test parameters for FR1 PCell with FR2 PSCell activation case

Parameter		Unit	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
Angle of arrival configuration			N/A				According to clause A.3.15.1			
Assumption for UE beams [Note 7]			N/A				Rough			
N_{oc} [Note 1]	Config 1,2,3	dBm/15kHz	Link only, see clause A.3.7A				-104.7			
N_{oc} [Note 1]	Config 1,2,3	dBm/SCS					-95.7			
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB					7			
	Config 1,2,3	dB					7			
SSB_RP[Note 2, Note 4]	Config 1,2,3	dBm/SCS					-88.7			
Io[Note 2, Note 4]	Config 1,2,3	dBm/95.04 MHz					-58.92			

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.

A.7.5.14.2 Test Requirements

During T2 the UE shall send the first SR on PSCell in the first available uplink SR resource no later than T3 which is:

$T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{IU} + 2$ ms

as defined on clause 8.17.2. In this test case:

$T_{processing}$ = 5 ms (no RRC parameter has been modified),

T_{search} = 0 ms (RACH-less based PSCell activation, with RLM and BFD are configured, PSCell and TCI state are known), and

T_{Δ} = 20 ms.

This allows T3 of $[T_{RRC_delay} + T_{IU} + 27]$ms

During T4 the UE shall stop all transmissions on the PSCell no later than in slot n + $\frac{T_{RRC_delay}}{NR\ slot\ length}$ as defined in 8.17.3.

During T2 the interruption of PCell during PSCell activation shall not happen outside the slot $m + T_{RRC_delay}$.

During T4 the interruption of PCell during PSCell deactivation shall not happen outside the slot $n + T_{RRC_delay}$.

The interruption duration on PCell due to activation and deactivation of PSCell shall not be more than the values specified for in Clause 8.17.2 and 8.17.3.

A.7.5.15 Void

A.7.5.16 UE L1-RSRP Scheduling and Measurement Restrictions on FR2-1

A.7.5.16.1 Test Purpose and Environment

The purpose of this test is to verify that the NR UE correctly follows the L1-RSRP scheduling restrictions requirements defined in clause 9.5.6.3 and measurement restrictions defined in clause 9.5.5.2.

There is no measurement gap and no DRX configured in the test. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured. The test is for sDCI based sceneriao and consists of two time periods, T1 and T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is configured with *groupBasedBeamReporting-r17* for SSB index 0 and SSB index 1.
- UE is configured with 2 different TCI states for PCell, PDCCH TCI state 0 (QCL-ed to SSB0) and TCI state 1 (QCL-ed to SSB1).
- *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.During T1, the time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival (AoA1 and AoA2) is shown in Figure A.7.5.16.1-1. UE transmits periodic L1-RSRP group-based beam reports for SSB index 0 and SSB index 1. After UE transmits first valid L1-RSRP group-based beam report, TCI state 0 and TCI state 1 are activated for CORESET index p and CORSET index q which indicates for 2 PDSCH reception.

During T2, the time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival is shown in Figure A.7.5.16.1-2. At the beginning of T2, the CSI-RS resource index 0 and CSI-RS resource index 1 are configured for measurement resources for L1-RSRP. CSI-RS resource 0 is QCL-ed to SSB index 0, and CSI-RS resource 1 is QCL-ed to SSB index 1. During T2, CSI-RS resource 0 is transmitted on AoA1 and CSI-RS resource 1 is transmitted on AoA2. During T2, after the CSI-RS configuration, PDSCH is always scheduled on the symbols overlapping with CSI-RS resource symbols.

For scheduling restriction relaxation, the UE is required to receive both PDSCHs on the symbols overlapped with CSI-RS configured for L1-RSRP and sends ACK correctly.

For measurement restriction relaxation, the UE is required to measure both CSI-RS resource index 0 and CSI-RS resource index 1 at the same time from the beginning of T2.

The test parameters are given in table A.7.5.16.1-1, table A.7.5.16.1-2, table A.7.5.16.1-3 and table A.7.5.16.1-4 below.

Table A.7.5.16.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.16.1-2: General test parameters for NR L1-RSRP scheduling and measurement restriction test case in FR2

Parameter	Unit	Value		Comment
RF Channel Number		1		
SSB configuration		SSB.1 FR2		
SMTC configuration		SMTC pattern 1		
CSI-RS configuration for CSI reporting		CSI-RS.3.4A TDD	CSI-RS.3.5A TDD	2 CSI-RS resources configured
CSI-RS resource index		0	1	
reportConfigType		periodic	periodic	
reportQuantity		cri-RSRP	cri-RSRP	
CSI reporting periodicity	slot	80	80	
DRX cycle length	s	OFF		
T1	s	[0.8]		
T2	s	[0.5]		

Table A.7.5.16.1-3: Cell specific test parameters for NR L1-RSRP scheduling and measurement restriction test case in FR2

Parameter	Unit	Cell 1
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated		24
PDSCH/PDCCH subcarrier spacing	KHz	120
PDSCH Reference measurement channel QCL-ed to SSB index 0		SR.3.2 TDD
PDSCH Reference measurement channel QCL-ed to SSB index 1		SR.3.2 TDD
RMSI CORESET RMC configuration		CR.3.1 TDD
Dedicated CORESET (CORESET index p) RMC configuration QCL-ed to SSB index 0		CCR.3.1 TDD
Dedicated CORESET (CORESET index q) RMC configuration QCL-ed to SSB index 1		CCR.3.1 TDD
PDSCH TCI state QCL-ed to SSB index 0		TCI.State.0
PDSCH TCI state QCL-ed to SSB index 1		TCI.State.1
OCNG Pattern		OP.4 defined in A.3.2.1
Initial BWP configuration		DLBWP.0.1 ULBWP.0.1
Dedicated UL BWP configuration		DLBWP.1.3 ULBWP.1.3
TRS Configuration QCL-ed to SSB index 0		TRS.2.1 TDD
TRS Configuration QCL-ed to SSB index 1		TBD
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH DMRS		
EPRE ratio of OCNG DMRS to SSS Note 1		
EPRE ratio of OCNG to OCNG DMRS Note 1		
Propagation condition		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols		

Table A.7.5.16.1-4: NR OTA test parameters for NR L1-RSRP scheduling and measurement restriction test case in FR2

Parameter	Unit	SSB index 0		SSB index 1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 5 according to A.3.15.1			
		AoA1		AoA2	
Beam Assumption Note 2		Rough		Rough	
SSB $\hat{E}_s/I_{ot}$ Note1, 3	dB	-2.1		-2.1	
SSB_RP Note1	dBm/ SCS	-91		-91	
CSI_RS_RP	dBm/ SCS	N/A	-85	N/A	-85
Io Note 4	dBm/95.04 MHz	-66.41		-66.41	
Time multiplexing of the downlink transmissions from each AoA		Defined in Figure A.7.5.16.1-1 for T1 and Figure A.7.5.16.1-2 for T2			

NOTE 1: SSB Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 2: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 3: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 4: Calculation of Io does not consider the different power level between CSI-RS and SSB

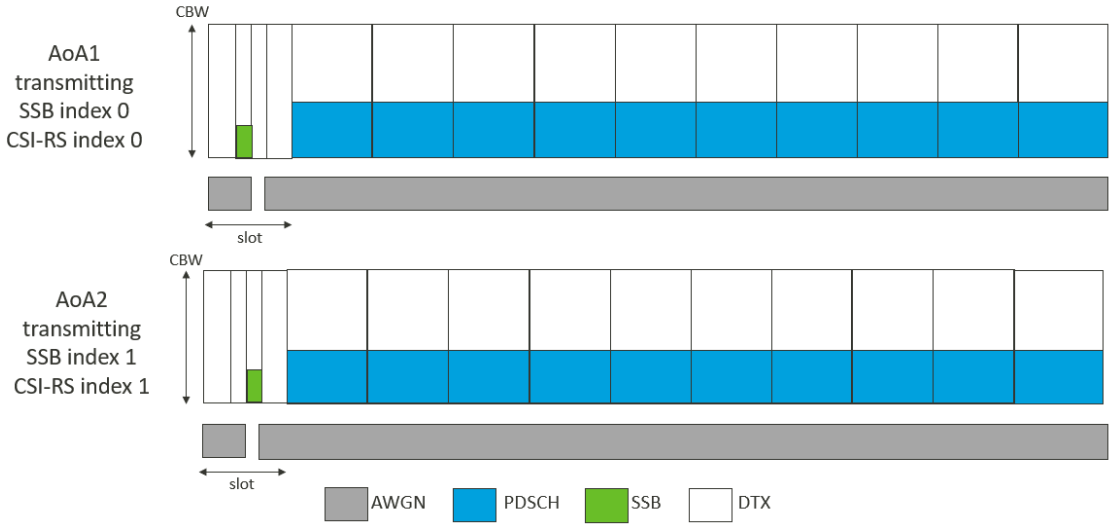


Figure A.7.5.16.1-1: Time multiplexed downlink transmissions during T1

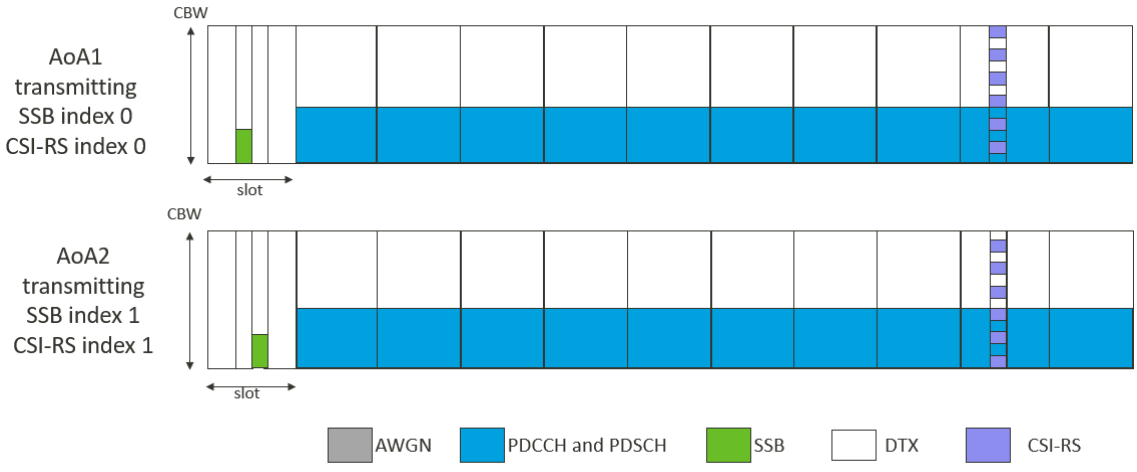


Figure A.7.5.16.1-2: Time multiplexed downlink transmissions during T2

A.7.5.16.2 Test Requirements

The UE behaviour follows the requirements defined in clause 9.5.6.3 and 9.5.5.2.

During T2,

- UE is required to receive both PDSCHs and send ACK correctly.
- No later than Y + 80 slot from the beginning of time period T2, UE shall send L1-RSRP report including the valid results for both CSI-RS resource 0 and CSI-RS resource 1 while meeting the accuracy requirements defined in clause 10.1.X.
  - Y is the RRC processing delay, which is 10 ms

A.7.5.17 SCG Activation and deactivation for FR1+FR1 inter-band with target PSCell in FR1

A.7.5.17.1 Test Purpose and Environment

The purpose of this test case is to test the PSCell activation delay for a UE configured with one deactivated SCG in NR-DC and when PSCell in one SCG is being activated. The test also tests the deactivation delay. The test case tests the requirements within which the UE shall be able to activate the deactivated SCG in clause 8.17.2 for when PSCell is known and TCI state is known. The PCell is in NR FR1 and the PSCell is in NR FR1.

The supported test configurations are defined in table A.7.5.17.1-1. The test parameters for NR cell are given in Tables A.7.5.17.1-2. And cell specific test parameters are described in Tables A.7.5.17.1-3.

During T1 the PSCell is configured in deactivated state. The TE ensures that the deactivated PSCell remain known until the PSCell is activated.

At T2 an RRC message for activation of PSCell is sent by the test equipment.The point in time at which the RRC message, for activating of the PSCell , is received at the UE in slot n defines as the starting point of T2

During T2, the test equipment monitors for PRACH preamble from the UE on the PSCell. The time when TE receives a preamble from the UE is denoted as starting point of T3.

During T3 the TE monitoris the msg3, and after sending the msg4, the TE sends the RRC deactivation command to the UE. The point in time at which the RRC message for deactivating the PSCell is received at the UE in slot n defines the starting time of T4.

During the time period T4, the UE is configured with measCyclePscell , *bfd-and-RLM* with value true . And the TE sends the 2nd RRC activation command.

The time when UE receives the 2nd RRC activation command in slot n , defines as the starting time of T5.

During T5, the test equipment monitors for SR from the UE on the PSCell. The time when test equipment receives a scheduling request from the UE is denoted as the ending point of the test.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of the PSCell, respectively.

For 1 st time activation during T2, the test equipment verifies the activation time by when the Random Access preamble from the UE is received in the activated PSCell.

During T4 and T5 the TE ensures that that TCI state is known.

For the 2nd time activation during T5, the test equipment verifies the activation time by when the SR from the UE is received in the activated PSCell. The TE verifies the deactivation time by counting the slots from the time when the PSCell deactivation command is sent until UL transmission from the PSCell is discontinued.

Table A.7.5.17.1-1: Supported test configurations for FR1 PSCell activation case

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

	Target PSCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target PSCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target PSCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.7.5.17.1-2: General Test Parameters for FR1FR1 PSCell activation and deactivation

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two NR radio channels are used for this test, cell 1 and cell2 use RF channel 1 and 2, respectively.
Initial Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Deactivated PSCell		Cell 2	To be activated PSCell on RF channel number 2.
Final Condition	Active PCell		Cell 1	PCell on RF channel number 1.
	Activated PSCell		Cell 2	PSCell activated on RF channel number 2.
DRX			OFF	Continuous monitoring of primary cell
Scheduling request resource priodicity			20 ms	At the starting of period T6, UE sends a SR on PUCCH for PSCell
T1		s	1	During this time the PSCell is deactivated
T2		s	1	During this time the TE activated the PSCell
T3		s	0.5	During this time the PSCell is activated
T4		s	0.5	During this time the TE deactivate the PSCell
T5		s	1	During this time, PSCell and TCI state shall be known the TE activate the Pscell

Table A.7.5.17.1-3: Cell specific test parameters for FR1-FR1 PSCell activation case

Parameter[Note 5]		Unit	Cell 1						Cell 2					
			T1	T2	T3	T4	T5	T6	T1	T2	T3	T4	T5	T6
SSB ARFCN			Freq1						Freq2					
Duplex mode	Config 1		FDD						TDD					
	Config 2,3		TDD											
TDD configuration	Config 1		Not Applicable						TDDConf.3.1					
	Config 2		TDDConf.1.1											
	Config 3		TDDConf.2.1											
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1											
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1											
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1											
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1											
TRS configuration	Config 1,2,3		N/A						TRS.2.1 TDD					
TCI state	Config 1,2,3		TCI.State.0											
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52						100: $N_{PRB,c}$ = 66					
	Config 3		40: $N_{PRB,c}$ = 106											
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD						-					
	Config 2		SR.1.1 TDD											
	Config 3		SR.2.1 TDD											
RMSI CORESET Parameters	Config 1		CR.1.1 FDD						-					
	Config 2		CR.1.1 TDD											
	Config 3		CR.2.1 TDD											
Dedicated CORESET Parameters	Config 1		CCR.1.1 FDD						-					
	Config 2		CCR.1.1 TDD											
	Config 3		CCR.2.1 TDD											
OCNG Patterns			OP.1											
SSB configuration	Config 1,2		SSB.1 FR1						SSB.3 FR1					
	Config 3		SSB.2 FR1											
CSI-RS configuration for CSI reporting	Config 1~3		N/A						CSI-RS.3.1 TDD					

Parameter[Note 5]		Unit	Cell 1						Cell 2					
			T1	T2	T3	T4	T5	T6	T1	T2	T3	T4	T5	T6
reportConfigType for CSI reporting			periodic						N/A					
reportConfigType for L1-RSRP			periodic						N/A					
reportQuantity for CSI reporting			cri-RI-PMI-CQI						N/A					
reportQuantity for L1-RSRP			ssb-Index-RSRP						N/A					
CSI reporting periodicity	Config 1,2	slot	5						N/A					
	Config 3		10											
L1-RSRP reporting periodicity [Note 7]	Config 1,2	slot	5						N/A					
	Config 3		10											
CSI reporting offset	Config 1,2	slot	2						N/A					
	Config 3		4											
L1-RSRP reporting offset	Config 1,2	slot	2						N/A					
	Config 3		4											
SMTC configuration			SMTC.1											
TimeAlignmentTimer			Infinity											
EPRE ratio of PSS to SSS		dB	0											
EPRE ratio of PBCH_DMRS to SSS														
EPRE ratio of PBCH to PBCH_DMRS														
EPRE ratio of PDCCH_DMRS to SSS														
EPRE ratio of PDCCH to PDCCH_DMRS														
EPRE ratio of PDSCH_DMRS to SSS														
EPRE ratio of PDSCH to PDSCH_DMRS														
EPRE ratio of OCNG DMRS to SSS[Note 1]														
EPRE ratio of OCNG to OCNG DMRS [Note 1]														
Propagation conditions			AWGN						AWGN					
Scheduling request resource priodicity		ms	N/A						20					
N_{oc} [Note2]		dBm/15kHz	-98						-98					
N_{oc} [Note2]	Config 1,2	dBm/SCS	-98						-98					
	Config 3		-95						-95					
$\hat{E}_s / I_{ot}$		dB	4			4			-Infinity			5		
$\hat{E}_s / N_{oc}$		dB	4			4			-Infinity			5		
SSB_RP	Config 1,2	dBm/SCS	-94			-94			-Infinity			-90		
	Config 3	dBm/SCS	-91			-91			-Infinity			-63.85		
Io[Note3]	Config 1,2	dBm/ 9.36 MHz	-64.59			-64.59			-70.05			-57.75		
	Config 3	dBm/ 38.16 MHz	-58.49			-58.49			-63.94			-57.75		
Propagation condition		-	AWGN						AWGN					

A.7.5.17.2 Test Requirements

RRC message for activation of the PSCell is received in slot *n* at the UE and denotes the starting point of T2. During T2 the UE shall send the first preamble on PSCell in the first available PRACH occation no later than:

$T_{activation_time} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{IU} + 2$ ms

After T2 as defined on clause 8.17.2.

In this test case:

$T_{processing}$ = 5 ms

T_{search} = 0 ms PSCell and TCI state are known, and

T_{Δ} = 20 ms.

Tiu = 10 ms.

This allows T2 of $T_{activation_time} = T_{RRC_delay}$ + 37 ms

The UE shall stop all transmissions on the PSCell no later than in slot n + $\frac{T_{RRC_delay}}{NR\ slot\ length}$ after T4, as defined in 8.17.3.

The 2nd RRC activation command is received in slot *n* at the UE as the starting time of T5. During T5 the UE shall send the first SR on PSCell in the first available uplink SR resource no later than T5 which is :

$T_{activation_time} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{IU}$ + 2 ms

as defined on clause 8.17.2. In this test case:

$T_{processing}$ = 5 ms (no RRC parameter has been modified)

T_{search} = 0 ms (RACH-less activation PSCell and TCI state are known), and

T_{Δ} = 20 ms.

Tiu = 10 ms.

This allows T5 PSCell activation time of $T_{activation_time} = T_{RRC_delay}$ + 37 ms

During T2 and T5 the interruption of PCell during PSCell activation shall not happen outside the slot $m + T_{RRC_delay}$.

During T4 the interruption of PCell during PSCell deactivation shall not happen outside the slot $n + T_{RRC_delay}$.

The interruption duration on PCell due to activation and deactivation of PSCell shall not be more than the values specified for in Clause 8.17.2 and 8.17.3.

A.7.5.18 Subsequent conditional PSCell addition/change

A.7.5.18.1 Intra-frequency subsequent CPC from FR1-FR2 NR-DC to FR1-FR2 NR-DC

A.7.5.18.1.1 Test purpose and environment

The purpose of this test is to verify that the subsequent conditional NR PSCell change under NR-DC is within the requirements stated in clause 8.11E.2.

For UE supporting subsequent conditional PSCell addition/change, UE only needs to pass either intra-frequency CPC from FR1-FR1 NR-DC to FR1-FR1 NR-DC defined in clause A.6.5.12.1. or intra-frequency CPC from FR1-FR2 NR-DC to FR1-FR2 NR-DC defined in clause A.7.5.18.1.1.

For UE which can pass this test, test of conditional PSCell addition and release delay defined in A.7.5.12 can be skipped.

Supported test configurations are shown in A.7.5.18.1.1-1. The test scenario comprises three NR cells, Cell 1, Cell 2 and Cell 3. Cell 1 is on radio channel 1 in FR1. Cell 2 and Cell 3 are on radio channel 2 in FR2. The test parameters for the NR Cell 1 are given in table A.3.7A. The NR Cell 1 once set up is not changed across time. The test parameters for NR Cell 2 and Cell 3 are given in Tables A.7.5.18.1.1-2, cell-specific parameters in A.7.5.18.1.1-3 and OTA parameters in A.7.5.18.1.1-4 below.

The test consists of three successive time periods with duration of T1, T2, and T3 respectively. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (NR PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell 1) and Cell 3 (NR PSCell 2) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell 1 is known to the UE.

At the start of time duration T1, the UE does not have any timing information of Cell 2. The TE shall configure subsequent conditional PSCell addition/change with Cell 2 and Cell 3 as target PSCells during T1, at a time earlier than T_{RRC_delay} before the beginning of T2.

At the start of T2, Cell 2 becomes detectable and meets the PSCell addition condition. UE shall be able to measure and detect that the condition is fulfilled, after which it will transmit the PRACH preamble to Cell 2 during T2.

Upon PSCell addition complete (UE transmits SN RRCReconfigurationcomplete message), T3 starts. At the start of T3, Cell 3 becomes detectable and meets the PSCell change condition. UE shall be able to measure and detect that the condition is fulfilled, after which it will transmit the PRACH preamble to Cell 3 during T3.

Table A.7.5.18.1.1-1: Supported test configurations for Intra-frequency Subsequent CPC from FR1-FR2 NR-DC to FR1-FR2 NR-DC

Configuration	Description
1	PCell (Cell 1): NR FDD, 15 kHz SSB SCS, 10 MHz bandwidth PSCell (Cell 2 and Cell 3): NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz bandwidth
2	PCell (Cell 1): NR TDD, 15 kHz SSB SCS, 10 MHz bandwidth PSCell (Cell 2 and Cell 3): NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz bandwidth
3	PCell (Cell 1): NR TDD, 30 kHz SSB SCS, 40 MHz bandwidth PSCell (Cell 2 and Cell 3): NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz bandwidth
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.18.1.1-2: General Test Parameters for subsequent CPC from FR1-FR2 NR-DC to FR1-FR2 NR-DC

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Three radio channels are used for this test. One for NR Cell 1, second for NR Cell 2 and Cell 3
Initial Condition	Active PCell		Cell 1, Cell 2	Cell 1: NR PCell on RF channel number 1. Cell 2: NR PSCell on RF channel number 2
	Neighbour cell		Cell 3	Neighbour cell on RF channel number 2.
Final Condition	Active PCell		Cell 1, Cell 3	Cell 1: PCell on RF channel number 1. Cell 3:NR PSCell on RF channel number 2
	Neighbour Cell		Cell 2	PSCell changed on RF channel number 2.
A4	Hysteresis	dB	0	Used to trigger conditional PSCell addition of Cell 2
	Threshold RSRP	dBm	-118	
	Time to Trigger	s	0	
A3		dB	0	Used to trigger conditional PSCell change from Cell 2 to Cell 3
DRX			OFF	Continuous monitoring of primary cell
Gap pattern ID			gp0	Gaps are configured during T1, T2 and released upon T3 starts.
PRACH configuration on cell2 and cell3			FR2 configuration 2	Captured in A.3.8.3.2
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on carrier frequency of cell2.
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on carrier frequency of cell3.
T1		s	1	During this time the PCell is known and Cell 2 is unknown.
T2		s	≤5	During this time Cell 2 meets the PSCell addition condition and UE adds this PSCell.
T3		s	≤5	During this time Cell 3 meets the PSCell change condition and UE sends PRACH to Cell 3.

Table A.7.5.18.1.1-3: Cell Specific Parameters for subsequent CPC from FR1-FR2 NR-DC to FR1-FR2 NR-DC (Cell 2, Cell 3)

Patameter	Unit	Config	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
NR Channel Number		1,2,3	1 for Cell 1					
NR Channel Number		1,2,3	2 for Cell 2 and Cell 3					
Duplex Mode		1,2,3	TDD					
TDD configuration		1,2,3	TDDConf.3.1					
$BW_{channel}$	MHz	1,2,3	100: $N_{PRB,c}$ = 66					
Data PRBs allocated		1,2,3	48					
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1					
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1					
TRS Configuration		1,2,3	TRS.2.1 TDD					
PDSCH/PDCCH TCI state		1,2,3	TCI.State.2					
PDSCH Reference measurement channel		1,2,3	SR.3.3 TDD					
RMSI CORESET Reference Channel		1,2,3	CR.3.2 TDD					
Dedicated CORESET Reference Channel		1,2,3	CCR.3.7 TDD					
OCNG Patterns		1,2,3	OP.4					
SSB configuration		1,2,3	SSB.8 FR2			SSB.4 FR2		
SMTC configuration		1,2,3	SMTC.2					
PDSCH/PDCCH subcarrier spacing	kHz	1,2,3	120					
TRS Configuration		1,2,3	TRS.2.1 TDD					
CSI-RS configuration for CSI reporting		1,2,3	CSI-RS.3.1 TDD					
reportConfigType		1,2,3	periodic					
reportQuantity		1,2,3	cri-RI-PMI-CQI					
CSI reporting periodicity	slot	1,2,3	40					
CSI reporting offset	slot	1,2,3	4					
EPRE ratio of PSS to SSS	dB	1,2,3	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								

EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation condition		1,2,3	AWGN

Table A.7.5.18.1.1-4: OTA related test parameters for subsequent CPC from FR1-FR2 NR-DC to FR1-FR2 NR-DC (Cell 2, Cell 3)

Parameter	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 2a according to clause A.3.15.2.1			Setup 2a according to clause A.3.15.2.1		
Assumption for UE beams Note 6		Rough			Rough		
$\hat{E}s$ Note2	dBm/SCS	-∞	-81	-81	-∞	-∞	-78
SSB_RP Note2, Note 4	dBm/SCS	-∞	-81	-81	-∞	-∞	-78
$\hat{E}_s/I_{ot}$ BB Note 2, Note 7	dB	-∞	4.88	4.88	-∞	-∞	7.88
Io Note 2, Note 4	dBm/95.04 MHz	N/A	-56.41	-56.41	N/A	N/A	-53.41

NOTE 1: Void

NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 3: Void

NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

NOTE 5: Void

NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.5.18.1.2 Test Requirements

T_{RRC_delay} +T_{Event_DU} for PSCell addition (Cell 2) occurs during T1 as the PSCell addition condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure} + T_{UE_preparation} + T_{processing} + T_{\Delta} + T_{PSCell_DU}$ + 2 ms from the start of T2.

The UE shall transmit the PRACH to Cell 3 less than $T_{config_PSCell_Subsequent_Change_Conditional}$ Note1 from the start of T3.

All the above test requirements shall be fulfilled for the observed PSCell change delay to be counted as correct. The rate of correct observed PSCell change delay during repeated tests shall be at least 90 %.

NOTE 1: The subsequent Conditional PSCell change delay during T3 can be expressed as follows:

$$T_{config_PSCell_Subsequent_Change_Conditional} = T_{Event_DU} + T_{measure} + T_{UE_preparation} + T_{processing} + T_{\Delta} + T_{PSCell_DU} + 2 \text{ ms}$$

Where:

T_{Event_DU} = 0 ms

$T_{measure}$ = 6720 ms for power class 1 or 4160 for power class 2/3/4

$T_{UE_preparation}$ = 10 ms

$T_{processing}$ = 40 ms

T_{Δ} = 20 ms

T_{PSCell_DU} = 1*10+10 = 20 ms

A.7.5.18.2 Inter-frequency subsequent CPA from FR1-FR2 NR-DC to FR1-FR2 NR-DC

A.7.5.18.2.1 Test Purpose and Environment

The purpose of this test is to verify that the subsequent conditional NR PSCell addition under NR-DC is within the requirements stated in clause 8.9C.2.

For UE supporting subsequent conditional PSCell addition/change, UE only needs to pass either inter-frequency CPA from FR1-FR1 NR-DC to FR1-FR1 NR-DC defined in clause A.6.5.12.2 or inter-frequency CPA from FR1-FR2 NR-DC to FR1-FR2 NR-DC defined in clause A.7.5.18.2.

For UE which can pass this test, test of conditional PSCell addition and release delay defined in A.7.5.12 can be skipped.

Supported test configurations are shown in A.7.5.18.2.1-1. The test parameters for the NR cell 1 are given in table A.3.7A. The NR cell 1 once set up is not changed across time.

The test parameters for NR cell 2, NR cell 3 are given in Tables A.7.5.18.2.1-2, cell-specific parameters in A.7.5.18.2.1-3 and OTA parameters in A.7.5.18.2.1-4 below. The test comprises of three NR carrier. There are three cells and one cell on each carrier. Before the test starts the UE is connected to Cell 1 (NR PCell) on radio channel 1, but is not aware of Cell 2 (NR candidate NR PSCell 1) on radio channel 2 and Cell 3 (NR candidate PSCell 2) on radio channel 3. The test consists of four successive time periods with duration of T1, T2, T3, T4.

During T1, the UE does not have any timing information of Cell 2 and Cell 3. The TE shall configure subsequent conditional PSCell addition/change with Cell 2 and Cell 3 as target PSCells during T1, at a time earlier than T_{RRC_delay} before the beginning of T2.

At the start of T2, Cell 2 becomes detectable and meets the PSCell addition condition. UE shall be able to measure and detect that the condition is fulfilled, after which the UE shall transmit the PRACH preamble to Cell 2. Upon PSCell addition complete (UE transmits SN RRCReconfigurationcomplete message), T3 starts.

During T3, the TE shall send a RRCRconfiguration message to the UE to release PSCell (Cell 2) on radio channel 2. Upon PSCell release complete (UE transmits SN RRCReconfigurationcomplete message), T4 starts.

At the start of T4, Cell 3 becomes detectable and meets the addition condition. UE shall be able to measure and detect that the condition is fulfilled, after which UE shall send PRACH to the PSCell (Cell 3).

Table A.7.5.18.2.1-1: Supported test configurations for Inter-frequency Subsequent CPA from FR1-FR2 NR-DC to FR1-FR2 NR-DC

Configuration	Description
1	Cell 1: FDD15 kHz SSB SCS, 10 MHz bandwidth, Cell 2: TDD 120kHz SSB SCS, 100 MHz bandwidth Cell 3: TDD 120kHz SSB SCS, 100 MHz bandwidth
2	Cell 1: TDD 15 kHz SSB SCS, 10 MHz bandwidth, Cell 2: TDD 120kHz SSB SCS, 100 MHz bandwidth Cell 3: TDD 120kHz SSB SCS, 100 MHz bandwidth

3	Cell 1: TDD 30 kHz SSB SCS, 40 MHz bandwidth, Cell 2: TDD 120kHz SSB SCS, 100 MHz bandwidth Cell 3: TDD 120kHz SSB SCS, 100 MHz bandwidth
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.18.2.1-2: General Test Parameters for subsequent CPA

Parameter		Unit	Value	Comment
RF Channel Number			1, 2, 3	Three NR radio channels are used for this test.
Initial Condition	Active serving cells		Cell 1	Cell 1: NR PCell on RF channel number 1
	Neighbour cell		Cell 2, Cell 3	Cell 2:NR PSCell on RF channel number 2 Neighbour cell on RF channel number 3
Final Condition	Active serving cells		Cell 1, Cell 3	Cell 1: PCell on RF channel number 1 Cell 3:NR PSCell on RF channel number 3
	Neighbour Cell		Cell 2	Neighbour cell on RF channel number 2.
A4	Hysteresis	dB	0	Hysteresis for evaluation of event A4.
	Threshold RSRP	dBm	-118	A4 event is used to trigger conditional PSCell addition of Cell 2 and Cell 3
	Time to Trigger	s	0	
DRX			OFF	Continuous monitoring of primary cell
Gap pattern ID			gp0	
PRACH configuration on cell2 and cell3			FR2 configuration 2	Captured in A.3.8.3.2
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on carrier frequency of cell2.
Cell-individual offset for cells on RF channel number 3		dB	0	Individual offset for cells on carrier frequency of cell3.
T1		s	1	UE is connected to Cell 1 (NR PCell) on radio channel 1, but is not aware of Cell 2 (NR PSCell 1) on radio channel 2 and Cell 3 (NR PSCell 2) on radio channel 3
T2		s	<7	During this time PSCell 1 meets the PSCell addition condition and the UE adds the PSCell (cell 2).
T3		s	1	During this time the UE releases the PSCell (cell 2).
T4		s	<7	During this time PSCell 2 meets the PSCell addition condition and the UE adds the PSCell (cell 3).

Table A.7.5.18.2.1-3: Cell Specific Parameters for subsequent CPA (cell 2, cell 3)

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
NR Channel Number		1,2,3	2 for cell 2, 3 for cell 3			
Duplex Mode		1,2,3	TDD			
TDD configuration		1,2,3	TDDConf.3.1			
$BW_{channel}$	MHz	1,2,3	100: $N_{PRB,c}$ = 66			
Data PRBs allocated		1,2,3	48			
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1			
TRS Configuration		1,2,3	TRS.2.1 TDD			
PDSCH/PDCCH TCI state		1,2,3	TCI.State.2			
PDSCH Reference measurement channel		1,2,3	SR.3.3 TDD			
RMSI CORESET Reference Channel		1,2,3	CR.3.2 TDD			
Dedicated CORESET Reference Channel		1,2,3	CCR.3.7 TDD			
OCNG Patterns		1,2,3	OP.3			
SSB configuration		1,2,3	SSB.1 FR2			
SMTC configuration		1,2,3	SMTC.2			
PDSCH/PDCCH subcarrier spacing	kHz	1,2,3	120			

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
TRS Configuration		1,2,3	TRS.2.1 TDD			
CSI-RS configuration for CSI reporting		1,2,3	CSI-RS.3.1 TDD			
reportConfigType		1,2,3	periodic			
reportQuantity		1,2,3	cri-RI-PMI-CQI			
CSI reporting periodicity	slot	1,2,3	40			
CSI reporting offset	slot	1,2,3	4			
EPRE ratio of PSS to SSS	dB	1,2,3	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
Propagation condition		1,2,3	AWGN			

Table A.7.5.18.2.1-4: OTA related test parameters

Parameter	Unit	Cell 2				Cell 3			
		T1	T2	T3	T4	T1	T2	T3	T4
Angle of arrival configuration		Setup 2a according to clause A.3.15.2.1				Setup 2a according to clause A.3.15.2.1			
Assumption for UE beams[Note 6]		Rough				Rough			
$\hat{E}s$ [Note2]	dBm/SCS	-∞	-81	-∞		-∞			-81
SSB_RP[Note2, Note 4]	dBm/SCS	-∞	-81	-∞		-∞			-81
$\hat{E}_s/I_{ot}$ BB [Note 2, Note 7]	dB	-∞	4.88	-∞		-∞			4.88
Io[Note 2, Note 4]	dBm/95.04 MHz	N/A	-56.41	N/A		N/A			-56.41

NOTE 1: Void
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.5.18.2.2 Test Requirements

$T_{RRC_delay} + T_{Event_DU}$ for PSCell addition (Cell 2) occurs during T1 as the PSCell addition condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall transmit the PRACH to PSCell (Cell 2) less than $T_{measure} + T_{UE_preparation} + T_{processing} + T_{\Delta} + T_{PSCell_DU} + 2$ msfrom the start of T2.

The UE shall transmit the PRACH to PSCell (Cell 3) less than $T_{config_PSCell_Addition_Conditional}$ [Note1] from the start of T4.

All the above test requirements shall be fulfilled for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90 %.

NOTE 1: The PSCell addition delay during T2 can be expressed as follows:

$$T_{config_PSCell_Addition_Conditional} = T_{Event_DU} + T_{measure} + T_{UE_preparation} + T_{processing} + T_{\Delta} + T_{PSCell_DU} + 2 \text{ ms}$$

Where:

T_{Event_DU} = 0

$T_{measure}$ = 6720 ms for power class 1 or 4160 for power class 2/3/4

$T_{UE_preparation}$ = 10 ms

$T_{processing}$ = 40 ms

T_{Δ} = 20 ms

T_{PSCell_DU} = 1*10+10 = 20 ms

A.7.6 Measurement procedure

A.7.6.1 Intra-frequency Measurements

A.7.6.1.1 SA event triggered reporting test without gap under non-DRX

A.7.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.1.1-1.

Table A.7.6.1.1.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.1.1-2, A.7.6.1.1.1-3 and A.7.6.1.1.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.1.1.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1, 2	PCell (Cell 1)	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration		1, 2	SMTC.1	
A3-Offset	dB	1, 2	-11	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	Synchronous cells
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.7.6.1.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
		2	48		48	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2	CCR.3.7 TDD		N/A	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.5		N/A	
cellIndividualOffset	dB	1~2	N/A		16	
SSB		1	SSB.1 FR2		SSB.7 FR2	
		2	SSB.2 FR2		SSB.8 FR2	
Propagation Condition		1, 2	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

Table A.7.6.1.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam assumption[Note 4]		1,2	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1	-64.41	-64.41	-Infinity	-64.41
		2	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1, 2	Defined in figure A.7.6.1.1.1-1			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Void NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.							

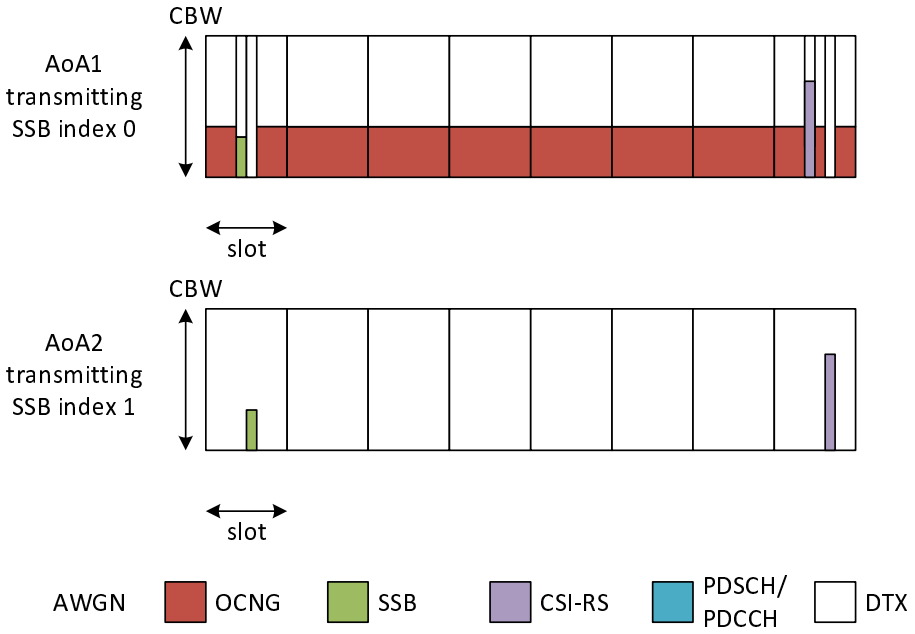


Figure A.7.6.1.1.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.7.6.1.1.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 2.4 s for a UE supporting power class 1,
- 1.44 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.2 SA event triggered reporting test without gap under DRX

A.7.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.2.1-1.

Table A.7.6.1.2.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.2.1-2 ~ 6.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.1.2.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1, 2	PCell (Cell 1)		
Neighbour cell		1, 2	Cell 2		Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2		One TDD carrier frequency is used for the NR cells.
SMTC configuration		1, 2	SMTC.1		
A3-Offset	dB	1, 2	-6		
CP length		1, 2	Normal		
Hysteresis	dB	1, 2	0		
Time To Trigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	DRX.1	DRX.7	DRX related parameters are defined in table A.7.6.1.2.1-5
Time offset between Cell 1 and Cell 2		1, 2	3 μs		Synchronous cells
T1	s	1, 2	5		
T2	s	1, 2	10	52	

Table A.7.6.1.2.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1, 2	66		66	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2	CCR.3.7 TDD		N/A	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.1		OP.1	
SSB		1	SSB.3 FR2		SSB.3 FR2	
		2	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1, 2	AWGN		AWGN	

Table A.7.6.1.2.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 1 defined in A.3.15.1			

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Beam assumption Note 4		1,2	Rough		Rough	
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	3.77	-1.52	-Infinity	-1.52
N_{oc} Note 2	dBm/15 KHz	1, 2	-98			
N_{oc} Note 2	dBm/SCS	1	-89			
		2	-86			
SSB_RP	dBm/SCS	1	-85	-85	-Infinity	-85
		2	-82	-82	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
Io	dBm/95.04 MHz	1, 2	-54.53	-52.18	See Cell 1 columns	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

Table A.7.6.1.2.1-5: Void

Table A.7.6.1.2.1-6: Void

A.7.6.1.2.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2 s for a UE supporting power class 1,
- 4.32 s for a UE supporting power class 2, 3 and 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2 s for a UE supporting power class 1,
- 30.72 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.3 SA event triggered reporting test with per-UE gaps under non-DRX

A.7.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.3.1-1.

Table A.7.6.1.3.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.3.1-2 ~ 4 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.1.3.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1, 2	PCell (Cell 1)	
Neighbour cell		1, 2	Cell 2	Cell to be identified
RF Channel Number		1, 2	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells
Gap type		1, 2	Per-UE gaps	
Measurement gap repitition periodicity	ms	1, 2	40	
Measurement gap length	ms	1, 2	6	
Measurement gap offset	ms	1, 2	39	
SMTC configuration		1, 2	SMTC.1	
CSI-RS parameters		1, 2	CSI-RS.3.2 TDD resource #0	Resource #1 is not used
A3-Offset	dB	1, 2	-11	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	Synchronous cells
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.7.6.1.3.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
		2	48		48	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	CSI-RS		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2	CR.3.2 TDD		N/A	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2	CCR.3.7 TDD		N/A	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.5		N/A	
cellIndividualOffset	dB	1~2	N/A		16	
SSB		1	SSB.3 FR2		SSB.7 FR2	
		2	SSB.4 FR2		SSB.8 FR2	
Propagation Condition		1, 2	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

Table A.7.6.1.3.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam Assumption[Note 4]		1,2	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1	-64.41	-64.41	-Infinity	-64.41
		2	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1	Defined in figure A.7.6.1.3.1-1			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Void NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.							

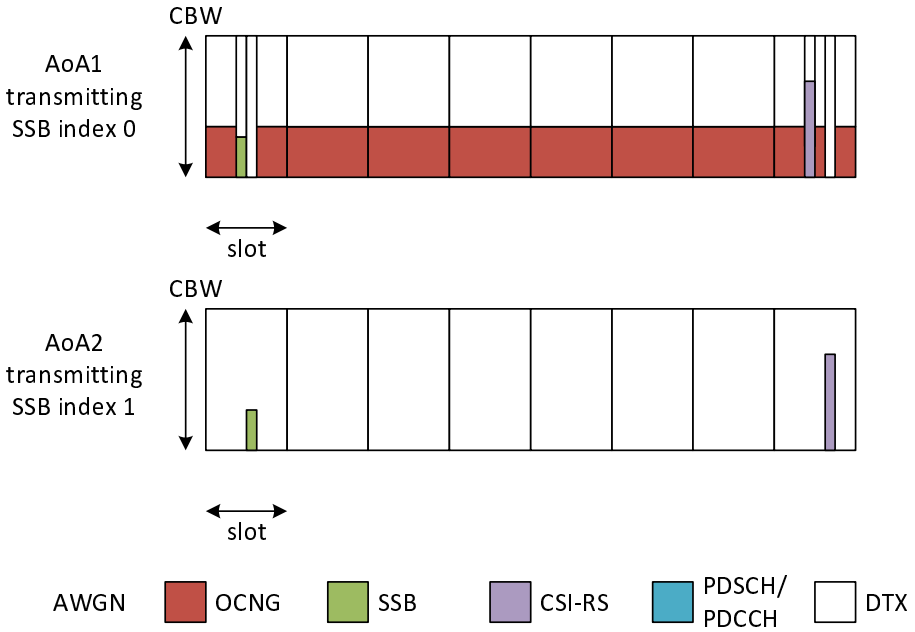


Figure A.7.6.1.3.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.7.6.1.3.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 3.2 s for a UE supporting power class 1,
- 1.92 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.4 SA event triggered reporting test with per-UE gaps under DRX

A.7.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.4.1-1.

Table A.7.6.1.4.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.4.1-2, A.7.6.1.4.1-3 and A.7.6.1.4.1-4 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.1.4.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1, 2	PCell (Cell 1)		
Neighbour cell		1, 2	Cell 2		Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2		One TDD carrier frequency is used for the NR cells.
Gap type		1, 2	Per-UE gaps		
Measurement gap repitition periodicity	ms	1, 2	40		
Measurement gap length	ms	1, 2	6		
Measurement gap offset	ms	1, 2	39		
SMTC configuration		1, 2	SMTC.1		
CSI-RS parameters		1, 2	CSI-RS.3.2 TDD resource #0		Resource #1 is not used
A3-Offset	dB	1, 2	-6		
CP length		1, 2	Normal		
Hysteresis	dB	1, 2	0		
Time To Trigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	DRX.1	DRX.7	DRX related parameters are defined in table A.7.6.1.2.1-5
Time offset between Cell 1 and Cell 2		1, 2	3 μs		Synchronous cells
T1	s	1, 2	5		
T2	s	1, 2	10	52	

Table A.7.6.1.4.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1, 2	66		66	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	SCSI-RS		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2	CCR.3.7 TDD		N/A	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.1		OP.1	
SSB		1	SSB.3 FR2		SSB.3 FR2	
		2	SSB.4 FR2		SSB.4 FR2	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1, 2	AWGN		AWGN	

Table A.7.6.1.4.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 1 defined in A.3.15.1			
Beam Assumption Note 4		1,2	Rough			
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	3.77	-1.52	-Infinity	-1.52
N_{oc} Note 2	dBm/15 KHz	1, 2	-98			
N_{oc} Note 2	dBm/SCS	1	-89			
		2	-86			
SSB_RP	dBm/SCS	1	-85	-85	-Infinity	-85
		2	-82	-82	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
Io	dBm/95.04 MHz	1,2	-54.53	-52.18	See Cell 1 columns	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

Table A.7.6.1.4.1-5: Void

Table A.7.6.1.4.1-6:Void

A.7.6.1.4.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2 s for a UE supporting power class 1,
- 4.32 s for a UE supporting power class 2, 3 and 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2 s for a UE supporting power class 1,
- 30.72 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.5 SA event triggered reporting test without gap under non-DRX for UE configured with *highSpeedMeasFlagFR2-r17*

A.7.6.1.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17* in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.5.1-1.

Table A.7.6.1.5.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.5.1-2, A.7.6.1.5.1-3 and A.7.6.1.5.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.1.5.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Value	Comment
highSpeedMeasFlagFR2-r17		1,2	Set2	*highSpeedMeasFlagFR2-r17* = set2 is configured
Active cell		1, 2	PCell (Cell 1)	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration		1, 2	SMTC.1	
A3-Offset	dB	1, 2	-11	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	Synchronous cells
T1	s	1, 2	1	
T2	s	1, 2	2	

Table A.7.6.1.5.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
		2	48		48	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
		2	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2	CCR.3.7 TDD		N/A	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.5		N/A	
cellIndividualOffset	dB	1~2	N/A		16	
SSB		1	SSB.1 FR2		SSB.7 FR2	
		2	SSB.2 FR2		SSB.8 FR2	
Propagation Condition		1, 2	No external noise (Note 2)		No external noise (Note 2) 19444 Hz Note 1	

NOTE 1: The AWGN 19444 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 19444 Hz.
NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

Table A.7.6.1.5.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam assumption Note 4		1,2	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1	-64.41	-64.41	-Infinity	-64.41
		2	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1, 2	Defined in figure A.7.6.1.1.1-1			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Void
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

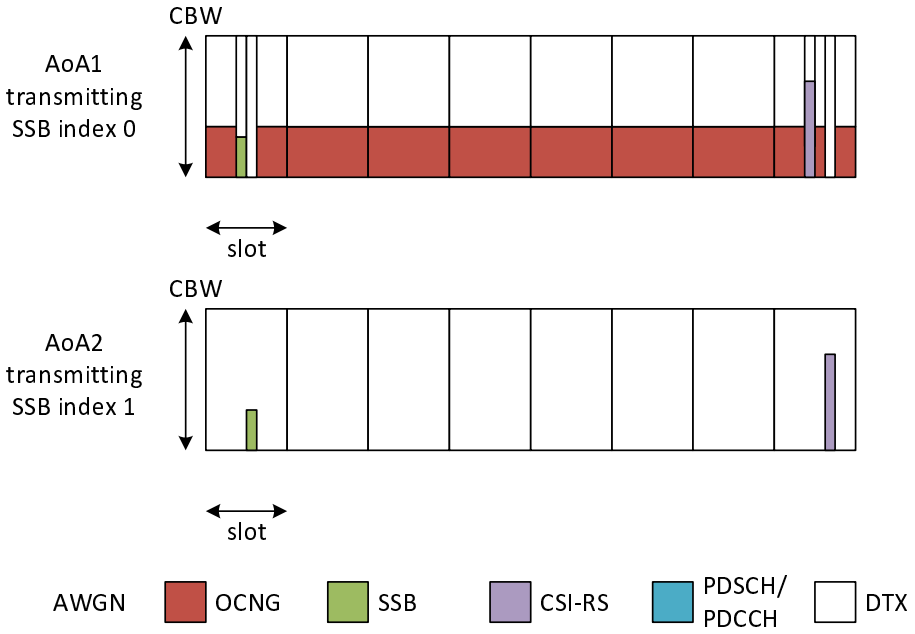


Figure A.7.6.1.5.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.7.6.1.5.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1140 ms from the beginning of time period T2.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.6 SA event triggered reporting test without gap under non-DRX for FR2-2

A.7.6.1.6.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.6.1-1.

Table A.7.6.1.6.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2-2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.6.1-2, A.7.6.1.6.1-3 and A.7.6.1.6.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.1.6.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1,2,3	PCell (Cell 1)	
Neighbour cell		1,2,3	Cell 2	Cell to be identified.
RF Channel Number		1,2,3	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration		1,2,3	SMTC.1	
A3-Offset	dB	1,2,3	-11	
CP length		1,2,3	Normal	
Hysteresis	dB	1,2,3	0	
Time To Trigger	s	1,2,3	0	
Filter coefficient		1,2,3	0	L3 filtering is not used
DRX		1,2,3	OFF	
Time offset between Cell 1 and Cell 2		1,2,3	3 μs	Synchronous cells
T1	s	1,2,3	5	
T2	s	1,2,3	5	

Table A.7.6.1.6.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1,2,3	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
		2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
		3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
Data PRBs allocated		1	66		66	
		2	66		66	
		3	33		33	
Initial BWP configuration		1,2,3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1,2,3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1,2,3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1,2,3	SSB		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2,3	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2,3	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2,3	CCR.3.7 TDD		N/A	
TRS configuration		1,2,3	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1,2,3	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1,2,3	120		120	
OCNG Patterns		1,2,3	OP.5		N/A	
cellIndividualOffset	dB	1,2,3	N/A		16	
SSB		1	SSB.1 FR2		SSB.7 FR2	
		2	SSB.9 FR2		SSB.15 FR2	
		3	SSB.10 FR2		SSB.16 FR2	
Propagation Condition		1, 2,3	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

Table A.7.6.1.6.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1,2,3	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam assumption Note 4		1,2,3	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-83	-83	-Infinity	-83
		3	-80	-80	-Infinity	-80
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2,3	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-83	-83	-Infinity	-83
		3	-80	-80	-Infinity	-80
Io	dBm/95.04 MHz	1,2,3	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1, 2,3	Defined in figure A.7.6.1.1.1-1			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Void
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

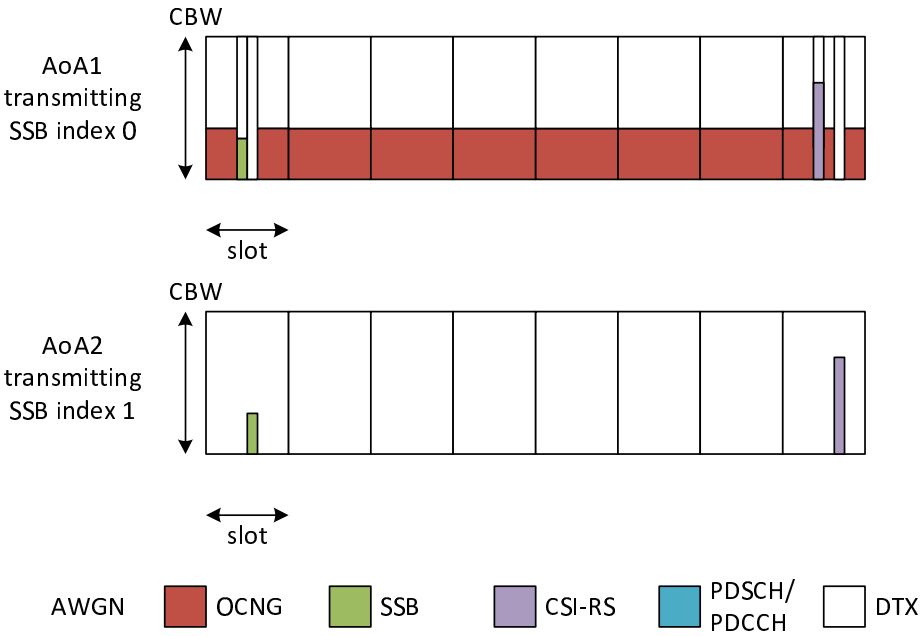


Figure A.7.6.1.6.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.7.6.1.6.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,

- 2.4 s (60*20 ms+60*20 ms)for a UE supporting power class 1,

- 1.44 s (36*20 ms+36*20 ms) for a UE supporting power class 2 and 3

For Configuration 2,

- 3.6 s (120*20 ms+60*20 ms) for a UE supporting power class 1,
- 2.16 s (72*20 ms+36*20 ms) for a UE supporting power class 2 and 3

For Configuration 3,

- 4.8 s (180*20 ms+60*20 ms) for a UE supporting power class 1,
- 2.88 s (108*20 ms+36*20 ms) for a UE supporting power class 2 and 3

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.7 SA event triggered reporting test without gap under DRX for FR2-2

A.7.6.1.7.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.7.1-1.

Table A.7.6.1.7.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2-2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.7.1-2 ~ 6.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.1.7.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1, 2,3	PCell (Cell 1)		
Neighbour cell		1, 2,3	Cell 2		Cell to be identified.
RF Channel Number		1, 2,3	1: Cell 1 and Cell 2		One TDD carrier frequency is used for the NR cells.
SMTC configuration		1, 2,3	SMTC.1		
A3-Offset	dB	1, 2,3	-6		

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
CP length		1, 2,3	Normal		
Hysteresis	dB	1, 2,3	0		
Time To Trigger	s	1, 2,3	0		
Filter coefficient		1, 2,3	0		L3 filtering is not used
DRX		1, 2,3	DRX.1	DRX.7	DRX related parameters are defined in table A.7.6.1.2.1-5
Time offset between Cell 1 and Cell 2		1, 2,3	3 μs		Synchronous cells
T1	s	1, 2,3	5		
T2	s	1, 2,3	10	52	

Table A.7.6.1.7.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2,3	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
		2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
		3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
Data PRBs allocated		1	66		66	
		2	66		66	
		3	33		33	
Initial BWP configuration		1, 2,3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2,3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2,3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2,3	SSB		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2,3	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2,3	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2,3	CCR.3.7 TDD		N/A	
TRS configuration		1, 2,3	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2,3	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2,3	120		120	
OCNG Patterns		1, 2,3	OP.1		OP.1	
SSB		1	SSB.1 FR2		SSB.7 FR2	
		2	SSB.9 FR2		SSB.15 FR2	
		3	SSB.10 FR2		SSB.16 FR2	
Propagation Condition		1, 2,3	AWGN		AWGN	

Table A.7.6.1.7.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2,3	Setup 1 defined in A.3.15.1			
Beam assumption[Note 4]		1,2,3	Rough		Rough	
$\hat{E}_s/I_{ot}$ [BB Note 5]	dB	1, 2,3	3.77	-1.52	-Infinity	-1.52
N_{oc} [Note 2]	dBm/15 KHz	1, 2,3	-98			
N_{oc} [Note 2]	dBm/SCS	1	-89			
		2	-83			
		3	-80			

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
SSB_RP	dBm/SCS	1	-85	-85	-Infinity	-85
		2	-79	-79	-Infinity	-79
		3	-76	-76	-Infinity	-76
$\hat{E}_s / N_{oc}$	dB	1, 2,3	4	4	-Infinity	4
Io	dBm/95.04 MHz	1, 2,3	-54.53	-52.18	See Cell 1 columns	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.1.7.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,

- 7.2 s (60*40 ms*1.5 +60*40 ms*1.5) for a UE supporting power class 1,
- 4.32 s (36*40 ms*1.5 + 36*40 ms*1.5) for a UE supporting power class 2 and 3

For Configuration 2,

- 10.8 s (120*40 ms*1.5 +60*40 ms*1.5) for a UE supporting power class 1,
- 6.48 s (72*40 ms*1.5 + 36*40 ms*1.5) for a UE supporting power class 2 and 3

For Configuration 3,

- 14.4 s (180*40 ms*1.5 + 60*40 ms*1.5) for a UE supporting power class 1,
- 8.64 s (108*40 ms*1.5 + 36*40 ms*1.5) for a UE supporting power class 2 and 3

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,

- 76.8 s (60*640 ms +60*640 ms) for a UE supporting power class 1,
- 46.08 s (36*640 ms + 36*640 ms) for a UE supporting power class 2 and 3

For Configuration 2,

- 115.2 s (120*640 ms +60*640 ms) for a UE supporting power class 1,
- 69.12 s (72*640 ms + 36*640 ms) for a UE supporting power class 2 and 3

For Configuration 3,

- 153.6 s (180*640 ms + 60*640 ms) for a UE supporting power class 1,
- 92.16 s (108*640 ms + 36*640 ms) for a UE supporting power class 2 and 3

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.8 SA event triggered reporting test with per-UE gaps under non-DRX for FR2-2

A.7.6.1.8.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.8.1-1.

Table A.7.6.1.8.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2-2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.8.1-2 ~ 4 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.1.8.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 with per-UE gaps without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1,2,3	PCell (Cell 1)	
Neighbour cell		1,2,3	Cell 2	Cell to be identified.
RF Channel Number		1,2,3	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Gap type		1,2,3	Per-UE gaps	
Measurement gap repitition periodicity	ms	1,2,3	40	
Measurement gap length	ms	1,2,3	6	
Measurement gap offset	ms	1,2,3	39	
SMTC configuration		1,2,3	SMTC.1	
CSI-RS parameters		1,2,3	CSI-RS.3.2 TDD	
A3-Offset	dB	1,2,3	-11	
CP length		1,2,3	Normal	
Hysteresis	dB	1,2,3	0	
Time To Trigger	s	1,2,3	0	
Filter coefficient		1,2,3	0	L3 filtering is not used
DRX		1,2,3	OFF	
Time offset between Cell 1 and Cell 2		1,2,3	3 μs	Synchronous cells
T1	s	1, 2,3	5	
T2	s	1, 2,3	5	

Table A.7.6.1.8.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2,3	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
		2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
		3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
Data PRBs allocated		1	66		66	
		2	66		66	
		3	33		33	
Initial BWP configuration		1,2,3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1,2,3	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1,2,3	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1,2,3	CSI-RS		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2,3	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2,3	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2,3	CCR.3.7 TDD		N/A	
TRS configuration		1,2,3	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1,2,3	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1,2,3	120		120	
OCNG Patterns		1,2,3	OP.5		N/A	
cellIndividualOffset	dB	1,2,3	N/A		16	
SSB		1	SSB.1 FR2		SSB.7 FR2	
		2	SSB.9 FR2		SSB.15 FR2	
		3	SSB.10 FR2		SSB.16 FR2	
Propagation Condition		1, 2,3	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

Table A.7.6.1.8.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2,3	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam Assumption[Note 4]		1,2,3	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-83	-83	-Infinity	-83
		3	-80	-80	-Infinity	-80
$\hat{E}_s / I_{ot}$ BB Note 5	dB	1,2,3	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-83	-83	-Infinity	-83
		3	-80	-80	-Infinity	-80
Io	dBm/95.04 MHz	1,2,3	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1,2,3	Defined in figure A.7.6.1.3.1-1			

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Void						
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

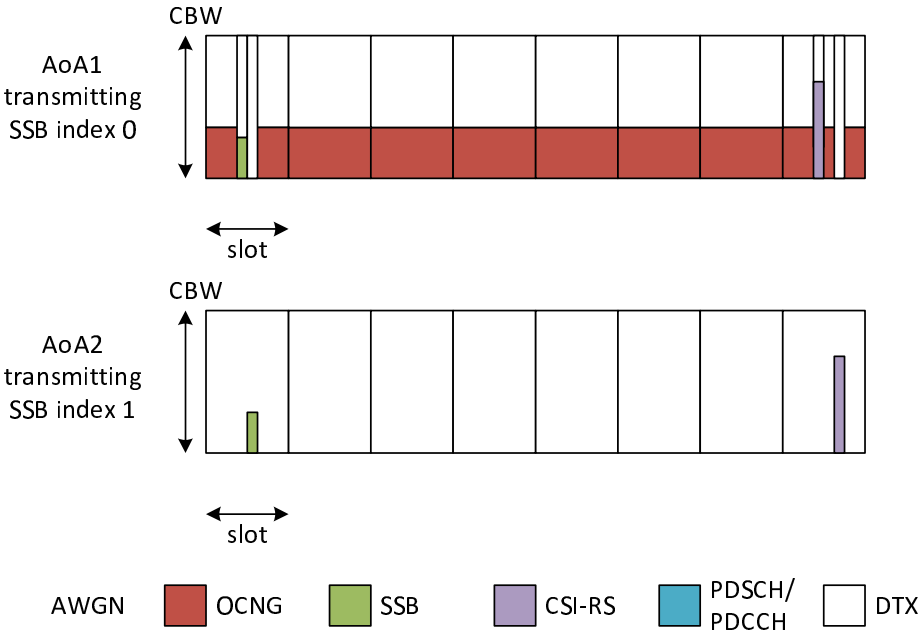


Figure A.7.6.1.8.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.7.6.1.8.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,

- 4.8 s (60*40 ms+60*40 ms) for a UE supporting power class 1,
- 2.88 s (36*40 ms+36*40 ms) for a UE supporting power class 2 and 3

For Configuration 2,

- 7.2 s (120*40 ms+60*40 ms) for a UE supporting power class 1,
- 4.32 s (72*40 ms+36*40 ms) for a UE supporting power class 2 and 3

For Configuration 3,

- 9.6 s (180*40 ms+60*40 ms) for a UE supporting power class 1,
- 5.76 s (108*40 ms+36*40 ms) for a UE supporting power class 2 and 3

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.9 SA event triggered reporting test with per-UE gaps under DRX for FR2-2

A.7.6.1.9.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.9.1-1.

Table A.7.6.1.9.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2-2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.9.1-2, A.7.6.1.9.1-3 and A.7.6.1.9.1-4 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.1.9.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 with per-UE gaps with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1,2,3	PCell (Cell 1)		
Neighbour cell		1,2,3	Cell 2		Cell to be identified.
RF Channel Number		1,2,3	1: Cell 1 and Cell 2		One TDD carrier frequency is used for the NR cells.
Gap type		1,2,3	Per-UE gaps		
Measurement gap repitition periodicity	ms	1,2,3	40		
Measurement gap length	ms	1,2,3	6		
Measurement gap offset	ms	1,2,3	39		
SMTC configuration		1,2,3	SMTC.1		
CSI-RS parameters		1,2,3	CSI-RS.3.2 TDD		
A3-Offset	dB	1,2,3	-6		
CP length		1,2,3	Normal		
Hysteresis	dB	1,2,3	0		
Time To Trigger	s	1,2,3	0		
Filter coefficient		1,2,3	0		L3 filtering is not used
DRX		1,2,3	DRX.1	DRX.7	DRX related parameters are defined in table A.7.6X.1.2.17.6.1.7.1-5
Time offset between Cell 1 and Cell 2		1,2,3	3 μs		Synchronous cells

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
T1	s	1,2,3	5		
T2	s	1,2,3	10	52	

Table A.7.6.1.9.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1,2,3	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
		2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
		3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
Data PRBs allocated		1	66		66	
		2	66		66	
		3	33		33	
Initial BWP configuration		1,2,3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1,2,3	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1,2,3	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1,2,3	CSI-RS		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2,3	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2,3	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2,3	CCR.3.7 TDD		N/A	
TRS configuration		1, 2,3	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		1, 2,3	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2,3	120		120	
OCNG Patterns		1, 2,3	OP.1		OP.1	
SSB		1	SSB.11 FR2		SSB.11 FR2	
		2,3	SSB.12 FR2		SSB.12 FR2	
Propagation Condition		1, 2,3	AWGN		AWGN	

Table A.7.6.1.9.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2,3	Setup 1 defined in A.3.15.1			
Beam Assumption[Note 4]		1,2,3	Rough			
$\hat{E}_s / I_{ot}$ [BB Note 5]	dB	1, 2,3	3.77	-1.52	-Infinity	-1.52
N_{oc} [Note 2]	dBm/15 KHz	1, 2,3	-98			
N_{oc} [Note 2]	dBm/SCS	1	-89			
		2	-83			
		3	-80			
SSB_RP	dBm/SCS	1	-85	-85	-Infinity	-85
		2	-79	-79	-Infinity	-79
		3	-76	-76	-Infinity	-76
$\hat{E}_s / N_{oc}$	dB	1, 2,3	4	4	-Infinity	4
Io	dBm/95.04 MHz	1,2,3	-54.53	-52.18	See Cell 1 columns	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.6.1.9.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,

- 7.2 s (60*40 ms*1.5 +60*40 ms*1.5) for a UE supporting power class 1,
- 4.32 s (36*40 ms*1.5 + 36*40 ms*1.5) for a UE supporting power class 2 and 3

For Configuration 2,

- 10.8 s (120*40 ms*1.5 +60*40 ms*1.5) for a UE supporting power class 1,
- 6.48 s (72*40 ms*1.5 + 36*40 ms*1.5) for a UE supporting power class 2 and 3

For Configuration 3,

- 14.4 s (180*40 ms*1.5 + 60*40 ms*1.5) for a UE supporting power class 1,
- 8.64 s (108*40 ms*1.5 + 36*40 ms*1.5) for a UE supporting power class 2 and 3

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,

- 76.8 s (60*640 ms +60*640 ms) for a UE supporting power class 1,
- 46.08 s (36*640 ms + 36*640 ms) for a UE supporting power class 2 and 3

For Configuration 2,

- 115.2 s (120*640 ms +60*640 ms) for a UE supporting power class 1,
- 69.12 s (72*640 ms + 36*640 ms) for a UE supporting power class 2 and 3

For Configuration 3,

- 153.6 s (180*640 ms + 60*640 ms) for a UE supporting power class 1,
- 92.16 s (108*640 ms + 36*640 ms) for a UE supporting power class 2 and 3

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.10 SA event triggered reporting test with SSB time index detection without gap under non-DRX for FR2-2

A.7.6.1.10.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.10.1-1.

Table A.7.6.1.10.1-1: supported test configurations

Configuration	Description
1	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode

There are two cells in the test, PCell (Cell 1) and a FR2-2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.10.1-2, A.7.6.1.10.1-3 and A.7.6.1.10.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.1.10.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1	PCell (Cell 1)	
Neighbour cell		1	Cell 2	Cell to be identified.
RF Channel Number		1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration		1	SMTC.1	
A3-Offset	dB	1	-11	
CP length		1	Normal	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX		1	OFF	
Time offset between Cell 1 and Cell 2		1	3 μs	Synchronous cells
T1	s	1	5	
T2	s	1	5	

Table A.7.6.1.10.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1	SSB		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
TRS configuration		1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1	120		120	
OCNG Patterns		1	OP.5		N/A	
cellIndividualOffset	dB	1	N/A		16	
SSB		1	SSB.10 FR2		SSB.16 FR2	
Propagation Condition		1	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

Table A.7.6.1.10.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam assumption[Note 4]		1	Rough		Rough	
E_s	dBm/SCS	1	-80	-80	-Infinity	-80
$\hat{E}_s / I_{ot}$ BB Note 5	dB	1	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-80	-80	-Infinity	-80
Io	dBm/95.04 MHz	1	-64.41	-64.41	-Infinity	-64.41
Time multiplexing of the downlink transmissions from each AoA		1	Defined in figure A.7.6X.1.1.1-1			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Void NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

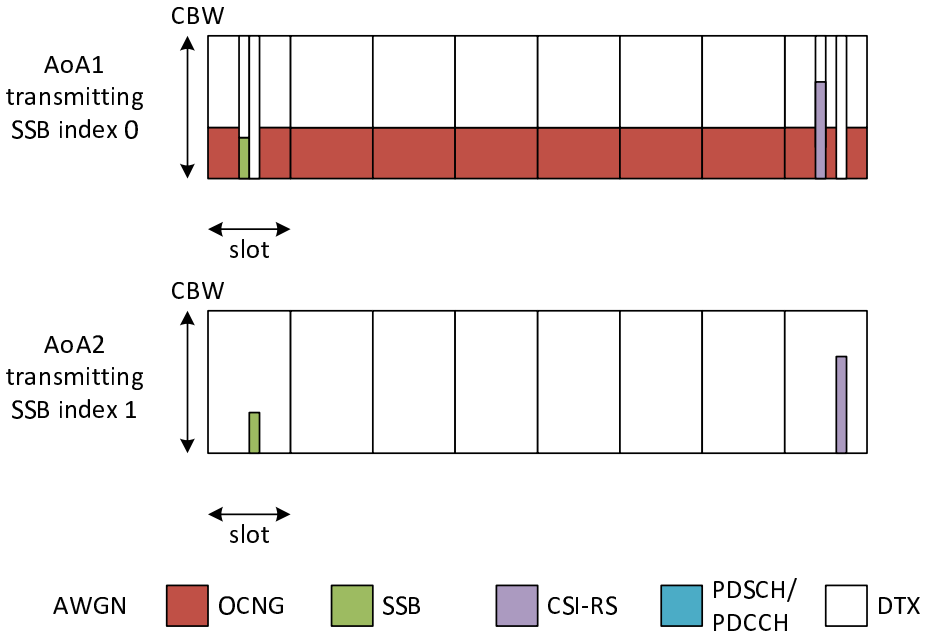


Figure A.7.6.1.10.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.7.6.1.10.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 6.24 s (180*20 ms + 60*20 ms +72*20 ms) for a UE supporting power class 1,
- 3.84 s (108*20 ms + 36*20 ms +48*20 ms) for a UE supporting power class 2 and 3

The UE is required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.11 SA event triggered reporting test with SSB time index detection with per-UE gaps under non-DRX for FR2-2

A.7.6.1.11.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.11.1-1.

Table A.7.6.1.11.1-1: supported test configurations

Configuration	Description
1	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode

There are two cells in the test, PCell (Cell 1) and a FR2-2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.11.1-2 ~ 4 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.1.11.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 with per-UE gaps without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1	PCell (Cell 1)	
Neighbour cell		1	Cell 2	Cell to be identified.
RF Channel Number		1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Gap type		1	Per-UE gaps	
Measurement gap repitition periodicity	ms	1	40	
Measurement gap length	ms	1	6	
Measurement gap offset	ms	1	39	
SMTC configuration		1	SMTC.1	
CSI-RS parameters		1	CSI-RS.3.2 TDD	
A3-Offset	dB	1	-11	
CP length		1	Normal	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX		1	OFF	
Time offset between Cell 1 and Cell 2		1	3 μs	Synchronous cells
T1	s	1	5	
T2	s	1	5	

Table A.7.6.1.11.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
		2	48		48	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1	CSI-RS		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
					N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
TRS configuration		1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1	120		120	
OCNG Patterns		1	OP.5		N/A	
cellIndividualOffset	dB	1	N/A		16	
SSB		1	SSB.12 FR2		SSB.16 FR2	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

Table A.7.6.1.11.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam Assumption[Note 4]		1	Rough		Rough	
E_s	dBm/SCS	1	-80	-80	-Infinity	-80
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-80	-80	-Infinity	-80
Io	dBm/95.04 MHz	1	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1	Defined in figure A.7.6X.1.3.1-1			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Void NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.							

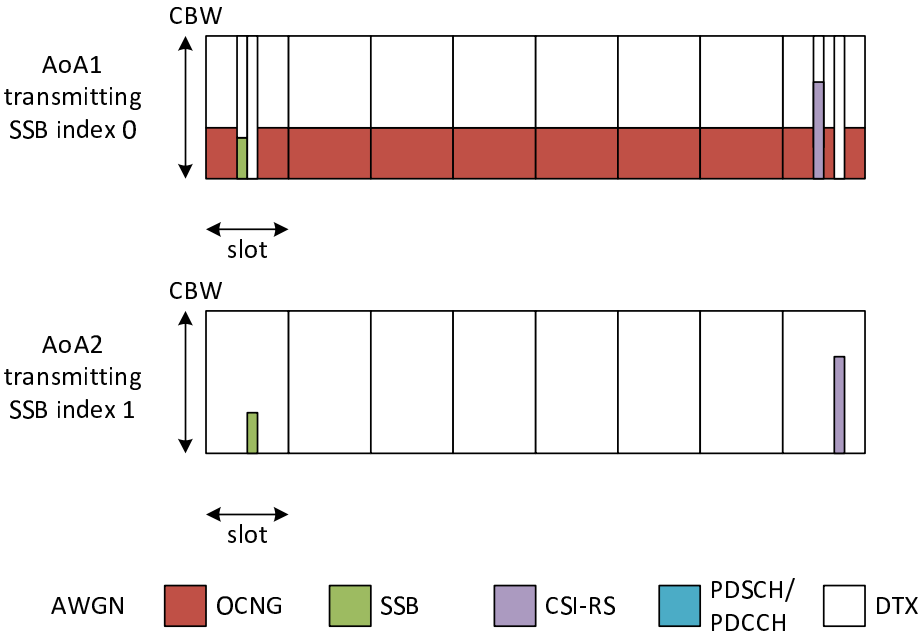


Figure A.7.6.1.11.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.7.6.1.11.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 12.48 s (180*40 ms +60*40 ms) for a UE supporting power class 1,
- 7.68 s (108*40 ms + 36*40 ms) for a UE supporting power class 2 and 3

The UE is required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.12 SA event triggered reporting test without gap under non-DRX when CD-SSB is outside active BWP

A.7.6.1.12.1 Test purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* makes correct reporting of an event when CD-SSB is outside active BWP. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.1.1-1.

The test environment is the same as in A.7.6.1.1 with following exceptions in table A.7.6.1.1.1-3.

Table A.7.6.1.12.1-1: NR Cell specific test parameters for intra-frequency event triggered reporting without gap under non-DRX when CD-SSB is outside active BWP

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		-	
Active DL BWP configuration		1, 2	DLBWP.1.5		-	
Active UL BWP configuration		1, 2	ULBWP.1.5		-	

A.7.6.1.12.2 Test Requirements

The test requirements are the same as in A.7.6.1.1.2.

A.7.6.1.13 SA event triggered reporting test without gap under non-DRX with NCD-SSB

A.7.6.1.13.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements when NCD-SSB is configured in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.13.1-1.

Table A.7.6.1.13.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.13.1-2, A.7.6.1.13.1-3 and A.7.6.1.13.1-4 below.

The CD-SSB is configured outside active DL BWP and NCD-SSB is configured fully within active DL BWP of FR1 PCell. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.1.13.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1, 2	PCell (Cell 1)	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration for CD-SSB		1, 2	SMTC.1	
SMTC configuration for NCD-SSB		1, 2	SMTC.10	
A3-Offset	dB	1, 2	-11	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	Synchronous cells
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.7.6.1.13.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
		2	48		48	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.2	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.2	
RLM-RS		1, 2	SSB		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2	CCR.3.7 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.0		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.5		N/A	
cellIndividualOffset	dB	1~2	N/A		16	
CD-SSB		1	SSB.3 FR2		SSB.3 FR2	
		2	SSB.4 FR2		SSB.4 FR2	
NCD-SSB		1	SSB.26 FR2		SSB.26 FR2	
		2	SSB.27 FR2		SSB.27 FR2	
Propagation Condition		1, 2	AWGN		AWGN	

NOTE 1: The starting PRB index of the CD-SSB can be any possible PRB index of the RF channel BW occurring after the last PRB of the DL active BWP.
NOTE 2: The starting PRB index of the NCD-SSB can be the same as the starting PRB index for DL active BWP.

Table A.7.6.1.13.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam assumption Note 4		1,2	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1	-64.41	-64.41	-Infinity	-64.41
		2	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1, 2	Defined in figure A.7.6.1.13.1-1			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Void
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

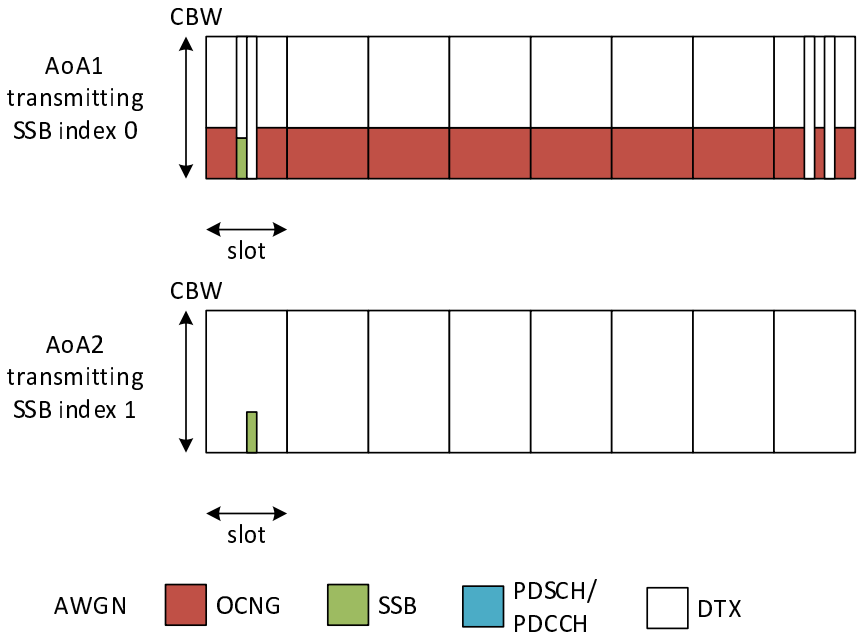


Figure A.7.6.1.13.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.7.6.1.13.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 9.6s for a UE supporting power class 1,
- 5.76s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.14 SA event triggered reporting test without gap under non-DRX for power class 6 UE supporting measEnhCAInterFreqFR2-r18

A.7.6.1.14.1 Test Purpose and Environment

The purpose of this test is to verify that the FR2 power class 6 UE makes correct reporting of an event. This test will partly verify the SA SCC intra-frequency NR cell measurement requirements specified in clause 9.2.5 for FR2 power class 6 UE supporting *measEnhCAInterFreqFR2-r18* and configured with *highSpeedMeasFlagFR2-r17*.

Three cells are deployed in the test: one FR2 PCell (Cell 1) on NR RF channel 1, one FR2 SCell (Cell 2) on NR RF channel 2, and one neighbouring cell (Cell 3) on NR RF channel 2. The supported test configurations are given in table A.7.6.1.14.1.1-1. The test parameters are given in tables A.7.6.1.14.1.1-2 and cell-specific parameters in A.7.6.1.14.1.1-3 below.

In the measurement control information, a measurement object is configured for the frequency of the SCell, and it is indicated to the UE that event-triggered reporting with Event A6 is used.

This test consists of two successive time periods, with time durations of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Table A.7.6.1.14.1-1 Test configuration

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.1.14.1-2: General test parameters

Parameter	Unit	Value	Comment
highSpeedMeasFlagFR2-r17		Set2	*highSpeedMeasFlagFR2-r17* = Set2 is configured
SMTC configuration		SMTC.1	As specified in clause A.3.11
A6-Offset	dB	-11	
Hysteresis	dB	0	
CP length		Normal	
Time to Trigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	DRX is not used
Time offset between serving and neighbour cells		3 ms	Synchronous cells.
T1	s	5	
T2	s	4.5	

Table A.7.6.1.14.1-3: Cell specific test parameters

Parameter	Unit	Cell 1		Cell 2		Cell 3	
		T1	T2	T1	T2	T1	T2
AoA setup Note 1		Setup 3 as specified in clause A.3.15					
		AoA1		AoA1		AoA2	
Beam Assumption Note 2		Rough		Rough		Rough	
NR RF Channel Number		1		2		2	
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		66		66		66	
BWP BW	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	

Parameter		Unit	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
BWP configuration	Initial DL BWP		DLBWP.0.1		DLBWP.0.1		N/A	
	Initial UL BWP		ULBWP.0.1		ULBWP.0.1		N/A	
	Active DL BWP		DLBWP.1.1		DLBWP.1.1		N/A	
	Active UL BWP		ULBWP.1.1		ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1			OP.1		OP.5		N/A	
PDSCH Reference measurement channel			SR.3.2 TDD		SR.3.2 TDD		-	
CORESET Reference Channel			CR.3.1 TDD		CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			SMTC.1		SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	120		120		120	
TRS configuration			TRS.2.1 TDD		TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			TCI.State.2		TCI.State.2		N/A	
$\hat{E}_s$		dBm/SCS	-89	-89	-89	-89	-Infinity	-89
SSB_RP Note 3		dBm/SCS Note4	-89	-89	-89	-89	-Infinity	-89
$\hat{E}_s / I_{ot\ BB}$ Note5		dB	-0.12	-0.12	-0.12	-0.12	-Infinity	-0.12
Io Note3		dBm/95.04 MHz Note6	-64.41	-64.41	-64.41	-64.41	-Infinity	-64.41
Propagation Condition			AWGN				AWGN 19444 Hz	

NOTE 1: The configuration for AoA1 and AoA2 can refer to Figure A.7.6.1.5.1.-1
NOTE 2: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 3: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.7.6.1.14.2 Test Requirements

The UE shall send one Event A6 triggered measurement report, with a measurement reporting delay less than 1000 ms from the beginning of time period T2.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2 Inter-frequency Measurements

A.7.6.2.1 SA event triggered reporting tests for FR2 without SSB time index detection when DRX is not used (PCell in FR2)

A.7.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.1.1-1, A.7.6.2.1.1-2, and A.7.6.2.1.1-3.

Measurement gap pattern configuration defined in table A.7.6.2.1.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.1.1-1.

Table A.7.6.2.1.1-1 SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void.	

Table A.7.6.2.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
offsetMO	dB	Config 1	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	5.2 for PC1; 3.5 for other PC	

Table A.7.6.2.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		Config 1	Setup 3 as specified in clause A.3.15			
			AoA1		AoA2	
Beam Assumption[Note 7]		1,2	Rough		Rough	
NR RF Channel Number		Config 1	1		2	
Duplex mode		Config 1	TDD		TDD	
TDD configuration		Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		Config 1	66		66	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
$\hat{E}_s$		dBm/SCS	Config 1	-87	-87	-Infinity	-87
SSB_RP Note 3		dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ BB Note 8		dB	Config 1	1.89	1.89	-Infinity	1.89
Io Note3		dBm/95.04 MHz Note 5	Config 1	-58.01	-58.01	-Infinity	-58.01
Propagation Condition			Config 1	No external noise (Note 9)		No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.7.6.2.1.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.2 SA event triggered reporting tests for FR2 without SSB time index detection when DRX is used (PCell in FR2)

A.7.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.2.1-1, A.7.6.2.2.1-2, and A.7.6.2.2.1-3.

Measurement gap pattern configuration defined in table A.7.6.2.2.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.2.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.2.1-1: SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void.	

Table A.7.6.2.2.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1	1, 2		Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39		
SMTC-SSB parameters		Config 1	SSB.3 FR2		As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Hysteresis	dB	Config 1	0		
CP length		Config 1	Normal		
TimeToTrigger	s	Config 1	0		
Filter coefficient		Config 1	0		L3 filtering is not used
DRX		Config 1	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3μs		Synchronous cells.
T1	s	Config 1	5		
T2	s	Config 1	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.7.6.2.2.1-3: Cell specific test parameters for CA inter-frequency event triggered reporting without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note2	dBm/15 kHz Note 5		-104.7		-104.7	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-95.7		-95.7	
SS-RSRP Note 3	dBm/SCS Note 5	Config 1	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1	6	6	-Infinity	9
Io Note3	dBm/95.04 MHz Note 5	Config 1	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.2.2.2 Test Requirements

In test 1 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.3 SA event triggered reporting tests for FR2 with SSB time index detection when DRX is not used (PCell in FR2)

A.7.6.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.3.1-1, A.7.6.2.3.1-2, and A.7.6.2.3.1-3.

Measurement gap pattern configuration defined in table A.7.6.2.3.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.3.1-1.

Table A.7.6.2.3.1-1: SA event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void.	

Table A.7.6.2.3.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
offsetMO	dB	Config 1	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	7 for PC1; 4.5 for other PC	

Table A.7.6.2.3.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		Config 1	Setup 3 as specified in clause A.3.15			
			AoA1		AoA2	
Beam Assumption[Note 7]		Config 1	Rough		Rough	
NR RF Channel Number		Config 1	1		2	
Duplex mode		Config 1	TDD		TDD	
TDD configuration		Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		Config 1	66		66	
BWP BW	MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
$\hat{E}_s$		dBm/SCS	Config 1	-87	-87	-Infinity	-87
SSB_RP Note 3		dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ BB Note 8		dB	Config 1	1.89	1.89	-Infinity	1.89
Io Note3		dBm/95.04 MHz Note5	Config 1	-58.01	-58.01	-Infinity	-58.01
Propagation Condition			Config 1	No external noise (Note 9)		No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.7.6.2.3.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

The UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.4 SA event triggered reporting tests for FR2 with SSB time index detection when DRX is used (PCell in FR2)

A.7.6.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.4.1-1, A.7.6.2.4.1-2, and A.7.6.2.4.1-3.

Measurement gap pattern configuration defined in table A.7.6.2.4.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.4.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.4.1-1: SA event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void.	

Table A.7.6.2.4.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1	1, 2		Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39		
SMTC-SSB parameters		Config 1	SSB.3 FR2		As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6		
Hysteresis	dB	Config 1	0		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
CP length		Config 1	Normal		
TimeToTrigger	s	Config 1	0		
Filter coefficient		Config 1	0		L3 filtering is not used
DRX		Config 1	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3μs		Synchronous cells.
T1	s	Config 1	5		
T2	s	Config 1	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	

Table A.7.6.2.4.1-3: Cell specific test parameters for CA inter-frequency event triggered reporting with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note2	dBm/15 kHz Note 5		-104.7		-104.7	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-95.7		-95.7	
SS-RSRP Note 3	dBm/SCS Note 5	Config 1	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1	6	6	-Infinity	9
Io Note3	dBm/95.04 MHz Note 5	Config 1	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.2.4.2 Test Requirements

In test 1 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 2 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.5 SA event triggered reporting tests for FR2 without SSB time index detection when DRX is not used (PCell in FR1)

A.7.6.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.5.1-1, A.7.6.2.5.1-2, and A.7.6.2.5.1-3.

In test 1 per-UE measurement gap pattern configuration # 0 as defined in table A.7.6.2.5.1-2 is provided for a UE that does not support per-FR gap and in test 2 no gap pattern is configured as defined in table A.7.6.2.5.1-2. If the UE supports per-FR gap, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.5.1-1.

Table A.7.6.2.5.1-1 SA event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.5.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3	NR cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0	Gap not configured	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39	N/A	
SMTC-SSB parameters on NR RF Channel 1		Config 1	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3	SSB.2 FR1		As specified in clause A.3.10.1
CSI-RS for tracking parameters on NR RF Channel 1		Config 1	TRS.1.1 FDD		
		Config 2	TRS.1.1 TDD		
		Config 3	TRS.1.2 TDD		
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2		As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3	6		
Hysteresis	dB	Config 1,2,3	0		
a4-Threshold	dBm	Config 1,2,3	-105		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	OFF		DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	5.2 for PC1; 3.5 for other PC	3 for PC1; 2 for other PC	

Table A.7.6.2.5.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3	N/A		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]			Config 1,2,3	N/A		Rough	
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD		TDD	
			Config 2,3	TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.3.1	
			Config 2	TDDConf.1.1		TDDConf.3.1	
			Config 3	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	52		66	
			Config 2	52		66	
			Config 3	106		66	
BWP BW		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		-	
			Config 2	SR.1.1 TDD			
			Config 3	SR.2.1 TDD			
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR.2.1 TDD			
Dedicated CORESET RMC configuration			Config 1	CCR.1.1 FDD		-	
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.2		SMTC.2	
			Config 2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15		120	
			Config 3	30		120	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
$\hat{E}_s$		dBm/SCS	Config 1,2,3			-Infinity	-87
SSB_RP[Note 3]		dBm/SCS	Config 1,2			-Infinity	-87
		Note 5	Config 3			-Infinity	-87

Parameter	Unit	Test configuration	Cell 1	Cell 2	
$\hat{E}_s/I_{ot}$ BB Note 8	dB	Config 1,2,3	NA Link only, see clause A.3.7A	-Infinity	14.69
	dBm/95.04 MHz Note 5	Config 1,2,3		-Infinity	-58.01
Propagation Condition		Config 1,2,3		No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SS B_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.7.6.2.5.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

In test 2, without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

2560 for UE supporting power class 1, or

1600 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.6 SA event triggered reporting tests for FR2 without SSB time index detection when DRX is used (PCell in FR1)

A.7.6.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.6.1-1, A.7.6.2.6.1-2, and A.7.6.2.6.1-3.

In test 1&2 per-UE measurement gap pattern configuration # 0 as defined in table A.7.6.2.6.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 no gap pattern is configured as defined in table A.7.6.2.6.1-2. If a UE supports per-FR gap it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.6.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.6.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.6.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
NR RF Channel Number		Config 1,2,3	1, 2				One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3	NR cell 1 (PCell)				NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2				NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0		Gap not configured		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39		N/A		
SMTC-SSB parameters on NR RF Channel 1		Config 1	SSB.1 FR1				As specified in clause A.3.10.1
		Config 2	SSB.1 FR1				As specified in clause A.3.10.1
		Config 3	SSB.2 FR1				As specified in clause A.3.10.1
CSI-RS for tracking parameters on NR RF Channel 1		Config 1	TRS.1.1 FDD				
		Config 2	TRS.1.1 TDD				
		Config 3	TRS.1.2 TDD				
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2				As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3	6				
Hysteresis	dB	Config 1,2,3	0				
a4-Threshold	dBm	Config 1,2,3	-105				
CP length		Config 1,2,3	Normal				
TimeToTrigger	s	Config 1,2,3	0				
Filter coefficient		Config 1,2,3	0				L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.7	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3 ms				Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs				Synchronous cells.
T1	s	Config 1,2,3	5				
T2	s	Config 1,2,3	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.7.6.2.6.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3	NA		Setup 1 as specified in clause A.3.15	
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD		TDD	
			Config 2,3	TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.3.1	
			Config 2	TDDConf.1.1		TDDConf.3.1	
			Config 3	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	52		66	
			Config 2	52		66	
			Config 3	106		66	
BWP BW		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		-	
			Config 2	SR.1.1 TDD			
			Config 3	SR.2.1 TDD			
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR.2.1 TDD			
Dedicated CORESET RMC configuration			Config 1	CCR.1.1 FDD		-	
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.2		SMTC.2	
			Config 2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15		120	
			Config 3	30		120	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note2	dBm/15 kHz Note 5		NA Link only, see clause A.3.7A		-104.7	
N_{oc} Note2	dBm/SCS Note 4	Config 1,2			-95.7	
		Config 3			-95.7	
SSB_RP Note 3	dBm/SCS Note 5	Config 1,2			-Infinity	-86.7
		Config 3			-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3			-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3			-Infinity	9
Io Note3	dBm/9.36 MHz	Config 1,2			-	-
	dBm/38.16 MHz	Config 3			-	-
	dBm/95.04 MHz Note 5	Config 1,2,3			-66.7	-57.2
Propagation Condition		Config 1,2,3	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone

A.7.6.2.6.2 Test Requirements

In test 1 with per-UE gap and in test 3 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.7 SA event triggered reporting tests for FR2 with SSB time index detection when DRX is not used (PCell in FR1)

A.7.6.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

n this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.7.1-1, A.7.6.2.7.1-2, and A.7.6.2.7.1-3.

In test 1 per-UE measurement gap pattern configuration # 0 as defined in table A.7.6.2.7.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement no gap pattern is configured as defined in table A.7.6.2.7.1-2. If the UE supports per-FR gap, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.7.1-1.

Table A.7.6.2.7.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.7.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3	NR cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0	Gap not configured	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39	N/A	
SMTC-SSB parameters on NR RF Channel 1		Config 1	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3	SSB.2 FR1		As specified in clause A.3.10.1
CSI-RS for tracking parameters on NR RF Channel 1		Config 1	TRS.1.1 FDD		
		Config 2	TRS.1.1 TDD		
		Config 3	TRS.1.2 TDD		
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2		As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3	6		
Hysteresis	dB	Config 1,2,3	0		
a4-Threshold	dBm	Config 1,2,3,4,5,6	-105		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	OFF		DRX is not used

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Time offset between serving and neighbour cells		Config 1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	7 for PC1; 4.5 for other PC	3.5 for PC1; 2.5 for other PC	

Table A.7.6.2.7.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3	NA		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]			Config 1,2,3	N/A		Rough	
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD		TDD	
			Config 2,3	TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.3.1	
			Config 2	TDDConf.1.1		TDDConf.3.1	
			Config 3	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	52		66	
			Config 2	52		66	
			Config 3	106		66	
BWP BW		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		-	
			Config 2	SR.1.1 TDD			
			Config 3	SR.2.1 TDD			
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR.2.1 TDD			
Dedicated CORESET RMC configuration			Config 1	CCR.1.1 FDD		-	
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.2		SMTC.2	
			Config 2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15		120	
			Config 3	30		120	
EPRE ratio of PSS to SSS							
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							

Parameter	Unit	Test configuration	Cell 1	Cell 2	
EPRE ratio of PDCCH DMRS to SSS		Config 1,2,3	0	0	
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
$\hat{E}_S$	dBm/SCS	Config 1,2, 3	NA Link only, see clause A.3.7A	-Infinity	-87
SSB_RP Note 3	dBm/SCS Note 5	Config 1,2		-Infinity	-87
		Config 3		-Infinity	-87
$\hat{E}_s / I_{ot}$ BB Note 8	dB	Config 1,2,3		-Infinity	14.69
	dBm/95.04 MHz Note 5	Config 1,2,3		Infinity	-58.01
Propagation Condition		Config 1,2,3		No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.7.6.2.7.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

In test 2 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

3360 for UE supporting power class 1, or

2080 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.8 SA event triggered reporting tests for FR2 with SSB time index detection when DRX is used (PCell in FR1)

A.7.6.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.8.1-1, A.7.6.2.8.1-2, and A.7.6.2.8.1-3.

In test 1&2 per-UE measurement gap pattern configuration # 0 as defined in table A.7.6.2.8.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement no gap pattern is configured as defined in table A.7.6.2.8.1-2.If a UE supports per-FR gap , it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.8.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.8.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.8.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
NR RF Channel Number		Config 1,2,3	1, 2				One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3	NR cell 1 (PCell)				NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2				NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0		Gap not configured		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39		N/A		
SMTC-SSB parameters on NR RF Channel 1		Config 1	SSB.1 FR1				As specified in clause A.3.10.1
		Config 2	SSB.1 FR1				As specified in clause A.3.10.1
		Config 3	SSB.2 FR1				As specified in clause A.3.10.1
CSI-RS for tracking parameters on NR RF Channel 1		Config 1	TRS.1.1 FDD				
		Config 2	TRS.1.1 TDD				
		Config 3	TRS.1.2 TDD				
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2				As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3	6				
Hysteresis	dB	Config 1,2,3	0				

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
a4-Threshold	dBm	Config 1,2,3	-105				
CP length		Config 1,2,3	Normal				
TimeToTrigger	s	Config 1,2,3	0				
Filter coefficient		Config 1,2,3	0				L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.7	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3 ms				Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs				Synchronous cells.
T1	s	Config 1,2,3	5				
T2	s	Config 1,2,3	11 for PC1; 6.5 for other PCTBD	108 for PC1; 67 for other PCTBD	11 for PC1; 6.5 for other PCTBD	108 for PC1; 67 for other PCTBD	

Table A.7.6.2.8.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3	NA		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]			Config 1,2,3	N/A		Rough	
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD		TDD	
			Config 2,3	TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.3.1	
			Config 2	TDDConf.1.1		TDDConf.3.1	
			Config 3	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	52		66	
			Config 2	52		66	
			Config 3	106		66	
BWP BW		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		-	
			Config 2	SR.1.1 TDD			
			Config 3	SR.2.1 TDD			
RMSI CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR.2.1 TDD			
Dedicated CORESET RMC configuration			Config 1	CCR.1.1 FDD		-	
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.2		SMTC.2	
			Config 2,3	SMTC.1		SMTC.1	

Parameter	Unit	Test configuration	Cell 1	Cell 2	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	15	120	
		Config 3	30	120	
EPRE ratio of PSS to SSS		Config 1,2,3	0	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	dBm/15 kHz Note 5		NA Link only, see clause A.3.7A	-104.7	
N_{oc} Note2	dBm/SCS Note 4	Config 1,2		-95.7	
		Config 3		-95.7	
SSB_RP Note 3	dBm/SCS Note 5	Config 1,2		-Infinity	-86.7
		Config 3		-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3		-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3		-Infinity	9
Io Note3	dBm/9.36 MHz	Config 1,2		-	-
	dBm/38.16 MHz	Config 3		-	-
	dBm/95.04 MHz Note 5	Config 1,2,3		-66.7	-57.2
Propagation Condition		Config 1,2,3		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.2.8.2 Test Requirements

In test 1 with per-UE gap and in test 3 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.9 SA event triggered reporting tests For FR2 without SSB time index detection when DRX is not used (PCell in FR2) (rel16 additional mandatory gap pattern 17)

A.7.6.2.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.9.1-1, A.7.6.2.9.1-2, and A.7.6.2.9.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.9.1-1.

Table A.7.6.2.9.1-1 SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void.	

Table A.7.6.2.9.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection (GP17)

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	17	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-15	
offsetMO	dB	Config 1	12	For cell 2
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	

Parameter	Unit	Test configuration	Value	Comment
T2	s	Config 1	6 (PC1) 4 (other PC)	

Table A.7.6.2.9.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection (GP17)

Parameter		Unit	Test configuration	Cell 1		Cell 1	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam assumption Note 7			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
TCI configuration			Config 1	CSI-RS.Config.0		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note 5		N/A		N/A	
N_{oc} Note2		dBm/SCS Note 4	Config 1	N/A		N/A	
SS-RSRP Note 3		dBm/SCS Note 5	Config 1	-87	-87	-Infinity	-87
$\hat{E}_s/I_{ot}$		dB	Config 1	N/A	N/A	-Infinity	N/A

Parameter	Unit	Test configuration	Cell 1		Cell 1	
			T1	T2	T1	T2
$\hat{E}_s/N_{oc}$	dB	Config 1	N/A	N/A	-Infinity	N/A
Io[Note3]	dBm/95.04 MHz Note 5	Config 1	-58.01	-58.01	-Infinity	-58.01
Propagation Condition		Config 1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.2.9.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 5120 ms (PC1) or 3200 ms (other than PC1) from the beginning of time period T2.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.10 SA event triggered reporting test without gap under non-DRX

A.7.6.2.10.1 Test Purpose and Environment

The purpose of this test is to verify that if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the network, the UE makes correct reporting of an event. This test will partly verify the inter-frequency without gap cell search requirements in clause 9.3.9. Supported test configurations are shown in table A.7.6.2.10.1-1.

Table A.7.6.2.10.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

There are two cells in the test, NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The SSB of Cell 2 is completely within UE's active BWP BW. The PRBs containing SSB from cell 1 and cell 2 should be different in frequency location within the cell bandwidth. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.2.10.1-2, A.7.6.2.10.1-3 and A.7.6.2.10.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.2.10.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1	PCell (Cell 1)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		1	Cell 2	NR cell 2 is on NR RF channel number 2.
RF Channel Number		1	1, 2	Two FR2 NR carrier frequencies is used.
SMTC configuration		1	SMTC.1	
A3-Offset	dB	1	-6	
CP length		1	Normal	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX		1	OFF	
Time offset between Cell 1 and Cell 2		1	3 μs	Synchronous cells
T1	s	1	5	
T2	s	1	5	

Table A.7.6.2.10.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1	SSB		SSB	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		CCR.3.1 TDD	
TRS configuration		1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1	TCI.State.2		N/A	
OCNG Patterns		1	OP.1		OP.1	
SSB		1	SSB.3 FR2		SSB.3 FR2	
Propagation Condition		1	AWGN			

Table A.7.6.2.10.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 defined in A.3.15.1			
Beam assumption[Note 4]		1	Rough		Rough	
$\hat{E}_s / I_{ot\ BB}$[Note 5]	dB	1	3.45	3.45	-Infinity	7.45
N_{oc}[Note 2]	dBm/15 KHz	1	-102			
N_{oc}[Note 2]	dBm/SCS	1	-93			
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-85
$\hat{E}_s / N_{oc}$	dB	1	4	4	-Infinity	8
Io	dBm/95.04 MHz	1	-58.56	-58.56	-63.95	-55.38

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SSB_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.6.2.10.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 2.4 s for a UE supporting power class 1,
- 1.44 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.11 SA event triggered reporting test without gap under DRX

A.7.6.2.11.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD inter-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.2.11.1-1.

Table A.7.6.2.11.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) on NR RF channel 1 and a FR2 neighbour cell (Cell 2) on NR RF channel 2. The SSB of Cell 2 is completely within UE's active BWP BW. The PRBs containing SSB from cell 1 and cell 2 should be different in frequency location within the cell bandwidth. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.2.11.1-2 ~ 6.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.11.1-2: General test parameters for inter-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Value	Comment
NR RF Channel Number		1, 2	1, 2	2 TDD carrier frequency are used for the NR cells.
Active cell		1, 2	PCell (Cell 1)	Cell 1 is on NR RF channel number 1.
Neighbour cell		1, 2	Cell 2	Cell to be identified. Cell 2 is on NR RF channel number 2.
SMTC configuration		1, 2	SMTC.1	
A3-Offset	dB	1, 2	-6	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	DRX.7	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	Synchronous cells
T1	s	1, 2	5	
T2	s	1, 2	52	

Table A.7.6.2.11.1-3: NR Cell specific test parameters for inter-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number		1, 2	1		2	
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2	DLBWP.1.1		N/A	
Active UL BWP configuration		1, 2	ULBWP.1.1		N/A	
RLM-RS		1, 2	SSB		N/A	
PDSCH RMC configuration		1, 2	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.3.1 TDD		N/A	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
SSB		1	SSB.3 FR2		SSB.3 FR2	
		2	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1, 2	AWGN			

Table A.7.6.2.11.1-4: NR OTA Cell specific test parameters for inter-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 1 defined in A.3.15.1			
Beam assumption[Note 4]		1,2	Rough		Rough	
$\hat{E}_s / I_{ot\ BB}$[Note 5]	dB	1, 2	3.77	3.77	-Infinity	3.77
N_{oc}[Note 2]	dBm/15 KHz	1, 2	-98			
N_{oc}[Note 2]	dBm/SCS	1	-89			
		2	-86			
SSB_RP	dBm/SCS	1	-85	-85	-Infinity	-85
		2	-82	-82	-Infinity	-82
$\hat{E}_s / N_{oc}$	dB	1, 2	4	4	-Infinity	4
Io	dBm/95.04 MHz	1	-54.53	-54.53	-59.98	-54.53

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SSB_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation. NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.6.2.11.2 Test Requirements

In test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2 s for a UE supporting power class 1,
- 30.72 s for a UE supporting power class 2, 3 and 4est

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.12 SA event triggered reporting tests for FR2-2 without SSB time index detection when DRX is not used (PCell in FR2-2)

A.7.6.2.12.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2-2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.1.12-1, A.7.6.2.12.1-2, and A.7.6.2.12.1-3.

Measurement gap pattern configuration defined in table A.7.6.2.12.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.12.1-1.

Table A.7.6.2.12.1-1 SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.6.2.12.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2-2 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1	Two FR2 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
		Config 2	SSB.11 FR2	
		Config 3	SSB.12 FR2	
offsetMO	dB	Config 1,2,3	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	Config 1,2,3	-11	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	5.2 for PC1; 3.5 for other PC	

Table A.7.6.2.12.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2-2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam Assumption[Note 7]			1,2,3	Rough		Rough	
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1,2,3	TDD		TDD	
TDD configuration			Config 1,2,3	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
			Config 2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
			Config 3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
Data PRBs allocated			Config 1	66		66	
			Config 2	66		66	
			Config 3	33		33	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
			Config 2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
			Config 3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,2,3	SR.3.1 TDD		-	
CORESET Reference Channel		Config 1,2,3	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2		Config 1,2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,3	120		120	
TRS configuration		Config 1,2,3	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		Config 1,2,3	TCI.State.2		N/A	
EPRE ratio of PSS to SSS		Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
$\hat{E}_s$	dBm/SCS	Config 1	-87	-87	-Infinity	-87
		Config 2	-81	-81	-Infinity	-81
		Config 3	-78	-78	-Infinity	-78
SSB_RP Note 3	dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87
		Config 2	-81	-81	-Infinity	-81
		Config 3	-78	-78	-Infinity	-78
$\hat{E}_s / I_{ot}$ BB Note 8	dB	Config 1,2,3	1.89	1.89	-Infinity	1.89
Io Note3	dBm/95.04 MHz Note 5	Config 1,2,3	-58.01	-58.01	-Infinity	-58.01
Propagation Condition		Config 1,2,3	No external noise (Note 9)		No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: VoidNOTE 3: SSBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.7.6.2.12.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,

7.68 s (96*40 ms + 96*40 ms) for UE supporting power class 1, or

4.8 s (60*40 ms +60*40 ms) for UE supporting other power class.

For Configuration 2,

11.52 s (192*40 ms + 96*40 ms) for UE supporting power class 1, or

7.2 s (120*40 ms +60*40 ms) for UE supporting other power class.

For Configuration 3,

15.36 s (288*40 ms + 96*40 ms) for UE supporting power class 1, or

9.6 s (180*40 ms +60*40 ms) for UE supporting other power class.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.13 SA event triggered reporting tests for FR2-2 without SSB time index detection when DRX is used (PCell in FR2-2)

A.7.6.2.13.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2-2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.63.2.13.1-1, A.7.6.2.13.1-2, and A.7.6.2.13.1-3.

Measurement gap pattern configuration defined in table A.7.6.2.13.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2132.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.13.1-1: SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.6.2.13.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2-2 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		Two FR2 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39		
SMTC-SSB parameters		Config 1	SSB.3 FR2		As specified in clause A.3.10.2
		Config 2	SSB.11 FR2		
		Config 3	SSB.12 FR2		
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.7.6.2.13.1-3: Cell specific test parameters for CA inter-frequency event triggered reporting without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1,2,3	Rough		Rough	
NR RF Channel Number			Config 1,2,3	1		2	
TDD configuration			Config 1,2,3	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1,2,3	TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
			Config 2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
			Config 3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
Data PRBs allocated			Config 1	66		66	
			Config 2	66		66	
			Config 3	33		33	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
			Config 2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
			Config 3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
PDSCH Reference measurement channel		Config 1,2,3	SR.3.1 TDD		-	
CORESET Reference Channel		Config 1,2,3	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2		Config 1,2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,3	120		120	
TRS configuration		Config 1,2,3	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		Config 1,2,3	TCI.State.2		N/A	
EPRE ratio of PSS to SSS		Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note 5	Config 1,2,3	-104.7		-104.7	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-95.7		-95.7	
		Config 2	-89.7		-89.7	
		Config 3	-86.7		-86.7	
SS-RSRP Note 3	dBm/SCS Note 5	Config 1	-89.7	-89.7	-Infinity	-86.7
		Config 2	-83.7	-83.7	-Infinity	-80.7
		Config 3	-80.7	-80.7	-Infinity	-77.7
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	6	6	-Infinity	9
Io Note3	dBm/95.04 MHz Note 5	Config 1,2,3	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Void

NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone

NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.2.13.2 Test Requirements

In test 1 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

For Configuration 1,

11.52 s (96*40 ms*1.5 + 96*40 ms*1.5) for UE supporting power class 1, or

7.2 s (60*40 ms*1.5 + 60*40 ms*1.5) for UE supporting other power class.

For Configuration 2,

17.28 s (192*40 ms*1.5 + 96*40 ms*1.5) for UE supporting power class 1, or

10.80 s (120*40 ms*1.5 + 60*40 ms*1.5) for UE supporting other power class.

For Configuration 3,

23.04 s (288*40 ms*1.5 + 96*40 ms*1.5) for UE supporting power class 1, or

14.40 s (180*40 ms*1.5 + 60*40 ms*1.5) for UE supporting other power class.

In test 2 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

For Configuratiojn 1,

122.88 s (96*640 ms + 96*640 ms) for UE supporting power class 1, or

76.80 s (60*640 ms + 60*640 ms) for UE supporting other power class.

For Configuratiojn 2,

184.32 s (192*640 ms + 96*640 ms) for UE supporting power class 1, or

115.20 s (120*640 ms + 60*640 ms) for UE supporting other power class.

For Configuratiojn 3,

245.76 s (288*640 ms + 96*640 ms) for UE supporting power class 1, or

153.60 s (180*640 ms + 60*640 ms) for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.14 SA event triggered reporting tests for FR2-2 with SSB time index detection when DRX is not used (PCell in FR2-2)

A.7.6.2.14.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2-2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.14.1-1, A.7.6.2.14.1-2, and A.7.6.2.14.1-3.

Measurement gap pattern configuration defined in table A.7.6.2.14.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.14.1-1.

Table A.7.6.2.14.1-1: SA event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.6.2.14.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2-2 with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
		Config 2	SSB.11 FR2	
		Config 3	SSB.12 FR2	
offsetMO	dB	Config 1,2,3	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	Config 1,2,3	-11	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	7 for PC1; 4.5 for other PC	

Table A.7.6.2.14.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2-2 with SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		Config 1,2,3	Setup 3 as specified in clause A.3.15			
			AoA1		AoA2	
Beam Assumption[Note 7]		Config 1,2,3	Rough		Rough	
NR RF Channel Number		Config 1,2,3	1		2	
Duplex mode		Config 1,2,3	TDD		TDD	
TDD configuration		Config 1,2,3	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	Config 1	100: $N_{PRB,c} = 66$		100: $N_{PRB,c} = 66$	
		Config 2	400: $N_{PRB,c} = 66$		100: $N_{PRB,c} = 66$	
		Config 3	400: $N_{PRB,c} = 33$		100: $N_{PRB,c} = 33$	
		Config 1	66		66	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
			Config 2	66		66	
			Config 3	33		33	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
			Config 2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
			Config 3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2,3	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1,2,3	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1,2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,3	120		120	
TRS configuration			Config 1,2,3	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1,2,3	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
$\hat{E}_s$		dBm/SCS	Config 1	-87	-87	-Infinity	-87
			Config 2	-81	-81	-Infinity	-81
			Config 3	-78	-78	-Infinity	-78
SSB_RP Note 3		dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87
			Config 2	-81	-81	-Infinity	-81
			Config 3	-78	-78	-Infinity	-78
$\hat{E}_s / I_{ot}$ BB Note 8		dB	Config 1,2,3	1.89	1.89	-Infinity	1.89
Io Note3		dBm/95.04 MHz Note5	Config 1,2,3	-58.01	-58.01	-Infinity	-58.01
Propagation Condition			Config 1,2,3	No external noise (Note 9)		No external noise (Note 9)	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Void						
NOTE 3: SBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Void						
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.						
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

A.7.6.2.14.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,

10.56 s (96*40 ms + 96*40 ms+72*40 ms) for UE supporting power class 1, or

6.72 s (60*40 ms+60*40 ms+48*40 ms) for UE supporting other power class.

For Configuration 2,

14.4 s (192*40 ms + 96*40 ms+72*40 ms) for UE supporting power class 1, or

9.12 s (120*40 ms+60*40 ms+48*40 ms) for UE supporting other power class.

For Configuration 3,

18.24 s (288*40 ms + 96*40 ms+72*40 ms) for UE supporting power class 1, or

11.52 s (180*40 ms+60*40 ms+48*40 ms) for UE supporting other power class.

The UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.15 SA event triggered reporting tests for FR2-2 with SSB time index detection when DRX is used (PCell in FR2-2)

A.7.6.2.15.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2-2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.15.1-1, A.7.6.2.15.1-2, and A.7.6.2.15.1-3.

Measurement gap pattern configuration defined in table A.7.6.2.15.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.15.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.15.1-1: SA event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.6.2.15.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2-2 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		Two FR2 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39		
SMTC-SSB parameters		Config 1	SSB.3 FR2		As specified in clause A.3.10.2
		Config 2	SSB.11 FR2		
		Config 3	SSB.12 FR2		
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	

Table A.7.6.2.15.1-3: Cell specific test parameters for CA inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		Config 1,2,3	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]		Config 1,2,3	Rough		Rough	
NR RF Channel Number		Config 1,2,3	1		2	
Duplex mode		Config 1,2,3	TDD		TDD	
TDD configuration		Config 1,2,3	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
			Config 2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
			Config 3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
			Config 1	66		66	
			Config 2	66		66	
			Config 3	33		33	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
			Config 2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
			Config 3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2,3	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1,2,3	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1,2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,3	120		120	
TRS configuration			Config 1,2,3	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1,2,3	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note 5		-104.7		-104.7	
N_{oc} Note2		dBm/SCS Note 4	Config 1	-95.7		-95.7	
			Config 2	-89.7		-89.7	
			Config 3	-86.7		-86.7	
SS-RSRP Note 3		dBm/SCS Note 5	Config 1	-89.7	-89.7	-Infinity	-86.7
			Config 2	-83.7	-83.7	-Infinity	-80.7
			Config 3	-80.7	-80.7	-Infinity	-77.7
$\hat{E}_s / I_{ot}$		dB	Config 1,2,3	6	6	-Infinity	9
$\hat{E}_s / N_{oc}$		dB	Config 1,2,3	6	6	-Infinity	9
Io Note3		dBm/95.04 MHz Note 5	Config 1,2,3	-59.7	-59.7	-66.7	-57.2

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		Config 1,2,3	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Void						
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.6.2.15.2 Test Requirements

In test 1 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

For Configuration 1,

15.84 s (96*40 ms*1.5+96*40 ms*1.5+72*40 ms*1.5) for UE supporting power class 1, or

10.08 s (60*40 ms*1.5+60*40 ms*1.5+48*40 ms*1.5) for UE supporting other power class.

For Configuration 2,

21.6 s (192*40 ms*1.5+96*40 ms*1.5+72*40 ms*1.5) for UE supporting power class 1, or

13.68 s (120*40 ms*1.5+60*40 ms*1.5+48*40 ms*1.5) for UE supporting other power class.

For Configuration 3,

27.36 s (288*40 ms*1.5+96*40 ms*1.5+48*40 ms*1.5) for UE supporting power class 1, or

17.28 s (180*40 ms*1.5+60*40 ms*1.5+48*40 ms*1.5) for UE supporting other power class.

In test 2 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

For Configuration 1,

168.96 s (96*640 ms+96*640 ms+72*640 ms) for UE supporting power class 1, or

107.52 s (60*640 ms+60*640 ms+48*640 ms) for UE supporting other power class.

For Configuration 2,

230.4 s (192*640 ms+96*640 ms+72*640 ms) for UE supporting power class 1, or

145.92 s (120*640 ms+60*640 ms+48*640 ms) for UE supporting other power class.

For Configuration 3,

291.84 s (288*640 ms+96*640 ms+72*640 ms) for UE supporting power class 1, or

184.32 s (180*640 ms+60*640 ms+48*640 ms) for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.16 SA event triggered reporting tests for FR2-2 without SSB time index detection when DRX is not used (PCell in FR1)

A.7.6.2.16.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2-2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.16.1-1, A.7.6.2.16.1-2, and A.7.6.2.16.1-3.

In test 1 per-UE measurement gap pattern configuration # 0 as defined in table A.7.6.2.16.1-2 is provided for a UE that does not support per-FR gap and in test 2 no gap pattern is configured as defined in table A.7.6.2.16.1-2. If the UE supports per-FR gap, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.16.1-1.

Table A.7.6.2.16.1-1 SA event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
9	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.16.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2-2 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3,4,5,6,7,8,9	1, 2		One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3,4,5,6,7,8,9	NR cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6,7,8,9	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6,7,8,9	0	Gap not configured	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6,7,8,9	39	N/A	
SMTC-SSB parameters on NR RF Channel 1		Config 1,4,7	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2,5,8	SSB.1 FR1		
		Config 3,6,9	SSB.2 FR1		
		Config 1,4,7	TRS.1.1 FDD		
		Config 2,5,8	TRS.1.1 TDD		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
CSI-RS for tracking parameters on NR RF Channel 1		Config 3,6,9	TRS.1.2 TDD		
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2		As specified in clause A.3.10.2
		Config 4,5,6	SSB.11 FR2		
		Config 7,8,9	SSB.12 FR2		
offsetMO	dB	Config 1,2,3,4,5,6,7,8,9	6		
Hysteresis	dB	Config 1,2,3,4,5,6,7,8,9	0		
a4-Threshold	dBm	Config 1,2,3,4,5,6,7,8,9	-105		
CP length		Config 1,2,3,4,5,6,7,8,9	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6,7,8,9	0		
Filter coefficient		Config 1,2,3,4,5,6,7,8,9	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6,7,8,9	OFF		DRX is not used
Time offset between serving and neighbour cells		Config 1,4,7	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3,5,6,8,9	3μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6,7,8,9	5		
T2	s	Config 1,2,3,4,5,6,7,8,9	5.2 for PC1; 3.5 for other PC	3 for PC1; 2 for other PC	

Table A.7.6.2.16.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2-2 without SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6,7,8,9	N/A		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]		Config 1,2,3,4,5,6,7,8,9	N/A		Rough	
NR RF Channel Number		Config 1,2,3,4,5,6,7,8,9	1		2	
Duplex mode		Config 1,4,7	FDD		TDD	
		Config 2,3,5,6,8,9	TDD		TDD	
TDD configuration		Config 1,4,7	Not Applicable		TDDConf.3.1	
		Config 2,5,8	TDDConf.1.1		TDDConf.3.1	
		Config 3,6,9	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$	MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
		Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
		Config 4	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
		Config 5	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
		Config 6	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 66	
		Config 7	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
		Config 8	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
		Config 9	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 33	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
Data PRBs allocated			Config 1	52		66	
			Config 2	52		66	
			Config 3	106		66	
			Config 4	52		66	
			Config 5	52		66	
			Config 6	106		66	
			Config 7	52		33	
			Config 8	52		33	
			Config 9	106		33	
BWP BW		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
			Config 4	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 5	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 6	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 66	
			Config 7	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 8	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 9	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 33	
BWP configuration	Initial DL BWP		Config 1,2,3,4,5,6,7,8,9	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3,4,5,6,7,8,9	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4,7	SR.1.1 FDD		-	
			Config 2,5,8	SR.1.1 TDD			
			Config 3,6,9	SR.2.1 TDD			
RMSI CORESET Reference Channel			Config 1,4,7	CR.1.1 FDD		-	
			Config 2,5,8	CR.1.1 TDD			
			Config 3,6,9	CR.2.1 TDD			
Dedicated CORESET RMC configuration			Config 1,4,7	CCR.1.1 FDD		-	
			Config 2,5,8	CCR.1.1 TDD			
			Config 3,6,9	CCR.2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1,4,7	SMTC.2		SMTC.2	
			Config 2,3,5,6,8,9	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,4,5,7,8	15		120	
			Config 3,6,9	30		120	
EPRE ratio of PSS to SSS			Config 1,2,3,4,5,6,7,8,9	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
$\hat{E}_s$		dBm/SCS	Config 1,2,3			-Infinity	-87

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		Config 4,5,6			-Infinity	-81
		Config 7,8,9			-Infinity	-78
SSB_RP Note 3	dBm/SCS Note 5	Config 1,2,3			-Infinity	-87
		Config 4,5,6			-Infinity	-81
		Config 7,8,9			-Infinity	-78
$\hat{E}_s/I_{ot}$ BB Note 8	dB	Config 1,2,3,4,5,6,7,8,9	NA Link only, see clause A.3.7A		-Infinity	14.69
	dBm/95.04 MHz Note 5	Config 1,2,3,4,5,6,7,8,9			-Infinity	-58.01
Propagation Condition		Config 1,2,3,4,5,6,7,8,9			No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SS B_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.7.6.2.16.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,2,3

7.68 s (96*40 ms+96*40 ms) for UE supporting power class 1, or

4.8 s (60*40 ms + 60*40 ms) for UE supporting other power class.

For Configuration 4,5,6

11.52 s (192*40 ms+96*40 ms) for UE supporting power class 1, or

7.2 s (120*40 ms + 60*40 ms) for UE supporting other power class.

For Configuration 7,8,9

15.36 s (288*40 ms+96*40 ms) for UE supporting power class 1, or

9.6 s (180*40 ms + 60*40 ms) for UE supporting other power class.

In test 2, without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,2,3

3.84 s (96*20 ms+96*20 ms) for UE supporting power class 1, or

2.4 s (60*20 ms + 60*20 ms) for UE supporting other power class.

For Configuration 4,5,6

5.76 s (192*20 ms+96*20 ms) for UE supporting power class 1, or

3.6 s (120*20 ms + 60*20 ms) for UE supporting other power class.

For Configuration 7,8,9

7.68 s (288*20 ms+96*20 ms) for UE supporting power class 1, or

4.8 s (180*20 ms + 60*20 ms) for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.17 SA event triggered reporting tests for FR2-2 without SSB time index detection when DRX is used (PCell in FR1)

A.7.6.2.17.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2-2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.17.1-1, A.7.6.2.17.1-2, and A.7.6.2.17.1-3.

In test 1&2 per-UE measurement gap pattern configuration # 0 as defined in table A.7.6.2.17.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 no gap pattern is configured as defined in table A.7.6.2.17.1-2. If a UE supports per-FR gap it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.17.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.17.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
9	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.17.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2-2 without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
NR RF Channel Number		Config 1,2,3,4,5,6,7,8,9	1, 2				One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3,4,5,6,7,8,9	NR cell 1 (PCell)				NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6,7,8,9	NR cell 2				NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6,7,8,9	0		Gap not configured		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6,7,8,9	39		N/A		
SMTC-SSB parameters on NR RF Channel 1		Config 1,4,7	SSB.1 FR1				As specified in clause A.3.10.1
		Config 2,5,8	SSB.1 FR1				
		Config 3,6,9	SSB.2 FR1				
CSI-RS for tracking parameters on NR RF Channel 1		Config 1,4,7	TRS.1.1 FDD				
		Config 2,5,8	TRS.1.1 TDD				
		Config 3,6,9	TRS.1.2 TDD				
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2				As specified in clause A.3.10.2
		Config 4,5,6	SSB.11 FR2				
		Config 7,8,9	SSB.12 FR2				
offsetMO	dB	Config 1,2,3,4,5,6,7,8,9	6				
Hysteresis	dB	Config 1,2,3,4,5,6,7,8,9	0				
a4-Threshold	dBm	Config 1,2,3,4,5,6,7,8,9	-105				
CP length		Config 1,2,3,4,5,6,7,7,8,9	Normal				
TimeToTrigger	s	Config 1,2,3,4,5,6,7,8,9	0				
Filter coefficient		Config 1,2,3,4,5,6,7,8,9	0				L3 filtering is not used
DRX		Config 1,2,3,4,5,6,7,8,9	DRX.1	DRX.7	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,4,7	3 ms				Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3,5,6,8,9	3μs				Synchronous cells.
T1	s	Config 1,2,3,4,5,6,7,8,9	5				
T2	s	Config 1,2,3,4,5,6,7,8,9	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.7.6.2.17.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2-2 without SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6,7,8,9	NA		Setup 1 as specified in clause A.3.15	
NR RF Channel Number		Config 1,2,3,4,5,6,7,8,9	1		2	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
Duplex mode			Config 1,4,7	FDD		TDD	
			Config 2,3,5,6,8,9	TDD		TDD	
TDD configuration			Config 1,4,7	Not Applicable		TDDConf.3.1	
			Config 2,5,8	TDDConf.1.1		TDDConf.3.1	
			Config 3,6,9	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
			Config 4	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 5	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 6	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 66	
			Config 7	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 8	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 9	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 33	
Data PRBs allocated			Config 1	52		66	
			Config 2	52		66	
			Config 3	106		66	
			Config 4	52		66	
			Config 5	52		66	
			Config 6	106		66	
			Config 7	52		33	
			Config 8	52		33	
			Config 9	106		33	
BWP BW		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
			Config 4	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 5	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 6	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 66	
			Config 7	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 8	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 9	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 33	
BWP configuration	Initial DL BWP		Config 1,2,3,4,5,6,7,8,9	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3,4,5,6,7,8,9	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4,7	SR.1.1 FDD		-	
			Config 2,5,8	SR.1.1 TDD			
			Config 3,6,9	SR.2.1 TDD			
RMSI CORESET Reference Channel			Config 1,4,7	CR.1.1 FDD		-	
			Config 2,5,8	CR.1.1 TDD			
			Config 3,6,9	CR.2.1 TDD			
Dedicated CORESET RMC configuration			Config 1,4,7	CCR.1.1 FDD		-	
			Config 2,5,8	CCR.1.1 TDD			
			Config 3,6,9	CCR.2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1,4,7	SMTC.2		SMTC.2	
			Config 2,3,5,6,8,9	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,4,5,7,8	15		120	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		Config 3,6,9	30		120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6,7,8,9	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note 5		NA Link only, see clause A.3.7A		-104.7	
N_{oc} Note2	dBm/SCS Note 4	Config 1,2,3			-95.7	
		Config 4,5,6			-89.7	
		Config 7,8,9			-86.7	
SSB_RP Note 3	dBm/SCS Note 5	Config 1,2,3			-Infinity	-86.7
		Config 4,5,6			-Infinity	-80.7
		Config 7,8,9			-Infinity	-77.7
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6,7,8,9			-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6,7,8,9			-Infinity	9
Io Note3	dBm/95.04 MHz Note 5	Config 1,2,3,4,5,6,7,8,9			-66.7	-57.2
Propagation Condition		Config 1,2,3,4,5,6,7,8,9	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone

A.7.6.2.17.2 Test Requirements

In test 1 with per-UE gap and in test 3 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

For Configuration 1,2,3

11.52 s (96*40 ms*1.5 + 96*40 ms*1.5) for UE supporting power class 1, or

7.2 s (60*40 ms*1.5 + 60*40 ms*1.5) for UE supporting other power class.

For Configuration 4,5,6

17.28 s (192*40 ms*1.5 + 96*40 ms*1.5) for UE supporting power class 1, or

10.80 s (120*40 ms*1.5 + 60*40 ms*1.5) for UE supporting other power class.

For Configuration 7,8,9

23.04 s (288*40 ms*1.5 + 96*40 ms*1.5) for UE supporting power class 1, or

14.40 s (180*40 ms*1.5 + 60*40 ms*1.5) for UE supporting other power class.

In test 2 with per-UE gap and in test 4 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

For Configuration 1,2,3

122.80 s (96*640 ms + 96*640 ms) for UE supporting power class 1, or

76.80 s (60*640 ms + 60*640 ms) for UE supporting other power class.

For Configuration 4,5,6

184.32 s (192*640 ms + 96*640 ms) for UE supporting power class 1, or

115.20 s (120*640 ms + 60*640 ms) for UE supporting other power class.

For Configuration 7,8,9

245.76 s (288*640 ms + 96*640 ms) for UE supporting power class 1, or

153.60 s (180*640 ms + 60*640 ms) for UE supporting other power class.

In test 1, 2, 3 and 4 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.18 SA event triggered reporting tests for FR2-2 with SSB time index detection when DRX is not used (PCell in FR1)

A.7.6.2.18.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

n this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2-2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.18.1-1, A.7.6.2.18.1-2, and A.7.6.2.18.1-3.

In test 1 per-UE measurement gap pattern configuration # 0 as defined in table A.7.6.2.18.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement no gap pattern is configured as defined in table A.7.6.2.18.1-2. If the UE supports per-FR gap, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.18.1-1.

Table A.7.6.2.18.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell

1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
9	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.18.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2-2 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3,4,5,6,7,8,9	1, 2		One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3,4,5,6,7,8,9	NR cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6,7,8,9	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6,7,8,9	0	Gap not configured	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6,7,8,9	39	N/A	
SMTC-SSB parameters on NR RF Channel 1		Config 1,4,7	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2,5,8	SSB.1 FR1		
		Config 3,6,9	SSB.2 FR1		
CSI-RS for tracking parameters on NR RF Channel 1		Config 1,4,7	TRS.1.1 FDD		
		Config 2,5,8	TRS.1.1 TDD		
		Config 3,6,9	TRS.1.2 TDD		
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2		As specified in clause A.3.10.2
		Config 4,5,6	SSB.11 FR2		
		Config 7,8,9	SSB.12 FR2		
offsetMO	dB	Config 1,2,3,4,5,6,7,8,9	6		
Hysteresis	dB	Config 1,2,3,4,5,6,7,8,9	0		
a4-Threshold	dBm	Config 1,2,3,4,5,6,7,8,9	-105		
CP length		Config 1,2,3,4,5,6,7,8,9	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6,7,8,9	0		
Filter coefficient		Config 1,2,3,4,5,6,7,8,9	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6,7,8,9	OFF		DRX is not used
Time offset between serving and neighbour cells		Config 1,4,7	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3,5,6,8,9	3μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6,7,8,9	5		
T2	s	Config 1,2,3,4,5,6,7,8,9	5.2 for PC1; 3.5 for other PC	3 for PC1; 2 for other PC	

Table A.7.6.2.18.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2-2 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3,4,5,6,7,8,9	N/A		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]			Config 1,2,3,4,5,6,7,8,9	N/A		Rough	
NR RF Channel Number			Config 1,2,3,4,5,6,7,8,9	1		2	
Duplex mode			Config 1,4,7	FDD		TDD	
			Config 2,3,5,6,8,9	TDD		TDD	
TDD configuration			Config 1,4,7	Not Applicable		TDDConf.3.1	
			Config 2,5,8	TDDConf.1.1		TDDConf.3.1	
			Config 3,6,9	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
			Config 4	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 5	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 6	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 66	
			Config 7	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 8	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 9	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 33	
Data PRBs allocated			Config 1	52		66	
			Config 2	52		66	
			Config 3	106		66	
			Config 4	52		66	
			Config 5	52		66	
			Config 6	106		66	
			Config 7	52		33	
			Config 8	52		33	
			Config 9	106		33	
BWP BW		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
			Config 4	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 5	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 6	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 66	
			Config 7	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 8	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 9	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 33	
BWP configuration	Initial DL BWP		Config 1,2,3,4,5,6,7,8,9	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3,4,5,6,7,8,9	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4,7	SR.1.1 FDD		-	
			Config 2,5,8	SR.1.1 TDD			
			Config 3,6,9	SR.2.1 TDD			
RMSI CORESET Reference Channel			Config 1,4,7	CR.1.1 FDD		-	
			Config 2,5,8	CR.1.1 TDD			
			Config 3,6,9	CR.2.1 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Dedicated CORESET RMC configuration		Config 1,4,7	CCR.1.1 FDD		-	
		Config 2,5,8	CCR.1.1 TDD			
		Config 3,6,9	CCR.2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2		Config 1,4,7	SMTC.2		SMTC.2	
		Config 2,3,5,6,8,9	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5,7,8	15		120	
		Config 3,6,9	30		120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6,7,8,9	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
$\hat{E}_S$	dBm/SCS	Config 1,2,3			-Infinity	-87
		Config 4,5,6			-Infinity	-81
		Config 7,8,9	NA Link only, see clause A.3.7A		-Infinity	-78
SSB_RP Note 3	dBm/SCS Note 5	Config 1,2,3			-Infinity	-87
		Config 4,5,6			-Infinity	-81
		Config 7,8,9			-Infinity	-78
$\hat{E}_s / I_{ot}$ BB Note 8	dB	Config 1,2,3,4,5,6,7,8,9			-Infinity	14.69
	dBm/95.04 MHz Note 5	Config 1,2,3,4,5,6,7,8,9			-Infinity	-58.01
Propagation Condition		Config 1,2,3,4,5,6,7,8,9			No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SS B_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.7.6.2.18.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,2,3

10.56 s (96*40 ms+96*40 ms+72*40 ms) for UE supporting power class 1, or

6.72 s (60*40 ms + 60*40 ms+48*40 ms) for UE supporting other power class.

For Configuration 4,5,6

14.4 s (192*40 ms+96*40 ms+72*40 ms) for UE supporting power class 1, or

9.12 s (120*40 ms + 60*40 ms+48*40 ms) for UE supporting other power class.

For Configuration 7,8,9

18.24 s (288*40 ms+96*40 ms+72*40 ms) for UE supporting power class 1, or

11.52 s (180*40 ms + 60*40 ms+48*40 ms) for UE supporting other power class.

In test 2 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,2,3

5.28 s (96*20 ms+96*20 ms+72*20 ms)for UE supporting power class 1, or

3.36 s (60*20 ms + 60*20 ms+48*20 ms) for UE supporting other power class.

For Configuration 4,5,6

7.2 s (192*20 ms+96*20 ms+72*20 ms) for UE supporting power class 1, or

4.56 s (120*20 ms + 60*20 ms+48*20 ms) for UE supporting other power class.

For Configuration 7,8,9

9.12 s (288*20 ms+96*20 ms+72*20 ms) for UE supporting power class 1, or

5.76 s (180*20 ms + 60*20 ms+48*20 ms) for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.19 SA event triggered reporting tests for FR2-2 with SSB time index detection when DRX is used (PCell in FR1)

A.7.6.2.19.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2-2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.19.1-1, A.7.6.2.19.1-2, and A.7.6.2.19.1-3.

In test 1&2 per-UE measurement gap pattern configuration # 0 as defined in table A.7.6.2.19.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement no gap pattern is configured as defined in table A.7.6.2.19.1-2. If a UE supports per-FR gap , it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.19.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.19.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
9	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.19.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2-2 with SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
NR RF Channel Number		Config 1,2,3,4,5,6,7,8,9	1, 2				One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3,4,5,6,7,8,9	NR cell 1 (PCell)				NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6,7,8,9	NR cell 2				NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6,7,8,9	0		Gap not configured		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6,7,8,9	39		N/A		
SMTC-SSB parameters on NR RF Channel 1		Config 1,4,7	SSB.1 FR1				As specified in clause A.3.10.1
		Config 2,5,8	SSB.1 FR1				
		Config 3,6,9	SSB.2 FR1				
CSI-RS for tracking parameters on NR RF Channel 1		Config 1,4,7	TRS.1.1 FDD				
		Config 2,5,8	TRS.1.1 TDD				
		Config 3,6,9	TRS.1.2 TDD				
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2				As specified in clause A.3.10.2
		Config 4,5,6	SSB.11 FR2				
		Config 7,8,9	SSB.12 FR2				
offsetMO	dB	Config 1,2,3,4,5,6,7,8,9	6				
Hysteresis	dB	Config 1,2,3,4,5,6,7,8,9	0				
a4-Threshold	dBm	Config 1,2,3,4,5,6,7,8,9	-105				
CP length		Config 1,2,3,4,5,6,7,7,8,9	Normal				
TimeToTrigger	s	Config 1,2,3,4,5,6,7,8,9	0				
Filter coefficient		Config 1,2,3,4,5,6,7,8,9	0				L3 filtering is not used
DRX		Config 1,2,3,4,5,6,7,8,9	DRX.1	DRX.7	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,4,7	3 ms				Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
		Config 2,3,5,6,8,9	3μs				Synchronous cells.
T1	s	Config 1,2,3,4,5,6,7,8,9	5				
T2	s	Config 1,2,3,4,5,6,7,8,9	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.7.6.2.19.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2-2 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3,4,5,6,7,8,9	NA		Setup 1 as specified in clause A.3.15	
NR RF Channel Number			Config 1,2,3,4,5,6,7,8,9	1		2	
Duplex mode			Config 1,4,7	FDD		TDD	
			Config 2,3,5,6,8,9	TDD		TDD	
TDD configuration			Config 1,4,7	Not Applicable		TDDConf.3.1	
			Config 2,5,8	TDDConf.1.1		TDDConf.3.1	
			Config 3,6,9	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
			Config 4	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 5	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 6	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 66	
			Config 7	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 8	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 9	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 33	
Data PRBs allocated			Config 1	52		66	
			Config 2	52		66	
			Config 3	106		66	
			Config 4	52		66	
			Config 5	52		66	
			Config 6	106		66	
			Config 7	52		33	
			Config 8	52		33	
			Config 9	106		33	
BWP BW		MHz	Config 1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 2	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			Config 3	40: $N_{PRB,c}$ = 106		100: $N_{PRB,c}$ = 66	
			Config 4	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 5	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			Config 6	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 66	
			Config 7	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 8	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 33	
			Config 9	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 33	
BWP configuration	Initial DL BWP		Config 1,2,3,4,5,6,7,8,9	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3,4,5,6,7,8,9	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4,7	SR.1.1 FDD		-	
			Config 2,5,8	SR.1.1 TDD			
			Config 3,6,9	SR.2.1 TDD			
RMSI CORESET Reference Channel			Config 1,4,7	CR.1.1 FDD		-	
			Config 2,5,8	CR.1.1 TDD			
			Config 3,6,9	CR.2.1 TDD			
Dedicated CORESET RMC configuration			Config 1,4,7	CCR.1.1 FDD		-	
			Config 2,5,8	CCR.1.1 TDD			
			Config 3,6,9	CCR.2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1,4,7	SMTC.2		SMTC.2	
			Config 2,3,5,6,8,9	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,4,5,7,8	15		120	
			Config 3,6,9	30		120	
EPRE ratio of PSS to SSS			Config 1,2,3,4,5,6,7,8,9	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note 5		NA Link only, see clause A.3.7A		-104.7	
N_{oc} Note2		dBm/SCS Note 4	Config 1,2,3			-95.7	
			Config 4,5,6			-89.7	
			Config 7,8,9			-86.7	
SSB_RP Note 3		dBm/SCS Note 5	Config 1,2,3			-Infinity	-86.7
			Config 4,5,6			-Infinity	-80.7
			Config 7,8,9			-Infinity	-77.7
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3,4,5,6,7,8,9			-Infinity	9
$\hat{E}_s/N_{oc}$		dB	Config 1,2,3,4,5,6,7,8,9			-Infinity	9
Io Note3		dBm/95.04 MHz Note 5	Config 1,2,3,4,5,6,7,8,9			-66.7	-57.2
Propagation Condition			Config 1,2,3,4,5,6,7,8,9	AWGN			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SSB_RP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone						

A.7.6.2.19.2 Test Requirements

In test 1 with per-UE gap and in test 3 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

For Configuration 1,2,3

15.84 s (96*40 ms*1.5+96*40 ms*1.5+72*40 ms*1.5) for UE supporting power class 1, or

10.08 s (60*40 ms*1.5+60*40 ms*1.5+48*40 ms*1.5) for UE supporting other power class.

For Configuration 4,5,6

21.6 s (192*40 ms*1.5+96*40 ms*1.5+72*40 ms*1.5) for UE supporting power class 1, or

13.68 s (120*40 ms*1.5+60*40 ms*1.5+48*40 ms*1.5) for UE supporting other power class.

For Configuration 7,8,9

27.36 s (288*40 ms*1.5+96*40 ms*1.5+72*40 ms*1.5) for UE supporting power class 1, or

17.28 s (180*40 ms*1.5+60*40 ms*1.5+48*40 ms*1.5) for UE supporting other power class.

In test 2 with per-UE gap and in test 4 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

For Configuration 1,2,3

168.69 s (96*640 ms+96*640 ms+72*640 ms) for UE supporting power class 1, or

107.52 s (60*640 ms+60*640 ms+48*640 ms) for UE supporting other power class.

For Configuration 4,5,6

230.4 s (192*640 ms+96*640 ms+72*640 ms) for UE supporting power class 1, or

145.92 s (120*640 ms+60*640 ms+48*640 ms) for UE supporting other power class.

For Configuration 7,8,9

291.84 s (288*640 ms+96*640 ms+72*640 ms) for UE supporting power class 1, or

184.32 s (180*640 ms+60*640 ms+48*640 ms) for UE supporting other power class.

In test 1, 2, 3 and 4 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.20 SA event triggered reporting tests for FR2 with measurement gap with priority and two periodic MUSIM gaps configured

A.7.6.2.20.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event on an inter-frequency layer based on measurement performed within a measurement gap when the UE is configured with two periodic MUSIM gaps. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.20.1-1, A.7.6.2.20.1-2, and A.7.6.2.20.1-3.

The three gaps, including a measurement gap and two periodic MUSIM gaps, are configured with different priority levels. In this test, the measurement gap has the lowest priority level, and the 2nd MUSIM gap has the highest priority level (i.e., priority of 2nd MUSIM gap > 1 st MUSIM gap > measurement gap) as defined in table A.7.6.2.20.1-2.

NOTE: the signaling procedure to trigger the UE to request MUSIM gaps before the test equipment configures MUSIM gaps to the UE is left to comformance test implementation.

Measurement gap pattern configuration defined in table A.7.6.2.20.1-2 is provided for a UE.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.20.1-1.

Table A.7.6.2.20.1-1: Supported test configurations.

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.2.20.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
Measurement gap offset	ms	Config 1	17	
Measurement gap priority		Config 1	3	Lowest priority level
MUSIM gap #1 Pattern Id		Config 1	0	As specified in table 9.1.10-1
MUSIM gap #1 offset	ms	Config 1	10	
MUSIM gap #1 priority		Config 1	2	Second priority level
MUSIM gap #2 Pattern Id		Config 1	1	As specified in table 9.1.10-1
MUSIM gap #2 offset	ms	Config 1	3	
MUSIM gap #2 priority		Config 1	1	Highest priority level
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
offsetMO	dB	Config 1	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used

Parameter	Unit	Test configuration	Value	Comment
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	10.4 for PC1; 6.5 for other PC	

Table A.7.6.2.20.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam Assumption[Note 7]			1,2	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
$\hat{E}_s$		dBm/SCS	Config 1	-87	-87	-Infinity	-87
SSB_RP [Note 3]		dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$\hat{E}_s/I_{ot}$ BB Note 8	dB	Config 1	1.89	1.89	-Infinity	1.89
Io Note3	dBm/95.04 MHz Note 5	Config 1	-58.01	-58.01	-Infinity	-58.01
Propagation Condition		Config 1	No external noise (Note 9)		No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SSBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.7.6.2.20.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

10240 for UE supporting power class 1, or

6400 for UE supporting other power class.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.21 SA event triggered reporting tests for FR2 with measurement gap without priority and periodic MUSIM gap configured

A.7.6.2.21.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event on an inter-frequency layer based on measurement performed within measurement gaps, when UE is also configured with MUSIM gaps. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters are given in tables A.7.6.2.21.1-1, A.7.6.2.21.1-2 and A.7.6.2.21.1-3.

Measurement gap and MUSIM gap pattern configurations defined in table A.7.6.2.21.1-2 are provided to the UE. When UE does not support per-FR gap, measurement gap pattern configuration is provided for a per-UE gap. When UE supports per-FR gap, measurement gap pattern configuration is provided for a per-FR2 gap. MUSIM gap is configured with shorter MGRP than the configured measurement gap.

NOTE: The interaction between the test equipment and UE before configuring the MUSIM gap to the UE is left to comformance test implementation.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.7.6.2.21.1-1 Supported test configurations

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.2.21.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	1 for per-UE gap, 14 for per-FR gap	As specified in table 9.1.2-1.
Measurement gap offset		Config 1	39	
MUSIM gap Pattern Id		Config 1	0	As specified in table 9.1.10-1.
MUSIM gap offset	ms	Config 1	2	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
offsetMO	dB	Config 1	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	10.4 for PC1; 6.5 for other PC	

Table A.7.6.2.21.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam Assumption[Note 7]			1,2	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1	SR.3.1 TDD		-	
CORESET Reference Channel		Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2		Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1	120		120	
TRS configuration		Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS		Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
$\hat{E}_S$	dBm/SCS	Config 1	-87	-87	-Infinity	-87
SSB_RP Note 3	dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ BB Note 8	dB	Config 1	1.89	1.89	-Infinity	1.89
Io Note3	dBm/95.04 MHz Note 5	Config 1	-58.01	-58.01	-Infinity	-58.01
Propagation Condition		Config 1	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: VoidNOTE 3: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.2.21.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 10240 for a UE supporting power class 1,
- 6400 for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.22 SA event triggered reporting tests with SSB time index detection when DRX is not used (PCell in FR2) for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*

A.7.6.2.22.1 Test Purpose and Environment

The purpose of this test is to verify that the PC6 UE makes correct reporting of an event when UE supporting *measEnhCAInterFreqFR2-r18* is configured with *highSpeedMeasInterFreq-r17*. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR carrier 1(RF channel 1) and NR cell2 as neighbor cell in FR2 on NR carrier 2(RF channel 2). The test parameters and configurations are given in tables A.7.6.2.22.1-1, A.7.6.2.22.1-2, and A.7.6.2.22.1-3.

Measurement gap pattern configuration defined in table A.7.6.2.22.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Supported test configurations are shown in table A.7.6.2.22.1-1.

Table A.7.6.2.22.1-1: SA event triggered reporting tests with SSB index reading for FR2 power class 6 UE configured with highSpeedMeasFlagFR2-r17

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.2.22.1-2: General test parameters for SA inter-frequency event triggered reporting with SSB time index detection for R2 power class 6 UE configured with highSpeedMeasFlagFR2-r17

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Three FR2 NR carrier frequencies are used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
offsetMO	dB	Config 1	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
highSpeedMeasFlagFR2-r17		Config 1	Set 2	
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.

Parameter	Unit	Test configuration	Value	Comment
T1	s	Config 1	5	
T2	s	Config 1	4.5 for PC6	

Table A.7.6.2.22.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection for FR2 power class 6 UE configured with highSpeedMeasFlagFR2-r17

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam Assumption Note 7			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	N/A		DLBWP.0.1	
	Initial UL BWP			N/A		ULBWP.0.1	
	Dedicated DL BWP			N/A		DLBWP.1.1	
	Dedicated UL BWP			N/A		ULBWP.1.1	
OCNG Patterns defined in A.3.2.1.1			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
$\hat{E}_s$		dBm/SCS	Config 1	-87	-87	-Infinity	-87
SSB_RP Note 3		dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ BB Note 8		dB	Config 1	1.89	1.89	-Infinity	1.89
Io Note3		dBm/95.04 MHz Note5	Config 1	-58.01	-58.01	-Infinity	-58.01
Propagation Condition			Config 1	AWGN		AWGN 19444 Hz	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Void						
NOTE 3: SBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.6.2.22.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is 2160 ms according to the requirements defiend in table 9.3.4-9 and table 9.3.4-10 in clause 9.3.4

The UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.23 SA event triggered reporting tests without SSB time index detection when DRX is not used (PCell in FR2) for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17*

A.7.6.2.23.1 Test Purpose and Environment

The purpose of this test is to verify that the FR2 power class 6 UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements specified in clause 9.3.4 for a FR2 power class 6 UE supporting *measEnhCAInterFreqFR2-r18* and configured with *highSpeedMeasFlagFR2-r17*.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.2.23.1-1, A.7.6.2.23.1-2, and A.7.6.2.23.1-3.

The measurement gap pattern configuration defined in table A.7.6.2.23.1-2 applies to a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured to a UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are specified in table A.7.6.2.23.1-1.

Table A.7.6.2.23.1-1 Test configuration

Config	Description
	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.2.23.1-2: General test parameters

Parameter	Unit	Value	Comment
highSpeedMeasFlagFR2-r17		Set1	
Gap Pattern Id		13	As specified in clause 9.1.2-1.
Measurement gap offset		39	

SSB		SSB.3 FR2	As specified in clause A.3.10.2
offsetMO	dB	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	-11	
Hysteresis	dB	0	
CP length		Normal	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	DRX is not used
Time offset between serving and neighbour cells		3μs	Synchronous cells.
T1	s	5	
T2	s	4.5	

Table A.7.6.2.23.1-3: Cell specific test parameters

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup			Setup 3 as specified in clause A.3.15.3			
			AoA1		AoA2	
Beam Assumption[Note 1]			Rough		Rough	
NR RF Channel Number			1		2	
Duplex mode			TDD		TDD	
TDD configuration			TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			66		66	
BWP BW		MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		DLBWP.0.1		N/A	
	Initial UL BWP		ULBWP.0.1		N/A	
	Dedicated DL BWP		DLBWP.1.1		N/A	
	Dedicated UL BWP		ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1			OP.1		OP.1	
PDSCH Reference measurement channel			SR.3.1 TDD		-	
CORESET Reference Channel			CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	120		120	
TRS configuration			TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			TCI.State.2		N/A	
EPRE ratio of PSS to SSS			0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
$\hat{E}_s$		dBm/SCS	-87	-87	-Infinity	-87
SSB_RP		dBm/SCS	-87	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ BB [Note 2]		dB	1.89	1.89	-Infinity	1.89
Io		dBm/95.04 MHz	-58.01	-58.01	-Infinity	-58.01
Propagation Condition			AWGN		AWGN 19444 Hz [Note 3]	

NOTE 1: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

NOTE 2: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

NOTE 3: The AWGN 19444 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 19444 Hz.

A.7.6.2.23.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1 s from the beginning of time period T2.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.3 L1-RSRP measurement for beam reporting

A.7.6.3.1 SSB based L1-RSRP measurement when DRX is not used

A.7.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.7.6.3.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.7.6.3.1.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.1.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.6.3.1.2-1 and table A.7.6.3.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.7.6.3.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~4		66
PDSCH Reference measurement channel	1		SR.3.2 TDD
	2		SR.3.3 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
	2		CR.3.2 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
	2		CCR.3.7 TDD
SSB configuration	1		SSB.1 FR2
	2		SSB.2 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3

Parameter	Config	Unit	Value
			ULBWP.1.3
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		Off
reportConfigType	1~2		periodic
reportQuantity	1~2		ssb-Index-RSRP
Number of reported RS	1~2		2
L1-RSRP reporting period	1~2	slot	320
T1	1~2	s	5
T2	1~2	s	2
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam Assumption Note 4	1-2		Rough			
N_{oc} Note2	1~2	dBm/15 kHz	-105			
N_{oc} Note2	1	dBm/SSB SCS	-96			
	2		-93			
$\hat{E}_s/I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB_RP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84
Io Note3	1	dBm/95.04 MHz	-63.97	-63.97	-66.98	-57.47
	2		-63.97	-63.97	-66.98	-57.47
$\hat{E}_s/N_{oc}$	1~2	dB	0	0	-Infinity	9
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.6.3.1.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 1680 for UE supporting power class 1
- 1200 for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.3.2 SSB based L1-RSRP measurement when DRX is used

A.7.6.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.7.6.3.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.7.6.3.2.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.2.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.6.3.2.2-1 and table A.7.6.3.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.7.6.3.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~2		66
PDSCH Reference measurement channel	1		SR.3.2 TDD
	2		SR.3.3 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
	2		CR.3.2 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
	2		CCR.3.7 TDD
SSB configuration	1		SSB.1 FR2
	2		SSB.2 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		DRX.3
reportConfigType	1~2		periodic
reportQuantity	1~2		ssb-Index-RSRP
Number of reported RS	1~2		2
L1-RSRP reporting period	1~2	slot	320
T1	1~2	s	5
T2	1~2	s	3
EPRE ratio of PSS to SSS	1~2	dB	0

EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam Assumption Note 4	1-2		Rough			
N_{oc} Note2	1~2	dBm/15 kHz	-105			
N_{oc} Note2	1	dBm/SSB SCS	-96			
	2		-93			
$\hat{E}_s/I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB_RP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84
Io Note3	1	dBm/95.04 MHz	-63.97	-63.97	-66.98	-57.47
	2		-63.97	-63.97	-66.98	-57.47
$\hat{E}_s/N_{oc}$	1~2	dB	0	0	-Infinity	9
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.6.3.2.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 2880 for UE supporting power class 1
- 1920 for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.3.3 CSI-RS based L1-RSRP measurement when DRX is not used

A.7.6.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.7.6.3.3.1-1.

Table A.7.6.3.3.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.3.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.6.3.3.2-1 and table A.7.6.3.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 480 ms from the beginning of the test, the DCI trigger comes in slot 1 of a frame and UE provides the report back based on the reporting configuration as defined in table A.7.6.3.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.7.6.3.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1		freq1
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
CSI-RS configuration	1		CSI-RS.3.3 TDD
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1		SMTC.1
TRS Configuration	1		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2
DRX configuration	1		Off
reportConfigType	1		aperiodic
reportQuantity	1		cri-RSRP
Number of reported RS	1		2
qcl-Info	1		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1		8
Propagation condition	1		AWGN
T1	1	s	5
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.3.2-1: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1		Setup 1 according to A.3.15.1	
Beam Assumption Note 4	1		Rough	Rough
N_{oc} Note1	1	dBm/15 kHz	-105	
N_{oc} Note1	1	dBm/SSB SCS	-95.97	
$\hat{E}_s / I_{ot}$	1	dB	0	9
CSI-RS RSRP Note2	1	dBm/SSB SCS	-95.97	-86.97
Io Note2	1	dBm/95.04 MHz	-63.97	-57.47
$\hat{E}_s / N_{oc}$	1	dB	0	9

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.3.3.3 Test Requirements

After 480 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.20.1. The reported L1-RSRP value shall include the Rx antenna gain in the range of [-10 ~ +20] dB.

For absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1, the UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.6.3.3.3-1.

For relative accuracy of CSI-RS0 compared with CSI-RS1, the UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

Table A.7.6.3.3.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}

NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class

A.7.6.3.4 CSI-RS based L1-RSRP measurement when DRX is used

A.7.6.3.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.7.6.3.4.1-1.

Table A.7.6.3.4.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

A.7.6.3.4.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.6.3.4.2-1 and table A.7.6.3.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 1440 ms from the beginning of the test, the DCI trigger comes in slot 1 of a frame and UE provides the report back based on the reporting configuration as defined in table A.7.6.3.4.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.7.6.3.4.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1		freq1
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
CSI-RS configuration	1		CSI-RS.3.3 TDD
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1		SMTC.1
TRS Configuration	1		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2
DRX configuration	1		DRX.3
reportConfigType	1		aperiodic
reportQuantity	1		cri-RSRP
Number of reported RS	1		2
qcl-Info	1		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1		8
Propagation condition	1		AWGN
T1	1	s	5
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.4.2-1: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1		Setup 1 according to A.3.15.1	
Beam Assumption Note 4	1		Rough	Rough
N_{oc} Note1	1	dBm/15 kHz	-105	
N_{oc} Note1	1	dBm/SSB SCS	-95.97	

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
$\hat{E}_s/I_{ot}$	1	dB	0	9
CSI-RS RSRP Note2	1	dBm/SSB SCS	-95.97	-86.97
Io Note2	1	dBm/95.04 MHz	-63.97	-57.47
$\hat{E}_s/N_{oc}$	1	dB	0	9
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation				

A.7.6.3.3.3 Test Requirements

After 1440 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.20.1. The reported L1-RSRP value shall include the Rx antenna gain in the range of [-10 ~ +20] dB.

For absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1, the UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.6.3.4.3-1.

For relative accuracy of CSI-RS0 compared with CSI-RS1, the UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

Table A.7.6.3.4.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}
NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.7.6.3.5 SSB based L1-RSRP measurement when DRX is used for power class 6 UE configured with *highSpeedMeasFlagFR2-r17*

A.7.6.3.5.1 Test Purpose and Environment

The purpose of this test is to verify that the power class 6 UE makes correct reporting of L1-RSRP measurement when *highSpeedMeasFlagFR2-r17* is configured. This test will partly verify the L1-RSRP measurement requirements for power class 6 UE configured with *highSpeedMeasFlagFR2-r17* in clause 9.5.4.1, with the testing configurations for NR cells in table A.7.6.3.5.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.7.6.3.5.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test for power class 6 UE configured with *highSpeedMeasFlagFR2-r17*

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.5.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.6.3.5.2-1 and table A.7.6.3.5.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.7.6.3.5.2-1: General test parameters

Parameter	Config	Unit	Value
highSpeedMeasFlagFR2-r17	1~2		Set 1
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~2		66
PDSCH Reference measurement channel	1		SR.3.2 TDD
	2		SR.3.3 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
	2		CR.3.2 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
	2		CCR.3.7 TDD
SSB configuration	1		SSB.1 FR2
	2		SSB.2 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		DRX.3
reportConfigType	1~2		periodic
reportQuantity	1~2		ssb-Index-RSRP
Number of reported RS	1~2		2
L1-RSRP reporting period	1~2	slot	320
T1	1~2	s	5
T2	1~2	s	3
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN 19444 Hz
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.5.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam Assumption Note 4	1-2		Rough			
N_{oc} Note2	1~2	dBm/15 kHz	-105			

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1	dBm/SSB SCS	-96			
	2		-93			
$\hat{E}_s/I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB_RP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84
Io Note3	1	dBm/95.04 MHz	-63.97	-63.97	-66.98	-57.47
	2		-63.97	-63.97	-66.98	-57.47
$\hat{E}_s/N_{oc}$	1~2	dB	0	0	-Infinity	9

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.3.5.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than 480 ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -5 to [+44] dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.3.6 Inter-cell SSB based L1-RSRP measurements on FR2 SCell when DRX is not used

A.7.6.3.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.13.4.1, with the testing configurations for NR serving cell in table A.7.6.3.6.1-1.

The AoA setup of FR2 cell for this test is Setup 3 as defined in clause A.3.15.

Table A.7.6.3.6.1-1: Applicable NR configurations for inter-cell SSB based L1-RSRP test in FR2

Config	Description
1	NR PCell 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR PCell 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode NR SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	NR PCell 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	NR PCell 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR SCell 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5	NR PCell 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode NR SCell 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
6	NR PCell 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR SCell 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.6.2 Test parameters

There are two cells in the test, Cell 1 is the serving cell in CA, including a FR1 PCC and FR2 SCC. Cell 2 is a FR2 cell with different PCI from Cell 1. The test parameters for Cell 1 are given in table A.7.6.3.6.2-1. The test parameters for FR2 Cell (Cell 2) are given in table A.7.6.3.6.2-2 and table A.7.6.3.6.2-3.

SSB#0 and SSB#1 is transmitted on Cell 1 FR2 SCC and Cell 2.In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on SSB#0, and report measurement results periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. At the beginning of T2, SSB#1 starts transmission and the UE is configured for L1-RSRP measurement on SSB#1. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured in CSI-ReportConfig and *additionalPCIList* configured in *CSI-SSB-ResourceSet*.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD on Cell 1 in FR1 and perform L1-RSRP measurements on the SSB#0in FR2.

Table A.7.6.3.6.2-1: Cell specific test parameters for FR1 PCell

Parameter	Config	Unit	Value
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2,5		10: $N_{PRB,c}$ = 52
	3,6		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
OCNG Patterns	1~6		OP.1
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
CSI-RS for tracking	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
DRX configuration	1~6		Off
SSB index assigned as RLM RS	1~6		0,1
SSB Index assigned as BFD RS (q_0)	1~6		0
SSB Index assigned as CBD RS (q_1)	1~6		1
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note2	1~6	dBm/15 kHz	-104
$\hat{E}_s / I_{ot}$	1~6	dB	17
$\hat{E}_s / N_{oc}$	1~6	dB	17

Parameter	Config	Unit	Value
SS-RSRP Note3	1~6	dBm/15 kHz	-87
Io Note3	1,2,4,5	dBm/ 9.36 MHz	-58.96
	3,6	dBm/ 38.16 MHz	-52.86
Propagation condition	1~6		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled within $BW_{occupied}$.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.			

Table A.7.6.3.6.2-2: Cell specific test parameters for FR2 SCell

Parameter	Config	Unit	Value
SSB ARFCN	1~6		Freq2
Duplex mode	1~6		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~6	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~6		66
PDSCH Reference measurement channel	1,2,3		SR.3.2 TDD
	4,5,6		SR.3.3 TDD
RMSI CORESET Reference Channel	1,2,3		CR.3.1 TDD
	4,5,6		CR.3.2 TDD
Dedicated CORESET Reference Channel	1,2,3		CCR.3.1 TDD
	4,5,6		CCR.3.7 TDD
SSB configuration	1,2,3		SSB.1 FR2
	4,5,6		SSB.2 FR2
OCNG Patterns	1~6		OP.1
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~6		SMTC.1
TRS Configuration	1~6		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~6		TCI.State.2
DRX configuration	1~6		Off
reportConfigType	1~6		periodic
reportQuantity	1~6		ssb-Index-RSRP
Number of reported RS	1~6		2
SSB index associated to serving PCI	1~6		0
SSB index associated to a PCI different from serving cell	1~6		1
Timing offset between two SSBs associated to different PCI	1~6		<CP
L1-RSRP reporting period	1~6	slot	320
T1	1~6	s	5
T2	1~6	s	2
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.6.2-2: SSB specific test parameters for FR2 SCell

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration	1~6		Setup 3 according to A.3.15.3			
			AoA1		AoA2	
Beam Assumption Note 4	1~6		Rough		Rough	
N_{oc} Note2	1~6	dBm/15 kHz	-105		-105	
N_{oc} Note2	1~3	dBm/SSB SCS	-96		-96	
	4~6		-93		-93	
$\hat{E}_s/I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB_RP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84
Io Note3	1	dBm/95.04 MHz	-63.97	-63.97	-66.98	-57.47
	2		-63.97	-63.97	-66.98	-57.47
$\hat{E}_s/N_{oc}$	1~2	dB	0	0	-Infinity	9

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.3.6.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 2160 for UE supporting power class 1
- 1680 for UE supporting power class 2, 3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.3.7 SSB based L1-RSRP measurement for FR2-2 when DRX is used

A.7.6.3.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.7.6.3.7.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.7.6.3.7.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	NR 960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.7.2 Test parameters

There is one cells in the test, the FR2-2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.6.3.7.2-1 and table A.7.6.3.7.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.7.6.3.7.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~3		freq1
Duplex mode	1~3		TDD
TDD Configuration	1~3		TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66
	2		400: $N_{PRB,c}$ = 66
	3		400: $N_{PRB,c}$ = 33
Data PRBs allocated	1		66
	2		66
	3		33
PDSCH Reference measurement channel	1		SR.3.2 TDD
	2		TBD
	3		TBD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
	2		TBD
	3		TBD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
	2		TBD
	3		TBD
SSB configuration	1		SSB.1 FR2
	2		TBD
	3		TBD
OCNG Patterns	1~3		OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~3		SMTC.1
TRS Configuration	1~3		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~3		TCI.State.2
DRX configuration	1~3		DRX.3
reportConfigType	1~3		periodic
reportQuantity	1~3		ssb-Index-RSRP
Number of reported RS	1~3		2
L1-RSRP reporting period	1	slot	TBD
	2		TBD
	3		TBD
T1	1~3	s	5
T2	1~3	s	3
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.7.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam Assumption Note 4	1-2		Rough			
N_{oc} Note2	1~2	dBm/15 kHz	-105			
N_{oc} Note2	1	dBm/SSB SCS	-96			
	2		-93			
$\hat{E}_s/I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB_RP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84
Io Note3	1	dBm/95.04 MHz	-63.97	-63.97	-66.98	-57.47
	2		-63.97	-63.97	-66.98	-57.47
$\hat{E}_s/N_{oc}$	1~2	dB	0	0	-Infinity	9

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.3.7.3 Test Requirements

The UE shall send L1-RSRP report every TBD slots. No later than X ms plus TBD slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- TBD for UE supporting power class 1
- TBD for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.3.8 CSI-RS based L1-RSRP measurement when DRX is not used and when CD-SSB is outside active BWP

A.7.6.3.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement when CD-SSB is outside active BWP. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in table A.7.6.3.3.1-1.

The test is for UE supporting *rlm-BM-BFD-CSI-RS-OutsideActiveBWP-r18* and the UE is not required past legacy test in A.7.6.3.3.

The test environment is the same as in A.7.6.3.3 with following exceptions in table A.7.6.3.3.2-1.

The value of parameter “Dedicated BWP configuration” is DLBWP.1.2 and ULBWP.1.2.

NOTE: The starting PRB index of the SSB can be any possible PRB index of the RF channel BW occurring after the last PRB of the DL active BWP.

The test requirements are the same as in A.7.6.3.3.3.

A.7.6.3.9 SSB based L1-RSRP measurement when DRX is not used when CD-SSB is outside active BWP

A.7.6.3.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *bwpOperationMeasWithoutInterrupt-r18* makes correct reporting of L1-RSRP measurement when CD-SSB is outside active BWP. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.7.6.3.1.1-1.

The test environment is the same as in A.7.6.3.1 with following exceptions in table A.7.6.3.1.2-1.

Parameter	Config	Unit	Value
Dedicated BWP configuration	1~2		DLBWP.1.5 ULBWP.1.5

A.7.6.3.9.2 Test Requirements

The test requirements are the same as in A.7.6.3.1.3.

A.7.6.3.10 SSB based L1-RSRP measurement for UE supporting NCD-SSB based L1 measurement outside active BWP when DRX is not used

A.7.6.3.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in table A.7.6.3.10.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.7.6.3.10.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.10.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.6.3.10.2-1 and table A.7.6.3.10.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured. During time duration T1, the UE shall not have any timing information of NR cell 2.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.7.6.3.10.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~2		66
PDSCH Reference measurement channel	1		SR.3.2 TDD
	2		SR.3.3 TDD

Parameter	Config	Unit	Value
RMSI CORESET Reference Channel	1		CR.3.1 TDD
	2		CR.3.2 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
	2		CCR.3.7 TDD
CD-SSB configuration	1		SSB.1 FR2
	2		SSB.2 FR2
NCD-SSB configuration	1		SSB.x FR2
	2		SSB.y FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 RedCap ULBWP.1.1 RedCap
SMTC configuration for NCD-SSB	1~2		SMTC.2 RedCap
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		Off
reportConfigType	1~2		periodic
reportQuantity	1~2		ssb-Index-RSRP
Number of reported RS	1~2		2.1
L1-RSRP reporting period	1~2	slot	320
T1	1~2	s	5
T2	1~2	s	2
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: NCD-SSB is configured within dedicated BWP.			

Table A.7.6.3.10.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam Assumption Note 4	1-2		Rough			
N_{oc} Note2	1~2	dBm/15 kHz	-105			
N_{oc} Note2	1	dBm/SSB SCS	-96			
	2		-93			
$\hat{E}_s / I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB_RP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84
Io Note3	1	dBm/95.04 MHz	-63.97	-63.97	-66.98	-57.47
	2		-63.97	-63.97	-66.98	-57.47
$\hat{E}_s / N_{oc}$	1~2	dB	0	0	-Infinity	9
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.6.3.10.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- [3360] for UE supporting power class 1
- [2080] for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.3.11 SSB based L1-RSRP measurement when DRX is used for power class 6 UE supporting simultaneousReceptionTwoQCL-r18

A.7.6.3.11.1 Test Purpose and Environment

The purpose of this test is to verify that the power class 6 UE supporting *simultaneousReceptionTwoQCL-r18* makes correct reporting of L1-RSRP measurement when *highSpeedMeasFlagFR2-r17* is configured, and when *highSpeedDeploymentTypeFR2-r17* is configured as bidirectional. This test will partly verify the L1-RSRP measurement requirements for power class 6 UE configured with *highSpeedMeasFlagFR2-r17* for FR2 in clause 9.5.4.1 with the testing configurations for NR cells in table A.7.6.3.11.1-1.

Table A.7.6.3.11.1-1: Test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.11.2 Test parameters

There is one cell in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.6.3.11.2-1 and table A.7.6.3.11.2-2 below.

There are two SSBs configured in Cell 1. In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on two different QCL Type D SSBs simultaneously and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.7.6.3.11.2-1: General test parameters

Parameter	Config	Unit	Value
highSpeedMeasFlagFR2-r17	1~2		Set 2
highSpeedDeploymentTypeFR2-r17	1~2		bidirectional
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~2		24
PDSCH Reference measurement channel	1		SR.3.2 TDD

Parameter	Config	Unit	Value
	2		SR.3.3 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
	2		CR.3.2 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
	2		CCR.3.7 TDD
SSB configuration	1		SSB.1 FR2
	2		SSB.2 FR2
OCNG Patterns	1~2		OP.5
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		DRX.3
reportConfigType	1~2		periodic
reportQuantity	1~2		ssb-Index-RSRP
Number of reported RS	1~2		2
L1-RSRP reporting period	1~2	slot	320
T1	1~2	s	5
T2	1~2	s	3
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN 19444 Hz
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.11.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 4c as defined in clause A.3.15.4.X			
Beam Assumption Note 4	1-2		Rough			
N_{oc} Note2	1~2	dBm/15 kHz	-105			
N_{oc} Note2	1	dBm/SSB SCS	-96			
	2		-93			
$\hat{E}_s / I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB_RP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84
Io Note3	1	dBm/95.04 MHz	-68.37	-68.37	-71.38	-61.86
	2		-68.37	-68.37	-71.38	-61.86
$\hat{E}_s / N_{oc}$	1~2	dB	0	0	-Infinity	9
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.6.3.11.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than 880 ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0, SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -5 to +44 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.4 CLI measurements

A.7.6.4.1 SRS-RSRP measurement with non-DRX

A.7.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of SRS-RSRP measurement. This test will verify the SRS-RSRP measurement requirements in clause 9.7.2.5 with the testing configurations for NR cells in table A.7.6.4.1.1-1.

Table A.7.6.4.1.1-1: Applicable NR configurations for FR2 SRS-RSRP test

Configuration	Description
1	NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode

A.7.6.4.1.2 Test Parameters

One cell is deployed in the test, which is FR2 PCell (Cell 1). The test parameters for PCell is given in table A.7.6.4.1.2-1 ~ A.7.6.4.1.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system transmits SRS resource for measurement in the DL slot according to the SRS configuration in table A.7.6.4.1.2-4 and the test parameters for the (virtual) neighbour cell UE in table A. 7.6.4.1.2-3. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

Table A.7.6.4.1.2-1: General test parameters for SRS-RSRP event triggered reporting for PCell in FR2

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	
RF Channel Number		1	1: Cell 1	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC.1	
SRS configuration		1	SRSConf.1	Table A.7.6.4.1.2-4
CP length		1	Normal	
i1-Threshold	dBm	1	-103	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX	ms	1	OFF	Non-DRX
Time offset between DL from serving cell and SRS from test system	µs	1	10.67	
T1	s	1	5	
T2	s	1	1	

Table A.7.6.4.1.2-2: NR Cell specific test parameters for SA SRS-RSRP event triggered reporting for PCell in FR2

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1	TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	
OCNG Patterns		1	OP.1	
TRS configuration			TRS.2.1. TDD	
PDSCH/PDCCH TCI state		1	TCI.State.2	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1	
Propagation Condition		1	AWGN	

Table A.7.6.4.1.2-3: NR OTA Cell specific test parameters for SA SRS-RSRP event triggered reporting for PCell and neighbour cell UE in FR2

Parameter	Unit	Test configuration	Cell 1		Neighbour cell UE	
			T1	T2	T1	T2
AoA setup		1	Setup 1 defined in A.3.15.1			
Beam assumption Note 4		1	Fine			
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
N_{oc} Note 2	dBm/SCS	1	-89		-89	
$\hat{E}_s/I_{ot}$	dB	1	-	-	-infinity	4
$\hat{E}_s/N_{oc}$	dB	1	4	4	-infinity	4
SRS-RSRP Note 3	dBm/SCS kHz	1	-	-	-infinity	-94
Io	dBm/95.04 MHz	1	-61.36	-55.91	-70.01	-68.82

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.
Note 5 : Cell 2 doesn't transmit during the SRS and the 2 previous symbols. Es/NoC is not applied to those symbols.

Table A.7.6.4.1.2-4: SRS configuration for measurement reporting

	Field	SRSConf.1	Comments
SRS-ResourceSet	srs-ResourceSetId	0	
	srs-ResourceIdList	0	
	resourceType	Periodic	
	Usage	Codebook	
SRS-Resource	SRS-ResourceId	0	
	nrofSRS-Ports	Port1	
	transmissionComb	n2	
	combOffset-n2	0	
	cyclicShift-n2	0	
	resourceMapping startPosition	0	
	resourceMapping nrofSymbols	n1	
	resourceMapping repetitionFactor	n1	

	Field	SRSConf.1	Comments
	freqDomainPosition	0	
	freqDomainShift	0	
	freqHopping c-SRS	12	
	freqHopping b-SRS	0	
	freqHopping b-hop	0	
	groupOrSequenceHopping	Neither	
	resourceType	Periodic	
	periodicityAndOffset	sl40, 25	
	sequenceId	0	Any 10 bit number

A.7.6.4.1.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 60 ms from the beginning of time period T2.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.4.2 CLI-RSSI measurement with non-DRX

A.7.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of CLI-RSSI measurement. This test will verify the CLI-RSSI measurement requirements in clause 9.7.3.5 with the testing configurations for NR cells in table A.7.6.4.2.1-1.

Table A.7.6.4.2.1-1: Applicable NR configurations for FR2 CLI-RSSI test

Configuration	Description
1	NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode

A.7.6.4.2.2 Test Parameters

One cell is deployed in the test, which is FR2 PCell (Cell 1). The test parameters for PCell is given in table A.7.6.4.2.2-1 ~ A.7.6.4.2.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI measurement resource and on 2 data symbols before. The CLI-RSSI measurement resource configuration is in table A.7.6.4.2.2-4.

Table A.7.6.4.2.2-1: General test parameters for CLI-RSSI event triggered reporting for PCell in FR2

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	NR Cell 1	
RF Channel Number		1	1: Cell 1	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC.1	
CLI-RSSI configuration		1	CLI-RSSIConf.1	Table A.7.6.4.2.2-4
CP length		1	Normal	
i1-Threshold	dBm	1	-94.5	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	

Filter coefficient		1	0	L3 filtering is not used
DRX		1	OFF	Non-DRX
Time offset between DL from serving cell and OCNG from test system	μs	1	10.67	
T1	s	1	5	
T2	s	1	1	

Table A.7.6.4.2.2-2: NR Cell specific test parameters for CLI-RSSI event triggered reporting for PCell in FR2

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1	TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD	
PUSCH parameters		1	N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	
OCNG Patterns Note 1		1	OP.1	
TRS configuration			TRS.2.1. TDD	
PDSCH/PDCCH TCI state		1	TCI.State.2	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1	
Propagation Condition		1	AWGN	
NOTE 1: OCNG is not transmitted in the CLI-RSSI measurement resources.				

Table A.7.6.4.2.2-3: NR OTA Cell specific test parameters for CLI-RSSI event triggered reporting for PCell in FR2

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
AoA setup		1	Setup 1 defined in A.3.15.1	
Beam assumption Note 3		1	Fine	Fine
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/15 kHz	1	-119	-108
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/SCS	1	-110	-99
Io on CLI-RSSI measurement resource	dBm/95.04 MHz	1	-81.01	-70.01
Io on CLI-RSSI measurement resource	dBm/1.08 MHz	1	-100.46	-89.46
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.				

Table A.7.6.4.2.2-4: CLI-RSSI measurement resource configuration for measurement reporting

	Field	CLI-RSSIConf.1
RSSI-Resource	rssi-ResourceId	0
	rssi-SCS	120
	startPRB	0
	nrofPRBs	66
	startPosition	3
	nrofSymbols	11
	rssi-PeriodicityAndOffset	sl40, 25

A.7.6.4.2.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 5 ms from the beginning of time period T2. The nominal RSSI used to evaluate the requirement shall be based on Io.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.5 NR Measurements with autonomous gaps

A.7.6.5.1 SA interfrequency CGI reporting in autonomous gaps test (PCell in FR2)

A.7.6.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an CGI. This test will partly verify the SA inter-frequency NR cell search requirements in clause 8.2.1.2.16 and 9.11

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.5.1.1-1, A.7.6.5.1.1-2, and A.7.6.5.1.1-3.

Measurement gap patterns are configured. During T1 the UE shall report event A3 for cell 2. Within 3 seconds of the event report, the test equipment shall add a measurement reporting configuration using *ReportConfigNR* which containsa ReportCGI IE with cellForWhichToReportCGI set to the physical Cell ID of cell 2 and including the optional IE useAutonomousGaps-r16

In the measurement control information, it is indicated to the UE to decode the CGI of the neighbour cell using autonomous gaps. The test consists of two time phases, T1 and T2. Time period T2 begins when the last TTI containing the RRC message implying SI reading is sent to the UE.

Supported test configurations are shown in table A.7.6.5.1.1-1.

Table A.7.6.5.1.1-1 SA interfrequency CGI reporting test in autonomous gaps

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.5.1.1-2: General test parameters for SA interfrequency CGI reporting in autonomous gaps

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
SI-RNTI scheduling rate	ms		20 ms	S-RNTI scheduled on 8 occasions per 160 ms transmission period
A3-Offset	dB	Config 1	-15	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	

Parameter	Unit	Test configuration	Value	Comment
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	<10	UE expected to report event A3 for cell 2 within 5,2 s (PC1)or 3.5 s (other PC) of the start of T1. Test equipment shall configure CGI reporting within 3 s after receiving the event A3 report. T2 begins 10 ms after test equipment has transmitted the RRC reconfiguration to configure CGI reporting.
T2	s	Config 1	1	

Table A.7.6.5.1.1-3: Cell specific test parameters SA interfrequency CGI reporting in autonomous gaps

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam Assumption[Note 7]			Config 1	Rough			
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		Not sent	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
TCI configuration			Config 1	CSI-RS.Config.0		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note 5		-99.03		-99.03	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-90		-90	
SS-RSRP Note 3	dBm/SCS Note 5	Config 1	-87		-93	
$\hat{E}_s/I_{ot}$	dB	Config 1	3		-3	
$\hat{E}_s/N_{oc}$	dB	Config 1	3		-3	
Io Note3	dBm/95.04 MHz Note 5	Config 1	-56.25		-59.25	
Propagation Condition		Config 1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.5.1.2 Test Requirements

The UE shall report the CGI of cell 2 within 10 + 25*T_{smtc} + 6* $T_{RMSI\text{-}scheduling}$ +20 ms +2 ms= 652 ms from the start of T2, allow 655 ms. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE shall be scheduled continuously throughout the test, and from the start of T3 until 655 ms the number of interrupted slots shall not exceed the allowed number as defined in clause 8.2.2.2.14.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.6 L1-SINR measurement for beam reporting

A.7.6.6.1 L1-SINR measurement with CSI-RS based CMR and no dedicated IMR configured when DRX is not used

A.7.6.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements in clause 9.8.4.1, with the testing configurations for NR cells in table A.7.6.6.1.1-1.

Table A.7.6.6.1.1-1: Applicable NR configurations for FR2 CSI-RS based L1-SINR test

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.6.1.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.6.6.1.2-1 and table A.7.6.6.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources. After 160 ms from the beginning of the test, the DCI trigger comes in slot 8 of a frame and UE provides the report back based on the reporting configuration as defined in table A.7.6.6.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.7.6.6.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1		freq1
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
CSI-RS configuration	1		CSI-RS.3.3 TDD
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1		SMTC.1
TRS Configuration	1		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2
DRX configuration	1		Off
reportConfigType	1		aperiodic
reportQuantity	1		cri-SINR
reportQuantity-r16	1		cri-SINR-r16
Number of reported RS	1		2
qcl-Info	1		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1		26
Propagation condition	1		AWGN
T1	1	s	5
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.6.1.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1		Setup 1 according to A.3.15.1	
Beam assumption Note 3	1		Rough	
N_{oc} Note1	1	dBm/15 kHz	-105	
N_{oc} Note1	1	dBm/SSB SCS	-95.97	
$\hat{E}_s/I_{ot}$	1	dB	0	9
CSI-RS RSRP Note3	1	dBm/SSB SCS	-95.97	-86.97
Io Note2	1	dBm/95.04 MHz	-63.97	-57.47
$\hat{E}_s/N_{oc}$	1	dB	0	9

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.6.1.3 Test Requirements

After 160 ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.28.1.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.6.2 L1-SINR measurement with SSB based CMR and dedicated IMR when DRX is used

A.7.6.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements in clause 9.8.4.2, with the testing configurations for NR cells in table A.7.6.6.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.7.6.6.2.1-1: Applicable NR configurations for FR2 L1-SINR measurement test with SSB based CMR and CSI-IM based IMR

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.6.2.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.6.6.2.2-1 and table A.7.6.6.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the SSBs and the associated CSI-IM resources, and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD measurements based on the SSBs, and UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-IM resources as IMR.

Table A.7.6.6.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
	2		SSB.2 FR2
CSI-IM configuration	1~2		CSI-IM.3.1 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		DRX.3
reportConfigType	1~2		periodic
reportQuantity-r16	1~2		ssb-Index-SINR-r16
Number of reported RS	1~2		2
L1-SINR reporting period	1~2	slot	640
T1	1~2	s	5
T2	1~2	s	2
Propagation condition	1~2		AWGN
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.6.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam assumption Note 4	1~2		Rough			
N_{oc} Note2	1~2	dBm/15 kHz	-105			
N_{oc} Note2	1	dBm/SSB SCS	-96			
	2		-93			
$\hat{E}_s / I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB RSRP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Io Note3	1	dBm/95.04 MHz	-64	-64	-67	-57.5
	2		-64	-64	-67	-57.5
$\hat{E}_s / N_{oc}$	1~2	dB	0	0	-Infinity	9
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SSB RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.6.6.2.3 Test Requirements

The UE shall send L1-SINR report every 640 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-SINR report including the results for both SSB#0+CSI-IM#0 and SSB#1+CSI-IM#1 while meeting the accuracy requirements defined in clause 10.1.28.2, where X is

- 2880 for UE supporting power class 1
- 1920 for UE supporting power class 2,3 or 4**.**

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.6.3 L1-SINR measurement with CSI-RS based CMR and dedicated IMR configured when DRX is used

A.7.6.6.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements with CSI-RS based CMR and dedicated IMR cofigured in clause 9.8.4.3, with the testing configurations for NR cells in table A.7.6.6.3.1-1.

Table A.7.6.6.3.1-1: Applicable NR configurations for FR2 L1-SINR test with CMR and dedicated IMR

Config	Description
1	LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.6.3.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.6.6.3.2-1 and table A.7.6.6.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the configured CSI-RS as CMR and an associated CSI-RS as IMR, and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources and the associated IMR. UE is also configured to measure L1-SINR based on SSB. After 1440 ms from the beginning of the test, the DCI trigger comes in slot 8 of a frame and UE provides the report back based on the reporting configuration as defined in table A.7.6.6.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs, and UE is configured to perform L1-SINR measurement based on the CSI-RS as CMR and the CSI-RS as IMR.

Table A.7.6.6.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1		freq1
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
CSI-RS as CMR configuration	1		CSI-RS.3.3 TDD
CSI-RS as IMR configuration	1		CSI-RS.3.2A TDD
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1		SMTC.1
TRS Configuration	1		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2
DRX configuration	1		DRX.3
reportConfigType	1		aperiodic
reportQuantity-r16	1		cri-SINR-r16
Number of reported RS	1		2
qcl-Info	1		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1		26
T1	1	s	5
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1		AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.7.6.6.3.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1~2		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 3	1~2		Rough	
N_{oc} Note1	1~2	dBm/15 kHz	-105	
N_{oc} Note1	1~2	dBm/SSB SCS	-95.97	
$\hat{E}_s / I_{ot}$	1~2	dB	0	9
CSI-RS RSRP Note2	1~2	dBm/SSB SCS	-95.97	-86.97
Io Note2	1~2	dBm/95.04 MHz	-63.97	-57.47
$\hat{E}_s / N_{oc}$	1~2	dB	0	9

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 3: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.6.3.3 Test Requirements

After 1440 ms from the beginning of the test, the UE shall send L1-SINR report at slot 26 from the reception of DCI triggering the L1-SINR measurement. The L1-SINR report shall include the results for both CSI-RS#0 as CMR + CSI-RS#0 as IMR and CSI-RS#1 as CMR + CSI-RS#1 as IMR while meeting the accuracy requirement in clause 10.1.28.3. The reported L1-SINR value shall consider the Rx antenna gain in the range of [-10 ~ +20] dB when calculated.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.7 CSI-RS based intra-frequency Measurements

A.7.6.7.1 SA event triggered reporting test without gap under DRX for CSI-RS based intra-frequency measurement

A.7.6.7.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency measurement requirements in clause 9.10.2 and 9.10.3. Supported test configurations are shown in table A.7.6.7.1.1-1.

Table A.7.6.7.1.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB and CSI-RS SCS, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.7.1.1-2 ~ 6.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.7.1.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Value	Comment
			Test 1	
Active cell		1	PCell (Cell 1)	
Neighbour cell		1	Cell 2	Cell to be identified.
RF Channel Number		1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
CSI-RS resource configuration		1	CSI-RS.RRM.FR2.1 TDD	
A3-Offset	dB	1	-6	
CP length		1	Normal	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	

Filter coefficient		1	0	L3 filtering is not used
DRX		1	DRX.1	DRX related parameters are defined in table A.3.3
Time offset between Cell 1 and Cell 2	μs	1	0.58	The timing of Cell 2 is CP later than the timing of Cell 1.
T1	s	1	5	
T2	s	1	10	

Table A.7.6.7.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1	SSB		SSB	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		CCR.3.1 TDD	
TRS configuration		1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1	TCI.State.2		N/A	
OCNG Patterns		1	OP.1		OP.1	
SMTC		1	SMTC.1			
SSB		1	SSB.3 FR2		SSB.7 FR2	
CSI-RS		1	CSI-RS.RRM.FR2.1 TDD		CSI-RS.RRM.FR2.1 TDD except Associated SSB index = 1, slotConfig = ms20 (slot 2)	
Propagation Condition		1	AWGN			

Table A.7.6.7.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 defined in A.3.15.1			
Beam assumption[Note 4]		1	Fine		Fine	
$\hat{E}_s/I_{ot}$ for SSB	dB	1	4	-1.46	-Infinity	-1.46
$\hat{E}_s/I_{ot}$ for CSI-RS	dB	1	4	-1.46	-Infinity	-1.46
N_{oc} [Note 2]	dBm/15 KHz	1	-98			
N_{oc} [Note 2]	dBm/SCS	1	-86			
CSI-RSRP	dBm/SCS	1	-82	-82	-Infinity	-82
SS-RSRP	dBm/SCS	1	-82	-82	-Infinity	-82
$\hat{E}_s/N_{oc}$ for SSB	dB	1	4	4	-Infinity	4
$\hat{E}_s/N_{oc}$ for CSI-RS	dB	1	4	4	-Infinity	4
Io	dBm/95.04 MHz	1	-54.53	-52.18	-54.53	-52.18

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: CSI-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in B.2.1, and does not limit UE implementation or test system implementation.						

A.7.6.7.1.2 Test Requirements

In this test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

- 9.6 s for a UE supporting power class 1,
- 5.76 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.8 CSI-RS based inter-frequency Measurements

A.7.6.8.1 SA event triggered reporting tests for FR2 CSI-RS based measurement when non-DRX is used (PCell in FR2)

A.7.6.8.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event for CSI-RS based L3 measurement. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.10.3.5.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.8.1.1-1, A.7.6.8.1.1-2, and A.7.6.8.1.1-3.

In test measurement gap pattern configuration # 13 as defined in table A.7.6.8.1.1-2 is provided for UE.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.8.1.1-1.

Table A.7.6.8.1.1-1: SA event triggered reporting tests for CSI-RS based L3 measurement for FR2-FR2

Config	Description
1	120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.8.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 CSI-RS based L3 measurement

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
SMTC configuration		Config 1	SMTC.1	As specified in clause A.3.11
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells	μs	Config 1	0.58	The timing of Cell 2 is CP later than the timing of Cell 1.
T1	s	Config 1	5	
T2	s	Config 1	11 for PC1; 7 for other PC	

Table A.7.6.8.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 CSI-RS based L3 measurement

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
TCI configuration			Config 1	CSI-RS.Config.0		N/A	
CSI-RS configuration for RRM				-		CSI-RS.RRM.FR2.1 TDD	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note 5		-104.7		-104.7	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-95.7		-95.7	
CSI-RSRP Note 3	dBm/SCS Note 5	Config 1	-89.7	-89.7	-Infinity	-86.7
SS-RSRP Note 3	dBm/SCS Note 5	Config 1	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s/I_{ot}$ for SSB	dB	Config 1	6	6	-Infinity	9
$\hat{E}_s/I_{ot}$ for CSI-RS	dB	Config 1	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$ for SSB	dB	Config 1	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$ for CSI-RS	dB	Config 1	6	6	-Infinity	9
Io Note3	dBm/95.04 MHz Note 5	Config 1	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.

A.7.6.8.1.2 Test Requirements

In the test the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10880 for UE supporting power class 1, or

6720 for UE supporting other power class

The UE is required to read the SSB index indicated by associatedSSB in the neighbour cell in this test

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.9 RSTD measurements

A.7.6.9.1 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA

A.7.6.9.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 9.9.2 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

Supported test configurations are shown in table A.7.7.1.1-1. The test parameters are as given in table 7.6.7.1.1-2, table A.7.6.9.1.1-3 and , table A.7.6.9.1.1-4.

Table A.7.6.9.1.1-1: Supported test configurations for NR RSTD

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layers.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #13 before T2.

Table A.7.6.9.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.3 FR2	
SMTC configuration	Config 1		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1

Parameter		Unit	Value	Comment
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.1 FR2	As specified in clause A.3. 31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#13	GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			4	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup			Setup 1	As defined in A.3.15.1
Beam assumption			Rough	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.6.9.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter	Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number		1	1	1
Positiong frequency layer		1	1	1
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132	200: $N_{PRB,c}$ = 132	200: $N_{PRB,c}$ = 132
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1		OP.1	N/A	N/A
EPRE ratio of PSS to SSS	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				

Parameter		Unit	Cell 1	Cell 2	Cell 3
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 190.08 MHz	-53.99	-53.99	-53.99
SSB_RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$	Config 1	dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB_RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.7.6.9.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
$BW_{channel}$		MHz	200: $N_{PRB,c}$ = 132	200: $N_{PRB,c}$ = 132	200: $N_{PRB,c}$ = 132
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
EPRE ratio of PRS to SSS					
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
Io Note4	Config 1	dBm/ 190.08 MHz	-55.48	-55.48	-55.48
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
PRP Note 4		dBm/SCS	-94.45	-100.67	-100.67
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: PRP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.
NOTE 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

Table A.7.6.9.1.-5: Void

A.7.6.9.1.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 9.9.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 9.9.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.7.6.9.2 NR RSTD measurement reporting delay test case for dual positioning frequency layers in FR2 SA

A.7.6.9.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 9.9.2 in an environment with AWGN propagation conditions in FR2 in standalone scenario when dual positioning frequency layer is configured.

Supported test configurations are shown in table A.7.6.9.2.1-1. The test parameters are as given in table 7.6.7.2.1-2, table A.7.6.9.2.1-3 and table A.7.6.9.2.1-4.

Table A.7.6.9.2.1-1: Supported test configurations for NR RSTD

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the 2 RF channels distributed in dual positioning frequency layers.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #13 before T2.

Table A.7.6.9.2.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first place in the respective neighbour cell list in the DL-TDOA assistance data for two positioning frequency layers.
SSB configuration	Config 1		SSB.3 FR2	
SMTC configuration	Config 1		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.1 FR2	As specified in clause A.3.31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#13	GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index

Parameter	Unit	Value	Comment
Number of cells provided in DL-TDOA assistance data		4	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup		Setup 1	As defined in A.3.15.1
Beam assumption		Rough	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.6.9.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	2
Positiong frequency layer			1	1	2
$BW_{channel}$		MHz	200: $N_{PRB,c}$ = 132	200: $N_{PRB,c}$ = 132	200: $N_{PRB,c}$ = 132
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/190.08 MHz	-53.99	-53.99	-57.00
SSB_RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB_RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.7.6.9.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
RF Channel Number			1	1	2
Positiong frequency layer			1	1	2
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
EPRE ratio of PBCH DMRS to SSS		dB	0	0	0
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
EPRE ratio of PRS to SSS					
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.7	-11.9	-13
Io Note4	Config 1	dBm/ 190.08 MHz	-55.75	-55.75	-56.79
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
PRP Note 4		dBm/SCS kHz	-94.7	-100.9	-102
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: PRP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.
NOTE 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

Table A.7.6.9.2.1-5: Void

A.7.6.9.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 9.9.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 9.9.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.7.6.9.3 NR RSTD measurement reporting delay test case for single positioning frequency layer with reduced number of samples in FR2 SA

A.7.6.9.3.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 9.9.2 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured. In this test PRS is transmitted within the active BWP of the UE.

Supported test configurations are shown in table A.7.6.9.3.1-1. The test parameters are as given in table 7.6.9.3.1-2, table A.7.6.9.3.1-3 and table A.7.6.9.3.1-4.

Table A.7.6.9.3.1-1: Supported test configurations for NR RSTD

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layer.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request. UE can support *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED*, and the LMF indicates the UE to perform positioning measurements with reduced number of samples N_{sample} via *reducedDL-PRS-ProcessingSamples*.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #13 before T2.

Table A.7.6.9.3.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.2 FR2	
$BW_{channel}$	Config 1	MHz	200: $N_{PRB,c}$ = 132	
SMTC configuration	Config 1		SMTC.1	

Parameter		Unit	Value	Comment
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.2 FR2	As specified in clause A.3. 31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#13	GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			4	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup			Setup 1	As defined in A.3.15.1
Beam assumption			Rough	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.6.9.3.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.5 FDD	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity

Parameter		Unit	Cell 1	Cell 2	Cell 3
Io Note 4	Config 1	dBm/ 190.08 MHz	-54.00	-54.00	-54.00
SSB RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.7.6.9.3.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	1	-1.2	-1.2
Io	Config 1	dBm/ 190.08 MHz	-51.23	-51.23	-51.23
PRS $\hat{E}_s/I_{ot}$		dB	-3	-6	-6
PRP Note 4		dBm/SCS	-88	-90.2	-90.2
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T3) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: PRP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.
NOTE 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.9.3.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 9.9.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 9.9.1.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.7.6.9.4 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA without measurement gap

A.7.6.9.4.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the gapless RSTD measurement requirements specified in clause 9.9.2.7 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured. Reporting delay test for gapless PRS measurement is conducted assuming that the PRS has higher priority, i.e., state 1, than all other DL signals/channels and is transmitted within active DL BWP of UE. Two sub-tests are defined, sub-test 1 is for N_{sample} = 4 and sub-test 2 is for N_{sample} = 1. For sub-test 2 LMF indicates UE to perform PRS measurement with reduced number of samples N_{sample} via *reducedDL-PRS-ProcessingSamples*.

Supported test configurations are shown in table A.7.6.9.4.1-1. The test parameters are as given in table A.7.6.9.4.1-2, table A.7.6.9.4.1-3, and table A.7.6.9.4.1-4.

Table A.7.6.9.4.1-1: Supported test configurations for NR RSTD

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layers.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first PRS processing window instance containing the PRS resources.

The UE is configured with PPW before T2.

Table A.7.6.9.4.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
$BW_{channel}$	Config 1	MHz	200: $N_{PRB,c}$ = 132	
SSB configuration	Config 1		SSB.3 FR2	
SMTC configuration	Config 1		SMTC.1	

Parameter		Unit	Value	Comment
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.4. FR2	As specified in clause A.3. 31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
PPW configuration			Table A.3.33-1: Reference PPW configuration	As defined in A.3.33
Time offset between serving and neighbour cells		µs	set to the UE reported capability for receive time difference threshold if the UE reported value is < 3µs 3µs otherwise	PRS are transmitted from synchronous cells
Expected RSTD		µs	0	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	Same as time offset between serving and neighbour cells	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			4	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [24]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		ms	10	The length of the time interval that follows after time interval T1 and processing time of assistance data. In this test UE is configured to measure single PFL within the configured PPW.
AoA setup			Setup 1	As defined in A.3.15.1
Beam assumption			Rough	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.6.9.4.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.5 FDD	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-89		

Parameter		Unit	Cell 1	Cell 2	Cell 3
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 190.08 MHz	-54.00	-54.00	-54.00
SSB RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		
NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.					

Table A.7.6.9.4.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1		Cell 2		Cell 3	
			Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2
RF Channel Number			1		1		1	
Positiong frequency layer			1		1		1	
Correlation Matrix and Antenna Configuration			1x2 Low		1x2 Low		1x2 Low	
OCNG patterns defined in A.3.2.1			OP.1		OP.1		OP.1	
PRACH configuration			FR2 PRACH configuration 1		FR2 PRACH configuration 1		FR2 PRACH configuration 1	
N_{oc} Note 3	Config 1	dBm/SCS	-89		-89		-89	
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	1	-11.67	-1.2	-11.67	-1.2
Io	Config 1	dBm/ 9.36 MHz	dBm/ 19.08 MHz	-55.48	-51.23	-55.48	-51.23	-55.48
PRS $\hat{E}_s/I_{ot}$		dB	-6	-3	-13	-6	-13	-6
PRS-RSRP Note 4		dBm/SCS	-94.45	-88	-100.67	-90.2	-100.67	-90.2
Propagation Condition			AWGN					
NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS. NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 4: PRP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted. NOTE 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.								

A.7.6.9.4.2 Test Requirements

The RSTD measurement time fulfils the gapless RSTD measurement reporting delay requirements specified in clause 9.9.2.7.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 9.9.2.7 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.7.6.9.5 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA in RRC_CONNECTED state with Rx TEG

A.7.6.9.5.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the Rx TEG based measurement period requirements specified in clause 9.9.2.5 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

Supported test configurations are shown in table A.7.6.9.5.1-1. The test parameters are as given in table A7.6.9.5.1-2, table A.7.6.9.5.1-3 and, table A.7.6.9.5.1-4.

Table A.7.6.9.5.1-1: Supported test configurations for NR RSTD

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layer.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #13 before T2.

The test applies to the UE supporting Rx TEG indicated via *NR-UE-TEG-Capability* and is requested to provide the Rx TEG in the test via *nr-UE-RxTEG-Request-r17* in *NR-TDOA-RequestLocationInformation*. In the location request *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* is set to n0. The UE shall perform and optionally report the Rx TEG based RSTD measurements.

The UE is capable of performing Rx TEG based RSTD measurements. UE may or may not be able to receive same DL PRS resource from the same TRP simultaneously from multiple Rx TEGs.

Table A.7.6.9.5.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
$BW_{channel}$	Config 1	MHz	200: $N_{PRB,c}$ = 132	
SSB configuration	Config 1		SSB.3 FR2	
SMTC configuration	Config 1		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.4. FR2	As specified in clause A.3. 31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#13	GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			4	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		s	1.28*$k_{multiTEG}$ Note 1	The length of the time interval that follows immediately after time interval T1
AoA setup			Setup 1	As defined in A.3.15.1

Parameter	Unit	Value	Comment
Beam assumption		Rough	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 1: $k_{multiTEG}=\left\lceil \frac{N_{TEG}}{k_{TEG,simul}} \right\rceil$ if UE is capable of receiving the same DL PRS resource from the same TRP simultaneously from multiple Rx TEGs, where N_{TEG} is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource, and $k_{TEG,simul}$ is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.			

Table A.7.6.9.5.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.5 FDD	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 190.08 MHz	-54.00	-54.00	-54.00
SSB RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		
NOTE 1: OCNG shall be used such that active cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.					

Table A.7.6.9.5.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.44	-11.67	-11.67
Io	Config 1	dBm/ 190.08 MHz	-55.48	-55.48	-55.48
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
PRP Note 4		dBm/SCS	-94.44	-100.67	-100.67

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
Propagation Condition		AWGN		
NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.				
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.				
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 4: PRP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.				
NOTE 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.				

A.7.6.9.5.2 Test Requirements

The RSTD measurement time fulfils the Rx TEG based RSTD measurement period requirements specified in clause 9.9.2.5. The UE shall perform and report the Rx TEG based RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 9.9.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD1970049.

A.7.6.9.6 NR RSTD measurement reporting delay test case for PRS aggregation in FR2 SA in RRC_CONNECTED mode

A.7.6.9.6.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement performed by UE by aggregating PRS resources from multiple positioning frequency layers (PFLs) meets the requirements specified in clause 9.9.2.10 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

Supported test configurations are shown in table A.7.6.9.6.1-1.

Table A.7.6.9.6.1-1: Supported test configurations for NR RSTD

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth per PFL, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. Each cell is associated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel #1. In addition, all cells/TRPs transmit DL PRS in two intra-band contiguous PFLs in RF channel #1 and RF channel #2. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS resources on two positioning frequency layers during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The UE is capable of performing RSTD measurements by aggregating PRS resources from two PFLs and is configured by the LMF to perform measurements by aggregating the PRS resources from two positioning frequency layers via *nr-DL-PRS-JointMeasurementRequestedPFL-List*. The *NR-DL-TDOA-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2.

The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first measurement gap instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #13 before T2.

The general test parameters are listed in table A.7.6.9.6.1-2, and cell specific test parameters are listed in table A.7.6.9.6.1-3 during T1 and table A.7.6.9.6.1-4 during T2.

Table A.7.6.9.6.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.3 FR2	
SMTC configuration	Config 1		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 FDD	
PRS Configuration per PFL	Config 1		PRS.1.1 FR2	As specified in clause A.3.31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#13	GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured
Radio frame receive time offset between the cells at the UE antenna connector		μs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells

Expected RSTD	µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells	µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		3	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup		Setup 1	As defined in A.3.15.1
Beam assumption		Rough	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.6.9.6.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter	Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number		1	1	1
Positiong frequency layer		1	1	1
$BW_{channel}$	MHz	200: $N_{RB,c}$ = 132	200: $N_{RB,c}$ = 132	200: $N_{RB,c}$ = 132
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1		OP.1	N/A	N/A
EPRE ratio of PSS to SSS	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				

N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 190.08MHz	-53.99	-53.99	-53.99
SSB_RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$	Config 1	dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.

Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 4: SSB_RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.7.6.9.6.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
RF Channel Number NOTE 6		1,2	1,2	1,2
Positioning frequency layer (PFL)		1,2	1,2	1,2
$BW_{channel}$ per PFL	MHz	200: $N_{RB,c}$ = 132	200: $N_{RB,c}$ = 132	200: $N_{RB,c}$ = 132
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1		OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				

EPRE ratio of OCNG to OCNG DMRS (Note 1) EPRE ratio of PRS to SSS					
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
Io Note4	Config 1	dBm/ 190.08MHz per PFL	-55.48	-55.48	-55.48
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
PRP Note 4		dBm/SCS	-94.45	-100.67	-100.67
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.

Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 4: PRP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.

Note 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

Note 6: Carriers are intra-band and contiguous to each other.

A.7.6.9.6.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 9.9.2.10.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 9.9.2.10 starting from the beginning of time interval T2.

***NOTE**: The actual overall delays measured in the test may be up to 2×TTI_{DCCH} higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.*

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23A.2, i.e., between RSTD_000000000 and RSTD_126083073.

A.7.6.10 PRS-RSRP measurements

A.7.6.10.1 PRS-RSRP reporting delay test case for single positioning frequency layer

A.7.6.10.1.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in clause 9.9.3.5 for single positioning frequency layer under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.7.6.10.1.1-1

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.6.10.1.1-2, and table A.7.6.10.1.1-3.

Table A.7.6.10.1.1-1: supported test configurations for PRS RSRP measurement for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.6.10.1.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		Config 1	GP#13 or GP#24[Note1]	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
Number of cells provided in assistance data		Config 1	4	Including the reference cell
T1	s	Config 1	5	
T2	s	Config 1	7	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.7.6.10.1.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]		Config 1	Rough		Rough	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting configuration			Config 1	'10'		'01'	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2		dBm/SCS Note 4	Config 1	-89		-89	
SSB_RP Note 3		dBm/SCS Note 5	Config 1	-91	-91	-Infinity	-99
PRP Note 3		dBm/SCS Note 5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$		dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$		dB	Config 1	-Infinity	-2	-Infinity	-10
SSB $\hat{E}_s/N_{oc}$		dB	Config 1	-2	-2	-Infinity	-10
Io Note3		dBm/190.08 MHz Note 5	Config 1	-54.88	-54.62	-54.88	-54.62
Propagation Condition			Config 1	AWGN			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.						
NOTE 3: SSB_RP/PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.6.10.1.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 9.9.3.5.The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9.3.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90 %, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1.24.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

A.7.6.10.2 PRS-RSRP reporting delay test case for dual positioning frequency layer

A.7.6.10.2.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in clause 9.9.3.5 for dual positioning frequency layers under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.7.6.10.2.1-1

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the different frequency from the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.6.10.2.1-2, and table A.7.6.10.2.1-3.

Table A.7.6.10.2.1-1: supported test configurations for PRS RSRP measurement for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.6.10.2.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		Config 1	GP#13 or GP#24[Note1]	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3µs	Synchronous cells.
Expected RSTD	µs	Config 1	3	
Expected RSTD uncertainty	µs	Config 1	5	
Number of cells provided in assistance data		Config 1	4	Including the reference cell
T1	s	Config 1	5	
T2	s	Config 1	7	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.7.6.10.2.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.1 FR2		PRS.1.2 FR2	
PRS muting configuration			Config 1	‘10’		‘01’	
EPRE ratio of PSS to SSS							
EPRE ratio of PBCH DMRS to SSS							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PBCH to PBCH DMRS		Config 1	0		0	
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-89		-89	
SSB_RP Note 3	dBm/SCS Note 5	Config 1	-92	-92	-Infinity	-102
PRP Note 3	dBm/SCS Note 5	Config 1	-Infinity	-92	-Infinity	-102
PRS $\hat{E}_s/I_{ot}$	dB	Config 1	-Infinity	-3	-Infinity	-13
PRS $\hat{E}_s/N_{oc}$	dB	Config 1	-Infinity	-3	-Infinity	-13
SSB $\hat{E}_s/N_{oc}$	dB	Config 1	-3	-3	-Infinity	-13
Io Note3	dBm/190.08 MHz Note 5	Config 1	-55.24	-55.24	-57.00	-56.79
Propagation Condition		Config 1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP/PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.10.2.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 9.9.3.5.The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9.3.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90 %, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1.24.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

A.7.6.10.3 PRS-RSRP reporting delay test case for reduced number of samples

A.7.6.10.3.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements for reduced number of samples specified in clause 9.9.3.5 for single positioning frequency layer under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.7.6.10.3.1-1. In this test PRS is transmitted within the active BWP of the UE.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. UE can support *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED*, and the LMF indicates the UE to perform positioning measurements with reduced number of samples N_{sample} via *reducedDL-PRS-ProcessingSamples.*

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.6.10.3.1-2, and table A.7.6.10.3.1-3.

Table A.7.6.10.3.1-1: supported test configurations for PRS RSRP measurement for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.6.10.3.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		Config 1	GP#13 or GP#24[Note1]	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
Number of cells provided in assistance data		Config 1	4	Including the reference cell
T1	s	Config 1	5	
T2	s	Config 1	7	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.7.6.10.3.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP BW		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS BW			Config 1	48 PRBs		48 PRBs	
PRS muting configuration			Config 1	'10'		'01'	
EPRE ratio of PSS to SSS		dB	Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
EPRE ratio of PRS to SSS							
N_{oc} Note2		dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2		dBm/SCS Note 4	Config 1	-89		-89	
PRS-RSRP Note 3		dBm/SCS Note 5	Config 1	-Infinity	-86.77	-Infinity	-90.73
PRS $\hat{E}_s/I_{ot}$		dB	Config 1	-Infinity	0	-Infinity	-6
PRS $\hat{E}_s/N_{oc}$		dB	Config 1	-Infinity	2.23	-Infinity	-1.73
Io Note3		dBm/190.08 MHz Note 5	Config 1	-51.76		-51.76	
Propagation Condition			Config 1	AWGN			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: PRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.6.10.3.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 9.9.3.5. The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9.3.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90 %, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1.24.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

A.7.6.10.4 PRS-RSRP reporting delay test case for single positioning frequency layer outside MG

A.7.6.10.4.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement outside MG requirements specified in clause 9.9.3.6 for single positioning frequency layer under AWGN propagation conditions in standalone scenario. There are two sub-tests in the test, sub-test 1 is to verify the delay requirements with Nsample=1, and sub-test 2 is to verify the delay requirements with Nsample=4.

Supported test configurations are shown in table A.7.6.10.4.1-1

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In sub-test 1, *reducedDL-PRS-ProcessingSamples* shall be included in the location information request and set to '*requested*', and *lowerRxBeamSweepingThan8-FR2* shall be included.

During T1, a PPW shall be configured for the PCell and be activated via DL MAC CE. The last PDSCH containing the MAC CE shall be transmitted before slot #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first PPW instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are as given in table A.7.6.10.4.1-2, and cell specific test parameters during T2 are listed in table A.7.6.10.4.1-3.

Table A.7.6.10.4.1-1: supported test configurations for PRS RSRP measurement for FR2

Config	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.6.10.4.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR Cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
PPW configuration		Config 1	PPW.1	As specified in clause A.3.33
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
CP length		Config 1	Normal	
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells	µs	Config 1	0.58, 2.0 or 3 Note 1	
Expected RSTD	µs	Config 1	0	
Expected RSTD uncertainty	µs	Config 1	Same as time offset between serving and neighbour cells	
Number of cells provided in assistance data		Config 1	4	Including the reference cell
T1	s	Config 1	5	
T2	s	Config 1	7	
NOTE 1: If UE indicates support of CP length for the receive time difference threshold, the time offset is set to 0.58 us; If UE indicates support of 1/4 symbol length for the receive time difference threshold, the time offset is set to 2.0 us, otherwise 3 us.				

Table A.7.6.10.4.1-3: Cell-specific test parameters during T2 for PRS RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP BW		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.4 FR2		PRS.1.4 FR2	
PRS muting configuration			Config 1	‘10’		‘01’	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2
EPRE ratio of PSS to SSS		Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-89		-89	
SS-RSRP Note 3	dBm/SCS Note 5	Config 1	-89	-89	-89	-89
PRS-RSRP Note 3	dBm/SCS Note 5	Config 1	-86.77	-91	-90.73	-99
PRS $\hat{E}_s/I_{ot}$	dB	Config 1	0	-2.41	-6	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	Config 1	2.23	-2	-1.73	-10
Io Note3	dBm/190.08 MHz Note 5	Config 1	-51.76	-54.62	-51.76	-54.62
Propagation Condition		Config 1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.10.4.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 9.9.3.6, with Nsample=1 for sub-test 1 and Nsample=4 for sub-test 2. The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9.3.6 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90 %, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1.24.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

A.7.6.11 UE Rx-Tx time difference measurements

A.7.6.11.1 UE Rx-Tx time difference measurements for single positioning frequency layer in FR2 SA

A.7.6.11.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 9.9.4.5 in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations in listed in table A.7.6.11.1.1-1.

Table A.7.6.11.1.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID #13 or ID #24 before T2.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.7.6.11.1.1-2 and table A.7.6.11.1.1-3 respectively.

Table A.7.6.11.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	200: $N_{PRB,c} = 132$	
SSB configuration		1	SSB.2 FR2	
SMTC configuration		1	SMTC.1	
Measurement gap		1	GP#24 or GP#13 Note 1	
CP length		1	Normal	
DRX		1	OFF	
Time offset between serving and neighbour cells	µs	1	3	Synchronous cells
Expected RSTD	µs	1	3	
Expected RSTD uncertainty	µs	1	5	
Number of cells provided in assistance data		1	4	Including the reference cell
T1	s	1	5	
T2	s	1	20	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.7.6.11.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS[Note 1]						
EPRE ratio of OCNG to OCNG DMRS [Note 1]						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting info		1	‘10’		‘01’	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} [Note 2]	dBm/SCS	1	-89			
N_{oc} [Note 2]	dBm/15 kHz	1	-98			
PRS $\hat{E}_s / I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s / N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
PRP [Note 3]	dBm/SCS kHz	1	-Infinity	-91	-Infinity	-99
Io	dBm/190.08 MHz	1	N/A	-54.62	N/A	-54.62
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

Table Table A.7.6.11.1.1-4: Void

A.7.6.11.1.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.7.6.11.2 UE Rx-Tx time difference measurement period for dual positioning frequency layers in FR2 SA

A.7.6.11.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 9.9.4.5 in AWGN propagation condition in FR2 in standalone scenario when dual positioning frequency layers are cnfigured.

The supported test configurations in listed in table A.7.6.11.2.1-1.

Table A.7.6.11.2.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on different RF channels in FR2.

transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID #13 or ID #24 before T2.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.7.6.11.2.1-2 and table A.7.6.11.2.1-3 respectively.

Table A.7.6.11.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1	1	For Cell 1
RF Channel Number		1	2	For Cell 2
$BW_{channel}$	MHz	1	200: $N_{PRB,c} = 132$	
SSB configuration		1	SSB.2 FR2	
SMTC configuration		1	SMTC.1	
Measurement gap		1	GP#24 or GP#13 Note 1	
CP length		1	Normal	

Parameter	Unit	Test configuration	Value	Comment
DRX		1	OFF	
Time offset between serving and neighbour cells	µs	1	3	Synchronous cells
Expected RSTD	µs	1	3	
Expected RSTD uncertainty	µs	1	5	
Number of cells provided in assistance data		1	4	Including the reference cell
T1	s	1	5	
T2	s	1	20	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.7.6.11.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS[Note 1]						
EPRE ratio of OCNG to OCNG DMRS [Note 1]						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting info		1	‘10’		‘01’	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} [Note 2]	dBm/SCS	1	-89			
N_{oc} [Note 2]	dBm/15 kHz	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-13
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-3	-Infinity	-13
PRP [Note 3]	dBm/SCS kHz	1	-Infinity	-92	-Infinity	-102
Io	dBm/190.08 MHz	1	N/A	-55.24	N/A	-56.79
Propagation Condition		1	AWGN			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

Table Table A.7.6.11.1.1-4: Void

A.7.6.11.2.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.7.6.11.3 UE Rx-Tx time difference measurements for single positioning frequency layer in FR2 SA with reduced sample number

A.7.6.11.3.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 9.9.4.5 with Nsample = 1 in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured. In this test PRS is transmitted within the active BWP of the UE. UE can support *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED*, and the LMF indicates the UE to perform positioning measurements with reduced number of samples N_{sample} via *reducedDL-PRS-ProcessingSamples*.

The supported test configurations are listed in table A.7.6.11.3.1-1.

Table A.7.6.11.3.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID #13 or ID #24 before T2.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.7.6.11.3.1-2 and table A.7.6.11.3.1-3 respectively.

Table A.7.6.11.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	200: $N_{PRB,c}$ = 132	
SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC.1	
Measurement gap		1	GP#24 or GP#13 Note 1	
CP length		1	Normal	
DRX		1	OFF	
Time offset between serving and neighbour cells	μs	1	3	Synchronous cells
Number of cells provided in assistance data		1	4	Including the reference cell
T1	s	1	5	
T2	s	1	20	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.7.6.11.3.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS BW			64 PRBs		64 PRBs	
PRS muting info		1	'10'		'01'	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
N_{oc} Note 2	dBm/15 kHz	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	0	-Infinity	-6
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	2.23	-Infinity	-1.73
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-86.77	-Infinity	-90.73

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Io	dBm/190.08 MHz	1	N/A	-51.76	N/A	-51.76
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP, PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.11.3.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.5 with Nsample=1.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.7.6.11.4 UE Rx-Tx time difference measurements without gaps in FR2 SA

A.7.6.11.4.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 9.9.4.6 in AWGN propagation condition in FR2 in standalone scenario. There are two sub-tests in the test, sub-test 1 is to verify the delay requirements with Nsample=1, and sub-test 2 is to verify the delay requirements with Nsample=4.

The supported test configurations are listed in table A.7.6.11.4.1-1.

Table A.7.6.11.4.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of PRS processing window containing the PRS resources.

The UE is configured with PRS processing window before T2.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.7.6.11.4.1-2 and table A.7.6.11.4.1-3 respectively.

Table A.7.6.11.4.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	200: $N_{PRB,c}$ = 132	
SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC.1	
PRS processing window		1	Table A.3.33-1: Reference PPW configuration	As defined in A.3.33
CP length		1	Normal	
DRX		1	OFF	
Time offset between serving and neighbour cells	µs	1	0.58, 2.25 or 3 Note 1	
Expected RSTD	µs	1	0	
Expected RSTD uncertainty	µs	1	Same as time offset between serving and neighbour cells	
Number of cells provided in assistance data		1	4	Including the reference cell
T1	s	1	5	
T2	s	1	20	

NOTE 1: The value is up to the UE capability. The possible UE capability value: (1/4 symbol, 1/2 symbol, CP length, half of slot). When the UE reported value is > 3 us, the time offset between serving and neighbour cells is set to 3 us; when the UE reported value is < 3 us, the time offset between serving and neighbour cells is set to the UE reported value.

Table A.7.6.11.4.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			Sub-test 1	Sub-test 2	Sub-tets 1	Sub-test 2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS BW		1	64PRBs	64 PRBs	64 PRBs	64 PRBs
PRS muting info		1	‘10’		‘01’	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			Sub-test 1	Sub-test 2	Sub-tets 1	Sub-test 2
N_{oc} Note 2	dBm/15 kHz	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	0	-2.41	-6	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	2.23	-2	-1.73	-10
PRS-RSRP Note 3	dBm/SCS kHz	1	-86.77	-91	-90.73	-99
Io	dBm/190.08 MHz	1	-51.76	-54.62	-51.76	-54.62
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.11.4.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.6.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.7.6.11.5 UE Rx-Tx time difference measurements for single positioning frequency layer in FR2 SA with RxTx TEG

A.7.6.11.5.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 9.9.4.5 in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured, and when UE is requested to measure a PRS resource with RxTx TEG.

The supported test configurations are listed in table A.7.6.11.5.1-1.

Table A.7.6.11.5.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The test applies to the UE supporting RxTx TEG indicated via *NR-UE-TEG-Capability* and is requested to provide the RxTx TEG in the test via *nr-UE-RxTxTEG-Request-r17* in *nr-Multi-RTT-RequestLocationInformation*. The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request. In *nr-Multi-RTT-RequestLocationInformation, measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* shall be set to 'n2'.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID #13 or ID #24 before T2.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.7.6.11.5.1-2 and table A.7.6.11.5.1-3 respectively.

Table A.7.6.11.5.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	200: $N_{PRB,c}$ = 132	
SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC.1	
Measurement gap		1	GP#24 or GP#13 Note 1	
CP length		1	Normal	
DRX		1	OFF	
Time offset between serving and neighbour cells	µs	1	3	Synchronous cells
Number of cells provided in assistance data		1	4	Including the reference cell
T1	s	1	5	
T2	s	1	20	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.7.6.11.5.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting info		1	'10'		'01'	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			

N_{oc} Note 2	dBm/15 kHz	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-91	-Infinity	-99
Io	dBm/190.08 MHz	1	N/A	-54.62	N/A	-54.62
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.11.5.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.5, with $k_{multiTEG}$=2 if UE does not support or indicate value 'n1' for *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*, and $k_{multiTEG}$=1 otherwise.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.7.6.11.6 UE Rx-Tx time difference measurements with PRS bandwidth aggregation in FR2 SA

A.7.6.11.6.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 9.9.4.9 for UE Rx-Tx measurements with PRS bandwidth aggregation. The tests are conducted under AWGN propagation condition with the UE operating in FR2 stand-alone mode and configured to perform UE Rx-Tx measurements by aggregating two intra-band contiguous positioning frequency layers (PFLs) in FR2.

The supported test configurations in listed in table A.7.6.11.6.1-1.

Table A.7.6.11.6.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: Cell 1 (PCell) and Cell 2 (neighbor cell). Each cell is sssociated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel

#1. In addition, both cells/TRPs transmit DL PRS in two intra-band contiguous PFLs in RF channel #1 and RF channel #2. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 transmit PRS only during the second time interval of duration T2. Similarly, the UE is configured to transmit positioning SRS during only during the second time interval of duration T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request.

The *NR-Multi-RTT-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2.

The *NR-Multi-RTT-RequestLocationInformation* message provided to the UE must request bandwidth aggregated measurements via *jointMeasurementsReq* and *nr-DL-PRS-JointMeasurementRequestedPFL-List.*

The UE is configured with measurement gap pattern ID #13 or ID #24 before T2.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The general test parameters and cell specific test parameters are as given in table A.7.6.11.6.1-2 and table A.7.6.11.6.1-3 respectively.

Table A.7.6.11.6.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2, all signals/channels except PRS in PFL2 are allocated within this channel.
			2	For both Cell 1 and Cell 2, only PRS in PFL2 is allocated within this channel.
$BW_{channel}$	MHz	1	200: $N_{RB,c}$ = 132	For both RF channels
SSB configuration		1	SSB.2 FR2	
SMTC configuration		1	SMTC.1	
Measurement gap		1	GP#24 or GP#13 Note 1	
CP length		1	Normal	
DRX		1	OFF	
Time offset between serving and neighbour cells	µs	1	3	Synchronous cells/TRPs
Expected RSTD	µs	1	3	
Expected RSTD uncertainty	µs	1	5	
T1	s	1	5	
T2	s	1	20	
Note 1: GP#24 is configured if the UE supports it, otherwise GP#13 is configured.				

Table A.7.6.11.6.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 5		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	

PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns Note 1		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1, 4						
EPRE ratio of OCNG to OCNG DMRS Note 1, 4						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration (for both PFL1 and PFL2)		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting info (*dl-PRS-MutingOption1* for both PFL1 and PFL2)		1	'10'		'01'	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-13
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-3	-Infinity	-13
PRP Note 3	dBm/SCS kHz	1	-Infinity	-92	-Infinity	-102
Io Note 3 (on symbols where PRS is not allocated)	dBm/190.08 MHz	1	N/A	-55.10	N/A	-55.10
Propagation Condition		1	AWGN			

Note 1:	OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.
Note 4:	The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 5:	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
Note 6:	Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
Note 7:	Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
Note 8:	As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.7.6.11.6.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.4.9.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.

A.7.6.12 PRS-RSRPP measurements

A.7.6.12.1 PRS-RSRPP reporting delay test case for single positioning frequency layer in FR2 in RRC_CONNECTED state

A.7.6.12.1.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRPP measurement requirements specified in clause 9.9.6.5 for single positioning frequency layer under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.7.6.12.1.1-1

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.6.12.1.1-2, and table A.7.6.12.1.1-3.

Table A.7.6.12.1.1-1: supported test configurations for PRS RSRPP measurement for FR2

Config	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.6.12.1.1-2: General test parameters for PRS RSRPP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		Config 1	GP#13 or GP#24[Note1]	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	7	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.7.6.12.1.1-3: Cell-specific test parameters for PRS RSRPP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.4 FR2		PRS.1.4 FR2	
PRS muting configuration			Config 1	‘10’		‘01’	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PSS to SSS						
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS		Config 1	0		0	
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-89		-89	
SS-RSRP Note 3	dBm/SCS Note 5	Config 1	-89	-89	-Infinity	-89
PRS-RSRP Note 3	dBm/SCS Note 5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$	dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	Config 1	-Infinity	-2	-Infinity	-10
Io Note3	dBm/190.08 MHz Note 5	Config 1	-54.00	-54.62	-54.00	-54.62
Propagation Condition		Config 1	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, τ_d = 0.45 μs and f_D = 5 Hz			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.12.1.2 Test Requirements

The PRS RSRPP measurement time fulfils the requirements specified in clause 9.9.6.5.The UE shall perform and report the PRS RSRPP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9.6.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90 %, where the reported PRS RSRPP measurement for each correct event shall be within the PRS RSRPP reporting range specified in clause 10.1.38, i.e., between PRS RSRPP_0 and PRS RSRPP_126.

A.7.6.12.2 PRS-RSRPP reporting delay test case for reduced number of samples for single positioning frequency layer in FR2 in RRC_CONNECTED state

A.7.6.12.2.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRPP measurement requirements specified in clause 9.9.6.5 for single positioning frequency layer under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.7.6.12.2.1-1. In this test PRS is transmitted within the active BWP of the UE. UE can support *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED*, and the LMF indicates the UE to perform positioning measurements with reduced number of samples N_{sample} via *reducedDL-PRS-ProcessingSamples*.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.6.12.2.1-2, and table A.7.6.12.2.1-3.

Table A.7.6.12.2.1-1: supported test configurations for PRS RSRPP measurement for FR2

Config	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.6.12.2.1-2: General test parameters for PRS RSRPP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		Config 1	GP#13 or GP#24[Note1]	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	7	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.7.6.12.2.1-3: Cell-specific test parameters for PRS RSRPP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP BW		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.4 FR2		PRS.1.4 FR2	
PRS muting configuration			Config 1	'10'		'01'	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2		dBm/SCS Note 4	Config 1	-89		-89	
SS-RSRP Note 3		dBm/SCS Note 5	Config 1	-89	-86.77	-Infinity	-90.73
PRS-RSRP Note 3		dBm/SCS Note 5	Config 1	-Infinity	-86.77	-Infinity	-90.73
PRS $\hat{E}_s / I_{ot}$		dB	Config 1	-Infinity	0	-Infinity	-6
PRS $\hat{E}_s / N_{oc}$		dB	Config 1	-Infinity	2.23	-Infinity	-1.73
Io Note3		dBm/190.08 MHz Note 5	Config 1	-54.00	-51.76	-54.00	-51.76
Propagation Condition			Config 1	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ µs and $f_D = 5$ Hz			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.6.12.2.2 Test Requirements

The PRS RSRPP measurement time fulfils the requirements specified in clause 9.9.6.5. The UE shall perform and report the PRS RSRPP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9.6.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90 %, where the reported PRS RSRPP measurement for each correct event shall be within the PRS RSRPP reporting range specified in clause 10.1.38, i.e., between PRS RSRPP_0 and PRS RSRPP_126.

A.7.6.12.3 PRS-RSRPP reporting delay test case for gapless measurement in FR2

A.7.6.12.3.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRPP measurement requirements specified in clause 9.9.6.6 for single positioning frequency layer under AWGN propagation conditions in standalone scenario. Reporting delay test for gapless PRS measurement is conducted assuming that the PRS has higher priority, i.e., state 1, than all other DL signals/channels and is transmitted within active DL BWP of UE. Two sub-tests are defined, sub-test 1 is for $N_{sample} = 4$ and sub-test 2 is for $N_{sample} = 1$. For sub-test 2 LMF indicates UE to perform PRS measurement with reduced number of samples N_{sample} via *reducedDL-PRS-ProcessingSamples*.

The supported test configurations are shown in table A.7.6.12.3.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first PRS processing window instance containing the PRS resources that is ΔT after slot #n, where $\Delta T = 50$ ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.6.12.3.1-2, and table A.7.6.12.3.1-3.

Table A.7.6.12.3.1-1: supported test configurations for PRS RSRPP measurement for FR2-FR2

Config	Description

1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.6.12.3.1-2: General test parameters for PRS RSRPP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
PPW configuration		Config 1	Table A.3.33-1: Reference PPW configuration	As defined in A.3.33
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells	µs	1, 2, 3	- set to the UE reported capability for receive time difference threshold if the UE reported value is < 3µs - 3µs otherwise	Synchronous cells
Expected RSTD	µs	1, 2, 3	0	
Expected RSTD uncertainty	µs	1, 2, 3	Same as time offset	
T1	s	Config 1	5	
T2	ms	Config 1	10	In this test UE is configured to measure single PFL within the configured PPW.

Table A.7.6.12.3.1-3: Cell-specific test parameters during T2

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP BW		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			Sub-test 1	Sub-test 2	Sub-test 1	Sub-test 2
PDSCH/PDCCH subcarrier spacing	kHz	Config 1	120		120	
PRS configuration		Config 1	PRS.1.4 FR2		PRS.1.4 FR2	
PRS BW			48 PRBs for sub-test 2		48 PRBs for sub-test 2	
PRS muting configuration		Config 1	'10'		'01'	
EPRE ratio of PSS to SSS		Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-89		-89	
SS-RSRP Note 3	dBm/SCS Note 5	Config 1	-91	-86.77	-99	-90.73
PRS-RSRP Note 3	dBm/SCS Note 5	Config 1	-91	-86.77	-99	-90.73
PRS $\hat{E}_s/I_{ot}$	dB	Config 1	-2.41	0	-12.12	-6
PRS $\hat{E}_s/N_{oc}$	dB	Config 1	-2	2.23	-10	-1.73
Io Note3	dBm/190.08 MHz Note 5	Config 1	-54.62	-51.76	-54.62	-51.76
Propagation Condition		Config 1	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ μs and $f_D = 5$ Hz			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.12.3.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9.6.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90 %.

A.7.6.13 UE Rx-Tx time difference measurements for PDC

A.7.6.13.1 UE Rx-Tx time difference measurement for propagation delay compensation using PRS in FR2

A.7.6.13.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement for RTT-based PDC meets the requirements specified in clause 9.12.4.1in AWGN propagation condition in FR2 in standalone scenario.

The supported test configurations in listed in table A.7.6.13.1.1-1.

Table A.7.6.13.1.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 100 MHz bandwidth, TDD duplex mode

The test is considered with one cell (Cell 1) in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. If the test is based on PRS, the Cell 1 mutes PRS transmission during T1 and transmits PRS during T2.

The *MeasObjectRxTxDiff-r17* with *prs-Ref-r17* , *measObject* with *measObjectRxTxDiff-17,* and *NR-DL-PRS-PDC-Info as defined in TS 38.331* shall be provided to the UE during T1.

The last TTI containing the RRC configuration shall be provided to the UE ΔT ms before the start of T2, where ΔT = 10 ms.

The beginning of the time interval T2 shall be aligned with the beginning of the first PRS resources.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.7.6.13.1.1-2. The test parameters for PRS are given Table A.7.6.13.1.1-3.

Table A.7.6.13.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value
Active cell		1	Cell 1
RF Channel Number		1	1
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66
SSB configuration		1	SSB.2 FR2
SMTC configuration		1	SMTC.1
Measurement gap		1	GP#24 or GP#13 Note 1
CP length		1	Normal
DRX		1	OFF
T1	s	1	5
T2	s	1	20
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.			

Table A.7.6.13.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15 AoA setup	
Beam Assumption Note 7		1	Rough	
TDD configuration		1	TDDConf.3.1	

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
PDSCH RMC configuration		1	SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	
OCNG Patterns		1	OP.1	
TRS Configuration		1	TRS.2.1 TDD	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1	
PRS configuration		1	PRS.1.1 FR2	
PRS muting info		1	'10'	
SRS configuration		1	PDC-SRS.3	
N_{oc} Note 2	dBm/SCS	1	-89	
N_{oc} Note 2	dBm/15 kHz	1	-98	
PRS $\hat{E}_s / I_{ot}$	dB	1	-Infinity	-2.41
PRS $\hat{E}_s / N_{oc}$	dB	1	-Infinity	-2
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-91
Io	dBm/95.04 MHz	1	N/A	-57.63
Propagation Condition		1	AWGN	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.13.1.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in 9.12.4.1.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

The reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1, for k=5.

The UE Rx-Tx time difference measurement time fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.39.2 for Cell 1.

A.7.6.13.2 UE Rx-Tx time difference measurement for propagation delay compensation using TRS in FR2

A.7.6.13.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement with TRS for RTT-based PDC meets the requirements specified in clause 9.12.4.2 for measurement delay and clause 10.1.39.3 for measurement accuracy in AWGN propagation condition in FR2 in standalone scenario.

The supported test configurations in listed in table A.7.6.13.2.1-1.

Table A.7.6.13.2.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 100 MHz bandwidth, TDD duplex mode

The test is considered with one cell (Cell 1) in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 does not have TRS transmission during T1 and transmits TRS during T2.

The *MeasObjectRxTxDiff-r17* with *csi-RS-Ref-r17*, and *measObject* with *measObjectRxTxDiff-17 as defined in TS 38.331* shall be provided to the UE during T1.

The last TTI containing the RRC configuration shall be provided to the UE ΔT ms before the start of T2, where ΔT = [10] ms is the maximum processing time of the measurement request.

The beginning of the time interval T2 shall be aligned with the beginning of the first TRS resources.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.7.6.13.2.1-2. The test parameters for PRS are given Table A.7.6.13.2.1-3.

Table A.7.6.13.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value
Active cell		1	Cell 1
RF Channel Number		1	1
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66
SSB configuration		1	SSB.2 FR2
CP length		1	Normal
DRX		1	OFF
T1	s	1	5
T2	s	1	20

Table A.7.6.13.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15 AoA setup	
Beam Assumption Note 7		1	Rough	
TDD configuration		1	TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	
OCNG Patterns		1	OP.1	
TRS Configuration		1	TRS.2.1 TDD	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1	
SRS configuration		1	PDC-SRS.3	
N_{oc} Note 2	dBm/SCS	1	-89	
N_{oc} Note 2	dBm/15 kHz	1	-98	
TRS $\hat{E}_s / I_{ot}$	dB	1	-Infinity	-2.41
TRS $\hat{E}_s / N_{oc}$	dB	1	-Infinity	-2
TRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-91

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
Io	dBm/95.04 MHz	1	N/A	-57.63
Propagation Condition		1	AWGN	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: TRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: TRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.13.2.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in 9.12.4.2.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

The UE Rx-Tx time difference measurement time fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.39.3.

The reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1, for k=5.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %.

A.7.6.14 SA event triggered reporting tests with Pre-MG

A.7.6.14.1 Intra-frequency measurement test with SA event triggered reporting tests: with autonomous activation/deactivation of Pre-MG in FR2

A.7.6.14.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event with autonomous activation/deactivation of Pre-MG. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.7.6.14.1.2 Test parameters

Supported test configurations are shown in table A.7.6.14.1.2-1. There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.14.1.2-2, A.7.6.14.1.2-3 and A.7.6.14.1.2-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A4 is used.

Before the test starts,

UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).

UE is configured with 2 different UE-specific bandwidth parts for Cell 1 (PCell), BWP-1 and BWP-2, before starting the test.

BWP-1 includes bandwidth of the initial DL BWP and SSB.

BWP-2 does not include bandwidth of the initial DL BWP and SSB.

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.

The TE schedules ontinuous DL data on PCell throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2 and T3, respectively.

During time period T1, BWP-1 is the active BWP. The Pre-MG is expected to be deactivated. UE shall be able to measure neighbor cell without gap.

The time period T2 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

During time period T3, BWP-2 is the active BWP. The Pre-MG is expected to be activated. UE shall be able to measure neighbor cell within Pre-MG.

Table A.7.6.14.1.2-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.14.1.2-2: General test parameters for intra-frequency event triggered reporting with network-controlled activation/deactivation of Pre-MG

Parameter	Unit	Value	Comment
Active cell		PCell (Cell 1)	
Neighbour cell		Cell 2	Cell to be identified.
RF Channel Number		1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration		SMTC.1	
A4-Threshold	dBm	-120	
CP length		Normal	
Hysteresis	dB	0	
Time To Trigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	
Gap Pattern Id		13	
Measurement gap offset	ms	39	
Time offset between Cell 1 and Cell 2		3 μs	Synchronous cells
T1	s	0.1	
T2	s	0.2	
T3	s	5	

Table A.7.6.14.1.2-3: NR Cell specific test parameters for intra-frequency event triggered reporting with network-controlled activation/deactivation of Pre-MG

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
TDD configuration		TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		24			24		
Initial BWP configuration		DLBWP.0.1 ULBWP.0.1			DLBWP.0.1 ULBWP.0.1		
BWP-1 Configuration		DLBWP.1.6 ULBWP.1.6			N/A		
BWP-2 Configuration		DLBWP.1.5 ULBWP.1.5			N/A		
RLM-RS		CSI-RS			N/A		
PDSCH RMC configuration		SR.3.2 TDD			N/A		
RMSI CORESET RMC configuration		CR.3.1 TDD			N/A		
Dedicated CORESET RMC configuration		CCR.3.1 TDD			N/A		

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
TRS configuration		TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI states		TCI.State.2			N/A		
PDSCH/PDCCH subcarrier spacing	kHz	120			120		
OCNG Patterns		OP.5			N/A		
cellIndividualOffset	dB	N/A			16		
SSB		SSB.3 FR2			SSB.7 FR2		
Propagation Condition		No external noise (Note 1)			No external noise (Note 1)		
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].							

Table A.7.6.14.1.2-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting with network-controlled activation/deactivation of Pre-MG

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 3 defined in A.3.15.3					
		AoA1			AoA2		
Beam assumption[Note 3]		Rough			Rough		
E_S	dBm/SCS	-89	-89	-89	-infinity	-Infinity	-89
$\hat{E}_s/I_{ot\ BB}$ [Note 4]	dB	-0.12	-0.12	-0.12	-Infinity	-Infinity	-0.12
SSB_RP	dBm/SCS	-89	-89	-89	-infinity	-Infinity	-89
Io	dBm/95.04 MHz	-64.41	-64.41	-64.41	-Infinity	-Infinity	-64.41
Time multiplexing of the downlink transmissions from each AoA		Defined in figure A.7.6.1.1.1-1					
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.							

A.7.6.14.1.3 Test Requirements

During T1, the UE shall be able to receive PDSCH and report corresponding valid ACK/NACK for those PDSCHs scheduled in the slots overlapped with the Pre-MG occasions.

During T2 and T3, the UE shall not report corresponding valid ACK/NACK for those PDSCHs scheduled in the slots overlapped with the Pre-MG occasions, starting from the 1 s^t complete Pre-MG occasion after the beginning of PCell's DL slot ($i+T_{BWPswitchDelay}$) + 5 ms as defined in clause 8.19.2.

The UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than Y ms from the beginning of time period T3, where Y is

- 3.2 s for a UE supporting power class 1 and 5,
- 1.92 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.14.2 Intra-frequency measurement test with SA event triggered reporting tests: with network-controlled activation/deactivation of Pre-MG in FR2

A.7.6.14.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event with network-controlled activation/deactivation of Pre-MG. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.7.6.14.2.2 Test parameters

Supported test configurations are shown in table A.7.6.14.2.2-1. There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.14.2.2-2, A.7.6.14.2.2-3 and A.7.6.14.2.2-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

Before the test starts,

UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).

UE is configured with 2 different UE-specific bandwidth parts for Cell 1 (PCell), BWP-1 and BWP-2, before starting the test.

BWP-1 includes bandwidth of the initial DL BWP and SSB with the Pre-MG status set to ‘deactivated’.

BWP-2 does not include bandwidth of the initial DL BWP and SSB with the Pre-MG status set to ‘activated’.

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.

The TE schedules continuous DL data on PCell throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2 and T3, respectively.

The time period T2 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell’s slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The time period T3 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell’s slot # denoted *j*. The UE shall switch its bandwidth part from BWP-2 to BWP-1.

Table A.7.6.14.2.2-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.14.2.2-2: General test parameters for intra-frequency event triggered reporting with network-controlled activation/deactivation of Pre-MG

Parameter	Unit	Value	Comment
Active cell		PCell (Cell 1)	
Neighbour cell		Cell 2	Cell to be identified.
RF Channel Number		1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration		SMTC.1	
A3-Offset	dB	-11	
CP length		Normal	
Hysteresis	dB	0	
Time To Trigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	

Gap Pattern Id		13	
Measurement gap offset	ms	39	
Time offset between Cell 1 and Cell 2		3 μs	Synchronous cells
T1	s	0.1	
T2	s	0.2	
T3	s	5	

Table A.7.6.14.2.2-3: NR Cell specific test parameters for intra-frequency event triggered reporting with network-controlled activation/deactivation of Pre-MG

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
TDD configuration		TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		24			24		
Initial BWP configuration		DLBWP.0.1 ULBWP.0.1			DLBWP.0.1 ULBWP.0.1		
BWP-1 Configuration		DLBWP.1.6 ULBWP.1.6			N/A		
BWP-2 Configuration		DLBWP.1.5 ULBWP.1.5			N/A		
RLM-RS		CSI-RS			N/A		
PDSCH RMC configuration		SR.3.2 TDD			N/A		
RMSI CORESET RMC configuration		CR.3.1 TDD			N/A		
Dedicated CORESET RMC configuration		CCR.3.1 TDD			N/A		
TRS configuration		TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI states		TCI.State.2			N/A		
PDSCH/PDCCH subcarrier spacing	kHz	120			120		
OCNG Patterns		OP.5			N/A		
cellIndividualOffset	dB	N/A			16		
SSB		SSB.3 FR2			SSB.7 FR2		
Propagation Condition		No external noise (Note 1)			No external noise (Note 1)		
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].							

Table A.7.6.14.2.2-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting with network-controlled activation/deactivation of Pre-MG

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 3 defined in A.3.15.3					
		AoA1			AoA2		
Beam assumption[Note 3]		Rough			Rough		
E_S	dBm/SCS	-89	-89	-89	-infinity	-infinity	-89
$\hat{E}_s / I_{ot}$ BB Note 4	dB	-0.12	-0.12	-0.12	-Infinity	-infinity	-0.12
SSB_RP	dBm/SCS	-89	-89	-89	-infinity	-infinity	-89
Io	dBm/95.04 MHz	-64.41	-64.41	-64.41	-Infinity	-infinity	-64.41
Time multiplexing of the downlink transmissions from each AoA		Defined in figure A.7.6.1.1.1-1					
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.							

A.7.6.14.2.3 Test Requirements

During T2, the UE shall not report corresponding valid ACK/NACK for those PDSCHs scheduled in the slots overlapped with the Pre-MG occasions, starting from the 1 s^t complete Pre-MG occasion after the beginning of PCell's DL slot ($i+T_{BWPswitchDelay}$) + 5 ms as defined in clause 8.19.2.

During T3, the UE shall be able to receive PDSCH and report corresponding valid ACK/NACK for those PDSCHs scheduled in the slots overlapped with the Pre-MG occasions, starting from the 1 s^t complete Pre-MG occasion after the beginning of PCell's DL slot ($j+T_{BWPswitchDelay}$) + 5 ms as defined in clause 8.19.2.

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T3, where X is

- 1.6 s for a UE supporting power class 1 and 5,
- 0.96 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.15 SA event triggered reporting tests with concurrent gaps

A.7.6.15.1 SA event triggered reporting tests For FR2 with fully non-overlapping concurrent MGs for SSB-based inter-frequency measurements

A.7.6.15.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event with fully non-overlapping concurrent MGs for SSB-based inter-frequency measurements. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: NR cell 1 as PCell in FR2 on NR RF channel 1, NR cell 2 as neighbour cell in FR2 on NR RF channel 2, and NR cell 3 as neighbour cell in FR2 on NR RF channel 3. The test parameters and configurations are given in tables A.7.6.15.1.1-1, A.7.6.15.1.1-2, and A.7.6.15.1.1-3.

Two measurement gaps with pattern configuration # 14 as defined in table A.7.6.15.1.1-2 are provided for UE. The measurement object for NR RF channel 2 is associated with MG#1, and measurement object for NR RF channel 3 is associated with MG#2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2 or NR cell 3.

Supported test configurations are shown in table A.7.6.15.1.1-1.

Table A.7.6.15.1.1-1 SA event triggered reporting tests without SSB index reading for FR2 with fully non-overlapping concurrent MGs for SSB-based inter-frequency measurements

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.15.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with fully non-overlapping concurrent MGs for SSB-based inter-frequency measurements

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2, 3	Three FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2 and 3	NR cell 2 is on NR RF channel number 2. NR cell 3 is on NR RF channel number 3.
Gap Pattern Id		Config 1	14 for both gaps	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	79 for MG#1 19 for MG#2	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
offsetMO	dB	Config 1	16	Applied to NR Cell 2 and 3 measurement object
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Cell 2 and 3 are synchronous cells to cell 1.
T1	s	Config 1	5	
T2	s	Config 1	10.4 for PC1 and PC5; 6.5 for other PC	

Table A.7.6.15.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with fully non-overlapping concurrent MGs for SSB-based inter-frequency measurements

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15					
				AoA1		AoA2		AoA2	
Beam Assumption[Note 4]			1,2	Rough		Rough		Rough	
NR RF Channel Number			Config 1	1		2		3	
Duplex mode			Config 1	TDD		TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A			
	Initial UL BWP			ULBWP.0.1		N/A			
	Dedicated DL BWP			DLBWP.1.1		N/A			
	Dedicated UL BWP			ULBWP.1.1		N/A			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1		SMTC.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
PDSCH/PDCCH subcarrier spacing	kHz	Config 1	120		120		120	
TRS configuration		Config 1	TRS.2.1 TDD		N/A		N/A	
PDSCH/PDCCH TCI state		Config 1	TCI.State.2		N/A		N/A	
EPRE ratio of PSS to SSS		Config 1	0		0		0	
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
$\hat{E}_S$	dBm/SCS	Config 1	-87	-87	-Infinity	-87	-Infinity	-87
SSB_RP Note 2	dBm/SCS Note3	Config 1	-87	-87	-Infinity	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ BB Note 5	dB	Config 1	1.89	1.89	-Infinity	1.89	-Infinity	1.89
Io Note 2	dBm/95.04 MHz Note3	Config 1	-58.01	-58.01	-Infinity	-58.01	-Infinity	-58.01
Propagation Condition		Config 1	No external noise (Note 6)					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 6: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].

A.7.6.15.1.2 Test Requirements

The UE shall send one Event A3 triggered measurement report for each neighboring cell, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

10240 for UE supporting power class 1 and 5, or

6400 for UE supporting other power class.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.15.2 SA event triggered reporting tests For FR2 with concurrent measurement gaps without SSB time index detection when DRX is not used (PCell in FR2)

A.7.6.15.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event for each neighbour cell. This test will partly verify the SA inter-frequency NR cell search requirements and collision handling between two partially-partial overlapping gaps in clause 9.1.8.

In this test, there are three cells: NR cell 1 as PCell in FR2 on NR RF channel 1, NR cell 2 as neighbour cell in FR2 on NR RF channel 2 and NR cell 3 as another neighbour cell in FR2 on NR RF channel 3. The test parameters and configurations are given in tables A.7.6.15.2.1-1, A.7.6.15.2.1-2, and A.7.6.15.2.1-3.

Two measurement gaps are configured to UE with measurement gap pattern configuration #13 and #14 respectively. Measurement gap with pattern #13 is associated with inter-frequency measurement on NR cell 2, and measurement gap with pattern #14 is associated with inter-frequency measurement on NR cell 3. Measurement gap pattern configuration # 13 and #14 as defined in table A.7.6.15.2.1-2 are provided to for UE that does not support per-FR gap and for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2 and NR cell 3.

Supported test configurations are shown in table A.7.6.15.2.1-1.

Table A.7.6.15.2.1-1 SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void.	

Table A.7.6.15.2.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 concurrent gap with partially partial overlapping scenario for SSB-based measurements without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2, 3	Three FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
1 s^{t} Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
2nd Neighbour cell		Config 1	NR cell 3	NR cell 3 is on NR RF channel number 3.
1 s^{t} Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
2nd Gap Pattern Id		Config 1	14	As specified in clause 9.1.2-1.
1 s^{t} gap offset		Config 1	39	
2nd gap offset		Config 1	4	
1 s^{t} gap priority		Config 1	2	Second level priority
2nd gap priority		Config 1	1	Highest priority
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
offsetMO	dB	Config 1	16	Applied to NR Cell 2 and NR Cell 3 measurement objects
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	10.4 for PC1 and PC5; 6.5 for other PC	

Table A.7.6.15.2.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15					
				AoA1		AoA2		AoA3	
Beam Assumption[Note 7]			1,2	Rough		Rough		Rough	
NR RF Channel Number			Config 1	1		2		3	
Duplex mode			Config 1	TDD		TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A		N/A	
	Initial UL BWP			ULBWP.0.1		N/A		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-		-	
SMTC configuration defined in A.3.11.1 and A.3.11.7			Config 1	SMTC.1		SMTC.1		SMTC.7	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
$\hat{E}_s$		dBm/SCS	Config 1	-87	-87	-Infinity	-87	-Infinity	-87
SSB_RP [Note 3]		dBm/SCS [Note5]	Config 1	-87	-87	-Infinity	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ [BB Note 8]		dB	Config 1	1.89	1.89	-Infinity	1.89	-Infinity	1.89
Io[Note3]		dBm/95.04 MHz Note 5	Config 1	-58.01	-58.01	-Infinity	-58.01	-Infinity	-58.01
Propagation Condition			Config 1	No external noise (Note 9)				No external noise (Note 9)	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Void								
NOTE 3: SSBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: Void								
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone								
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone								
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation								
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.								
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].								

A.7.6.15.2.2 Test Requirements

For both NR cell 2 and NR cell 3, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

10240 for UE supporting power class 1 and 5, or

6400 for UE supporting other power class.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.15.3 SA event triggered reporting tests for FR2 concurrent gap with partially partial overlapping scenario for SSB-based measurements and PRS-based measurement

A.7.6.15.3.1 Test Purpose and Environment

The purpose of this test is to verify that the concurrent gap capable UE makes correct reporting of events. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4 and PRS-RSRP measurement delay requirements specified in clause 9.9.3.5.

In this test, there are three cells: NR cell 1 as PCell in FR2 on NR RF channel 1, NR cell 2 as neighbour cell in FR2 on NR RF channel 2, and NR cell 3 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in tables A.7.6.15.3.1-1, A.7.6.15.3.1-2 and A.7.6.15.3.1-3.

Two measurement gap patterns (MeasGapId #0 and MeasGapId #1) are configured with the gap pattern ID #0 and #1 as defined in table A.7.6.15.3.1-2. MeasGapId #1 is configured with a higher priority than MeasGapId #0. MeasGapId #0 and MeasGapId #1 are associated with the MOs for RF channel numbers #1 and #2, respectively.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used for carrier 2. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2 and NR cell 3. Cell 1 and cell 3 transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance of MeasGapId #1 containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

Table A.7.6.15.3.1-1: SA event triggered reporting tests for FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.15.3.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 concurrent gap with partially partial overlapping scenario for SSB-based measurements and PRS measurement

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 3 2: Cell 2	Two TDD carrier frequencies are used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2, NR cell 3	Cell 2 is an inter-frequency cell neighbor cell Cell 3 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		Config 1	0 for MeasGapId #0 1 for MeasGapId #1	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	7 for MeasGapId #0 11 for MeasGapId #1	
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between cell 1 and neighbour cell 2		Config 1	3μs	Synchronous cells.
Time offset between cell 1 and neighbour cell 3		Config 1	3μs	Synchronous cells.
Expected RSTD between cell 1 and cell 3	μs	Config 1	3	
Expected RSTD uncertainty between cell 1 and cell 3	μs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	11	

Table A.7.6.15.3.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 concurrent gap with partially-partial overlapping scenario for SSB-based measurements and PRS measurement

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15					
Beam Assumption[Note 7]			Config 1	Rough		Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A			
	Initial UL BWP			ULBWP.0.1		N/A			
	Dedicated DL BWP			DLBWP.1.1		N/A			
	Dedicated UL BWP			ULBWP.1.1		N/A			
OCNG Patterns			Config 1	OP.1		OP.1		OP.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
PDSCH Reference measurement channel		Config 1	SR.3.1 TDD		-		-	
CORESET Reference Channel		Config 1	CR.3.1 TDD		-		-	
Dedicated CORESET RMC configuration		Config 1	CCR.3.1 TDD		-		-	
TRS configuration		Config 1	TRS.2.1 TDD		-		-	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1	120		120		120	
SSB parameters		Config 1	SSB.1 FR2		SSB.1 FR2		SSB.1 FR2	
SMTC configuration defined in A.3.11		Config 1	SMTC.1		SMTC.4		SMTC.4	
PRS configuration		Config 1	PRS.1.1 FR2		N/A		PRS.1.2 FR2	
PRS muting configuration		Config 1	'10'		N/A		'01'	
EPRE ratio of PSS to SSS		Config 1	0		0		0	
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz Note 5		-102		-104.7		-102	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-93		-95.7		-93	
SSB_RP Note 3	dBm/SCS Note 5	Config 1	-89.7	-89.7	-Infinity	-86.7	-Infinity	-86.7
SSB $\hat{E}_s / N_{oc}$	dB	Config 1	3.3	3.3	-Infinity	9.0	-Infinity	6.3
PRS-RSRP Note 3	dBm/SCS Note 5	Config 1	-Infinity	-96	N/A	N/A	-Infinity	-103
PRS $\hat{\mathrm{E}}_s / \mathrm{I}_{ot}$	dB	Config 1	-Infinity	-3	N/A	N/A	-Infinity	-10
PRS $\hat{E}_s / N_{oc}$	dB	Config 1	-Infinity	-3	N/A	N/A	-Infinity	-10
Io Note3	dBm/95.04 MHz Note 5	Config 1	-59.05	-55.32	-66.7	-57.2	-59.05	-55.32
Propagation Condition		Config 1	AWGN					

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io values were derived for symbols without PRS.

NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone

NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.15.3.2 Test Requirements

The UE shall send one Event A3 triggered measurement report for cell 2, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

10240 for UE supporting power class 1 and 5, or

6400 for UE supporting other power class.

The PRS RSRP measurement time fulfils the requirements specified in clause 9.9.3.5. The UE shall perform and report the PRS RSRP measurements for Cell 3 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9.3.5 starting from the beginning of time interval T2.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90 %, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1.24.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

IUE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.16 SA event triggered reporting tests with NCSG

A.7.6.16.1 SA event triggered reporting test with per-UE NCSG under non-DRX

A.7.6.16.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.7.1 and 9.2.7.2, and also verify the scheduling availability during intra-frequency measurement with NCSG in clause 9.2.7.3. Supported test configurations are shown in table A.7.6.16.1.1-1.

The serving frequency should be selected for which UE reports ‘ncsg’.

Table A.7.6.16.1.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.16.1.1-2 ~ 4 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

During T2, the UE is continuously scheduled with data on the PCell.

The UE is capable of NCSG and report ‘*ncsg*’ through *NeedForGapNCSG-InfoNR* for PCell.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.16.1.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE NCSG without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1, 2	PCell (Cell 1)	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
NCSG type		1, 2	Per-UE	
NCSG pattern		1, 2	13	
NCSG repitition periodicity	ms	1, 2	40	
ML	ms	1, 2	5	
NCSG offset	ms	1, 2	39	
SMTC configuration		1, 2	SMTC.1	
CSI-RS parameters		1, 2	CSI-RS.3.2 TDD	
A3-Offset	dB	1, 2	-11	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	Synchronous cells
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.7.6.16.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE NCSG without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
		2	48		48	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	CSI-RS		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	
		2	CR.3.2 TDD		CR.3.2 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		CCR.3.1 TDD	
		2	CCR.3.7 TDD		CCR.3.7 TDD	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.5		N/A	
cellIndividualOffset	dB	1~2	N/A		16	
SSB		1	SSB.3 FR2		SSB.7 FR2	
		2	SSB.4 FR2		SSB.8 FR2	
Propagation Condition		1, 2	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

Table A.7.6.16.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE NCSG without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam Assumption Note 4		1,2	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1	-64.41	-64.41	-Infinity	-64.41
		2	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1	Defined in figure A.7.6.16.1.1-1			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Void
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

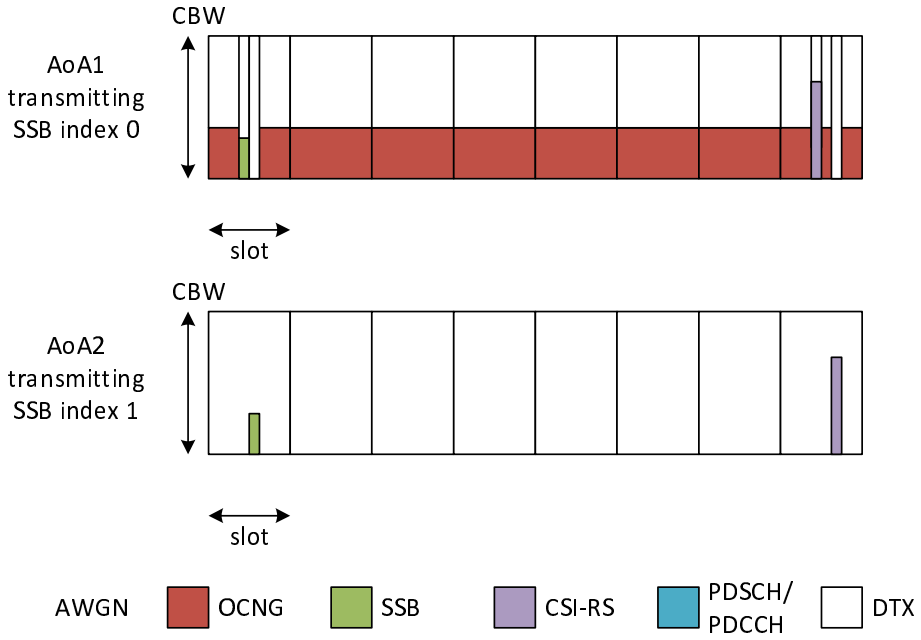


Figure A.7.6.16.1.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.7.6.16.1.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 3.2 s for a UE supporting power class 1 and 5,
- 1.92 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T2, UE shall send HARQ ACK/NACK for the corresponding PDSCH scheduled in PCell in all the slots except for the case where PDSCH or PUCCH is overlapped with the VIL of NCSG pattern.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.16.2 SA event triggered reporting tests on inter-frequency measurement with NCSG for FR2 when DRX is not used (PCell in FR2)

A.7.6.16.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.10. The test will partly verify the interruption requirements on PCell in clause 9.1.9.1.

The serving frequency and the target frequency should be selected such that UE reports 'ncsg' for the target frequency given the serving frequency.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.7.6.16.2.1-1, A.7.6.16.2.1-2, and A.7.6.16.2.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.16.2.1-1.

Table A.7.6.16.2.1-1 SA event triggered reporting tests with NCSG without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void.	

Table A.7.6.16.2.1-2: General test parameters for SA inter-frequency event triggered reporting with NCSG for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
NCSG Pattern Id		Config 1	0	As specified in clause 9.1.9.3-1.
NCSG offset		Config 1	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
offsetMO	dB	Config 1	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	5.2 for PC1 and PC5; 3.5 for other PC	

Table A.7.6.16.2.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting with NCSG for FR2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam Assumption[Note 7]			1,2	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns			Config 1	OP.2		OP.2	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note 5		-104.7		-104.7	
N_{oc} Note2		dBm/SCS Note 4	Config 1	-95.7		-95.7	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$\hat{E}_s/N_{oc}$	dB	Config 1	6	6	-Infinity	9
SSB_RP Note 3	dBm/SCS Note5	Config 1	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s/I_{ot}$ BB Note 8	dB	Config 1	6	6	-Infinity	9
Io Note3	dBm/95.04 MHz Note 5	Config 1	-59.74	-59.74	-66.7	-57.2
Propagation Condition		Config 1	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.16.2.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1 and 5, or

3200 for UE supporting other power class.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE shall be scheduled on PCell continuously throughout the test. During the time duration T2, the interruption on PCell shall not be more than the values specified for SA in clause 9.1.9.1.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

NOTE: For a UE that supports per-FR NCSG, it only needs to pass test case with per-FR NCSG, otherwise, it only needs to pass test case with per-UE NCSG.

A.7.6.16.3 Event triggered reporting test on deactivated SCell measurement via NCSG in FR2 in non-DRX

A.7.6.16.3.1 Test Purpose and Environment

The purpose of this test is to verify that the delay and interruption requirements for deactived SCell measurement stated in clause 9.2.7 and 8.2 respectively, when both PCell and SCell are in FR2.

The supported test configurations are shown in table A.7.6.16.3.1-1 below. The general test parameters are defined in table A.7.6.16.3.1-2. Three cells are deployed in the test, which are one FR2 PCell (Cell 1) on frequency 1 and one FR2 SCell (Cell 2) on frequency 2 and one neighboring cell (Cell 3) on frequency 2. The cell-specific test parameters are given in A.7.6.16.3.1-3 below. OTA related test parameters are shown in table A.7.6.16.3.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the SCell, and it is indicated to the UE that event-triggered reporting with Event A6 is used. The test consists of 2 successive time periods, with duration of T1 and T2, respectively.

Before the test starts the UE is connected to PCell (Cell 1) but is not aware of SCell (Cell 2) nor the neighboring cell (Cell 3). The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the deactivated SCC.

NCSG is configured with the NCSG pattern ID #0 as defined in table A.7.6.16.3.1-2.

Table A.7.6.16.3.1-1: Supported test configurations for FR2 deactivated SCell measurement via NCSG

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Same configuration applies to both PCell and SCell	

Table A.7.6.16.3.1-2: General test parameters for FR2 deactivated SCell measurement via NCSG

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two NR radio channels are used for this test. Cell 1 uses RF channel 1. Cell 2 and Cell 3 use RF channel 2.
Hysteresis	dB	0	
A6-Offset	dBm	-11	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	DRX is not used
NCSG Pattern Id		0	As specified in clause Table 9.1.9.3-1.
NCSG offset	ms	39	
NCSG mgta	ms	0	
Time offset between Cell 2 and Cell 3	us	3	Synchronous cells
SCell measurement cycle (measCycleSCell)	ms	160	
T1	s	5	
T2	s	15	

Table A.7.6.16.3.1-3: Cell specific test parameters for FR2 deactivated SCell measurement via NCSG

Parameter[Note 5]	Unit	Cell 1	Cell 2	Cell 3
SSB ARFCN		freq1	freq2	freq2
Duplex mode		TDD		
TDD configuration		TDDConf.3.1		
Downlink initial BWP Configuration		DLBWP.0.1	DLBWP.0.1	DLBWP.0.1
Downlink dedicated BWP Configuration		DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
Uplink initial BWP configuration		ULBWP.0.1	ULBWP.0.1	ULBWP.0.1
Uplink dedicated BWP configuration		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
TRS configuration		TRS.2.1 TDD	TRS.2.1 TDD	N/A
TCI state		TCI.State.0	TCI.State.0	N/A
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		
Data PRBs allocated		24	24	24
PDSCH Reference measurement channel		SR.3.2 TDD	SR.3.2 TDD	N/A
RMSI CORESET Parameters		CR.3.1 TDD	-	N/A
Dedicated CORESET Parameters		CCR.3.1 TDD	CCR.3.1 TDD	N/A
OCNG Patterns		OP.1	OP.5	N/A
SSB Configuration		SSB.1 FR2	SSB.3 FR2	SSB.7 FR2
SMTC Configuration		SMTC.1	SMTC.1	
cellIndividualOffset		N/A	N/A	16
EPRE ratio of PSS to SSS	dB	0		
EPRE ratio of PBCH_DMRS to SSS				
EPRE ratio of PBCH to PBCH_DMRS				

Parameter[Note 5]	Unit	Cell 1	Cell 2	Cell 3
EPRE ratio of PDCCH_DMRS to SSS				
EPRE ratio of PDCCH to PDCCH_DMRS				
EPRE ratio of PDSCH_DMRS to SSS				
EPRE ratio of PDSCH to PDSCH_DMRS				
EPRE ratio of OCNG DMRS to SSS[Note 1]				
EPRE ratio of OCNG to OCNG DMRS [Note 1]				
Propagation conditions		No external noise (Note 2)		
NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].				

Table A.7.6.16.3.1-4: OTA related test parameters for FR2 deactivated SCell measurement via NCSG

Parameter	Unit	Cell 1		Cell 2		Cell 3	
		T1	T2	T1	T2	T1	T2
Angle of arrival configuration		Setup 3 defined in A.3.15.3					
		AoA1		AoA1		AoA2	
Assumption for UE beams [Note 3]		Rough		Rough		Rough	
E_s	dB	-89		-89	-89	-infinity	-89
SSB_RP[Note2]	dBm/SCS [Note4]	-89		-89	-89	-infinity	-89
$\hat{E}_s / I_{ot}$ BB Note 4	dB	-0.12		-0.12	-0.12	-infinity	-0.12
Io[Note2]	dBm/95.04 MHz [Note4]	-64.41		-64.41	-64.41	--infinity	-64.41
Time multiplexing of the downlink transmissions from each AoA		N/A		Defined in figure A.7.6.1.1.1-1			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.							
NOTE 2: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 3: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.							
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4							

A.7.6.16.3.2 Test Requirements

UE shall send one Event A6 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

12.8 s for UE supporting power class 1 and 5, or

7.68 s for UE supporting other power class.

UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

During the T1 and T2, UE be able to report ACK/NACK for all slots with PDCCH/PDSCH on PCell excluding those slots overlapped with

VIL1, ML and VIL2 of NCSG for intra-band FR2 CA

VIL1 and VIL2 of NCSG for inter-band FR2 CA

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.17 SA event triggered reporting tests for concurrent measurement gaps with Pre-MG in FR2

A.7.6.17.1 SA event triggered reporting test for FR2 with one pre-configured gap and one measurement gap

A.7.6.17.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event with with one pre-configured gap and one measurement gap for SSB-based measurements. This test will partly verify the SA NR cell search requirements in clause 9.2.5 and 9.3.4, pre-configured gap activation delay in clause 8.19 and measurement gap collision handling in clause 9.1.12.

In this test, there are three cells: NR cell 1 as PCell in FR2 on NR RF channel 1, NR cell 2 as intra-frequency neighbour cell in FR2 on NR RF channel 1, and NR cell 3 as inter-frequency neighbour cell in FR2 on NR RF channel 2.

Two measurement gaps with pattern configuration # 13 and 14 as defined in table A.7.6.17.1.1-2 are provided for UE. The measurement object #1 for NR RF channel 1 is associated with MG#1, and measurement object #2 for NR RF channel 2 is associated with MG#2. MG#1 is a pre-configured measurement gap, and with higher priority than MG#2.

Before the test starts,

UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).

UE is configured with 2 different UE-specific bandwidth parts for Cell 1 (PCell), BWP-1 and BWP-2, before starting the test.

BWP-1 includes bandwidth of the initial DL BWP and SSB with the Pre-MG status set to ‘deactivated’ (*preConfGapStatus* of the pre-MG on BWP-1 is set to ‘0’).

BWP-2 does not include bandwidth of the initial DL BWP and SSB with the Pre-MG status set to ‘activated’ (*preConfGapStatus* of the pre-MG on BWP-2 is set to ‘1’).

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.

The TE schedules continuous DL data on PCell throughout the test.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of 2 successive time periods, with durations of T1 and T2, respectively. Before the test starts, the UE shall not have any timing information of NR Cell 2 or NR Cell 3.

During T1, UE active DL BWP is BWP-1, and the pre-configured gap (MG#1) is deactivated. Cell 3 is switched ON from the beginning of T1, and UE is expected to search for Cell 3 in MG#2.

The time period T2 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell’s slot # denoted by *i*. The UE shall switch its DL active BWP from BWP-1 to BWP-2, and the pre-configured gap shall be activated. Cell 2 is switched ON from the beginning of T2, and UE is expected to search for Cell 2 in MG#1.

Supported test configurations are shown in table A.7.6.17.1.1-1. The general and cell specific test parameters are given in tables A.7.6.17.1.1-2, and A.7.6.17.1.1-3.

Table A.7.6.17.1.1-1 SA event triggered reporting tests without SSB index reading for FR2 with fully non-overlapping concurrent MGs for SSB-based inter-frequency measurements

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.17.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with fully non-overlapping concurrent MGs for SSB-based inter-frequency measurements

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR Cell 2 and 3	NR Cell 2 is on NR RF channel number 1. NR Cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1	14 for MG#1 (80 ms MGRP) 13 for MG#2 (40 ms MGRP)	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	79 for MG#1 4 for MG#2	
SMTC configuration		Config 1	SMTC.1 for MO#1 SMTC.7 for MO#2	As specified in clause A.3.11
offsetMO	dB	Config 1	16	Applied to NR Cell 2 and 3 measurement object
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between Cell 1 and Cell 2		Config 1	3μs	Cell 2 is synchronous to Cell 1
Time offset between Cell 1 and Cell 3		Config 1	5 ms	Cell 3 is asynchronous to Cell 1
T1	s	Config 1	5.2	
T2	s	Config 1	6.5	

Table A.7.6.17.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with fully non-overlapping concurrent MGs for SSB-based inter-frequency measurements

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
AoA setup		Config 1	Setup 3 as specified in clause A.3.15					
			AoA1		AoA2		AoA2	
Beam Assumption[Note 4]		Config 1	Rough		Rough		Rough	
NR RF Channel Number		Config 1	1		1		2	
Duplex mode		Config 1	TDD		TDD		TDD	
TDD configuration		Config 1	TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		Config 1	66		66		66	
BWP-1 Configuration		Config 1	DLBWP.1.6 ULBWP.1.6		N/A		N/A	
BWP-2 Configuration		Config 1	DLBWP.1.5 ULBWP.1.5		N/A		N/A	
SSB configuration			SSB.3 FR2		SSB.7 FR2		SSB.3 FR2	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1	OP.1		N/A		N/A	
PDSCH Reference measurement channel		Config 1	SR.3.1 TDD		N/A		N/A	
CORESET Reference Channel		Config 1	CR.3.1 TDD		N/A		N/A	
TRS configuration		Config 1	TRS.2.1 TDD		N/A		N/A	
PDSCH/PDCCH TCI state		Config 1	TCI.State.2		N/A		N/A	
EPRE ratio of PSS to SSS								
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
EPRE ratio of PDCCH DMRS to SSS		Config 1	0		0		0	
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
$\hat{E}_s$	dBm/SCS	Config 1	-87	-87	-Infinity	-87	-87	-87
SSB_RP Note 2	dBm/SCS Note3	Config 1	-87	-87	-Infinity	-87	-87	-87
$\hat{E}_s/I_{ot}$ BB Note 5	dB	Config 1	1.89	1.89	-Infinity	1.89	1.89	1.89
Io Note 2	dBm/95.04 MHz Note3	Config 1	-58.01	-58.01	-Infinity	-58.01	58.01	-58.01
Propagation Condition		Config 1	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.17.1.2 Test Requirements

For UE supporting FG 32-2:

During T1, the UE shall report ACK/NACK for PDSCHs scheduled in the slots that are not overlapped with the MG#2 occasions. The UE shall send one Event A3 triggered measurement report for Cell 3, with a measurement reporting delay less than X ms from the beginning of time period T1, where X is

5120 for UE supporting power class 1 and 5, or

3200 for UE supporting other power class.

X is derived based on the requirements for inter-frequency measurement in clause 9.3.4 and 9.3.5.

For UE not supporting FG 32-2:

During T1, the UE shall report ACK/NACK at least for PDSCHs scheduled in the slots that are not overlapped with the non-dropped MG#2 occasions. The UE shall send one Event A3 triggered measurement report for Cell 3, with a measurement reporting delay less than X ms from the beginning of time period T1, where X is

10240 for UE supporting power class 1 and 5, or

6400 for UE supporting other power class.

X is derived based on the requirements for inter-frequency measurement in clause 9.3.4 and 9.3.5.

For both UE supporting FG 32-2 and not supporting FG 32-2:

During T2, the UE shall report ACK/NACK for PDSCHs scheduled in the slots that are not overlapped with the MG#1 occasions or non-dropped MG#2 occasions after MG#1 is activated, i.e. starting from the 1 s^t complete MG#1 occasion after the beginning of PCell's DL slot $(i+T_{BWPswitchDelay})$ + 5 ms as defined in clause 8.19.2. The UE shall send one Event

A3 triggered measurement report for Cell 2, with a measurement reporting delay less than Y ms from the beginning of time period T2, where Y is

6480 for UE supporting power class 1 and 5, or

3920 for UE supporting other power class.

Y is derived based on the requirements for intra-frequency measurement in clause 9.2.6 plus 80 ms, considering that the frist MG#1 occasion in T2 may collide with the pre-configured gap activation delay.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.17.2 Inter-frequency measurement test with SA event triggered reporting tests: with autonomous activation/deactivation of Pre-MGs in FR2

A.7.6.17.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event with autonomous activation/deactivation of Pre-MGs within FR2 concurrent gaps. This test will partly verify the TDD inter-frequency cell search requirements in clause 9.2.6.and 9.3.4. Also, this test will also jointly verify pre-configured measurement gap activation/deactivation delay in clause 8.19.2.

A.7.6.17.2.2 Test parameters

Two cells are deployed in the test, which are FR2 PCell (Cell 1) in FR1 on NR RF channel 1 and a neighbour cell (Cell 2) in FR2 on NR RF channel 2. The supported test configurations are shown in table A.7.6.18.1.2-1. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.17.2.2-2, A.7.6.17.2.2-3 and A.7.6.17.2.2-4 below.

Two pre-configured measurement gaps with same pattern (# 13) but different offset as defined in table A.7.6.18.1.1-2 are provided for UE. The measurement object for NR RF channel 1 is associated with MG#1, and measurement object for NR RF channel 2 is associated with MG#2.

In the measurement control information, two measurement object is configured for the frequency of the PCell and neihghbour cell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

Before the test starts,

UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).

UE is configured with 2 different UE-specific bandwidth parts for Cell 1 (PCell), BWP-1 and BWP-2, before starting the test.

BWP-1 includes bandwidth of the initial DL BWP and SSBs.

BWP-2 does not include bandwidth of the initial either switched DL BWP and SSBs.

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.

The TE schedules continuous DL data on PCell throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2 and T3, respectively.

During time period T1, BWP-1 is the active BWP. The Pre-MG#1 is expected to be deactivated and the Pre-MG#2 is expected to be activated. UE shall be able to measure Cell 1 without gap but Cell 2 with the activated Pre-MG#2.

The time period T2 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*.

During time period T3, BWP-2 is the active BWP. Both Pre-MG#1 and Pre-MG#2 expected to be activated. UE shall be able to measure Cell 1 and Cell 2 with the activated Pre-MG#1 and Pre-MG#2 respectively.

Table A.7.6.17.2.2-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.17.2.2-2: General test parameters for intra-frequency event triggered reporting with autonomous activation/deactivation of Pre-MG

Parameter	Unit	Test configuration	Value	Comment
Active cell		Config 1	PCell (Cell 1)	
Neighbour cell		Config 1	Cell 2	Cells to be identified.
RF Channel Number		Config 1	1: Cell 1 , 2: Cell 2	
SMTC configuration		Config 1	SMTC.1	Same configuration for MO1 and MO2
A4-Threshold	dBm	Config 1	-120	
CP length		Config 1	Normal	
Hysteresis	dB	Config 1	0	
Time To Trigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	
Gap Pattern Id		Config 1	13	For both pre-conifgured gaps
Measurement gap offset	ms	Config 1	9 for MeasGapId #1 19 for MeasGapId #2	No overlapping cases
Time offset between serving and neighbour cells		Config 1	3 μs	Synchronous cells
T1	s	Config 1	5	
T2	s	Config 1	0.2	
T3	s	Config 1	10.4 for PC1 and PC5; 6.5 for other PC	

Table A.7.6.17.2.2-3: NR Cell specific test parameters for intra-frequency event triggered reporting with autonomous activation/deactivation of Pre-MG

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
TDD configuration		TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		24			24		
Initial BWP configuration		DLBWP.0.1 ULBWP.0.1			DLBWP.0.1 ULBWP.0.1		
BWP-1 Configuration		DLBWP.1.6 ULBWP.1.6			N/A		
BWP-2 Configuration		DLBWP.1.5 ULBWP.1.5			N/A		
RLM-RS		CSI-RS			N/A		
PDSCH RMC configuration		SR.3.2 TDD			N/A		
RMSI CORESET RMC configuration		CR.3.1 TDD			N/A		
Dedicated CORESET RMC configuration		CCR.3.1 TDD			N/A		
TRS configuration		TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI states		TCI.State.2			N/A		
PDSCH/PDCCH subcarrier spacing	kHz	120			120		
OCNG Patterns		OP.5			N/A		
cellIndividualOffset	dB	N/A			16		
SSB		SSB.1 FR2			SSB.7 FR2		
Propagation Condition		AWGN			AWGN		

Table A.7.6.17.2.2-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting with automous activation/deactivation of Pre-MG

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 3 defined in A.3.15.3					
		AoA1			AoA2		
Beam assumption Note 3		Rough			Rough		
E_S	dBm/SCS	-89	-89	-89	-infinity	-89	-89
$\hat{E}_s/I_{ot}$ BB Note 4	dB	-0.12	-0.12	-0.12	-Infinity	-0.12	-0.12
SSB_RP	dBm/SCS	-89	-89	-89	-infinity	-89	-89
Io	dBm/95.04 MHz	-64.41	-64.41	-64.41	-Infinity	-64.41	-64.41
Time multiplexing of the downlink transmissions from each AoA		Defined in figure A.7.6.1.1.1-1					

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.17.2.3 Test Requirements

During T1, the UE shall be able to receive PDSCH and report corresponding valid ACK/NACK for those PDSCHs scheduled in the slots that are not overlapped with the Pre-MG#2 occasions.

During T2 and T3, the UE shall be able to receive PDSCH and report corresponding valid ACK/NACK for those PDSCHs scheduled in the slots that are not overlapped with the Pre-MG#1 or Pre-MG#2 occasions, starting from the 1 s^t complete Pre-MG#1 occasion after the beginning of PCell's DL slot ($i+T_{BWPswitchDelay}$) + 5 ms as defined in clause 8.19.5.

The UE shall send one Event A3 triggered measurement report for measurements on cell 2, with a measurement reporting delay less than Y ms from the beginning of time period T3, where Y is

- 5120 ms for a UE supporting power class 1 and 5,
- 3200 ms for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.18 SA event triggered reporting tests with concurrent gaps and NCSG

A.7.6.18.1 SA event triggered reporting tests For FR2 with concurrent measurement gaps and NCSG without SSB time index detection when DRX is not used (PCell in FR2)

A.7.6.18.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event for each neighbour cell. This test will partly verify the SA inter-frequency NR cell search requirements and collision handling between partially-partial overlapped concurrent gaps and NCSG in clause 9.1.13.

In this test, there are three cells: NR cell 1 as PCell in FR2 on NR RF channel 1, NR cell 2 as neighbour cell in FR2 on NR RF channel 2 and NR cell 3 as another neighbour cell in FR2 on NR RF channel 3. The test parameters and configurations are given in tables A.7.6.18.1.1-1, A.7.6.18.1.1-2, and A.7.6.18.1.1-3.

During T2, the UE is continuously scheduled with data on the PCell when measuring within NCSG.

One measurement gap and one NCSG are configured to UE with measurement gap pattern #13 and NCSG pattern #14 respectively. Measurement gap with pattern #13 is associated with inter-frequency measurement on NR cell 2, and NCSG with pattern #14 is associated with inter-frequency measurement on NR cell 3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2 and NR cell 3.

Supported test configurations are shown in table A.7.6.18.1.1-1.

Table A.7.6.18.1.1-1 SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.6.18.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 partially overlapped concurrent gap and NCSG for SSB-based measurements without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2, 3	Three FR2 NR carrier frequencies are used.
Active cell		Config 1	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
1 s^{t} Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
2nd Neighbour cell		Config 1	NR cell 3	NR cell 3 is on NR RF channel number 3.
Measurement Gap Pattern Id		Config 1	13	As specified in table 9.1.2-1.
NCSG Pattern Id		Config 1	14	As specified in table 9.1.9.3-1.
Measurement Gap offset	ms	Config 1	39	
NCSG offset	ms	Config 1	4	
Measurement Gap priority		Config 1	2	Second level priority
NCSG priority		Config 1	1	Highest priority
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
offsetMO	dB	Config 1	16	Applied to NR Cell 2 and NR Cell 3 measurement objects
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	

Parameter	Unit	Test configuration	Value	Comment
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	5.2 for PC1 and PC5; 3.5 for other PC	

Table A.7.6.18.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15					
				AoA1		AoA2		AoA3	
Beam Assumption[Note 7]			1,2	Rough		Rough		Rough	
NR RF Channel Number			Config 1	1		2		3	
Duplex mode			Config 1	TDD		TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A		N/A	
	Initial UL BWP			ULBWP.0.1		N/A		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-		-	
SMTC configuration defined in A.3.11.1 and A.3.11.7			Config 1	SMTC.1		SMTC.1		SMTC.7	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
$\hat{E}_S$	dBm/SCS	Config 1	-87	-87	-Infinity	-87	-Infinity	-87
SSB_RP Note 3	dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ BB Note 8	dB	Config 1	1.89	1.89	-Infinity	1.89	-Infinity	1.89
Io Note3	dBm/95.04 MHz Note 5	Config 1	-58.01	-58.01	-Infinity	-58.01	-Infinity	-58.01
Propagation Condition		Config 1	AWGN				AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SSBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.6.18.1.2 Test Requirements

For both NR cell 2 and NR cell 3, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

10240 for UE supporting power class 1 and 5, or

6400 for UE supporting other power class.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

During the T1 and T2, UE shall be able to report ACK/NACK for all slots with PDCCH/PDSCH on PCell excluding those slots overlapped with

VIL1 and VIL2 of NCSG

Measurement gap

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.19 SA event triggered reporting tests with NeedForGap in FR2

A.7.6.19.1 SA event triggered reporting test for UE indicating *NeedforInterruptionInfoNR* under non-DRX and no interruption outside configured measurement gaps

A.7.6.19.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test partly verifies the TDD intra-frequency cell search and measurement requirements in clause 9.2.6.1 and 9.2.6.2. This test also verifies that the UE does not cause interruption outside measurement gap when SMTC occasions overlap with measurement gap occassions. Supported test configurations are shown in table A.7.6.19.1.1-1.

The UE who passes this test can skip the corresponding Rel-15 test cases.

Table A.7.6.19.1.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

There are two cells in the test, a FR2 PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.19.1.1-2, A.7.6.19.1.1-3 and A.7.6.19.1.1-4 below. The serving frequency selected for this test case should be one in which the UE reports *NeedForGapsInfoNR-r16* = 'no-gap' and *NeedForInterruptionInfoNR-r18* = 'no-gap-with-interruption' for the PCell.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

The UE operates in an active BWP which does not contain cell-defined SSB so that the UE uses configured measurement gaps to measure on the intra-frequency target SSB.

The TE schedules continuous DL data on PCell throughout the test.

Table A.7.6.19.1.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2

Parameter	Unit	Config	Value	Comment
Active cell		1	PCell (Cell 1)	
Neighbour cell		1	Cell 2	Cell to be identified.
RF Channel Number		1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration		1	SMTC.1	20 ms SMTC periodicity
Measurement gap pattern		1	13	Half of the SMTC occasions are overlapped in MG.
Measurement gap offset		1	39	
A3-Offset	dB	1	-11	
CP length		1	Normal	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX		1	OFF	
Time offset between Cell 1 and Cell 2		1	3 μs	Synchronous cells
T1	s	1	5	
T2	s	1	5	

Table A.7.6.19.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1	CSI-RS		N/A	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
TRS configuration		1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1	120		120	
OCNG Patterns		1	OP.5		N/A	
cellIndividualOffset	dB	1	N/A		16	
CD-SSB		1	SSB.1 FR2		SSB.7 FR2	
Propagation Condition		1	AWGN		AWGN	

Table A.7.6.19.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam assumption[Note 4]		1	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
$\hat{E}_s / I_{ot}$ BB Note 5	dB	1	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
Io	dBm/95.04 MHz	1	-64.41	-64.41	-Infinity	-64.41
Time multiplexing of the downlink transmissions from each AoA		1	Defined in figure A.7.6.19.1.1-1			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Void
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

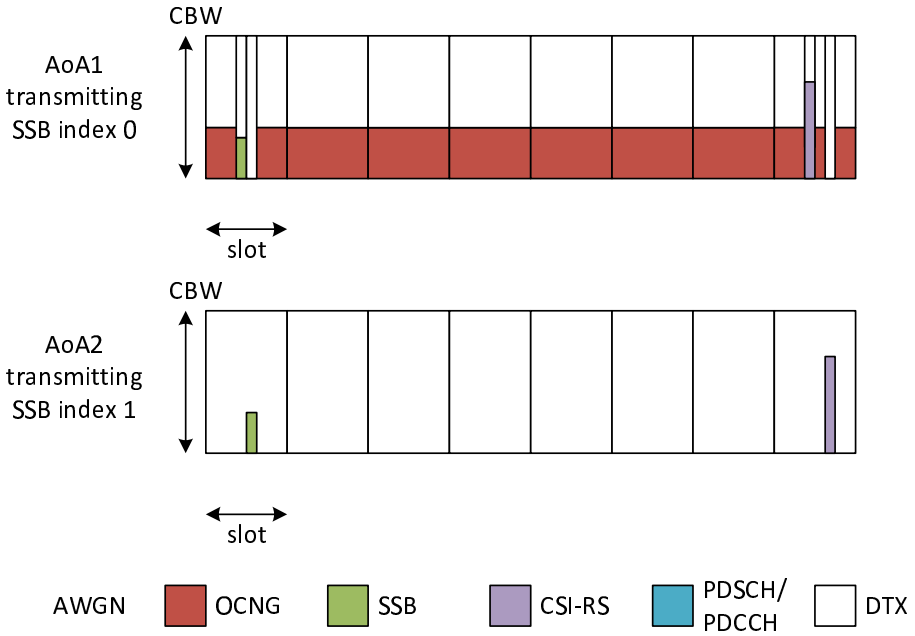


Figure A.7.6.19.1.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.7.6.19.1.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 3200 ms for a UE supporting power class 1 and 5,
- 1920 ms for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

UE shall report corresponding HARQ-ACK/NACK for those PDSCHs scheduled in the slots that are not overlapped with the measurement gap. UE is not allowed to cause any interruption outside the configured measurement gap occasions.

A.7.6.19.2 SA event triggered reporting test without gap under non-DRX

A.7.6.19.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.19.2.1-1.

Table A.7.6.19.2.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.19.2.1-2, A.7.6.19.2.1-3 and A.7.6.19.2.1-4 below. The serving frequency selected for this test case should be one in which the UE reports *NeedForGapsInfoNR-r16* = 'no-gap' and *NeedForInterruptionInfoNR-r18* = 'no-gap-no-interruption' for the PCell.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

The TE schedules continuous DL data on PCell throughout the test.

Table A.7.6.19.2.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1, 2	PCell (Cell 1)	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration		1, 2	SMTC.1	
CSI-RS parameters		1, 2	CSI-RS.3.2 TDD resource #0	Resource #1 is not used
A3-Offset	dB	1, 2	-11	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	Synchronous cells
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.7.6.19.2.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
		2	48		48	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	CSI-RS		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2	CCR.3.7 TDD		N/A	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.5		N/A	
cellIndividualOffset	dB	1~2	N/A		16	
SSB		1	SSB.1 FR2		SSB.7 FR2	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
		2	SSB.2 FR2		SSB.8 FR2	
Propagation Condition		1, 2	AWGN		AWGN	

Table A.7.6.19.2.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam assumption[Note 4]		1,2	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1	-64.41	-64.41	-Infinity	-64.41
		2	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1, 2	Defined in figure A.7.6.19.2.1-1			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

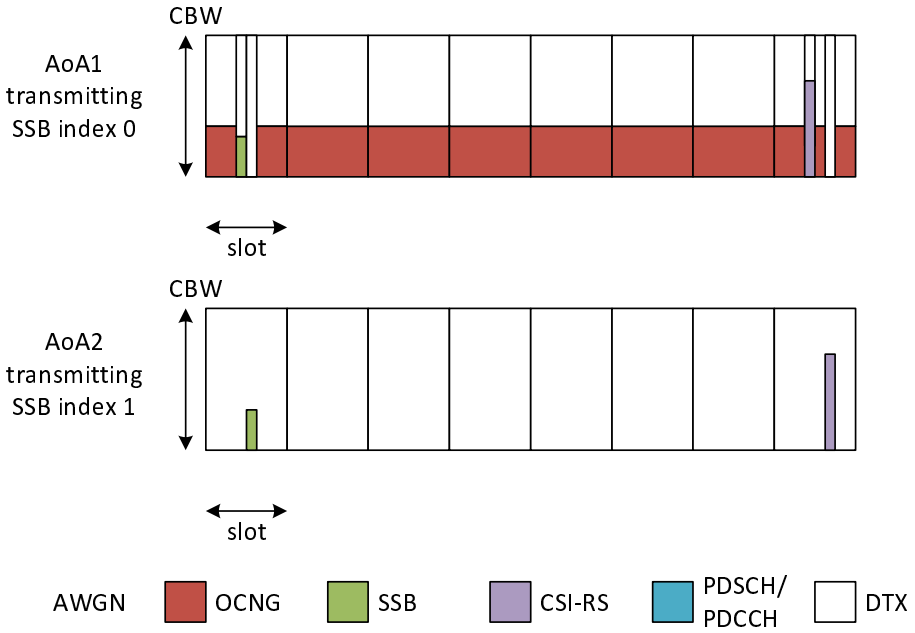


Figure A.7.6.19.2.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.7.6.19.2.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 1.6 s for a UE supporting power class 1 and 5,
- 1.08 s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

UE shall report corresponding HARQ-ACK/NACK for all PDSCHs scheduled during the test.

A.7.6.19.3 SA event triggered reporting test without gap without interruption under non-DRX

A.7.6.19.3.1 Test Purpose and Environment

The purpose of this test is to verify that if UE reports "*no-gap*" via *interFreq-needForGap-r16* and reports "*no-gap-no-interruption*" via *interFreq-needForInterruption-r18*, the UE makes correct reporting of an event. This test will partly verify the inter-frequency without gap cell search requirements in clause 9.3.9. Supported test configurations are shown in table A.7.6.19.3.1-1.

Table A.7.6.19.3.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

There are two cells in the test, NR cell 1 as PCell in FR2 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters for the Cell 1 and Cell 2 are given in tables A.7.6.19.3.1-2, A.7.6.19.3.1-3 and A.7.6.19.3.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the neighbour cell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.19.3.1-2: General test parameters for inter-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without interruption

Parameter	Unit	Config	Value	Comment
Active cell		1	PCell (Cell 1)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		1	Cell 2	NR cell 2 is on NR RF channel number 2.
RF Channel Number		1	1, 2	Two FR2 NR carrier frequencies are used.
SMTC configuration		1	SMTC.1	
A3-Offset	dB	1	-6	
CP length		1	Normal	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX		1	OFF	
Time offset between Cell 1 and Cell 2		1	3 μs	Synchronous cells
T1	s	1	5	
T2	s	1	5	

Table A.7.6.19.3.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		-	
Active DL BWP configuration		1	DLBWP.1.1		-	
Active UL BWP configuration		1	ULBWP.1.1		-	
RLM-RS		1	SSB		SSB	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		CCR.3.1 TDD	
TRS configuration		1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1	TCI.State.2		N/A	
OCNG Patterns		1	OP.1		OP.1	
SSB		1	SSB.3 FR2		SSB.3 FR2	
Propagation Condition		1	AWGN			

Table A.7.6.19.3.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 defined in A.3.15.1			
Beam assumption[Note 4]		1	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1	4	4	-Infinity	8
N_{oc} Note 2	dBm/15 KHz	1	-102			
N_{oc} Note 2	dBm/SCS	1	-93			
SS-RSRP	dBm/SCS	1	-89	-89	-Infinity	-85
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	8
Io	dBm/95.04MHz	1	-58.56		-55.38	

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.19.3.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 2.4s for a UE supporting power class 1,
- 1.44s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

During the T1 and T2, UE shall be able to report ACK/NACK for all slots with PDCCH/PDSCH on PCell excluding those symbles as defined in clause 9.3.9.4.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.20 LTM Intra-frequency L1-RSRP measurement

A.7.6.20.1 Intra-frequency SSB based L1-RSRP measurement in FR2

A.7.6.20.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of SSB based intra-frequency L1-RSRP measurement on neighbor cell in FR2. This test will partly verify the L1-RSRP measurement requirements in clause 9.14, with the testing configurations for NR cells in table A.7.6.20.1.1-1.

The AoA setup of FR2 cell for this test is Setup 1 as defined in clause A.3.15.

Table A.7.6.20.1.1-1: Applicable NR configurations for SSB based Intra-frequency L1-RSRP LTM measurement with activated TCI state test in FR2

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.7.6.20.1.2 Test parameters

There are two cells in the test, which are FR2 PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

Measurement period and measurement accuracy is tested by using the parameters in table A.7.6.20.1.2-1 and table A.7.6.20.1.2-2.

There are two tests in the test case, test 1 and test 2:

- In test 1, time offset between cells is within CP length.
- In test 2, time offset between cells is larger than CP length.

If a UE does not support *multiCellL1-measRTD-greaterThan-CP-r18*, it is only required to pass test 1. Otherwise, it is only required to pass test 2.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs, and report measurement results periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. SSB_RP of Cell 2 in T1 and T2 are different. No gap patterns are configured in the test case.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 (PCell) on RF channel 1 (PCC).
- A measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. Before the start of the T1, event is triggered, and UE has sent a measurement report for the Cell 2 with SSB Index.
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.
- The UE has performed L3 measurement on Cell 2.

At the beginning of T2, SSB_RP of Cell 2 change to different values from T1. T2 starts at the beginning of a frame with an odd SFN.

Table A.7.6.20.1.2-1: General test parameters for SSB based intra-frequency L1-RSRP LTM measurement without activated TCI state test in FR2

Parameter		Unit	Value		Comment
			Test 1	Test 2	
Active cell			Cell 1		
Neighbouring cell			Cell 2		Cell 2 is the candidate cell
A3-Offset		dB	-15		
Hysteresis		dB	0		
Time To Trigger		ms	0		
Filter coefficient			0		L3 filtering is not used
DRX			OFF		DRX is not used
Time offset between cells			0.2 µs	2µs	The timing of Cell 2 is later than the timing of Cell 1
deriveSSB-IndexFromCell			Enabled		
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	320		Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1		Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1		
	spCellInclusion		N/A		
ltm-ConfigComplete			True		Candidate cell's configuration is complete configuration
T1		s	1.5		
T2		s	≤ 2		

Table A.7.6.20.1.2-2: Cell specific test parameters for SSB based intra-frequency L1-RSRP LTM measurement without activated TCI state test in FR2

Parameter	Config	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
SSB ARFCN	1~2		Freq1			
Duplex mode	1~2		TDD			
TDD Configuration	1~2		TDDConf.3.1			
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66			
Data PRBs allocated	1~2		66			
PDSCH/PDCCH subcarrier spacing	1~2	KHz	120			
PUCCH/PUSCH subcarrier spacing	1~2	KHz	120			
PDSCH Reference measurement channel	1		SR.3.2 TDD		N/A	
	2		SR.3.3 TDD		N/A	
RMSI CORESET Reference Channel	1,		CR.3.1 TDD		N/A	
	2		CR.3.2 TDD		N/A	
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD		N/A	
	2		CCR.3.7 TDD		N/A	
SSB configuration	1		SSB.3 FR2		SSB.7 FR2	
	2		SSB.8 FR2		SSB.4 FR2	
OCNG Patterns	1~2		OP.4		N/A	

Parameter	Config	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1			
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3			
SMTC configuration	1~2		SMTC.1			
TRS Configuration	1~2		TRS.2.1 TDD		N/A	
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2		N/A	
EPRE ratio of PSS to SSS	1~2	dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition	1~2		AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						

Table A.7.6.20.1.2-3: NR OTA Cell specific test parameters for SSB based intra-frequency L1-RSRP LTM measurement without activated TCI state test in FR2

Parameter	Config	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Angle of arrival configuration	1~2		Setup 1 according to A.3.15.1			
Beam Assumption Note 4	1~2		Rough		Rough	
$\hat{E}_s / I_{ot}$ BB Note 5	1~2	dB	-1.5	16.5	-1.5	16.5
SSB_RP Note3	1	dBm/SSB SCS	-103	-85	-103	-85
	2		-100	-82	-100	-82
Io Note3	1	dBm/95.04 MHz	-74	-56	-74	-56
	2		-74	-56	-74	-56
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 5: Calculation of Es/Iot$_{BB}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.6.20.1.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots in T2. The UE shall start to report a larger L1-RSRP value of Cell 2 in no later than 960 ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the valid results for Cell 2 while meeting the accuracy requirements defined in clause 10.1.20A. The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.21 LTM Inter-frequency L1-RSRP measurement with measurement gap

A.7.6.21.1 Inter-frequency SSB-based L1-RSRP measurement with measurement gap for LTM in FR2

A.7.6.21.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of inter-frequency L1-RSRP measurement with MG for LTM. This test will partly verify the L1-RSRP measurement requirements in clause 9.15.5, with the testing configurations in tables A.7.6.21.1.1-1, A.7.6.21.1.2-1, A.7.6.21.1.2-2 and A.7.6.21.1.2-3.

The AoA setup of FR2 cell for this test is Setup 1 as defined in clause A.3.15.

Table A.7.6.21.1.1-1: Applicable NR configurations for SSB based inter-frequency L1-RSRP measurement with measurement gap for LTM

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: Target NR cell has the same SCS, BW and duplex mode as NR serving cell	

A.7.6.21.1.2 Test parameters

There are two cells in the test, Cell 1 is the PCell on NR RF channel number 1 and Cell 2 is a neighbor cell NR RF channel number 2. The test parameters for Cell 1 and Cell 2 are given in table A.7.6.21.1.2-2 and table A.7.6.21.1.2-3.

The test consists of two successive time periods, with time duration of T1 and T2 respectively. SSB_RP of Cell 2 in T1 and T2 are different. Measurement gap is configured in the test.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 (PCell) on RF channel 1 (PCC).
- A measurement object is configured for the RF channel 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used. Before the start of the T1, event is triggered, and UE has sent a measurement report for the Cell 2 with SSB Index.
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.

At the beginning of T2, SSB_RP of Cell 2 changes to a different value from T1.

Table A.7.6.21.1.2-1: General test parameters for SSB based inter-frequency L1-RSRP LTM measurement with measurement gap test in FR2

Parameter		Unit	Value	Comment
Active cell			Cell 1	
Neighbouring cell			Cell 2	Cell 2 is the candidate cell
A3-Offset		dB	-15	
offsetMO		dB	16	Applied to NR Cell 2 measurement object
Hysteresis		dB	0	
Time To Trigger		ms	0	
Filter coefficient			0	L3 filtering is not used
maxNrofRS-IndexesToReport			1	
includeBeamMeasurements			True	
DRX			OFF	DRX is not used
Time offset between cells			3 μs	The timing of Cell 2 is later than the timing of Cell 1
deriveSSB-IndexFromCell			Enabled	Not relevant to this test case
Gap Pattern Id			13	
Measurement gap offset		ms	39	
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	320	Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1	Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1	

Parameter	Unit	Value	Comment
spCellInclusion		N/A	
ltm-ConfigComplete		True	Candidate cell's configuration is complete configuration
T1	s	2	
T2	s	≤2	

Table A.7.6.21.1.2-1: Cell specific test parameters for SSB based inter-frequency L1-RSRP LTM measurement with measurement gap test in FR2

Parameter	Config	Unit	Cell 1	Cell 2
SSB ARFCN	1~2		freq1	freq 2
Duplex mode	1~2		TDD	
TDD Configuration	1~2		TDDConf.3.1	
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1~2		66	
PDSCH/PDCCH subcarrier spacing	1~2	KHz	120	
PUCCH/PUSCH subcarrier spacing	1~2	KHz	120	
PDSCH Reference measurement channel	1		SR.3.2 TDD	N/A
	2		SR.3.3 TDD	N/A
RMSI CORESET Reference Channel	1		CR.3.1 TDD	N/A
	2		CR.3.2 TDD	N/A
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	N/A
	2		CCR.3.7 TDD	N/A
SSB configuration	1		SSB.3 FR2	SSB.3 FR2
	2		SSB.4 FR2	SSB.4 FR2
OCNG Patterns	1~2		OP.1	OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3	
SMTC configuration	1~2		SMTC.1	SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD	N/A
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2	N/A
EPRE ratio of PSS to SSS	1~2	dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation condition	1~2		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.7.6.21.1.2-3: SSB specific test parameters for neighbor cell

Parameter	Config	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Angle of arrival configuration	1~2		Setup 1 according to A.3.15.1			
Beam Assumption Note 4	1~2		Rough		Rough	
$\hat{E}_s / I_{ot}$ BB Note 5	1~2	dB	16.5	16.5	-1.5	16.5
SSB_RP Note3	1	dBm/SSB SCS	-85	-85	-103	-85
	2		-82	-82	-100	-82
Io Note3	1	dBm/95.04 MHz	-56	-56	-74	-56
	2		-56	-56	-74	-56

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Config	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.6.21.1.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots in T2. The UE shall start to report a larger L1-RSRP value of Cell 2 in no later than 1280 ms plus 320 slots from the beginning of time period T2. UE shall send L1-RSRP report including the valid results for Cell 2 while meeting the accuracy requirements defined in clause 10.1.20B.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.22 LTM Inter-frequency L1-RSRP measurement without measurement gap

A.7.6.22.1 Inter-frequency SSB based L1-RSRP measurement without measurement gap in FR2

A.7.6.22.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *interFreqSSB-L1-MeasWithoutGaps-r18* makes correct reporting of inter-frequency L1-RSRP measurement without gap for LTM. This test will partly verify the L1-RSRP measurement requirements in clause 9.15.6, with the testing configurations in tables A.7.6.22.1.1-1, A.7.6.22.1.2-1, A.7.6.22.1.2-2, A.7.6.22.1.2-3 and A.7.6.22.1.2-4.

The AoA setup of FR2 cell for this test is Setup 1 as defined in clause A.3.15.

Table A.7.6.22.1.1-1: Applicable NR configurations for SSB based inter-frequency L1-RSRP LTM measurement without gap in FR2

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	
NOTE 2: Target NR cell has the same SCS, BW and duplex mode as NR serving cell	

A.7.6.22.1.2 Test parameters

There are two cells in the test, Cell 1 is the PCell on NR RF channel number 1 and Cell 2 is a neighbor cell NR RF channel number 2. The SSB of Cell 2 is completely within UE's active BWP BW. The PRBs containing SSB from Cell 1 and Cell 2 should be different in frequency location within the cell bandwidth. The test parameters for Cell 1 are given in table A.7.6.22.1.2-1. The test parameters for Cell 2 are given in table A.7.6.22.1.2-2 and table A.7.6.22.1.2-3.

There are two tests in the test case, test 1 and test 2:

- In test 1, time offset between cells is within CP length.
- In test 2, time offset between cells is larger than CP length.

UE not capable of *multiCellL1-measRTD-greaterThan-CP-r18* is only required to pass test 1. Otherwise, it is only required to pass test 2.

The test consists of two successive time periods, with time duration of T1 and T2 respectively. SSB_RP of Cell 2 in T1 and T2 are different. No measurement gap is configured in the test.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 (PCell) on RF channel 1 (PCC).
- A measurement object is configured for the RF channel 2, and it is indicated to the UE that event-triggered reporting with Event A3 is used. Before the start of the T1, event is triggered, and UE has sent a measurement report for the Cell 2 with SSB Index.
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.

At the beginning of T2, SSB_RP of Cell 2 changes to a different value from T1. T2 starts at the beginning of a frame with an odd SFN.

Table A.7.6.22.1.2-1: General test parameters for SSB based inter-frequency L1-RSRP LTM measurement test in FR2

Parameter		Unit	Value		Comment
			Test 1	Test 2	
Active cell			Cell 1		
Neighbouring cell			Cell 2		Cell 2 is the candidate cell
RF Channel Number			1: Cell 1 2: Cell 2		
A3-Offset		dB	-15		
Hysteresis		dB	0		
Time To Trigger		ms	0		
Filter coefficient			0		L3 filtering is not used
maxNrofRS-IndexesToReport			1		
includeBeamMeasurements			True		
DRX			OFF		DRX is not used
Time offset between cells			0.2 µs	2µs	The timing of Cell 2 is later than the timing of Cell 1
LTM-CSI-ReportConfig	L1-RSRP reporting period	slot	320		Periodic L1-RSRP reporting configured
	nrOfReportedCells		n1		Report candidate cell's (Cell 2) L1-RSRP measurement results.
	nrOfReportedRS-PerCell		n1		
	spCellInclusion		N/A		
ltm-ConfigComplete			True		Candidate cell's configuration is complete configuration
T1		s	1.5		
T2		s	≤2		

Table A.7.6.22.1.2-2: Cell specific test parameters for SSB based inter-frequency L1-RSRP LTM measurement test in FR2

Parameter	Config	Unit	Cell 1	Cell 2
SSB ARFCN	1~2		freq1	freq2
Duplex mode	1~2		TDD	
TDD Configuration	1~2		TDDConf.3.1	
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1~2		66	
PDSCH/PDCCH subcarrier spacing	1~2	KHz	120	
PUCCH/PUSCH subcarrier spacing	1~2	KHz	120	
PDSCH Reference measurement channel	1		SR.3.2 TDD	N/A
	2		SR.3.3 TDD	N/A
RMSI CORESET Reference Channel	1		CR.3.1 TDD	N/A
	2		CR.3.2 TDD	N/A
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	N/A
	2		CCR.3.7 TDD	N/A

Parameter	Config	Unit	Cell 1	Cell 2
SSB configuration	1		SSB.3 FR2	
	2		SSB.4 FR2	
OCNG Patterns	1~2		OP.4	N/A
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3	
SMTC configuration	1~2		SMTC.1	
TRS Configuration	1~2		TRS.2.1 TDD	N/A
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2	N/A
EPRE ratio of PSS to SSS	1~2	dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation condition	1~2		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Table A.7.6.22.1.2-3: NR OTA Cell specific test parameters for SSB based inter-frequency L1-RSRP LTM measurement without measurement gap in FR2

Parameter	Config	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Angle of arrival configuration	1~2		Setup 1 according to A.3.15.1			
Beam Assumption Note 3	1~2		Rough		Rough	
$\hat{E}_s/I_{ot}$ BB Note 4	1~2	dB	-1.5	16.5	-1.5	16.5
SSB_RP Note2	1	dBm/SSB SCS	-103	-85	-103	-85
	2		-100	-82	-100	-82
Io Note2	1	dBm/95.04 MHz	-74	-56	-74	-56
	2		-74	-56	-74	-56
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.6.22.1.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots in T2. No later than 960 ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the valid results for Cell 2 while meeting the accuracy requirements defined in clause 10.1.20B.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.23 Idle Mode CA/DC Measurements

A.7.6.23.1 Test case for Idle mode fast CA/DC eEMR measurement for FR2 without valid reporting

A.7.6.23.1.1 Test Purpose and Environment

The purpose of this test is to verify UE measurement reporting behaviour as specified in clause 4.7 when the UE supports *measValidationReportEMR-r18*. This test will partly verify the fast CA/DC measurement reporting requirements in clause 4.7 when *measIdleValidityDuration* is configured for the test case when there are no measurement results to report at RRC connection setup.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 1 and NR cell 2 as inter-frequency neighbour cell in FR2 on NR RF channel 2. The test parameters are given in tables A.7.6.23.1.1-1, A.7.6.23.1.1-2, A.7.6.23.1.1-3 and A.7.6.23.1.1-4.

The test consists of 4 successive time periods, with time duration of T1, T2, T3 and T4 respectively.

Before T1, the UE is connected to cell 1 and configured with inter-frequency measurement on cell 2 with periodic reporting. The time when a valid measurement report is received at TE defines the starting point of T1.

During T1, the UE is configured with early measurement reporting for cell 2 in *measIdleCarrierListNR-r16*. Beam level reporting for early measurements is not configured. The time point when UE receives RRC_Release message from the TE defines the starting point of T2.

During T2 and T3 the UE is in idle mode. The time when T331 timer expires defines the ending point of T2.

At the beginning of T2, cell 2 becomes detectable however cell reselection shall not be performed. Signal level of cell 2 is set to the value given in table A.7.6.23.1.1-3. The time when T331 timer expires defines the ending point of T2.At the beginning of T3, the signal level of the neighbour cell is set to turned off. The duration of the T3 equals to *measIdleValidityDuration*.

The time when TE sends the paging message is defined as the starting point of T4. During T4, in this test the UE shall not send measurement report.

Table A.7.6.23.1.1-1: supported test configuration

Config	Description for serving cell	Description for neighbor cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell		

Table A.7.6.23.1.1-2: General test parameters for Idle mode fast CA/DC eEMR measurement for FR2

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	One FR1 and one FR2 NR carrier frequencies are used.
Active cell		Config 1,2,3	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell2	NR cell 2 is on NR RF channel number 2.
SMTC-SSB parameters		Config 1	Cell 1: SSB.1 FR1 Cell 2: SSB.1 FR2	
		Config 2	Cell 1: SSB.1 FR1 Cell 2: SSB.1 FR2	
		Config 3	Cell 1: SSB.2 FR1 Cell 2: SSB.2 FR2	
Hysteresis	dB	Config 1,2,3	0	
PRACH configuration index		Config 1,2,3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	

Parameter	Unit	Test configuration	Value	Comment
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX in connected mode		Config 1,2,3	OFF	DRX is not used
DRX in idle mode	s	Config 1,2,3	0.32	The value shall be used for all cells in the test.
T331	s		30	
measIdleValidityDuration	s		50	
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	1	
T2	s	Config 1,2,3	30	
T3	s	Config 1,2,3	50	
T4	s	Config 1,2,3	1	

Table A.7.6.23.1.1-3: Cell specific test parameters in Idle and Connected mode for Idle mode fast CA/DC eEMR measurement for FR2

Parameter		Unit	Test configuration	Cell 1				Cell 2			
				T1	T2	T3	T4	T1	T2	T3	T4
NR RF Channel Number			Config 1,2,3	1				2			
Duplex mode			Config 1	FDD				TDD			
			Config 2,3	TDD				TDD			
TDD configuration			N.A	N.A				TDDConf.3.1			
			TDDConf.1.1	TDDConf.1.1				TDDConf.3.1			
			TDDConf.2.1	TDDConf.2.1				TDDConf.3.1			
BWchannel		MHz	Config 1,2	10: $N_{PRB,c}$ = 52				100: $N_{PRB,c}$ = 66			
			Config 3	40: $N_{PRB,c}$ = 106				100: $N_{PRB,c}$ = 66			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52				100: $N_{PRB,c}$ = 66			
			Config 3	40: $N_{PRB,c}$ = 106				100: $N_{PRB,c}$ = 66			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1				NA			
	Initial UL BWP			ULBWP.0.1				NA			
	Dedicated DL BWP			DLBWP.1.1				NA			
	Dedicated UL BWP			ULBWP.1.1				NA			
TRS configuration			Config 1	TRS.1.1 FDD				NA			
			Config 2	TRS.1.1 TDD				NA			
			Config 3	TRS.1.2 TDD				NA			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1				OP.1			
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD				SR.3.1 TDD			
			Config 2	SR.1.1 TDD				SR.3.1 TDD			
			Config 3	SR2.1 TDD				SR.3.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD				CR.3.1 TDD			
			Config 2	CR.1.1 TDD				CR.3.1 TDD			
			Config 3	CR2.1 TDD				CR.3.1 TDD			
SSB parameters			Config 1	SSB.1 FR1				SSB.1 FR2			
			Config 2	SSB.1 FR1				SSB.1 FR2			
			Config 3	SSB.2 FR1				SSB.1 FR2			
SMTC configuration defined in A.3.11			Config 1	SMTC.2				SMTC.1			
			Config 2, 3	SMTC.1				SMTC.1			
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15				120			
			Config 3	30				120			

Parameter	Unit	Test configuration	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
EPRE ratio of PSS to SSS		Config 1,2,3	0				0			
EPRE ratio of PBCH DMRS to SSS										
EPRE ratio of PBCH to PBCH DMRS										
EPRE ratio of PDCCH DMRS to SSS										
EPRE ratio of PDCCH to PDCCH DMRS										
EPRE ratio of PDSCH DMRS to SSS										
EPRE ratio of PDSCH to PDSCH										
EPRE ratio of OCNG DMRS to SSS(Note 1)										
EPRE ratio of OCNG to OCNG DMRS (Note 1)										
N_{oc} Note2	dBm/15 kHz		-98				See Table A.7.6.23.1.1-4			
N_{oc} Note2	dBm/SCS	Config 1,2	-98							
		Config 3	-95							
SS-RSRP Note 3	dBm/SCS	Config 1,2	-91							
		Config 3	-88							
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,	7							
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	7							
IoNote3	dBm/9.36 MHz	Config 1,2	-62.26							
	dBm/38.16 MHz	Config 3	-56.15							
Propagation Condition		Config 1,2,3	AWGN				AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.7.6.23.1.1-4: OTA related test parameters for Test case Idle mode fast CA/DC eEMR measurement for FR2

Parameter		Unit	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
Angle of arrival configuration			N/A				Setup 1 defined in clause A.3.15.1			
Assumption for UE beams Note 7			N/A				Rough			
N_{oc} Note 1	Config 1,2,3	dBm/15 kHz	N/A				-104.7	-104.7	-104.7	-104.7
N_{oc} Note 1	Config 1,2,3	dBm/SCS					-95.7	-95.7	-95.7	-95.7
$\hat{E}_s/N_{oc}$	Config 1,2,3	dB					7	7	-infinity	-infinity
$\hat{E}_s/I_{ot}$	Config 1,2,3	dB					7	7	-infinity	-infinity
SSB_RP Note 2, Note 4	Config 1,2,3	dBm/SCS					-88.7	-88.7	-infinity	-infinity
Io Note 2, Note 4	Config 1,2,3	dBm/95.04 MHz					-58.92	-58.92	-66.68	-66.68

Parameter	Unit	Cell 1				Cell 2			
		T1	T2	T3	T4	T1	T2	T3	T4
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.									
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.									
NOTE 3: Void									
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone									
NOTE 5: Void									
NOTE 6: Void									
NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.									

A.7.6.23.1.2 Test Requirements

During the period T2 and T3, the UE shall not perform reselection.

At the start of T4 the UE is paged for connection setup. During the connection setup the UE is requested to transmit early measurement report for cell 2.

The UE shall NOT send early measurement report to the PCell in this test.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.23.2 Test case for Idle mode fast CA/DC cell reselection measurement for FR2 without valid reporting

A.7.6.23.2.1 Test Purpose and Environment

The purpose of this test is to verify UE measurement reporting behaviour as specified in clause 4.7 when the UE supports *measValidationReportReselectionMeasurements-r18* This test will partly verify the fast CA/DC measurement reporting requirements in clause 4.7 when *measReselectionValidityDuration-r18* is configured for the test case when there are no measurement results to report at RRC connection setup.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 1 and NR cell 2 as inter-frequency neighbour cell in FR2 on NR RF channel 2. The test parameters are given in tables A.7.6.23.2-1, A.7.6.23.2-2, A.7.6.23.2-3 and A.7.6.23.2-4.

The test consists of 4 successive time periods, with time duration of T1, T2, T3 and T4 respectively.

Before T1, the UE is connected to cell 1 and configured with inter-frequency measurement on cell 2 with periodic reporting. The time when a valid measurement report is received at TE defines the starting point of T1.

During T1, the UE is configured with early measurement reporting for cell 2 in *MeasReselectionCarrierListNR-r18*. Beam level reporting for early measurements is not configured. The time point when UE receives RRC_Release message from the TE defines the starting point of T2.

During T2 and T3 the UE is in idle mode.

At the beginning of T2, cell 2 becomes detectable however no cell reselection is being performed. Signal level of cell 2 is set to the level according to Table A.7.6.23.2-3. The duration of T2 is set to fixed value according to the Table A.7.6.23.2-2.

At the beginning of T3, the signal level of the neighbour cell is set to turned off. The duration of the T3 equals to *measReselectionValidityDuration-r18.*

The time when TE sends the paging message defined as the starting point of T4.

During T4, UE shall not send measurement report.

Table A.7.6.23.2-1: supported test configuration

Config	Description for serving cell	Description for neighbor cell

1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell		

Table A.7.6.23.2-2: General test parameters for Idle mode fast CA/DC cell reselection measurement for FR2

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	One FR1 and one FR2 NR carrier frequencies are used.
Active cell		Config 1,2,3	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell2	NR cell 2 is on NR RF channel number 2.
SMTC-SSB parameters		Config 1	Cell 1: SSB.1 FR1 Cell 2: SSB.1 FR2	
		Config 2	Cell 1: SSB.1 FR1 Cell 2: SSB.1 FR2	
		Config 3	Cell 1: SSB.2 FR1 Cell 2: SSB.2 FR2	
Hysteresis	dB	Config 1,2,3	0	
PRACH configuration index		Config 1,2,3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX in connected mode		Config 1,2,3	OFF	DRX is not used
DRX in idle mode	s	Config 1,2,3	0.32	The value shall be used for all cells in the test.
T331	s		30	
measIdleValidityDuration	s		50	
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	1	
T2	s	Config 1,2,3	30	
T3	s	Config 1,2,3	50	
T4	s		1	

Table A.7.6.23.2-3: Cell specific test parameters in Idle and Connected mode for Idle mode fast CA/DC cell-reselection measurement for FR2

Parameter	Unit	Test configuration	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
NR RF Channel Number		Config 1,2,3	1				2			
Duplex mode		Config 1	FDD				TDD			
		Config 2,3	TDD				TDD			
TDD configuration		N.A	N.A				TDDConf.3.1			
		TDDConf.1.1	TDDConf.1.1				TDDConf.3.1			
		TDDConf.2.1	TDDConf.2.1				TDDConf.3.1			
BWchannel	MHz	Config 1,2	10: $N_{PRB,c}$ = 52				100: $N_{PRB,c}$ = 66			
		Config 3	40: $N_{PRB,c}$ = 106				100: $N_{PRB,c}$ = 66			
BWP BW	MHz	Config 1,2	10: $N_{PRB,c}$ = 52				100: $N_{PRB,c}$ = 66			

Parameter		Unit	Test configuration	Cell 1				Cell 2			
				T1	T2	T3	T4	T1	T2	T3	T4
			Config 3	40: $N_{PRB,c}$ = 106				100: $N_{PRB,c}$ = 66			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1				NA			
	Initial UL BWP			ULBWP.0.1				NA			
	Dedicated DL BWP			DLBWP.1.1				NA			
	Dedicated UL BWP			ULBWP.1.1				NA			
TRS configuration			Config 1	TRS.1.1 FDD				NA			
			Config 2	TRS.1.1 TDD				NA			
			Config 3	TRS.1.2 TDD				NA			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1				OP.1			
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD				SR.3.1 TDD			
			Config 2	SR.1.1 TDD				SR.3.1 TDD			
			Config 3	SR2.1 TDD				SR.3.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD				CR.3.1 TDD			
			Config 2	CR.1.1 TDD				CR.3.1 TDD			
			Config 3	CR2.1 TDD				CR.3.1 TDD			
SSB parameters			Config 1	SSB.1 FR1				SSB.1 FR2			
			Config 2	SSB.1 FR1				SSB.1 FR2			
			Config 3	SSB.2 FR1				SSB.1 FR2			
SMTC configuration defined in A.3.11			Config 1	SMTC.2				SMTC.1			
			Config 2, 3	SMTC.1				SMTC.1			
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15				120			
			Config 3	30				120			
EPRE ratio of PSS to SSS			Config 1,2,3	0				0			
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of PDCCH DMRS to SSS											
EPRE ratio of PDCCH to PDCCH DMRS											
EPRE ratio of PDSCH DMRS to SSS											
EPRE ratio of PDSCH to PDSCH											
EPRE ratio of OCNG DMRS to SSS(Note 1)											
EPRE ratio of OCNG to OCNG DMRS (Note 1)											
N_{oc} Note2		dBm/15 kHz		-98				See Table A.7.6.23.2-4			
N_{oc} Note2		dBm/SCS	Config 1,2	-98							
			Config 3	-95							
SS-RSRP Note 3		dBm/SCS	Config 1,2	-91							
			Config 3	-88							
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3	7							
$\hat{E}_s/N_{oc}$		dB	Config 1,2,3	7							
IoNote3		dBm/9.36 MHz	Config 1,2	-62.26							
		dBm/38.16 MHz	Config 3	-56.15							
Propagation Condition			Config 1,2,3	AWGN				AWGN			

Parameter	Unit	Test configuration	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.										

Table A.7.6.23.2-4: OTA related test parameters for Test case Idle mode fast CA/DC cell-reselection measurement for FR2

Parameter		Unit	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
Angle of arrival configuration			N/A				Setup 1 defined in clause A.3.15.1			
Assumption for UE beams Note 7			N/A				Rough			
N_{oc} Note 1	Config 1,2,3	dBm/15 kHz	N/A				-104.7	-104.7	-104.7	-104.7
N_{oc} Note 1	Config 1,2,3	dBm/SCS					-95.7	-95.7	-95.7	-95.7
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB					7	7	-infinity	-infinity
$\hat{E}_s / I_{ot}$	Config 1,2,3	dB					7	7	-infinity	-infinity
SSB_RP Note 2, Note 4	Config 1,2,3	dBm/SCS					-88.7	-88.7	-infinity	-infinity
Io Note 2, Note 4	Config 1,2,3	dBm/95.04 MHz					-58.92	-58.92	-66.68	-66.68
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Void NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: Void NOTE 6: Void NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.										

A.7.6.23.2.2 Test Requirements

During the period T2 and T3, the UE shall not perform reselection.

At the start of T4 the UE is paged for connection setup. During the connection setup the UE is requested to transmit early measurement report for cell 2.

The UE shall NOT send early measurement report to the PCell in this test.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.23.3 Test case for Idle mode fast CA/DC cell reselection measurement for FR2 with valid reporting

A.7.6.23.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE performs the required measurements on the serving cell and the configured inter-frequency carrier for idle mode measurement reporting after the UE has entered Idle mode when the UE supports *measValidationReportReselectionMeasurements-r18*. This test will partly verify the fast CA/DC

measurement reporting requirements in clause 4.7 when *measReselectionValidityDuration-r18* is configured for the test case when there are measurement results to report at RRC connection setup.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters are given in tables A.7.6.23.3.1-1, A.7.6.23.3.1-2, A.7.6.23.3.1-3 and A.7.6.23.3.1-4.

The test consists of 4 successive time periods, with time duration of T1, T2, T3 and T4 respectively.

During T1, the UE is connected to cell 1 only and shall not have any timing information of cell 2. UE is configured with early measurement reporting for cell 2 in *MeasReselectionCarrierListNR-r18*. Beam level reporting for early measurements is not configured. The time point when UE receives RRC_Release message from the TE defines as the starting point of T2.

During T2, cell 2 becomes detectable however no cell reselection is being performed. Signal level of cell 2 is set to fixed value according to Table A.7.6.23.3-2. The duration of T2 is set to fixed value according to the Table A.7.6.23.3-2.

The duration of the T3 equals to the configured value *measReselectionValidityDuration-r18.* During T3, the signal level of cell 2 is set to another value according to the Table A.7.6.23.3-2.

The time when TE sends the paging message defines the starting point of T4.

During T4, UE shall send measurement report within the duration of T4.

Table A.7.6.23.3-1: supported test configuration

Config	Description for serving cell	Description for neighbor cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell		

Table A.7.6.23.3-2: General test parameters for Idle mode fast CA/DC cell reselection measurement for FR2

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	One FR1 and one FR2 NR carrier frequencies are used.
Active cell		Config 1,2,3	NR cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell2	NR cell 2 is on NR RF channel number 2.
SMTC-SSB parameters		Config 1	Cell 1: SSB.1 FR1 Cell 2: SSB.1 FR2	
		Config 2	Cell 1: SSB.1 FR1 Cell 2: SSB.1 FR2	
		Config 3	Cell 1: SSB.2 FR1 Cell 2: SSB.2 FR2	
Hysteresis	dB	Config 1,2,3	0	
PRACH configuration index		Config 1,2,3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX in connected mode		Config 1,2,3	OFF	DRX is not used
DRX in idle mode	s	Config 1,2,3	0.32	The value shall be used for all cells in the test.
T331	s		30	

Parameter	Unit	Test configuration	Value	Comment
measIdleValidityDuration	s		50	
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	1	
T2	s	Config 1,2,3	30	
T3	s	Config 1,2,3	50	
T4	s		1	

Table A.7.6.23.3-3: Cell specific test parameters in Idle and Connected mode for Idle mode fast CA/DC cell-reselection measurement for FR2

Parameter		Unit	Test configuration	Cell 1				Cell 2			
				T1	T2	T3	T4	T1	T2	T3	T4
NR RF Channel Number			Config 1,2,3	1				2			
Duplex mode			Config 1	FDD				TDD			
			Config 2,3	TDD				TDD			
TDD configuration			N.A	N.A				TDDConf.3.1			
			TDDConf.1.1	TDDConf.1.1				TDDConf.3.1			
			TDDConf.2.1	TDDConf.2.1				TDDConf.3.1			
BWchannel		MHz	Config 1,2	10: $N_{PRB,c}$ = 52				100: $N_{PRB,c}$ = 66			
			Config 3	40: $N_{PRB,c}$ = 106				100: $N_{PRB,c}$ = 66			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52				100: $N_{PRB,c}$ = 66			
			Config 3	40: $N_{PRB,c}$ = 106				100: $N_{PRB,c}$ = 66			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1				NA			
	Initial UL BWP			ULBWP.0.1				NA			
	Dedicated DL BWP			DLBWP.1.1				NA			
	Dedicated UL BWP			ULBWP.1.1				NA			
TRS configuration			Config 1	TRS.1.1 FDD				NA			
			Config 2	TRS.1.1 TDD				NA			
			Config 3	TRS.1.2 TDD				NA			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1				OP.1			
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD				SR.3.1 TDD			
			Config 2	SR.1.1 TDD				SR.3.1 TDD			
			Config 3	SR2.1 TDD				SR.3.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD				CR.3.1 TDD			
			Config 2	CR.1.1 TDD				CR.3.1 TDD			
			Config 3	CR2.1 TDD				CR.3.1 TDD			
SSB parameters			Config 1	SSB.1 FR1				SSB.1 FR2			
			Config 2	SSB.1 FR1				SSB.1 FR2			
			Config 3	SSB.2 FR1				SSB.1 FR2			
SMTC configuration defined in A.3.11			Config 1	SMTC.2				SMTC.1			
			Config 2, 3	SMTC.1				SMTC.1			
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15				120			
			Config 3	30				120			
EPRE ratio of PSS to SSS			Config 1,2,3	0				0			
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											

Parameter	Unit	Test configuration	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
EPRE ratio of PDCCH DMRS to SSS										
EPRE ratio of PDCCH to PDCCH DMRS										
EPRE ratio of PDSCH DMRS to SSS										
EPRE ratio of PDSCH to PDSCH										
EPRE ratio of OCNG DMRS to SSS(Note 1)										
EPRE ratio of OCNG to OCNG DMRS (Note 1)										
N_{oc} Note2	dBm/15 kHz		-98				See Table A.7.6.23.3-4			
N_{oc} Note2	dBm/SCS	Config 1,2	-98							
		Config 3	-95							
SS-RSRP Note 3	dBm/SCS	Config 1,2	-91							
		Config 3	-88							
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,	7							
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	7							
IoNote3	dBm/9.36 MHz	Config 1,2	-62.26							
	dBm/38.16 MHz	Config 3	-56.15							
Propagation Condition		Config 1,2,3	AWGN				AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.7.6.23.3-4: OTA related test parameters for Test case Idle mode fast CA/DC cell-reselection measurement for FR2

Parameter		Unit	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
Angle of arrival configuration			N/A				Setup 1 defined in clause A.3.15.1			
Assumption for UE beams Note 7			N/A				Rough			
N_{oc} Note 1	Config 1,2,3	dBm/15 kHz	N/A				-104.7	-104.7	-104.7	-104.7
N_{oc} Note 1	Config 1,2,3	dBm/SCS					-95.7	-95.7	-95.7	-95.7
$\hat{E}_s/N_{oc}$	Config 1,2,3	dB					7	7	-0.5	- 0.5
$\hat{E}_s/I_{ot}$	Config 1,2,3	dB					7	7	-0.5	-0.5
SSB_RP Note 2, Note 4	Config 1,2,3	dBm/SCS					-88.7	-88.7	-96.5	-96.5
Io Note 2, Note 4	Config 1,2,3	dBm/95.04 MHz					-58.92	-58.92	-69.3	-69.3

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

Parameter	Unit	Cell 1				Cell 2			
		T1	T2	T3	T4	T1	T2	T3	T4
NOTE 5: Void NOTE 6: Void NOTE 7: Information about types of UE beam is given in clause B.2.1.3 and does not imit UE implementation or test system implementation.									

A.7.6.23.3.2 Test Requirements

During the period T2 and T3, the UE shall not perform reselection.

At the start of T4 the UE is paged for connection setup. During the connection setup the UE is requested to transmit early measurement report for cell 2.

The UE shall send early measurement report to the PCell with valid measurement results.

After receiving the requested early measurement report, the test equipment verifies the accuracy of measurement reported for Cell 2 meets the requirements in clause 10.1.4B for SS-RSRP and in clause 10.1.8B for SS-RSRQ and test ends. In the test case, the reported measurements are considered valid if they fulfil measurement accuracy requirements according to Cell 2 signal level during T3.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.6.24 RSCPD measurements

A.7.6.24.1 NR RSCPD with RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA in RRC_CONNECTED state

A.7.6.24.1.1 Test Purpose and Environment

The purpose of the test is to verify that the DL RSCPD measurement reported together with the RSTD measurement meets the requirements specified in clause 9.9.7 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

Supported test configurations are shown in table A.7.6.24.1.1-1.

Table A.7.6.24.1.1-1: Supported test configurations for NR DL RSCPD

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layer.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *NR-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. In *NR-DL-TDOA-RequestLocationInformation*, the UE is configured to perform DL RSCPD measurement via *dl-PRS-RSCPD-Request*. The UE is configured to perform both RSCPD and RSTD measurements within the time window indicated to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig*. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #13 before T2.

The general test parameters are listed in table A.7.6.24.1.1-2. Cell specific parameters during T1 are listed in table A.7.6.24.1.1-3. Cell specific parameters during T2 are listed in table A.7.6.24.1.1-4.

Table A.7.6.24.1.1-2: General test parameters for RSCPD with RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.3 FR2	
SMTC configuration	Config 1		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.2 FR2	As specified in clause A.3.31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#13	GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured
Time window configuration			MTW.1	As specified in clause A.3.38
Radio frame receive time offset between the cells at the UE antenna connector		μs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		μs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator

Expected RSTD uncertainty for all neighbour cells	μs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		3	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup		Setup 1	As defined in clause A.3.15.1
Beam assumption		Rough	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.6.24.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positioning frequency layer			1	1	1
$BW_{channel}$		MHz	200: $N_{RB,c}$ = 132	200: $N_{RB,c}$ = 132	200: $N_{RB,c}$ = 132
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 190.08MHz	-53.99	-53.99	-53.99
SSB_RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity

SSB $\hat{E}_s/N_{oc}$	Config 1	dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.

Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 4: SSB_RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.7.6.24.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
RF Channel Number			1	1	1
Positioning frequency layer			1	1	1
$BW_{channel}$		MHz	200: $N_{RB,c}$ = 132	200: $N_{RB,c}$ = 132	200: $N_{RB,c}$ = 132
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
EPRE ratio of PRS to SSS					
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89

PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
Io Note4	Config 1	dBm/ 190.08MHz	-55.48	-55.48	-55.48
PRS $\hat{E}_s/I_{ot}$ Note 5		dB	-6	-13	-13
PRP Note 4		dBm/SCS	-94.45	-100.67	-100.67
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.

Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over sub-carriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 4: PRP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.

Note 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.7.6.24.1.2 Test Requirements

The RSCPD reported together with RSTD measurement time fulfils the requirements specified in the clause 9.9.7.

The UE shall perform and report the RSCPD and RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 9.9.7 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2\times TTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The reported DL RSCPD measurement shall be within the DL RSCPD reporting range specified in the clause 10.1.43.3 and the reported RSTD measurement shall be within the RSTD reporting range specified in the clause 10.1.23.

A.7.6.25 RSCP measurements

A.7.6.25.1 DL RSCP with UE Rx-Tx time difference measurements for single positioning frequency layer in FR2 SA

A.7.6.25.1.1 Test purpose and environment

The purpose of the test is to verify that the DL RSCP and UE Rx-Tx time difference measurements meet the requirements specified in clause 9.9.8.5 in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured for both DL RSCP measurement and UE Rx-Tx time difference measurement.

The supported test configurations are listed in table A.7.6.25.1.1-1.

Table A.7.6.25.1.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message as defined in TS 37.355 [34], shall be provided to the UE during T1. In *NR-Multi-RTT-RequestLocationInformation*, the UE is configured to perform DL RSCP measurement via *nr-DL-PRS-RSCP-Request*. The UE is configured to perform both DL RSCP and UE Rx-Tx time difference measurements within the time window indicated to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig*. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources to be measured within the configured time window.

The UE is configured with measurement gap pattern ID #0 or ID #24 before T2.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are listed in table A.7.6.25.1.1-2 and table A.7.6.25.1.1-3.

Table A.7.6.25.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	200: $N_{RB,c} = 132$	
SSB configuration		1	SSB.2 FR2	
SMTC configuration		1	SMTC.1	
Measurement gap		1	GP#24 or GP#13 Note 1	
CP length		1	Normal	
DRX		1	OFF	
Time offset between serving and neighbour cells	µs	1	3	Synchronous cells
Time window configuration		1	MTW.1	As specified in clause A.3.38
T1	s	1	5	
T2	s	1	20	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.7.6.25.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						

EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting info		1	'10'		'01'	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
N_{oc} Note 2	dBm/15 kHz	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
PRP Note 3	dBm/SCS kHz	1	-Infinity	-91	-Infinity	-99
Io	dBm/190.08 MHz	1	N/A	-54.62	N/A	-54.62
Propagation Condition		1	AWGN			

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.

Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.

Note 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Note 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.7.6.25.1.2 Test requirements

The DL RSCP with UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9.8 with Nsample=4 for UE Rx-Tx time difference.

The UE shall perform and report the DL RSCP and UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified DL RSCP with UE Rx-Tx time difference measurement time specified in clause 9.9.8 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%. The reported DL RSCP measurement shall be within the DL RSCP reporting range specified in clause 10.1.44 and the reported UE Rx-Tx measurement shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.

A.7.7 Measurement Performance requirements

Unless explicitly stated otherwise:

- Reported measurements shall be within defined range of accuracy limits defined in clause 10 for at least 90 % of the reported cases. If multiple measurement performance requirements are verified in the same test, the reported measurements for each requirement shall be within defined range of accuracy limits of the corresponding requirement defined in clause 10 for at least 90 % of the reported cases.
- Measurements are performed in RRC_CONNECTED state.
- The reference channels assume transmission of PDSCH with a maximum number of 5 HARQ transmissions unless otherwise specified.

A.7.7.1 SS-RSRP

A.7.7.1.1 SA intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.3.1.1 and 10.1.3.1.2 for intra-frequency measurements.

A.7.7.1.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in table A.7.7.1.1.2-2 and A.7.7.1.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1. The test consists of two time phases T1 and T2.

Table A.7.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.1.1.2-2: SS-RSRP Intra frequency general test parameters

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		24		24	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3. 2TDD	-	SR.3. 2 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Reference channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void

Table A.7.7.1.1.2-3: SS-RSRP Intra frequency OTA related test parameters

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 7		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-91.6		N/A	
N_{oc} Note1	dBm/SCS Note4	-82.6		N/A	
$\hat{E}_s / N_{oc}$	dB	6.0	1.0	N/A	N/A
E_s	dBm/SCS Note4			(Table B.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2-2 Rx Beam Peak +2.1 dB)
SSB_RP Note2	dBm/SCS	-76.6	-81.6	(Table B.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2-2 Rx Beam Peak +2.1 dB)
$\hat{E}_s / I_{ot}$ BB Note6	dB	2.44	-5.98	-5.98	-5.98
Io Note2	dBm/95.04 MHz Note4	-50.05		(Table B.2.2-2 Rx Beam Peak +29.70 dB)	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Void					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: Void					
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.3.1.1 and relative accuracy requirements in clause 10.1.3.1.2. The following requirements are to be verified:

During T1:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.7.7.1.1.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3.1.2-1.

During T2:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.7.7.1.1.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3.1.2-1.

During T1 and T2:

Relative accuracy of Cell 1 during T2 compared with Cell 1 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3.1.2-1

Relative accuracy of Cell 2 during T2 compared with Cell 2 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3.1.2-1.

Table A.7.7.1.1.3-1: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	$SSB_RP1 - \delta + G_{min} \le$ Reported RSRP(dBm) $\le SSB_RP1 + \delta + G_{max}$
Cell 2	$SSB_RP2 - \delta + G_{min} \le$ Reported RSRP(dBm) $\le SSB_RP2 + \delta + G_{max}$
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.3.1.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.7.7.1.2 SA inter-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.5.1.1 and 10.1.5.1.2 for intrer-frequency measurements with the testing configurations for NR cells in table A.7.7.1.2.1-1.

Table A.7.7.1.2.1-1: Applicable NR configurations for FR2 inter-frequency SS-RSRP accuracy test

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

A.7.7.1.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 1 and Cell 2 are given in table A.7.7.1.2.2-1 and table A.7.7.1.2.2-2 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in table A.7.7.1.2.2-1 and table A.7.7.1.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.7.7.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN	1~2		freq1	freq2	freq1	freq2
$BW_{channel}$	1~2		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1		24		24	
	2		48		48	
Gap pattern ID			0		0	
Duplex mode	1~2		TDD		TDD	
TDD configuration	1~2		TDDConf.3.1		TDDConf.3.1	
PDSCH Reference measurement channel	1		SR.3. 2 TDD	-	SR.3. 2 TDD	-
	2		SR.3.3 TDD		SR.3.3 TDD	
RMSI CORESET Reference Channel	1		CR.3.1 TDD	-	CR.3.1 TDD	-
	2		CR.3.2 TDD		CR.3.2 TDD	
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	-	CCR.3.1 TDD	-
	2		CCR.3.7 TDD		CCR.3.7 TDD	
SSB configuration	1		SSB.3 FR2		SSB.3 FR2	
	2		SSB.4 FR2		SSB.4 FR2	
PDSCH/PDCCH subcarrier spacing	1~2	kHz	120		120	
OCNG Patterns	1~2		OP.3		OP.3	
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1~2		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2		TCI.State.2	
SMTC configuration	1~2		SMTC.1		SMTC.1	
Time offset between Cell 2 and Cell 1	1~2	µs	3		3	
EPRE ratio of PSS to SSS	1~2	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition	1~2	-	AWGN	AWGN	AWGN	AWGN
Antenna configuration	1~2	-	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void.

Table A.7.7.1.2.2-2: SS-RSRP inter frequency OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration	1~2		Setup 4b according to clause A.3.15.4.2		Setup 4b according to clause A.3.15.4.2	
			AoA1 Spherical coverage	AoA2 Rx Beam Peak	AoA1 Spherical coverage	AoA2 Rx Beam Peak
Assumption for UE beams[Note 7]	1~2		Rough		Rough	
N_{oc} [Note1]	1	dBm/15 kHz[Note4]	-90.6	-90.6	(Table B.2.3-2 Rx Beam Peak[Note 8] +1.97 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] -3.03 dB)
	2		-93.7	-93.7		
N_{oc} [Note1]	1	dBm/SCS[Note4]	-81.6	-81.6	(Table B.2.3-2 Rx Beam Peak[Note 8] +11.0 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +6.0 dB)
	2		-81.7	-81.7	(Table B.2.3-2 Rx Beam Peak[Note 8] +14.0 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +9.0 dB)
$\hat{E}_s / N_{oc}$	1~2	dB	6.0	6.0	17.0	-1.0
SSB_RP[Note2]	1	dBm/SCS	-75.6	-75.6	(Table B.2.3-2 Rx Beam Peak[Note 8] +28.0 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +5.0 dB)
	2		-75.7	-75.7	(Table B.2.3-2 Rx Beam Peak[Note 8] +31.0 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +8.0 dB)
($SSB_RP_{Cell\ 1}$ – $SSB_RP_{Cell\ 2}$)	1~2	dB	0		23.00	
$\hat{E}_s / I_{ot\ BB}$[Note6]	1	dB	5.26	5.96	9.53	-3.46
	2		4. 61	5.91		
Io[Note2]	1	dBm/95.04 MHz [Note4]	-50.00	-50.00	(Table B.2.3-2 Rx Beam Peak[Note 8] +52.68 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +33.13 dB)
	2		-50.09	-50.09	(Table B.2.3-2 Rx Beam Peak[Note 8] +55.69 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +36.14 dB)
($Io_{freq\ 1}$ – $Io_{freq\ 2}$)	1~2	dB	0		19.55	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, Es/Iot, Io, ($SSB_RP_{Cell\ 2}$ – $SSB_RP_{Cell\ 1}$) and ($Io_{freq\ 2}$ – $Io_{freq\ 1}$) levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P or ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
NOTE 8: The value in table B.2.3-2 is the Minimum SSB_RP for SCS_{SSB} = 120 kHz, selected according to the operating band of Cell 2 and UE power class, without $\Delta MB_{P,n}$ adjustment.						

A.7.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirements in clause 10.1.5.1.1 and the relative requirements in clause 10.1.5.1.2.

Test 1:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.7.7.1.2.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in A.7.7.1.2.3-2.

Test 2:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.7.7.1.2.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in A.7.7.1.2.3-2.

Table A.7.7.1.2.3-1: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 1	SSB_RP1 -δ +G_{min} +X ≤ Reported RSRP(dBm) ≤ SSB_RP1 +δ +G_{max}
Cell 2	SSB_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP2 +δ +G_{max}
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.5.1.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	
NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.	

Table A.7.7.1.2.3-2: SS-RSRP relative accuracy test requirement

	Test requirement Notes1,2,3,4, 5, 6, 7
Cell 2 – Cell 1	SSB_RP2 - SSB_RP1 -δ - D - G_{inter} ≤ Reported RSRP(dB) ≤ SSB_RP2 - SSB_RP1 +δ + G_{inter} –(X) + E
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP relative accuracy requirement from Table 10.1.5.1.2-1	
NOTE 3: Void	
NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.	
NOTE 5: D is the margin due to mis-alignment between fine beam and rough beam. D is the Rough Beam gain reduction in Rx beam peak direction from Table B.2.1.5.3-1, selected according to the UE power class. D is always a positive value.	
NOTE 6: G_{inter} is the margin due to different antenna gain caused by frequency separation. G_{inter} is from Table B.2.1.5.2-1, selected according to the UE power class, and is always a positive value	
NOTE 7: E = 3 (dB) is an additional margin to account for the actual gain difference between peak direction and spherical coverage using rough beams.	

A.7.7.1.3 SA inter-frequency measurement accuracy with FR1 serving cell and FR2 target cell

A.7.7.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.5.1.1 for inter-frequency measurements with the testing configurations in table A.7.7.1.3.1-1.

Table A.7.7.1.3.1-1: Applicable NR configurations for FR2 inter-frequency SS-RSRP accuracy test

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	

A.7.7.1.3.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) in FR1 and Cell 2 in FR2 . The test parameters for the Cell 1 and Cell 2 are given in table A.7.7.1.3.2-1 and table A.7.7.1.3.2-2 below. Absolute accuracy of RSRP inter-frequency measurements are tested by using the parameters in table A.7.7.1.3.2-1 and table A.7.7.1.3.2-2. The inter-frequency measurements are supported by a measurement gap.

Table A.7.7.1.3.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN	1~3		freq1	freq2	freq1	freq2
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52	100: $N_{PRB,c}$ = 66	10: $N_{PRB,c}$ = 52	100: $N_{PRB,c}$ = 66
	2		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	3		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
Data PRBs allocated	1,2		52	24	52	66
	3		106		106	
Duplex mode	1		FDD	TDD	FDD	TDD
	2		TDD		TDD	
	3		TDD		TDD	
TDD configuration	1		N/A	TDDConf.3.1	N/A	TDDConf.3.1
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1	SSB.3 FR2	SSB.1 FR1	SSB.3 FR2
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~3		OP.1	OP.3	OP.1	OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~3		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1~3		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1~3		TCI.State.2		TCI.State.2	

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SMTC configuration	1~3		SMTC.1		SMTC.1	
Time offset between Cell 2 and Cell 1	1~3	µs	3		3	
EPRE ratio of PSS to SSS	1~3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition	1~3	-	NA Link only, see clause A.3.7A	AWGN	NA Link only, see clause A.3.7A	AWGN
Antenna configuration	1~3	-		1x2		1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Void						

Table A.7.7.1.3.2-2: SS-RSRP inter-frequency OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration according to clause A.3.15			NA	Setup 2b	NA	Setup 2b
Assumption for UE beams Note 4			N/A	Rough	N/A	Rough
N_{oc}	1~3	dBm/15 kHz	Link only, see clause A.3.7A	-90	Link only, see clause A.3.7A	NA
N_{oc}	1~3	dBm/SSB SCS				NA
$\hat{E}_s/N_{oc}$	1~3	dB		5		NA
E_s	1~3	dBm/SCS				(Table B.2.3-2 Spherical coverage +1 dB)
SSB_RP Note1	1~3	dBm/SCS		-76.0		(Table B.2.3-2 Spherical coverage +1 dB)
$\hat{E}_s/I_{otBB}$ Note6	1~3	dB		4.35		-3.81
Io Note1	1~3	dBm/ 95.04 MHz		-50.18		SSB_RP+28.98
NOTE 1: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 2: Void						
NOTE 3: No additional noise is added by the test system in Test 2.						
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 5: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.7.1.3.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 shall fulfil the Absolute requirement in clause 10.1.5.1.1.

Test 1:

Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.7.7.1.3.3.

Test 2:

Absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.7.7.1.3.3.

Table A.7.7.1.3.3: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 2	SSB_RP1 -δ +G_{min} +X ≤ Reported RSRP(dBm) ≤ SSB_RP1 +δ +G_{max}
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.5.1.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	
NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.	

A.7.7.2 SS-RSRQ

A.7.7.2.1 SA intra-frequency measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.8.1.1.

A.7.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.7.2.1.2-1. . The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in table A.7.7.2.1.2-2 and table A.7.7.2.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell.

Table A.7.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Configuration	**Description**
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter		**Unit**	**Test 1**		**Test 2**	
			Cell 1	**Cell 2**	**Cell 1**	**Cell 2**
Cell ID			489	0	489	0
SSB ARFCN			Freq1		Freq1	
Duplex mode			TDD		TDD	
TDD configuration			TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			66		66	
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
TRS configuration			TRS.2.1 TDD		TRS.2.1 TDD	
TCI state			TCI.State.0		TCI.State.0	
PDSCH Reference measurement channel			SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel			CR.3.1 TDD	-	CR.3.1 TDD	
Control channel RMC			CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns			OP.1	OP.1	OP.1	OP.1
SMTC configuration			SMTC.1			
SSB configuration			SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
PDSCH/PDCCH subcarrier spacing		kHz	120	120	120	120
SS-RSSI-Measurement			Not Applicable			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition			AWGN		AWGN	
Antenna configuration			1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void.

Table A.7.7.2.1.2-3: SS-RSRQ Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1according to clause A.3.15.1	
Assumption for UE beams Note 9		Rough			
N_{oc} Note1	dBm/15 kHz Note4	-95		-95	
N_{oc} Note1	dBm/SCS Note3	-86		-86	
$\hat{E}_s / N_{oc}$	dB	3		3	
SSB_RP Note2	dBm/SCS Note4	-83	-83	-89	-89
SS-RSRQ Note2	dB	-14.77	-14.77	-16.81	-16.81
$\hat{E}_s / I_{ot}$	dB	-1.76	-1.76	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-50		-54	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRQ, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
NOTE 6: Void NOTE 7: Void NOTE 8: Void NOTE 9: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.7.2.1.3 Test Requirements

The SS-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal SS-RSRQ+2.5 dB to Nominal SS-RSRQ-2.5 dB and the SS-RSRQ measurement accuracy in test 2 shall be within the range Nominal RSRQ+3.5 dB to Nominal RSRQ-3.5 dB according to the requirements in clause 10.1.8.1.1.Nominal RSRQ is the value shown in table A.7.7.2.1.2-3.

A.7.7.2.2 SA Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.7.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.9.1.1 and 10.1.9.1.2 for inter-frequency measurement.

A.7.7.2.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.7.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in table A.7.7.2.2.2-2 and table A.7.7.2.2.2-3.. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A. 7.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.2.2.2-2: SS-RSRQ Inter frequency general test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			Freq1	freq2	freq1	Freq2
SSB Configuration			SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
Duplex mode			TDD		TDD	
TDD configuration			TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
TRS configuration			TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state			TCI.State.0	-	TCI.State.0	-
Data PRBs allocated			66		66	
PDSCH Reference measurement channel			SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel			CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns			OP.1	OP.1	OP.1	OP.1
SMTC configuration			SMTC.1	SMTC.1	SMTC.1	SMTC.1
PDSCH/PDCCH subcarrier spacing		kHz	120	120	120	120
EPRE ratio of PSS to SSS		dB	0	0	0	0

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Void NOTE 3: Void NOTE 4: Void					

Table A.7.7.2.2.2-3: SS-RSRQ Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
AoA setup		Setup 1 in clause A.3.15.		Setup 1 in clause A.3.15.	
Assumption for UE beams Note 8		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-94.03	-94.03	-94.03	-94.03
N_{oc} Note1	dBm/SCS Note3	-85.0	-85.0	-85.0	-85.0
$\hat{E}_s / N_{oc}$	dB	-1.75		-1.75	
SSB_RP Note2	dBm/SCS Note4	-86.75	-86.75	-88	-88
SS-RSRQ Note2	dB	-14.75	-14.75	-15.56	-15.56
$\hat{E}_s / I_{ot}$	dB	-1.75	-1.75	-3	-3
Io Note2	dBm/95.04 MHz Note4	-53.8	-53.8	-54.25	-54.25
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SS-RSRQ, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone NOTE 6: Void NOTE 7: Void NOTE 8: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.7.2.2.3 Test Requirements

The SS-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal SS-RSRQ+2.5 dB to Nominal SS-RSRQ -2.5 dB and the SS-RSRQ measurement accuracy in test 2 shall be within the range Nominal SS-RSRQ +3.5 dB to Nominal SS-RSRQ -3.5 dB according to the requirements in clause 10.1.10.1.1.

The SS-RSRQ relative measurement accuracy shall fulfil the requirements in clause 10.1.10.1.2.

A.7.7.3 SS-SINR

A.7.7.3.1 SA intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.13.1.1.

A.7.7.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.7.3.1.2-1. . The absolute accuracy of SS-SINR intra-frequency measurement is test by using the parameters in table A.7.7.3.1.2-2 and table A.7.7.3.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.7.7.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		Freq2		Freq2	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		66		66	
Downlink initial BWP configuration		DLBWP.0.1			
Downlink dedicated BWP configuration		DLBWP.1.1			
Uplink initial BWP configuration		ULBWP.0.1			
Uplink dedicated BWP configuration		ULBWP.1.1			
DRX cycle configuration	ms	Not applicable			
TRS configuration		TRS.2.1 TDD			
TCI state		TCI.State.0			
PDSCH Reference measurement channel		SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	
Dedicated RMSI CORESET Reference Channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1			
SSB configuration		SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
SS-RSSI-Measurement		Not Applicable			
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void

Table A.7.7.3.1.2-3: SS-SINR Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 9		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-105		-105	
N_{oc} Note1	dBm/SCS Note3	-96		-96	
$\hat{E}_s / N_{oc}$	dB	4.54		2.66	
SSB_RP Note2	dBm/SCS Note4	-91.46	-93.34	-99	-99
SS-SINR Note2	dB	0	-3.2	-4.76	-4.76
$\hat{E}_s / I_{ot}$	dB	0	-3.2	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-59.2		-64	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-SINR, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Void
NOTE 7: Void
NOTE 8: Void
NOTE 9: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.3.1.3 Test Requirements

The SS-SINR absolute measurement accuracy in test 1 shall be within the range Nominal SS-SINR+3B to Nominal SS-SINR -3 dB and the SS-SINR measurement accuracy in test 2 shall be within the range Nominal SS-SINR +3.5 dB to Nominal SS-SINR -3.5 dB according to the requirements in clause 10.1.10.13.1.

A.7.7.3.2 SA Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.7.7.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.15.1.1 and 10.1.15.1.2 for inter-frequency measurement.

A.7.7.3.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.7.7.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in table A.7.7.3.2.2-2 and table A.7.7.3.2.2-3. In all test cases, Cell 1 is the PCell and Cell 2 is target cell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.7.7.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.3.2.2-2: SS-SINR Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		66		66		66	
Downlink initial BWP configuration		DLBWP.0.1					
Downlink dedicated BWP configuration		DLBWP.1.1					
Uplink initial BWP configuration		ULBWP.0.1					
Uplink dedicated BWP configuration		ULBWP.1.1					
DRX cycle configuration	ms	Not applicable					
TRS configuration		TRS.2.1 TDD					
TCI state		TCI.State.0					
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1	SMTC.1	SMTC.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
Propagation conditions		AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void

Table A.7.7.3.2.2-3: SS-SINR Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration	degrees	Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 10		Rough		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-105	-105	-105	-105	-105	-105
N_{oc} Note1	dBm/SCS Note3	-96	-96	-96	-96	-96	-96
$\hat{E}_s / N_{oc}$	dB	-0.5		-0.5		11.0	
SSB_RP Note2	dBm/SCS Note4	-96.5	-96.5	-85	-85	-99	-99
SS-SINR Note2	dB	-0.5	-0.5	11	11	-3.0	-3.0
$\hat{E}_s / I_{ot}$	dB	-0.5	-0.5	11	11	-3.0	-3.0
Io Note2	dBm/95.04 MHz Note4	-69.3	-69.3	-55.4	-55.4	-65.24	-65.24

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 2: SS-SINR, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 3: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone							
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone							
NOTE 6: Void							
NOTE 7: Void							
NOTE 8: Void							
NOTE 9: Void							
NOTE 10: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation							

A.7.7.3.2.3 Test Requirements

The SS-SINR absolute measurement accuracy in test 1 shall be within the range Nominal SS-SINR +3 dB to Nominal SS-SINR -3 dB and the SS-SINR measurement accuracy in test 2 shall be within the range Nominal SS-SINR +3.5 dB to Nominal SS-SINR -3.5 dB according to the requirements in clause 10.1.15.1.1.

The SS-SINR relative measurement accuracy shall fulfil the requirements in clause 10.1.15.1.2.

A.7.7.4 L1-RSRP measurement for beam reporting

A.7.7.4.1 SSB based L1-RSRP measurement

A.7.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.5.2 and clause 10.1.20.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.7.7.4.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.7.7.4.1.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.7.7.4.1.2 Test parameters

In this set of test cases there is one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.7.4.1.2-1 and table A.7.7.4.1.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.7.7.4.1.2-1 and table A.7.7.4.1.2-2.

Here is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.7.7.4.1.2-1: FR2 SSB based L1-RSRP general test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~2		freq1	freq1
Duplex mode	1~2		TDD	TDD
TDD Configuration	1~2		TDDConf.3.1	TDDConf.3.1

Parameter	Config	Unit	Test 1	Test 2
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~2		66	66
PDSCH Reference measurement channel	1		SR.3.2 TDD	SR.3.2 TDD
	2		SR.3.3 TDD	SR.3.3 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD	CR.3.1 TDD
	2		CR.3.2 TDD	CR.3.2 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	CCR.3.1 TDD
	2		CCR.3.7 TDD	CCR.3.7 TDD
SSB configuration	1		SSB.1 FR2	SSB.1 FR2
	2		SSB.2 FR2	SSB.2 FR2
OCNG Patterns	1~2		OP.1	OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
TRS Configuration	1~2		TRS.2.1 TDD	TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2	TCI.State.2
SMTC configuration	1~2		SMTC.1	SMTC.1
reportConfigType	1~2		periodic	periodic
reportQuantity	1~2		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1~2		2	2
L1-RSRP reporting period	1~2		slot320	slot320
Propagation condition	1~2		AWGN	AWGN
Antenna configuration	1~2		1x2	1x2
EPRE ratio of PSS to SSS	1~2	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Table A.7.7.4.1.2-2: FR2 SSB based L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			SSB0	SSB1	SSB0	SSB1
Angle of arrival configuration			Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough		Rough	
N_{oc}	1~2	dBm/15 kHz	-100		n.a.	
N_{oc}	1	dBm/SSB SCS	-91		n.a.	
	2		-88		n.a.	
$\hat{E}_s / I_{ot}$	1~2	dB	10	-2	n.a.	
SSB_RP Note1	1	dBm/SCS	-81	-93	As in table B.2.4-2	
	2		-78	-90	As in table B.2.4-2	
Io Note1	1~2	dBm/ 95.04 MHz	-51.57		SSB_RP+28.98	
$\hat{E}_s / N_{oc}$	1~2	dB	10	-2	n.a.	

NOTE 1: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 2: Void
NOTE 3: No additional noise is added by the test system in Test 2.

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			SSB0	SSB1	SSB0	SSB1
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.7.4.1.3 Test Requirements

After 320 ms from the beginning of the test, the L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 1 shall fulfil the requirements in clauses 10.1.20.1. The following requirements are to be verified:

For Test 1:

Absolute accuracy of SSB0. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.7.4.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.1.2-1.

For Test 2:

Absolute accuracy of SSB resource reported by UE in L1-RSRP report (SSB0 or SSB1). The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.7.4.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.1.2-1.

Table A.7.7.4.1.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
SSB0	$SSB_RP0 - \delta + G_{min} \le$ Reported RSRP(dBm) $\le SSB_RP0 + \delta + G_{max}$
SSB1	$SSB_RP1 - \delta + G_{min} \le$ Reported RSRP(dBm) $\le SSB_RP1 + \delta + G_{max}$
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the SSB n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.1.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.7.7.4.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.7.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.5.3 and clause 10.1.20.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in table A.7.7.4.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.7.7.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

A.7.7.4.2.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.7.4.2.2-1 and table A.7.7.4.2.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.7.7.4.2.2-1 and table A.7.7.4.2.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.7.7.4.2.2-1: FR2 CSI-RS based L1-RSRP general test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1		freq1	freq1
Duplex mode	1		TDD	TDD
TDD Configuration	1		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2	SSB.1 FR2
OCNG Patterns	1		OP.1	OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
TRS Configuration	1		TRS.2.1 TDD	TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2	TCI.State.2
SMTC configuration	1		SMTC.1	SMTC.1
CSI-RS	1		CSI-RS.3.2 TDD	CSI-RS.3.2 TDD
reportConfigType	1		periodic	periodic
reportQuantity	1		cri-RSRP	cri-RSRP
Number of reported RS	1		2	2
L1-RSRP reporting period	1		slot80	slot80
Propagation condition	1		AWGN	AWGN
Antenna configuration	1		1x2	1x2
EPRE ratio of PSS to SSS	1	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Table A.7.7.4.2.2-2: FR2 CSI-RS based L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			CSI-RS0	CSI-RS1	CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough		Rough	
N_{oc}	1~2	dBm/15 kHz	-100		n.a.	
N_{oc}	1~2	dBm/SSB SCS	-91		n.a. n.a.	
$\hat{E}_s / I_{ot}$	1~2	dB	10	-2	n.a.	
CSI-RS-RSRP Note1	1~2	dBm/SCS	-81	-93	As in table B.2.4-2	
Io Note1	1~2	dBm/ 95.04 MHz	-59.86		SS-RSRP+28.98	
$\hat{E}_s / N_{oc}$	1~2	dB	-51.57	-2	n.a.	

NOTE 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			CSI-RS0	CSI-RS1	CSI-RS0	CSI-RS1
NOTE 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 3: No additional noise is added by the test system in Test 2.						
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.7.4.2.3 Test Requirements

After 640 ms from the beginning of the test, the L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 1 shall fulfil the requirements in clause 10.1.20.2. The following requirements are to be verified:

For Test 1:

Absolute accuracy of CSI-RS0. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.7.4.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

For Test 2:

Absolute accuracy of CSI-RS resource reported by UE in L1-RSRP report (CSI-RS0 or CSI-RS1). The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.7.4.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

Table A.7.7.4.2.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}
NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.7.7.5 CLI measurements

A.7.7.5.1 SA SRS-RSRP measurement accuracy with FR2 serving cell

A.7.7.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SRS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.22.1.1 with the testing configurations for NR cells in table A.7.7.5.1.1-1.

Table A.7.7.5.1.1-1: Applicable NR configurations for FR2 SRS-RSRP accuracy test

Config	Description
1	120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.7.7.5.1.2 Test parameters

In this set of test cases there is one cell in the test, FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.7.5.1.2-1 and A.7.7.5.1.2-2 below. The test parameter for the (virtual) neighbor cell UE transmitting SRS are given in table A.7.7.5.1.2-2.

Before the test UE is configured to perform SRS-RSRP measurement. During the test, the test system transmits SRS resources for measurement in the DL slots according to the SRS configuration in table A.7.7.5.1.2-3. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

Table A.7.7.5.1.2-1: FR2 test parameters for SRS-RSRP accuracy

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1		freq1	freq1
Duplex mode	1		TDD	TDD
TDD configuration	1		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1		SSB.3 FR2	SSB.3 FR2
OCNG Patterns	1		OP.1	OP.1
TRS configuration	1		TRS.2.1 TDD	TRS.2.1 TDD
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
SMTC configuration	1		SMTC.1	SMTC.1
Time offset between DL from serving cell and SRS from test system	1	µs	10.76	10.67
EPRE ratio of PSS to SSS	1	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation condition	1		AWGN	AWGN
Antenna configuration	1		1x2	1x2
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Table A.7.7.5.1.2-2: SRS-RSRP accuracy OTA related test parameters for PCell and Neighbour cell UE in FR2

Parameter	Unit	T1	T2
Angle of arrival configuration		Setup 1 defined A.3.15.1	Setup 1 defined A.3.15.1
Beam assumption Note 5		Fine	Fine
N_{oc} Note1	dBm/15 kHz Note3	-100	N/A
N_{oc} Note1	dBm/SCS Note3	-91	N/A
$\hat{E}_s / N_{oc}$	dB	2	N/A
E_s	dBm/SCS Note3		(Table B.2.7-2 Rx Beam Peak)
SRS_RP Note2	dBm/SCS	-89	(Table B.2.7-2 Rx Beam Peak)
$\hat{E}_s / I_{ot\ BB}$ Note4	dB	>1	1
Io Note2	dBm/95.04 MHz Note3	-57.89	(Table B.2.7-2 Rx Beam Peak +50.79 dB)

Parameter	Unit	T1	T2

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 2 dB for UE multi-band relaxation factor $\sum MB_P$ from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.

Table A.7.7.5.1.2-3: SRS configuration parameters for FR2 SRS-RSRP accuracy

	Field	SRSConf.1
SRS-ResourceSet	srs-ResourceSetId	0
	srs-ResourceIdList	0
	resourceType	Periodic
	Usage	Codebook
SRS-Resource	SRS-ResourceId	0
	nrofSRS-Ports	Port1
	transmissionComb	n2
	combOffset-n2	0
	cyclicShift-n2	0
	resourceMapping startPosition	0
	resourceMapping nrofSymbols	n1
	resourceMapping repetitionFactor	n1
	freqDomainPosition	0
	freqDomainShift	0
	freqHopping c-SRS	12
	freqHopping b-SRS	0
	freqHopping b-hop	0
	groupOrSequenceHopping	Neither
	resourceType	Periodic
	periodicityAndOffset-p	sl160,25
	sequenceId	0

A.7.7.5.1.3 Test Requirements

The SRS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.22.1.1. The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table A.7.7.5.1.3-1.

During T2:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table A.7.7.5.1.3-1.

Table A.7.7.5.1.3-1: SRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
SRS	SRS_RP -δ +G_{min} ≤ Reported SRS-RSRP(dBm) ≤SRS_RP +δ +G_{max}

NOTE 1: SRS_RP is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test

NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.22.1.1-2, selected according to the Io used in the test
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class

A.7.7.5.2 SA CLI-RSSI measurement accuracy with FR2 serving cell

A.7.7.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CLI-RSSI measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.22.2.1 with the testing configurations for NR cells in table A.7.7.5.2.1-1.

Table A.7.7.5.2.1-1: Applicable NR configurations for FR2 CLI-RSSI accuracy test

Config	Description
1	120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.7.7.5.2.2 Test parameters

In this set of test cases there is one cell in the test, FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.7.5.2.2-1 and A.7.7.5.2.2-2 below.

Before the test UE is configured to perform CLI-RSSI measurement. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI resource and on 2 data symbol before. The CLI-RSSI measurement resource configuration is in table A.7.7.5.2.2-3.

Table A.7.7.5.2.2-1: FR2 test parameters for CLI-RSSI accuracy

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1		freq1	freq1
Duplex mode	1		TDD	TDD
TDD configuration	1		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1		SSB.3 FR2	SSB.3 FR2
OCNG Patterns Note2	1		OP.1	OP.1
TRS configuration	1		TRS.2.1 TDD	TRS.2.1 TDD
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
SMTC configuration	1		SMTC.1	SMTC.1
Time offset between DL from serving cell and OCNG from test system	1	μs	10.67	10.67
EPRE ratio of PSS to SSS	1	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation condition	1		AWGN	AWGN
Antenna configuration	1		1x2	1x2
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: OCNG is not transmitted in the CLI-RSSI measurement resources.				

Table A.7.7.5.2.2-2: CLI-RSSI accuracy OTA related test parameters

Parameter	Unit	T1	T2
Angle of arrival configuration		Setup 1 defined A.3.15.1	
Beam assumption Note 5		Fine	
N_{oc} on CLI-RSSI measurement resource Note1	dBm/15 kHz Note3	-100	
N_{oc} on CLI-RSSI measurement resource Note1	dBm/SCS Note3	-91	
$\hat{E}_s / N_{oc}$ on CLI-RSSI measurement resource	dB	-Infinity	
RSRP on CLI-RSSI measurement resource Note2	dBm/SCS	-Infinity	
$\hat{E}_s / I_{ot\ BB}$ on CLI-RSSI measurement resource Note4	dB	-Infinity	
Io on CLI-RSSI measurement resource Note2	dBm/95.04 MHz Note3	-62.01	
Io on CLI-RSSI measurement resource Note2	dBm/1.08 MHz	-81.46	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 4: Calculation of Es/Iot$_{BB}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 2 dB for UE multi-band relaxation factor $\sum MB_P$ from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.

Table A.7.7.5.2.2-3: CLI-RSSI measurement resource configuration for FR2 CLI-RSSI accuracy

	Field	SRSConf.1
CLI-RSSI measurement resource	rssi-ResourceId	0
	rssi-SCS	120 kHz
	startPRB	0
	nrofPRBs	66
	startPosition	3
	nrofSymbols	11
	rssi-PeriodicityAndOffset	sl160, 25

A.7.7.5.2.3 Test Requirements

The CLI-RSSI measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.22.2.1. The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table A.7.7.5.2.3-1.

During T2:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table A.7.7.5.2.3-1.

Table A.7.7.5.2.3-1: CLI-RSSI absolute accuracy test requirement

	Test requirement Notes1,2,3
	Io -δ +G_{min} ≤ Reported CLI-RSSI(dBm) ≤Io +δ +G_{max}

NOTE 1: Io is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for 1.08 MHz
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.22.1.1-2, selected according to the Io used in the test

NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class

A.7.7.6 L1-SINR measurement for beam reporting

A.7.7.6.1 L1-SINR measurement with CSI-RS based CMR and no dedicated IMR configured and CSI-RS resource set with repetition off

A.7.7.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.8.4.1 and clause 10.1.28.1 for L1-SINR measurements based on CSI-RS with the testing configurations for NR cells in table A.7.7.6.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.7.7.6.1.1-1: Applicable NR configurations for FR2 L1-SINR test with CSI-RS based CMR and no dedicated IMR configured

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

A.7.7.6.1.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.7.6.1.2-1 and table A.7.7.6.1.2-2 below. The absolute and relative accuracy of L1-SINR measurements are tested by using the parameters in table A.7.7.6.1.2-1 and table A.7.7.6.1.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.7.7.6.1.2-1: FR2 CSI-RS based L1-SINR general test parameters

Parameter	Config	Unit	Test 1
SSB ARFCN	1		freq1
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.3 ULBWP.1.3
TRS Configuration	1		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2
SMTC configuration	1		SMTC.1
CSI-RS	1		CSI-RS.3.2 TDD
reportConfigType	1		periodic
reportQuantity	1		cri-SINR-r16
nrofReportedRS	1		2
L1-SINR reporting period	1		slot80
Propagation condition	1		AWGN
Antenna configuration	1		1x2
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			

Parameter	Config	Unit	Test 1
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			

Table A.7.7.6.1.2-2: FR2 CSI-RS based L1-SINR OTA related test parameters

Parameter	Config	Unit	Test 1	
			CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough	
N_{oc}	1~2	dBm/15 kHz	-100	
N_{oc}	1~2	dBm/SSB SCS	-91	
$\hat{E}_s / I_{ot}$	1~2	dB	10	-2
CSI-RS-RSRP Note1	1~2	dBm/SCS	-81	-93
Io Note1	1~2	dBm/ 95.04 MHz	-51.57	-59.86
$\hat{E}_s / N_{oc}$	1~2	dB	10	-2
NOTE 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 3: Void.				
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation				

A.7.7.6.1.3 Test Requirements

After 640 ms from the beginning of the test, the L1-SINR measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 1 shall fulfil the requirements in clauses 10.1.28.1. The following requirements are to be verified:

For Test 1:

Absolute accuracy of CSI-RS0. The UE is deemed to meet the requirement if the reported L1-SINR is in the range shown in table A.7.7.6.1.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the reported differential L1-SINR is in the range shown in table A.7.7.6.1.3-1.

Table A.7.7.6.1.3-1: L1-SINR absolute accuracy test requirement

	Test requirement Notes1,2
CSI-RS0	L1-SINR0-δ≤ Reported SINR(dB) ≤L1-SINR0+δ
NOTE 1: L1-SINR0 is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS 0 under consideration	
NOTE 2: δ is the SINR absolute accuracy requirement from Table 10.1.28.2.1-1, selected according to the Io used in the test	

Table A.5.7.6.1.3-2: L1-SINR relative accuracy test requirement

	Test requirement Notes1,2
CSI-RS0 - CSI-RS1	L1-SINR0 - L1-SINR1 - σ≤ Reported DIFFSINR (dB) ≤ L1-SINR0 - L1-SINR1 + σ

NOTE 1: L1-SINRn is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration
NOTE 2: σ is the SINR relative requirement from Table 10.1.28.1.2-1, selected according to the Io used in the test

A.7.7.6.2 L1-SINR measurement with SSB based CMR and dedicated IMR

A.7.7.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.8.4.2 and clause 10.1.28.2 for L1-SINR measurements with SSB based CMR and CSI-IM based IMR, with the testing configurations for NR cells in table A.7.7.6.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.7.7.6.2.1-1: Applicable NR configurations for FR2 L1-SINR measurement test with SSB based CMR and CSI-IM based IMR

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.7.7.6.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.7.6.2.2-1 and table A.7.7.6.2.2-2 below. The absolute and relative accuracy of L1-SINR measurements are tested by using the parameters in table A.7.7.6.2.2-1 and table A.7.7.6.2.2-2.

Here is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources and one CSI-IM resource set with two CSI-IM resource. UE is configured to perform RLM and BFD measurement based on the SSB resources 0 and 1. UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-IM resources as IMR.

Table A.7.7.6.2.2-1: FR2 L1-SINR general test parameters with SSB based CMR and CSI-IM based IMR

Parameter	Config	Unit	Test 1
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
	2		SSB.2 FR2
CSI-IM configuration	1~2		CSI-IM 3.1 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
SMTC configuration	1~2		SMTC.1
reportConfigType	1~2		periodic
reportQuantity-r16	1~2		ssb-Index-SINR-r16
Number of reported RS	1~2		2
L1-SINR reporting period	1~2		slot640
Propagation condition	1~2		AWGN
Antenna configuration	1~2		1x2
EPRE ratio of PSS to SSS	1~2	dB	0

Parameter	Config	Unit	Test 1
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			

Table A.7.7.6.2.2-2: FR2 L1-SINR SSB specific test parameters

Parameter	Config	Unit	Test 1	
			SSB0	SSB1
Angle of arrival configuration			Setup 1 according to A.3.15.1	
Assumption for UE beams Note 3			Rough	
N_{oc}	1~2	dBm/15 kHz	-100	
N_{oc}	1	dBm/SSB SCS	-91	
	2		-88	
$\hat{E}_s / I_{ot}$	1~2	dB	10	-2
SS-RSRP Note1	1	dBm/SCS	-81	-93
	2		-78	-90
Io Note1	1~2	dBm/95.04 MHz	-51.57	-59.86
$\hat{E}_s / N_{oc}$	1~2	dB	10	-2
NOTE 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 3: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation				

A.7.7.6.2.3 Test Requirements

After 640 ms from the beginning of the test, the L1-SINR measurement accuracy for SSB#0+CSI-IM#0 and SSB#1+CSI-IM#1 of Cell 1 shall fulfil the requirements in clauses 10.1.28.2. The following requirements are to be verified:

For Test 1:

Absolute accuracy of SSB#0+CSI-IM#0. The UE is deemed to meet the requirement if the reported L1-SINR is in the range shown in table A.7.7.6.2.3-1.

Relative accuracy of SSB#0+CSI-IM#0 compared with SSB#1+CSI-IM#1. The UE is deemed to meet the requirement if the reported differential L1-SINR is in the range shown in table A.7.7.6.2.3-2.

Table A.7.7.6.2.3-1: L1-SINR absolute accuracy test requirement

	Test requirement Notes1,2
SSB#0+CSI-IM#0	L1_SINR0 -δ ≤ Reported SINR(dB) ≤ L1_SINR0 +δ
NOTE 1: L1_SINR0 is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the SSB#0+CSI-IM#0 under consideration	
NOTE 2: δ is the SINR absolute accuracy requirement from Table 10.1.28.2.1-2, selected according to the Io used in the test	

Table A.7.7.6.2.3-2: L1-SINR relative accuracy test requirement

	Test requirement Notes1,2
SSB#0+CSI-IM#0 - SSB#1+CSI-IM#1	L1-SINR0 - L1-SINR1 - σ≤ Reported DIFFSINR (dB) ≤ L1-SINR0 - L1-SINR1 + σ
NOTE 1: L1-SINRn is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the SSB#n+CSI-IM#n under consideration NOTE 2: σ is the SINR relative requirement from Table 10.1.28.2.2-1, selected according to the Io used in the test	

A.7.7.6.3 L1-SINR measurement with CSI-RS based CMR and dedicated IMR

A.7.7.6.3.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will partly verify the requirements in clauses 9.8.4.3 and clause 10.1.28.3 for L1-SINR measurements based on CSI-RS as both CMR and IMR with the testing configurations for NR cell in table A.7.7.6.3.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.7.7.6.3.1-1: Applicable NR configurations for FR2 L1-SINR measurement test with CSI-RS based both CMR based IMR

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

A.7.7.6.3.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.7.6.3.2-1 and table A.7.7.6.3.2-2 below. The absolute and relative accuracy of L1-SINR measurements are tested by using the parameters in table A.7.7.6.3.2-1 and table A.7.7.6.3.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured two CSI-RS resource sets with two CSI-RS resources for each set. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB. UE is configured to perform L1-SINR measurement based on the configured CSI-RS as both CMR and IMR.

Table A.7.7.6.3.2-1: FR2 L1-SINR measurement test with CSI-RS based both CMR and IMR

Parameter	Config	Unit	Test 1
SSB ARFCN	1		freq1
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1
TRS Configuration	1		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2
SMTC configuration	1		SMTC.1
CSI-RS configuration as CMR	1		CSI-RS.3.2 TDD
CSI-RS configuration as IMR	1		CSI-RS.3.3A TDD
reportConfigType	1		periodic
reportQuantity-r16	1		cri-SINR-r16
nrofReportedRS	1		2

Parameter	Config	Unit	Test 1
L1-RSRP reporting period	1		slot80
Propagation condition	1		AWGN
Antenna configuration	1		1x2
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			

Table A.7.7.6.3.2-2: FR2 CSI-RS based L1-SINR measurement OTA related test parameters

Parameter	Config	Unit	Test 1	
			CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough	
N_{oc}	1~2	dBm/15 kHz	-100	
N_{oc}	1~2	dBm/SSB SCS	-91	
$\hat{E}_s / I_{ot}$	1~2	dB	10	0
CSI-RS-RSRP Note1	1~2	dBm/SCS	-81	-91
Io Note1	1~2	dBm/ 95.04 MHz	-51.57	-59.86
$\hat{E}_s / N_{oc}$	1~2	dB	10	0
NOTE 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 3: No additional noise is added by the test system in Test 2.				
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation				

A.7.7.6.3.3 Test Requirements

After 640 ms from the beginning of the test, the L1-SINR measurement accuracy for CSI-RS#0 for CMR +CSI-RS#0 for IMR and CSI-RS#1 for CMR +CSI-RS#0 for IMR of Cell 1 shall fulfil the requirements in clause 10.1.28.3. The following requirements are to be verified:

Absolute accuracy of CSI-RS#0 for CMR + CSI-RS#0 for IMR. The UE is deemed to meet the requirement if the reported L1-SINR is in the range shown in table A.7.7.6.3.3-1.

Relative accuracy of CSI-RS#0 for CMR + CSI-RS#0 for IMR compared with CSI-RS#1 for CMR + CSI-RS#1 for IMR. The UE is deemed to meet the requirement if the reported differential L1-SINR is in the range shown in table A.7.7.6.3.3-2.

Table A.7.7.6.3.3-1: L1-SINR absolute accuracy test requirement

	Test requirement Notes1,2
CSI-RS#0 for CMR + CSI-RS#0 for IMR	L1-SINR0 -δ≤ Reported SINR(dBm) ≤L1-SINR 0 +δ
NOTE 1: L1-SINRn is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS#n under consideration	
NOTE 2: δ is the SINR absolute accuracy requirement from Table 10.1.28.3.1-1.	

Table A.7.7.6.3.3-2: L1-SINR relative accuracy test requirement

	Test requirement Notes1,2
(CSI-RS#0 for CMR + CSI-RS#0 for IMR) – (CSI-RS#1 for CMR + CSI-RS#1 for IMR)	L1-SINR0 - L1-SINR1 - σ≤ Reported DIFFSINR (dB) ≤ L1-SINR0 - L1-SINR1 + σ
NOTE 1: L1-SINRn is the equivalent SINR received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the (CSI-RS#n for CMR + CSI-RS#n for IMR) under consideration NOTE 2: σ is the SINR relative requirement from Table 10.1.28.3.2-1, selected according to the Io used in the test	

A.7.7.7 CSI-RSRP

A.7.7.7.1 SA intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.7.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.3.2.1 and 10.1.3.2.2 for intra-frequency measurements.

A.7.7.7.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.7.7.1.2-1. Both absolute and relative accuracy of CSI-RSRP intra-frequency measurements are tested by using the parameters in table A.7.7.7.1.2-2 and A.7.7.7.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1. The test consists of two time phases T1 and T2.

Table A.7.7.7.1.2-1: CSI-RSRP Intra frequency CSI-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.7.1.2-2: CSI-RSRP Intra frequency general test parameters

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 24		100: $N_{PRB,c}$ = 24	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SMTC configuration		SMTC.1		SMTC.1	

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
CSI-RS configuration for RRM		CSI-RS.RRM.FR2.1 TDD			
Time offset with Cell 1	µs	-	0.58	-	0.58
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.7.7.7.1.2-3: CSI-RSRP Intra frequency OTA related test parameters

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 7		Rough		Assumption for UE beams Note 7	
N_{oc} Note1	dBm/15 kHz Note4	-91.6		N/A	
N_{oc} Note1	dBm/SCS Note4	-82.6		N/A	
$\hat{E}_s / N_{oc}$ for SSB	dB	6.0	1.0	N/A	N/A
$\hat{E}_s / N_{oc}$ for CSI-RS	dB	6.0	1.0	N/A	N/A
E_s for SSB	dBm/SCS Note4			(Table B.2.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2.2-2 Rx Beam Peak +2.1 dB)
E_s for CSI-RS	dBm/SCS Note4			(Table B.2.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2.2-2 Rx Beam Peak +2.1 dB)
CSI-RS_RP Note2	dBm/SCS	-76.6	-81.6	(Table B.2.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2.2-2 Rx Beam Peak +2.1 dB)
$\hat{E}_s / I_{ot}$ BB Note6	dB	2.44	-5.98	-5.98	-5.98
Io Note2	dBm/95.04 MHz Note4	-50.05		(Table B.2.2.2-2 Rx Beam Peak +29.70 dB)	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: CSI-RS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.7.7.1.3 Test Requirements

The CSI-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.3.2.1 and relative accuracy requirements in clause 10.1.3.2.2. The following requirements are to be verified:

During T1:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported CSI-RSRP is in the range shown in table A.7.7.7.1.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported CSI-RSRP meets the requirements in table 10.1.3.2.2-1.

During T2:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported CSI-RSRP is in the range shown in table A.7.7.7.1.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported CSI-RSRP meets the requirements in table 10.1.3.2.2-1.

During T1 and T2:

Relative accuracy of Cell 1 during T2 compared with Cell 1 during T1. The UE is deemed to meet the requirement if the difference in reported CSI-RSRP meets the requirements in table 10.1.3.2.2-1

Relative accuracy of Cell 2 during T2 compared with Cell 2 during T1. The UE is deemed to meet the requirement if the difference in reported CSI-RSRP meets the requirements in table 10.1.3.2.2-1.

Table A.7.7.7.1.3-1: CSI-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	CSI-RS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ CSI-RS_RP1 +δ +G_{max}
Cell 2	CSI-RS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ CSI-RS_RP2 +δ +G_{max}
NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.3.2.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.7.7.7.2 SA inter-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.7.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.5.2.1 and 10.1.5.2.2 for inter-frequency measurements with the testing configurations for NR cells in table A.7.7.7.2.1-1.

Table A.7.7.7.2.1-1: Applicable NR configurations for FR2 inter-frequency CSI-RSRP accuracy test

Configuration	Description
1	120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

A.7.7.7.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 1 and Cell 2 are given in table A.7.7.7.2.2-1 and table A.7.7.7.2.2-2 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in table A.7.7.7.2.2-1 and table A.7.7.7.2.2-2. The inter-frequency measurements are supported by a measurement gap.

Table A.7.7.7.2.2-1: CSI-RSRP inter-frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
$BW_{channel}$			100: $N_{PRB,c}$ = 24		100: $N_{PRB,c}$ = 24	
Gap pattern ID			0		0	
Duplex mode			TDD	TDD	TDD	TDD
TDD configuration			TDDConf.3.1		TDDConf.3.1	
PDSCH Reference measurement channel			SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel			CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Reference Channel			CCR.3.1 TDD	-	CCR.3.1 TDD	-
SSB configuration			SSB.3 FR2		SSB.3 FR2	
SMTC configuration			SMTC.1		SMTC.1	
OCNG Patterns			OP.3		OP.3	
Initial BWP Configuration			DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration			DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration			TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration			TCI.State.2		TCI.State.2	
CSI-RS configuration for RRM			CSI-RS.RRM.FR2.1 TDD		CSI-RS.RRM.FR2.1 TDD	
Time offset between Cell 2 and Cell 3		µs	0.58		0.58	
EPRE ratio of PSS to SSS EPRE ratio of PBCH DMRS to SSS EPRE ratio of PBCH to PBCH DMRS EPRE ratio of PDCCH DMRS to SSS EPRE ratio of PDCCH to PDCCH DMRS EPRE ratio of PDSCH DMRS to SSS EPRE ratio of PDSCH to PDSCH DMRS EPRE ratio of OCNG DMRS to SSS Note 1 EPRE ratio of OCNG to OCNG DMRS Note 1		dB	0	0	0	0
Propagation condition		-	AWGN	AWGN	AWGN	AWGN
Antenna configuration		-	1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						

Table A.7.7.7.2.2-2: SS-RSRP inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 4b according to clause A.3.15.4.2		Setup 4b according to clause A.3.15.4.2	
		AoA1 Spherical coverage	AoA2 Rx Beam Peak	AoA1 Spherical coverage	AoA2 Rx Beam Peak
N_{oc} Note1	dBm/15 kHz Note4	-90.6	-90.6	(Table B.2.3.2-2 Rx Beam Peak +1.97 dB)	(Table B.2.3.2-2 Rx Beam Peak - 3.03 dB)
Assumption for UE beams Note 7		Rough		Rough	

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
N_{oc} Note1	dBm/SCS Note4	-81.6	-81.6	(Table B.2.3.2-2 Rx Beam Peak +11.0 dB)	(Table B.2.3.2-2 Rx Beam Peak +6.0 dB)
$\hat{E}_s / N_{oc}$ for SSB	dB	6.0	6.0	17.0	-1.0
$\hat{E}_s / N_{oc}$ for CSI-RS	dB	6.0	6.0	17.0	-1.0
CSI-RS_RP Note2	dBm/SCS	-75.60	-75.60	(Table B.2.3.2-2 Rx Beam Peak +28.0 dB)	(Table B.2.3.2-2 Rx Beam Peak +5.0 dB)
($CSI\text{-}RS_RP_{Cell\ 1}$ – $CSI\text{-}RS_RP_{Cell\ 2}$)	dB	0		23.00	
$\hat{E}_s / I_{ot\ BB}$ Note6 for SSB	dB	5.29	5.96	8.86	-3.92
$\hat{E}_s / I_{ot\ BB}$ Note6 for CSI-RS	dB	5.29	5.96	8.86	-3.92
Io Note2	dBm/95.04 MHz Note4	-50.03	-50.03	(Table B.2.3.2-2 Rx Beam Peak +52.68 dB)	(Table B.2.3.2-2 Rx Beam Peak +33.13 dB)
($Io_{freq\ 1}$ – $Io_{freq\ 2}$)	dB	0		19.55	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: CSI-RS_RP, Es/Iot, Io, ($CSI\text{-}RS_RP_{Cell\ 2}$ – $CSI\text{-}RS_RP_{Cell\ 1}$) and ($Io_{freq\ 2}$ – $Io_{freq\ 1}$) levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P or ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.7.2.3 Test Requirements

The CSI-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirements in clause 10.1.5.2.1 and the relative requirements in clause 10.1.5.2.2.

Test 1:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported CSI-RSRP is in the range shown in table A.7.7.7.2.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported CSI-RSRP meets the requirements in A.7.7.7.2.3-2.

Test 2:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported CSI-RSRP is in the range shown in table A.7.7.7.2.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported CSI-RSRP meets the requirements in A.7.7.7.2.3-2.

Table A.7.7.7.2.3-1: CSI-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 1	$CSI\text{-}RS_RP1 - \delta + G_{min} + X \leq$ Reported RSRP(dBm) $\leq CSI\text{-}RS_RP1 + \delta + G_{max}$

Cell 2	CSI-RS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ CSI-RS_RP2 +δ +G_{max}
NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.5.2.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	
NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.	

Table A.7.7.7.2.3-2: CSI-RSRP relative accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 2 – Cell 1	CSI-RS_RP2 – CSI-RS_RP1 – δ – D – G_{inter} ≤ Reported RSRP(dB) ≤ CSI-RS_RP2 – CSI-RS_RP1 + δ + G_{inter} – (X) + E
NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP relative accuracy requirement from Table 10.1.5.2.2-1	
NOTE 3: Void	
NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.	
NOTE 5: D is the margin due to mis-alignment between fine beam and rough beam. D is the Rough Beam gain reduction in Rx beam peak direction from Table B.2.1.5.3-1, selected according to the UE power class. D is always a positive value.	
NOTE 6: G_{inter} is the margin due to different antenna gain caused by frequency separation. G_{inter} is from Table B.2.1.5.2-1, selected according to the UE power class, and is always a positive value.	
NOTE 7: E = 3 (dB) is an additional margin to account for the actual gain difference between peak direction and spherical coverage using rough beams.	

A.7.7.8 CSI-RSRQ

A.7.7.8.1 SA intra-frequency measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.8.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.8.2.1.

A.7.7.8.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.7.8.1.2-1. The absolute accuracy of CSI-RSRQ intra-frequency measurement is tested by using the parameters in table A.7.7.8.1.2-2 and table A.7.7.8.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell.

Table A.7.7.8.1.2-1: CSI-RSRQ Intra frequency CSI-RSRQ supported test configurations

Configuration	Description
1	120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.8.1.2-2: CSI-RSRQ Intra frequency test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		Freq1		Freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
TRS configuration			TRS.2.1 TDD		TRS.2.1 TDD	
TCI state			TCI.State.0		TCI.State.0	
PDSCH Reference measurement channel			SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel			CR.3.1 TDD	-	CR.3.1 TDD	
Control channel RMC			CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns			OP.1	OP.1	OP.1	OP.1
Time offset with Cell 1		µs	-	0.58	-	0.58
SMTC configuration			SMTC.1			
SSB configuration			SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
PDSCH/PDCCH subcarrier spacing		kHz	120	120	120	120
CSI-RS configuration for RRM			CSI-RS.RRM.FR2.1 TDD			
EPRE ratio of CSI-RS to SSS		dB	0	0	0	0
EPRE ratio of PSS to SSS						
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition			AWGN		AWGN	
Antenna configuration			1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Table A.7.7.8.1.2-3: CSI-RSRQ Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1according to clause A.3.15.1	
Assumption for UE beams Note 7		Rough			
N_{OC} Note1	dBm/15 kHz Note4	-95		-95	
N_{OC} Note1	dBm/SCS Note3	-86		-86	
CSI-RSRP Note2	dBm/SCS Note4	-83	-83	-89	-89
CSI-RSRQ Note2	dB	-14.77	-14.77	-16.81	-16.81
$\hat{E}_s/N_{oc}$ for SSB	dB	3	3	-3	-3
$\hat{E}_s/N_{oc}$ for CSI-RS	dB	3	3	-3	-3
$\hat{E}_s/I_{ot}$ for SSB	dB	-1.76	-1.76	-4.76	-4.76
$\hat{E}_s/I_{ot}$ for CSI-RS	dB	-1.76	-1.76	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-50		-54	-54

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: CSI-RSRQ, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: CSI-RSRQ and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone					
NOTE 6: NR operating band groups are as defined in clause 3.5.2.					
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.7.8.1.3 Test Requirements

The CSI-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal CSI-RSRQ+2.5 dB to Nominal CSI-RSRQ-3.5 dB and the CSI-RSRQ measurement accuracy in test 2 shall be within the range Nominal CSI-RSRQ+3.5 dB to Nominal CSI-RSRQ-4.5 dB according to the requirements in clause 10.1.8.2.1 with an additional -1 dB margin reflecting the possible impact of UE self noise in the test. Nominal RSRQ is the value shown in table A.7.7.8.1.2-3.

A.7.7.8.2 SA Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.7.7.8.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.10.2.1 and 10.1.10.2.2 for inter-frequency measurement.

A.7.7.8.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.7.7.8.2.2-1. Both absolute accuracy and relative accuracy requirements of CSI-RSRQ inter-frequency measurement are tested by using test parameters in table A.7.7.8.2.2-2 and table A.7.7.8.2.2-3. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A. 7.7.8.2.2-1: CSI-RSRQ Inter frequency supported test configurations

Configuration	Description
1	120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.8.2.2-2: CSI-RSRQ Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		Freq1	freq2	freq1	Freq2
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
Time offset with Cell 1	µs	-	0.58	-	0.58
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
CSI-RS configuration for RRM		CSI-RS.RRM.FR2.1 TDD			
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of CSI-RS to SSS					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Table A.7.7.8.2.2-3: CSI-RSRQ Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
AoA setup		Setup 1 in clause A.3.15.		Setup 1 in clause A.3.15.	
Assumption for UE beams Note 6		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-94.03		-94.03	
N_{oc} Note1	dBm/SCS Note3	-85.0		-85.0	
CSI-RSRP Note2	dBm/SCS Note4	-86.75	-86.75	-88	-88
CSI-RSRQ Note2	dB	-14.75	-14.75	-15.56	-15.56
$\hat{E}_s/N_{oc}$ for SSB	dB	-1.75	-1.75	-3	-1.75
$\hat{E}_s/N_{oc}$ for CSI-RS	dB	-1.75	-1.75	-3	-1.75
$\hat{E}_s/I_{ot}$ for SSB	dB	-1.75	-1.75	-3	-3
$\hat{E}_s/I_{ot}$ for CSI-RS	dB	-1.75	-1.75	-3	-3
Io Note2	dBm/95.04 MHz Note4	-53.8	-53.8	-54.25	-54.25

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: CSI-RSRQ, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: CSI-RSRQ and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.8.2.3 Test Requirements

The CSI-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal CSI-RSRQ+2.5 dB to Nominal CSI-RSRQ -3.5 dB and the CSI-RSRQ measurement accuracy in test 2 shall be within the range Nominal CSI-RSRQ +3.5 dB to Nominal CSI-RSRQ -4.5 dB according to the requirements in clause 10.1.10.2.1 with an additional -1 dB margin reflecting the possible impact of UE self noise in the test.

The CSI-RSRQ relative measurement accuracy shall fulfil the requirements in clause 10.1.10.2.2.

A.7.7.9 CSI-SINR

A.7.7.9.1 SA intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.9.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.13.2.1.

A.7.7.9.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.7.9.1.2-1. . The absolute accuracy of CSI-SINR intra-frequency measurement is test by using the parameters in table A.7.7.9.1.2-2 and table A.7.7.9.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.7.7.9.1.2-1: CSI-SINR Intra frequency CSI-SINR supported test configurations

Configuration	Description
1	120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.9.1.2-2: CSI-SINR Intra frequency test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		Freq2		Freq2	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1			
Downlink dedicated BWP configuration		DLBWP.1.1			
Uplink initial BWP configuration		ULBWP.0.1			
Uplink dedicated BWP configuration		ULBWP.1.1			
DRX cycle configuration	ms	Not applicable			
TRS configuration		TRS.2.1 TDD			
TCI state		TCI.State.0			
PDSCH Reference measurement channel		SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	
Dedicated RMSI CORESET Reference Channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
Time offset with Cell 1	µs	-	0.29	-	0.29
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1			
SSB configuration		SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
CSI-RS configuration for RRM		CSI-RS.RRM.FR2.1 TDD			
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
SS-RSSI-Measurement		Not Applicable			
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of CSI-RS to SSS					
EPRE ratio of OCNG to SSS Note 1					
Propagation conditions		AWGN			
Antenna configuration		1x2			

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					

Table A.7.7.9.1.2-3: CSI-SINR Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 9		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-105		-105	
N_{oc} Note1	dBm/SCS Note3	-96		-96	
CSI-RSRP Note2	dBm/SCS Note4	-91.46	-93.34	-99	-99
CSI-SINR Note2	dB	0	-3.2	-4.76	-4.76
$\hat{E}_s / N_{oc}$ for SSB	dB	4.54	2.66	-3	-3
$\hat{E}_s / N_{oc}$ for CSI-RS	dB	4.54	2.66	-3	-3
$\hat{E}_s / I_{ot}$ for SSB	dB	0	-3.2	-4.76	-4.76
$\hat{E}_s / I_{ot}$ for CSI-RS	dB	0	-3.2	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-59.2		-64	
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone					
NOTE 6: NR operating band groups are as defined in clause 3.5.2.					
NOTE 7: Void					
NOTE 8: Void					
NOTE 9: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.7.9.1.3 Test Requirements

The CSI-SINR absolute measurement accuracy in test 1 shall be within the range Nominal CSI-SINR+XdB to Nominal CSI-SINR –X-1 dB and the CSI-SINR measurement accuracy in test 2 shall be within the range Nominal CSI-SINR +YdB to Nominal CSI-SINR –Y-1 dB according to the requirements in clause 10.1.13.2.1 with an additional -1 dB margin reflecting the possible impact of UE self noise in the test. The relative CSI-SINR measurement accuracy shall fulfil the requirements in clause 10.1.13.2.1.

Editor's note: The values of X and Y are pending on the accuracy requirement discussion

A.7.7.9.2 SA Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.7.7.9.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.15.2.1 and 10.1.15.2.2 for inter-frequency measurement.

A.7.7.9.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.7.7.9.2.2-1. Both absolute accuracy and relative accuracy requirements of CSI-SINR inter-frequency measurement are tested by using test parameters in table A.7.7.9.2.2-2 and table A.7.7.9.2.2-3. In all test cases, Cell 1 is the PCell and Cell 2 is target cell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.7.7.9.2.2-1: CSI-SINR Inter frequency CSI-SINR supported test configurations

Configuration	Description
1	120 kHz SSB and CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.9.2.2-2: CSI-SINR Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1					
Downlink dedicated BWP configuration		DLBWP.1.1					
Uplink initial BWP configuration		ULBWP.0.1					
Uplink dedicated BWP configuration		ULBWP.1.1					
DRX cycle configuration	ms	Not applicable					
TRS configuration		TRS.2.1 TDD					
TCI state		TCI.State.0					
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
Time offset with Cell 1	µs	-	0.29	-	0.29	-	0.29
OCNG Patterns		OP.1	OP.1	OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1	SMTC.1	SMTC.1
CSI-RS configuration for RRM		CSI-RS.RRM.FR2.1 TDD					
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG to SSS[Note 1]							
Propagation conditions		AWGN					
Antenna configuration		1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: CSI-SINR, CSI-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.7.7.9.2.2-3: CSI-SINR Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration	degrees	Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 10		Rough		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-105		-105		-105	
N_{oc} Note1	dBm/SCS Note3	-96		-96		-96	
CSI-RSRP Note2	dBm/SCS Note4	-96.5	-96.5	-85	-85	-99	-99
CSI-SINR Note2	dB	-0.5	-0.5	11	11	-3.0	-3.0
$\hat{E}_s / N_{oc}$ for SSB	dB	-0.5	-0.5	11.0	11.0	-3.0	-3.0
$\hat{E}_s / N_{oc}$ for CSI-RS	dB	-0.5	-0.5	11.0	11.0	-3.0	-3.0
$\hat{E}_s / I_{ot}$ for SSB	dB	-0.5	-0.5	11	11	-3.0	-3.0
$\hat{E}_s / I_{ot}$ for CSI-RS	dB	-0.5	-0.5	11	11	-3.0	-3.0
Io Note2	dBm/95.04 MHz Note4	-69.3		-55.4		-65.24	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: CSI-SINR, CSI-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: CSI-SINR and CSI-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: NR operating band groups are as defined in clause 3.5.2.
NOTE 7: Void
NOTE 8: Void
NOTE 9: Void
NOTE 10: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.9.2.3 Test Requirements

The CSI-SINR absolute measurement accuracy in test 1 shall be within the range Nominal CSI-SINR +XdB to Nominal CSI-SINR –X-1 dB and the CSI-SINR measurement accuracy in test 2 shall be within the range Nominal CSI-SINR +YdB to Nominal CSI-SINR –Y-1 dB according to the requirements in clause 10.1.15.2.1 with an additional -1 dB margin reflecting the possible impact of UE self noise in the test.

The CSI-SINR relative measurement accuracy shall fulfil the requirements in clause 10.1.15.2.2.

A.7.7.10 RSTD measurements

A.7.7.10.1 RSTD measurement accuracy test case for single positioning frequency layer

A.7.7.10.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.7.7.10.1.1-1.

Table A.7.7.10.1.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cells. Both cells are on the same NR RF channel in FR2. GP#24 is configured if UE supports GP#24, otherwise, GP#13 is configured for the test. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9.2.

Table A.7.7.10.1.1-2: RSTD accuracy test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
Measurement gap		GP#24 or GP#13		GP#24 or GP#13	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2	PRS.1.2 FR2	PRS.1.2 FR2
PRS Resource slot offset	slot	0	2	0	2
Expected RSTD	µs	N/A	3	N/A	3
Expected RSTD uncertainty	µs	N/A	5	N/A	5
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
EPRE ratio of PRS to SSS	dB	0	0	0	0
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.

Table A.7.7.10.1.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams[Note 5]		Rough		Rough	
N_{OC} [Note1]	dBm/SCS[Note3]	-89		-89	
PRS $\hat{E}_s / N_{oc}$	dB	-5.7	-11.9	-5.7	-11.9
PRP[Note2]	dBm/SCS	-94.7	-100.9	-94.7	-100.9
PRS $\hat{E}_s / I_{ot}$	dB	-6	-13	-6	-13
Io[Note2]	dBm/190.08 MHz [Note3]	-55.75	-55.75	-55.75	-55.75

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.
NOTE 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 4: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.10.1.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.7.7.10.2 RSTD measurement accuracy test case for dual positioning frequency layer

A.7.7.10.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9.2.

The supported test configurations are specified in table A.7.7.10.2.1-1.

Table A.7.7.10.2.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell on NR RF channel #1 in FR2. Cell 2 is a neighbour cell on a different NR RF channel #2 in FR2. GP#24 is configured if UE supports GP#24, otherwise, GP#13 is configured for the test.

Table A.7.7.10.2.1-2: RSTD accuracy test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN		freq1	freq2	freq1	freq2
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Measurement gap		GP#24 or GP#13		GP#24 or GP#13	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2	PRS.1.2 FR2	PRS.1.2 FR2
PRS Resource slot offset	slot	0	2	0	2
Expected RSTD	µs	N/A	3	N/A	3
Expected RSTD uncertainty	µs	N/A	5	N/A	5
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
EPRE ratio of PRS to SSS	dB	0	0	0	0
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.					

Table A.7.7.10.2.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/SCS Note3	-89		-89	
PRS $\hat{E}_s / N_{oc}$	dB	-6	-13	-6	-13
PRP Note2	dBm/SCS	-95	-102	-95	-102
PRS $\hat{E}_s / I_{ot}$	dB	-6	-13	-6	-13
Io Note2	dBm/190.08 MHz Note3	-56.03	-56.79	-56.03	-56.79
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
NOTE 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 4: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					
NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.7.10.2.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.7.7.10.3 RSTD measurement accuracy test case with reduced number of samples for single positioning frequency layer in FR2 in RRC_CONNECTED state

A.7.7.10.3.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions. In this test UE that supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* is configured by LMF to perform PRS measurement with reduced number of samples.

The supported test configurations are specified in table A.7.7.10.3.1-1.

Table A.7.7.10.3.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR2. GP#24 is configured if UE supports GP#24, otherwise, GP#13 is configured for the test. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the UE before the start of the test. The test duration should be longer than the UE measurement period as defined in clause 9.9.2.7.

Table A.7.7.10.3.1-2: RSTD accuracy test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
PRS configuration		PRS.1.2 FR2	PRS.1.2 FR2	PRS.1.2 FR2	PRS.1.2 FR2
PRS BW		64 PRBs	64 PRBs	128 PRBs	128 PRBs
PRS Resource slot offset	slot	0	2	0	2
Expected RSTD	µs	N/A	3	N/A	3
Expected RSTD uncertainty	µs	N/A	5	N/A	5
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.7.7.10.3.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/SCS Note3	-89		-89	
PRS $\hat{E}_s / N_{oc}$	dB	-1.44	-3.65	-1.44	-3.65
PRS-RSRP Note2	dBm/SCS	-90.44	-92.65	-90.44	-92.65
SS-RSRP Note2	dBm/SCS	-90.44	-92.65	-90.44	-92.65
PRS $\hat{E}_s / I_{ot\ BB}$ Note4	dB	-3	-6	-3	-6
Io Note2	dBm/190.08 MHz Note3	-53.68	-53.68	-53.68	-53.68
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					
NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.7.10.3.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.7.7.10.4 RSTD measurement accuracy test case with Rx TEG

A.7.7.10.4.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement when the measurements of reference cell and neighbor cell are within the same Rx TEG meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.7.7.10.4.1-1.

Table A.7.7.10.4.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR2. GP#24 is configured if UE supports GP#24, otherwise, GP#13 is configured for the test. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the UE before the start of the test.

The UE is requested to provide the Rx TEG in the test via *nr-UE-RxTEG-Request-r17* in *NR-TDOA-RequestLocationInformation*.

The test applies to the UE supporting *Rx TEG* defiend in *NR-UE-TEG-Capability* and reporting the same Rx TEG for the measurements of reference cell and neighbour cell.

Table A.7.7.10.4.1-2: RSTD accuracy test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2	PRS.1.2 FR2	PRS.1.2 FR2
PRS Resource slot offset	slot	0	2	0	2
Expected RSTD	µs	N/A	3	N/A	3
Expected RSTD uncertainty	µs	N/A	5	N/A	5
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
EPRE ratio of PRS to SSS					

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.7.7.10.4.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/SCS Note3	-89		-89	
PRS $\hat{E}_s / N_{oc}$	dB	-5.7	-11.9	-5.7	-11.9
PRP Note2	dBm/SCS	-94.7	-100.9	-94.7	-100.9
PRS $\hat{E}_s / I_{ot}$ Note4	dB	-6	-13	-6	-13
Io Note2	dBm/190.08 MHz Note3	-55.75	-55.75	-55.75	-55.75
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 4: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					
NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.7.10.4.2 Test Requirements

The RSTD measurement for Cell 1 and Cell 2 should both fulfil the absolute accuracy requirements with same Rx TEG for reference cell and neighbour cell defined in clause 10.1.23.2.

A.7.7.10.5 NR RSTD measurement accuracy test case for PRS aggregation in FR2 SA in RRC_CONNECTED mode

A.7.7.10.5.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement performed by UE by aggregating PRS resources from two positioning frequency layers (PFLs) meets the accuracy requirements specified in clause 10.1.23A.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.7.7.10.5.1-1.

Table A.7.7.10.5.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth per PFL, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cells. Each cell is associated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel #1. In addition, all cells/TRPs transmit DL PRS in two

intra-band contiguous PFLs in RF channel #1 and RF channel #2. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

GP#24 is configured if UE supports GP#24, otherwise, GP#13 is configured for the test. The UE is capable of performing RSTD measurements by aggregating PRS resources from two PFLs and is configured by the LMF to perform measurements by aggregating the PRS resources from two PFLs via *nr-DL-PRS-JointMeasurementRequestedPFL-List*. The *NR-DL-TDOA-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34], shall be provided to the UE before the start of the test.

The test duration should be larger than the UE measurement period as defined in clause 9.9.2.10.

Table A.7.7.10.5.1-2: RSTD accuracy test parameters for PRS aggregation

Parameter	Unit	Cell 1	Cell 2
PRS ARFCN		freq1, freq2	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$ per carrier	MHz	200: $N_{RB,c}$ = 132	
Measurement gap		GP#24 or GP#13	
Downlink initial BWP configuration		DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-
DRX cycle configuration		Not applicable	-
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2
PRS Resource slot offset	slot	0	4
Expected RSTD	µs	N/A	3
Expected RSTD uncertainty	µs	N/A	5
Time offset with Cell 1	µs	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
EPRE ratio of PRS to SSS	dB	0	0
Propagation conditions		AWGN	AWGN
Antenna configuration		1x2	1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS. Note 2: Carriers with PRS resources for aggregation are intra-band and contiguous to each other.			

Table A.7.7.10.5.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 5		Rough	
N_{oc} Note1	dBm/SCS Note3	-89	
PRS $\hat{E}_s/N_{oc}$	dB	-5.7	-11.9
PRP Note2	dBm/SCS	-94.7	-100.9
PRS $\hat{E}_s/I_{ot}$	dB	-6	-13
Io Note2 per PFL	dBm/190.08 MHz Note3	-55.75	-55.75

Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over sub-carriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.
Note 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
Note 4: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
Note 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.

A.7.7.10.5.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23A.2.

A.7.7.11 PRS-RSRP measurements

A.7.7.11.1 SA measurement accuracy with PRS in FR2

A.7.7.11.1.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.24.2.1 and 10.1.24.2.2.

A.7.7.11.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.7.11.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in table A.7.7.11.1.2-2 and A.7.7.11.1.2-3. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.7.7.11.1.2-1: PRS-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.7.11.1.2-2: PRS-RSRP general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
Measurement gap		GP#13 or GP#24 Note2			
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
Expected RSTD	µs	3			
Expected RSTD uncertainty	µs	5			
PRS configuration		PRS.1.3 FR2	PRS.1.3 FR2	PRS.1.4 FR2	PRS.1.4 FR2
PRS Resource slot offset	slot	0	2	0	2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
EPRE ratio of PRS to SSS	dB	0	0	0	0
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.

Table A.7.7.11.1.2-3: PRS-RSRP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 7		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-98		-98	
N_{oc} Note1	dBm/SCS Note4	-89		-89	
PRS $\hat{E}_s / N_{oc}$	dB	-2	-10	-2	10
PRP Note2	dBm/SCS	-91	-99	-91	-99
PRS $\hat{E}_s / I_{ot}$	dB	-2.41	-12.12	-2.41	-12.12
Io Note2	dBm/190.08 MHz Note4	-54.62		-54.62	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.11.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.24.2.1 if the reported PRS-RSRP is in the range shown in table A.7.7.11.1.3-1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1.24.2.2.

Table A.7.7.11.1.3-1: PRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}

NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.24.2.1-2, selected according to the Io used in the test.
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.6.1-1, selected according to the UE power class

A.7.7.11.2 SA measurement accuracy with PRS in FR2 with reduced sample number

A.7.7.11.2.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRP measurement with reduced sample number is within the specified limits. This test will verify the requirements in clauses 10.1.24.2.1 and 10.1.24.2.2.

A.7.7.11.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.7.11.2.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in table A.7.7.11.2.2-2 and A.7.7.11.2.2-3. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.7.7.11.2.2-1: PRS-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.7.11.2.2-2: PRS-RSRP general test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Cell ID		489	0
SSB ARFCN		freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-
DRX cycle configuration		Not applicable	-
Measurement gap		GP#13 or GP#24 Note2	
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3
PRS configuration		PRS.1.4 FR2	PRS.1.4 FR2
PRS BW	RB	64	64
PRS Resource slot offset	slot	0	2
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation conditions		AWGN	AWGN
Antenna configuration		1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.			

Table A.7.7.11.2.2-3: PRS-RSRP OTA related test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 7		Rough	

Parameter	Unit	Test 1	
		Cell 1	Cell 2
N_{oc} Note1	dBm/15 kHz Note4	-98	
N_{oc} Note1	dBm/SCS Note4	-89	
$\hat{E}_s / N_{oc}$	dB	2.23	-1.73
E_s	dBm/SCS Note4	-	-
PRS_RP Note2	dBm/SCS	-86.77	-90.73
SSB_RP Note2	dBm/SCS	-86.77	-90.73
$\hat{E}_s / I_{ot}$ BB Note6	dB	0	-6
Io Note2	dBm/190.08 MHz Note4	-51.76	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.11.2.3 Test Requirements

In the test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.24.2.1 if the reported PRS-RSRP is in the range shown in table A.7.7.11.2.3-1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1.24.2.2.

Table A.7.7.11.2.3-1: PRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}

NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.24.2.1-2, selected according to the Io used in the test.
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.6.1-1, selected according to the UE power class

A.7.7.12 UE Rx-Tx time difference measurements

A.7.7.12.1 UE Rx-Tx time difference measurement accuracy for single positioning frequency layer in FR2 SA

A.7.7.12.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.25.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configuration is listed in table A.7.7.12.1.1-1.

Table A.7.7.12.1.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE before the start of the test.

The UE is configured with measurement gap pattern ID #13 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.7.7.12.1.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.7.7.12.1.2-1.

Table A.7.7.12.1.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]		1	Rough	Rough	Rough	Rough
Measurement gap		1	GP#24 or GP#13 [Note 8]		GP#24 or GP#13 [Note 8]	
DRX		1	OFF		OFF	
Time offset with Cell 1	μs	1	N/A	3	N/A	3
TDD configuration		1	TDDConf.3.1	TDDConf.3.1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A	CR.3.1 TDD	N/A
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A	CCR.3.1 TDD	N/A
OCNG Patterns		1	OP.1	OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD	N/A	TRS.2.1 TDD	N/A
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1	DLBWP.1.1	N/A	DLBWP.1.1	N/A
Active UL BWP configuration		1	ULBWP.1.1	N/A	ULBWP.1.1	N/A
PRS configuration		1	PRS.1.1 FR2	PRS.1.1 FR2	PRS.1.2 FR2	PRS.1.2 FR2
PRS Resource slot offset	slot	1	0	2	0	2
SRS configuration		1	POS-SRS.3	N/A	POS-SRS.3	N/A
N_{oc} Note 2	dBm/SCS	1	-89		-89	
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	-12.12	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-2	-10	-2	-10
PRP Note 3	dBm/SCS kHz	1	-91	-99	-91	-99
Io	dBm/190.08 MHz	1	-54.62	-54.62	-54.62	-54.62
Propagation Condition		1	AWGN		AWGN	

NOTE 1: Void.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.
NOTE 9: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

Table A.7.7.12.1.2-2: Void

A.7.7.12.1.3 Test requirements

The UE Rx-Tx time difference measurement fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25.2 for both Cell 1 and Cell 2.

A.7.7.12.2 UE Rx-Tx time difference measurement accuracy with reduced number of samples in FR2 SA

A.7.7.12.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy with reduced number of samples is within the specified limits. This test will verify the requirements in clause 10.1.25.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configuration is listed in table A.7.7.12.2.1-1.

Table A.7.7.12.2.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR2.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE before the start of the test.

The UE is configured to measure UE Rx-Tx time difference using reduced number of samples via *reducedDL-PRS-ProcessingSamples* in *NR-Multi-RTT-RequestLocationInformation* during the test.

The UE is configured with measurement gap pattern ID #13 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.7.7.12.2.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.7.7.12.2.2-1.

Table A.7.7.12.2.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]		1	Rough	Rough
Measurement gap		1	GP#24 or GP#13 [Note 8]	
DRX		1	OFF	
Time offset with Cell 1	µs	1	N/A	3
TDD configuration		1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A
OCNG Patterns		1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.2.1 TDD	N/A
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1	DLBWP.1.1	N/A
Active UL BWP configuration		1	ULBWP.1.1	N/A
PRS configuration		1	PRS.1.1 FR2	PRS.1.1 FR2
PRS BW		1	64 PRBs	64 PRBs
PRS Resource slot offset	slot	1	0	2
SRS configuration		1	POS-SRS.3	N/A
N_{oc} Note 2	dBm/SCS	1	-89	
N_{oc} Note 2	dBm/15 kHz	1	-98	
PRS $\hat{E}_s/I_{ot}$	dB	1	0	-6
PRS $\hat{E}_s/N_{oc}$	dB	1	2.23	-1.73
PRP Note 3	dBm/SCS kHz	1	-86.77	-90.73
Io	dBm/190.08 MHz	1	-51.76	-51.76
Propagation Condition		1	AWGN	

NOTE 1: Void.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.
NOTE 9: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.7.12.2.3 Test requirements

The UE Rx-Tx time difference measurement with reduced number of samples fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25.2 for both Cell 1 and Cell 2.

A.7.7.12.3 UE Rx-Tx time difference measurement accuracy with RxTx TEG

A.7.7.12.3.1 Test purpose and environment

The purpose of the test is to verify that the relative UE Rx-Tx time difference measurement accuracy when the two measurements are within the same RxTx TEG is within the specified limits. This test will verify the requirements in clause 10.1.25.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configuration is listed in table A.7.7.12.3.1-1.

Table A.7.7.12.3.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE before the start of the test.

The UE is requested to provide the RxTx TEG in the test via *nr-UE-RxTxTEG-Request-r17* in *NR-Multi-RTT-RequestLocationInformation*.

The test applies to the UE supporting *RxTx TEG* defiend in *NR-UE-TEG-Capability* and reporting the same RxTx TEG for the two UE Rx-Tx measurements.

The UE is configured with measurement gap pattern ID #13 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The UE Rx-Tx time difference is derived by the difference of the receiving timing and the transmit timing for each cell.

A.7.7.12.3.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.7.7.12.3.2-1.

Table A.7.7.12.3.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]		1	Rough	Rough	Rough	Rough
Measurement gap		1	GP#24 or GP#13 [Note 8]		GP#24 or GP#13 [Note 8]	
DRX		1	OFF		OFF	
Time offset with Cell 1	μs	1	N/A	3	N/A	3
TDD configuration		1	TDDConf.3.1	TDDConf.3.1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A	CR.3.1 TDD	N/A
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A	CCR.3.1 TDD	N/A
OCNG Patterns		1	OP.1	OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD	N/A	TRS.2.1 TDD	N/A
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1	DLBWP.1.1	N/A	DLBWP.1.1	N/A
Active UL BWP configuration		1	ULBWP.1.1	N/A	ULBWP.1.1	N/A
PRS configuration		1	PRS.1.1 FR2	PRS.1.1 FR2	PRS.1.2 FR2	PRS.1.2 FR2
PRS Resource slot offset	slot	1	0	2	0	2
SRS configuration		1	POS-SRS.3	N/A	POS-SRS.3	N/A
N_{oc} Note 2	dBm/SCS	1	-89		-89	
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
PRS $\hat{E}_s/I_{ot}$	dB	1	-6	-13	-6	-13
PRS $\hat{E}_s/N_{oc}$	dB	1	-5.7	-11.9	-5.7	-11.9
PRP Note 3	dBm/SCS kHz	1	-94.7	-100.9	-94.7	-100.9
Io	dBm/190.08 MHz	1	-55.75	-55.75	-55.75	-55.75
Propagation Condition		1	AWGN		AWGN	

NOTE 1: Void.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.
NOTE 9: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.7.12.3.3 Test requirements

The relative accuracy is derived by the difference of the UE Rx-Tx measurements on the two cells.

The UE Rx-Tx time difference measurements for Cell 1 and Cell 2 fulfil the relative UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25.2.

A.7.7.12.4 UE Rx-Tx time difference measurement accuracy with PRS bandwidth aggregation in FR2 SA

A.7.7.12.4.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.25A. The tests are conducted under AWGN propagation condition with the UE operating in FR2 stand-alone mode and configured to perform UE Rx-Tx measurements by aggregating two intra-band contiguous positioning frequency layers (PFLs) in FR2.

The supported test configurations are listed in table A.7.7.12.4.1-1.

Table A.7.7.12.4.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: Cell 1 (PCell) and Cell 2 (neighbor cell). Each cell is sssociated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel #1. In addition, both cells/TRPs transmit DL PRS in two intra-band contiguous PFLs in RF channel #1 and RF channel #2.. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE before the start of the test.

The *NR-Multi-RTT-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2.

The *NR-Multi-RTT-RequestLocationInformation* message provided to the UE must request bandwidth aggregated measurements via *jointMeasurementsReq* and *nr-DL-PRS-JointMeasurementRequestedPFL-List.*

The UE is configured with measurement gap pattern ID #13 or ID #24 before the start of the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

The general test parameters and cell specific test parameters are as given in table A.7.7.12.4.1-2 and table A.7.7.12.4.1-3 respectively.

Table A.7.7.12.4.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].

RF Channel Number		1	1	For both Cell 1 and Cell 2, all signals/channels except PRS in PFL2 are allocated within this channel.
			2	For both Cell 1 and Cell 2, only PRS in PFL2 is allocated within this channel.
$BW_{channel}$	MHz	1	200: $N_{RB,c}$ = 132	For both RF channels
SSB configuration		1	SSB.2 FR2	
SMTC configuration		1	SMTC.1	
Measurement gap		1	GP#24 or GP#13 Note 1	
CP length		1	Normal	
DRX		1	OFF	
Time offset between serving and neighbour cells	µs	1	3	Synchronous cells/TRPs
Expected RSTD	µs	1	3	
Expected RSTD uncertainty	µs	1	5	
Note 1: GP#24 is configured if the UE supports it, otherwise GP#13 is configured.				

Table A.7.7.12.4.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15	
Beam Assumption Note 4		1	Rough	Rough
TDD configuration		1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A
OCNG Patterns Note 1		1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.2.1 TDD	N/A
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A
Active BWP configuration		1	DLBWP.1.1 ULBWP.1.1	N/A
PRS configuration (for both PFL1 and PFL2)		1	PRS.1.2 FR2	PRS.1.2 FR2
PRS Resource slot offset (for both PFL1 and PFL2)	slot	1	0	4
SRS configuration		1	POS-SRS.3	N/A
N_{oc} Note 2	dBm/SCS	1	-89	

PRS $\hat{E}_s/I_{ot}$	dB	1	-3	-13
PRS $\hat{E}_s/N_{oc}$	dB	1	-3	-13
PRP Note 3	dBm/SCS kHz	1	-92	-102
Io Note 3 (on symbols where PRS is not allocated)	dBm/190.08 MHz	1	-55.10	-55.10
Propagation Condition		1	AWGN	

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
Note 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
Note 6: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
Note 7: As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.7.7.12.4.2 Test requirements

The UE Rx-Tx time difference measurement fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25A for both Cell 1 and Cell 2.

A.7.7.13 PRS-RSRPP measurements

A.7.7.13.1 SA measurement accuracy with PRS in FR2

A.7.7.13.1.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRPP measurement in RRC_CONNECTED is within the specified limits. This test will verify the requirements in clauses 10.1.38.2.

A.7.7.13.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.7.13.1.2-1. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.7.7.13.1.2-1: PRS-RSRPP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.7.13.1.2-2: PRS-RSRPP general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
Measurement gap		GP#13 or GP#24 Note2			
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	μs	-	3	-	3
PRS configuration		PRS.1.3 FR2	PRS.1.3 FR2	PRS.1.4 FR2	PRS.1.4 FR2
PRS Resource slot offset	slot	0	2	0	2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ μs and $f_D = 5$ Hz			
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.					

Table A.7.7.13.1.2-3: PRS-RSRPP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 7		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-98		Same as Test 1	
N_{oc} Note1	dBm/SCS Note4	-89		Same as Test 1	
$\hat{E}_s / N_{oc}$	dB	-2	-10	-2	-10
E_s	dBm/SCS Note4	-	-	-	-

Parameter	Unit	Test 1		Test 2	
PRS_RP Note2	dBm/SCS	-91	-99	-91	-99
$\hat{E}_s / I_{ot}$ BB Note6	dB	-2.41	-12.12	-2.41	-12.12
Io Note2	dBm/190.08 MHz Note4	-54.62		-54.62	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.13.1.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.38.2 if the reported PRS-RSRPP is in the range shown in table A.7.7.13.1.2-1.

Table A.7.7.13.1.3-1: PRS-RSRPP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}

NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.24.2.1-2, selected according to the Io used in the test.
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.6.1-1, selected according to the UE power class

A.7.7.13.2 SA measurement accuracy with reduced PRS samples in FR2

A.7.7.13.2.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRPP measurement accuracy with N_{sample} = 1 in FR2 is within the specified limits. This test will verify the requirements in clauses 10.1.38.2.

The UE under test should support *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED*, and the TE indicates the UE to perform positioning measurements with reduced number of samples. The PRS bandwidth is contained within the active BWP and the power difference between the serving cell SS-RSRP and neighbour cell PRS-RSRP is within [6] dB, so that N_{sample} = 1 is assumed.

A.7.7.13.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.7.13.2.2-1. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.7.7.13.2.2-1: PRS-RSRPP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.7.13.2.2-2: PRS-RSRPP general test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Cell ID		489	0
SSB ARFCN		freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-
DRX cycle configuration		Not applicable	-
Measurement gap		GP#13 or GP#24 Note2	
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3
PRS configuration		PRS.1.4 FR2	PRS.1.4 FR2
PRS bandwidth		48 PRBs	48 PRBs
PRS Resource slot offset	slot	0	2
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation conditions		Two-tap channel Note3	
Antenna configuration		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.
NOTE 3: The two-tap channel model is defined in 38.101-4 annex B.2.4 (a = 1, τ_d=0.45 µs and f_D=5 Hz).

Table A.7.7.13.2.2-3: PRS-RSRPP OTA related test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 7		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-98	
N_{oc} Note1	dBm/SCS Note4	-89	
$\hat{E}_s / N_{oc}$	dB	-2	-10
E_s	dBm/SCS Note4	-	-
PRS_RP Note2	dBm/SCS	-91	-99
SS_RP Note2	dBm/SCS	-91	-99
$\hat{E}_s / I_{ot}$ BB Note6	dB	-2.41	-12.12
Io Note2	dBm/190.08 MHz Note4	-54.62	

Parameter	Unit	Test 1	
		Cell 1	Cell 2
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 2: PRS_RP, SS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 3: Void			
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone			
NOTE 5: Void			
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.			
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.			

A.7.7.13.2.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.38.2 if the reported PRS-RSRPP is in the range shown in table A.7.7.13.2.3-1.

Table A.7.7.13.2.3-1: PRS-RSRPP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRPP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRPP(dBm) ≤ PRS_RP2 +δ +G_{max}
NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table [10.1.24.Z.1-2], selected according to the Io used in the test.	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.6.1-1, selected according to the UE power class	

A.7.7.14 L1-RSRP measurement for group-based beam reporting

A.7.7.14.1 SSB based L1-RSRP measurement

A.7.7.14.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy for group-based beam reporting is within the specified limits. This test will verify the requirements in clauses 9.5.2 and clause 10.1.20.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.7.7.14.1.1-1.

The AoA setup for this test is Setup 5 as defined in clause A.3.15.5.

The UE which passes this test can skip A.7.7.4.1.

Table A.7.7.14.1.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.7.7.14.1.2 Test parameters

In this set of test cases there is one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.7.14.1.2-1 and table A.7.7.14.1.2-2 below. The absolute and relative accuracy of L1-RSRP measurements is tested by using the parameters in table A.7.7.14.1.2-1 and table A.7.7.14.1.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured two CSI resource sets with one SSB resource in each set. UE is configured to perform RLM, BFD measurement based on the SSB resources 0 and UE is configured to perform group-based L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.7.7.14.1.2-1: FR2 SSB based L1-RSRP general test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1, 2		freq1	freq1
Duplex mode	1, 2		TDD	TDD
TDD Configuration	1, 2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1, 2	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1, 2		66	66
PDSCH Reference measurement channel	1		SR.3.2 TDD	SR.3.2 TDD
	2		SR.3.3 TDD	SR.3.3 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD	CR.3.1 TDD
	2		CR.3.2 TDD	CR.3.2 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	CCR.3.1 TDD
	2		CCR.3.7 TDD	CCR.3.7 TDD
SSB configuration	1		SSB.1 FR2	SSB.1 FR2
	2		SSB.2 FR2	SSB.2 FR2
OCNG Patterns	1, 2		OP.1	OP.1
Initial BWP Configuration	1, 2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1, 2		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
TRS Configuration	1, 2		TRS.2.1 TDD	TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1, 2		TCI.State.2	TCI.State.2
SMTC configuration	1, 2		SMTC.1	SMTC.1
reportConfigType	1, 2		periodic	periodic
reportQuantity	1, 2		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1, 2		2	2
L1-RSRP reporting period	1, 2		slot320	slot320
Propagation condition	1, 2		AWGN	AWGN
Antenna configuration	1, 2		1x2	1x2
EPRE ratio of PSS to SSS	1, 2	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Table A.7.7.14.1.2-2: FR2 SSB based L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			SSB0	SSB1	SSB0	SSB1
Angle of arrival configuration			Setup 5 according to A.3.15.5		Setup 5 according to A.3.15.5	
Assumption for UE beams Note 4			Rough		Rough	
N_{oc}	1~2	dBm/15 kHz	-100		n.a.	
N_{oc}	1	dBm/SSB SCS	-91		n.a.	
	2		-88		n.a.	

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			SSB0	SSB1	SSB0	SSB1
$\hat{E}_s/I_{ot}$	1~2	dB	10	-2	n.a.	
SSB_RP Note1	1	dBm/SCS	-81	-93	As in table B.2.4-2	
	2		-78	-90	As in table B.2.4-2	
Io Note1	1~2	dBm/ 95.04 MHz	-51.57		SSB_RP+28.98	
$\hat{E}_s/N_{oc}$	1~2	dB	10	-2	n.a.	
NOTE 1: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 2: Void NOTE 3: No additional noise is added by the test system in Test 2. NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.7.14.1.3 Test Requirements

After 320 ms from the beginning of the test, the UE shall send L1-RSRP measurement report with SSB0 and SSB1 as a resource group, where the accuracy of the reported measurement results for SSB0 and SSB1 of Cell 1 shall fulfil the requirements in clauses 10.1.20.1. The following requirements are to be verified:

For Test 1:

Absolute accuracy of SSB0 and SSB1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.7.14.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.1.2-1.

For Test 2:

Absolute accuracy of SSB resource reported by UE in L1-RSRP report (SSB0 or SSB1). The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.7.14.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.1.2-1.

Table A.7.7.14.1.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
SSB0	SSB_RP0 - δ + G_{min} ≤ Reported RSRP (dBm) ≤ SSB_RP0 + δ + G_{max}
SSB1	SSB_RP1 - δ + G_{min} ≤ Reported RSRP (dBm) ≤ SSB_RP1 + δ + G_{max}
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the SSB n under consideration NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.1.1-1, selected according to the Io used in the test NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.7.7.14.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.7.7.14.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy for group-based beam reporting is within the specified limits. This test will verify the requirements in clauses 9.5.3 and clause 10.1.20.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in table A.7.7.14.2.1-1.

The AoA setup for this test is Setup X1 as defined in clause A.3.15.X1.

Table A.7.7.14.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

A.7.7.14.2.2 Test parameters

In this set of test cases there is one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.7.7.14.2.2-1 and table A.7.7.14.2.2-2 below. The absolute and relative accuracy of L1-RSRP measurements is tested by using the parameters in table A.7.7.14.2.2-1 and table A.7.7.14.2.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured two CSI resource sets with one CSI-RS resource in each set. UE is configured to perform RLM and BFD based on SSB 0 and 1 and UE is configured to perform group-based L1-RSRP measurement based on the CSI resources. CSI-RS resources are not transmitted in the same OFDM symbols as SSB.

Table A.7.7.14.2.2-1: FR2 CSI-RS based L1-RSRP general test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1		freq1	freq1
Duplex mode	1		TDD	TDD
TDD Configuration	1		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2	SSB.1 FR2
OCNG Patterns	1		OP.1	OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
TRS Configuration	1		TRS.2.1 TDD	TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2	TCI.State.2
SMTC configuration	1		SMTC.1	SMTC.1
CSI-RS resource sets	1		TBD	TBD
reportConfigType	1		periodic	periodic
reportQuantity	1		cri-RSRP	cri-RSRP
Number of reported RS	1		2	2
L1-RSRP reporting period	1		slot80	slot80
Propagation condition	1		AWGN	AWGN
Antenna configuration	1		1x2	1x2
EPRE ratio of PSS to SSS	1	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Table A.7.7.14.2.2-2: FR2 CSI-RS based L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			CSI-RS0	CSI-RS1	CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 5 according to A.3.15.5		Setup 5 according to A.3.15.5	

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			CSI-RS0	CSI-RS1	CSI-RS0	CSI-RS1
Assumption for UE beams Note 4			Rough		Rough	
N_{oc}	1~2	dBm/15 kHz	-100		n.a.	
N_{oc}	1~2	dBm/SSB SCS	-91		n.a. n.a.	
$\hat{E}_s / I_{ot}$	1~2	dB	10	-2	n.a.	
CSI-RS-RSRP Note1	1~2	dBm/SCS	-81	-93	As in table B.2.4-2	
Io Note1	1~2	dBm/ 95.04 MHz	-59.86		SS-RSRP+28.98	
$\hat{E}_s / N_{oc}$	1~2	dB	-51.57	-2	n.a.	

NOTE 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 3: No additional noise is added by the test system in Test 2.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.14.2.3 Test Requirements

After 640 ms from the beginning of the test, the L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 1 shall fulfil the requirements in clause 10.1.20.2. The following requirements are to be verified:

For Test 1:

Absolute accuracy of CSI-RS0 and CSI-RS1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.7.14.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

For Test 2:

Absolute accuracy of CSI-RS resource reported by UE in L1-RSRP report (CSI-RS0 or CSI-RS1). The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.7.14.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

Table A.7.7.14.2.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 – δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 + δ + G_{max}
CSI-RS1	CSI-RS _RP1 – δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 + δ + G_{max}

NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class

A.7.7.15 LTM L1-RSRP measurement

A.7.7.15.1 SSB based inter-frequency L1-RSRP measurement

A.7.7.15.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause10.1.20B.1.1] for inter-frequency L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.7.7.15.1.1-1.

Prior to the start of the test,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is provided with *LTM-Candidate-r18* for Cell 2.
- A measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A4 is used.
- UE is configured with SSB-based L1-RSRP measurements and periodic L1-RSRP measurement reports on candidate cell (Cell 2) in PUCCH format 2.
- The UE has reported L3 measurement results and performed SSB based L1-RSRP measurement on Cell 2.

Table A.7.7.15.1.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.7.7.15.1.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.7.15.1.2-1 and table A.7.7.15.1.2-2 below. The absolute accuracy of inter-frequency L1-RSRP measurements are tested by using the parameters in table A.7.7.15.1.2-1 and table A.7.7.15.1.2-2. The inter-frequency L1-RSRP measurements are supported by a measurement gap.

Before the test, UE is configured L1-RSRP measurement on SSB0 of Cell 2.

Table A.7.7.15.1.2-1: FR2 SSB based inter-frequency L1-RSRP general test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN	1~2		freq1	freq2	freq1	freq2
$BW_{channel}$	1~2		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1~2		66		66	
Gap pattern ID	1~2		13		13	
Measurement gap offset	1~2		39		39	
Duplex mode	1~2		TDD		TDD	
TDD configuration	1~2		TDDConf.3.1		TDDConf.3.1	
PDSCH Reference measurement channel	1		SR.3. 2 TDD	-	SR.3. 2 TDD	-
	2		SR.3.3 TDD		SR.3.3 TDD	
RMSI CORESET Reference Channel	1		CR.3.1 TDD	-	CR.3.1 TDD	-
	2		CR.3.2 TDD		CR.3.2 TDD	
Control Channel RMC	1		CCR.3.1 TDD	-	CCR.3.1 TDD	-
	2		CCR.3.7 TDD		CCR.3.7 TDD	
SSB configuration	1		SSB.3 FR2		SSB.3 FR2	
	2		SSB.4 FR2		SSB.4 FR2	
PDSCH/PDCCH subcarrier spacing	1~2	kHz	120		120	
OCNG Patterns	1~2		OP.1		OP.1	

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1~2		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2		TCI.State.2	
SMTC configuration	1~2		SMTC.1		SMTC.1	
offsetMO	1~2	dB	16 for Cell 2	-	16 for Cell 2	-
a4-Threshold	1~2	dBm	-120 for Cell 2	-	-120 for Cell 2	-
LTM reportConfigType	1~2		periodic	-	periodic	-
ltm-ResourcesForChannelMeasurement	1~2		SSB0 of Cell 2	-	SSB0 of Cell 2	-
LTM L1-RSRP reporting period	1~2		slot320	-	slot320	-
nrOfReportedCells	1~2		1	-	1	-
nrOfReportedRS-PerCell	1~2		1	-	1	-
spCellInclusion	1~2		N/A	-	N/A	
Time offset between Cell 2 and Cell 1	1~2	μs	3		3	
EPRE ratio of PSS to SSS	1~2	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition	1~2	-	AWGN	AWGN	AWGN	AWGN
Antenna configuration	1~2	-	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Table A.7.7.15.1.2-2: FR2 SSB based inter-frequency L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration	1~2		Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4	1~2		Rough		Rough	
N_{oc} Note1	1	dBm/15 kHz Note4	-100		n.a.	
	2					
N_{oc} Note1	1	dBm/SCS Note4	-91		n.a.	
	2		-88		n.a.	
$\hat{E}_s / N_{oc}$	1~2	dB	10	-2	n.a.	
$\hat{E}_s / I_{ot}$ Note2	1~2	dB	10	-2	n.a.	
SSB_RP Note2	1	dBm/SCS	-81	-93	As in table B.2.4.1-2	
	2		-78	-90	As in table B.2.4.1-2	
Io Note2	1	dBm/95.04 MHz Note3	-51.57	-59.86	SSB_RP+28.98	
	2		-51.57	-59.86	SSB_RP+28.98	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
NOTE 2: SSB_RP, Es/Iot, Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.7.15.1.3 Test Requirements

The L1-RSRP measurement accuracy for Cell 2 shall fulfil the absolute requirements in clause 10.1.20B.1.1.

Test 1:

Absolute accuracy of SSB0 in Cell 2. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.7.15.1.3-1.

Test 2:

Absolute accuracy of SSB0 in Cell 2. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.7.7.15.1.3-1.

Table A.7.7.15.1.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
SSB0	$SSB_RP0 - \delta + G_{min} \leq$ Reported RSRP(dBm) $\leq SSB_RP0 + \delta + G_{max}$
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the SSB n under consideration NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20B.1.1-1, selected according to the Io used in the test NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.7.7.16 RSCPD Measurements

A.7.7.16.1 RSCPD with RSTD measurement accuracy in FR2 SA in RRC_CONNECTED

A.7.7.16.1.1 Test purpose and environment

The purpose of the test is to verify that the accuracy of RSCPD measurement reported with RSTD measurement is within the specified limits. This test will verify the requirements in clause 10.1.43.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.7.7.16.1.1-1.

Table A.7.7.16.1.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* with *dl-PRS-RSCPD-Request* from LMF via LPP [34] as defined in TS 37.355 [34], clause 6.5.12, to enable UE to perform and report RSCPD in RRC_CONNECTED, shall be provided to the UE before the start of the test.
The UE is configured with measurement gap pattern ID #13 or ID #24 before the test.

The test duration should be larger than the UE measurement period as defined in clause 9.9.2.

A.7.7.16.1.2 Test parameters

The RSCPD with RSTD accuracy test parameters are given in table A.7.7.16.1.2-1 and table A.7.7.16.1.2-2.

Table A.7.7.16.1.2-1: RSCPD accuracy test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
PRS ARFCN		Freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{RB,c}$ = 132	
Measurement gap		GP#24 or GP#13	
Downlink initial BWP configuration		DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-
DRX cycle configuration		Not applicable	-
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2
PRS Resource slot offset	slot	0	4
Expected RSTD	µs	N/A	3
Expected RSTD uncertainty	µs	N/A	5
Time offset with Cell 1	µs	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
EPRE ratio of PRS to SSS	dB	0	0
Propagation conditions		AWGN	AWGN
Antenna configuration		1x2	1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.			

Table A.7.7.16.1.2-2: RSCPD accuracy OTA related test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 5		Rough	
N_{oc} Note1	dBm/SCS Note3	-89	
PRS $\hat{E}_s / N_{oc}$	dB	-5.7	-11.9
PRP Note2	dBm/SCS	-94.7	-100.9
PRS $\hat{E}_s / I_{ot}$ Note 4	dB	-6	-13

Io[Note 2]	dBm/190.08 MHz [Note3]	-55.75	-55.75

Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.

Note 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.

Note 4: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

Note 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.16.1.3 Test requirements

The RSCPD reported together with RSTD fulfils RSCPD measurement accuracy specified in clause 10.1.43.2 for Cell 2.

A.7.7.17 RSCP with UE Rx-Tx time difference measurements

A.7.7.17.1 RSCP with UE Rx-Tx time difference measurement accuracy in FR2 SA

A.7.7.17.1.1 Test purpose and environment

The purpose of the test is to verify that the accuracy of DL RSCP measurement reported with UE Rx-Tx time difference measurement is within the specified limits. This test will verify the requirements in clause 10.1.44.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configuration is listed in table A.7.7.12.2.1-1.

Table A.7.7.12.2.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR2.

The *NR-Multi-RTT-ProvideAssistanceData*, *NR-Multi-RTT-RequestLocationInformation* with *nr-DL-PRS-RSCP-Request* from LMF via LPP [34] and *NR-Multi-RTT-MeasurementCapability* as defined in TS 37.355 [34], clause 6.5.12, to enable UE to perform and report RSCP in RRC CONNECTED, shall be provided to the UE before the start of the test.

The UE is configured with measurement gap pattern ID #13 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.7.7.17.1.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.7.7.17.1.2-1.

Table A.7.7.17.1.2-1: RSCP with UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15	
Beam Assumption Note 7		1	Rough	Rough
Measurement gap		1	GP#24 or GP#13 Note 7	
DRX		1	OFF	
Time offset with Cell 1	μs	1	N/A	3
TDD configuration		1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A
OCNG Patterns		1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS				
EPRE ratio of OCNG to OCNG DMRS				
EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.2.1 TDD	N/A
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1	DLBWP.1.1	N/A
Active UL BWP configuration		1	ULBWP.1.1	N/A
PRS configuration		1	PRS.1.1 FR2	PRS.1.1 FR2
PRS BW		1	64 PRBs	64 PRBs
PRS Resource slot offset	slot	1	0	4
SRS configuration		1	POS-SRS.3	N/A
N_{oc} Note 1	dBm/SCS	1	-89	
N_{oc} Note 1	dBm/15 kHz	1	-98	
PRS $\hat{E}_s / I_{ot}$	dB	1	0	-6
PRS $\hat{E}_s / N_{oc}$	dB	1	2.23	-1.73
PRP Note 3	dBm/SCS kHz	1	-86.77	-90.73
Io	dBm/190.08 MHz	1	-51.76	-51.76
Propagation Condition		1	AWGN	

Note 1:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2:	PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3:	PRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4:	Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
Note 5:	As observed with 0 dBi gain antenna at the centre of the quiet zone.
Note 6:	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
Note 7:	GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.
Note 8:	Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.7.7.17.1.3 Test requirements

The RSCP with UE Rx-Tx time difference measurements fulfils the RSCP measurement accuracy requirements specified in clause 10.1.44.2 for both Cell 1 and Cell 2.

A.7.8 Measurement procedure in RRC_INACTIVE

A.7.8.1 RSTD measurements

A.7.8.1.1 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA in RRC_INACTIVE state

A.7.8.1.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 5.6.2.5 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.7.8.1.1.1-1.

Table A.7.8.1.1.1-1: Supported test configurations for NR RSTD

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layers.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell 3. During T2 UE shall be in RRC_INACTIVE state and all cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s).

The UE is configured with DRX cycle of 0.64 s.

The general test parameters are listed in table A.7.8.1.1.1-2, and cell specific test parameters are listed in table Table A.7.8.1.1.1-3 and table A.7.8.1.1.1-4.

Table A.7.8.1.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
$BW_{channel}$		MHz	200: $N_{PRB,c}$ = 132	
SSB configuration	Config 1		SSB.2 FR2	
SMTC configuration	Config 1		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.4. FR2	As specified in clause A.3. 31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	0.64	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			4	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test

Parameter	Unit	Value	Comment
T2	s	[1.28]	The length of the time interval that follows immediately after time interval T1
AoA setup		Setup 1	As defined in A.3.15.1
Beam assumption		Rough	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.8.1.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.5 FDD	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 190.08 MHz	-54.00	-54.00	-54.00
SSB RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
$\hat{E}_s/N_{oc}$		dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.

NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.7.8.1.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.44	-11.67	-11.67
Io	Config 1	dBm/ 19.08 MHz	-55.48	-55.48	-55.48
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
Propagation Condition		AWGN		
NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T3) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.				
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.				
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

A.7.8.1.1.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 5.6.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.7.8.1.2 NR RSTD measurement reporting delay test case with reduced number of samples in RRC_INACTIVE, FR1 SA

A.7.8.1.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 5.6.2 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single-sample measurements are requested by the LMF. This test is applicable to UEs that support *supportedDL-PRS-ProcessingSamples-RRC-Inactive*.

The supported test configurations are specified in table A.7.8.1.2.1-1.

Table A.7.8.1.2.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and in RRC_INACTIVE state during T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2. PRS resources from all three cells are transmitted within the initial DL BWP of the UE and with the same numerology as the initial DL BWP.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle in RRC_INACTIVE.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The *nr-DL-TDOA-RequestLocationInformation* IE should indicate to the UE that single-sample measurements are requested, i.e. requestedDL-PRS-ProcessingSamples-r17 is set to m1.

The general test parameters are listed in table A.7.8.1.2.1-2, and cell specific test parameters are listed in table A.7.8.1.2.1-3 and A.7.8.1.2.1-4.

Table A.7.8.1.2.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.2 FR2	
SMTC configuration	Config 1		SMTC.1	
Initial BWP configuration	Config 1		DLBWP.0.1 ULBWP.0.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.2 FR2	As specified in clause A.3.31.
PRS Resource slot offset	Config 1	slots	Cell 1, 2, 3: 0	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX cycle length		s	0.64	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			4	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]

Parameter	Unit	Value	Comment
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	[5]	The length of the time interval that follows immediately after time interval T1
AoA setup		Setup 1	As defined in A.3.15.1
Beam assumption		Rough	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.8.1.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 190.08 MHz	-54.00	-54.00	-54.00
SSB RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
$\hat{E}_s/N_{oc}$		dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.7.8.1.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	1	-1.2	-1.2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
Io Note 4	Config 1	dBm/ 190.08 MHz	-51.23	-51.23	-51.23
PRS $\hat{E}_s/I_{ot}$		dB	-3	-6	-6
Propagation Condition			AWGN		
NOTE 1: OCNG shall be used such that all active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols, except for slots where PRS is transmitted by any of the cells.					
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.					
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 4: Io levels apply only for symbols where PRS is transmitted.					

A.7.8.1.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 5.6.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.7.8.1.3 NR RSTD measurement reporting delay test case for PRS aggregation in FR2 SA in RRC_INACTIVE state

A.7.8.1.3.1 Test purpose and environment

The purpose of the test is to verify that the RSTD measurement with PRS aggregation in RRC_INACTIVE state meets the requirements specified in clause 5.6.2.6 in AWGN propagation condition in FR2 in standalone scenario when two intra-band contiguous positioning frequency layers (PFL) are configured.

The supported test configurations are listed in table A.7.8.1.3.1-1.

Table A.7.8.1.3.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

There are 6 synchronous cells in the test: Cell 1, Cell 2, Cell 3 Cell 4, Cell 5 and Cell 6. Cell 1 is the PCell on NR RF channel 1 in FR2. Cell 2 and Cell 3 are neighbour cells on the same RF channel as Cell 1. Cell 4, Cell 5 and Cell 6 are the neighbour cells on a different NR RF channel, i.e., RF channel 2, in FR2. Cell 1 and Cell 4, Cell 2 and Cell 5, Cell 3 and Cell 6 are respectively intra-band contiguous and PRS resources are transmitted by the same Tx chain for each combination.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2, Cell 3, Cell 4, Cell 5 and Cell 6. During T2 UE shall be in RRC_INACTIVE state and all 6 cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

In *NR-TDOA-ProvideAssistanceData*, there are three *NR-linkedDL-PRS-ResourceSetID-PRS-AggregationList*. The first list indicates aggregation of PRS resource sets from Cell 1 and Cell 4, and the second list indicates aggregation of PRS resource sets from Cell 2 and Cell 5. The third list indicates aggregation of PRS resource sets from Cell 3 and Cell 6. In *NR-TDOA-RequestLocationInformation*, the IE *nr-DL-PRS-JointMeasurementRequestedPFL-List* is included and indicates aggregation of PFLs on RF channel 1 and RF channel 2.

The UE is configured with DRX cycle of 0.64 s.

The general test parameters are given in table A.7.8.1.3.1-2, and cell specific test parameters for T1 and T2 are listed in table A.7.8.1.3.1-3 and table A.7.8.1.3.1-4, respectively.

Table A.7.8.1.3.1-2: General test parameters for RSTD measurement with PRS aggregation reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1, Cell 4	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2, Cell 3, Cell 4, Cell 5 and Cell 6	Cell 2, Cell 3, Cell 4, Cell 5 and Cell 6 appear at the first, second, third, fourth and fifth places in the neighbour cell list in the DL-TDOA assistance data.
$BW_{channel}$		MHz	200: $N_{RB,c}$ = 132	
SSB configuration	Config 1		SSB.2 FR2	
SMTC configuration	Config 1		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.4. FR2	As specified in clause A.3. 31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0 and (PCI of Cell 1 – PCI of Cell 4)mod6=0 and (PCI of Cell 1 – PCI of Cell 5)mod6=0 and (PCI of Cell 1 – PCI of Cell 6)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters

CP length		Normal	
DRX	s	0.64	
Radio frame receive time offset between the cells at the UE antenna connector	µs	Cell 2, Cell 4, Cell 5 to Cell 1: 0 Cell 3, Cell 6 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD	µs	Cell 2 to 6: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells	µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		6	Including the reference cells
PRS muting info		Cell 1, Cell 4: '10' Cell 2, Cell 5: '01' Cell 3, Cell 6: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1, Cell 4: 0 Cell 2, Cell 5: 0 Cell 3, Cell 6: 1	
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup		Setup 1	As defined in A.3.15.1
Beam assumption		Rough	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.8.1.3.1-3: Cell-specific test parameters for RSTD measurement with PRS aggregation reporting delay during T1

Parameter		Unit	Cell 1, Cell 4	Cell 2, Cell 5	Cell 3, Cell 6
NR RF Channel Number			1, 2	1, 2	1, 2
Positiong frequency layer			PFL 1, 2	PFL 1, 2	PFL 1, 2
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1 Note 1			OP.5 FDD	N/A	N/A
N_{oc} Note 3, 5	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$ Note 5		dB	-Infinity	-Infinity	-Infinity
Io Note 4, 5	Config 1	dBm/ 190.08MHz	-54.00	-54.00	-54.00
SSB RP Note4, 5	Config 1	dBm/SCS	-89	-Infinity	-Infinity
$\hat{E}_s/N_{oc}$ Note 5		dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

Note 1:	OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
Note 3:	Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 4:	SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.
Note 5:	The values are defined separately for the cells from which the transmitted PRS resources are aggregated.

Table A.7.8.1.3.1-4: Cell-specific test parameters for RSTD measurement with PRS aggregation reporting delay during T2

Parameter		Unit	Cell 1, Cell 4	Cell 2, Cell 5	Cell 3, Cell 6
			T2	T2	T2
RF Channel Number			1, 2	1, 2	1, 2
Positiong frequency layer			PFL 1, 2	PFL 1, 2	PFL 1, 2
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3, 4	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$ Note 4	Config 1	dB	-5.44	-11.67	-11.67
Io Note 4	Config 1	dBm/ 19.08MHz	-55.48	-55.48	-55.48
PRS $\hat{E}_s/I_{ot}$ Note 4		dB	-6	-13	-13
Propagation Condition			AWGN		
Note 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.					
Note 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.					
Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
Note 4: The values are defined separately for the cells from which the transmitted PRS resources are aggregated.					

A.7.8.1.3.2 Test requirements

The RSTD measurement time with PRS aggregation in RRC_INACTIVE state fulfils the requirements specified in clause 5.6.2.6.

The UE shall perform and report the RSTD measurements by aggregating PRS resources from Cell 2 and Cell 5, Cell 3 and Cell 6 respectively with respect to the Cell 1 and Cell 4 from which the transmitted PRS resources are also aggregated, within the time duration specified in clause 5.6.2.6 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events observed during repeated tests shall be at least 90%, where the reported RSTD measurement with PRS aggregation for each correct event shall be within the RSTD reporting range specified in clause 10.1.23A.3.

A.7.8.1.4 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA in RRC_INACTIVE state with eDRX > 10.24s

A.7.8.1.4.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 5.6.2.5 for RSTD measurements in RRC_INACTIVE with eDRX and periodic reporting. The tests are conducted under AWGN propagation condition with the UE operating in FR2 stand-alone mode and configured to perform RSTD measurements on a single positioning frequency layer (PFL) in FR2.

The supported test configurations are listed in table A.7.8.1.4.1-1.

Table A.7.8.1.4.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

There are three cells in the test: Cell 1 (PCell and RSTD reference cell), Cell 2 (neighbor cell) and Cell 3 (neighbor cell). All cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and released to RRC_INACTIVE state before the start of T2. All cells transmit PRS only during the second time interval of duration T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *NR-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE at least ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the DL-TDOA assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the start of the first PRS resource instance received after the UE has transitioned to RRC_INACTIVE.

The test concludes after the UE reports the first set of measurements based on the configured reporting periodicity.

The general test parameters and cell specific test parameters are as given in table A.7.8.1.4.1-2 and table A.7.8.1.4.1-3 respectively.

Table A.7.8.1.4.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1	Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.

Neighbour cells		1	Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
RF Channel Number		1	1	For Cell 1, Cell 2 and Cell 3
$BW_{channel}$	MHz	1	100: $N_{RB,c}$ = 66	
SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX	s	1	0.64	
eDRX cycle length (for both RAN and CN)	s	1	40.96	
PTW length (for both RAN and CN)	s	1	1.28	
Reporting periodicity	s	1	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34].
Time offset between serving and neighbour cells	µs	1	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	Synchronous cells
Expected RSTD	µs	1	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty	µs	1	5	
Number of cells provided in DL-TDOA assistance data		1	3	Including the reference cell
PRS muting info		1	Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to NR-MutingPattern-r16 in DL-PRS-MutingOption1-r16 defined in TS 37.355 [34]
PRS resource RE offset		1	Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	1	5	
T2	s	1	41	

Table A.7.8.1.4.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15					
Beam Assumption[Note 5]		1	Rough		Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A		N/A	
OCNG Patterns[Note 1]		1	OP.1		OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0		0	
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								

EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS Note 1, 4								
EPRE ratio of OCNG to OCNG DMRS Note 1, 4								
EPRE ratio of PRS to SSS								
TRS Configuration		1	TRS.2.1 TDD		N/A		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting info (*dl-PRS-MutingOption1*)		1	'10'		'01'		'10'	
N_{oc} Note 2	dBm/SCS	1	-89					
PRS $\hat{E}_s / I_{ot}$	dB	1	-Infinity	-6	-Infinity	-13	-Infinity	-13
PRS $\hat{E}_s / N_{oc}$	dB	1	-Infinity	-6	-Infinity	-13	-Infinity	-13
PRP Note 3	dBm/SCS kHz	1	-Infinity	-95	-Infinity	-102	-Infinity	-102
Io Note 3 (on symbols where PRS is not allocated)	dBm/95.04 MHz	1	N/A	-58.7	N/A	-58.7	N/A	-58.7
Propagation Condition		1	AWGN					

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.
Note 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
Note 6: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.7.8.1.4.2 Test requirements

The RSTD measurement time shall fulfill the requirements specified in clause 5.6.2.5.

The UE shall perform and report the RSTD measurements for Cell 1, Cell 2 and Cell 3 within the specified measurement period duration starting from the beginning of time interval T2. The requirement shall be evaluated based on the first measurement report received from the UE.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

A test is considered complete after the UE has reported the first set of measurements based on the configured reporting interval.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3.

A.7.8.2 PRS-RSRP measurements

A.7.8.2.1 PRS-RSRP reporting delay test case for single positioning frequency layer in RRC_INACTIVE

A.7.8.2.1.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in clause 5.6.3.5 for single positioning frequency layer under AWGN propagation conditions in RRC_INACTIVE. Supported test configurations are shown in table A.7.8.2.1.1-1

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

During T1 UE is in RRC_CONNECTED, the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.8.2.1.1-2, and table A.7.8.2.1.1-3.

Table A.7.8.2.1.1-1: supported test configurations for PRS RSRP measurement for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.8.2.1.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
CP length		Config 1	Normal	
DRX		Config 1	0.64 s	
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	[41]	

Table A.7.8.2.1.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP BW		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.2 FR2		PRS.1.2 FR2	
PRS muting configuration			Config 1	'10'		'01'	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2		dBm/SCS Note4	Config 1	-89		-89	
SS-RSRP Note 3		dBm/SCS Note 5	Config 1	-91	-91	-Infinity	-99
PRS-RSRP Note 3		dBm/SCS Note 5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$		dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$		dB	Config 1	-Infinity	-2	-Infinity	-10
Io Note3		dBm/190.08 MHz Note 5	Config 1	-54.62		-54.62	
Propagation Condition			Config 1	AWGN			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.8.2.1.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 5.6.3.5.The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 5.6.3.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90 %, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1.24.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

A.7.8.2.2 PRS-RSRP reporting delay test case with reduced number of samples in RRC_INACTIVE

A.7.8.2.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement meets the delay requirements specified in clause 5.6.3.5 in an environment with AWGN propagation conditions when single-sample measurements are requested by the LMF. This test is applicable to UEs that support *supportedDL-PRS-ProcessingSamples-RRC-Inactive*.

The supported test configurations are specified in table A.7.8.2.2.1-1.

Table A.7.8.2.2.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and in RRC_INACTIVE state during T2. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2. PRS resources from both cells are transmitted within the initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle in RRC_INACTIVE.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *DL-AoD assistance* data and location information request.

The *nr-DL-AoD-RequestLocationInformation* IE should indicate to the UE that single-sample measurements are requested, i.e. requestedDL-PRS-ProcessingSamples-r17 is set to m1.

The general test parameters are listed in table A.7.8.2.2.1-2, and cell specific test parameters are listed in table A.7.8.2.2.1-3.

Table A.7.8.2.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX cycle length	s	Config 1	0.64	
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
T1	s	Config 1	3	
T2	s	Config 1	[5]	

Table A.7.8.2.2.1-3: Cell specific test parameters

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP BW		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration[Note8]			Config 1	PRS.1.2 FR2		PRS.1.2 FR2	
PRS Resource slot offset		slots	Config 1	0		0	
PRS muting configuration			Config 1	‘10’		‘01’	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PSS to SSS		Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2	dBm/SCS Note4	Config 1	-89		-89	
SS-RSRP Note 3	dBm/SCS Note 5	Config 1	-89	-89	-89	-89
PRS-RSRP Note 3	dBm/SCS Note 5	Config 1	-Infinity	-86.77	-Infinity	-90.73
PRS $\hat{E}_s / I_{ot}$	dB	Config 1	-Infinity	0	-Infinity	-6
PRS $\hat{E}_s / N_{oc}$	dB	Config 1	-Infinity	2.23	-Infinity	-1.73
Io Note3	dBm/190.08 MHz Note 5	Config 1	N/A	-51.76	N/A	-51.76
Propagation Condition		Config 1	AWGN			

NOTE 1: OCNG shall be used such that all active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols, except for slots where PRS is transmitted by any of the cells.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io levels apply only for symbols where PRS is transmitted.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Void.

A.7.8.2.2.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 5.6.3.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.7.8.2.3 PRS-RSRP reporting delay in RRC_INACTIVE with eDRX

A.7.8.2.3.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in clause 5.6.3.5 for single positioning frequency layer under AWGN propagation conditions in RRC_INACTIVE when configured with eDRX. Supported test configurations are shown in table A.7.8.2.3.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

During T1 UE is in RRC_CONNECTED, the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34], shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.8.2.3.1-2 and table A.7.8.2.3.1-3.

Table A.7.8.2.3.1-1: Supported test configurations

Config	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.8.2.3.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
CP length		Config 1	Normal	
DRX		Config 1	0.64s	
CN and RAN eDRX configuration		Config 1	eDRX cycle = 40.96s PTW length = 1.28s	
Reporting periodicity	s	1	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34]
Time offset between serving and neighbour cells		Config 1	3µs	Synchronous cells.
Expected RSTD	µs	Config 1	3	
Expected RSTD uncertainty	µs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	41	

Table A.7.8.2.3.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{RB,c}$ = 132		200: $N_{RB,c}$ = 132	
BWP BW		MHz	Config 1	200: $N_{RB,c}$ = 132		200: $N_{RB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.2 FR2		PRS.1.2 FR2	
PRS muting configuration			Config 1	'10'		'01'	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2		dBm/SCS Note4	Config 1	-89		-89	
SS-RSRP Note 3		dBm/SCS Note 5	Config 1	-91	-91	-Infinity	-99
PRS-RSRP Note 3		dBm/SCS Note 5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$		dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$		dB	Config 1	-Infinity	-2	-Infinity	-10

Io[Note3]	dBm/19 0.08 MHz Note 5	Config 1	-54.62	-54.62
Propagation Condition		Config 1	AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
Note 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.8.2.3.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 5.6.3.5. The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 5.6.3.5 with $T_{available_PRS}$ = 0.64s starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

A test is complete after the UE has reported the first set of results based on the configured reporting interval.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1.24.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

A.7.8.3 UE Rx-Tx time difference measurements

A.7.8.3.1 UE Rx-Tx time difference measurements for single positioning frequency layer in FR2 SA

A.7.8.3.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement in RRC_INACTIVE state meets the requirements specified in clause 5.6.4 in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations in listed in table A.7.8.3.1.1-1.

Table A.7.8.3.1.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.7.8.3.1.1-2 and table A.7.8.3.1.1-3 respectively.

Table A.7.8.3.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	200: $N_{PRB,c}$ = 132	
SSB configuration		1	SSB.2 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX cycle		1	0.64 s	
Time offset between serving and neighbour cells	μs	1	3	Synchronous cells
T1	s	1	5	
T2	s	1	20	

Table A.7.8.3.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS[Note 1]						
EPRE ratio of OCNG to OCNG DMRS[Note 1]						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting info		1	'10'		'01'	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
N_{oc} Note 2	dBm/15 kHz	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
PRP Note 3	dBm/SCS kHz	1	-Infinity	-91	-Infinity	-99
Io	dBm/190.08 MHz	1	N/A	-54.62	N/A	-54.62
Propagation Condition		1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

A.7.8.3.1.2 Test requirements

The UE Rx-Tx time difference measurement time in RRC_INACTIVE state fulfils the requirements specified in clause 5.6.4.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time specified in clause 5.6.4 starting from the beginning of time interval T2.

NOTE The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.7.8.3.2 UE Rx-Tx time difference measurement with reduced number of samples in RRC_INACTIVE, FR2 SA

A.7.8.3.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement meets the requirements specified in clause 5.6.4.5 in AWGN propagation condition in FR2 in standalone scenario when single-sample measurements are requested by the LMF. This test is applicable to UEs that support *supportedDL-PRS-ProcessingSamples-RRC-Inactive*.

The supported test configurations in listed in table A.7.8.3.2.1-1.

Table A.7.8.3.2.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and in RRC_INACTIVE state during T2. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2. PRS resources from both cells are transmitted within the initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle in RRC_INACTIVE.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The *nr-Multi-RTT-RequestLocationInformation* IE should indicate to the UE that single-sample measurements are requested, i.e. requestedDL-PRS-ProcessingSamples-r17 is set to m1.

The UE is configured to transmit SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.7.8.3.2.1-2 and table A.7.8.3.2.1-3 respectively.

Table A.7.8.3.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	200: $N_{PRB,c} = 132$	
SSB configuration		1	SSB.2 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX cycle length	s	1	0.64	
Time offset between serving and neighbour cells	μs	1	3	Synchronous cells
T1	s	1	3	
T2	s	1	[5]	

Table A.7.8.3.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration[Note 9]		1	PRS.1.2 FR2		PRS.1.2 FR2	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
PRS Resource slot offset	slots	1	0		0	
PRS muting info		1	'10'		'01'	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
N_{oc} Note 2	dBm/15 kHz	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	0	-Infinity	-6
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	2.23	-Infinity	-1.73
PRS-RSRP Note 3	dBm/SCS kHz	1	-Infinity	-86.77	-Infinity	-90.73
SS-RSRP Note 3	dBm/SCS kHz	1	-89	-86.77	-89	-90.73
Io	dBm/190.08 MHz	1	N/A	-51.76	N/A	-51.76
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io levels apply only for symbols where PRS is transmitted.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: OCNG shall be used such that all active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols, except for slots where PRS is transmitted by any of the cells.
NOTE 9: Void.

A.7.8.3.2.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 5.6.4.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90 %, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.7.8.3.3 UE Rx-Tx time difference measurements with PRS bandwidth aggregation in FR2 SA

A.7.8.3.3.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 5.6.4.6 for UE Rx-Tx measurements with PRS bandwidth aggregation. The tests are conducted under AWGN propagation condition with the UE operating in FR2 stand-alone mode and configured to perform UE Rx-Tx measurements by aggregating two intra-band contiguous positioning frequency layers (PFLs) in FR2.

The supported test configurations in listed in table A.7.8.3.3.1-1.

Table A.7.8.3.3.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: Cell 1 (PCell) and Cell 2 (neighbor cell). Each cell is sssociated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel #1. In addition, both cells/TRPs transmit DL PRS in two intra-band contiguous PFLs in RF channel #1 and RF channel #2.. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and in RRC_INACTIVE state during T2. Cell 1 and Cell 2 transmit PRS only during the second time interval of duration T2. Similarly, the UE is configured to transmit positioning SRS during only during the second time interval of duration T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle in RRC_INACTIVE.

The *NR-Multi-RTT-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2.

The *NR-Multi-RTT-RequestLocationInformation* message provided to the UE must request bandwidth aggregated measurements via *jointMeasurementsReq* and *nr-DL-PRS-JointMeasurementRequestedPFL-List.*

The general test parameters and cell specific test parameters are as given in table A.7.8.3.3.1-2 and table A.7.8.3.3.1-3, respectively.

Table A.7.8.3.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2, all signals/channels except PRS in PFL2 are allocated within this channel.
			2	For both Cell 1 and Cell 2, only PRS in PFL2 is allocated within this channel.
$BW_{channel}$	MHz	1	200: $N_{RB,c}$ = 132	For both RF channels
SSB configuration		1	SSB.2 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX	s	1	0.64	
Time offset between serving and neighbour cells	µs	1	3	Synchronous cells/TRPs
Expected RSTD	µs	1	3	
Expected RSTD uncertainty	µs	1	5	
T1	s	1	5	
T2	s	1	20	

Table A.7.8.3.3.1-3: Cell specific test parameters

Parameter	Unit		Cell 1	Cell 2

		Test configuration	T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 5		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns Note 1		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1, 4						
EPRE ratio of OCNG to OCNG DMRS Note 1, 4						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration (for both PFL1 and PFL2)		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting info (*dl-PRS-MutingOption1* for both PFL1 and PFL2)		1	‘10’		‘01’	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-13
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-3	-Infinity	-13
PRP Note 3	dBm/SCS kHz	1	-Infinity	-92	-Infinity	-102
Io Note 3 (on symbols where PRS is not allocated)	dBm/190.08 MHz	1	N/A	-55.10	N/A	-55.10
Propagation Condition		1	AWGN			

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.
NOTE 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 6: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
NOTE 7: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 8: As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.7.8.3.3.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 5.6.4.6.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.7.8.3.4 UE Rx-Tx time difference measurements for single positioning frequency layer with eDRX > 10.24s in FR2 SA

A.7.8.3.4.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 5.6.4.5 for UE Rx-Tx measurements in RRC_INACTIVE with eDRX. The tests are conducted under AWGN propagation condition with the UE operating in FR2 stand-alone mode and configured to perform UE Rx-Tx measurements on a single positioning frequency layer (PFL) in FR2.

The supported test configurations in listed in table A.7.8.3.4.1-1.

Table A.7.8.3.4.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB and PRS SCS, 100 MHz bandwidth, TDD duplex mode

There are two cells in the test: Cell 1 (PCell) and Cell 2 (neighbor cell). Both cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and in RRC_INACTIVE state during T2. Cell 1 and Cell 2 transmit PRS only during the second time interval of duration T2. Similarly, the UE is configured to transmit positioning SRS during only during the second time interval of duration T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle in RRC_INACTIVE.

The general test parameters and cell specific test parameters are as given in table A.7.8.3.4.1-2 and table A.7.8.3.4.1-3 respectively.

Table A.7.8.3.4.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	100: $N_{RB,c}$ = 66	
SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX	s	1	0.64	
eDRX cycle length (for both RAN and CN)	s	1	40.96	
PTW length (for both RAN and CN)	s	1	1.28	
Reporting periodicity	s	1	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34].
Time offset between serving and neighbour cells	µs	1	3	Synchronous cells
Expected RSTD	µs	1	3	
Expected RSTD uncertainty	µs	1	5	
T1	s	1	5	
T2	s	1	20	

Table A.7.8.3.4.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 5]		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns[Note 1]		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						

EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1, 4						
EPRE ratio of OCNG to OCNG DMRS Note 1, 4						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting info (*dl-PRS-MutingOption1*)		1	'10'		'01'	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-13
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-3	-Infinity	-13
PRP Note 3	dBm/SCS kHz	1	-Infinity	-92	-Infinity	-102
Io Note 3 (on symbols where PRS is not allocated)	dBm/95.04 MHz	1	N/A	-58.11	N/A	-58.11
Propagation Condition		1	AWGN			

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.

NOTE 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

NOTE 6: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

NOTE 7: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.

NOTE 8: As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.7.8.3.4.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 5.6.4.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

A test is complete after the UE has reported the first set of results based on the configured reporting interval.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.3.1.

A.7.8.4 PRS-RSRPP measurements

A.7.8.4.1 PRS-RSRPP reporting delay test case for single positioning frequency layer in FR2 in RRC_INACTIVE state

A.7.8.4.1.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRPP measurement requirements specified in clause 5.6.5.5 for single positioning frequency layer under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.7.8.4.1.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2. During T2 UE shall be in RRC_INACTIVE state and both cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.8.4.1.1-2, and table A.7.8.4.1.1-3.

Table A.7.8.4.1.1-1: supported test configurations for PRS RSRPP measurement for FR2

Config	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.8.4.1.1-2: General test parameters for PRS RSRPP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX	s	Config 1	0.64	ON
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.

Parameter	Unit	Test configuration	Value	Comment
Expected RSTD	µs	Config 1	3	
Expected RSTD uncertainty	µs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	7	

Table A.7.8.4.1.1-3: Cell-specific test parameters for PRS RSRPP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP BW		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.4 FR2		PRS.1.4 FR2	
PRS muting configuration			Config 1	'10'		'01'	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2		dBm/SCS Note 4	Config 1	-89		-89	
SS-RSRP Note 3		dBm/SCS Note 5	Config 1	-89	-91	-Infinity	-99
PRS-RSRP Note 3		dBm/SCS Note 5	Config 1	-Infinity	-91	-Infinity	-99

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
PRS $\hat{E}_s/I_{ot}$	dB	Config 1	-Infinity	-2.12	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	Config 1	-Infinity	-2	-Infinity	-10
Io[Note3]	dBm/190.08 MHz Note 5	Config 1	-54.00	-54.62	-54.00	-54.62
Propagation Condition		Config 1	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ μs and $f_D = 5$ Hz			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.8.4.1.2 Test Requirements

The PRS RSRPP measurement time fulfils the requirements specified in clause 5.6.5.5.The UE shall perform and report the PRS RSRPP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 5.6.5.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90 %, where the reported PRS RSRPP measurement for each correct event shall be within the PRS RSRPP reporting range specified in clause 10.1.X, i.e., between PRS RSRPP_0 and PRS RSRPP_126.

A.7.8.4.2 PRS-RSRPP reporting delay test with reduced number of samples for single positioning frequency layer in FR2 in RRC_INACTIVE state

A.7.8.4.2.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRPP measurement requirements specified in clause 5.6.5.5 for single positioning frequency layer under AWGN propagation conditions in standalone scenario for reduced number of samples. In this test UE that supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* is configured by LMF to perform PRS measurement with reduced number of samples. Supported test configurations are shown in table A.7.8.4.2.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2. During T2 UE shall be in RRC_INACTIVE state and both cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.8.4.2.1-2, and table A.7.8.4.2.1-3.

Table A.7.8.4.2.1-1: supported test configurations for PRS RSRPP measurement for FR2

Config	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.8.4.2.1-2: General test parameters for PRS RSRPP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX	s	Config 1	0.64	ON
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	7	

Table A.7.8.4.2.1-3: Cell-specific test parameters for PRS RSRPP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP BW		MHz	Config 1	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Dedicated CORESET RMC configuration		Config 1	CCR.3.1 TDD		-	
TRS configuration		Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1	120		120	
PRS configuration		Config 1	PRS.1.4 FR2		PRS.1.4 FR2	
PRS BW		Config 1	48 PRBs		48 PRBs	
PRS muting configuration		Config 1	'10'		'01'	
EPRE ratio of PSS to SSS		Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-89		-89	
SS-RSRP Note 3	dBm/SCS Note 5	Config 1	-89	-86.77	-Infinity	-90.73
PRS-RSRP Note 3	dBm/SCS Note 5	Config 1	-Infinity	-86.77	-Infinity	-90.73
PRS $\hat{E}_s/I_{ot}$	dB	Config 1	-Infinity	0	-Infinity	-6
PRS $\hat{E}_s/N_{oc}$	dB	Config 1	-Infinity	2.23	-Infinity	-1.73
Io Note3	dBm/190.08 MHz Note 5	Config 1	-54.00	-51.76	-54.00	-51.76
Propagation Condition		Config 1	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ µs and $f_D = 5$ Hz			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone

NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.7.8.4.2.2 Test Requirements

The PRS RSRPP measurement time fulfils the requirements specified in clause 5.6.5.5. The UE shall perform and report the PRS RSRPP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 5.6.5.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90 %, where the reported PRS RSRPP measurement for each correct event shall be within the PRS RSRPP reporting range specified in clause 10.1.38, i.e., between PRS RSRPP_0 and PRS RSRPP_126.

A.7.8.4.3 PRS-RSPP reporting delay in RRC_INACTIVE state with eDRX > 10.24s in FR2

A.7.8.4.3.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 5.6.5.5 for PRS-RSRPP measurements in RRC_INACTIVE with eDRX and periodic reporting. The tests are conducted under AWGN propagation condition with the UE operating in FR2 stand-alone mode and configured to perform PRS-RSRPP measurements on a single positioning frequency layer (PFL) in FR2.

The supported test configurations are listed in table A.7.8.4.3.1-1.

Table A.7.8.4.3.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

There are two cells in the test: Cell 1 (PCell) and Cell 2 (neighbor cell). Both cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and released to RRC_INACTIVE state before the start of T2. Both cells transmit PRS only during the second time interval of duration T2.

The *NR-DL-AoD-ProvideAssistanceData* and *NR-DL-AoD-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE at least ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the DL-AoD assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the start of the first PRS resource instance received after the UE has transitioned to RRC_INACTIVE.

The test concludes after the UE reports the first set of measurements based on the configured reporting periodicity.

The general test parameters and cell specific test parameters are as given in table A.7.8.4.3.1-2 and table A.7.8.4.3.1-3, respectively.

Table A.7.8.4.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1	1	For Cell 1 and Cell 2
$BW_{channel}$	MHz	1	100: $N_{RB,c}$ = 66	

SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX	S	1	0.64	
eDRX cycle length (for both RAN and CN)	S	1	40.96	
PTW length (for both RAN and CN)	S	1	1.28	
Reporting periodicity	S	1	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34].
Time offset between serving and neighbour cells	µs	1	3	Synchronous cells
Expected RSTD	µs	1	3	
Expected RSTD uncertainty	µs	1	5	
T1	S	1	5	
T2	S	1	41	

Table A.7.8.4.3.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 5		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns Note 1		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1, 4						
EPRE ratio of OCNG to OCNG DMRS Note 1, 4						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting info (*dl-PRS-MutingOption1*)		1	‘10’		‘01’	
N_{oc} Note 2	dBm/SCS	1	-89			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-13

PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-3	-Infinity	-13
PRP Note 3	dBm/SCS kHz	1	-Infinity	-92	-Infinity	-102
Io Note 3 (on symbols where PRS is not allocated)	dBm/95.04 MHz	1	N/A	-58.11	N/A	-58.11
Propagation Condition		1	AWGN			

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.

Note 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Note 6: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

Note 7: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.

Note 8: As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.7.8.4.3.2 Test requirements

The PRS-RSRPP measurement time shall fulfill the requirements specified in clause 5.6.5.5.

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2 within the specified measurement period duration starting from the beginning of time interval T2. The requirement shall be evaluated based on the first measurement report received from the UE.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS-RSRPP measurement for each correct event shall be within the PRS-RSRPP reporting range specified in clause 10.1.38.3.

A.7.8.5 RSCPD Measurements

A.7.8.5.1 DL RSCPD reported with RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA in RRC_INACTIVE state

A.7.8.5.1.1 Test Purpose and Environment

The purpose of the test is to verify that the DL RSCPD reported with RSTD measurement meets the requirements specified in clause 5.6.7.5 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

The test environment is the same as in clause A.7.8.1.1 with the following additional configuration in table A.7.8.5.1.1-1 and description.

In *nr-DL-TDOA-RequestLocationInformation*, the UE is configured to perform DL RSCPD measurement via *dl-PRS-RSCPD-Request*. The UE also is configured to perform both RSCPD and RSTD measurements within the time window indicated to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig*.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s) to be measured within the configured time window.

Table A.7.8.5.1.1-1: Time window configuration

Parameter		Unit	Value	Comment
Indicated time window configuration	Config 1		MTW.1	As specified in clause A.3.38

A.7.8.5.1.2 Test Requirements

The DL RSCPD reported with RSTD measurement time fulfils the requirements specified in clause 5.6.7.5.

The UE shall perform and report the DL RSCPD and DL RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6.7.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3 and the reported RSCPD measurement for each correct event shall be within the RSCPD reporting range specified in clause 10.1.43.3.

A.7.8.6 RSCP Measurements

A.7.8.6.1 DL RSCP with UE Rx-Tx time difference measurements in RRC_INACTIVE for single positioning frequency layer in FR2 SA

A.7.8.6.1.1 Test purpose and environment

The purpose of the test is to verify that the DL RSCP and UE Rx-Tx time difference measurements in RRC_INACTIVE state meet the requirements specified in clause 5.6.8.5 in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured for both DL RSCP measurement and UE Rx-Tx time difference measurement.

The supported test configurations are listed in table A.7.8.6.1.1-1.

Table A.7.8.6.1.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message as defined in TS 37.355 [34], shall be provided to the UE during T1. In *NR-Multi-RTT-RequestLocationInformation*, the UE is configured to perform DL RSCP measurement via *nr-DL-PRS-RSCP-Request*. The UE is configured to perform both DL RSCP and UE Rx-Tx time difference measurements within the time window indicated to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig*, but the time window periodicity is not configured. The last slot containing the two messages for the multi-RTTI assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 shall be aligned with the start of the configured time window containing the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are listed in table A.7.8.6.1.1-2 and table A.7.8.6.1.1-3.

Table A.7.8.6.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	200: $N_{RB,c}$ = 132	
SSB configuration		1	SSB.2 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX cycle		1	0.64s	
Time offset between serving and neighbour cells	μs	1	3	Synchronous cells
Time window configuration		1	MTW.2	As specified in clause A.3.38
T1	s	1	5	
T2	s	1	20	

Table A.7.8.6.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						

EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting info		1	'10'		'01'	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
N_{oc} Note 2	dBm/15 kHz	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
PRP Note 3	dBm/SCS kHz	1	-Infinity	-91	-Infinity	-99
Io	dBm/190.08 MHz	1	N/A	-54.62	N/A	-54.62
Propagation Condition		1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.

NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.

NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

NOTE 9: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

A.7.8.6.1.2 Test requirements

The DL RSCP with UE Rx-Tx time difference measurement time in RRC_INACTIVE state fulfils the requirements specified in clause 5.6.8.

The UE shall perform and report the DL RSCP and UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified DL RSCP with UE Rx-Tx time difference measurement time specified in clause 5.6.8 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported DL RSCP measurement for each correct event shall be within the DL RSCP reporting range specified in clause 10.1.44 and the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1.25.

A.7.9 Measurement performance requirements in RRC_INACTIVE

A.7.9.1 RSTD measurements

A.7.9.1.1 RSTD measurement accuracy test case for single positioning frequency layer in FR2 in RRC_INACTIVE state

A.7.9.1.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement in RRC_INACTIVE state meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.7.9.1.1.1-1.

Table A.7.9.1.1.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cells. Both cells are on the same NR RF channel in FR2. The UE is configured with DRX cycle of 0.64 s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355[34] shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 5.6.2.5.

Table A.7.9.1.1.1-2: RSTD accuracy test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2	PRS.1.2 FR2	PRS.1.2 FR2
PRS Resource slot offset	slot	0	4	0	4
Expected RSTD	µs	N/A	3	N/A	3
Expected RSTD uncertainty	µs	N/A	5	N/A	5
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.7.9.1.1.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/SCS Note3	-89		-89	
$\hat{E}_s / N_{oc}$	dB	-5.7	-11.9	-5.7	-11.9
PRS-RSRP Note2	dBm/SCS	-94.7	-100.9	-94.7	-100.9
$\hat{E}_s / I_{ot}$ BB Note4	dB	-6	-13	-6	-13
Io Note2	dBm/190.08 MHz Note3	-55.75	-55.75	-55.75	-55.75
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					
NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.9.1.1.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.7.9.1.2 RSTD measurement accuracy test case with reduced number of samples for single positioning frequency layer in FR2 in RRC_INACTIVE state

A.7.9.1.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement in RRC_INACTIVE state meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions. In this test UE that supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* is configured by LMF to perform PRS measurement with reduced number of samples.

The supported test configurations are specified in table A.7.9.1.2.1-1.

Table A.7.9.1.2.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cells. Both cells are on the same NR RF channel in FR2. The UE is configured with DRX cycle of 0.64 s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 5.6.2.5.

Table A.7.9.1.2.1-2: RSTD accuracy test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	DLBWP.0.1	DLBWP.0.1	DLBWP.0.1
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
PRS configuration		PRS.1.3 FR2	PRS.1.3 FR2	PRS.1.4 FR2	PRS.1.4 FR2
PRS BW		64 PRBs	64 PRBs	128 PRBs	128 PRBs
PRS Resource slot offset	slot	0	4	0	4
Expected RSTD	µs	N/A	3	N/A	3
Expected RSTD uncertainty	µs	N/A	5	N/A	5
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.7.9.1.2.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/SCS Note3	-89		-89	
$\hat{E}_s / N_{oc}$	dB	-1.44	-3.65	-1.44	-3.65
PRS-RSRP Note2	dBm/SCS	-90.44	-92.65	-90.44	-92.65
SS-RSRP Note2	dBm/SCS	-90.44	-92.65	-90.44	-92.65
$\hat{E}_s / I_{ot\ BB}$ Note4	dB	-3	-6	-3	-6
Io Note2	dBm/190.08 MHz Note3	-53.68	-53.68	-53.68	-53.68

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.9.1.2.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.7.9.1.3 RSTD measurement accuracy for PRS aggregation in FR2 in RRC_INACTIVE state

A.7.9.1.3.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement with PRS aggregation on two PFLs meets the accuracy requirements specified in clause 10.1.23A.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.7.9.1.3.1-1.

Table A.7.9.1.3.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are four synchronous cells: Cell 1, Cell 2, Cell 3 and Cell 4. Cell 1 is the reference as well as the PCell on NR RF channel #1 in FR2. Cell 2 is a neighbour cell on the same NR RF channel as Cell 1. Cell 3 and Cell 4 are neighbor cells in a different NR RF channel #2 in FR2. Cell 1 and Cell 3 are intra-band contiguous, and PRS resources from Cell 1 and Cell 3 are transmitted by the same Tx chain. Cell 2 and Cell 4 are intra-band contiguous, and PRS resources from Cell 2 and Cell 4 are transmitted by the same Tx chain.

GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured. The UE is configured with DRX cycle of 0.64s.

The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 5.6.2.6.

In *NR-TDOA-ProvideAssistanceData*, there are two *NR-linkedDL-PRS-ResourceSetID-PRS-AggregationList*. The first list indicates aggregation of resource sets from Cell 1 and Cell 3, and the second list indicates aggregation of resource sets from Cell 2 and Cell 4. In *NR-TDOA-RequestLocationInformation*, *nr-DL-PRS-JointMeasurementRequestedPFL-List* is included and indicates aggregation of PFLs on NR RF channel #1 and NR RF channel #2.

Table A.7.9.1.3.1-2: RSTD accuracy test parameters

Parameter	Unit	Cell 1	Cell 2	Cell 3	Cell 4
PRS ARFCN		freq1	freq1	freq2	freq2
Duplex mode		TDD			
TDD configuration		TDDConf.3.1			
$BW_{channel}$	MHz	200: $N_{RB,c}$ = 132			
Downlink initial BWP configuration		DLBWP.0.1	-	-	-
Uplink initial BWP configuration		ULBWP.0.1	-	-	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	-	-
TRS configuration		TRS.2.1 TDD	-	-	-
TCI state		TCI.State.0	-	-	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	-	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	-	-
Control channel RMC		CCR.3.1 TDD	-	-	-
OCNG Patterns		OP.3			
SSB configuration		SSB.3 FR2			
SMTC configuration		SMTC.1			
PRS configuration		PRS.1.2 FR2			
PRS Resource slot offset	slot	0	4	0	4
Expected RSTD	µs	N/A	3	0	3
Expected RSTD uncertainty	µs	N/A	5	0	5
Time offset with Cell 1	µs	-	3	0	3
EPRE ratio of PSS to SSS	dB	0			
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN			
Antenna configuration		1x2			
Note 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.					

Table A.7.9.1.3.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Cell 1	Cell 2	Cell 3	Cell 4
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/SCS Note3	-89		-89	
$\hat{E}_s / N_{oc}$	dB	-5.7	-11.9	-5.7	-11.9
PRS-RSRP Note2	dBm/SCS	-94.7	-100.9	-94.7	-100.9
$\hat{E}_s / I_{ot}$ BB Note4	dB	-6	-13	-6	-13
Io Note2	dBm/190.08 MHz Note3	-55.75	-55.75	-55.75	-55.75

Note 1:	Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2:	SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3:	Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
Note 4:	Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
Note 5:	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.9.1.3.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23A.2.

A.7.9.2 PRS-RSRP measurements

A.7.9.2.1 SA measurement accuracy with PRS in FR2 in RRC_INACTIVE

A.7.9.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRP measurement accuracy in RRC_INACTIVE is within the specified limits. This test will verify the requirements in clauses 10.1.24.2.1 and 10.1.24.2.2.

A.7.9.2.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.9.2.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in table A.7.9.2.1.2-2 and A.7.9.2.1.2-3. In all test cases, Cell 1 is the PCell.

Table A.7.9.2.1.2-1: PRS-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.9.2.1.2-2: PRS-RSRP general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
DRX cycle configuration		1.28 s	-	1.28 s	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	μs	-	3	-	3
PRS configuration		PRS.1.3 FR2	PRS.1.3 FR2	PRS.1.4 FR2	PRS.1.4 FR2
PRS Resource slot offset	slot	0	4	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.7.9.2.1.2-3: PRS-RSRP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 7		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-98		Same as Test 1	
N_{oc} Note1	dBm/SCS Note4	-89		Same as Test 1	
$\hat{E}_s / N_{oc}$	dB	-2	-10	-2	-10
E_S	dBm/SCS Note4	-	-	-	-
PRS_RP Note2	dBm/SCS	-91	-99	-91	-99
$\hat{E}_s / I_{ot}$ BB Note6	dB	-2.41	-12.12	-2.41	-12.12
Io Note2	dBm/190.08 MHz Note4	-54.62		-54.62	
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Void					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: Void					

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.					
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.9.2.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.24.2.1 if the reported PRS-RSRP is in the range shown in table A.7.9.2.1.3-1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1.24.2.2.

Table A.7.9.2.1.3-1: PRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	$PRS_RP1 - \delta + G_{min} \leq$ Reported RSRP(dBm) $\leq PRS_RP1 + \delta + G_{max}$
Cell 2	$PRS_RP2 - \delta + G_{min} \leq$ Reported RSRP(dBm) $\leq PRS_RP2 + \delta + G_{max}$
NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.24.2.1-2, selected according to the Io used in the test.	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.6.1-1, selected according to the UE power class	

A.7.9.2.2 PRS-RSRP measurements with reduced number of sample in RRC_INACTIVE

A.7.9.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.24.2.1 and 10.1.24.2.2.

A.7.9.2.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.9.2.2.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in table A.7.9.2.2.2-2 and A.7.9.2.2.2-3. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.7.9.2.2.2-1.

Table A.7.9.2.2.2-1: PRS-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.9.2.2.2-2: PRS-RSRP general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c} = 132$		200: $N_{PRB,c} = 132$	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
DRX cycle configuration	s	0.64			
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
PRS configuration		PRS.1.3 FR2	PRS.1.3 FR2	PRS.1.4 FR2	PRS.1.4 FR2
PRS BW		64 PRBs	64 PRBs		
PRS Resource slot offset	slot	0	4	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
EPRE ratio of PRS to SSS					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.7.9.2.2.2-3: PRS-RSRP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 7		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-98		Same as Test 1	
N_{oc} Note1	dBm/SCS Note4	-89		Same as Test 1	
$\hat{E}_s / N_{oc}$	dB	2.23	-1.73	2.23	-1.73
E_s	dBm/SCS Note4	-	-	-	-
PRS_RP Note2	dBm/SCS	-86.77	-90.73	-86.77	-90.73
$\hat{E}_s / I_{ot\ BB}$ Note6	dB	0	-6	0	-6
Io Note2	dBm/190.08 MHz Note4	-51.76		-51.76	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.9.2.2.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.24.2.1 if the reported PRS-RSRP is in the range shown in table A.7.9.2.2.3-1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1.24.2.2.

Table A.7.9.2.2.3-1: PRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}
NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.24.2.1-2, selected according to the Io used in the test.	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.6.1-1, selected according to the UE power class	

A.7.9.3 UE Rx-Tx time difference measurements

A.7.9.3.1 UE Rx-Tx time difference measurements in RRC_INACTIVE

A.7.9.3.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.25.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario.

The supported test configuration is listed in table A.7.9.3.1.1-1.

Table A.7.9.3.1.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE before the start of the test.

The UE is configured to transmit SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.7.9.3.1.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.7.9.3.1.2-1.

Table A.7.9.3.1.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]		1	Rough	Rough	Rough	Rough
DRX	s	1	0.64		0.64	
Time offset with Cell 1	μs	1	N/A	3	N/A	3
TDD configuration		1	TDDConf.3.1	TDDConf.3.1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A	CR.3.1 TDD	N/A
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A	CCR.3.1 TDD	N/A
OCNG Patterns		1	OP.1	OP.1	OP.1	OP.1
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A	DLBWP.0.1 ULBWP.0.1	N/A
PRS configuration		1	PRS.1.1 FR2	PRS.1.2 FR2	PRS.1.1 FR2	PRS.1.2 FR2
PRS Resource slot offset	slot	1	0	4	0	4
SRS configuration		1	POS-SRS.3	N/A	POS-SRS.3	N/A
N_{oc} Note 2	dBm/SCS	1	-89		-89	
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	-12.12	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-2	-10	-2	-10
PRS-RSRP [Note 3]	dBm/SCS kHz	1	-91	-99	-91	-99
Io	dBm/190.08 MHz	1	-54.62	-54.62	-54.62	-54.62
Propagation Condition		1	AWGN		AWGN	

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
NOTE 1: Void.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone						
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone						
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.7.9.3.1.3 Test requirements

The UE Rx-Tx time difference measurement time fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25.2 for both Cell 1 and Cell 2.

A.7.9.3.2 UE Rx-Tx time difference measurement accuracy with reduced number of samples in FR2 SA

A.7.9.3.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy with reduced number of samples in RRC_INACTIVE state is within the specified limits. This test will verify the requirements in clause 10.1.25.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configuration is listed in table A.7.9.3.2.1-1.

Table A.7.9.3.2.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE before the start of the test. The UE is configured to measure UE Rx-Tx time difference using reduced number of samples via *requestedDL-PRS-ProcessingSamples* in *NR-Multi-RTT-RequestLocationInformation*.

UE shall be configured to enter into RRC_INACTIVE state before the start of the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.7.9.3.2.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.7.9.3.2.2-1.

Table A.7.9.3.2.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15	
Beam Assumption Note 7		1	Rough	Rough
DRX cycle		1	0.64 s	
Time offset with Cell 1	μs	1	N/A	3
TDD configuration		1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A
OCNG Patterns		1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.2.1 TDD	N/A
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A
PRS configuration		1	PRS.1.1 FR2	PRS.1.1 FR2
PRS BW		1	64 PRBs	64 PRBs
PRS Resource slot offset	slot	1	0	4
SRS configuration		1	POS-SRS.3	N/A
N_{oc} Note 2	dBm/SCS	1	-89	
N_{oc} Note 2	dBm/15 kHz	1	-98	
PRS $\hat{E}_s/I_{ot}$	dB	1	0	-6
PRS $\hat{E}_s/N_{oc}$	dB	1	2.23	-1.73
PRP Note 3	dBm/SCS kHz	1	-86.77	-90.73
Io	dBm/190.08 MHz	1	-51.76	-51.76
Propagation Condition		1	AWGN	

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
NOTE 1: Void. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: PRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.				

A.7.9.3.2.3 Test requirements

The UE Rx-Tx time difference measurement with reduced number of samples in RRC_INACTIVE state fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25.2 for both Cell 1 and Cell 2.

A.7.9.3.3 UE Rx-Tx time difference measurement accuracy with PRS bandwidth aggregation in FR2 SA in RRC_INACTIVE state

A.7.9.3.3.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.25A. The tests are conducted under AWGN propagation condition with the UE operating in FR2 stand-alone mode and configured to perform UE Rx-Tx measurements by aggregating two intra-band contiguous positioning frequency layers (PFLs) in FR2.

The supported test configurations are listed in table A.7.9.3.3.1-1.

Table A.7.9.3.3.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: Cell 1 (PCell) and Cell 2 (neighbor cell). Each cell is sssociated with a different TRP/DL PRS ID in the *NR-DL-PRS-AssistanceData* TS 37.355 [34]. Cell 1 transmissions other than DL PRS are allocated in RF channel #1. In addition, both cells/TRPs transmit DL PRS in two intra-band contiguous PFLs in RF channel #1 and RF channel #2.. PFL1 is allocated within RF channel #1 and PFL2 is allocated within RF channel #2. Except for the frequency offset between them, both PFLs have identical PRS configuration.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE before the start of the test.

The *NR-Multi-RTT-ProvideAssistanceData* message provided to the UE must include *NR-DL-PRS-AggregationInfo-r18* linking each PRS resource in PFL1 to the corresponding PRS resource in PFL2.

The *NR-Multi-RTT-RequestLocationInformation* message provided to the UE must request bandwidth aggregated measurements via *jointMeasurementsReq* and *nr-DL-PRS-JointMeasurementRequestedPFL-List.*

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

The general test parameters and cell specific test parameters are as given in table A.7.9.3.3.1-2 and table A.7.9.3.3.1-3, respectively.

Table A.7.9.3.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2, all signals/channels except PRS in PFL2 are allocated within this channel.
			2	For both Cell 1 and Cell 2, only PRS in PFL2 is allocated within this channel.
$BW_{channel}$	MHz	1	200: $N_{RB,c}$ = 132	For both RF channels
SSB configuration		1	SSB.2 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX	s	1	0.64	
Time offset between serving and neighbour cells	µs	1	3	Synchronous cells/TRPs
Expected RSTD	µs	1	3	
Expected RSTD uncertainty	µs	1	5	

Table A.7.9.3.3.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 4]		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns[Note 1]		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS[Note 1]						
EPRE ratio of OCNG to OCNG DMRS [Note 1]						

EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.2.1 TDD	N/A
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A
Active BWP configuration		1	DLBWP.1.1 ULBWP.1.1	N/A
PRS configuration (for both PFL1 and PFL2)		1	PRS.1.2 FR2	PRS.1.2 FR2
PRS Resource slot offset (for both PFL1 and PFL2)	slot	1	0	4
SRS configuration		1	POS-SRS.3	N/A
N_{oc} Note 2	dBm/SCS	1	-89	
PRS $\hat{E}_s/I_{ot}$	dB	1	-3	-13
PRS $\hat{E}_s/N_{oc}$	dB	1	-3	-13
PRP Note 3	dBm/SCS kHz	1	-92	-102
Io Note 3 (on symbols where PRS is not allocated)	dBm/190.08 MHz	1	-55.10	-55.10
Propagation Condition		1	AWGN	

Note 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.
Note 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
Note 6: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
Note 7: As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.7.9.3.3.2 Test requirements

The UE Rx-Tx time difference measurement fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1.25A for both Cell 1 and Cell 2.

A.7.9.4 PRS-RSRPP measurements

A.7.9.4.1 SA measurement accuracy in FR2 in RRC INACTIVE

A.7.9.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRPP measurement accuracy in RRC_INACTIVE state is within the specified limits. This test will verify the requirements in clauses 10.1.38.2.

A.7.9.4.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.9.4.1.2-1. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.7.9.4.1.2-1.

Table A.7.9.4.1.2-1: PRS-RSRPP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.9.4.1.2-2: PRS-RSRPP general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132		200: $N_{PRB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
DRX cycle configuration	ms	640			
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
PRS configuration		PRS.1.3 FR2	PRS.1.3 FR2	PRS.1.4 FR2	PRS.1.4 FR2
PRS Resource slot offset	slot	0	4	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		Two-tap channel Note 2			
Antenna configuration		1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The two-tap channel model is defined in 38.101-4 annex B.2.4 (a = 1, τ_d=0.45 µs and f_D=5 Hz).

Table A.7.9.4.1.2-3: PRS-RSRPP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2

Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 7		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-98		Same as Test 1	
N_{oc} Note1	dBm/SCS Note4	-89		Same as Test 1	
$\hat{E}_s / N_{oc}$	dB	-2	-10	-2	-10
E_s	dBm/SCS Note4	-	-	-	-
PRS_RP Note2	dBm/SCS	-91	-99	-91	-99
$\hat{E}_s / I_{ot}$ BB Note6	dB	-2.41	-12.12	-2.41	-12.12
Io Note2	dBm/190.08 MHz Note4	-54.62		-54.62	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

A.7.9.4.1.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.38.2. if the reported PRS-RSRPP is in the range shown in table A.7.9.4.1.3-1.

Table A.7.9.4.1.3-1: PRS-RSRPP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRPP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRPP(dBm) ≤ PRS_RP2 +δ +G_{max}

NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.
NOTE 2: δ is the RSRP absolute accuracy requirement from Table [10.1.24.Z.1-2], selected according to the Io used in the test.
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.6.1-1, selected according to the UE power class

A.7.9.4.2 SA measurement accuracy with reduced PRS samples in FR2 in RRC INACTIVE

A.7.9.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRPP measurement accuracy with N_{sample} = 1 in FR2in RRC_INACTIVE state is within the specified limits. This test will verify the requirements in clauses 10.1.38.2. The UE under test should support *supportedDL-PRS-ProcessingSamples-RRC-Inactive*, and the TE indicates the UE to perform positioning measurements with reduced number of samples. The PRS bandwidth is contained within the initial DL BWP and the power difference between the serving cell SS-RSRP and neighbour cell PRS-RSRP is within 6 dB, so that N_{sample} = 1 is assumed.

A.7.9.4.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.9.4.2.2-1. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.7.9.4.2.2-1: PRS-RSRPP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.9.4.2.2-2: PRS-RSRPP general test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Cell ID		489	0
SSB ARFCN		freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{PRB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
DRX cycle configuration	ms	640	
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3
PRS configuration		PRS.1.4 FR2	PRS.1.4 FR2
PRS bandwidth		64 PRBs	64 PRBs
PRS Resource slot offset	slot	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation conditions		Two-tap channel Note 2	

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Antenna configuration		1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: The two-tap channel model is defined in 38.101-4 annex B.2.4 (a = 1, τ_d=0.45 μs and f_D=5 Hz).			

Table A.7.9.4.2.2-3: PRS-RSRPP OTA related test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams[Note 7]		Rough	
N_{oc} Note1	dBm/15 kHz[Note4]	-98	
N_{oc} Note1	dBm/SCS[Note4]	-89	
$\hat{E}_s / N_{oc}$	dB	2.23	-1.73
E_S	dBm/SCS[Note4]	-	-
PRS_RP[Note2]	dBm/SCS	-86.77	-90.73
SS_RP[Note2]	dBm/SCS	-86.77	-90.73
$\hat{E}_s / I_{ot}$ BB Note6	dB	0	-6
Io[Note2]	dBm/190.08 MHz [Note4]	-51.76	
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 2: PRS_RP, SS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 3: Void			
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone			
NOTE 5: Void			
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.			
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.			

A.7.9.4.2.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.38.2 if the reported PRS-RSRPP is in the range shown in table A.7.9.4.2.3-1.

Table A.7.9.4.2.3-1: PRS-RSRPP absolute accuracy test requirement

	Test requirement [Notes1,2,3]
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRPP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRPP(dBm) ≤ PRS_RP2 +δ +G_{max}
NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table [10.1.24.Z.1-2], selected according to the Io used in the test.	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.6.1-1, selected according to the UE power class	

A.7.9.5 RSCPD Measurements

A.7.9.5.1 RSCPD with RSTD measurement accuracy in FR2 SA in RRC_INACTIVE

A.7.9.5.1.1 Test purpose and environment

The purpose of the test is to verify that the accuracy of RSCPD measurement reported with RSTD measurement is within the specified limits. This test will verify the requirements in clause 10.1.43.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.7.9.5.1.1-1.

Table A.7.9.5.1.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* with *dl-PRS-RSCPD-Request* from LMF via LPP as defined in TS 37.355 [34], clause 6.5.12, to enable UE to perform and report RSCPD in RRC_INACTIVE, shall be provided to the UE before the start of the test.

A.7.9.5.1.2 Test parameters

The RSCPD with RSTD accuracy test parameters are given in table A.7.9.5.1.2-1.

Table A.7.9.5.1.2-1: RSCPD with UE RSTD measurement accuracy test parameters in RRC_INACTIVE

Parameter	Unit	Test 1	
		Cell 1	Cell 2
PRS ARFCN		Freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{RB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-
DRX cycle configuration		Not applicable	-
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2
PRS Resource slot offset	Slot	0	4
Expected RSTD	µs	N/A	3
Expected RSTD uncertainty	µs	N/A	5
Time offset with Cell 1	µs	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			

EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
EPRE ratio of PRS to SSS	dB	0	0
Propagation conditions		AWGN	AWGN
Antenna configuration		1x2	1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.			

Table A.7.7. 5.1.2-2: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 5		Rough	
N_{oc} Note1	dBm/SCS Note3	-89	
PRS $\hat{E}_s / N_{oc}$	dB	-5.7	-11.9
PRP Note2	dBm/SCS	-94.7	-100.9
PRS $\hat{E}_s / I_{ot}$ Note 4	dB	-6	-13
Io Note2	dBm/190.08 MHz Note3	-55.75	-55.75
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.			
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.			
NOTE 4: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.			
NOTE 5: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.			

A.7.9.5.1.3 Test requirements

The RSCPD reported together with RSTD fulfils RSCPD measurement accuracy specified in clause 10.1.43.2 for Cell 2.

A.7.9.6 RSCP Measurements

A.7.9.6.1 RSCP with UE Rx-Tx time difference measurement accuracy in FR2 SA

A.7.9.6.1.1 Test purpose and environment

The purpose of the test is to verify that the accuracy of DL RSCP measurement reported with UE Rx-Tx time difference measurement in RRC_INACTIVE is within the specified limits. This test will verify the requirements in clause 10.1.44.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configuration is listed in table A.7.9. 6.1.1-1.

Table A.7.9.6.1.1-1: Supported test configurations

Config	Description
1	120 kHz SSB and PRS SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR2.

The *NR-Multi-RTT-ProvideAssistanceData , NR-Multi-RTT-RequestLocationInformation* with *nr-DL-PRS-RSCP-Request* from LMF via LPP and *NR-Multi-RTT-MeasurementCapability* as defined in TS 37.355 [34], clause 6.5.12, to enable UE to perform and report RSCP in RRC INACTIVE, shall be provided to the UE before the start of the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.7.9.6.1.2 Test parameters

The test parameters are given in table A.7.9. 6.1.2-1.

Table A.7.9. 6.1.2-1: RSCP with UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15	
Beam Assumption Note 6		1	Rough	Rough
DRX	s	1	0.64	
Time offset with Cell 1	µs	1	N/A	3
TDD configuration		1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A
OCNG Patterns		1	OP.1	OP.1
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A
PRS configuration		1	PRS.1.1 FR2	PRS.1.2 FR2
PRS Resource slot offset	slot	1	0	4
SRS configuration		1	POS-SRS.3	N/A
N_{oc} Note 1	dBm/SCS	1	-89	
N_{oc} Note 1	dBm/15 kHz	1	-98	
PRS $\hat{E}_s / I_{ot}$	dB	1	-2.41	-12.12
PRS $\hat{E}_s / N_{oc}$	dB	1	-2	-10
PRS-RSRP Note 2	dBm/SCS kHz	1	-91	-99
Io	dBm/190.08 MHz	1	-54.62	-54.62
Propagation Condition		1	AWGN	

Parameter	Unit	Test configuration	Test 1	
			Cell 1	Cell 2
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 3: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.				
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.				
NOTE 6: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.				
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.				

A.7.9.6.1.3 Test requirements

The RSCP measurement reported with UE Rx-Tx time difference measurements fulfils the RSCP measurement accuracy requirements specified in clause 10.1.44.2 for both Cell 1 and Cell 2.

A.7.10 Measurement Procedure in RRC_IDLE

A.7.10.1 RSTD Measurements

A.7.10.1.1 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA in RRC_IDLE state for non-RedCap UE

A.7.10.1.1.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 4.5.2.5 for RSTD measurements in RRC_IDLE without eDRX. The tests are conducted under AWGN propagation condition with the UE operating in FR2 stand-alone mode and configured to perform RSTD measurements on a single positioning frequency layer (PFL) in FR2.

The supported test configurations are listed in table A.7.10.1.1.1-1.

Table A.7.10.1.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

There are three cells in the test: Cell 1 (PCell and RSTD reference cell), Cell 2 (neighbor cell) and Cell 3 (neighbor cell). All cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and released to RRC_IDLE state before the start of T2. All cells transmit PRS only during the second time interval of duration T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *NR-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE

at least ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the DL-TDOA assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s).

The UE is configured with DRX cycle of 0.64 s.

The general test parameters are listed in table A.7.10.1.1.1-2, and cell specific test parameters are listed in table A.7.10.1.1.1-2, table A.7.10.1.1.1-3, and table A.7.10.1.1.1-4.

Table A.7.10.1.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
$BW_{channel}$		MHz	200: $N_{RB,c}$ = 132	
SSB configuration	Config 1		SSB.2 FR2	
SMTC configuration	Config 1		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.4. FR2	As specified in clause A.3. 31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	0.64	
Radio frame receive time offset between the cells at the UE antenna connector		μs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		μs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator

Expected RSTD uncertainty for all neighbour cells	µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		3	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup		Setup 1	As defined in A.3.15.1
Beam assumption		Rough	Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation

Table A.7.10.1.1.1-2-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.5 FDD	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 190.08MHz	-54.00	-54.00	-54.00
SSB RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
$\hat{E}_s/N_{oc}$		dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.

NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.7.10.1.1.1-2-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.44	-11.67	-11.67
Io	Config 1	dBm/ 19.08MHz	-55.48	-55.48	-55.48
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T3) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

A.7.10.1.1.2 Test requirements

The RSTD measurement time shall fulfill the requirements specified in clause 4.5.2.5.

The UE shall perform and report the RSTD measurements for Cell 1, Cell 2 and Cell 3 within the specified measurement period duration starting from the beginning of time interval T2.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3.

A.7.10.1.2 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA in RRC_IDLE state with eDRX > 10.24s

A.7.10.1.2.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 4.5.2.5 for RSTD measurements in RRC_IDLE with eDRX and periodic reporting. The tests are conducted under AWGN propagation condition with the

UE operating in FR2 stand-alone mode and configured to perform RSTD measurements on a single positioning frequency layer (PFL) in FR2.

The supported test configurations are listed in table A.7.10.1.2.1-1.

Table A.7.10.1.2.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

There are three cells in the test: Cell 1 (PCell and RSTD reference cell), Cell 2 (neighbor cell) and Cell 3 (neighbor cell). All cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and released to RRC_IDLE state before the start of T2. All cells transmit PRS only during the second time interval of duration T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *NR-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE at least ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the DL-TDOA assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the start of the first PRS resource instance received after the UE has transitioned to RRC_IDLE.

The test concludes after the UE reports the first set of measurements based on the configured reporting periodicity.

The general test parameters and cell specific test parameters are as given in table A.7.10.1.2.1-2 and table A.7.10.1.2.1-3, respectively.

Table A.7.10.1.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1	Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbour cells		1	Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
RF Channel Number		1	1	For Cell 1, Cell 2 and Cell 3
$BW_{channel}$	MHz	1	100: $N_{RB,c}$ = 66	
SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX	s	1	0.64	
eDRX cycle length (for both RAN and CN)	s	1	40.96	
PTW length (for both RAN and CN)	s	1	1.28	
Reporting periodicity	s	1	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34].
Time offset between serving and neighbour cells	µs	1	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	Synchronous cells

Parameter	Unit	Test configuration	Value	Comment
Expected RSTD	μs	1	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty	μs	1	5	
Number of cells provided in DL-TDOA assistance data		1	3	Including the reference cell
PRS muting info		1	Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to NR-MutingPattern-r16 in DL-PRS-MutingOption1-r16 defined in TS 37.355 [34]
PRS resource RE offset		1	Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	1	5	
T2	s	1	41	

Table A.7.10.1.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15					
Beam Assumption[Note 5]		1	Rough		Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A		N/A	
OCNG Patterns[Note 1]		1	OP.1		OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0		0	
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS[Note 1, 4]								
EPRE ratio of OCNG to OCNG DMRS[Note 1, 4]								
EPRE ratio of PRS to SSS								
TRS Configuration		1	TRS.2.1 TDD		N/A		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A		N/A	
Active DL BWP configuration		1	DLBWP.1.1		N/A		N/A	
Active UL BWP configuration		1	ULBWP.1.1		N/A		N/A	
PRS configuration		1	PRS.1.1 FR2		PRS.1.1 FR2		PRS.1.1 FR2	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
PRS muting info (*dl-PRS-MutingOption1*)		1	'10'		'01'		'10'	
N_{oc} Note 2	dBm/SCS	1	-89					
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-6	-Infinity	-13	-Infinity	-13
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-6	-Infinity	-13	-Infinity	-13
PRP Note 3	dBm/SCS kHz	1	-Infinity	-95	-Infinity	-102	-Infinity	-102
Io Note 3 (on symbols where PRS is not allocated)	dBm/95.04 MHz	1	N/A	-58.7	N/A	-58.7	N/A	-58.7
Propagation Condition		1	AWGN					

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.
NOTE 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 6: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
NOTE 7: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 8: As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.7.10.1.2.2 Test requirements

The RSTD measurement time shall fulfill the requirements specified in clause 4.5.2.5.

The UE shall perform and report the RSTD measurements for Cell 1, Cell 2 and Cell 3 within the specified measurement period duration starting from the beginning of time interval T2. The requirement shall be evaluated based on the first measurement report received from the UE.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

A test is considered complete after the UE has reported first set of measurement based on the configured reporting periodicity.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3.

A.7.10.1.3 NR RSTD measurement reporting delay test case for PRS aggregation in FR2 SA in RRC_IDLE state

A.7.10.1.3.1 Test purpose and environment

The purpose of the test is to verify that the RSTD measurement with PRS aggregation in RRC_IDLE state meets the requirements specified in clause 4.5.2.6 in AWGN propagation condition in FR2 in standalone scenario when two intra-band contiguous positioning frequency layers (PFLs) are configured.

The test environment and configurations reuse the test case for RRC_INACTIVE state defined in clause A.7.8.1.3 except that UE shall be in RRC_IDLE state and all 6 cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DLBWP during T2.

A.7.10.1.3.2 Test requirements

The RSTD measurement time with PRS aggregation in RRC_IDLE state fulfils the requirements specified in clause 4.5.2.6.

The UE shall perform and report the RSTD measurements by aggregating PRS resources from Cell 2 and Cell 5, Cell 3 and Cell 6 respectively with respect to the Cell 1 and Cell 4 from which the transmitted PRS resources are also aggregated, within the time duration specified in clause 4.5.2.6 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events observed during repeated tests shall be at least 90%, where the reported RSTD measurement with PRS aggregation for each correct event shall be within the RSTD reporting range specified in clause 10.1.23A.3.

A.7.10.2 PRS-RSRP Measurements

A.7.10.2.1 PRS-RSRP reporting delay test case for single positioning frequency layer in RRC_IDLE state for non-RedCap UE in FR2

A.7.10.2.1.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in clause 4.5.3.5 for single positioning frequency layer under AWGN propagation conditions in RRC_IDLE state. Supported test configurations are shown in table A.7.10.2.1.1-1.

Table A.7.10.2.1.1-1: supported test configurations for PRS RSRP measurement for FR2.

Config	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

During T1 UE is in RRC_CONNECTED state, the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34], shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_IDLE state.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.10.2.1.1-2 and table A.7.10.2.1.1-3.

Table A.7.10.2.1.1-2: General test parameters for PRS RSRP measurement reporting delay.

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
CP length		Config 1	Normal	
DRX	s	Config 1	0.64	
Time offset between serving and neighbour cells	µs	Config 1	3	Synchronous cells.
Expected RSTD	µs	Config 1	3	
Expected RSTD uncertainty	µs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	41	

Table A.7.10.2.1.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay.

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	200: $N_{RB,c}$ = 132		200: $N_{RB,c}$ = 132	
BWP BW		MHz	Config 1	200: $N_{RB,c}$ = 132		200: $N_{RB,c}$ = 132	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.2 FR2		PRS.1.2 FR2	
PRS muting configuration			Config 1	‘10’		‘01’	
EPRE ratio of PSS to SSS							
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PDCCH DMRS to SSS		Config 1	0		0	
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note 5		-98		-98	
N_{oc} Note2	dBm/SCS Note 4	Config 1	-89		-89	
SS-RSRP Note 3	dBm/SCS Note 5	Config 1	-91	-91	-Infinity	-99
PRS-RSRP Note 3	dBm/SCS Note 5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$	dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	Config 1	-Infinity	-2	-Infinity	-10
Io Note3	dBm/19 0.08 MHz Note 5	Config 1	-54.62		-54.62	
Propagation Condition		Config 1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.

A.7.10.2.1.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 4.5.3.5. The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 4.5.3.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1.24.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

A.7.10.2.2 PRS-RSRP reporting delay test case in RRC_IDLE state in FR2 when eDRX cycle > 10.24s

A.7.10.2.2.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in clause 4.5.3.5 for single positioning frequency layer under AWGN propagation conditions in RRC_IDLE when configured with eDRX.

The supported test configurations in table A.7.8.2.3.1-1 apply for this test.

The test procedure in clause A.7.8.2.3.1 apply for this test, except that during T2, UE is in RRC_IDLE state.

The general test parameters as specified in table A.7.8.2.3.1-2 apply for this test, except those specified in table A.7.10.2.2.1-1.

The cell specific test parameters as specified in table A.7.8.2.3.1-3 apply for this test.

Table A.7.10.2.2.1-1: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
CN eDRX configuration		Config 1	eDRX cycle = 40.96s PTW length = 1.28s	

A.7.10.2.2.2 Test Requirements

The test requirements in clause A.7.8.2.3.2 apply for this test, except that the time limits are specified in clause 4.5.3.5.

A.7.10.3 RSCPD Measurements

A.7.10.3.1 DL RSCPD reported with RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA in RRC_IDLE state

A.7.10.3.1.1 Test Purpose and Environment

The purpose of the test is to verify that the DL RSCPD reported with RSTD measurement meets the requirements specified in clause 5.6.7.5 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

The test environment is the same as in clause A.7.10.1.1 with the following additional configuration in table A.7.10.3.1.1-1 and description.

In *nr-DL-TDOA-RequestLocationInformation*, the UE is configured to perform DL RSCPD measurement via *dl-PRS-RSCPD-Request*. The UE also is configured to perform both RSCPD and RSTD measurements within the time window indicated to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig*.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s) to be measured within the configured time window.

Table A.7.10.3.1.1-1: Time window configuration

Parameter	Unit	Value	Comment

Indicated time window configuration	Config 1		MTW.1	As specified in clause A.3.38

A.7.10.3.1.2 Test Requirements

The DL RSCPD reported with RSTD measurement time fulfils the requirements specified in clause 5.6.7.5.

The UE shall perform and report the DL RSCPD and DL RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6.7.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1.23.3 and the reported RSCPD measurement for each correct event shall be within the RSCPD reporting range specified in clause 10.1.43.3.

A.7.11 Measurement Performance Requirements in RRC_IDLE

A.7.11.1 RSTD Measurements

A.7.11.1.1 NR RSTD measurement accuracy test case for single positioning frequency layer in FR2 SA in RRC_IDLE state for non-RedCap UE

A.7.11.1.1.1 Test purpose and environment

The purpose of the test is to verify that the RSTD measurement in RRC_IDLE state without eDRX meets the accuracy requirements specified in clause 10.1.23.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.7.11.1.1.1-1.

Table A.7.11.1.1.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR2. The UE is configured with DRX cycle of 0.64s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34], shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 5.6.2.5.

The RSTD accuracy test parameters are listed in table A.7.11.1.1.1-2, and the RSTD accuracy OTA related test parameters are listed in table A.7.11.1.1.1-3.

Table A.7.11.1.1.1-2: RSTD accuracy test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	

$BW_{channel}$	MHz	200: $N_{RB,c}$ = 132		200: $N_{RB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2	PRS.1.2 FR2	PRS.1.2 FR2
PRS Resource slot offset	slot	0	4	0	4
Expected RSTD	µs	N/A	3	N/A	3
Expected RSTD uncertainty	µs	N/A	5	N/A	5
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.7.11.1.1.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/SCS Note3	-89		-89	
$\hat{E}_s / N_{oc}$	dB	-5.7	-11.9	-5.7	-11.9
PRS-RSRP Note2	dBm/SCS	-94.7	-100.9	-94.7	-100.9
$\hat{E}_s / I_{ot}$ BB Note4	dB	-6	-13	-6	-13
Io Note2	dBm/190.08 MHz Note3	-55.75	-55.75	-55.75	-55.75
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time					

and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.

NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

NOTE 5: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.

A.7.11.1.1.2 Test requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23.2.

A.7.11.1.2 RSTD measurement accuracy test case for single positioning frequency layer in FR2 SA in RRC_IDLE state with eDRX > 10.24s

A.7.11.1.2.1 Test purpose and environment

The purpose of this test is to verify that RSTD measurements performed in RRC_IDLE with eDRX and periodic reporting satisfy the measurement accuracy requirements specified in clause 10.1.23.2. The tests are conducted under AWGN propagation condition with the UE operating in FR2 stand-alone mode and configured to perform RSTD measurements on a single positioning frequency layer (PFL) in FR2.

The supported test configurations are listed in table A.7.11.1.2.1-1.

Table A.7.11.1.2.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

There are two synchronous cells in the test: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR2.

The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34], shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 4.5.2.5.

The general test parameters and cell specific test parameters are as given in table A.7.11.1.2.1-2 and table A.7.11.1.2.1-3 respectively.

Table A.7.11.1.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1	Cell 1	
Neighbour cell		1	Cell 2	
RF Channel Number		1	1	For Cell 1 and Cell 2
$BW_{channel}$	MHz	1	200: $N_{RB,c}$ = 132	
SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX	s	1	0.64	

eDRX cycle length	s	1	40.96	
PTW length	s	1	1.28	
Reporting periodicity	s	1	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34].
Time offset between serving and neighbour cell	µs	1	3	Synchronous cells
Expected RSTD	µs	1	3	
Expected RSTD uncertainty	µs	1	5	

Table A.7.11.1.2.1-3: Cell specific test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
AoA setup		Setup 1 as specified in clause A.3.15			
Beam Assumption Note 4		Rough		Rough	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET RMC configuration		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET RMC configuration		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
Initial BWP configuration		DLBWP.0.1 ULBWP.0.1	-	DLBWP.0.1 ULBWP.0.1	-
Dedicated BWP configuration		DLBWP.1.1 ULBWP.1.1	-	DLBWP.1.1 ULBWP.1.1	-
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2	PRS.1.2 FR2	PRS.1.2 FR2
PRS Resource slot offset	slot	0	4	0	4
N_{oc} Note 2	dBm/SCS	-89			
PRS $\hat{E}_s / I_{ot}$	dB	-6	-13	-6	-13
PRS $\hat{E}_s / N_{oc}$	dB	-6	-13	-6	-13
PRP Note 3	dBm/SCS kHz	-95	-102	-95	-102
Io Note 3 (on symbols where PRS is not allocated)	dBm/190.08 MHz	-55.86	-55.86	-55.86	-55.86
Propagation conditions		AWGN			
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.					

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in clause B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
NOTE 6: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 7: As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.7.11.1.2.2 Test requirements

The reported RSTD measurements shall fulfill the absolute accuracy requirements specified in clause 10.1.23.2.

A.7.11.1.3 NR RSTD measurement accuracy test case for PRS aggregation in FR2 SA in RRC_IDLE state

A.7.11.1.3.1 Test purpose and environment

The purpose of the test is to verify that the RSTD measurement results with PRS aggregation in RRC_IDLE state meets the requirements specified in clause 10.1.23A.2 in AWGN propagation condition in FR2 in standalone scenario when two intra-band contiguous positioning frequency layers (PFLs) are configured.

The test environment and configurations reuse the test case for RRC_INACTIVE state defined in clause A.7.9.1.3, except that UE shall be in RRC_IDLE state and all 4 cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP during T2.

A.7.11.1.3.2 Test requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1.23A.2.

A.7.11.2 PRS-RSRP measurements

A.7.11.2.1 PRS-RSRP measurement accuracy test case for non-RedCap UE in FR2 in RRC_IDLE state

A.7.11.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRP measurement accuracy in RRC_IDLE is within the specified limits. This test will verify the requirements in clauses 10.1.24.2.1 and 10.1.24.2.2.

A.7.11.2.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.11.2.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in tables A.7.11.2.1.2-2 and A.7.11.2.1.2-3. In all test cases, Cell 1 is the PCell.

Table A.7.11.2.1.2-1: PRS-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

Table A.7.11.2.1.2-2: PRS-RSRP general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{RB,c}$ = 132		200: $N_{RB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
DRX cycle configuration		1.28s	-	1.28s	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	μs	-	3	-	3
PRS configuration		PRS.1.3 FR2	PRS.1.3 FR2	PRS.1.4 FR2	PRS.1.4 FR2
PRS Resource slot offset	slot	0	4	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.7.11.2.1.2-3: PRS-RSRP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note3	-98		Same as Test 1	
N_{oc} Note1	dBm/SCS Note3	-89		Same as Test 1	
$\hat{E}_s / N_{oc}$	dB	-2	-10	-2	-10
E_s	dBm/SCS Note3	-	-	-	-
PRS_RP Note2	dBm/SCS	-91	-99	-91	-99

$\hat{E}_s/I_{ot}$ BB Note4	dB	-2.41	-12.12	-2.41	-12.12
Io Note2	dBm/190.08 MHz Note3	-54.62		-54.62	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.11.2.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.24.2.1 if the reported PRS-RSRP is in the range shown in table A.7.11.2.1.3-1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1.24.2.2.

Table A.7.11.2.1.3-1: PRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}

Note 1: PRS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.
Note 2: δ is the RSRP absolute accuracy requirement from table 10.1.24.2.1-2, selected according to the Io used in the test.
Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from table B.2.1.6.1-1, selected according to the UE power class.

A.7.11.2.2 PRS-RSRP measurement accuracy test case in RRC_IDLE state in FR2 for case 2 when eDRX cycle > 10.24s

A.7.11.2.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement in RRC_IDLE with eDRX meets the accuracy requirements specified in clauses 10.1.24.2.1 and 10.1.24.2.2 in an environment with AWGN propagation conditions.

A.7.11.2.2.1 Test parameters

The supported test configurations in table A.7.9.2.1.2-1 apply for this test.

The test procedure in clause A.7.9.2.1.2 apply for this test, except that UE is in RRC_IDLE state.

The general test parameters as specified in table A.7.9.2.1.2-2 apply for this test, except those additionally specified in table A.7.11.2.2.1-1.

The OTA related test parameters in table A.7.9.2.1.2-3 apply for this test.

Table A.7.11.2.2.1-1: PRS-RSRP test parameters

Parameter	Unit	Test configuration	Value	Comment
eDRX cycle length (for CN eDRX)	s	1, 2, 3	40.96	

Parameter	Unit	Test configuration	Value	Comment
PTW window length	s	1, 2, 3	1.28	

A.7.11.2.2.2 Test Requirements

The test requirements in clause A.7.9.2.1.3 apply for this test.

A.7.11.3 RSCPD measurements

A.7.11.3.1 RSCPD with RSTD measurement accuracy in FR2 SA in RRC_IDLE

A.7.11.3.1.1 Test purpose and environment

The purpose of the test is to verify that the accuracy of RSCPD measurement reported with RSTD measurement is within the specified limits. This test will verify the requirements in clause 10.1.43.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.7.11.3.1.1-1.

Table A.7.11.3.1.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 200 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* with *dl-PRS-RSCPD-Request* from LMF via LPP [34] as defined in TS 37.355 [34], clause 6.5.12, to enable UE to perform and report RSCPD in RRC_IDLE, shall be provided to the UE before the start of the test.

A.7.11.3.1.2 Test parameters

The RSCPD with RSTD accuracy test parameters are given in table A.7.11.3.1.1.2-1.

Table A.7.11.3.1.2-1: RSCPD with UE RSTD measurement accuracy test parameters in RRC_IDLE

Parameter	Unit	Test 1	
		Cell 1	Cell 2
PRS ARFCN		Freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	200: $N_{RB,c}$ = 132	
Downlink initial BWP configuration		DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-
DRX cycle configuration		Not applicable	-
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1

Parameter	Unit	Test 1	
		Cell 1	Cell 2
SSB configuration		SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2
PRS Resource slot offset	slot	0	4
Expected RSTD	µs	N/A	3
Expected RSTD uncertainty	µs	N/A	5
Time offset with Cell 1	µs	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
EPRE ratio of PRS to SSS	dB	0	0
Propagation conditions		AWGN	AWGN
Antenna configuration		1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.			

Table A.7. 11.3.1.2-1-2: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 5		Rough	
N_{oc} Note1	dBm/SCS Note3	-89	
PRS $\hat{E}_s / N_{oc}$	dB	-5.7	-11.9
PRP Note2	dBm/SCS	-94.7	-100.9
PRS $\hat{E}_s / I_{ot}$ Note 4	dB	-6	-13
Io Note2	dBm/190.08 MHz Note3	-55.75	-55.75
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.			
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.			
NOTE 4: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.			
NOTE 5: Information about types of UE beam is given in clause B.2.1.3 and does not limit UE implementation or test system implementation.			

A.7.11.3.1.3 Test requirements

The RSCPD reported together with RSTD fulfils RSCPD measurement accuracy specified in clause 10.1.43.2 for Cell 2.

A.8 E-UTRA standalone tests for NR RRM

Editor notes: All NR RRM tests under E-UTRA standalone operations are included in this annex. All EN-DC related NR RRM tests are in A.4 and A.5.

A.8.1 Void

A.8.2 RRC_IDLE state mobility

A.8.2.1 Inter-RAT NR Cell re-selection

A.8.2.1.1 E-UTRA Cell reselection to higher priority NR target Cell in FR1

A.8.2.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the E-UTRAN to NR inter-RAT cell reselection requirements specified in clause 4.2.2.5.6 in TS 36.133 [15].

The test scenario comprises of 1 E-UTRA cell and 1 NR cell as given in tables A.8.2.1.1.1-1, A.8.2.1.1.1-2, A.8.2.1.1.1-3 and A.8.2.1.1.1-4. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. E-UTRA cell 1 is already identified by the UE prior to the start of the test. Cell 2 is of higher priority than cell 1.

Table A.8.2.1.1.1-1: Supported test configurations

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.8.2.1.1.1-2: General test parameters for E-UTRA cell re-selection FR1 NR cell test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell 2	The UE camps on cell 2 in the initial phase
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell 1	
T1 end condition	Active cell			Cell 1	During T1 period the UE reselects to cell 1
	Neighbour cell			Cell 2	
T3 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 2	The UE shall perform reselection to cell 2 during T3
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell 1	
RF Channel Number			1, 2, 3, 4, 5, 6	1, 2	E-UTRAN radio channel (1) and NR radio channel (2) are used for this test
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2, 5	3 μs	Synchronous cells
			3, 6	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	1.28	The value shall be used for all cells in the test.

Parameter	Unit	Test configuration	Value	Comment
NR PRACH configuration index		1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
T1	s	1, 2, 3, 4, 5, 6	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2	s	1, 2, 3, 4, 5, 6	>7	During T2, cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that cell 2 has not been detected by the UE prior to the start of period T3.
T3	s	1, 2, 3, 4, 5, 6	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.8.2.1.1.1-3: Cell specific test parameters for NR cell 2

Parameter	Unit	Test configuration	Cell 2		
			T1	T2	T3
TDD configuration		1, 4	N/A		
		2, 5	TDDConf.1.1		
		3, 6	TDDConf.2.1		
PDSCH Reference measurement channel		1, 4	SR.1.1 FDD		
		2, 5	SR.1.1 TDD		
		3, 6	SR.2.1 TDD		
RMSI CORESET Reference Channel		1, 4	CR.1.1 FDD		
		2, 5	CR.1.1 TDD		
		3, 6	CR.2.1 TDD		
RMC CORESET Reference Channel		1, 4	CCR.1.1 FDD		
		2, 5	CCR.1.1 TDD		
		3, 6	CCR.2.1 TDD		
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		
SMTC configuration		1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration		1, 4	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.2 FR1		
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1		
RLM-RS		1, 2, 3, 4, 5, 6	SSB		
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140		
		3, 6	-137		
Pcompensation	dB	1, 2, 3, 4, 5, 6	0		
$Qhyst_s$	dB	1, 2, 3, 4, 5, 6	0		
$Qoffset_{s,n}$	dB	1, 2, 3, 4, 5, 6	0		
Cell_selection_and_reselection_quality_measurement		1, 2, 3, 4, 5, 6	SS-RSRP		
$\hat{E}_s/I_{ot}$	dB	1, 4	-4	-infinity	12
		2, 5			
		3, 6			
N_{oc} Note2	dBm/SCS	1, 4	-98		
		2, 5	-98		
		3, 6	-95		
N_{oc} Note2	dBm/15 kHz	1, 4	-98		
		2, 5			

Parameter	Unit	Test configuration	Cell 2		
			T1	T2	T3
		3, 6			
$\hat{E}_s / N_{oc}$	dB	1, 4	-4	-infinity	12
		2, 5			
		3, 6			
SS-RSRP Note3	dBm/SCS	1, 4	-102	-infinity	-86
		2, 5	-102	-infinity	-86
		3, 6	-99	-infinity	-83
Io	dBm/9.36 MHz	1, 4	-68.60	-70.05	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-70.05	-57.78
	dBm/38.16 MHz	3, 6	-62.50	-63.95	-51.69
Treselection	s	1, 2, 3, 4, 5, 6	0	0	0
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6	50		
$Thresh_{x, highP}$	dB	1, 2, 3, 4, 5, 6	48		
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6	44		
$Thresh_{x, lowP}$	dB	1, 2, 3, 4, 5, 6	50		
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.8.2.1.1.1-4: Cell specific test parameters for E-UTRA cell 1

Parameter	Unit	Cell 1		
		T1	T2	T3
E-UTRA RF Channel number		1		
$BW_{channel}$	MHz	10		
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6		
PBCH_RA	dB	0		
PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			
PHICH_RA	dB			
PHICH_RB	dB			
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA Note 1	dB			
OCNG_RB Note 1	dB			
Qrxlevmin	dBm	-140		
N_{oc} Note 2	dBm/15 kHz	-98		
RSRP Note 3	dBm/15 KHz	-84	-84	-84
$\hat{E}_s / I_{ot}$	dB	14	14	14
$\hat{E}_s / N_{oc}$	dB	14	14	14
$Treselection_{EUTRAN}$	s	0		
SnonintrasearchP	dB	50		
$Thresh_{x, highP}$	dB	48		
$Thresh_{serving, lowP}$	dB	44		
$Thresh_{x, lowP}$	dB	50		
Propagation Condition		AWGN		

Parameter	Unit	Cell 1		
		T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.8.2.1.1.2 Test Requirements

The cell reselection delay to a higher priority NR cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate,\ NR} + T_{SI\text{-}NR,}$ and to a lower priority cell can be expressed as: $T_{evaluate,\ EUTRAN} + T_{SI\text{-}EUTRA,}$

Where:

$T_{higher_priority_search}$ See clause 4.2.2 in TS 36.133 [15]

$T_{evaluate,\ NR}$ See Table 4.2.2.5.6-1 in clause 4.2.2.5.6 in TS 36.133 [15]

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

$T_{evaluate,\ EUTRAN}$ See Table 4.2.2.5-1 in clause 4.2.2.5

$T_{SI\text{-}EUTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority NR cell and 7.68 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 8 s.

A.8.2.1.2 E-UTRA Cell reselection to lower priority NR target Cell in FR1 for UE configured with highSpeedInterRAT-NR-r16

A.8.2.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the E-UTRAN to NR inter-RAT cell reselection requirements specified in clause 4.2.2.5.6 in 36.133 [15].

The test scenario comprises of 1 E-UTRA cell and 1 NR cell as given in tables A.8.2.1.2.1-1, A.8.2.1.2.1-2, A.8.2.1.2.1-3 and A.8.2.1.2.1-4. In SIB of the E-UTRA cell, highSpeedInterRAT-NR-r16 is configured and the carrier of NR cell is configured with highSpeedCarrierNR-r16. The test consists of two time periods, with time duration of T1 and T2 respectively. Both E-UTRA cell 1 and NR cell 2 are already identified by the UE prior to the start of the test. NR cell 2 is of lower priority than E-UTRA cell 1.

Table A.8.2.1.2.1-1: Supported test configurations for UE configured with highSpeedInterRAT-NR-r16

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode

6	LTE TDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.8.2.1.2.1-2: General test parameters in E-UTRA cell re-selection FR1 NR cell test case for UE configured with highSpeedInterRAT-NR-r16

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE camps on cell 1 in the initial phase
T1 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 2	The UE shall perform reselection to cell 2 during T1
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell 1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell 1	The UE shall perform reselection to cell 1 during T2 for iteration of the tests.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell 2	
RF Channel Number			1, 2, 3, 4, 5, 6	1, 2	E-UTRAN radio channel (1) and NR radio channel (2) are used for this test
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2, 5	3 µs	Synchronous cells
			3, 6	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	0.32	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
T1		s	1, 2, 3, 4, 5, 6	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.8.2.1.2.1-3: Cell specific test parameters for NR cell 2 in E-UTRA cell re-selection FR1 NR cell test case for UE configured with highSpeedInterRAT-NR-r16

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
TDD configuration		1, 4	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH Reference measurement channel		1, 4	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET Reference Channel		1, 4	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
RMC CORESET Reference Channel		1, 4	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration		1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration		1, 4	SSB.1 FR1	

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
Pcompensation	dB	1, 2, 3, 4, 5, 6	0	
$Qhyst_s$	dB	1, 2, 3, 4, 5, 6	0	
$Qoffset_{s,n}$	dB	1, 2, 3, 4, 5, 6	0	
Cell_selection_and_ reselection_quality_measurement		1, 2, 3, 4, 5, 6	SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1, 4	14	14
		2, 5		
		3, 6		
N_{oc} Note2	dBm/SCS	1, 4	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc} Note2	dBm/15 kHz	1, 4	-98	
		2, 5		
		3, 6		
$\hat{E}_s / N_{oc}$	dB	1, 4	14	14
		2, 5		
		3, 6		
SS-RSRP Note3	dBm/SCS	1, 4	-84	-84
		2, 5	-84	-84
		3, 6	-81	-81
Io	dBm/9.36 MHz	1, 4	-55.88	-55.88
	dBm/9.36 MHz	2, 5	-55.88	-55.88
	dBm/38.16 MHz	3, 6	-47.79	-47.79
Treselection	s	1, 2, 3, 4, 5, 6	0	
Snonintrasearch	dB	1, 2, 3, 4, 5, 6	Not sent	
$Thresh_{x,high}$	dB	1, 2, 3, 4, 5, 6	48	
$Thresh_{serving,low}$	dB	1, 2, 3, 4, 5, 6	44	
$Thresh_{x,low}$	dB	1, 2, 3, 4, 5, 6	50	
Propagation Condition		1, 2, 4, 5	AWGN 1944 Hz Note 4	
		3,6	AWGN 3334 Hz Note 5	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.
NOTE 5: The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334 Hz.

Table A.8.2.1.2.1-4: Cell specific test parameters for E-UTRA cell 1 in E-UTRA cell re-selection FR1 NR cell test case for UE configured with highSpeedInterRAT-NR-r16

Parameter	Unit	Cell 1	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	

OCNG Patterns defined in TS 36.133 clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc} Note 2	dBm/15 kHz	-98	
RSRP Note 3	dBm/15 KHz	-102	-86
$\hat{E}_s / I_{ot}$	dB	-4	12
$\hat{E}_s / N_{oc}$	dB	-4	12
$Treselection_{EUTRAN}$	s	0	
Snonintrasearch	dB	50	
$Thresh_{x, high}$	dB	48	
$Thresh_{serving, low}$	dB	44	
$Thresh_{x, low}$	dB	50	
Propagation Condition		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Void.

A.8.2.1.2.2 Test Requirements

The cell reselection delay to a lower priority NR cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on cell 2.

The cell re-selection delay to a lower priority cell shall be less than 3 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, NR_HST} + T_{SI-NR,}$

Where:

$T_{evaluate, NR_HST}$ See Table 4.2.2.5.6-2 in clause 4.2.2.5.6 in [15]

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 2.24 s, allow 3 s for the cell re-selection delay to a lower priority NR cell.

A.8.2.2 E-UTRA – NR Inter-RAT Early Measruement Reporting

A.8.2.2.1 E-UTRA – NR Early Measurement Reporting for NR in FR1

A.8.2.2.1.1 Test Purpose and Environment

This test is to verify the requirement for the E-UTRAN to NR inter-RAT Idle mode DC measurement requirements specified in clause 4.9.2.4 in TS 36.133 [15]. This test is also to verify the accuracy requirement for the E-UTRAN to NR inter-RAT Idle mode DC measurement requirements specified in clause 9.11.1A and 9.11.2A in TS 36.133 [15]. Supported test configurations are shown in table A.8.2.2.1.1-1.

Table A.8.2.2.1.1-1: Supported test configurations

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

The test scenario comprises of 1 E-UTRA cell (Cell 1) and 1 NR cell (Cell 2). The the test parameters and applicability for the E-UTRAN cell are defined in table A.8.2.2.1.1-4. The general test parameters and the cell specific test parameters for the NR cell are specified in table A.8.2.2.1.1-2 and table A.8.2.2.1.1-3, respectively.

The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Prior to the start of the time duration T1, the UE shall be connected to Cell 1. During T1, Cell 2 shall be powered off. At the end of T1, the RRC connection to Cell 1 is released and UE is configured Idle mode DC measurement on the carrier frequency of Cell 2. Time duration T2 starts when the RRC connection is released, and during the T2 UE is in Idle mode. Cell 2 shall be powered on from the beginning of T2. At beginning of T3 the UE is paged for connection setup and requested by the network to send idle mode measurements.

Table A.8.2.2.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4, 5, 6	E-UTRAN Cell 1	
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 2	Cell 2 is of higher priority.
RF Channel Number		1, 2, 3, 4, 5, 6	1: Cell 1 2: Cell 2	
DRX cycle length	s	1, 2, 3, 4, 5, 6	1.28	
Time offset between Cell 1 and Cell 2		1, 2, 3, 4, 5, 6	3 μs	
T1	s	1, 2, 3, 4, 5, 6	0.5	
T2	s	1, 2, 3, 4, 5, 6	71	
T3	s	1, 2, 3, 4, 5, 6	2	
T331	s	1, 2, 3, 4, 5, 6	300	

Table A.8.2.2.1.1-3: Cell specific test parameters for NR cell 2

Parameter	Unit	Test configuration	Cell 2		
			T1	T2	T3
TDD configuration		1, 4	N/A		
		2, 5	TDDConf.1.1		
		3, 6	TDDConf.2.1		
PDSCH Reference measurement channel		1, 4	SR.1.1 FDD		
		2, 5	SR.1.1 TDD		
		3, 6	SR.2.1 TDD		
RMSI CORESET Reference Channel		1, 4	CR.1.1 FDD		

		2, 5	CR.1.1 TDD		
		3, 6	CR.2.1 TDD		
RMC CORESET Reference Channel		1, 4	CCR.1.1 FDD		
		2, 5	CCR.1.1 TDD		
		3, 6	CCR.2.1 TDD		
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		
SMTC configuration		1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration		1, 4	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.2 FR1		
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1		
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140		
		3, 6	-137		
Pcompensation	dB	1, 2, 3, 4, 5, 6	0		
Qhysts	dB	1, 2, 3, 4, 5, 6	0		
Qoffsets, n	dB	1, 2, 3, 4, 5, 6	0		
Cell_selection_and_ reselection_quality_measurement		1, 2, 3, 4, 5, 6	SS-RSRP		
N_{oc} Note2	dBm/SCS	1, 4	-98		
		2, 5	-98		
		3, 6	-95		
N_{oc} Note2	dBm/15 kHz	1, 4	-98		
		2, 5			
		3, 6			
$\hat{E}_s / N_{oc}$	dB	1, 2, 3, 4, 5, 6	-infinity	-4	-4
$\hat{E}_s / I_{ot}$	dB	1, 2, 3, 4, 5, 6	-infinity	-4	-4
SS-RSRP Note3	dBm/SCS	1, 4	-infinity	-102	-102
		2, 5	-infinity	-102	-102
		3, 6	-infinity	-99	-99
SS-RSRQ Note3	dB	1, 4	-infinity	-16.25	-16.25
		2, 5	-infinity	-16.25	-16.25
		3, 6	-infinity	-16.25	-16.25
Io	dBm/9.36 MHz	1, 4	-70.05	-68.60	-68.60
	dBm/9.36 MHz	2, 5	-70.05	-68.60	-68.60
	dBm/38.16 MHz	3, 6	-63.96	-62.50	-62.50
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.8.2.2.1.1-4: Cell specific test parameters for E-UTRA cell 1

Parameter	Unit	Cell 1		
		T1	T2	T3
E-UTRA RF Channel number		1		
$BW_{channel}$	MHz	10		
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6		
PBCH_RA	dB	0		
PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			

PHICH_RA	dB			
PHICH_RB	dB			
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA Note 1	dB			
OCNG_RB Note 1	dB			
Qrxlevmin	dBm	-140		
N_{oc} Note 2	dBm/15 kHz	-98		
RSRP Note 3	dBm/15 KHz	-84	-84	-84
RSRQ Note 3	dB	-10.96	-10.96	-10.96
$\hat{E}_s/I_{ot}$	dB	14	14	14
$\hat{E}_s/N_{oc}$	dB	14	14	14
$Treselection_{EUTRAN}$	s	0		
SnonintrasearchP	dB	50		
$Thresh_{x, highP}$	dB	48		
$Thresh_{serving, lowP}$	dB	44		
$Thresh_{x, lowP}$	dB	50		
beamMeasConfigIdle		True		
Propagation Condition		AWGN		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.8.2.2.1.2 Test Requirements

At the beginning of the time-period T2 the connection is released, and UE enters idle mode. During the time period T2 the UE is in Idle mode and Cell 2 is active. The UE shall not perform reselection. The UE shall perform Idle Mode DC measurement according to clause 4.9.2.4 in TS 36.133 [15]. UE shall be able to detect, acqure the SSB index and measure the SS-RSRP and SS-RSRQ from Cell 2 for Idle mode DC measurement during T2.

NOTE: The Idle mode DC measurement period for the test setup can be expressed as: $T_{higher_priority_search}$ + $T_{SSB_index,NR}$ + $T_{evaluate, NR}$.

Where:

$T_{higher_priority_search}$ See clause 4.2.2 in TS 36.133 [15]

$T_{SSB_index,NR}$ See Table 4.9.2.4-1 in clause 4.9.2.4 in TS 36.133 [15]

$T_{evaluate, NR}$ See Table 4.2.2.5.6-1 in clause 4.2.2.5.6 in TS 36.133 [15]

This gives a total of 70.24 s, allow 71 s for the T2.

At the start of T3 the UE is paged for connection setup. During the connection setup the UE is requested to transmit early measurement report. The UE shall send early measurement report to the PCell.

After receiving the requested early measurement report, the test equipment verifies the accuracy of measurement reported for serving Cell 1 and Cell 2 meets the requirements in section 9.1.2B in TS 36.133 [15] and section 9.1.3B, respectively and test ends.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.8.2.2.2 E-UTRA – NR Early Measurement Reporting for NR in FR2

A.8.2.2.2.1 Test Purpose and Environment

This test is to verify the requirement for the E-UTRAN to NR inter-RAT Idle mode DC measurement requirements specified in clause 4.9.2.4 in TS 36.133 [15]. This test is also to verify the accuracy requirement for the E-UTRAN to NR inter-RAT Idle mode DC measurement requirements specified in clause 9.11.1A and 9.11.2A in TS 36.133 [15]. Supported test configurations are shown in table A.8.2.2.2.1-1.

Table A.8.2.2.2.1-1: Supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

The test scenario comprises of 1 E-UTRA cell (Cell 1) and 1 NR cell (Cell 2). The the test parameters and applicability for the E-UTRAN cell are defined in table A.8.2.2.2.1-4. The general test parameters and the cell specific test parameters for the NR cell are speficied in table A.8.2.2.2.1-2 and table A.8.2.2.2.1-3, respectively.

The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Prior to the start of the time duration T1, the UE shall be connected to Cell 1. During T1, Cell 2 shall be powered off. At the end of T1, the RRC connection to Cell 1 is released and UE is configured Idle mode DC measurement on the carrier frequency of Cell 2. Time duration T2 starts when the RRC connection is released, and during the T2 UE is in Idle mode. Cell 2 shall be powered on from the beginning of T2. At beginning of T3 the UE is paged for connection setup and requested by the network to send idle mode measurements.

Table A.8.2.2.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	E-UTRAN Cell 1	E-UTRA cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2	NR Cell 2	Cell 2 is of higher priority.
E-UTRA RF Channel Number		1, 2	1	One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2	1	One FR2 NR carrier frequency is used.
DRX cycle length	s	1, 2	1.28	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	
T1	s	1, 2	0.5	
T2	s	1, 2	128	
T3	s	1, 2	2	
T331	s	1, 2	300	

Table A.8.2.2.2.1-3: Cell specific test parameters for NR cell 2

Parameter	Unit	Test configuration	Cell 2		
			T1	T2	T3
TDD configuration		1, 2	TDDConf.3.1		
PDSCH Reference measurement channel		1, 2	SR.3.1 TDD		
RMSI CORESET Reference Channel		1, 2	CR.3.1 TDD		
RMC CORESET Reference Channel		1, 2	CCR.3.1 TDD		
OCNG Patterns		1, 2	OP.1		
$BW_{channel}$	MHz	1, 2	100		
Data PRBs allocated		1, 2	66		

SMTC configuration		1, 2	SMTC.1		
SSB configuration		1, 2	SSB.1 FR2		
Initial DL BWP configuration		1, 2	DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1		
RLM-RS			SSB		
Qrxlevmin			-140		
Pcompensation			0		
Qhysts			0		
Qoffsets, n			0		
Cell_selection_and_reselection_quality_measurement			SS-RSRP		
AoA setup			Setup 1 defined in A.3.15.1		
Beam assumption Note 4			Rough		
$\hat{E}_s/I_{ot\ BB}$ Note 5	dB	1, 2	-infinity	-4.18	-4.18
N_{oc} Note2	dBm/SCS	1, 2	-98		
N_{oc} Note2	dBm/15kHz	1, 2	-107		
$\hat{E}_s / N_{oc}$	dB	1, 2	-infinity	-4	-4
SS-RSRP Note3	dBm/SCS	1, 2	-infinity	-102	-102
SS-RSRQ Note3	dB	1, 2	-infinity	-16.25	-16.25
Io	dBm/95.04 MHz	1, 2	-69.01	-67.56	-67.56
Propagation Condition		1, 2	AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4.

Table A.8.2.2.2.1-4: Cell specific test parameters for E-UTRA cell 1

Parameter	Unit	Cell 1		
		T1	T2	T3
E-UTRA RF Channel number		1		
$BW_{channel}$	MHz	10		
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6		
PBCH_RA	dB	0		
PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			
PHICH_RA	dB			
PHICH_RB	dB			
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA Note 1	dB			
OCNG_RB Note 1	dB			
Qrxlevmin	dBm	-140		
N_{oc} Note 2	dBm/15 kHz	-98		
RSRP Note 3	dBm/15 KHz	-84	-84	-84

RSRQ Note 3	dB	-10.96	-10.96	-10.96
$\hat{E}_s/I_{ot}$	dB	14	14	14
$\hat{E}_s/N_{oc}$	dB	14	14	14
$Treselection_{EUTRAN}$	s	0		
SnonintrasearchP	dB	N/A		
$Thresh_{x, highP}$	dB	48		
$Thresh_{serving, lowP}$	dB	44		
$Thresh_{x, lowP}$	dB	50		
beamMeasConfigIdle		False		
Propagation Condition		AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.8.2.2.2.2 Test Requirements

At the beginning of the time-period T2 the connection is released, and UE enters idle mode. During the time period T2 the UE is in Idle mode and Cell 2 is active. The UE shall not perform reselection. The UE shall perform Idle Mode DC measurement according to clause 4.9.2.4 in TS 36.133 [15]. UE shall be able to detect, acqure the SSB index and measure the SS-RSRP and SS-RSRQ from Cell 2 for Idle mode DC measurement during T2.

NOTE: The Idle mode DC measurement period for the test setup can be expressed as: $T_{detect, NR}$.

Where:

$T_{detect, NR}$ See Table 4.2.2.5.6-1 in clause 4.2.2.5.6 in TS 36.133 [15]

This gives a total of 128 s, allow 128 s for the T2.

At the start of T3 the UE is paged for connection setup. During the connection setup the UE is requested to transmit early measurement report. The UE shall send early measurement report to the PCell.

After receiving the requested early measurement report, the test equipment verifies the accuracy of measurement reported for serving Cell 1 and Cell 2 meets the requirements in section 9.1.2B in TS 36.133 [15] and section 9.1.3B, respectively and test ends.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.8.3 RRC_CONNECTED state mobility

A.8.3.1 Handover

A.8.3.1.1 E-UTRAN - NR handover in FR1

A.8.3.1.1.1 Test Purpose and Environment

This test shall verify the E-UTRAN to NR FR1 handover requirements as specified in clause 6.1.2.1 specified in clause 5.3.4 in TS 36.133 [15].

The test comprises of one E-UTRA carrier and one NR carrier. There are two cells and one cell on each carrier. Cell 1 is the E-UTRAN and Cell 2 is an inter-RAT NR neighbour cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement

report. Gap pattern configuration with id #0 as specified in table 8.1.2.1-1 of TS 36.133 [15] is configured before T2 begins to enable inter-RAT frequency monitoring.

A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.8.3.1.1-1. General test parameters are provided in table A.8.3.1.1-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.8.3.1.1-3 and A.8.3.1.1-4 respectively.

Table A.8.3.1.1-1: Supported test configurations for E-UTRAN inter-RAT NR handover

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.8.3.1.1-2: General test parameters for E-UTRAN inter-RAT NR handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	E-UTRAN cell
	Neighbouring cell		Cell 2	NR cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
b2-Threshold1		dBm	-83	Absolute E-UTRAN RSRP threshold for event B2
b2-Threshold2NR		dBm	As specified in table A.8.3.1.1-4	Absolute NR SS-RSRP threshold for event B2
Hysteresis		dB	0	
TimeToTrigger		s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
Gap pattern configuration Id			0	As specified in table 8.1.2.1-1 started before T2 starts [15]
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.8.3.1.1-3: Cell specific test parameters for E-UTRAN inter-RAT NR handover (Cell 1)

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6	2		
Duplex mode		1, 2, 3	FDD		
		4, 5, 6	TDD		
TDD special subframe configuration[Note1]		4, 5, 6	6		
TDD uplink-downlink configuration[Note1]		4, 5, 6	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
PRACH Configuration[Note2]		1, 2, 3	4		
		4, 5, 6	53		
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD		
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note3]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD		
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note4]					
OCNG_RB[Note4]					
N_{oc}[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	7	7	7
$\hat{E}_s/I_{ot}$[Note6]	dB	1, 2, 3, 4, 5, 6	7	7	7
RSRP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-91	-91	-91
SCH_RP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-91	-91	-91
Io[Note6]	dBm/9 MHz	1, 2, 3, 4, 5, 6	-62.43	-62.43	-62.43
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix [Note7]		1, 2, 3, 4, 5, 6	1x2 Low		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.3.1.1-4: Cell specific test parameters E-UTRAN inter-RAT NR handover (Cell 2)

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6	1		
Duplex mode		1, 4	FDD		
		2, 3, 5, 6	TDD		
TDD Configuration		2, 5	TDDConf.1.1		
		3, 6	TDDConf.2.1		

Parameter		Unit	Configuration	Cell 2		
				T1	T2	T3
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)		
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)		
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)		
PDSCH reference measurement channel			1, 4	SR.1.1 FDD		
			2, 5	SR.1.1 TDD		
			3, 6	SR.2.1 TDD		
CORSET reference channel			1, 4	CR.1.1 FDD		
			2, 5	CR.1.1 TDD		
			3, 6	CR.2.1 TDD		
PRACH configuration				FR1 PRACH configuration 1		
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1		
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration			1, 2, 4, 5	SSB.1 FR1		
			3, 6	SSB.2 FR1		
b2-Threshold2NR		dBm	1, 2, 4, 5	-106		
			3, 6	-103		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0		
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6	-98		
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-98		
			3, 6	-95		
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	-inifinity	0	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	-inifinity	0	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-inifinity	-98	-98
			3, 6	-inifinity	-95	-95
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-70.05	-67.04	-67.04
		dBm/38.16 MHz	3, 6	-63.96	-60.94	-60.94
Propagation condition			1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6	1x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.8.3.1.1.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 112 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in TS36.133.

$T_{interrupt}$ = 62 ms in the test; $T_{interrupt}$ is defined in TS36.133 clause 5.3.4.3.

This gives a total of 112 ms.

A.8.4 Measurement procedure

A.8.4.1 E-UTRA – NR Inter-RAT SFTD Measurement Delay

A.8.4.1.1 E-UTRA – NR Inter-RAT SFTD Measurement Delay in non-DRX

A.8.4.1.1.1 Test Purpose and Environment

The purpose of this test is to partly verify that measurement reporting delay for SFTD between E-UTRA PCell and inter-RAT NR neighbour cell in FR1 is within the requirements stated in clauses 8.1.2.4.25 and 8.1.2.4.26 of TS 36.133 [15] for E-UTRA FDD and TDD, respectively, when no measurement gaps are provided and no DRX is configured.

The tests consist of a single time period of duration T1. Two carriers are used in the tests: one E-UTRA carrier with the PCell (Cell 1), and one NR carrier with the NR neighbour cell (Cell 2).

Prior to the start of time duration T1, the UE is connected to Cell 1 and configured to carry out intra-frequency measurements only. The point in time at which the UE receives, at the UE antenna connector(s), a RRC message containing a measurement configuration for SFTD measurements on RF channel 1 defines the start of time duration T1. Following the start of T1 the UE shall detect Cell 2, determine the SFN and frame time difference of Cell 2 relative to Cell 1, and send a measurement report.

The supported test configurations are listed in table A.8.4.1.1.1-1 below. Test parameters and cell-specific parameters for the NR cell are provided in tables A.8.4.1.1.1-2 and A.8.4.1.1.1-3 below, respectively. Cell-specific parameters for the E-UTRA cell are provided in table A.3.7.2.1-1 in clause A.3.7.2.1.

Table A.8.4.1.1.1-1: Applicable E-UTRA and NR configurations for inter-RAT SFTD measurement delay test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.8.4.1.1.1-2: Applicable E-UTRA and NR configurations for inter-RAT SFTD measurement delay test

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1		One NR FR1 carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	Cell 1		Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	Cell 2		Cell 2 is on NR RF channel number 1.
SSB configuration		Config 1,4	SSB.1 FR1		As specified in clause A.3.10.1

		Config 2,5	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1		As specified in clause A.3.10.1
CP length		Config 1,2,3,4,5,6	Normal		Applicable to both cells.
DRX		Config 1,2,3,4,5,6	OFF		DRX is not used
Frame time offset between serving and neighbour cells	ms	Config 1,2,4,5	3	7	Asynchronous cells. The timing of Cell 2 relative to the timing of Cell 1.
	µs	Config 3,6	3		Synchronous cells.
SFN offset between serving and neighbour cells		Config 1,2,3,4,5,6	0	1	SFN of Cell 2 relative to SFN of Cell 1.
T1	s	Config 1,2,3,4,5,6	1		

Table A.8.4.1.1.1-3: Cell specific test parameters for Cell 2 in inter-RAT SFTD measurement delay test

Parameter	Unit	Test configuration	Cell 2
NR RF Channel Number		Config 1,2,3,4,5,6	1
Duplex mode		Config 1,4	FDD
		Config 2,3,5,6	TDD
$BW_{channel}$	MHz	Config 1,4	10: $N_{PRB,c}$ = 52
		Config 2,5	10: $N_{PRB,c}$ = 52
		Config 3,6	40: $N_{PRB,c}$ = 106
TDD configuration		Config 2,5	TDDConf.1.1
		Config 3,6	TDDConf.2.1
OCNG Pattern defined in A.3.2.1.1		Config 1,2,3,4,5,6	OP.1
SMTC configuration		Config 1,2,3,4,5,6	SMTC.1
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15
		Config 3,6	30
EPRE ratio of PSS to SSS	dB	Config 1,2,3,4,5,6	0
EPRE ratio of PBCH DMRS to SSS	dB		
EPRE ratio of PBCH to PBCH DMRS	dB		
EPRE ratio of OCNG DMRS to SSS Note 1	dB		
EPRE ratio of OCNG to OCNG DMRS Note 1	dB		
N_{oc} Note2	dBm/15kHz		-98
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98
		Config 3,6	-95
SS-RSRP Note 3, 4	dBm/SCS	Config 1,2,4,5	-94
		Config 3,6	-91
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6	4
Io Note 3	dBm/9.36 MHz	Config 1,2,4,5	-64.59
	dBm/38.16 MHz	Config 3,6	-58.50
Propagation Condition		Config 1,2,3,4,5,6	AWGN

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.1.1.2 Test Requirements

Following the start of T1, the UE shall detect Cell 2 and determine the relative time difference between Cell 1 and Cell 2. At latest at $T_{RRC_procedure_delay} + T_{measure_SFTD1}$ after the beginning of time duration T1, the UE shall send a measurement report on SFTD between Cell 1 and Cell 2.

The observed rate of successful SFTD reports in repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2\times TTI_{DCCH}$ longer than the measurement reporting delays above due to TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.1.2 E-UTRA – NR Inter-RAT SFTD Measurement Delay in DRX

A.8.4.1.2.1 Test Purpose and Environment

The purpose of this test is to partly verify that measurement reporting delay for SFTD between E-UTRA PCell and inter-RAT NR neighbour cell in FR1 is within the requirements stated in clauses 8.1.2.4.25 and 8.1.2.4.26 of TS 36.133 [15] for E-UTRA FDD and TDD, respectively, when no measurement gaps are provided and DRX is configured.

The tests consist of a single time period of duration T1. Two carriers are used in the tests: one E-UTRA carrier with the PCell (Cell 1), and one NR carrier with the NR neighbour cell (Cell 2).

Prior to the start of time duration T1, the UE is connected to Cell 1 and configured to carry out intra-frequency measurements only. The point in time at which the UE receives, at the UE antenna connector(s), a RRC message containing a measurement configuration for SFTD measurements on RF channel 1 defines the start of time duration T1. Following the start of T1 the UE shall detect Cell 2, determine the SFN and frame time difference of Cell 2 relative to Cell 1, and send a measurement report.

The supported test configurations are listed in table A.8.4.1.2.1-1 below. Test parameters are provided in tables A.8.4.1.2.1-2 below. Cell-specific parameters for the E-UTRA and NR cells are provided in table A.3.7.2.1-1 in clause A.3.7.2.1, and table A.8.4.1.1.1-3 in clause A.8.4.1.1.1, respectively.

Table A.8.4.1.2.1-1: Applicable E-UTRA and NR configurations for inter-RAT SFTD measurement delay test in DRX

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.8.4.1.2.1-2: Applicable E-UTRA and NR configurations for inter-RAT SFTD measurement delay test in DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1		One NR FR1 carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	Cell 1		Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	Cell 2		Cell 2 is on NR RF channel number 1.
SSB configuration		Config 1,4	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2,5	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1		As specified in clause A.3.10.1
CP length		Config 1,2,3,4,5,6	Normal		Applicable to both cells.

DRX		Config 1,2,3,4,5,6	DRX.4		DRX configuration as specified in clause A.3.3.4
Frame time offset between serving and neighbour cells	ms	Config 1,2,4,5	3	7	Asynchronous cells. The timing of Cell 2 relative to the timing of Cell 1.
	µs	Config 3,6	3		Synchronous cells.
SFN offset between serving and neighbour cells		Config 1,2,3,4,5,6	0	1	SFN of Cell 2 relative to SFN of Cell 1.
T1	s	Config 1,2,3,4,5,6	1		

A.8.4.1.2.2 Test Requirements

Following the start of T1, the UE shall detect Cell 2 and determine the relative time difference between Cell 1 and Cell 2. At latest at the earliest DRX activity time following upon $T_{RRC_procedure_delay} + T_{measure_SFTD1}$ from the beginning of time duration T1, the UE shall send a measurement report on SFTD between Cell 1 and Cell 2.

The observed rate of successful SFTD reports in repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ longer than the measurement reporting delays above due to TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2 E-UTRA – NR Inter-RAT Measurements

A.8.4.2.1 NR Inter-RAT event triggered reporting tests for FR1 without SSB time index detection when DRX is not used

A.8.4.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in tables A.8.4.2.1.1-1, A.8.4.2.1.1-2, A.8.4.2.1.1-3 and A.8.4.2.1.1-4.

Measurement gap pattern configuration is defined in table A.8.4.2.1.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.1.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.1.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6	1	One E-UTRAcarrier frequency is used.
NR RF Chanel Number		1, 2, 3, 4, 5, 6	1	One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)	E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2	NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39	As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	Note 1	E-UTRA RSRP threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6	Note 2	SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0	
CP length		1, 2, 3, 4, 5, 6	Normal	
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0	
Filter coefficient		1, 2, 3, 4, 5, 6	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	OFF	DRX is not used
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3μs	Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5	
T2	s	1, 2, 3, 4, 5, 6	1	
NOTE 1: The value of b2-Threshold1 is defined in table A.8.4.2.1.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.8.4.2.1.1-4				

Table A.8.4.2.1.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
			10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	17	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2, 3, 4, 5, 6	17	17
RSRP Note5	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
SCH_RP Note5	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
Io Note5	dBm/9 MHz	1, 2, 3, 4, 5, 6	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.4.2.1.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5	10: $N_{PRB,c}$ = 52	
		3, 6	40: $N_{PRB,c}$ = 106	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
Io Note3	dBm/9.36 MHz	1, 2, 4, 5	-70.05	-62.26
	dBm/38.16 MHz	3, 6	-63.95	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.1.2 Test Requirements

The UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.2 NR Inter-RAT event triggered reporting tests for FR1 without SSB time index detection when DRX is used

A.8.4.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in tables A.8.4.2.2.1-1, A.8.4.2.2.1-2, A.8.4.2.2.1-3 and A.8.4.2.2.1-4.

In tests 1 and 2, measurement gap pattern configuration is defined in table A.8.4.2.2.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.2.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.2.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6	1		One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2, 3, 4, 5, 6	1		One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)		E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2		NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39		As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	Note 1		E-UTRA RSRP threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6	Note 2		SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0		
CP length		1, 2, 3, 4, 5, 6	Normal		
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0		
Filter coefficient		1, 2, 3, 4, 5, 6	0		L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.9	DRX.12	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 4	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3μs		Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5		
T2	s	1, 2, 3, 4, 5, 6	2	11	
NOTE 1: The value of b2-Threshold1 is defined in table A.8.4.2.2.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.8.4.2.2.1-4					

Table A.8.4.2.2.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters:		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
DL Reference Measurement Channel[Note2]			20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	17	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	17	17
RSRP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
SCH_RP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
Io[Note5]	dBm/9 MHz	1, 2, 3, 4, 5, 6	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition [Note6]		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix [Note6]		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.4.2.2.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
$BW_{channel}$	MHz	1, 2, 4, 5	10: $N_{PRB,c}$ = 52	
		3, 6	40: $N_{PRB,c}$ = 106	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
Io Note3	dBm/9.36 MHz	1, 2, 4, 5	-70.05	-62.26
	dBm/38.16 MHz	3, 6	-63.95	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	TDL-C 300 ns 100 Hz	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1 and 2, the UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.3 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection when DRX is not used

A.8.4.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in tables A.8.4.2.3.1-1, A.8.4.2.3.1-2, A.8.4.2.3.1-3 and A.8.4.2.3.1-4.

Measurement gap pattern configuration is defined in table A.8.4.2.3.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.3.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.3.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6	1	One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)	E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2	NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39	As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	Note 1	E-UTRA RSRP threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6	Note 2	SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0	
CP length		1, 2, 3, 4, 5, 6	Normal	
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0	
Filter coefficient		1, 2, 3, 4, 5, 6	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	OFF	DRX is not used
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3μs	Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5	
T2	s	1, 2, 3, 4, 5, 6	2	

NOTE 1: The value of b2-Threshold1 is defined in table A.8.4.2.3.1-3
NOTE 2: The value of b2-Threshold2NR is defined in table A.8.4.2.3.1-4

Table A.8.4.2.3.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	17	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	17	17
RSRP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
SCH_RP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
Io[Note5]	dBm/9 MHz	1, 2, 3, 4, 5, 6	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition [Note6]		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix [Note6]		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.4.2.3.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5	10: $N_{PRB,c}$ = 52	
		3, 6	40: $N_{PRB,c}$ = 106	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
$N_{_}$ Note2	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
$N_{_}$ Note2	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
Io Note3	dBm/9.36 MHz	1, 2, 4, 5	-70.05	-62.26
	dBm/38.16 MHz	3, 6	-63.95	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{_}$ to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.3.2 Test Requirements

The UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 1040 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.4 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection when DRX is used

A.8.4.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in tables A.8.4.2.4.1-1, A.8.4.2.4.1-2, A.8.4.2.4.1-3 and A.8.4.2.4.1-4.

In tests 1 and 2, measurement gap pattern configuration is defined in table A.8.4.2.4.1-2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.4.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.4.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6	1		One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2, 3, 4, 5, 6	1		One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)		E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2		NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39		As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	Note 1		E-UTRA RSRP threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6	Note 2		SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0		
CP length		1, 2, 3, 4, 5, 6	Normal		
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0		
Filter coefficient		1, 2, 3, 4, 5, 6	0		L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.9	DRX.12	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 4	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3μs		Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5		
T2	s	1, 2, 3, 4, 5, 6	2	13	
NOTE 1: The value of b2-Threshold1 is defined in table A.8.4.2.4.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.8.4.2.4.1-4					

Table A.8.4.2.4.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				

Parameter	Unit	Configuration	Cell 1	
			T1	T2
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	17	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2, 3, 4, 5, 6	17	17
RSRP Note5	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
SCH_RP Note5	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
Io Note5	dBm/9 MHz	1, 2, 3, 4, 5, 6	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.4.2.4.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5	10: $N_{PRB,c}$ = 52	
		3, 6	40: $N_{PRB,c}$ = 106	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
$N_{}$ Note2	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
$N_{}$ Note2	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
Io[Note3]	dBm/9.36 MHz	1, 2, 4, 5	-70.05	-62.26
	dBm/38.16 MHz	3, 6	-63.95	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				

A.8.4.2.4.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 12160 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1 and 2, the UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.5 NR Inter-RAT event triggered reporting tests for FR2 without SSB time index detection when DRX is not used

A.8.4.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in tables A.8.4.2.5.1-1, A.8.4.2.5.1-2 and A.8.4.2.5.1-3.

The cell specific test parameters for E-UTRA Cell 1 as PCell are defined in clause A.3.7.2.2.

Measurement gap pattern configuration defined in table A.8.4.2.5.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have timing information of NR cell 2.

Table A.8.4.2.5.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR2 in non-DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.5.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		1, 2	1	One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2	1	One FR2 NR carrier frequency is used.
Active cell		1, 2	E-UTRA cell 1 (PCell)	E-UTRA cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2	NR cell 2	NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39	As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1	SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B1 [16]
Hysteresis	dB	1, 2	0	
CP length		1, 2	Normal	
TimeToTrigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	DRX is not used
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3μs	Synchronous cells.
T1	s	1, 2	10	
T2	s	1, 2	6	
NOTE 1: The value of b1-ThresholdNR is defined in table A.8.4.2.5.1-3				

Table A.8.4.2.5.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in non-DRX

Parameter		Unit	Test configuration	Cell 2	
				T1	T2
AoA setup defined in A.3.15.2.1			1, 2	Setup 2a	
Assumption for UE beams[Note 5]			1, 2	Rough	
NR RF Channel Number			1, 2	1	
Duplex mode			1, 2	TDD	
TDD configuration			1, 2	TDDConf.3.1	
$BW_{channel}$		MHz	1, 2	100: $N_{PRB,c}$ = 24	
OCNG patterns defined in A.3.2.1.1			1, 2	OP. 3	
SMTC configuration defined in A.3.11.1 and A.3.11.2			1	SMTC.2	
			2	SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	1, 2	120	
b1-ThresholdNR	UE power class 3	dBm/SCS	1, 2	-112	
EPRE ratio of PSS to SSS			1, 2	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS (Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
$\hat{E}_s$		dBm/SCS	1, 2	- Infinity	-80.6

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
SS B_RP Note 3	dBm/SCS	1, 2	-Infinity	-80.6
$\hat{E}_s/I_{ot}$ BB Note 6	dB	1, 2	-Infinity	8.3
Io Note3	dBm/95.04 MHz	1, 2	-Infinity	-56.0
Propagation Condition		1, 2	AWGN	

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 6: Calculation of Es/Iot$_{BB}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.8.4.2.5.2 Test Requirements

The UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms and D2 ms from the beginning of time period T2 for a UE incapable of per-FR gap and for a UE capable of per-FR gap, respectively. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is not required to report SSB time index.

Table A.8.4.2.5.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in non-DRX

Test case	Measurement reporting delay (ms)	
	Test 1: D1 ms	Test 2: D2 ms
UE power class 3	3200	1600

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.6 NR Inter-RAT event triggered reporting tests for FR2 without SSB time index detection when DRX is used

A.8.4.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in tables A.8.4.2.6.1-1, A.8.4.2.6.1-2 and A.8.4.2.6.1-3.

The cell specific test parameters for E-UTRA Cell 1 as PCell are defined in clause A.3.7.2.2.

Measurement gap pattern configuration defined in table A.8.4.2.6.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have timing information of NR cell 2.

Table A.8.4.2.6.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR2 in DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.6.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2	1		One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2	1		One FR2 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)		E-UTRA cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2		NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39		As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1		SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B1 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0		
CP length		1, 2, 3, 4, 5, 6	Normal		
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0		
Filter coefficient		1, 2, 3, 4, 5, 6	0		L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.9	DRX.12	As specified in clause A.3.3
Time offset between serving and neighbour cells		1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3μs		Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5		
T2	s	1, 2, 3, 4, 5, 6	6	83	
NOTE 1: The value of b1-ThresholdNR is defined in table A.8.4.2.6.1-3					

Table A.8.4.2.6.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in DRX

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
AoA setup defined in A.3.15.1		1, 2	Setup 1	
Assumption for UE beams[Note 5]		1, 2	Rough	
NR RF Channel Number		1, 2	1	
Duplex mode		1, 2	TDD	
TDD configuration		1, 2	TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66	
OCNG patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1	SMTC.2	
		2	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120	
b1-ThresholdNR UE power class 3	dBm/SCS	1, 2	-106	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz	1, 2	-104.7	
N_{oc} Note2	dBm/SCS	1, 2	-95.7	
SS-RSRP Note 3	dBm/SCS	1, 2	-Infinity	-87.7
$\hat{E}_s/I_{ot}$	dB	1, 2	-Infinity	8
$\hat{E}_s/N_{oc}$	dB	1, 2	-Infinity	8
Io Note3	dBm/95.04 MHz	1, 2	-66.7	-58. 0
Propagation Condition		1, 2	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.8.4.2.6.2 Test Requirements

In test 1, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms and D3 ms from the beginning of time period T2 for a UE incapable of per-FR gap and for a UE capable of per-FR gap, respectively. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D2 ms and D4 ms from the beginning of time period T2 for a UE incapable of per-FR gap and for a UE capable of per-FR gap, respectively. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1 and 2, the UE is not required to report SSB time index.

Table A.8.4.2.6.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in DRX

Test case	Measurement reporting delay (ms)			
	D1 ms	D2 ms	D3 ms	D4 ms
UE power class 3	4800	51200	4800	51200

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.7 NR Inter-RAT event triggered reporting tests for FR2 with SSB time index detection when DRX is not used

A.8.4.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in tables A.8.4.2.7.1-1, A.8.4.2.7.1-2 and A.8.4.2.7.1-3.

The cell specific test parameters for E-UTRA Cell 1 as PCell are defined in clause A.3.7.2.2.

Measurement gap pattern configuration defined in table A.8.4.2.7.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.7.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR2 in non-DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.7.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Numbers		1, 2	1	One E-UTRA carrier frequency is used.
NR RF Channel Numbers		1, 2	1	One FR2 NR carrier frequency is used.
Active cell		1, 2	E-UTRA cell 1 (PCell)	E-UTRA cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2	NR cell 2	NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39	As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1	SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B1 [16]
Hysteresis	dB	1, 2	0	
CP length		1, 2	Normal	
TimeToTrigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	DRX is not used
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3μs	Synchronous cells.
T1	s	1, 2	5	
T2	s	1, 2	5	
NOTE 1: The value of b1-ThresholdNR is defined in table A.8.4.2.7.1-3				

Table A.8.4.2.7.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
AoA setup defined in A.3.15.1		1, 2	Setup 1	
Assumption for UE beams[Note 5]		1, 2	Rough	

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2	1	
Duplex mode		1, 2	TDD	
TDD configuration		1, 2	TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66	
OCNG patterns defined in A.3.2.1.1		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1	SMTC.2	
		2	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120	
b1-ThresholdNR UE power class 3	dBm/SCS	1, 2	-106	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
$\hat{N}$ Note2	dBm/15kHz	1, 2	-104.7	
N_{oc} Note2	dBm/SCS	1, 2	-95.7	
SS-RSRP Note 3	dBm/SCS	1, 2	-Infinity	-87.7
$\hat{E}_s/I_{ot}$	dB	1, 2	-Infinity	8
$\hat{E}_s/N_{oc}$	dB	1, 2	-Infinity	8
Io Note3	dBm/95.04 MHz	1, 2	-66.7	-58. 0
Propagation Condition		1, 2	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.8.4.2.7.2 Test Requirements

the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms and D2 ms from the beginning of time period T2 for a UE incapable of per-FR gap and for a UE capable of per-FR gap, respectively. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

Table A.8.4.2.7.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in non-DRX

Test case	Measurement reporting delay (ms)	
	D1 ms	D2 ms
UE power class 3	4160	2080

A.8.4.2.8 NR Inter-RAT event triggered reporting tests for FR2 with SSB time index detection when DRX is used

A.8.4.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in tables A.8.4.2.8.1-1, A.8.4.2.8.1-2 and A.8.4.2.8.1-3.

The cell specific test parameters for E-UTRA Cell 1 as PCell are defined in clause A.3.7.2.2.

Measurement gap pattern configuration defined in table A.8.4.2.8.1-2 is provided for a UE that does not support per-FR gap, and no gap pattern (Gap Pattern Id and Measurement gap offset) is configured for a UE capable of per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.8.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR2 in DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.8.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2	1		One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2	1		One FR2 NR carrier frequency is used.
Active cell		1, 2	E-UTRA cell 1 (PCell)		E-UTRA cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2	NR cell 2		NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39		As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1		SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B1 [16]
Hysteresis	dB	1, 2	0		
CP length		1, 2	Normal		
TimeToTrigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX			DRX.9	DRX.12	As specified in clause A.3.3
Time offset between serving and neighbour cells		1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3μs		Synchronous cells.
T1	s	1, 2	5		
T2	s	1, 2	7	70	
NOTE 1: The value of b1-ThresholdNR is defined in table A.8.4.2.8.1-3					

Table A.8.4.2.8.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
AoA setup defined in A.3.15.1		1, 2	Setup 1	
Assumption for UE beams Note 5		1, 2	Rough	
NR RF Channel Number		1, 2	1	
Duplex mode		1, 2	TDD	
TDD configuration		1, 2	TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66	
OCNG patterns defined in A.3.2.1.1		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1	SMTC.2	
		2	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120	
b1-ThresholdNR UE power class 3	dBm/SCS	1, 2	-106	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz	1, 2	-104.7	
N_{oc} Note2	dBm/SCS	1, 2	-95.7	
SS-RSRP Note 3	dBm/SCS	1, 2	-Infinity	-87.7
$\hat{E}_s/I_{ot}$	dB	1, 2	-Infinity	8
$\hat{E}_s/N_{oc}$	dB	1, 2	-Infinity	8
Io Note3	dBm/95.04 MHz	1, 2	-66.7	-58. 0
Propagation Condition		1, 2	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.8.4.2.8.2 Test Requirements

In test 1, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms and D3 ms from the beginning of time period T2 for a UE incapable of per-FR gap and for a UE capable of per-FR gap, respectively. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D2 ms from the beginning of time period T2 for a UE incapable of per-FR gap and for a UE capable of per-FR gap, respectively. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1 and 2, the UE is required to report SSB time index.

Table A.8.4.2.8.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in DRX

Test case	Measurement reporting delay (ms)			
	D1 ms	D2 ms	D3 ms	D4 ms
UE power class 3	6240	66560	6240	66560

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.9 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection in DRX for UE configured with highSpeedInterRAT-NR-r16

A.8.4.2.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements when UE is configured with *highSpeedInterRAT-NR-r16*.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in tables A.8.4.2.9.1-1, A.8.4.2.9.1-2, A.8.4.2.9.1-3 and A.8.4.2.9.1-4.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.9.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR1 for UE configured with highSpeedInterRAT-NR-r16

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.9.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection for UE configured with highSpeedInterRAT-NR-r16

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6	1	One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)	E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2	NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39	As specified in TS 36.331 [16].

Parameter	Unit	Test configuration	Value	Comment
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	Note 1	E-UTRA RSRP threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6	Note 2	SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0	
CP length		1, 2, 3, 4, 5, 6	Normal	
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0	
Filter coefficient		1, 2, 3, 4, 5, 6	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.5	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3μs	Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5	
T2	s	1, 2, 3, 4, 5, 6	5	
NOTE 1: The value of b2-Threshold1 is defined in table A.8.4.2.9.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.8.4.2.9.1-4				

Table A.8.4.2.9.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting with NR neigbour cell in FR1 with SSB time index detection for UE configured with highSpeedInterRAT-NR-r16

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	17	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2, 3, 4, 5, 6	17	17
RSRP Note5	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
SCH_RP Note5	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
Io Note5	dBm/9 MHz	1, 2, 3, 4, 5, 6	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2, 3, 4, 5, 6	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.4.2.9.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection for UE configured with highSpeedInterRAT-NR-r16

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5	10: $N_{PRB,c}$ = 52	
		3, 6	40: $N_{PRB,c}$ = 106	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
Io Note3	dBm/9.36 MHz	1, 2, 4, 5	-70.05	-62.26
	dBm/38.16 MHz	3, 6	-63.95	-56.16
Propagation Condition		1, 2, 4, 5	AWGN1944	
		3,6	AWGN3334	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.9.2 Test Requirements

The UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 4.8 s from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.3 E-UTRAN - NR Inter-RAT event-triggered without measurement gaps

A.8.4.3.1 NR Inter-RAT event triggered reporting tests for FR2 without MG nor DRX

A.8.4.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.29 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.30 of TS 36.133 [15] for E-UTRAN TDD-NR measurements, as well as the interruption requriements in clause 7.8.2.22.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in tables A.8.4.3.1.1-1, A.8.4.3.1.1-2 and A.8.4.3.1.1-3.

The cell specific test parameters for E-UTRA Cell 1 as PCell are defined in clause A.3.7.2.2.

No measurement gap is configured for the test. UE is continuously scheduled in DL in LTE PCell during the test.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have timing information of NR cell 2.

Table A.8.4.3.1.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR2 in non-DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.3.1.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 without MG nor DRX

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		1, 2	1	One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2	1	One FR2 NR carrier frequency is used.
Active cell		1, 2	E-UTRA cell 1 (PCell)	E-UTRA cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2	NR cell 2	NR cell 2 is on NR RF channel number 1.
b1-ThresholdNR	dBm	1, 2	Note 1	SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B1 [16]
SMTC configuration		1, 2	SMTC.3	As defined in A.3.11.
Hysteresis	dB	1, 2	0	
CP length		1, 2	Normal	
TimeToTrigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	DRX is not used
Time offset between serving and neighbour cells		1, 2	3μs	Synchronous cells.
T1	s	1, 2	10	
T2	s	1, 2		
NOTE 1: The value of b1-ThresholdNR is defined in table A.8.4.3.1.1-3				

Table A.8.4.3.1.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
AoA setup defined in A.3.15.2.1		1, 2	Setup 2a	
Assumption for UE beams[Note 5]		1, 2	Rough	

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2	1	
Duplex mode		1, 2	TDD	
TDD configuration		1, 2	TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 24	
OCNG patterns defined in A.3.2.1.1		1, 2	OP. 3	
SSB configuration		1, 2	SSB.3 FR2	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120	
b1-ThresholdNR UE power class 3	dBm/SCS	1, 2	-112	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
$\hat{E}_S$	dBm/SCS	1, 2	- Infinity	-80.6
SS B_RP Note 3	dBm/SCS	1, 2	-Infinity	-80.6
$\hat{E}_s / I_{ot}$ BB Note 6	dB	1, 2	-Infinity	8.3
Io Note3	dBm/95.04 MHz	1, 2	-Infinity	-56.0
Propagation Condition		1, 2	AWGN	

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.8.4.3.1.2 Test Requirements

In the test, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms from the beginning of time period T2, where D1 = 12.8 s for UE power class 3.

During the test, the interruption ratio (number of interrupted subframes over the number of total subframes) in LTE PCell shall be less than 1.25 %, and each interruption shall not exceed 1 subframe.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

In the test, the UE is not required to report SSB time index.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.3.2 NR Inter-RAT event triggered reporting tests for FR1 without gaps when DRX is not used

A.8.4.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event when performing inter-RAT NR measurements without gaps and with or without interruptions. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.29 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.30 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

The purpose of this test is also to verify that the interruption ratio does not exceed the limits for the LTE PCell during the inter-RAT NR measurement without gaps and with interruptions. This test will verify the interruption ratio for LTE PCell in standalone LTE specified in clause 7.8.2.22.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in tables A.8.4.3.2.1-1, A.8.4.3.2.1-2, A.8.4.3.2.1-3 and A.8.4.3.2.1-4.

The serving frequency should be selected for this test case should be one in which the UE reports UE capabilities interRAT-NeedForGapsNR-r16=FALSE and interRAT-NeedForInterruptionNR-r18=’nogap-interruption’ or interRAT-NeedForInterruptionNR-r18=’nogap-nointerruption’.

No measurement gap is configured for the test. UE is continuously scheduled in DL in LTE PCell during the test.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 Inter RAT neighbour becomes better than threshold) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.3.2.1-1: NR inter-RAT event triggered reporting tests without gaps and with interruptions

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.3.2.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without gaps and with interruptions

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6	1	One E-UTRAcarrier frequency is used.
NR RF Chanel Number		1, 2, 3, 4, 5, 6	1	One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA Cell 1 (PCell)	E-UTRA Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 2	NR Cell 2 is on NR RF channel number 1.
b1-ThresholdNR	dBm	1, 2, 3, 4, 5, 6	Note 1	SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B1 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0	
CP length		1, 2, 3, 4, 5, 6	Normal	
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0	
Filter coefficient		1, 2, 3, 4, 5, 6	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	OFF	DRX is not used
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3µs	Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5	
T2	s	1, 2, 3, 4, 5, 6	2	
NOTE 1: The value of b1-ThresholdNR is defined in table A.8.4.3.2.1-4				

Table A.8.4.3.2.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neighbour cell in FR1 without gaps and with interruptions

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	17	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	17	17
RSRP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
SCH_RP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
Io[Note5]	dBm/9 MHz	1, 2, 3, 4, 5, 6	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition [Note6]		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix [Note6]		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.4.3.2.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5	10: $N_{PRB,c}$ = 52	
		3, 6	40: $N_{PRB,c}$ = 106	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration defined in A.3.11		1, 4	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	
		3, 6	30	
b1-ThresholdNR	dBm/SCS	1, 2, 4, 5	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
Io Note3	dBm/9.36 MHz	1, 2, 4, 5	-70.05	-62.26
	dBm/38.16 MHz	3, 6	-63.95	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2	

NOTE 1: OCNG shall be used such that the cell is fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.3.2.2 Test Requirements

The UE shall be continuously scheduled on PCell during the entire length of T1 and T2. During both time durations the interruption ratio should not exceed 2.5 %.

In the test, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms from the beginning of time period T2.

- D1 = 1280 for a UE that supports interRAT-NeedForInterruptionNR-r18=’nogap-interruption’
- D1 = 800 for a UE that supports interRAT-NeedForInterruptionNR-r18=’nogap-nointerruption’

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The UE is not required to report SSB time index.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.5 Measurement performance

A.8.5.1 SFTD accuracy

A.8.5.1.1 SFTD accuracy

A.8.5.1.1.1 Test Purpose

The purpose of this set of tests is to verify that the SFTD measurement accuracy is within the specified limits. This test will verify the requirements as specified in clause 9.1.27 in TS 36.133 [15] for inter-RAT FR1 SFTD measurements.

A.8.5.1.1.2 Test Environment

Supported test configurations are shown in table A.8.5.1.1.2-1. In this set of test cases there are two cells on different carriers. Cell 1 is E-UTRAN PCell and Cell 2 is inter-RAT NR FR1 target cell. The test parameters of cell 1 are given in clause A.8.5.1.1.2-2. The test parameters of cell 2 are given in table A.8.5.1.1.2-3. The SFTD between PCell and target cell shall be set by the test equipment to one of the time differences in table A.8.5.1.1.2-4.

Table A.8.5.1.1.2-1: Supported test configurations for SFTD accuracy

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.8.5.1.1.2-2: Test parameters for SFTD accuracy (Cell 1)

Parameter	Unit	Test 1
E-UTRA RF Channel Number		1
Duplex mode		FDD or TDD
TDD special subframe configuration[Note1]		6
TDD uplink-downlink configuration[Note1]		1
$BW_{channel}$		5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100
PDSCH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD

Parameter	Unit	Test 1
OCNG Patterns[Note2]		5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD
PBCH_RA	dB	0
PBCH_RB	dB	
PSS_RA	dB	
SSS_RA	dB	
PCFICH_RB	dB	
PHICH_RA	dB	
PHICH_RB	dB	
PDCCH_RA	dB	
PDCCH_RB	dB	
PDSCH_RA	dB	
PDSCH_RB	dB	
OCNG_RA[Note3]	dB	
OCNG_RB[Note3]	dB	
N_{oc}[Note4]	dBm/15 kHz	-104
$\hat{E}_s/N_{oc}$	dB	-3
$\hat{E}_s/I_{ot}$	dB	-3
RSRP [Note5]	dBm/15 kHz	-107
SCH_RP [Note5]	dBm/15 kHz	-107
Io [Note5]	dBm/Ch BW	-74.45 +10log ($N_{PRB,c}$ /50)
Propagation Condition		AWGN
Antenna Configuration		1x2
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23]. NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively. NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 5: Es/Iot, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		

Table A.8.5.1.1.2-3: Test parameters for SFTD accuracy (Cell 2)

Parameter	Config	Unit	Test 1
SSB ARFCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2,5		10: $N_{PRB,c}$ = 52
	3,6		40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
RMC CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.1 FR1
	2,5		SSB.1 FR1

Parameter		Config	Unit	Test 1
		3,6		SSB.2 FR1
SMTC configuration		1~6		SMTC.1
DL BWP configuration		1~6		DLBWP.1.1
UL BWP configuration		1~6		ULBWP.1.1
OCNG Patterns		1~6		OP.1
EPRE ratio of PSS to SSS		1~6	dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15kHz	-104
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SSB SCS	-104
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-101
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
$\hat{E}_s / I_{ot}$		1~6	dB	-3
$\hat{E}_s / N_{oc}$		1~6	dB	-3

Parameter		Config	Unit	Test 1
SS-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SCS	-107
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-104
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/9.36 MHz	-74.28
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6	dBm/38.16 MHz	-68.18
	NR_FDD_FR1_B, NR_TDD_FR1_B			
	NR_FDD_FR1_C, NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G, NR_TDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_N			
Propagation condition		1~6		AWGN
Antenna configuration		1~6		1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Parameter	Config	Unit	Test 1
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification			

Table A.8.5.1.1.2-4: Timing offsets for SFTD accuracy test

Condition	SFN offset between PCell and PSCell	Frame boundary offset between PCell and PSCell (Ts)
1	100	-122000
2	300	-60540
3	500	1000
4	700	62540
5	900	124000

A.8.5.1.1.3 Test Requirements

The SFTD reported by the UE consists of 2 elements, SFN offset and frame boundary offset between PCell and inter-RAT NR target cell. The reported SFTD accuracy shall fulfil the requirement in clause 9.1.27 in TS 36.133 [15].

A.8.5.2 E-UTRA – NR Inter-RAT Measurement Performance requirements

A.8.5.2.1 SS-RSRP

A.8.5.2.1.1 E-UTRAN – NR inter-RAT measurements with FR1 target cell

A.8.5.2.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.1 in TS 36.133 [15] for inter-RAT FR1 SS-RSRP measurements.

A.8.5.2.1.1.2 Test Parameters

Supported test configurations are shown in table A.8.5.2.1.1.2-1. In this test case there are two cells on different carriers. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1. Cell 2 is the inter-RAT NR FR1 target cell. The absolute accuracy requirements of SS-RSRP inter-RAT measurement is tested by using test parameters in table A.8.5.2.1.1.2-2.

Table A.8.5.2.1.1.2-1: SS-RSRP Inter-RAT SS-RSRP supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.8.5.2.1.1.2-2: SS-RSRP inter-RAT test parameters

Parameter			Unit	Test 1		Test 2	
				Cell 2		Cell 2	
SSB ARFCN				freq1		freq1	
Duplex mode		Config 1,4		FDD			
		Config 2,3,5,6		TDD			
TDD configuration		Config 1,4		Not Applicable			
		Config 2,5		TDDConf.1.1			
		Config 3,6		TDDConf.2.1			
Downlink initial BWP configuration				DLBWP.0.1			
Uplink initial BWP configuration				ULBWP.0.1			
DRX Cycle configuration			ms	Not Applicable			
PDSCH Reference measurement channel		Config 1,4		-		-	
		Config 2,5					
		Config 3,6					
RMSI CORESET Reference Channel		Config 1,4		-		-	
		Config 2,5					
		Config 3,6					
Dedicated CORESET Reference Channel		Config 1,4		-		-	
		Config 2,5					
		Config 3,6					
OCNG Patterns				OP.1			
SS-RSSI-Measurement				Not Applicable			
SMTC configuration				SMTC.1			
SSB configuration		Config 1,2,4,5		SSB.1 FR1			
		Config 3,6		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing		Config 1,2,4,5	kHz	15			
		Config 3,6		30			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config 1,2,3,4,5,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15kHz	-94.65		-117	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-116.5	
		NR_FDD_FR1_C, NR_TDD_FR1_C				-116	
		NR_FDD_FR1_D NR_TDD_FR1_D				-115.5	
		NR_FDD_FR1_E NR_TDD_FR1_E				-115	
		NR_FDD_FR1_F				-114.5	
		NR_FDD_FR1_G, NR_TDD_FR1_G				-114	
		NR_FDD_FR1_H				-113.5	
		NR_FDD_FR1_N				-110.5	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-94.65		Same as Noc for 15kHz	
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-91.65		-114	
		NR_FDD_FR1_B, NR_TDD_FR1_B				-113.5	

Parameter			Unit	Test 1	Test 2
				Cell 2	Cell 2
		NR_FDD_FR1_C, NR_TDD_FR1_C			-113
		NR_FDD_FR1_D NR_TDD_FR1_D			-112.5
		NR_FDD_FR1_E NR_TDD_FR1_E			-112
		NR_FDD_FR1_F			-111.5
		NR_FDD_FR1_G, NR_TDD_FR1_G			-111
		NR_FDD_FR1_H			-110.5
		NR_FDD_FR1_N			-107.5
$\hat{E}_s / I_{ot}$			dB	10	-4
$\hat{E}_s / N_{oc}$			dB	10	-4
SS-RSRP[Note3]	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-84.65	-121
		NR_FDD_FR1_B, NR_TDD_FR1_B			-120.5
		NR_FDD_FR1_C, NR_TDD_FR1_C			-120
		NR_FDD_FR1_D NR_TDD_FR1_D			-119.5
		NR_FDD_FR1_E NR_TDD_FR1_E			-119
		NR_FDD_FR1_F			-118.5
		NR_FDD_FR1_G, NR_TDD_FR1_G			-118
		NR_FDD_FR1_H			-117.5
		NR_FDD_FR1_N			-114.5
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-81.65	-118
		NR_FDD_FR1_B, NR_TDD_FR1_B			-117.5
		NR_FDD_FR1_C, NR_TDD_FR1_C			-117
		NR_FDD_FR1_D NR_TDD_FR1_D			-116.5
		NR_FDD_FR1_E NR_TDD_FR1_E			-116
		NR_FDD_FR1_F			-115.5
		NR_FDD_FR1_G, NR_TDD_FR1_G			-115
		NR_FDD_FR1_H			-114.5
		NR_FDD_FR1_N			-111.5
Io[Note3]	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-56.28	-87.76
		NR_FDD_FR1_B, NR_TDD_FR1_B			-87.26
		NR_FDD_FR1_C, NR_TDD_FR1_C			-86.76
		NR_FDD_FR1_D NR_TDD_FR1_D			-86.26
		NR_FDD_FR1_E NR_TDD_FR1_E			-85.76
		NR_FDD_FR1_F			-85.26
		NR_FDD_FR1_G, NR_TDD_FR1_G			-84.76
		NR_FDD_FR1_H			-84.26
		NR_FDD_FR1_N			-81.26
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-50.19	-84.76

Parameter			Unit	Test 1	Test 2
				Cell 2	Cell 2
		NR_FDD_FR1_B, NR_TDD_FR1_B			-84.26
		NR_FDD_FR1_C, NR_TDD_FR1_C			-83.76
		NR_FDD_FR1_D NR_TDD_FR1_D			-83.26
		NR_FDD_FR1_E NR_TDD_FR1_E			-82.76
		NR_FDD_FR1_F			-82.26
		NR_FDD_FR1_G, NR_TDD_FR1_G			-81.76
		NR_FDD_FR1_H			-81.26
		NR_FDD_FR1_N			-78.26
Propagation condition			-	AWGN	
Antenna configuration			-	1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 5: NR operating band groups are as defined in clause 3.5.2.					
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.					

A.8.5.2.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.1 in TS 36.133 [15].

A.8.5.2.1.2 E-UTRAN – NR inter-RAT measurements with FR2 target cell

A.8.5.2.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.1 in TS 36.133 [15] for inter-RAT FR2 SS-RSRP measurements.

A.8.5.2.1.2.2 Test Parameters

Supported test configurations are shown in table A.8.5.2.1.2.2-1. In this test case there are two cells on different carriers. Absolute accuracy requirements of SS-RSRP inter-RAT measurement are tested by using test setup in table A.8.5.2.1.2.2-2 and table A.8.5.2.1.2.2-3. In all test cases, Cell 2 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1.

Table A.8.5.2.1.2.2-1: SS-RSRP Inter-RAT SS-RSRP supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.8.5.2.1.2.2-2: SS-RSRP Inter-RAT general test parameters

Parameter	Unit	Test 1	Test 2
		Cell 2	Cell 2
SSB ARFCN		Freq1	freq1
Duplex mode		TDD	TDD
TDD configuration		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66

Downlink initial BWP configuration		DLBWP.0.1	
Uplink initial BWP configuration		ULBWP.0.1	
DRX cycle configuration	ms	Not applicable	
PDSCH Reference measurement channel		-	-
RMSI CORESET Reference Channel		-	-
OCNG Patterns		OP.1	OP.1
SMTC configuration		SMTC.1	SMTC.1
SSB configuration		SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Void NOTE 3: Void NOTE 4: Void			

Table A.8.5.2.1.2.2-3: SS-RSRP Inter-RAT OTA related test parameters

Parameter	Unit	Test 1	Test 2
		Cell 2	Cell 2
Angle of arrival configuration		Setup 1 according to A.3.15.1	Setup 1 according to A.3.15.1
Assumption for UE beams Note 10		Rough	Rough
N_{oc} Note1	dBm/15kHz Note4	-105	N/A
N_{oc} Note1	dBm/SCS Note4	-96	N/A
Es	dBm/SCS Note4		(Table B.2.3-2 Rx Beam Peak +1 dB) (Note 7)
$\hat{E}_s / N_{oc}$	dB	11	N/A
SSB_RP Note2	dBm/SCS Note4	-85	(Table B.2.3-2 Rx Beam Peak +1 dB) (Note 7)
$\hat{E}_s / I_{ot}$ BB Note 2, Note 9	dB	9.97	-3.81
Io Note2	dBm/95.04 MHz Note4	-55.65	(Table B.2.3-2 Rx Beam Peak +30 dB) (Note 8)

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 5: Void
NOTE 6: Void
NOTE 7: SSB_RP is applied at 1 dB above the minimum level specified in table B.2.3-2 for beam peak.
NOTE 8: Io is applied at $10\log_{10}(792)$dB+1 dB above the minimum level specified in table B.2.3-2 for beam peak.
NOTE 9: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.8.5.2.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.1 in TS 36.133 [15].

A.8.5.2.2 SS-RSRQ

A.8.5.2.2.1 E-UTRAN – NR inter-RAT measurements with FR1 target cell

A.8.5.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.2 in TS 36.133 [15] for inter-RAT FR1 SS-RSRQ measurements.

A.8.5.2.2.1.2 Test Parameters

Supported test configurations are shown in table A.8.5.2.2.1.2-1. In this test case there are two cells on different carriers. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1. Cell 2 is the inter-RAT NR FR1 target cell. The absolute accuracy requirements of SS-RSRP inter-RAT measurement is tested by using test parameters in table A.8.5.2.2.1.2-2.

Table A.8.5.2.2.1.2-1: SS-RSRQ Inter-RAT SS-RSRQ supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.8.5.2.2.1.2-2: SS-RSRQ inter-RAT test parameters

Parameter		Unit	Test 1	Test 2	Test 3
			Cell 2	Cell 2	Cell 2
SSB ARFCN			freq1	freq1	freq1
Duplex mode	Config 1,4		FDD		
	Config 2,3,5,6		TDD		
TDD configuration	Config 1,4		Not Applicable		
	Config 2,5		TDDConf.1.1		
	Config 3,6		TDDConf.2.1		
Downlink initial BWP configuration			DLBWP.0.1		
Uplink initial BWP configuration			ULBWP.0.1		
DRX Cycle configuration		ms	Not Applicable		
PDSCH Reference measurement channel	Config 1,4		-	-	-
	Config 2,5				
	Config 3,6				
RMSI CORESET Reference Channel	Config 1,4		-	-	-
	Config 2,5				
	Config 3,6				
Dedicated CORESET Reference Channel	Config 1,4		-	-	-
	Config 2,5				
	Config 3,6				
OCNG Patterns			OP.1		
SS-RSSI-Measurement			Not Applicable		
SMTC configruation			SMTC.1		
SSB configuration	Config 1,2,4,5		SSB.1 FR1		
	Config 3,6		SSB.2 FR1		

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2		Cell 2		Cell 2	
PDSCH/PDCCH subcarrier spacing		Config 1,2,4,5	kHz	15					
		Config 3,6		30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15kHz	-80.18		-106		-116	
		NR_FDD_FR1_B						-115.5	
		NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
	Config 3,6			-86.27		-113		Same as Noc for Config 1,2,4,5	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-80.18		-106		Same as Noc for 15kHz	
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-83.27		-110		-113	
		NR_FDD_FR1_B						-112.5	
		NR_TDD_FR1_C						-112	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-111.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-111	
		NR_FDD_FR1_F						-110.5	
		NR_FDD_FR1_G						-110	
		NR_FDD_FR1_H						-109.5	
		NR_FDD_FR1_N						-106.5	
$\hat{E}_s / I_{ot}$			dB	-1.75		-1.75		-1.75	
$\hat{E}_s / N_{oc}$			dB	-1.75		-1.75		-1.75	
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-81.93		-107.75		-117.75	
		NR_FDD_FR1_B						-117.25	
		NR_TDD_FR1_C						-116.75	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-116.25	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-115.75	
		NR_FDD_FR1_F						-115.25	
		NR_FDD_FR1_G						-114.75	
		NR_FDD_FR1_H						-114.25	
		NR_FDD_FR1_N						-111.25	
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85.02		-111.75		-114.75	
		NR_FDD_FR1_B						-114.25	
		NR_TDD_FR1_C						-113.75	

Parameter			Unit	Test 1	Test 2	Test 3
				Cell 2	Cell 2	Cell 2
		NR_FDD_FR1_D, NR_TDD_FR1_D				-113.25
		NR_FDD_FR1_E, NR_TDD_FR1_E				-112.75
		NR_FDD_FR1_F				-112.25
		NR_FDD_FR1_G				-111.75
		NR_FDD_FR1_H				-111.25
		NR_FDD_FR1_N				-108.25
SS-RSRQ Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-14.77	-40.59	-14.76
		NR_FDD_FR1_B				
		NR_TDD_FR1_C				
		NR_FDD_FR1_D, NR_TDD_FR1_D				
		NR_FDD_FR1_E, NR_TDD_FR1_E				
		NR_FDD_FR1_F				
		NR_FDD_FR1_G				
		NR_FDD_FR1_H				
		NR_FDD_FR1_N				
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-50	-75.83	-85.83
		NR_FDD_FR1_B				-85.33
		NR_TDD_FR1_C				-84.83
		NR_FDD_FR1_D, NR_TDD_FR1_D				-84.33
		NR_FDD_FR1_E, NR_TDD_FR1_E				-83.83
		NR_FDD_FR1_F				-83.33
		NR_FDD_FR1_G				-82.83
		NR_FDD_FR1_H				-82.33
		NR_FDD_FR1_N				-79.33
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-50	-76.73	-79.73
		NR_FDD_FR1_B				-79.23
		NR_TDD_FR1_C				-78.73
		NR_FDD_FR1_D, NR_TDD_FR1_D				-78.23
		NR_FDD_FR1_E, NR_TDD_FR1_E				-77.73
		NR_FDD_FR1_F				-77.23
		NR_FDD_FR1_G				-76.73
		NR_FDD_FR1_H				-76.53
		NR_FDD_FR1_N				-73.53
Propagation condition			-	AWGN		
Antenna configuration			-	1x2		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.8.5.2.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.2 in TS 36.133 [15].

A.8.5.2.2.2 E-UTRAN – NR inter-RAT measurements with FR2 target cell

A.8.5.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.2 in TS 36.133 [15] for inter-RAT FR2 SS-RSRQ measurements.

A.8.5.2.2.2.2 Test Parameters

Supported test configurations are shown in table A.8.5.2.2.2.2-1. In this test case there are two cells on different carriers. Absolute accuracy requirements of SS-RSRQ inter-RAT measurement are tested by using test setup in table A.8.5.2.2.2.2-2 and table A.8.5.2.2.2.2-3. In all test cases, Cell 2 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1.

Table A.8.5.2.2.2.2-1: SS-RSRQ Inter-RAT SS-RSRQ supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.8.5.2.2.2.2-2: SS-RSRQ Inter-RAT general test parameters

Parameter	Unit	Test 1	Test 2
		Cell 2	Cell 2
SSB ARFCN		Freq1	freq1
Duplex mode		TDD	TDD
TDD configuration		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
Downlink initial BWP configuration		DLBWP.0.1	
Uplink initial BWP configuration		ULBWP.0.1	
DRX cycle configuration	ms	Not applicable	
PDSCH Reference measurement channel		-	-
RMSI CORESET Reference Channel		-	-
OCNG Patterns		OP.1	OP.1
SMTC configuration		SMTC.1	SMTC.1
SSB configuration		SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Void NOTE 3: Void NOTE 4: Void			

Table A.8.5.2.2.2.2-3: SS-RSRQ Inter-RAT OTA related test parameters

Parameter	Unit	Test 1	Test 2
		Cell 2	Cell 2
Angle of arrival configuration		Setup 1 according to A.3.15.1	Setup 1 according to A.3.15.1
Assumption for UE beams Note 10		Rough	Rough
N_{oc} Note1	dBm/15kHz Note4	-104.7	(Table B.2.3-2 Rx Beam Peak -5 dB)

Parameter	Unit	Test 1	Test 2
		Cell 2	Cell 2
			(Note 7)
N_{oc} Note1	dBm/SCS Note4	-95.7	(Table B.2.3-2 Rx Beam Peak +4 dB) (Note 7)
$\hat{E}_s / N_{oc}$	dB	-0.5	-1.75
SSB_RP Note2	dBm/SCS Note4	-96.2	(Table B.2.3-2 Rx Beam Peak +2.25 dB) (Note 8)
SS-RSRQ Note2	dB	-3.27	-14.82
$\hat{E}_s / I_{ot}$ Note2	dB	-0.5	-1.75
Io Note2	dBm/95.04 MHz Note4	-63.95	(Table B.2.3-2 Rx Beam Peak +35.22 dB) (Note 9)

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, SS-RSRQ, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 5: Void
NOTE 6: Void
NOTE 7: N_{oc} for SCS 15kHz is applied at $-10\log_{10}(8)+4$ dB above the minimum level specified in table B.2.3-2 for beam peak. N_{oc} for SCS 120kHz is applied at 4 dB above the minimum level specified in table B.2.3-2 for beam peak.
NOTE 8: SSB_RP is applied at 2.25 dB above the minimum level specified in table B.2.3-2 for beam peak.
NOTE 9: Io is applied at $10\log_{10}(792)+6.22$ dB above the minimum level specified in table B.2.3-2 for beam peak.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.8.5.2.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.2 in TS 36.133 [15].

In this test case there are two cells on different carriers and measurement gaps are provided

A.8.5.2.3 SS-SINR

A.8.5.2.3.1 E-UTRAN – NR inter-RAT measurements with FR1 target cell

A.8.5.2.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS- SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.3 in TS 36.133 [15] for inter-RAT FR1 SS-SINR measurements.

A.8.5.2.3.1.2 Test Parameters

Supported test configurations are shown in table A.8.5.2.3.1.2-1. In this test case there are two cells on different carriers. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1. Cell 2 is the inter-RAT NR FR1 target cell. The absolute accuracy requirements of SS-RSRP inter-RAT measurement is tested by using test parameters in table A.8.5.2.3.1.2-2.

Table A.8.5.2.3.1.2-1: SS- SINR Inter-RAT SS- SINR supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode

6	LTE TDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.8.5.2.3.1.2-2: SS-SINR inter-RAT test parameters

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2		Cell 2		Cell 2	
SSB ARFCN				freq1		freq1		freq1	
Duplex mode		Config 1,4		FDD					
		Config 2,3,5,6		TDD					
TDD configuration		Config 1,4		Not Applicable					
		Config 2,5		TDDConf.1.1					
		Config 3,6		TDDConf.2.1					
Downlink initial BWP configuration				DLBWP.0.1					
Uplink initial BWP configuration				ULBWP.0.1					
DRX Cycle configuration			ms	Not Applicable					
PDSCH Reference measurement channel		Config 1,4		-		-		-	
		Config 2,5							
		Config 3,6							
RMSI CORESET Reference Channel		Config 1,4		-		-		-	
		Config 2,5							
		Config 3,6							
Dedicated CORESET Reference Channel		Config 1,4		-		-		-	
		Config 2,5							
		Config 3,6							
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
SMTC configruation				SMTC.1					
SSB configuration		Config 1,2,4,5		SSB.1 FR1					
		Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing		Config 1,2,4,5	kHz	15					
		Config 3,6		30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS (Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15kHz	-880		-108.5		-119.5	
		NR_FDD_FR1_B, NR_TDD_FR1_B						-119	
		NR_FDD_FR1_C, NR_TDD_FR1_C						-118.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-118	
		NR_FDD_FR1_E NR_TDD_FR1_E						-117.5	
		NR_FDD_FR1_F						-117	
		NR_FDD_FR1_G, NR_TDD_FR1_G						-116.5	
		NR_FDD_FR1_H						-116	
		NR_FDD_FR1_N						-113	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	[-80]		-88		-108.5	
	Config 3,6	NR_FDD_FR1_A		-85		-105.5		-116.5	

Parameter			Unit	Test 1	Test 2	Test 3
				Cell 2	Cell 2	Cell 2
		NR_TDD_FR1_A NOTE 6				
		NR_FDD_FR1_B, NR_TDD_FR1_B				-116
		NR_FDD_FR1_C, NR_TDD_FR1_C				-115.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-115
		NR_FDD_FR1_E NR_TDD_FR1_E				-114.5
		NR_FDD_FR1_F				-114
		NR_FDD_FR1_G, NR_TDD_FR1_G				-114.5
		NR_FDD_FR1_H				-113]
		NR_FDD_FR1_N				-110
$\hat{E}_s/I_{ot}$			dB	-1.75	20	-4.0
$\hat{E}_s/N_{oc}$			dB	-1.75	20	-4.0
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-89.75	-88.5	-123.5
		NR_FDD_FR1_B, NR_TDD_FR1_B				-123
		NR_FDD_FR1_C, NR_TDD_FR1_C				-122.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-122
		NR_FDD_FR1_E NR_TDD_FR1_E				-121.5
		NR_FDD_FR1_F				-121
		NR_FDD_FR1_G, NR_TDD_FR1_G				-120.5
		NR_FDD_FR1_H				-120
		NR_FDD_FR1_N				-117
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-86.75	-85.5	-120.5
		NR_FDD_FR1_B, NR_TDD_FR1_B				-120
		NR_FDD_FR1_C, NR_TDD_FR1_C				-119.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-119
		NR_FDD_FR1_E NR_TDD_FR1_E				-118.5
		NR_FDD_FR1_F				-118
		NR_FDD_FR1_G, NR_TDD_FR1_G				-117.5
		NR_FDD_FR1_H				-117
		NR_FDD_FR1_N				-114
SS-SINR Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-1.75	20	-4.0
		NR_FDD_FR1_B, NR_TDD_FR1_B				
		NR_FDD_FR1_C, NR_TDD_FR1_C				
		NR_FDD_FR1_D NR_TDD_FR1_D				
		NR_FDD_FR1_E NR_TDD_FR1_E				
		NR_FDD_FR1_F				
		NR_FDD_FR1_G, NR_TDD_FR1_G				
		NR_FDD_FR1_H				

Parameter			Unit	Test 1	Test 2	Test 3
				Cell 2	Cell 2	Cell 2
		NR_FDD_FR1_N				
Io[Note3]	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.83	-60.5	-90.09
		NR_FDD_FR1_B, NR_TDD_FR1_B				-89.59
		NR_FDD_FR1_C, NR_TDD_FR1_C				-89.09
		NR_FDD_FR1_D NR_TDD_FR1_D				-88.59
		NR_FDD_FR1_E NR_TDD_FR1_E				-88.09
		NR_FDD_FR1_F				-87.59
		NR_FDD_FR1_G, NR_TDD_FR1_G				-87.09
		NR_FDD_FR1_H				-86.59
		NR_FDD_FR1_N				-83.59
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	-51.73	-54.41	-84
		NR_FDD_FR1_B, NR_TDD_FR1_B				-83.5
		NR_FDD_FR1_C, NR_TDD_FR1_C				-83
		NR_FDD_FR1_D NR_TDD_FR1_D				-82.5
		NR_FDD_FR1_E NR_TDD_FR1_E				-82
		NR_FDD_FR1_F				-81.5
		NR_FDD_FR1_G, NR_TDD_FR1_G				-81
		NR_FDD_FR1_H				-80.5
		NR_FDD_FR1_N				-77.5
Propagation condition			-	AWGN		
Antenna configuration			-	1x2		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.8.5.2.3.1.3 Test Requirements

The SS-SINR measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.3 in TS 36.133 [15].

A.8.5.2.3.2 E-UTRAN – NR inter-RAT measurements with FR2 target cell

A.8.5.2.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS- SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.3 in TS 36.133 [15] for inter-RAT FR2 SS-SINR measurements.

A.8.5.2.3.2.2 Test Parameters

Supported test configurations are shown in table A.8.5.2.3.2.2-1. In this test case there are two cells on different carriers. Absolute accuracy requirements of SS-SINR inter-RAT measurement are tested by using test setup in table A.8.5.2.3.2.2-2 and A.8.5.2.3.2.2-3. In all test cases, Cell 2 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in table A.3.7.2.1-1.

Table A.8.5.2.3.2.2-1: SS-SINR Inter-RAT SS-SINR supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.8.5.2.3.2.2-2: SS-SINR Inter-RAT general test parameters

Parameter	Unit	Test 1	Test 2	Test 3
		Cell 2	Cell 2	Cell 2
SSB ARFCN		Freq1	freq1	freq1
Duplex mode		TDD	TDD	TDD
TDD configuration		TDDConf.3.1	TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66
Downlink initial BWP configuration		DLBWP.0.1		
Uplink initial BWP configuration		ULBWP.0.1		
DRX cycle configuration	ms	Not applicable		
PDSCH Reference measurement channel		-	-	-
RMSI CORESET Reference Channel		-	-	-
OCNG Patterns		OP.1	OP.1	OP.1
SMTC configuration		SMTC.1	SMTC.1	SMTC.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0
EPRE ratio of PBCH_DMRS to SSS				
EPRE ratio of PBCH to PBCH_DMRS				
EPRE ratio of PDCCH_DMRS to SSS				
EPRE ratio of PDCCH to PDCCH_DMRS				
EPRE ratio of PDSCH_DMRS to SSS				
EPRE ratio of PDSCH to PDSCH_DMRS				
EPRE ratio of OCNG DMRS to SSS[Note 1]				
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Void NOTE 3: Void NOTE 4: Void				

Table A.8.5.2.3.2.2-3: SS-SINR Inter-RAT OTA related test parameters

Parameter	Unit	Test 1	Test 2	Test 3
		Cell 2	Cell 2	Cell 2
Angle of arrival configuration		Setup 1 according to A.3.15.1	Setup 1 according to A.3.15.1	Setup 1 according to A.3.15.1
Assumption for UE beams[Note 10]		Rough	Rough	Rough
N_{oc} [Note1]	dBm/15kHz [Note4]	-104.7	-104.7	(Table B.2.3-2 Rx Beam Peak -5 dB) (Note 7)
N_{oc} [Note1]	dBm/SCS [Note4]	-95.7	-95.7	(Table B.2.3-2 Rx Beam Peak +4 dB) (Note 7)
$\hat{E}_s / N_{oc}$	dB	-0.5	11	-1.0
SSB_RP[Note2]	dBm/SCS [Note4]	-96. 2	-84.7	(Table B.2.3-2 Rx Beam Peak +3 dB) (Note 8)
SS-SINR[Note2]	dB	-0.5	11	-1.0
$\hat{E}_s / I_{ot}$ [Note2]	dB	-0.5	11	-1.0

Io[Note2]	dBm/95.04 MHz [Note4]	-63.95	-55.38	(Table B.2.3-2 Rx Beam Peak +35.54 dB) (Note 9)

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, SS-SINR, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 5: Void
NOTE 6: Void
NOTE 7: N_{oc} for SCS 15kHz is applied at $-10\log_{10}(8)+4$ dB above the minimum level specified in table B.2.3-2 for beam peak. N_{oc} for SCS 120kHz is applied at 4 dB above the minimum level specified in table B.2.3-2 for beam peak.
NOTE 8: SSB_RP is applied at 3 dB above the minimum level specified in table B.2.3-2 for beam peak.
NOTE 9: Io is applied at level $10\log_{10}(792)+6.54$ dB above the minimum level specified in table B.2.3-2 for beam peak.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.8.5.2.3.2.3 Test Requirements

The SS-SINR measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.3 in TS 36.133 [15].

A.9 V2X Tests

A.9.1 V2X Tests in FR1

A.9.1.1 Test for V2X UE Transmit Timing

A.9.1.1.1 Test for GNSS as Synchronization Reference Source

A.9.1.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the UE timing requirements as specified in clause 12.2.2, when the GNSS is used as timing reference. For this test, the UE is triggered by the test loop function to transmit for V2X sidelink communication.

Table A.9.1.1.1.1-1 defines test parameters for UE transmit timing accuracy tests for V2X. There is one GNSS based synchronization source during the test. The test system can emulate and send the GNSS signal to the test UE. The test parameters for GNSS signals are defined in B.4.1.

Table A.9.1.1.1.1-1: V2X Sidelink Test Parameters for UE Transmit Timing Tests for GNSS as Timing Reference

Parameter	Unit	Value	Comment
RF Channel Number		1	HD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 1	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS	kHz	30	
Active cell		None	
Active SyncRef UE		None	
V2X sidelink communication preconfiguration		As specified in section A.3.21.2	IE values unless specified otherwise in this test.
PSCCH Reference Measurement Channel		CC.1A HD	As specified in table A.3.21.3-1
PSSCH Reference Measurement Channel		CD.1A HD	As specified in table A.3.21.3-2
Propagation condition		AWGN	

NOTE 1: The UE is only required to be tested in one of the supported test configurations.

A.9.1.1.1.2 Test requirements

For parameters specified in tables A.9.1.1.1-1, the timing accuracy for V2X sidelink transmission shall be within the limits defined in clause 12.2.2. The timing accuracy is verified by using PSSCH transmissions.

A.9.1.1.2 Test for SyncRef UE as Synchronization Reference Source

A.9.1.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the timing requirements for V2X sidelink transmissions specified in clause 12.2.5, when SyncRef UE is used as timing reference. For this test, the UE is triggered by the test loop function to transmit for V2X sidelink communication.

Table A.9.1.1.2.1-1 defines test parameters for UE transmit timing accuracy tests for V2X sidelink Communication. There is one active SyncRef UE in this test without either serving cell and or GNSS signals. Before the test starts, the UE has been synchronized to the SyncRef UE. The transmit timing accuracy is verified by using the transmission timing of PSSCH transmissions.

Table A.9.1.1.2.1-1: General Test Parameters for V2X UE Transmit Timing Test for SyncRef UE as Timing Reference

Parameter		Unit	Value	Comment
RF Channel Number			1	HD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 3		MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS		kHz	30	
Active cell			None	
Active SyncRef UE			SyncRef UE 1	Transmitting S-SSB on RF channel number 1
V2X sidelink communication preconfiguration			As specified in section A.3.21.2	IE values unless specified otherwise in this test.
PSCCH Reference Measurement Channel			CC.1A HD	As specified in table A.3.21.3-1
PSSCH Reference Measurement Channel			CD.1A HD	As specified in table A.3.21.3-2
N_{oc} Note1,2		dBm/30kHz	-95	
SyncRef UE 1	sl-SSB-TimeAllocation		sl-SSB-TimeAllocation1	
	slssid		30	
	inCoverage		TRUE	In MIB-SL
	networkControlledSyncTx		ON	
	V2X sidelink communication configuration		As specified in section A.3.21.2	IE values unless specified otherwise in this test.
	$\hat{E}_s / N_{oc}$		3	
	PSBCH-RSRP Note1, Note 2	dBm/30kHz	-92	
Propagation condition			AWGN	

NOTE 1: PSBCH-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 2: S-PSS E_s/N_{oc} and S-SSS E_s/N_{oc} are set the same as PSBCH E_s/N_{oc}.
NOTE 3: The UE is only required to be tested in one of the supported test configurations.

A.9.1.1.2.2 Test requirements

For parameters specified in tables A.9.1.1.2.1-1, the timing accuracy for V2X sidelink transmission shall be within the limits defined in clause 12.2.5. The timing accuracy is verified by using PSSCH transmissions.

A.9.1.1.3 Test for FR1 NR Cell as Synchronization Reference Source

A.9.1.1.3.1 Test Purpose and Environment

The purpose of this test is to verify the timing requirements for V2X sidelink transmissions specified in clause 12.2.3, when the downlink timing of the serving cell (RRC_IDLE) or PCell (RRC_CONNECTED) on a non-V2X sidelink carrier is used as timing reference. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X sidelink communication.

This test is applicable for V2X sidelink communication capable UEs that support NR Uu and sidelink operation.

Table A.9.1.1.3.1-1, A.9.1.1.3.1-2 and A.9.1.1.3.1-3 define test parameters for UE transmit timing accuracy tests for V2X sidelink Communication. There is one active cell (PCell) in this test. The transmit timing accuracy is verified by using the transmission timing of PSSCH transmissions.

Table A.9.1.1.3.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	NR Uu: FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR Uu: TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR Uu: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.9.1.1.3.1-2: V2X Sidelink Test Parameters for V2X UE Transmit Timing Accuracy Test for gNB as Timing Reference

Parameter	Unit	Value	Comment
RF Channel Number		1	HD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 1	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS	kHz	30	
Active cell		Cell 1	
Active SyncRef UE		None	
V2X sidelink communication configuration		As specified in section A.3.21.2	IE values unless specified otherwise in this test.
PSCCH Reference Measurement Channel		CC.1A HD	As specified in table A.3.21.3-1
PSSCH Reference Measurement Channel		CD.1A HD	As specified in table A.3.21.3-2
NOTE 1: The UE is only required to be tested in one of the supported test configurations.			

Table A.9.1.1.3.1-3: Cell Test Parameters for V2X UE Transmit Timing Accuracy Test for gNB as Timing Reference

Parameter		Unit	Cell 1
RF Channel Number			2
Duplex Mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
Channel Bandwidth ($BW_{channel}$)	Config 1,2	MHz	10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
Initial BWP Configuration			DLBWP.0.1 ULBWP.0.1
Dedicated BWP Configuration			DLBWP.1.1 ULBWP.1.1
DRX Cycle			N/A
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD

Parameter		Unit	Cell 1
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration			SMTC.2
OCNG Patterns			OP.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-98
N_{oc} Note2	Config 1,2	dBm/SCS	-98
	Config 3		-95
$\hat{E}_s / N_{oc}$		dB	3
SS-RSRP Note3	Config 1,2	dBm/SCS	-95
	Config 3		-92
Io Note 3	Config 1,2	dBm/9.36 MHz	-65.2
	Config 3	dBm/38.1 MHz	-59.2
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.9.1.1.3.2 Test requirements

For parameters specified in tables A.9.1.1.3.1-1 A.9.1.1.3.1-2 and A.9.1.1.3.1-3, the timing accuracy for V2X sidelink transmission shall be within the limits defined in clause 12.2.3. The timing accuracy is verified by using PSSCH transmissions.

A.9.1.2 Test for Initiation/Cease of S-SSB Transmission with V2X Sidelink Communication

A.9.1.2.1 Test for FR1 NR Cell as synchronization reference source without gap under non-DRX

A.9.1.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the V2X UE meets the requirements related to the maximum evaluation time allowed to initiate and cease S-SSB transmissions defined in clause 12.3.1.1, when the reference timing used for sidelink transmissions is a NR serving cell in FR1 on a non-V2X sidelink carrier.

This test is applicable for V2X sidelink communication capable UEs that support NR Uu and sidelink operation.

Supported test configurations for FR1 NR cell are shown in table A.9.1.2.1.1-1.

Table A.9.1.2.1.1-1: Supported Test Configurations for FR1 NR cell as synchronization reference source

Configuration	Description
1	NR Uu: FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR Uu: TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR Uu: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE 1: The UE is only required to pass in one of the supported test configurations in FR1. NOTE 2: For NR SL, SL BW is one between 20 MHz and 40 MHz, and SL SCS is 30kHz.	

The test parameters are given in table A.9.1.2.1.1-2 and table A.9.1.2.1.1-3 below. There is one active cell in this test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively.

During T1, the SS-RSRP of the PCell is above *syncTxThreshIC* and the UE is not expected to be transmitting S-SSB.

During T2, the SS-RSRP of the PCell is lowered below *syncTxThreshIC* and the UE is expected to initiate S-SSB transmissions.

During T3, the SS-RSRP of the PCell is increased back to be above *syncTxThreshIC* and the UE is expected to cease S-SSB transmissions.

Table A.9.1.2.1.1-2: Test Parameters for Initiation/Cease of S-SSB Transmission Test for FR1 NR cell as synchronization reference source

Parameter	Unit	Value	Comment
SCS	kHz	30	
Active cell		Cell 1	Serving cell on RF channel number 1
Active SyncRef UE		None	
Active V2X UE		V2X UE	Transmitting S-SSB on RF channel number 2 (HD carrier in Band n47 or n38)
V2X sidelink communication configuration		As specified in table A.3.21.2-2	IE values unless specified otherwise in this test
networkControlledSyncTx		Not configured	
syncTxThreshIC	dBm/SCS	-110	In SIB12
DRX		OFF	
T1	s	3	
T2	s	5.24	
T3	s	5.24	

Table A.9.1.2.1.1-3: FR1 NR Cell Specific Test Parameters for Initiation/Cease of S-SSB Transmission Test for FR1 NR cell as synchronization reference source

Parameter		Unit	Cell 1		
			T1	T2	T3
NR RF Channel Number			1		
Duplex Mode	Config 1		FDD		
	Config 2,3		TDD		
TDD configuration	Config 1		Not applicable		
	Config 2		TDDConf.1.1		
	Config 3		TDDConf.2.1		
Channel Bandwidth ($BW_{channel}$)	Config 1,2	MHz	10:$N_{PRB,c}$ = 52		
	Config 3		40:$N_{PRB,c}$ = 106		
Initial BWP Configuration			DLBWP.0.1 ULBWP.0.1		
Dedicated BWP Configuration			DLBWP.1.1 ULBWP.1.1		
DRX Cycle		ms	N/A		
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD		
	Config 2		SR.1.1 TDD		
	Config 3		SR.2.1 TDD		
CORESET Reference Channel	Config 1		CR.1.1 FDD		
	Config 2		CR.1.1 TDD		
	Config 3		CR.2.1 TDD		
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD		
	Config 2		CCR.1.1 TDD		
	Config 3		CCR.2.1 TDD		
SSB configuration	Config 1,2		SSB.1 FR1		
	Config 3		SSB.2 FR1		

Parameter		Unit	Cell 1		
			T1	T2	T3
SMTC Configuration	Config 1		SMTC.2		
	Config 2,3		SMTC.1		
TRS configuration	Config 1		TRS.1.1 FDD		
	Config 2		TRS.1.1 TDD		
	Config 3		TRS.1.2 TDD		
OCNG Patterns			OP.1		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-110		
	Config 1,2	dBm /SCS	-110		
	Config 3		-107		
$\hat{E}_s / N_{oc}$		dB	4.5	-4.5	4.5
$\hat{E}_s / I_{ot}$		dB	4.5	-4.5	4.5
SS-RSRP Note3	Config 1,2	dBm /SCS	-105.5	-114.5	-105.5
	Config 3		-102.5	-111.5	-102.5
Io Note3	Config 1,2	dBm /9.36 MHz	-76.2	-80.7	-76.2
	Config 3	dBm/ 38.16 MHz	-70.1	-74.6	-70.1
Propagation condition			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.9.1.2.1.2 Test Requirements

The S-SSB transmission initiation delay is defined as the time from the beginning of time period T2 up to the moment when the UE initiates the S-SSB transmission.

The S-SSB transmission initiation delay shall be less than 0.56 s.

The S-SSB transmission cease delay is defined as the time from the beginning of time period T3 up to the moment when the UE ceases the S-SSB transmission.

The S-SSB transmission cease delay shall be less than 0.56 s.

The rate of correct initiation/cease delay of S-SSB transmissions observed during repeated tests shall be at least 90 %.

NOTE: The initiation/cease delay of S-SSB transmissions can be expressed as: $T_{evaluate,SLSS}$ + S-SSB period,

Where:

$T_{evaluate,SLSS}$ = 0.4 sec (as specified in clause 12.3.1.1);

S-SSB period = 160 ms.

A.9.1.2.2 Test for SyncRef UE as synchronization reference source

A.9.1.2.2.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to the evaluation time allowed to initiate and cease S-SSB transmissions defined in clause 12.3.1.4, when the reference timing used for sidelink transmissions is a SyncRef UE.

The test parameters are given in table A.9.1.2.2.1-1 and table A.9.1.2.2.1-2 below. There are neither active cells nor GNSS signals in this test. There is one active SyncRef UE (SyncRef UE 1) in this test. The test system shall emulate SyncRef UE 1 to transmit S-SSB every synchronization period.

Prior to start of test, test system is required to ensure that the V2X UE is synchronized to the SyncRef UE 1 and is transmitting S-SSB as derived from the S-SSB of SyncRef UE 1 as per clause 5.8.5.3 of TS 38.331[2]. For the test configuration, the SLSSID used by the V2X UE shall be 30 with *inCoverage* IE in MIB-SL set as FALSE. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively.

During T1, the PSBCH-RSRP of SyncRef UE 1 is above *syncTxThreshOOC* and the UE is not expected to be transmitting S-SSB.

During T2, the PSBCH-RSRP of SyncRef UE 1 is lowered below *syncTxThreshOOC* and the UE is expected to initiate S-SSB transmissions.

During T3, the PSBCH-RSRP of SyncRef UE 1 is increased back to be above *syncTxThreshOOC* and the UE is expected to cease S-SSB transmissions.

Table A.9.1.2.2.1-1: Test Parameters for Initiation/Cease of S-SSB Transmission Test for SyncRef UE as synchronization reference source

Parameter	Unit	Value	Comment
SCS	kHz	30	
Active cell		None	
Active SyncRef UE		SyncRef UE 1	Transmitting S-SSB on RF channel number 1(HD carrier in Band n47 or n38)
Active V2X UE		V2X UE	Transmitting S-SSB on RF channel number 1(HD carrier in Band n47 or n38)
V2X sidelink communication preconfiguration		As specified in table A.3.21.2-2	IE values unless specified otherwise in this test
networkControlledSyncTx		Not configured	
syncTxThreshOoC	dBm/30kHz	-100	
T1	s	3	
T2	s	5.24	
T3	s	5.24	

Table A.9.1.2.2.1-2: SyncRef UE Specific Test Parameters for Initiation/Cease of S-SSB Transmission Test for SyncRef UE as synchronization reference source

Parameter	Unit	SyncRef UE 1		
		T1	T2	T3
NR RF Channel Number		1		
V2X SL communication resource pool configuration		As specified in table A.3.21.2-2		
Channel Bandwidth ($BW_{channel}$) Note3	MHz	20($N_{PRB,c}$ = 50) or 40($N_{PRB,c}$ = 100)		
SLSSID		30		
inCoverage		TRUE		
networkControlledSyncTx		ON		
N_{oc} Note1	dBm/30 kHz	-98		
$\hat{E}_s / I_{ot}$	dB	5.5	-3.5	5.5
PSBCH $\hat{E}_s / N_{oc}$	dB	5.5	-3.5	5.5
PSBCH-RSRP Note2	dBm/30 kHz	-92.5	-101.5	-92.5
Io Note2	dBm /18 MHz	-63.6	-68.6	-63.6
	dBm/36 MHz	-60.6	-65.6	-60.6
Propagation condition		AWGN		

NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PSBCH-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io level is based on the allocated PRBs for S-PSS/S-SSS/PSBCH symbols.
NOTE 3: The UE is only required to be tested in one of the supported test configurations.
NOTE 4: S-PSS Es/Noc and S-SSS Es/Noc are set the same as PSBCH Es/Noc.

A.9.1.2.2.2 Test Requirements

The S-SSB transmission initiation delay is defined as the time from the beginning of time period T2 up to the moment when the UE initiates the S-SSB transmission.

The S-SSB transmission initiation delay shall be less than 0.8 s.

The S-SSB transmission cease delay is defined as the time from the beginning of time period T3 up to the moment when the UE ceases the S-SSB transmission.

The S-SSB transmission cease delay shall be less than 0.8 s.

The rate of correct initiation/cease delay of S-SSB transmissions observed during repeated tests shall be at least 90 %.

NOTE: The initiation/cease delay of S-SSB transmissions can be expressed as: $T_{evaluate,SLSS}$ + S-SSB period,

Where:

- $T_{evaluate,SLSS}$ = 0.64 sec (as specified in clause 12.3.1.4);
- S-SSB period = 160 ms.

A.9.1.2.3 Test for SyncRef UE as synchronization reference source when SL-DRX is used

A.9.1.2.3.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to the evaluation time allowed to initiate and cease S-SSB transmissions defined in clause 12.3.1.4, when the reference timing used for sidelink transmissions is a SyncRef UE and SL-DRX is used.

The test parameters are given in table A.9.1.2.3.1-1 and table A.9.1.2.3.1-2 below. There are neither active cells nor GNSS signals in this test. There is one active SyncRef UE (SyncRef UE 1) in this test. The test system shall emulate SyncRef UE 1 to transmit S-SSB every synchronization period.

Prior to start of test, test system is required to ensure that the V2X UE is synchronized to the SyncRef UE 1 and is transmitting S-SSB as derived from the S-SSB of SyncRef UE 1 as per clause 5.8.5.3 of TS 38.331[2]. For the test configuration, the SLSSID used by the V2X UE shall be 30 with *inCoverage* IE in MIB-SL set as FALSE. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively.

During T1, the PSBCH-RSRP of SyncRef UE 1 is above *syncTxThreshOOC* and the UE is not expected to be transmitting S-SSB.

During T2, the PSBCH-RSRP of SyncRef UE 1 is lowered below *syncTxThreshOOC* and the UE is expected to initiate S-SSB transmissions.

During T3, the PSBCH-RSRP of SyncRef UE 1 is increased back to be above *syncTxThreshOOC* and the UE is expected to cease S-SSB transmissions.

Table A.9.1.2.3.1-1: Test Parameters for Initiation/Cease of S-SSB Transmission Test for SyncRef UE as synchronization reference source when SL-DRX is used

Parameter	Unit	Value	Comment
SCS	kHz	30	

Active cell		None	
Active SyncRef UE		SyncRef UE 1	Transmitting S-SSB on RF channel number 1(HD carrier in Band n47 or n38)
Active V2X UE		V2X UE	Transmitting S-SSB on RF channel number 1(HD carrier in Band n47 or n38)
V2X sidelink communication preconfiguration		As specified in table A.3.21.2-2	IE values unless specified otherwise in this test
networkControlledSyncTx		Not configured	
syncTxThreshOoC	dBm/30kHz	-97	
SL-DRX		SL-DRX.2	SL-DRX configuration as specified in clause A.3.21.4
T1	s	3	
T2	s	5.24	
T3	s	5.24	

Table A.9.1.2.3.1-2: SyncRef UE Specific Test Parameters for Initiation/Cease of SLSS Transmission Test for SyncRef UE as synchronization reference source when SL-DRX is used

Parameter	Unit	Cell 1		
		T1	T2	T3
NR RF Channel Number		1		
V2X SL communication resource pool configuration		As specified in table A.3.21.2-2		
Channel Bandwidth ($BW_{channel}$) Note3	MHz	20($N_{PRB,c}$ = 50) or 40($N_{PRB,c}$ = 100)		
SLSSID		30		
inCoverage		FALSE		
networkControlledSyncTx		ON		
N_{oc} Note1	dBm/30 kHz	-98		
$\hat{E}_s/I_{ot}$	dB	5.5	-3.5	5.5
PSBCH $\hat{E}_s/N_{oc}$	dB	5.5	-3.5	5.5
PSBCH-RSRP Note2	dBm/30 kHz	-92.5	-101.5	-92.5
Io Note2	dBm /3.96 MHz	-70.2	-75.2	-70.2
Propagation condition		AWGN		

NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PSBCH-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io level is based on the allocated PRBs for PSPSS/PSSSS/PSBCH symbols.
NOTE 3: The UE is only required to be tested in one of the supported test configurations.
NOTE 4: PSSSS Es/Noc and PSPSS Es/Noc are set the same as PSBCH Es/Noc.

A.9.1.2.3.2 Test Requirements

The S-SSB transmission initiation delay is defined as the time from the beginning of time period T2 up to the moment when the UE initiates the S-SSB transmission.

The S-SSB transmission initiation delay shall be less than 1.44 s.

The S-SSB transmission cease delay is defined as the time from the beginning of time period T3 up to the moment when the UE ceases the S-SSB transmission.

The S-SSB transmission cease delay shall be less than 1.44 s.

The rate of correct initiation/cease delay of S-SSB transmissions observed during repeated tests shall be at least 90 %.

NOTE: The initiation/cease delay of S-SSB transmissions can be expressed as: $T_{evaluate,SLSS}$ + S-SSB period,

Where:

- $T_{evaluate,SLSS}$ = 1.28 sec (as specified in clause 12.3.1.4);
- S-SSB period = 160 ms.

A.9.1.2.4 Test for SyncRef UE as synchronization reference source with CCA

A.9.1.2.4.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to the evaluation time allowed to initiate and cease S-SSB transmissions defined in clause 12.3A.1.4, when the reference timing used for sidelink transmissions is a SyncRef UE.

The test parameters are given in table A.9.1.2.4.1-1 and table A.9.1.2.4.1-2 below. There are neither active cells nor GNSS signals in this test. There is one active SyncRef UE (SyncRef UE 1) in this test. The test system shall emulate SyncRef UE 1 to transmit S-SSB every synchronization period.

Prior to start of test, test system is required to ensure that the sidelink UE is synchronized to the SyncRef UE 1 and is transmitting S-SSB as derived from the S-SSB of SyncRef UE 1 as per clause 5.8.5.3 of TS 38.331[2]. For the test configuration, the SLSSID used by the sidelink UE shall be 30 with *inCoverage* IE in MIB-SL set as FALSE. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Two counters, l_{CCA_2} and l_{CCA_3}, as defined in A.3.26.4.1 will be used with time duration of T2 and T3 respectively.

During T1, the PSBCH-RSRP of SyncRef UE 1 is above *syncTxThreshOOC* and the UE is not expected to be transmitting S-SSB.

During T2, the PSBCH-RSRP of SyncRef UE 1 is lowered below *syncTxThreshOOC* and the UE is expected to initiate S-SSB transmissions. The counter l_{CCA_2} is initialized as 0 at the beginning of T2 and tracks the number of unavailable SSB periods as defined in A.3.26.4.1 until the end of T2.

During T3, the PSBCH-RSRP of SyncRef UE 1 is increased back to be above *syncTxThreshOOC* and the UE is expected to cease S-SSB transmissions. The counter l_{CCA_3} is initialized as 0 at the beginning of T3 and tracks the number of unavailable SSB periods as defined in A.3.26.4.1 until the end of T3.

Table A.9.1.2.4.1-1: Test Parameters for Initiation/Cease of S-SSB Transmission Test for SyncRef UE as synchronization reference source with CCA

Parameter	Unit	Value	Comment
SCS	kHz	30	
Active cell		None	
Active SyncRef UE		SyncRef UE 1	Transmitting S-SSB on RF channel number 1
Active sidelink UE		Sidelink UE	Transmitting S-SSB on RF channel number 1
Sidelink communication preconfiguration		As specified in table A.3.21.2-1 and table A.3.21.2-2	IE values unless specified otherwise in this test
networkControlledSyncTx		Not configured	
syncTxThreshOoC	dBm/30kHz	-97	
T1	s	3	
T2	s	5.24	
T3	s	5.24	

Table A.9.1.2.4.1-2: SyncRef UE Specific Test Parameters for Initiation/Cease of S-SSB Transmission Test for SyncRef UE as synchronization reference source with CCA

Parameter	Unit	SyncRef UE 1

		T1	T2	T3
NR RF Channel Number		1		
SL CCA model		As specified in clause A.3.26.4.1		
$P_{CCA_SL_SyncRefUE_1}$		0.75		
$P_{CCA_SL_SyncRefUE_2}$		0.75		
L_{CCA_SL}		4		
SL communication resource pool configuration		As specified in table A.3.21.2-1 and table A.3.21.2-2		
Channel Bandwidth ($BW_{channel}$) Note3	MHz	20($N_{PRB,c}$ = 50) or 40($N_{PRB,c}$ = 100)		
SLSSID		30		
inCoverage		TRUE		
networkControlledSyncTx		ON		
N_{oc} Note1	dBm/30 kHz	-98		
$\hat{E}_s / I_{ot}$	dB	5.5	-3.5	5.5
PSBCH $\hat{E}_s / N_{oc}$	dB	5.5	-3.5	5.5
PSBCH-RSRP Note2	dBm/30 kHz	-92.5	-101.5	-92.5
Io Note2	dBm/3.96 MHz	-70.2	-75.2	-70.2
Propagation condition		AWGN		
NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: PSBCH-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io level is based on the allocated PRBs for S-PSS/S-SSS/PSBCH symbols.				
NOTE 3: The UE is only required to be tested in one of the supported test configurations.				
NOTE 4: S-PSS Es/Noc and S-SSS Es/Noc are set the same as PSBCH Es/Noc.				

A.9.1.2.4.2 Test Requirements

The S-SSB transmission initiation delay is defined as the time from the beginning of time period T2 up to the moment when the UE initiates the S-SSB transmission.

The S-SSB transmission initiation delay shall be less than $T_{evaluate,SLSS_CCA}$ + S-SSB period.

The S-SSB transmission cease delay is defined as the time from the beginning of time period T3 up to the moment when the UE ceases the S-SSB transmission.

The S-SSB transmission cease delay shall be less than $T_{evaluate,SLSS_CCA}$ + S-SSB period.

Where:

- $T_{evaluate,SLSS_CCA}$ = (4+L_{SLSS})$\times$ S-SSB periods [ms] (as specified in clause 12.3A.1.4) and L_{SLSS} = l_{CCA_2} or l_{CCA_3}, is the number of unavailable S-SSB period during time duration of T2 and T3 respectively;
- S-SSB period = 160 ms.

The rate of correct initiation/cease delay of S-SSB transmissions observed during repeated tests shall be at least 90 %.

A.9.1.3 Test for V2X Synchronization Reference Selection/Reselection

A.9.1.3.1 Test for GNSS configured as the highest priority

A.9.1.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to SyncRef UE selection / reselection defined in clause 12.4, when GNSS is configured as the highest priority. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

The test parameters are given in table A.9.1.3.1.1-1and A.9.1.3.1.1-2 below. There are no GNSS signals in this test. There are three active SyncRef UEs (SyncRef UE 1, SyncRef UE 2 and SyncRef UE 3) in this test. The test system shall emulate SyncRef UE 1, SyncRef UE 2 and SyncRef UE 3 to transmit S-SSB every S-SSB period.

The test system can verify the selection / reselection of SyncRef UE by monitoring the SLSS ID used by the V2X UE for its S-SSB transmissions. When the V2X UE is not synchronized to any SyncRef UE, then the V2X UE shall use the SLSS ID belonging to set id_oon. When the V2X UE is synchronized to a SyncRef UE, the V2X UE shall derive its SLSS ID from the SLSS ID of the SyncRef UE as per clause 5.8.5.3 of TS 38.331[2].

The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. SyncRef UE 1, SyncRef UE 2 and SyncRef UE 3 are all powered off before starting the test. During T1, SyncRef UE 1 is powered ON and the V2X UE will select SyncRef UE 1 as synchronization source. During T2, SyncRef UE 2 is powered ON and the V2X UE will select SyncRef UE 2 as the synchronization source. During T3, SyncRef UE 3 is powered ON and the V2X UE will reselect to SyncRef UE 3 as the synchronization source.

Table A.9.1.3.1.1-1: Test Parameters for V2X Synchronization Reference Selection/Reselection Tests for GNSS configured as the highest priority

Parameter		Unit	Value	Comment
SCS		kHz	30	
Initial condition	Active synchronization source		Sync Ref UE 1	DUT transmits for V2X Sidelink Communication and S-SSB with SLSS ID = 30 and in-coverage set as FALSE in MIB-SL.
T2 end condition	Active synchronization source		Sync Ref UE 2	DUT transmits for V2X Sidelink Communication and S-SSB with SLSS ID = 336 and in-coverage set as FALSE in MIB-SL.
Final condition	Active synchronization source		Sync Ref UE 3	UE transmits for V2X Sidelink Communication and S-SSB with SLSS ID = 0 and in-coverage set as FALSE in MIB-SL.
Active SyncRef UEs			SyncRef UE 1 SyncRef UE 2 SyncRef UE 3	Transmitting S-SSB on RF channel number 1 (HD carrier in Band n47 or n38)
Timing offset among SyncRef UEs		µs	CP/2	Synchronous
Frequency offset of SyncRef UE 1,2,3		ppm	0	
V2X sidelink Communication configuration			As specified in table A. 3.21.2-2	IE values unless specified otherwise in this test.
sl-SyncPriority			gnss	
syncTxThreshOoC			+infinity	syncTxThreshOoC
T1		s	24	
T2		s	16	
T3		s	3.2	

Table A.9.1.3.1.1-2: SyncRef UE Specific Test Parameters for V2X Synchronization Reference Selection/Reselection Tests for GNSS configured as the highest priority

Parameter	Unit	SyncRef UE 1			SyncRef UE 2			SyncRef UE 3		
		T1	T2	T3	T1	T2	T3	T1	T2	T3
NR RF Channel Number		1(HD carrier in Band n47 or n38)								
Channel Bandwidth ($BW_{channel}$) Note 4	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)								
V2X Sidelink Communication resource pool configuration		As specified in table A.3.21.2-2								
networkControlledSyncTx		ON			N/A			ON		
syncTxThreshOoC	dBm/15 kHz	N/A			+infinity			N/A		
SLSSID		30			0			0		
inCoverage (in MIB-SL)		TRUE			FALSE			TRUE		
N_{oc} Note1	dBm/30 kHz	-95								

$\hat{E}_s / N_{oc}$	dB	0	0	0	-infinity	0	0	-infinity	-infinity	3
$\hat{E}_s / I_{ot}$ Note2	dB	0	0	-4.76	-infinity	0	0	-infinity	-infinity	0
PSBCH-RSRP Note2, Note 3	dBm/30 kHz	-95	-95	-95	-infinity	-95	-95	-infinity	-infinity	-92
Io Note2	dBm/18 MHz	-70.78	-70.78	-67.78	-73.79	-70.78	-70.78	-70.78	-70.78	-67.78
	dBm/36 MHz	-70.78	-70.78	-67.78	-73.79	-70.78	-70.78	-70.78	-70.78	-67.78
Propagation Condition		AWGN								

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, Io, PSBCH-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: S-PSS Es/Iot and S-SSS Es/Iot are set the same as PSBCH Es/Iot.
NOTE 4: The UE is only required to be tested in one of the supported test configurations.

A.9.1.3.1.2 Test Requirements

During T1, SyncRef UE selection delay is defined as the time from the beginning of T1 to the time UE is synchronized to SyncRef UE 1, and changes its S-SSB transmissions timing and SLSS ID to follow SyncRef UE 1 as the synchronization source. For the test configuration, the SLSS ID will be changed to 30 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE selection delay from start of T1.

The SyncRef UE selection delay shall be less than 8.8 sec. The SyncRef UE selection delay can be expressed as:

SyncRef UE selection delay = $T_{detect,SyncRef\ UE} + T_{evaluate,SLSS}$ + S-SSB period

Where

- $T_{detect,SyncRef\ UE}$ = 8 sec (as specified in sub-clause 12.4)
- $T_{evaluate,SLSS}$ = 0.64 sec (as specified in sub-clause 12.3)
- S-SSB period = 160 ms

This gives a total of 8.8 seconds.

2) During T2, SyncRef UE reselection delay is defined as the time from the beginning of T2 to the time UE changes its synchronization source from SyncRef UE 1 to SyncRef UE 2 and changes its S-SSB transmissions timing and SLSS ID to follow SyncRef UE 2 as the synchronization source. For the test configuration, the SLSS ID will be changed to 336 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE reselection delay from start of T2.

The SyncRef UE reselection delay shall be less than 8.8 sec. The SyncRef UE reselection delay can be expressed as:

SyncRef UE reselection delay = $T_{detect,SyncRef\ UE} + T_{evaluate,SLSS}$ + S-SSB period

Where

- $T_{detect,SyncRef\ UE}$ = 8 sec (as specified in sub-clause 12.4)
- $T_{evaluate,SLSS}$ = 0.64 (as specified in sub-clause 12.3)
- S-SSB period = 160 ms

This gives a total of 8.8 seconds.

3) During T3, SyncRef UE reselection delay is defined as the time from the beginning of T3 to the time UE changes its synchronization source from SyncRef UE 2 to SyncRef UE 3, and changes its S-SSB transmissions timing and SLSS ID to follow SyncRef UE 3 as the synchronization source. For the test configuration, the SLSS ID will still be 0 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE reselection delay from start of T3.

The SyncRef UE reselection delay shall be less than 2.4 sec. The SyncRef UE reselection delay can be expressed as:

SyncRef UE reselection delay = $T_{detect,SyncRef\ UE}$ + $T_{evaluate,SLSS}$ + S-SSB period

Where

- $T_{detect,SyncRef\ UE}$ = 1.6 sec (as specified in sub-clause 12.4)
- $T_{evaluate,SLSS}$ = 0.64 (as specified in sub-clause 12.3)
- S-SSB period = 160 ms

This gives a total of 2.4 seconds.

The test system will verify that the V2X UE does not drop or delay more than 6 % of its V2X data and S-SSB transmissions during the duration of T2, and does not drop or delay more than 30 % of its S-SSB transmissions during the duration of T3.

The rate of correct SyncRef UE selection / reselection observed during repeated tests shall be at least 90 %.

A.9.1.3.2 Test for FR1 NR Cell configured as the highest priority

A.9.1.3.2.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to SyncRef UE selection / reselection defined in clause 12.4, when gNB is configured as the highest priority. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

This test is applicable for V2X sidelink communication capable UEs that support gNB as synchronization source and sidelink operation.

Table A.9.1.3.2.1-1: Void

The test parameters are given in table A.9.1.3.2.1-2 and A.9.1.3.2.1-3 below. There are no active cells and GNSS is reliable during the whole test. The test system can emulate and send the GNSS signal to the test UE. The test parameters for GNSS signals are defined in B.4.1. There are two active SyncRef UEs (SyncRef UE 1 and SyncRef UE 2) in this test. The test system shall emulate SyncRef UE 1 and SyncRef UE 2 to transmit S-SSB every S-SSB period.

The test system can verify the selection / reselection of SyncRef UE by monitoring the SLSS ID used by the V2X UE for its S-SSB transmissions. When the V2X UE is synchronized to a SyncRef UE, the V2X UE shall derive its SLSS ID from the SLSS ID of the SyncRef UE as per clause 5.8.5.3 of TS 38.331[2].

The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. During T1, both SyncRef UE 1 and SyncRef UE 2 are powered off and the V2X UE will select GNSS as synchronization source. During T2, SyncRef UE 1 is powered ON and the V2X UE will select SyncRef UE 1 as the synchronization source. During T3, a higher priority SyncRef UE 2 is additionally powered ON and the V2X UE will reselect to the higher priority SyncRef UE 2 as the synchronization source.

Table A.9.1.3.2.1-2: Test Parameters for V2X Synchronization Reference Selection/Reselection Tests for FR1 NR Cell configured as the highest priority

Parameter		Unit	Value	Comment
SCS		kHz	30	
Initial condition	Active synchronization source		GNSS	DUT transmits for V2X Sidelink Communication and S-SSB with SLSS ID = 0 and in-coverage set as TRUE in MIB-SL.
T2 end condition	Active synchronization source		Sync Ref UE 1	DUT transmits for V2X Sidelink Communication and S-SSB with SLSS ID = 336+59 and in-coverage set as FALSE in MIB-SL.
Final condition	Active synchronization source		Sync Ref UE 2	UE transmits for V2X Sidelink Communication and S-SSB with SLSS ID = 30 and in-coverage set as FALSE in MIB-SL.
Active cell			None	

Parameter	Unit	Value	Comment
Active SyncRef UEs		SyncRef UE 1 SyncRef UE 2	Transmitting S-SSB on RF channel number 1
Timing offset between SyncRef UE 1 and SyncRef UE 2	ms	3	Asynchronous
Frequency offset of SyncRef UE 1,2	ppm	0	
V2X sidelink Communication preconfiguration		As specified in table A.3.21.2-2	IE values unless specified otherwise in this test.
syncPriority		*gnb*	
syncTxThreshOoC		13 (+infinity)	
T1	s	24	
T2	s	16	
T3	s	16	

Table A.9.1.3.2.1-3: SyncRef UE Specific Test Parameters for V2X Synchronization Reference Selection/Reselection Tests for FR1 NR Cell configured as the highest priority

Parameter	Unit	SyncRef UE 1			SyncRef UE 2		
		T1	T2	T3	T1	T2	T3
NR RF Channel Number		1(HD carrier in Band n47 or n38)					
Channel Bandwidth ($BW_{channel}$) Note 4	MHz	20($N_{PRB,c}$ = 50) or 40($N_{PRB,c}$ = 100)					
V2X Sidelink Communication resource pool configuration		As specified in table A.3.21.2-2			As specified in table A.3.21.2-2		
networkControlledSyncTx		N/A			ON		
syncTxThreshOoC	dBm/15 kHz	+infinity			N/A		
SLSSID		59			30		
inCoverage (in MIB-SL)		FALSE			TRUE		
N_{oc} Note1	dBm/30 kHz	-95					
$\hat{E}_s / N_{oc}$	dB	-infinity	0	0	-infinity	-infinity	3
$\hat{E}_s / I_{ot}$ Note2,	dB	-infinity	0	-4.76	-infinity	-infinity	0
Io Note2,	dBm/18 MHz	-73.79	-70.78	-70.78	-73.79	-73.79	-70.78
	dBm/36 MHz	-73.79	-70.78	-70.78	-73.79	-73.79	-70.78
PSBCH-RSRP Note2, Note 3	dBm/30 kHz	-infinity	-95	-95	-infinity	-infinity	-92
Propagation Condition		AWGN					

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, Io, PSBCH-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: S-PSS Es/Iot and S-SSS Es/Iot are set the same as PSBCH Es/Iot.
NOTE 4: The UE is only required to be tested in one of the supported test configurations.

A.9.1.3.2.2 Test Requirements

1) During T2, SyncRef UE selection delay is defined as the time from the beginning of T2 to the time UE is synchronized to SyncRef UE 1 and changes its S-SSB transmissions timing and SLSS ID to follow SyncRef UE 1 as the synchronization source. For the test configuration, the SLSS ID will be changed to 336+59 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE selection delay from start of T2.

The SyncRef UE selection delay shall be less than 8.8 sec. The SyncRef UE selection/reselection delay can be expressed as:

SyncRef UE selection/reselection delay = $T_{detect,SyncRef\ UE}$ + $T_{evaluate,SLSS}$ + S-SSB period

Where

- $T_{detect,SyncRef\ UE}$ = 8 sec (as specified in sub-clause 12.4)
- $T_{evaluate,SLSS}$ = 0.64 sec (as specified in sub-clause 12.3)

- S-SSB period = 160 ms

This gives a total of 8.8 seconds.

2) During T3, SyncRef UE reselection delay is defined as the time from the beginning of T3 to the time UE changes its synchronization source from SyncRef UE 1 to SyncRef UE 2, and changes its S-SSB transmissions timing and SLSS ID to follow SyncRef UE 2 as the synchronization source. For the test configuration, the SLSS ID will be changed to 30 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE selection delay from start of T3.

The SyncRef UE reselection delay shall be less than 8.8 sec. The SyncRef UE selection/reselection delay can be expressed as:

SyncRef UE selection/reselection delay = $T_{detect,SyncRef\ UE}$ + $T_{evaluate,SLSS}$ + S-SSB period

Where

- $T_{detect,SyncRef\ UE}$ = 8 sec (as specified in sub-clause 12.4)
- $T_{evaluate,SLSS}$ = 0.64 sec (as specified in sub-clause 12.3)
- S-SSB period = 160 ms

This gives a total of 8.8 seconds.

The test system will verify that the V2X UE does not drop or delay more than 6 % of its V2X data and S-SSB transmissions during the duration of T2 and T3.

The rate of correct SyncRef UE selection / reselection observed during repeated tests shall be at least 90 %.

A.9.1.3.3 Test for GNSS configured as the highest priority under SL-DRX

A.9.1.3.3.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to SyncRef UE selection / reselection defined in clause 12.4, when GNSS is configured as the highest priority and SL-DRX is configured. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

The test parameters are given in table A.9.1.3.3.1-1and A.9.1.3.3.1-2 below. There are no GNSS signals in this test. There are three active SyncRef UEs (SyncRef UE 1, SyncRef UE 2 and SyncRef UE 3) in this test. The test system shall emulate SyncRef UE 1, SyncRef UE 2 and SyncRef UE 3 to transmit S-SSB every S-SSB period.

The test system can verify the selection / reselection of SyncRef UE by monitoring the SLSS ID used by the V2X UE for its S-SSB transmissions. When the V2X UE is not synchronized to any SyncRef UE, then the V2X UE shall use the SLSS ID belonging to set id_oon. When the V2X UE is synchronized to a SyncRef UE, the V2X UE shall derive its SLSS ID from the SLSS ID of the SyncRef UE as per clause 5.8.5.3 of TS 38.331[2].

The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. SyncRef UE 1, SyncRef UE 2 and SyncRef UE 3 are all powered off before starting the test. During T1, SyncRef UE 1 is powered ON and the V2X UE will select SyncRef UE 1 as synchronization source. During T2, SyncRef UE 2 is powered ON and the V2X UE will select SyncRef UE 2 as the synchronization source. During T3, SyncRef UE 3 is powered ON and the V2X UE will reselect to SyncRef UE 3 as the synchronization source. SL-DRX is configured during the entire test period.

Table A.9.1.3.3.1-1: Test Parameters for V2X Synchronization Reference Selection/Reselection Tests for GNSS configured as the highest priority

Parameter		Unit	Value	Comment
SCS		kHz	30	
Initial condition	Active synchronization source		Sync Ref UE 1	DUT transmits for V2X Sidelink Communication and S-SSB with SLSS ID = 30 and in-coverage set as FALSE in MIB-SL.
T2 end condition	Active synchronization source		Sync Ref UE 2	DUT transmits for V2X Sidelink Communication and S-SSB with

				SLSS ID = 336 and in-coverage set as FALSE in MIB-SL.
Final condition	Active synchronization source		Sync Ref UE 3	UE transmits for V2X Sidelink Communication and S-SSB with SLSS ID = 0 and in-coverage set as FALSE in MIB-SL.
Active SyncRef UEs			SyncRef UE 1 SyncRef UE 2 SyncRef UE 3	Transmitting S-SSB on RF channel number 1 (HD carrier in Band n47 or n38)
Timing offset among SyncRef UEs		μs	CP/2	Synchronous
Frequency offset of SyncRef UE 1,2,3		ppm	0	
V2X sidelink Communication configuration			As specified in table A. 3.21.2-2	IE values unless specified otherwise in this test.
sl-SyncPriority			gnss	
syncTxThreshOoC			+infinity	syncTxThreshOoC
SL-DRX			SL.DRX.2	As specified in clause A.3.21.4
T1		s	24	
T2		s	16	
T3		s	3.2	

Table A.9.1.3.3.1-2: SyncRef UE Specific Test Parameters for V2X Synchronization Reference Selection/Reselection Tests for GNSS configured as the highest priority

Parameter	Unit	SyncRef UE 1			SyncRef UE 2			SyncRef UE 3		
		T1	T2	T3	T1	T2	T3	T1	T2	T3
NR RF Channel Number		1(TDD carrier in Band n47 or n38)								
Channel Bandwidth ($BW_{channel}$) Note 4	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)								
V2X Sidelink Communication resource pool configuration		As specified in table A.3.21.2-2								
networkControlledSyncTx		ON			N/A			ON		
syncTxThreshOoC	dBm/15 kHz	N/A			+infinity			N/A		
SLSSID		30			0			0		
inCoverage (in MIB-SL)		TRUE			FALSE			TRUE		
N_{oc} Note1	dBm/30 kHz	-95								
$\hat{E}_s / N_{oc}$	dB	0	0	0	-infinity	0	0	-infinity	-infinity	3
$\hat{E}_s / I_{ot}$	dB	0	0	-4.76	-infinity	0	0	-infinity	-infinity	0
PSBCH-RSRP Note2, Note 3	dBm/30 kHz	-95	-95	-95	-infinity	-95	-95	-infinity	-infinity	-92
Propagation Condition		AWGN								

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PSBCH-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: S-PSS Es/Iot and S-SSS Es/Iot are set the same as PSBCH Es/Iot.
NOTE 4: The UE is only required to be tested in one of the supported test configurations.

A.9.1.3.3.2 Test Requirements

During T1, SyncRef UE selection delay is defined as the time from the beginning of T1 to the time UE is synchronized to SyncRef UE 1, and changes its S-SSB transmissions timing and SLSS ID to follow SyncRef UE 1 as the synchronization source. For the test configuration, the SLSS ID will be changed to 30 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE selection delay from start of T1.

The SyncRef UE selection delay shall be less than 8.8 sec. The SyncRef UE selection delay can be expressed as:

SyncRef UE selection delay = $T_{detect,SyncRef\ UE} + T_{evaluate,SLSS}$ + S-SSB period

Where

- $T_{detect,SyncRef\ UE}$ = 8 sec (as specified in sub-clause 12.4)
- $T_{evaluate,SLSS}$ = 0.64 sec (as specified in sub-clause 12.3)
- S-SSB period = 160 ms

This gives a total of 8.8 seconds.

2) During T2, SyncRef UE reselection delay is defined as the time from the beginning of T2 to the time UE changes its synchronization source from SyncRef UE 1 to SyncRef UE 2 and changes its S-SSB transmissions timing and SLSS ID to follow SyncRef UE 2 as the synchronization source. For the test configuration, the SLSS ID will be changed to 336 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE reselection delay from start of T2.

The SyncRef UE reselection delay shall be less than 8.8 sec. The SyncRef UE reselection delay can be expressed as:

SyncRef UE reselection delay = $T_{detect,SyncRef\ UE}$ + $T_{evaluate,SLSS}$ + S-SSB period

Where

- $T_{detect,SyncRef\ UE}$ = 8 sec (as specified in sub-clause 12.4)
- $T_{evaluate,SLSS}$ = 0.64 (as specified in sub-clause 12.3)
- S-SSB period = 160 ms

This gives a total of 8.8 seconds.

3) During T3, SyncRef UE reselection delay is defined as the time from the beginning of T3 to the time UE changes its synchronization source from SyncRef UE 2 to SyncRef UE 3, and changes its S-SSB transmissions timing and SLSS ID to follow SyncRef UE 3 as the synchronization source. For the test configuration, the SLSS ID will still be 0 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE reselection delay from start of T3.

The SyncRef UE reselection delay shall be less than 2.4 sec. The SyncRef UE reselection delay can be expressed as:

SyncRef UE reselection delay = $T_{detect,SyncRef\ UE}$ + $T_{evaluate,SLSS}$ + S-SSB period

Where

- $T_{detect,SyncRef\ UE}$ = 1.6 sec (as specified in sub-clause 12.4)
- $T_{evaluate,SLSS}$ = 0.64 (as specified in sub-clause 12.3)
- S-SSB period = 160 ms

This gives a total of 2.4 seconds.

The test system will verify that the V2X UE does not drop its V2X data and SLSS transmissions at most in an aggregated window of 480 ms during the duration of T2, and does not drop or delay at most an aggregated window of 24 ms of its S-SSB transmissions during the duration of T3.

The rate of correct SyncRef UE selection / reselection observed during repeated tests shall be at least 90 %.

A.9.1.3.4 Test for FR1 NR Cell configured as the highest priority under SL-DRX

A.9.1.3.4.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to SyncRef UE selection / reselection defined in clause 12.4, when gNB is configured as the highest priority and SL-DRX is configured. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

This test is applicable for V2X sidelink communication capable UEs that support gNB as synchronization source and sidelink operation.

The test parameters are given in table A.9.1.3.4.1-1 and A.9.1.3.4.1-2 below. There are no active cells and GNSS is reliable during the whole test. The test system can emulate and send the GNSS signal to the test UE. The test parameters for GNSS signals are defined in B.4.1. There are two active SyncRef UEs (SyncRef UE 1 and SyncRef UE 2) in this test. The test system shall emulate SyncRef UE 1 and SyncRef UE 2 to transmit S-SSB every S-SSB period.

The test system can verify the selection / reselection of SyncRef UE by monitoring the SLSS ID used by the V2X UE for its S-SSB transmissions. When the V2X UE is synchronized to a SyncRef UE, the V2X UE shall derive its SLSS ID from the SLSS ID of the SyncRef UE as per clause 5.8.5.3 of TS 38.331[2].

The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. During T1, both SyncRef UE 1 and SyncRef UE 2 are powered off and the V2X UE will select GNSS as synchronization source. During T2, SyncRef UE 1 is powered ON and the V2X UE will select SyncRef UE 1 as the synchronization source. During T3, a higher priority SyncRef UE 2 is additionally powered ON and the V2X UE will reselect to the higher priority SyncRef UE 2 as the synchronization source. SL-DRX is configured during the entire test period.

Table A.9.1.3.4.1-1: Test Parameters for V2X Synchronization Reference Selection/Reselection Tests for FR1 NR Cell configured as the highest priority

Parameter		Unit	Value	Comment
SCS		kHz	30	
Initial condition	Active synchronization source		GNSS	DUT transmits for V2X Sidelink Communication and S-SSB with SLSS ID = 0 and in-coverage set as TRUE in MIB-SL.
T2 end condition	Active synchronization source		Sync Ref UE 1	DUT transmits for V2X Sidelink Communication and S-SSB with SLSS ID = 336+59 and in-coverage set as FALSE in MIB-SL.
Final condition	Active synchronization source		Sync Ref UE 2	UE transmits for V2X Sidelink Communication and S-SSB with SLSS ID = 30 and in-coverage set as FALSE in MIB-SL.
Active cell			None	
Active SyncRef UEs			SyncRef UE 1 SyncRef UE 2	Transmitting S-SSB on RF channel number 1
Timing offset between SyncRef UE 1 and SyncRef UE 2		ms	3	Asynchronous
Frequency offset of SyncRef UE 1,2		ppm	0	
V2X sidelink Communication preconfiguration			As specified in table A.3.21.2-2	IE values unless specified otherwise in this test.
syncPriority			*gnb*	
syncTxThreshOoC			13 (+infinity)	
SL-DRX			SL.DRX.2	As specified in clause A.3.21.4
T1		s	24	
T2		s	16	
T3		s	16	

Table A.9.1.3.4.1-2: SyncRef UE Specific Test Parameters for V2X Synchronization Reference Selection/Reselection Tests for FR1 NR Cell configured as the highest priority

Parameter	Unit	SyncRef UE 1			SyncRef UE 2		
		T1	T2	T3	T1	T2	T3
NR RF Channel Number		1(HD carrier in Band n47 or n38)					
Channel Bandwidth ($BW_{channel}$) Note 4	MHz	20($N_{PRB,c}$ = 50) or 40($N_{PRB,c}$ = 100)					
V2X Sidelink Communication resource pool configuration		As specified in table A.3.21.2-2			As specified in table A.3.21.2-2		
networkControlledSyncTx		N/A			ON		
syncTxThreshOoC	dBm/15 kHz	+infinity			N/A		
SLSSID		59			30		
inCoverage (in MIB-SL)		FALSE			TRUE		
N_{oc} Note1	dBm/30 kHz	-95					

$\hat{E}_s / N_{oc}$	dB	-infinity	0	0	-infinity	-infinity	3
$\hat{E}_s / I_{ot}$	dB	-infinity	0	-4.76	-infinity	-infinity	0
PSBCH-RSRP Note2, Note 3	dBm/30 kHz	-infinity	-95	-95	-infinity	-infinity	-92
Propagation Condition		AWGN					
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 2: PSBCH-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 3: S-PSS Es/Iot and S-SSS Es/Iot are set the same as PSBCH Es/Iot.							
NOTE 4: The UE is only required to be tested in one of the supported test configurations.							

A.9.1.3.4.2 Test Requirements

1) During T2, SyncRef UE selection delay is defined as the time from the beginning of T2 to the time UE is synchronized to SyncRef UE 1 and changes its S-SSB transmissions timing and SLSS ID to follow SyncRef UE 1 as the synchronization source. For the test configuration, the SLSS ID will be changed to 336+59 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE selection delay from start of T2.

The SyncRef UE selection delay shall be less than 8.8 sec. The SyncRef UE selection/reselection delay can be expressed as:

SyncRef UE selection/reselection delay = $T_{detect,SyncRef\ UE}$ + $T_{evaluate,SLSS}$ + S-SSB period

Where

- $T_{detect,SyncRef\ UE}$ = 8 sec (as specified in sub-clause 12.4)
- $T_{evaluate,SLSS}$ = 0.64 sec (as specified in sub-clause 12.3)
- S-SSB period = 160 ms

This gives a total of 8.8 seconds.

2) During T3, SyncRef UE reselection delay is defined as the time from the beginning of T3 to the time UE changes its synchronization source from SyncRef UE 1 to SyncRef UE 2, and changes its S-SSB transmissions timing and SLSS ID to follow SyncRef UE 2 as the synchronization source. For the test configuration, the SLSS ID will be changed to 30 (with in-coverage IE in MIB-SL set to FALSE) after SyncRef UE selection delay from start of T3.

The SyncRef UE reselection delay shall be less than 8.8 sec. The SyncRef UE selection/reselection delay can be expressed as:

SyncRef UE selection/reselection delay = $T_{detect,SyncRef\ UE}$ + $T_{evaluate,SLSS}$ + S-SSB period

Where

- $T_{detect,SyncRef\ UE}$ = 8 sec (as specified in sub-clause 12.4)
- $T_{evaluate,SLSS}$ = 0.64 sec (as specified in sub-clause 12.3)
- S-SSB period = 160 ms

This gives a total of 8.8 seconds.

The test system will verify that the V2X UE does not drop or delay its V2X data and SLSS transmissions at most in an aggregated window of 480 ms during the duration of T2 and T3.

The rate of correct SyncRef UE selection / reselection observed during repeated tests shall be at least 90 %.

A.9.1.4 Test for L1 SL-RSRP Measurement

A.9.1.4.1 Test for V2X UE Autonomous Resource Selection/Reselection

A.9.1.4.1.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to autonomous resource selection / reselection for V2X UE in mode 2 defined in clause 12.5. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

The test parameters are given in table A.9.1.4.1.1-1and A. 9.1.4.1.1-2 below. There are 50 active V2X sidelink UEs (UE0~UE49) in this test. Both the UE under test and active V2X sidelink UEs select GNSS as synchronization reference source. The test system can emulate and send the GNSS signal to the test UE and active V2X sidelink UEs. The test parameters for GNSS signals are defined in B.4.1. The test system shall emulate the active V2X sidelink UEs to transmit PSCCH/PSSCH every 5 ms. At the beginning of whole test, the test equipment shall send one AT command to trigger the UE under test continuously transmits PSCCH/PSSCH.

The test consists of two duration T1 and T2. During T1, the signal from Test Equipement are configured such that

- he measured PSSCH-RSRP for 20 active V2X sidelink UEs(UE10~UE29) is above the measurement threshold, and the resource occupied by the 20 active V2X sidelink UEs is expected to be excluded in the resource selection procedure and,
- the measured PSSCH-RSRP for other 30 active V2X sidelink UEs(UE0~UE9, UE30~UE49) is low the measurement threshold, and the resource occupied by the 30 active V2X sidelink UEs is expected to be included in the resource selection procedureDuring T2, the signal from Test Equipement are configured such that
- the measured PSSCH-RSRP or the 20 active V2X sidelink UEs(UE10~UE29) is below the measurement threshold, and the resource occupied by the 20 active V2X sidelink UEs is expected to be included in the resource selection procedure and,
- the measured PSSCH-RSRP for other 30 active V2X sidelink UEs(UE0~UE9, UE30~UE49) is above the measurement threshold, and the resource occupied by the 30 active V2X sidelink UEs is expected to be excluded in the resource selection procedure.

Table A. 9.1.4.1.1-1: Test Parameters for V2X UE Autonomous Resource Selection/Reselection Tests for PSSCH-RSRP measurements

Parameter		Unit	Value	Comment
NR RF Channel Number			1	HD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 2		MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS		kHz	30	
V2X sidelink communication pre-configuration			As specified in table A.3.21.2-1 and A.3.21.2-3	IE values unless specified otherwise in this test.
sl-TimeResource-r16 included in SL-ResourcePool			1111111111	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
sl-NumSubchannel-r16 included in SL-ResourcePool			5	Indicates the number of sub-channels for TX resource pool
sl-SubchannelSize-r16 included in SL-ResourcePool			10	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB
Number of Active Sidelink UEs			50	Active Sidelink UE i = 0, .., 49
SL-Thres-RSRP			12	Corresponding -106 dBm as defined in section 6.3.5 in TS38.331[2] Same for all priority level pairs.
Active Sidelink UEs	V2X sidelink Communication preconfiguration		As specified in table A.3.21.2-1 And A.3.21.2-3	IE values unless specified otherwise in this test.

Parameter		Unit	Value	Comment
(UE i = 0, .., 49)	sl-TimeResource-r16 included in SL-ResourcePool		{1$_i$} Note1	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
	sl-NumSubchannel-r16 included in SL-ResourcePool		1	Indicates the number of sub-channels for TX resource pool
	sl-StartRB-Subchannel-r16 included in SL-ResourcePool		floor(i/10)x10	Indicates the lowest PRB index of the subchannel with the lowest index. UE 0~9 start PRB=0; UE 10~19 start PRB=10; UE 20~29 start PRB=20; UE 30~39 start PRB=30; UE 40~49 start PRB=40;
	sl-SubchannelSize-r16 included in SL-ResourcePool		10	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB
	sl-ResourceReservePeriod2-r16	ms	5	
Timing offset among Active Sidelink UEs		μs	CP/2	Synchronous
NOTE 1: {1$_i$} is a sequence of nine 0's with one 1 in (mod(i,10)+1'th position. NOTE 2: The UE is only required to be tested in one of the supported test configurations.				

Table A.9.1.4.1.1-2: Active Sidelink UE Specific Test Parameters for V2X UE Autonomous Resource Selection/Reselection Tests for PSSCH-RSRP measurements

Parameter	Unit	Active Sidelink UE i (i = 0, .., 49)	
		T1	T2
NR RF Channel Number	-	1	
Channel Bandwidth ($BW_{channel}$) Note 5	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
PSCCH RMC (defined in A.3.21.3)	-	CC.1A HD	
PSSCH RMC (defined in A.3.21.3)	-	CD.1A HD	
N_{oc} Note1	dBm/30 kHz	-111	-121
$\hat{E}_s/N_{oc}$ Note3	dB	10	
$\hat{E}_s/I_{ot}$ Note2,3	dB	10	
$\hat{E}_s/N_{oc}$ Note4	dB	0	20
$\hat{E}_s/I_{ot}$ Note2,4	dB	0	20
PSSCH-RSRP1 Note 2,3	dBm/SCS	-101	-111
PSSCH -RSRP2 Note 2,4	dBm/SCS	-111	-101
Io Note 2	dBm/18 MHz	-77.42	-74.03
	dBm/36 MHz	-77.42	-74.03
Antenna Configuration	-	1x2	
Propagation Condition	-	AWGN	

NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, PSSCH-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: For UE 20 to 29, occupying subchannel #2
NOTE 4: For UE 0 to 19 and 30 to 49, occupying subchannel #0/1/3/4
NOTE 5: The UE is only required to be tested in one of the supported test configurations.

A.9.1.4.1.2 Test Requirements

The test time T1 and T2 should be long enough. The rate of PSSCH transmissions on the resources on subchannel #1 or #2 shall be less than 10 % during T1. The rate of PSSCH transmissions on the resources on subchannel #1 or #2 shall be more than 90 % during T2.

A.9.1.4.2 Test for V2X UE Resource Pre-emption

A.9.1.4.2.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to autonomous resource pre-emption for V2X UE in mode 2 defined in clause 12.5. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

The test parameters are given in table A. 9.1.4.2.1-1and A.12. 9.1.4.1-2 below. There is one active V2X sidelink UE in this test. Both the UE under test and the active V2X sidelink UE select GNSS as synchronization reference source. The test system can emulate and send the GNSS signal to the test UE and active V2X sidelink UEs. The test parameters for GNSS signals are defined in B.4.1. At the beginning of whole test, the test equipment shall send one message with a SL-SCH MAC PDU as specified in clause 6.1.6 in TS 38.321[7], in order to make sure that the UE under test needs continuously transmit PSCCH/PSSCH.

The test consists of two duration T1 and T2. During T1, the signal from Test Equipement are configured such that the active V2X sidelink UE is not transmitting. The UE under test shall transmit SL data and reserve future resources. The resource reservation is decoded by the active V2X sidelink UE. The point in time at which resource reservation from the UE under test is decoded by the active V2X sidelink UE defines the start of time period T2. During T2, the active V2X sidelink UE reserves the same resource as the UE under test with high priority data no later than slot n- $T_{pre\text{-}empt}$.

Table A.9.1.4.2.1-1: Test Parameters for V2X UE Resource Pre-emption Tests for PSSCH-RSRP measurements

Parameter	Unit	Value	Comment
NR RF Channel Number		1	HD carrier in Band n47 and n38
Channel Bandwidth ($BW_{channel}$) Note 1	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS	kHz	30	
V2X sidelink communication pre-configuration		As specified in table A.3.21.2-1 and A.3.21.2-3	IE values unless specified otherwise in this test.
sl-TimeResource-r16 included in SL-ResourcePool in SL-ResourcePool in sl-TxPoolSelectedNormal-r16		10000000000000000000	Indicates the time resource of resource pool within *sl-Period*. (see TS 38.213 [3]) Note that this is for Tx pool.
sl-TimeResource-r16 included in SL-ResourcePool in sl-RxPool-r16		11111111111111111111	Indicates the time resource of resource pool within *sl-Period*. (see TS 38.213 [3]) Note that this is for Rx pool.
sl-NumSubchannel-r16 included in SL-ResourcePool		1	Indicates the number of subchannels in the corresponding resource pool, which consists of contiguous PRBs only

Parameter		Unit	Value	Comment
sl-SubchannelSize-r16 included in SL-ResourcePool			10	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB
sl-StartRB-Subchannel-r16 included in SL-ResourcePool			10	Indicates the lowest PRB index of the subchannel with the lowest index.
Number of Active Sidelink UEs			1	
SL-Thres-RSRP			12	Corresponding -106 dBm as defined in section 6.3.8 in TS38.331[2]
Active Sidelink UEs	V2X sidelink Communication preconfiguration		As specified in table A.3.21.2-1 and A.3.21.2-3	IE values unless specified otherwise in this test.
	sl-TimeResource-r16 included in SL-ResourcePool		1111111111111111111	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
	sl-NumSubchannel-r16 included in SL-ResourcePool		1	Indicates the number of sub-channels for TX resource pool
	sl-StartRB-Subchannel-r16 included in SL-ResourcePool		10	Indicates the lowest PRB index of the subchannel with the lowest index.
	Sl-SubchannelSize-r16 included in SL-ResourcePool		10	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB
Timing offset among Active Sidelink Ues		μs	CP/2	Synchronous
NOTE 1: The UE is only required to be tested in one of the supported test configurations.				

Table A.9.1.4.2.1-2: Active Sidelink UE Specific Test Parameters for V2X UE Resource Pre-emption Tests for PSSCH-RSRP measurements

Parameter	Unit	Active Sidelink UE	
		T1	T2
NR RF Channel Number	-	1	
Channel Bandwidth ($BW_{channel}$) Note 3	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
PSCCH RMC (defined in A.3.21.3)	-	CC.1A HD	
PSSCH RMC (defined in A.3.21.3)	-	CD.1A HD	
N_{oc} Note1	dBm/30 kHz	N/A	-100
PSCCH $\hat{E}_s/N_{oc}$	dB		5
PSSCH $\hat{E}_s/N_{oc}$	dB		5
PSCCH $\hat{E}_s/I_{ot}$ Note2	dB		5
PSSCH $\hat{E}_s/I_{ot}$ Note2	dB		5
PSSCH-RSRP Note 2	dBm/30kHz		-95
Io Note 2	dBm/18 MHz		-73.01
	dBm/36 MHz		-73.01
Antenna Configuration	-	1x2	
Propagation Condition	-	AWGN	

NOTE 1:	Interference from other Ues and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2:	Es/Iot, PSSCH-RSRP and Io have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3:	The UE is only required to be tested in one of the supported test configurations.

A.9.1.4.2.2 Test Requirements

The test time T1 and T2 should be long enough. The UE under test is required to trigger resource reselection and not to transmit on the reserved resource at slot n when the high priority reservation is transmitted by the active V2X sidelink UE before n-$T_{pre\text{-}empt}$, where

$T_{pre\text{-}empt} = T_3 + T_{proc,0}$

T_3 = 5 slots and $T_{proc,0}$= 1 slot for FR1.

The rate of PSSCH transmissions on the resources at slot n shall be less than 10 % during repeated tests.

A.9.1.4.3 Test for V2X UE Resource Re-evaluation

A.9.1.4.3.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to autonomous resource re-evaluation for V2X UE in mode 2 defined in clause 12.5. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

The test parameters are given in table A.9.1.4.3.1-1, A.9.1.4.3.1-2 and A.9.1.4.3.1-3 below. There are 130 active V2X sidelink UEs in this test. The first 100 active V2X sidelink UEs are scheduled with 50 ms periodicity. The last 30 active V2X sidelink Ues are aperiodic service UE with retransmission reservation period equaling 15 ms.

Both the UE under test and active V2X sidelink Ues select GNSS as synchronization reference source. The test system can emulate and send the GNSS signal to the test UE and active V2X sidelink Ues. The test parameters for GNSS signals are defined in B.4.1.

The test consists of three duration T0, T1, T2.

During T0, the signal from Test Equipement are configured. The resource occupied by the active V2X sidelink UEs is expected to be excluded in the resource selection procedure such that the measured PSSCH-RSRP is above the measurement threshold. The test equipment shall just configure the resource pool for the test UE without the MAC PDU for transmission channel configuration.

During T1, the signal from Test Equipement are configured. Some of the resource occupied by the active V2X sidelink Ues is expected to be excluded in the resource selection procedure such that the measured PSSCH-RSRP is above the measurement threshold and some of the resource occupied by the active V2X sidelink Ues is expected to be included in the resource selection procedure such that the measured PSSCH-RSRP is below the measurement threshold. The test system shall emulate the active V2X sidelink Ues to transmit PSCCH/PSSCH every 50 ms according to the RSRP level specified in the Table A. 9.1.4.3.1-2, but UE #0~29 will be silent during T2.

At the end of T1, where slot index mod 100 = 99, the test equipment shall send one message with a SL-SCH MAC PDU as specified in clause 6.1.6 in TS 38.321[7], in order to make sure that the UE under test shall be scheduled to periodically transmit PSCCH/PSSCH.

During T2, the additional aperiodic active V2X sidelink UEs from Test Equipement are configured in the beginning 30 slots, and the resource occupied by these active V2X sidelink UEs is expected to be excluded in the resource re-evaluation procedure such that the measured PSSCH-RSRP is above the measurement threshold shown in table A. 9.1.4.3.1-2. The test system shall emulate the active V2X sidelink UEs to transmit PSCCH/PSSCH with the maximum number of reserved PSCCH/PSSCH resources equalling n2 and time resource assignment interval as 15 ms.

During T2, the test UE is expeted to reselect the resources and transmit the PSCCH/PSSCH in the newly re-evaluated resources.

Table A.9.1.4.3.1-1: Test Parameters for V2X UE Resource Selection Tests for Re-evaluation

Parameter		Unit	Value	Comment
NR RF Channel Number			1	HD carrier in Band n47 and n38
Channel Bandwidth ($BW_{channel}$) Note 2		MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS		kHz	30	
V2X sidelink communication pre-configuration			As specified in table A.3.21.2-2	IE values unless specified otherwise in this test.
sl-TimeResource-r16 included in SL-ResourcePool			1111111111111111111 1111111111111111111 1111111111111111111 1111111111111111111 1111111111111111111	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
sl-NumSubchannel-r16 included in SL-ResourcePool			1	Indicates the number of sub-channels for TX resource pool
sl-SubchannelSize-r16 included in SL-ResourcePool			10	
sl-StartRB-Subchannel-r16			0	
Number of Active Sidelink UEs			130	Active Sidelink UE i = 0, .., 129
SL-Thres-RSRP-r16			13	Corresponding -104 dBm as defined in section 6.3.5 in TS38.331[2]
Active Sidelink UEs(UE i=0-99)	V2X sidelink Communication preconfiguration		As specified in table A.3.21.2-2	IE values unless specified otherwise in this test.
	sl-TimeResource-r16 included in SL-ResourcePool		$\{1_i\}^{Note1}$	Indicates the bitmap of the TX resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213 [3])
	sl-NumSubchannel-r16 included in SL-ResourcePool		1	Indicates the number of sub-channels for TX resource pool
	sl-SubchannelSize-r16 included in SL-ResourcePool		10	Indicates the size of sub-channels for TX resource pool
	sl-ResourceReservePeriod2-r16	ms	50	
Active Sidelink UEs(UE i= 100-129)	V2X sidelink Communication preconfiguration		As specified in table A.3.21.2-2	IE values unless specified otherwise in this test.
	sl-TimeResource-r16 included in SL-ResourcePool		$\{1_i\}^{Note1}$	Indicates the bitmap of the TX resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213 [3])
	sl-NumSubchannel-r16 included in SL-ResourcePool		1	Indicates the number of sub-channels for TX resource pool
	sl-SubchannelSize included in SL-ResourcePool		10	Indicates the size of sub-channels for TX resource pool
	sl-MultiReserveResource-r16		enabled	
	sl-MaxNumPerReserve-r16		n2	
	sl-ResourceReservePeriod2-r16		0	Unit:ms
Timing offset among Active Sidelink UEs		µs	CP/2	Synchronous
T0		s	1	
T1		ms	50	
T2		ms	50	
NOTE 1: $\{1_i\}$ is a sequence of ninety-nine 0's with one 1 in (mod(i,100)+1)'th position. NOTE 2: The UE is only required to be tested in one of the supported test configurations.				

Table A.9.1.4.3.1-2: Active Sidelink UE Specific Test Parameters for V2X UE Resource Selection Tests for Re-evaluation (UE #0...99)

Parameter	Unit	Active Sidelink UE i (i = 0, .., 99)	
		T1	T2
NR RF Channel Number	-	1	
Channel Bandwidth ($BW_{channel}$) Note 7	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
PSCCH RMC (defined in A.3.21.3)	-	CC.1A HD	
PSSCH RMC (defined in A.3.21.3)	-	CD.1A HD	
N_{oc} Note1	dBm/SCS	-113	
PSSCH1 $\hat{E}_s/N_{oc}$ Note 3	dB	16	16
PSSCH2 $\hat{E}_s/N_{oc}$ Note 4	dB	2	2
PSSCH3 $\hat{E}_s/N_{oc}$ Note 5	dB	16	-infinity
PSSCH4 $\hat{E}_s/N_{oc}$ Note 6	dB	2	2
PSSCH1 $\hat{E}_s/I_{ot}$ Note2,3	dB	16	[-0.11] Note 10
		16	16 Note 11
PSSCH2 $\hat{E}_s/I_{ot}$ Note2,4	dB	2	[-14.11]
PSSCH3 $\hat{E}_s/I_{ot}$ Note2,5	dB	16	-infinity
PSSCH4 $\hat{E}_s/I_{ot}$ Note2,6	dB	2	2
PSSCH -RSRP1 Note 2, 3	dBm/SCS	-97	-97
PSSCH -RSRP2 Note 2, 4	dBm/SCS	-111	-111
PSSCH -RSRP3 Note 2, 5	dBm/SCS	-97	-infinity
PSSCH -RSRP4 Note 2, 6	dBm/SCS	-111	-111
Io Note 2, 8	dBm/18 MHz	-76.10	-76.10
	dBm/36 MHz	-76.10	-76.10
Io Note 2, 9	dBm/18 MHz	-88.08	[-75.93]
	dBm/36 MHz	-88.08	[-75.93]
Io Note 2, 10	dBm/18 MHz	-76.10	[-73.14]
	dBm/36 MHz	-76.10	[-73.14]
Io Note 2, 11	dBm/18 MHz	-76.10	-76.10
	dBm/36 MHz	-76.10	-76.10
Io Note 2, 12	dBm/18 MHz	-88.08	-88.08
	dBm/36 MHz	-88.08	-88.08
Antenna Configuration	-	1x2	
Propagation Condition	-	AWGN	

NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: $\hat{E}_s/I_{ot}$, PSSCH-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 3: UE #50~64 and UE #85~99 will periodically occupy the subchannels on the slot with "#slot index mod 100" = #50-64 and #85-99.

NOTE 4: UE #30~49 will periodically occupy the subchannels on the slot with "#slot index mod 100" = #30-49.

NOTE 5: UE #0~29 will periodically occupy the subchannels on the slot with "#slot index mod 100" = #0-29.

NOTE 6: UE #65~84 will periodically occupy the subchannels on the slot with "#slot index mod 100" = #65-84.

NOTE 7: The UE is only required to be tested in one of the supported configurations.

NOTE 8: Calculated on slot #0~29.

NOTE 9: Calculated on slot #30~49.

Note 10: Calculated on slot #50~59.

Note 11: Calculated on slot #60~64 and slot #85~99.

Note 12: Calculated on slot #65~84.

Table A.9.1.4.3.1-3: Active Sidelink UE Specific Test Parameters for V2X UE Resource Selection Tests for Re-evaluation (UE #100…129)

Parameter	Unit	Active Sidelink UE i (i = 100, .., 129)	
		T1	T2
NR RF Channel Number	-	1	
Channel Bandwidth ($BW_{channel}$) Note 4	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
PSCCH RMC (defined in A.3.21.3)	-	CC.1A HD	
PSSCH RMC (defined in A.3.21.3)	-	CD.1 A HD	
N_{oc} Note1	dBm/SCS	-103	
PSSCH $\hat{E}_s/N_{oc}$	dB	-infinity	16
PSSCH $\hat{E}_s/I_{ot}$ Note2	dB	-infinity	16 Note 5
		-infinity	[11.88] Note 6
		-infinity	[-0.11] Note 7
PSSCH-RSRP Note 2, Note 3	dBm/SCS	-infinity	-97
Io Note 2, 5	dBm/18 MHz	-76.10	-76.10
	dBm/36 MHz	-76.10	-76.10
Io Note 2, 6	dBm/18 MHz	-88.08	[-75.93]
	dBm/36 MHz	-88.08	[-75.93]
Io Note 2, 7	dBm/18 MHz	-76.10	[-73.14]
	dBm/36 MHz	-76.10	[-73.14]
Antenna Configuration	-	1x2	
Propagation Condition	-	AWGN	

NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, PSSCH-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: UE #100~129 will occupy the subchannels on the slots with "#slot index mod 100"= #0-29 during T2.
NOTE 4: The UE is only required to be tested in one of the supported configurations.
NOTE 5: Calculated on slot #0~29.
NOTE 6: Calculated on slot #30~49.
NOTE 7: Calculated on slot #50~59.

A.9.1.4.3.2 Test Requirements

The rate of PSSCH transmissions on the resources of the subchannels which are occupied by UE #65-84 shall be more than 90 % during T2.

A.9.1.4.4 Test for V2X UE Autonomous Resource Selection/Reselection with Periodic Sensing

A.9.1.4.4.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to autonomous resource selection / reselection for V2X UE in mode 2 with partial sensing support defined in clause 12.5. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

The test parameters are given in table A.9.1.4.4.1-1and A. 9.1.4.4.1-2 below. There are 100 active V2X sidelink UEs (UE0~UE99) in this test. Both the UE under test and active V2X sidelink UEs select GNSS as synchronization reference source. The test system can emulate and send the GNSS signal to the test UE and active V2X sidelink UEs. The test parameters for GNSS signals are defined in B.4.1. The test system shall emulate the active V2X sidelink UEs to transmit PSCCH/PSSCH every 10 ms. At the beginning of whole test, the test equipment shall send one message with a SL-SCH MAC PDU as specified in clause 6.1.6 in TS 38.321[7] and ensure that the UE under test needs to continuously transmit PSCCH/PSSCH with 10 ms period. Upon receiving the MAC PDU, UE starts resource selection to transmit PSCCH/PSSCH based on the available sensing results.

The test consists of two duration T1 and T2. During T1, the signals from Test Equipment are configured such that

- the measured PSSCH-RSRP for 40 active V2X sidelink UEs(UE20~UE59) is above the measurement threshold, and the resource occupied by the 40 active V2X sidelink UEs is expected to be excluded in the resource selection procedure and,

- the measured PSSCH-RSRP for other 60 active V2X sidelink UEs(UE0~UE19, UE60~UE99) is low the measurement threshold, and the resource occupied by the 60 active V2X sidelink UEs is expected to be included in the resource selection procedure.

During T2, the signals from Test Equipment are configured such that

- the measured PSSCH-RSRP for the 40 active V2X sidelink UEs(UE20~UE59) is below the measurement threshold, and the resource occupied by the 40 active V2X sidelink UEs is expected to be included in the resource selection procedure and,

- the measured PSSCH-RSRP for other 60 active V2X sidelink UEs(UE0~UE19, UE60~UE99) is above the measurement threshold, and the resource occupied by the 60 active V2X sidelink UEs is expected to be excluded in the resource selection procedure.

Table A.9.1.4.4.1-1: Test Parameters for V2X UE Autonomous Resource Selection/Reselection Tests with Periodic Sensing

Parameter		Unit	Value	Comment
NR RF Channel Number			1	TDD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 2		MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS		kHz	30	
V2X sidelink communication pre-configuration			As specified in table A.3.21.2-1 and A.3.21.2-3	IE values unless specified otherwise in this test.
sl-TimeResource-r16 included in SL-ResourcePool			1111111111	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
sl-NumSubchannel-r16 included in SL-ResourcePool			5	Indicates the number of sub-channels for TX resource pool
sl-SubchannelSize-r16 included in SL-ResourcePool			10	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB
Number of Active Sidelink UEs			100	Active Sidelink UE i = 0, .., 49
SL-ThresPSSCH-RSRP			12	Corresponding -106 dBm as defined in section 6.3.5 in TS38.331[2]
Active Sidelink UEs (UE i = 0, .., 99)	V2X sidelink Communication preconfiguration		As specified in table A.3.21.2-1 And A.3.21.2-3	IE values unless specified otherwise in this test.
	sl-TimeResource-r16 included in SL-ResourcePool		$\{1_i\}$ Note1	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
	sl-NumSubchannel-r16 included in SL-ResourcePool		1	Indicates the number of sub-channels for TX resource pool
	sl-StartRB-Subchannel-r16 included in SL-ResourcePool		floor(i/20)x10	Indicates the lowest PRB index of the subchannel with the lowest index. UE 0~19 start PRB=0; UE 20~39 start PRB=10; UE 40~59 start PRB=20; UE 60~79 start PRB=30; UE 80~99 start PRB=40;

Parameter		Unit	Value	Comment
	sl-SubchannelSize-r16 included in SL-ResourcePool		10	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB
	sl-ResourceReservePeriod2-r16	ms	10	
Timing offset among Active Sidelink UEs		μs	CP/2	Synchronous
NOTE 1: {1i} is a sequence of nine 0's with one 1 in (mod(i,10)+1'th position. NOTE 2: The UE is only required to be tested in one of the supported test configurations.				

Table A.9.1.4.4.1-2: Active Sidelink UE Specific Test Parameters for V2X UE Autonomous Resource Selection/Reselection Tests with Periodic Sensing

Parameter	Unit	Active Sidelink UE i (i = 0, .., 99)	
		T1	T2
NR RF Channel Number	-	1	
Channel Bandwidth ($BW_{channel}$) Note 5	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS	kHz	30	
PSCCH RMC (defined in A.3.21.3)	-	CC.1A HD	
PSSCH RMC (defined in A.3.21.3)	-	CD.1A HD	
N_{oc} Note1	dBm/30 kHz	-111	-121
$\hat{E}_s / N_{oc}$ Note3	dB	10	
$\hat{E}_s / I_{ot}$ Note2,3	dB	10	
$\hat{E}_s / N_{oc}$ Note4	dB	0	20
$\hat{E}_s / I_{ot}$ Note2,4	dB	0	20
PSSCH-RSRP1 Note 2,3	dBm/30k Hz	-101	-111
PSSCH -RSRP2 Note 2,4	dBm/30k Hz	-111	-101
SL-RSSI1 Note 2,3	dBm/3.6 MHz	-79.79	-89.79
SL-RSSI2 Note 2,4	dBm/3.6 MHz	-87.20	-80.17
Antenna Configuration	-	1x2	
Propagation Condition	-	AWGN	
NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: Es/Iot, PSSCH-RSRP and SL-RSSI levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: For UE 20 to 59, occupying subchannel #1/2 NOTE 4: For UE 0 to 19 and 60 to 99, occupying subchannel #0/3/4 NOTE 5: The UE is only required to be tested in one of the supported test configurations.			

A.9.1.4.4.2 Test Requirements

The test time T1 and T2 should be long enough. The rate of PSSCH transmissions on the resources on subchannel #1 or #2 shall be less than 10 % during T1. The rate of PSSCH transmissions on the resources on subchannel #1 or #2 shall be more than 90 % during T2.

A.9.1.4.5 Test for V2X UE Autonomous Resource Selection/Reselection with Contiguous Sensing

A.9.1.4.5.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to autonomous resource selection / reselection for V2X UE in mode 2 performing contiguous sensing configured with M=31 defined in clause 12.5. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

The test parameters are given in table A.9.1.4.5.1-1and A. 9.1.4.5.1-2 below. There are 50 active V2X sidelink UEs (UE0~UE49) in this test. Both the UE under test and active V2X sidelink UEs select GNSS as synchronization reference source. The test system can emulate and send the GNSS signal to the test UE and active V2X sidelink UEs. The test parameters for GNSS signals are defined in B.4.1. The test system shall emulate the active V2X sidelink UEs to transmit PSCCH/PSSCH every 5 ms. Starting from the beginning of whole test, the test equipment shall send a message with a SL-SCH MAC PDU every 5 ms as specified in clause 6.1.6 in TS 38.321[7] to schedule an aperiodic transmission and ensure that the UE under test needs continuously transmit PSCCH/PSSCH every 5 ms.

The test consists of two duration T1 and T2. During T1, the signal from Test Equipment are configured such that

- the measured PSSCH-RSRP for 20 active V2X sidelink UEs (UE10~UE29) is above the measurement threshold, and the resource occupied by the 20 active V2X sidelink UEs is expected to be excluded in the resource selection procedure and,
- the measured PSSCH-RSRP for other 30 active V2X sidelink UEs(UE0~UE9, UE30~UE49) is low the measurement threshold, and the resource occupied by the 30 active V2X sidelink UEs is expected to be included in the resource selection procedure.

During T2, the signal from Test Equipment are configured such that

- the measured PSSCH-RSRP for the 20 active V2X sidelink UEs(UE10~UE29) is below the measurement threshold, and the resource occupied by the 20 active V2X sidelink UEs is expected to be included in the resource selection procedure and,
- the measured PSSCH-RSRP for other 30 active V2X sidelink UEs(UE0~UE9, UE30~UE49) is above the measurement threshold, and the resource occupied by the 30 active V2X sidelink UEs is expected to be excluded in the resource selection procedure.

Table A.9.1.4.5.1-1: Test Parameters for V2X UE Autonomous Resource Selection/Reselection Tests with Contiguous Sensing

Parameter	Unit	Value	Comment
NR RF Channel Number		1	TDD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 2	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS	kHz	30	
V2X sidelink communication pre-configuration		As specified in table A.3.21.2-1 and A.3.21.2-3	IE values unless specified otherwise in this test.
sl-TimeResource-r16 included in SL-ResourcePool		1111111111	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
sl-NumSubchannel-r16 included in SL-ResourcePool		5	Indicates the number of sub-channels for TX resource pool
sl-SubchannelSize-r16 included in SL-ResourcePool		10	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB
Number of Active Sidelink UEs		50	Active Sidelink UE i = 0, .., 49
SL-ThresPSSCH-RSRP		12	Corresponding -106 dBm as defined in section 6.3.5 in TS38.331[2]

Parameter		Unit	Value	Comment
Active Sidelink UEs (UE i = 0, .., 49)	V2X sidelink Communication preconfiguration		As specified in table A.3.21.2-1 And A.3.21.2-3	IE values unless specified otherwise in this test.
	sl-TimeResource-r16 included in SL-ResourcePool		{1$_i$} Note1	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
	sl-NumSubchannel-r16 included in SL-ResourcePool		1	Indicates the number of sub-channels for TX resource pool
	sl-StartRB-Subchannel-r16 included in SL-ResourcePool		floor(i/10)x10	Indicates the lowest PRB index of the subchannel with the lowest index. UE 0~9 start PRB=0; UE 10~19 start PRB=10; UE 20~29 start PRB=20; UE 30~39 start PRB=30; UE 40~49 start PRB=40;
	sl-SubchannelSize-r16 included in SL-ResourcePool		10	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB
Timing offset among Active Sidelink UEs		μs	CP/2	Synchronous
NOTE 1: {1$_i$} is a sequence of nine 0's with one 1 in (mod(i,10)+1'th position. NOTE 2: The UE is only required to be tested in one of the supported test configurations.				

Table A.9.1.4.5.1-2: Active Sidelink UE Specific Test Parameters for V2X UE Autonomous Resource Selection/Reselection Tests with Contiguous Sensing

Parameter	Unit	Active Sidelink UE i (i = 0, .., 49)	
		T1	T2
NR RF Channel Number	-	1	
Channel Bandwidth ($BW_{channel}$) Note 5	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS	kHz	30	
PSCCH RMC (defined in A.3.21.3)	-	CC.1A HD	
PSSCH RMC (defined in A.3.21.3)	-	CD.1A HD	
N_{oc} Note1	dBm/30 kHz	-111	-121
$\hat{E}_s/N_{oc}$ Note3	dB	10	
$\hat{E}_s/I_{ot}$ Note2,3	dB	10	
$\hat{E}_s/N_{oc}$ Note4	dB	0	20
$\hat{E}_s/I_{ot}$ Note2,4	dB	0	20
PSSCH-RSRP1 Note 2,3	dBm/30kHz	-101	-111
PSSCH -RSRP2 Note 2,4	dBm/30kHz	-111	-101
SL-RSSI1 Note 2,3	dBm/3.6 MHz	-79.79	-89.79
SL-RSSI2 Note 2,4	dBm/3.6 MHz	-87.20	-80.17
Antenna Configuration	-	1x2	
Propagation Condition	-	AWGN	
NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: Es/Iot, PSSCH-RSRP and SL-RSSI levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: For UE 10 to 29, occupying subchannel #1/2 NOTE 4: For UE 0 to 9 and 30 to 49, occupying subchannel #0/3/4 NOTE 5: The UE is only required to be tested in one of the supported test configurations.			

A.9.1.4.5.2 Test Requirements

The test time T1 and T2 should be long enough. The rate of PSSCH transmissions on the resources on subchannel #1 or #2 shall be less than 10 % during T1. The rate of PSSCH transmissions on the resources on subchannel #1 or #2 shall be more than 90 % during T2.

A.9.1.4.6 Test for V2X UE Autonomous Resource Selection/Reselection in SL-DRX

A.9.1.4.6.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to autonomous resource selection / reselection for V2X UE in mode 2 defined in clause 12.5. For this test, the UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

The test parameters are given in table A.9.1.4.6.1-1and A. 9.1.4.6.1-2 below. There are 50 active V2X sidelink UEs (UE0~UE49) and another V2X sidelink UE as the receiver for the UE under test in this test. The UE under test, the receiver UE and active V2X sidelink UEs select GNSS as synchronization reference source. The test system can emulate and send the GNSS signal to the test UE, the receiver V2X sidelink UE and active V2X sidelink UEs. The test parameters for GNSS signals are defined in B.4.1. The test system shall emulate the active V2X sidelink UEs to transmit PSCCH/PSSCH every 5 ms. At the beginning of whole test, the test equipment shall send one message with a SL-SCH MAC PDU as specified in clause 6.1.6 in TS 38.321[7] and ensure that the UE under test needs continuously transmit PSCCH/PSSCH to the receiver SL UE.

The receiver UE runs one DRX cycle with 40 ms cycle length and 10 ms on time, 0 ms inactivity timer, and 10 ms offset. The UE under test and the 50 active UEs are in non-DRX mode.

The test consists of two duration T1 and T2. During T1, the signals from Test Equipment are configured such that

- the measured PSSCH-RSRP for 20 active V2X sidelink UEs(UE10~UE29) is above the measurement threshold, and the resource occupied by the 20 active V2X sidelink UEs is expected to be excluded in the resource selection procedure and,
- the measured PSSCH-RSRP for other 30 active V2X sidelink UEs(UE0~UE9, UE30~UE49) is low the measurement threshold, and the resource occupied by the 30 active V2X sidelink UEs is expected to be included in the resource selection procedure.

During T2, the signals from Test Equipment are configured such that

- the measured PSSCH-RSRP for the 20 active V2X sidelink UEs(UE20~UE29) is below the measurement threshold, and the resource occupied by the 20 active V2X sidelink UEs is expected to be included in the resource selection procedure and,
- the measured PSSCH-RSRP for other 30 active V2X sidelink UEs(UE0~UE9, UE30~UE49) is above the measurement threshold, and the resource occupied by the 30 active V2X sidelink UEs is expected to be excluded in the resource selection procedure.

Table A.9.1.4.6.1-1: Test Parameters for V2X UE Autonomous Resource Selection/Reselection Tests in SL-DRX

Parameter	Unit	Value	Comment
NR RF Channel Number		1	TDD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 2	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS	kHz	30	
V2X sidelink communication pre-configuration		As specified in table A.3.21.2-1 and A.3.21.2-3	IE values unless specified otherwise in this test.
sl-TimeResource-r16 included in SL-ResourcePool		1111111111	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within

Parameter		Unit	Value	Comment
				a SFN cycle (see TS 38.213[3])
sl-NumSubchannel-r16 included in SL-ResourcePool			5	Indicates the number of sub-channels for TX resource pool
sl-SubchannelSize-r16 included in SL-ResourcePool			10	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB
Number of Active Sidelink UEs			50	Active Sidelink UE i = 0, .., 49
SL-ThresPSSCH-RSRP			12	Corresponding -106 dBm as defined in section 6.3.5 in TS38.331[2]
Active Sidelink UEs (UE i = 0, .., 49)	V2X sidelink Communication preconfiguration		As specified in table A.3.21.2-1 And A.3.21.2-3	IE values unless specified otherwise in this test.
	sl-TimeResource-r16 included in SL-ResourcePool		$\{1_i\}$ Note1	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
	sl-NumSubchannel-r16 included in SL-ResourcePool		1	Indicates the number of sub-channels for TX resource pool
	sl-StartRB-Subchannel-r16 included in SL-ResourcePool		floor(i/10)x10	Indicates the lowest PRB index of the subchannel with the lowest index. UE 0~9 start PRB=0; UE 10~19 start PRB=10; UE 20~29 start PRB=20; UE 30~39 start PRB=30; UE 40~49 start PRB=40;
	sl-SubchannelSize-r16 included in SL-ResourcePool		10	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB
	sl-ResourceReservePeriod2-r16	ms	5	
Timing offset among Active Sidelink UEs		µs	CP/2	Synchronous
NOTE 1: $\{1_i\}$ is a sequence of nine 0's with one 1 in (mod(i,10)+1'th position. NOTE 2: The UE is only required to be tested in one of the supported test configurations.				

Table A.9.1.4.6.1-2: Active Sidelink UE Specific Test Parameters for V2X UE Autonomous Resource Selection/Reselection Tests in SL-DRX

Parameter	Unit	Active Sidelink UE i (i = 0, .., 49)	
		T1	T2
NR RF Channel Number	-	1	
Channel Bandwidth ($BW_{channel}$) Note 5	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS	kHz	30	
PSCCH RMC (defined in A.3.21.3)	-	CC.1A HD	
PSSCH RMC (defined in A.3.21.3)	-	CD.1A HD	
N_{oc} Note1	dBm/30 kHz	-111	-121
$\hat{E}_s / N_{oc}$ Note3	dB	10	
$\hat{E}_s / I_{ot}$ Note2,3	dB	10	

Parameter	Unit	Active Sidelink UE i (i = 0, .., 49)	
		T1	T2
$\hat{E}_s / N_{oc}$ Note4	dB	0	20
$\hat{E}_s / I_{ot}$ Note2,4	dB	0	20
PSSCH-RSRP1 Note 2,3	dBm/30kHz	-101	-111
PSSCH -RSRP2 Note 2,4	dBm/30kHz	-111	-101
SL-RSSI1 Note 2,3	dBm/3.6 MHz	-79.79	-89.79
SL-RSSI2 Note 2,4	dBm/3.6 MHz	-87.20	-80.17
Antenna Configuration	-	1x2	
Propagation Condition	-	AWGN	

NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, PSSCH-RSRP and SL-RSSI levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: For UE 10 to 29, occupying subchannel #1/2
NOTE 4: For UE 0 to 9 and 30 to 49, occupying subchannel #0/3/4
NOTE 5: The UE is only required to be tested in one of the supported test configurations.

A.9.1.4.6.2 Test Requirements

The test time T1 and T2 should be long enough. The rate of PSSCH transmissions on the resources on subchannel #1 or #2 shall be less than 10 % during T1. The rate of PSSCH transmissions on the resources on subchannel #1 or #2 shall be more than 90 % during T2. The PSSCH transmission should happen only in the receiver SL UE SL-DRX active time.

A.9.1.5 Test for Congestion Control Measurement

A.9.1.5.1 Test Purpose and Environment

The purpose of this test is to verify the congestion control measurement requirements in section 12.6. For UE supporting NR Uu and sidelink operation, this test will also verify that V2X UE makes correct reporting of an event.

The test parameters are given in table A.9.1.5.1-1, Table A.9.1.5.1-2 , A.9.1.5.1-3 and A.9.1.5.1-4 below. There are 4 active V2X sidelink UEs in this test. The test system shall emulate the active sidelink UE to transmit PSCCH/PSSCH every 50 ms. Additionally, For UE supporting NR Uu and sidelink operation, there is an active Cell (Cell 1) in this test. For UE only supporting NR sidelink, There are no active cell and GNSS is reliable during the whole test. The test system can emulate and send the GNSS signal to the test UE. The test parameters for GNSS signals are defined in B.4.1.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During T1, all of active V2X sidelink UEs are configured to transmit PSCCH/PSSCH with lower transmission power every 50 ms. During T2, all of active V2X sidelink UEs are configured to transmit PSCCH/PSSCH with higher transmission power every 50 ms.

For UE supporting NR Uu and sidelink operation, the UE under test and all active sidelink UEs select PCell as synchonization source In the measurement control information it is indicated to the V2X UE that event-triggered reporting with Event C1 is used.

For UE only supporting NR sidelink, the UE under test and all active sidelink UEs select GNSS as synchonization source. The UE is triggered by the test loop function or the upper layers to transmit for V2X Sidelink Communication.

For UE supporting NR Uu and sidelink operation, Supported test configurations for FR1 NR cell are shown in table A.9.1.5.1.1-1.

Table A.9.1.5.1.1-1: Supported Test Configurations for FR1 NR cell (only for UE supporting both NR Uu and sidelink operation)

Configuration	Description
1	NR Uu: FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz

2	NR Uu: TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR Uu: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.9.1.5.1-2: General test parameters for Congestion Control Measurement Test for V2X UE

Parameter		Unit	Value	Comment
NR RF Channel Number			1	HD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$)Note 2		MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
SCS		kHz	30	
V2X sidelink communication configuration			As specified in table A.3.21.2-1 and A.3.21.2-3	IE values unless specified otherwise in this test.
sl-TimeResource-r16 included in SL-ResourcePool			1111111111111111111 1111111111111111111 1111111111111111111 1111111111111111111 1111111111111111111	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
sl-NumSubchannel-r16 included in SL-ResourcePool			1	ENUMERATED {n1}
sl-SubchannelSize included in SL-ResourcePool			10	ENUMERATED {n10}
sl-StartRB-Subchannel-r16			0	
threshS-RSSI-CBR			19	Corresponding -74 dBm as defined in section 6.3.8 in TS38.331[2]
Active Cell Note 3			Cell 1	
Number of Active Sidelink UEs every 50 ms			4	Active Sidelink UE i, where i = 0, 1, 2, 3
Active Sidelink UEs (i = 0,1,2,3)	V2X sidelink Communication configuration		As specified in table A.3.21.2-1 and A.3.21.2-3	IE values unless specified otherwise in this test.
	sl-TimeResource-r16 included in SL-ResourcePool		$\{1_i\}^{Note1}$	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
	sl-NumSubchannel-r16 included in SL-ResourcePool		1	
	sl-SubchannelSize included in SL-ResourcePool		10	
Timing offset between V2X UE and Active Sidelink UEs		µs	CP/2	Synchronous
c1-Threshold-r16Note 3			2	Corresponding 0.02 as defined in section 6.3.2 in TS38.331[2]
sl-CBR-RangeConfigList-r16 Note 4			[2 100]	Two ranges are defined by this list: 0 to 0.02 and 0.02 to 1
sl-CR-Limit-r16 Note 4			10000 and 10	Corresponding to the two CBR ranges: if CBR > 0.02, CR ≤ 0.001, otherwise CR > 0.001
sl-Thres-RSRP-r16 Note 4			12	Configure threshold <-98.64 dBm/30kHz to ensure not blocking transmission
Hysteresis			0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
T1		s	5	
T2		s	5	

NOTE 1: $\{1_i\}$ is a sequence of ninety nine 0's with one 1 in i+1'th position.
NOTE 2: The UE is only required to be tested in one of the channel bandwidths.
NOTE 3: Only for UE supporting both Uu and sidelink operation.
NOTE 4: Only for UE supporting sidelink operation but not supporting Uu.

Table A.9.1.5.1-3: Active sidelink UE specific test parameters for Congestion Control Measurement Test for V2X UE

Parameter	Unit	Active Sidelink UE *i* (*i* = 0, 1, 2, 3)	
		T1	T2
NR RF Channel Number		1	
Channel Bandwidth ($BW_{channel}$) Note 7	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
PSCCH RMC (defined in A.3.21.3)		CC.1A HD	
PSSCH RMC (defined in A.3.21.3)		CD.1A HD	
N_{oc} Note1	dBm/30 kHz	-103	
$\hat{E}_s/N_{oc}$	dB	4.35	10.32
SL-RSSI1 Note 2,3	dBm/3.6 MHz	-76.5	-71.5
SL-RSSI2 Note 2,4	dBm/3.6 MHz	-82.21	-82.21
Io1 Note 2,5	dBm/18 MHz	-76.5	-71.5
	dBm/36 MHz	-76.5	-71.5
Io2 Note 2,6	dBm/18 MHz	-82.21	-82.21
	dBm/36 MHz	-82.21	-82.21
Propagation Condition	-	AWGN	

NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SL-RSSI1, SL-RSSI2, Io1 and Io2 levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SL-RSSI1 is the SL-RSSI level measured on the slot# 0 - 3 with “SFN mod 5 = 0”.
NOTE 4: SL-RSSI2 is the SL-RSSI level measured on the slot# 4-9 with “SFN mod 5 = 0” and the slot# 0-9 with “SFN mod 5 = 1,…, 4”.
NOTE 5: Io1 is the Io level measured on the slot# 0 - 3 with “SFN mod 5 = 0”.
NOTE 6: Io2 is the Io level measured on the slot# 4-9 with “SFN mod 5 = 0” and the slot# 0-9 with “SFN mod 5 = 1,…, 4”.
NOTE 7: The UE is only required to be tested in one of the supported test configurations.

Table A.9.1.5.1-4: Cell Test Parameters for Congestion Control Measurement Test for V2X UE (only for UE supporting both NR Uu and sidelink operation)

Parameter		Unit	Cell 1
RF Channel Number			2
Duplex Mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
Channel Bandwidth ($BW_{channel}$)	Config 1,2	MHz	10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
Initial BWP Configuration			DLBWP.0.1 ULBWP.0.1
Dedicated BWP Configuration			DLBWP.1.1 ULBWP.1.1
DRX Cycle			N/A
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration			SMTC.2
OCNG Patterns			OP.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			

Parameter		Unit	Cell 1
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-98
N_{oc} Note2	Config 1,2	dBm/SCS	-98
	Config 3		-95
$\hat{E}_s / N_{oc}$		dB	3
SS-RSRP Note3	Config 1,2	dBm/SCS	-95
	Config 3		-92
Io Note 3	Config 1,2	dBm/9.36 MHz	-65.2
	Config 3	dBm/38.1 MHz	-59.2
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.9.1.5.2 Test Requirements

For UEs that support NR Uu and sidelink operation, the UEs shall not send event C1 triggered measurement reports during T1 and shall send event C1 triggered measurement reports during T2.

For UEs that support sidelink operation only, the UE channel occupancy ratio shall be larger than 0.001 during T1, and the UE channel occupancy ratio shall be smaller than 0.001 curing T2.

The rate of correct events observed during repeated tests shall be at least 98 %.

A.9.1.6 Test for Interruption

A.9.1.6.1 Test for Interruption to WAN due to V2X Sidelink Communication

A.9.1.6.1.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to interruptions due to V2X sidelink communication defined in clause 12.7.1 under the following additional conditions:

- The UE is out of coverage on the V2X sidelink carrier and is associated with a serving cell on a non-V2X sidelink carrier

This test is applicable for V2X sidelink communication capable UEs that support inter-band concurrent V2X sidelink operation.

For this test, the UE is triggered by the test loop function or the upper layers to monitor V2X sidelink communication.

The test parameters are given in table A.9.1.6.1.1-1, table A.9.1.6.1.1-2, table A.9.1.6.1.1-3 and table A.9.1.6.1.1-4. The test consists of one active cell (PCell) on the serving RF channel 1, and there are no active cells on RF channel 2. On RF channel 2, the test consists of 8 active Sidelink UEs in this test transmitting V2X sidelink communication. The UE under test and all active sidelink UEs select the active cell as synchonization source.

The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively.

During T1, the UE is in RRC_IDLE and monitoring the V2X sidelink communication transmission from other active Sidelink UEs on the V2X sidelink communication resources.

During T2, the test system establishes a RRC connection with the UE. No PDSCH traffic is scheduled for UE, and the UE is expected to transmit *SidelinkUEInformationNR* indicating *sl-RxInterestedFreqList*. On reception of *SidelinkUEInformationNR*, the test system shall send RRC reconfiguration message to the UE and wait for the UE to respond with RRC reconfiguration complete message before transitioning to T3. If the UE does not transmit *SidelinkUEInformationNR* for up to 2 second, the test system shall transition to T3.

During T3, the UE is scheduled with PDSCH traffic on PCell downlink. The test system will count the missed ACK/NACKs during T3 to verify the allowed interruptions during V2X sidelink communication.

Table A.9.1.6.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	NR Uu: FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR Uu: TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR Uu: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.9.1.6.1.1-2: Test Parameters for Interruptions due to V2X Sidelink Communication

Parameter	Unit	Value	Comment
RF Channel Number	-	1, 2	RF channel 1 is non-V2X sidelink carrier RF channel 2 is V2X sidelink carrier
SCS	kHz	30	
Active cell	-	Cell 1	PCell on RF channel number 1
CP length of Cell 1	-	Normal	
T1	s	5.12	
T2	s	Up to receiving RRC reconfiguration setup complete from the UE, or up to 2 second if UE does not transmit *SidelinkUEInformationNR* during this period.	
T3	s	10	

Table A.9.1.6.1.1-3: Sidelink Communication Configuration for Interruptions due to V2X Sidelink Communication

Parameter		Unit	Value	Comment
RF Channel Number		-	2	HD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 1		MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
V2X sidelink Communication configuration		-	As specified in section A.3.21.2	IE values unless specified otherwise in this test.
Number of Active Sidelink UEs		-	8	Active Sidelink UE i = 0, .., 7
Active Sidelink UEs (UE i = 0, .., 7)	V2X sidelink Communication configuration	-	As specified in section A.3.21.2	IE values unless specified otherwise in this test.
	PSCCH Reference Measurement Channel	-	CC.1A HD	As specified in table A.3.21.3-1
	PSSCH Reference Measurement Channel	-	CD.1A HD	As specified in table A.3.21.3-2
	sl-NumSubchannel-r16 included in SL-ResourcePool	-	1	Indicates the number of sub-channels for TX resource pool
	sl-StartRB-Subchannel-r16 included in SL-ResourcePool	-	i	Indicates the lowest PRB index of the subchannel with the lowest index for

Parameter		Unit	Value	Comment
				active Sidelink UE i = 0, .., 7.
	PSBCH-RSRP	dBm/30kHz	-95	
NOTE 1: The UE is only required to be tested in one of the supported test configurations.				

Table A.9.1.6.1.1-4: Cell specific test parameters for interruptions due to V2X slidelink communication

Parameter		Unit	Cell 1		
			T1	T2	T3
RF Channel Number			1		
UE RRC state			IDLE	CONNECTED	
Duplex Mode	Config 1		FDD		
	Config 2,3		TDD		
TDD configuration	Config 1		Not Applicable		
	Config 2		TDDConf.1.1		
	Config 3		TDDConf.2.1		
Channel Bandwidth ($BW_{channel}$)	Config 1,2	MHz	10: $N_{PRB,c}$ = 52		
	Config 3		40: $N_{PRB,c}$ = 106		
Initial BWP Configuration			DLBWP.0.1 ULBWP.0.1		
Dedicated BWP Configuration			DLBWP.1.1 ULBWP.1.1		
DRX Cycle			N/A		
PDSCH Reference measurement channel	Config 1		N/A	None	SR.1.1 FDD
	Config 2		N/A	None	SR.1.1 TDD
	Config 3		N/A	None	SR.2.1 TDD
CORESET Reference Channel	Config 1		CR.1.1 FDD		
	Config 2		CR.1.1 TDD		
	Config 3		CR.2.1 TDD		
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD		
	Config 2		CCR.1.1 TDD		
	Config 3		CCR.2.1 TDD		
SSB configuration	Config 1,2		SSB.1 FR1		
	Config 3		SSB.2 FR1		
SMTC Configuration			SMTC.2		
OCNG Patterns			OP.1		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-98		
N_{oc} Note2	Config 1,2	dBm/SCS	-98		
	Config 3		-95		
$\hat{E}_s / N_{oc}$		dB	3		
SS-RSRP Note3	Config 1,2	dBm/SCS	-95		
	Config 3		-92		
Io Note 3	Config 1,2	dBm/9.36 MHz	-65.3		
	Config 3	dBm/38.1 MHz	-59.2		
Antenna Configuration			1x2		
Propagation Condition			AWGN		

Parameter	Unit	Cell 1		
		T1	T2	T3
NOTE 1: OCNG shall be used such that cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.9.1.6.1.2 Test Requirements

The UE shall be continuously scheduled on PCell on RF channel 1 during T3. During T3, the interruption on PCell shall not be more than the values specified in clause 12.7.1..

A.9.1.6.2 Test for interruption to WAN at transitions between active and non-active during SL-DRX in asynchronous case

A.9.1.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that when V2X sidelink is in SL-DRX and NR PCell is in non-DRX, NR PCell interruptions due to transitions of V2X sidelink UE from active to non-active and from non-active to active do not exceed the limits in terms of missing ACK/NACK. This test will verify the missing ACK/NACK rate on NR PCell in clause 12.7.4 under the following additional conditions:

- The UE is out of coverage on the V2X sidelink carrier and is associated with a serving cell on a non-V2X sidelink carrier.
- The UE is in sidelink resource allocation mode 1.

This test is applicable for V2X sidelink communication capable UEs that support inter-band concurrent V2X sidelink operation.

For this test, the UE is triggered by the test loop function or the upper layers to monitor V2X sidelink communication.

The test parameters are given in table A.9.1.6.2.1-1, table A.9.1.6.2.1-2, and table A.9.1.6.2.1-3. The test consists of one active cell (PCell) on the serving RF channel 1, and there are no active cells on RF channel 2. The UE under test selects GNSS as the synchonization source.

The test consists of one time period, with duration of T1. During T1, NR PCell is continuously scheduled in DL while V2X sidelink is not scheduled and has SL-DRX configured. Prior to start of T1 the SL-DRX inactivity timer for the V2X sidelink has already expired. PDCCH indicating a new transmission on PCell shall be sent continuously during the entire time duration to ensure UE would not enter DRX state on PCell.

Table A.9.1.6.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	NR Uu: FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR Uu: TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR Uu: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.9.1.6.2.1-2: Test Parameters for Interruptions at transitions between active and non-active during SL-DRX in asynchronous case

Parameter	Unit	Value	Comment
RF Channel Number	-	1, 2	RF channel 1 is non-V2X sidelink carrier RF channel 2 is V2X sidelink carrier
SCS	kHz	30	
Active cell	-	Cell 1	PCell on RF channel number 1
CP length of Cell 1	-	Normal	

SL-DRX		SL-DRX.3	SL-DRX related parameters are defined in table A.3.21.4.2-1
T1	s	10	

Table A.9.1.6.2.1-3: Cell specific test parameters for interruptions at transitions between active and non-active during SL-DRX in asynchronous case

Parameter		Unit	Cell 1
			T1
RF Channel Number			1
UE RRC state			CONNECTED
Duplex Mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
Channel Bandwidth ($BW_{channel}$)	Config 1,2	MHz	10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
Initial BWP Configuration			DLBWP.0.1 ULBWP.0.1
Dedicated BWP Configuration			DLBWP.1.1 ULBWP.1.1
DRX Cycle			N/A
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration			SMTC.2
OCNG Patterns			OP.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-98
N_{oc} Note2	Config 1,2	dBm/SCS	-98
	Config 3		-95
$\hat{E}_s / N_{oc}$		dB	3
SS-RSRP Note3	Config 1,2	dBm/SCS	-95
	Config 3		-92
Io Note 3	Config 1,2	dBm/9.36 MHz	-65.3
	Config 3	dBm/38.1 MHz	-59.2
Antenna Configuration			1x2
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.9.1.6.2.2 Test Requirements

The UE shall be continuously scheduled on PCell on RF channel 1 during the entire length of T1. UE shall not be scheduled in V2X sidelink during T1. During the time duration T1 the UE shall transmit at least 99.375 % of ACK/NACK on NR PCell.

Interruption on NR PCell shall not exceed X as defined in table A.9.1.6.2.2-1.

Table A.9.1.6.2.2-1: Interruption length X at transition between active and non-active during SL-DRX

μ	NR Slot length (ms)	Interruption length X
		Async
0	1	2
1	0.5	2
2	0.25	3

The rate of correct events observed during repeated tests shall be at least 90 %.

A.9.1.6.3 Test for Interruption at NR Sidelink Diccovery Configuration

A.9.1.6.3.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to interruptions due to NR sidelink discovery configuration defined in clause 12.7.8 under the following additional conditions:

- The UE is out of coverage on the NR sidelink carrier and is associated with a serving cell on a NR non-sidelink carrier

This test is applicable for NR sidelink discovery capable UEs that support inter-band concurrent sidelink operation.

For this test, the UE is triggered by the test loop function or the upper layers to monitor NR sidelink discovery.

The test parameters are given in table A.9.1.6.3.1-1, table A.9.1.6.3.1-2, table A.9.1.6.3.1-3 and table A.9.1.6.3.1-4. The test consists of one active cell (PCell) on the serving RF channel 1, and there are no active cells on RF channel 2. On RF channel 2, the test consists of 8 active Sidelink UEs in this test transmitting sidelink discovery. The UE under test and all active sidelink UEs select the active cell as synchonization source.

The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively.

During T1, the UE is in RRC_IDLE and monitoring NR sidelink discovery announcements from other active Sidelink UEs on NR sidelink discovery resources.

During T2, the test system establishes a RRC connection with the UE. No PDSCH traffic is scheduled for UE, and the UE is expected to transmit *SidelinkUEInformationNR* indicating *sl-RxInterestedFreqListDisc*. On reception of *SidelinkUEInformationNR*, the test system shall send RRC reconfiguration message to the UE and wait for the UE to respond with RRC reconfiguration complete message before transitioning to T3. If the UE does not transmit *SidelinkUEInformationNR* for up to 2 second, the test system shall transition to T3.

During T3, the UE is scheduled with PDSCH traffic on PCell downlink. The test system will count the missed ACK/NACKs during T3 to verify the allowed interruptions during NR sidelink discovery.

Table A.9.1.6.3.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	NR Uu: FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR Uu: TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR Uu: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.9.1.6.3.1-2: Test Parameters for Interruptions at NR Sidelink Discovery Configuration

Parameter	Unit	Value	Comment
RF Channel Number	-	1, 2	RF channel 1 is NR non-sidelink carrier RF channel 2 is NR sidelink carrier
SCS	kHz	30	
Active cell	-	Cell 1	PCell on RF channel number 1
CP length of Cell 1	-	Normal	
T1	s	5.12	
T2	s	Up to receiving RRC reconfiguration setup complete from the UE, or up to 2 second if UE does not transmit *SidelinkUEInformationNR* during this period.	
T3	s	5	

Table A.9.1.6.3.1-3: Sidelink Discovery Configuration for Interruptions at NR Sidelink Discovery Configuration

Parameter		Unit	Value	Comment
RF Channel Number		-	2	HD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 1		MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
NR sidelink discovery configuration		-	As specified in section A.3.21.2	IE values unless specified otherwise in this test.
Number of Active Sidelink UEs		-	8	Active Sidelink UE i = 0, .., 7
Active Sidelink UEs (UE i = 0, .., 7)	NR sidelink discovery configuration	-	As specified in section A.3.21.2	IE values unless specified otherwise in this test.
	PSCCH Reference Measurement Channel	-	CC.1A HD	As specified in table A.3.21.3-1
	PSSCH Reference Measurement Channel	-	CD.1A HD	As specified in table A.3.21.3-2
	sl-NumSubchannel-r16 included in SL-ResourcePool	-	1	Indicates the number of sub-channels for TX resource pool
	sl-StartRB-Subchannel-r16 included in SL-ResourcePool	-	i	Indicates the lowest PRB index of the subchannel with the lowest index for active Sidelink UE i = 0, .., 7.
	PSBCH-RSRP	dBm/30kHz	-95	
NOTE 1: The UE is only required to be tested in one of the supported test configurations.				

Table A.9.1.6.3.1-4: Cell specific test parameters for interruptions at NR Sidelink Discovery Configuration

Parameter		Unit	Cell 1		
			T1	T2	T3
RF Channel Number			1		
UE RRC state			IDLE	CONNECTED	
Duplex Mode	Config 1		FDD		
	Config 2,3		TDD		
TDD configuration	Config 1		Not Applicable		
	Config 2		TDDConf.1.1		
	Config 3		TDDConf.2.1		
Channel Bandwidth ($BW_{channel}$)	Config 1,2	MHz	10: $N_{PRB,c}$ = 52		
	Config 3		40: $N_{PRB,c}$ = 106		
Initial BWP Configuration			DLBWP.0.1 ULBWP.0.1		

Dedicated BWP Configuration			DLBWP.1.1 ULBWP.1.1		
DRX Cycle			N/A		
PDSCH Reference measurement channel	Config 1		N/A	None	SR.1.1 FDD
	Config 2		N/A	None	SR.1.1 TDD
	Config 3		N/A	None	SR.2.1 TDD
CORESET Reference Channel	Config 1		CR.1.1 FDD		
	Config 2		CR.1.1 TDD		
	Config 3		CR.2.1 TDD		
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD		
	Config 2		CCR.1.1 TDD		
	Config 3		CCR.2.1 TDD		
SSB configuration	Config 1,2		SSB.1 FR1		
	Config 3		SSB.2 FR1		
SMTC Configuration			SMTC.2		
OCNG Patterns			OP.1		
EPRE ratio of PSS to SSS		dB	0		
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-98		
N_{oc} Note2	Config 1,2	dBm/SCS	-98		
	Config 3		-95		
$\hat{E}_s / N_{oc}$		dB	3		
SS-RSRP Note3	Config 1,2	dBm/SCS	-95		
	Config 3		-92		
Io Note 3	Config 1,2	dBm/9.36 MHz	-65.3		
	Config 3	dBm/38.1 MHz	-59.2		
Antenna Configuration			1x2		
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.9.1.6.3.2 Test Requirements

The UE shall be continuously scheduled on PCell on RF channel 1 during T3. During T3, the interruption on PCell shall not be more than the values specified in clause 12.7.8.

A.9.1.7 Selection / Reselection of relay UE

A.9.1.7.1 Test Purpose and Environment

The purpose of this test is to verify the requirements related to selection / reselection of relay UE defined in clauses 12.10. In the test, the UE under test is configured with PCell or an Sidelink UE but not both, based on the scenarios (U2N or U2U relay) UE supported, and is configured with resource pools for NR sidelink discovery message as required for remote UE operation.

This test is applicable to UEs capable of NR sidelink communication and sidelink discovery, and further support the optional feature of sidelink remote UE operation.

The test parameters are given in table A.9.1.7.1.1-0, table A.9.1.7.1.1-1, table A.9.1.7.1-2, table A.9.1.7.1-3, table A.9.1.7.1-4, table A.9.1.7.1-5, and table A.9.1.7.1-6 below. The test consists of one active serving cell (cell 1, configured as Table A.9.1.7.1-5) or an Sidelink UE (Sidelink UE 1, configured as Table A.9.1.7.1-6), one remote UE and two active Sidelink relay UEs (Sidelink Relay UE 1, Sidelink Relay UE 2). The relay UEs are configured in mode 2 to be transmitting relay discovery messages every discovery period, which is determined by resource reservation period indicated by sl-ResourceReservePeriodList.

The test system shall ensure that the remote UE under test has transmitted *SidelinkUEInformationNR* message and has been configured with the sidelink discovery resource pool and sidelink communication resource pool respectively for relay operation prior to the start of the test.

The tests consist of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively.

During T1, RSRP of cell 1 or SL-RSRP of Sidelink UE 1 is kept higher than *threshHighRemote* (within *sl-remoteUE-Config*), and the remote UE is not required to perform relay UE selection.

During T2, RSRP of cell 1 or SL-RSRP of Sidelink UE 1 is configured to be lower than *threshHighRemote*. The UE is expected to start looking for relay UE. The test system shall ensure that the UE under test has been configured the resource pool prior to end of T2 duration. During T2, the SD-RSRP of Sidelink Relay UE 1 and Sidelink Relay UE 2 is configured to be lower than the detection threshold and no relay UE will be available for the remote UE under test.

During T3, the SD-RSRP of Sidelink Relay UE 1 is raised above the threshold *sl-RSRP-Thresh* and the UE is expected to perform relay selection to Sidelink Relay UE 1. The test system can determine that the remote UE has selected a relay by monitoring the configured sidelink communication resource for the ProSe direct link establishment request message to the relay UE.

During T4, the UE is expected to complete the sidelink connection establishment with the relay UE. Note that the RSRP of the serving cell (cell 1) or SL-RSRP of Sidelink UE 1 and the SD-RSRP of sidelink relay UEs are kept unchanged during T3 and T4. The period T4 ends when Sidelink Relay UE1 sends the sidelink communication response message back to the remote UE.

During T5, SD-RSRP of Sidelink Relay UEs are modified such that the remote UE is expected to reselect to Sidelink Relay UE2.

Table A.9.1.7.1-0: Supported test configurations for FR1 PCell

Configuration	Description
1	NR Uu: FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR Uu: TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR Uu: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.9.1.7.1-1: Test parameters for selection / reselection of relay UE test for NR FR1

Parameter	Unit	Value	Comment
NR RF Channel Number		1	HD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 1	MHz	20 (NRB,c = 50) or 40 (NRB,c = 100)	
SCS	kHz	30	
Traffic destination		Cell 1 or Sidelink UE 1	Serving NR cell will broadcast SIB12. Sidelink UE 1 will use the configuration in SL-PreconfigurationNR.
Active Relay UEs		Relay UE 1, Relay UE 2	Transmitting relay discovery message
CP length of Cell 1 and Sidelink UE 1		Normal	
T1	ms	100	
T2	s	Up to receiving RRC reconfiguration setup complete from the UE, or up to 1 sec if UE does not transmit *SidelinkUEInformationNR* during this period.	
T3	s	1	

T4	s	2	
T5	s	1	
NOTE 1: The UE is only required to be tested in one of the supported test configurations.			

Table A.9.1.7.1-2: Sidelink discovery configuration for selection / reselection of relay UE test for NR FR1

Parameter	Unit	Value	Comment
NR RF Channel Number		1	HD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 1	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
Resource pool configuration for sidelink discovery		As specified in table A.3.21.2-2 Note 2	IE values unless specified otherwise in this test.
sl-TimeResource included in *sl-DiscTxPoolSelected-r17* and *sl-DiscRxPool-r17*		0000111100	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
sl-NumSubchannel included in *sl-DiscTxPoolSelected-r17* and *sl-DiscRxPool-r17*		2	Indicates the number of sub-channels for TX resource pool
sl-SubchannelSize included in *sl-DiscTxPoolSelected-r17* and *sl-DiscRxPool-r17*		10	Indicates the minimum granularity in frequency domain for the sensing for PSSCH resource selection in the unit of PRB
sl-ResourceReservePeriodList	s	0.04	Indicates the resource reservation period for discovery period
threshHighRemote within sl-remoteUE-Config		-91 dBm	
sl-RSRP-Thresh within sl-remoteUE-Config		-91 dBm	
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: This test is according to the principle defined in section A.3.21.			

Table A.9.1.7.1-3: Sidelink Communication configuration for selection / reselection of relay UE test

Parameter		Unit	Value	Comment
RF Channel Number		-	1	HD carrier in Band n47 or n38
Channel Bandwidth ($BW_{channel}$) Note 1		MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)	
Sidelink Communication configuration		-	As specified in section A.3.21.2	IE values unless specified otherwise in this test.
sl-TimeResource		-	0000000011	Indicates the bitmap of the TX and Rx resource pool, which is defined by repeating the bitmap within a SFN cycle (see TS 38.213[3])
Number of Active Sidelink Relay UEs		-	2	Active Sidelink UE i = 0, 1
Active Sidelink Relay UEs (UE i = 0, 1) and Sidelink UE 1 Note 2	PSCCH Reference Measurement Channel	-	CC.1A HD	As specified in table A.3.21.3-1
	PSSCH Reference Measurement Channel	-	CD.1A HD	As specified in table A.3.21.3-2
	sl-NumSubchannel-r16 included in SL-ResourcePool	-	1	Indicates the number of sub-channels for TX resource pool
	sl-SubchannelSize-r16 included in SL-ResourcePool		10	Indicates the minimum granularity in frequency domain for the sensing for

				PSSCH resource selection in the unit of PRB
	sl-StartRB-Subchannel-r16 included in SL-ResourcePool	-	floor(i)x10	Indicates the lowest PRB index of the subchannel with the lowest index for Sidelink Relay UE i = 0 starts PRB=0; Sidelink Relay UE i = 1 starts PRB=10. Sidelinke UE 1 i = 2 starts PRB=20.
	PSBCH-RSRP	dBm/30kHz	-95	
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: The parameters for Sidelink UE 1 are applicable only when it exists.				

Table A.9.1.7.1-4: Sidelink Relay UE specific test parameters for selection / reselection of relay UE test for NR FR1

Parameter	Unit	Relay UE 1					Relay UE 2				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
NR RF Channel Number		1 (HD carrier in Band n47 or n38)									
$BW_{channel}$ Note 4	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)									
SCS	kHz	30									
Sidelink Discovery resource pool configuration		As specified in table A.9.1.7.1-2									
Transmission frequency		Every discovery period (40 ms)									
Resource allocation		Non-overlapping PRBs									
N_{oc} Note1	dBm/30 kHz	-97									
$\hat{E}_s / N_{oc}$	dB	-inf	-inf	10.5	10.5	-1.5	-inf	-inf	-inf	-inf	10.5
SD-RSRP / SL-RSRP Note2, Note 3	dBm/30 kHz	-inf	-inf	-86.5	-86.5	-98.5	-inf	-inf	-inf	-inf	-86.5
Antenna Configuration	-	1x2									
Propagation Condition		AWGN									
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: SD-RSRP / SL-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: PSCCH-DMRS Es/Iot is set the same as PSSCH-DMRS Es/Iot. NOTE 4: This test is according to the principle defined in section A.3.21.2.											

Table A.9.1.7.1-5: Cell specific test parameters for selection / reselection of relay UE test for NR FR1

Parameter		Unit	Cell 1				
			T1	T2	T3	T4	T5
NR RF Channel Number			2				
Serving/Non-serving			Serving				
Duplex Mode	Config 1		FDD				
	Config 2,3		TDD				
TDD configuration	Config 1		Not Applicable				
	Config 2		TDDConf.1.1				
	Config 3		TDDConf.2.1				
Channel Bandwidth ($BW_{channel}$)	Config 1,2		10: $N_{PRB,c}$ = 52				
	Config 3		40: $N_{PRB,c}$ = 106				
Initial BWP Configuration			DLBWP.0.1 ULBWP.0.1				
Dedicated BWP Configuration			DLBWP.1.1 ULBWP.1.1				
DRX Cycle			N/A				
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD				
	Config 2		SR.1.1 TDD				
	Config 3		SR.2.1 TDD				

Parameter		Unit	Cell 1				
			T1	T2	T3	T4	T5
CORESET Reference Channel	Config 1		CR.1.1 FDD				
	Config 2		CR.1.1 TDD				
	Config 3		CR.2.1 TDD				
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD				
	Config 2		CCR.1.1 TDD				
	Config 3		CCR.2.1 TDD				
SSB configuration	Config 1,2		SSB.1 FR1				
	Config 3		SSB.2 FR1				
SMTC Configuration			SMTC.2				
OCNG Patterns			OP.1				
EPRE ratio of PSS to SSS		dB	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
Correlation Matrix and Antenna Configuration			1x2 Low				
drx-Configuration			N/A				
PDCCH/PCFICH/PHICH Reference measurement channel Note1			R.11 FDD				
OCNG Pattern defined in A.3.2.1			OP.16 FDD				
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-97				
N_{oc} Note2	Config 1,2,	dBm/SCS	-97				
	Config 3		-94				
$\hat{E}_s / N_{oc}$		dB	10.5	1.5	1.5	1.5	1.5
SS-RSRP Note3	Config 1,2,	dBm/SCS	-86.5	-95.5	-95.5	-95.5	-95.5
	Config 3		-83.5	-92.5	-92.5	-92.5	-92.5
Propagation condition			AWGN				
Correlation Matrix and Antenna Configuration			1x2 Low				

NOTE 1: OCNG shall be used such that cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.9.1.7.1-6: Sidelink UE specific test parameters for selection / reselection of relay UE test for NR FR1

Parameter	Unit	Remote UE 2				
		T1	T2	T3	T4	T5
NR RF Channel Number		1 (HD carrier in Band n47 or n38)				
$BW_{channel}$ Note 4	MHz	20 ($N_{PRB,c}$ = 50) or 40 ($N_{PRB,c}$ = 100)				
SCS	kHz	30				
Resource allocation		Non-overlapping PRBs				
N_{oc} Note1	dBm/30 kHz	-97				
$\hat{E}_s / N_{oc}$	dB	10.5	-1.5	-1.5	-1.5	-1.5
SD-RSRP / SL-RSRP Note2, Note 3	dBm/30 kHz	[-86.5]	[-98.5]	[-98.5]	[-98.5]	[-98.5]
Antenna Configuration	-	1x2				
Propagation Condition		AWGN				

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SD-RSRP / SL-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: PSCCH-DMRS Es/Iot is set the same as PSSCH-DMRS Es/Iot.
NOTE 4: This test is according to the principle defined in section A.3.21.2.

A.9.1.7.2 Test Requirements

Sidelink relay UE selection delay is defined as the time from the beginning of time period T3 to the moment when the UE selects the Sidelink Relay UE1 and transmits the PC5-SP direct communication setup message using Sidelink Communications.

The test system shall verify that the sidelink relay UE selection delay is less than 680 ms.

NOTE: The sidelink relay UE selection delay can be expressed as ($T_{evaluate, SL_Relay_Intra}$ + 40 ms).

Sidelink relay UE reselection time is defined as the time from the beginning of time period T5 to the moment when the UE reselects to Sidelink relay UE2 and transmits the direct communication setup message using Sidelink Communications.

The test system shall verify that the sidelink relay UE reselection delay is less than 840 ms.

NOTE: The sidelink relay UE reselection delay can be expressed as ($T_{measure, SL_Relay_Intra}$ + $T_{evaluate, SL_Relay_Intra}$ + 40 ms).

A.9A Tests for NR Sidelink Measurements for Positioning

A.9A.1 Tests for NR Sidelink Measurements for Positioning in FR1

A.9A.1.1 Measurement delay tests

A.9A.1.1.1 NR SL RSTD measurement reporting delay test case in FR1 SA

A.9A.1.1.1.1 Test Purpose and Environment

The purpose of the test is to verify that the SL RSTD measurement meets the requirements specified in clause 12A.2 in an environment with AWGN propagation conditions in FR1 in standalone NR scenario, with additionally configured single frequency layer for SL positioning.

This test is applicable for UEs supporting NR Uu and V2X or 5G ProSe operation, which are capable of performing SL RSTD measurements.

The supported NR Uu test configurations are specified in table A.9A.1.1.1.1-1.

Table A.9A.1.1.1.1-1: Supported test configurations for FR1 NR Cell 1

NR Uu configuration	Description
Uu_conf1	NR Uu: 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
Uu_conf2	NR Uu: 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
Uu_conf3	NR Uu: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

The supported NR SL test configurations are specified in table A.9A.1.1.1.1-2.

Table A.9A.1.1.1.1-2: Supported test configurations for NR SL UEs

NR SL configuration	Description
SL_conf1	NR SL: 15 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf2	NR SL: 30 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf3	NR SL: 30 kHz SSB SCS, 20 MHz bandwidth, HD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test, there is one target UE receiving SL-PRS and performing SL RSTD measurements and three anchor UEs (anchor UE 1, anchor UE 2, and anchor UE 3) transmitting SL-PRS for the SL RSTD measurements on NR SL RF channel 2. Anchor UE 1 is the reference anchor UE for the measurements. The target UE and all the anchor UEs are in RRC_CONNECTED state, with Cell 1 as their PCell in FR1 on NR Uu RF channel 1. Cell 1 is also the synchronization source of the target UE and all anchor UEs in the test.

The test consists of two consecutive time intervals, with duration of T1 and T2. Before T2 starts, the UEs have been synchronized to Cell 1. During time duration T1, the target UE shall not have any timing information of anchor UE 2 and anchor UE 3. All three anchor UEs transmit SL-PRS during T2.

The *SL-TDOA-ProvideAssistanceData* and *SL-TDOA-RequestLocationInformation* as defined in TS 38.355 [37, clause 6.9], shall be provided to the target UE via Cell 1 during T1. The last TTI containing the two messages shall be provided to the target UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *SL-TDOA assistance* data and location information request.

The general test parameters are listed in table A.9A.1.1.1.1-3. NR Uu specific test parameters for Cell 1 and NR Uu UE-specific test parameters for all UEs in the test are listed in table A.9A.1.1.1.1-4 and A.9A.1.1.1.1-5, respectively. Anchor UE specific test parameters for SL RSTD measurement reporting delay during T1 and T2 are listed in table A.9A.1.1.1.1-6.

Table A.9A.1.1.1.1-3: General test parameters for SL RSTD measurement reporting delay

Parameter	Unit	Value	Comment
Serving cell		Cell 1	NR PCell of the target UE and all anchor UEs (anchor UE 1, anchor UE 2, anchor UE 3), in FR1 on NR Uu RF channel 1. This cell is also the synchronization source for SL operation for all UEs in the test.
CP length		Normal	
DRX		OFF	
Measurement gap		OFF	
Target UE		UE 0	The performing SL RSTD measurements based on SL-PRS transmissions from anchor UEs
Reference anchor UE		UE 1	Reference anchor UE is the UE in the SL-TDOA assistance data with respect to which the SL RSTD measurement is defined, as specified in TS 38.215 [4] and TS 38.355 [37]. The reference anchor UE is UE 1 in this test case.
Other anchor UEs		UE 2 and UE 3	Anchor UE 2 and Anchor UE 3 appear at the first and second places in the anchor UE list SL-RTD-Info in the SL-TDOA assistance data.
Number of anchor UEs provided in SL-TDOA assistance data		4	Including the reference anchor UE
Sidelink communication configuration		As specified in table A.3.21.2-2	
Target UE antenna configuration		1 x 2	

Timing offset between the anchor UEs at the target UE antenna connector	µs	UE2 to UE1: 0 UE3 to UE1: 3	Synchronous transmissions
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.9A.1.1.1.1-4: NR Uu specific test parameters for Cell 1Parameter		**Unit**	**Value**	**Comment**
NR Uu RF channel number			1	RF channel of Cell 1.
SSB configuration	Uu_conf1		SSB.1 FR1	SSB configuration of Cell 1.
	Uu_conf2		SSB.1 FR1	
	Uu_conf3		SSB.2 FR1	
SMTC configuration	Uu_conf1		SMTC.2	SMTC configuration of Cell 1.
	Uu_conf2		SMTC.1	
	Uu_conf3		SMTC.1	
PDSCH RMC configuration	Uu_conf1		SR.1.1 FDD	
	Uu_conf2		SR.1.1 TDD	
	Uu_conf3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Uu_conf1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Uu_conf2		CR.1.1 TDD	
	Uu_conf3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Uu_conf1		CCR.1.1 FDD	
	Uu_conf2		CCR.1.1 TDD	
	Uu_conf3		CCR.2.1 TDD	
Initial BWP configuration	Uu_conf1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Uu_conf1,2,3		DLBWP.1.1	
Active UL BWP configuration	Uu_conf1,2,3		ULBWP.1.1	

Table A.9A.1.1.1.1-5: NR Uu UE-specific test parameters for UE 0, UE 1, UE 2, and UE 3

Parameter	**Unit**	**Value**	**Comment**
NR Uu RF channel number		1	RF channel of Cell 1.
DRX		OFF	
OCNG Patterns		OP.1	
EPRE ratio of PSS to SSS	dB	0	
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			

EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-110	
	Config 1, 2	dBm /SCS	-110	
	Config 3		-107	
SSB $\hat{E}_s / N_{oc}$		dB	4.5	
SSB $\hat{E}_s / I_{ot}$		dB	4.5	
SS-RSRP Note3	Config 1,2	dBm /SCS	-105.5	
	Config 3		-102.5	
Io Note3	Config 1,2	dBm/ 19.08MHz	-73.1	
	Config 3	dBm/ 38.16MHz	-70.1	
Propagation condition			AWGN	

NOTE 1: OCNG shall be used such that cell 1 is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.9A.1.1.1.1-6: Anchor UEs specific test parameters on the SL carrier

Parameter		Unit	Anchor UE 1		Anchor UE 2		Anchor UE 3	
			T1	T2	T1	T2	T1	T2
SL RF Channel number			2		2		2	
SL DRX			OFF		OFF		OFF	
networkControlledSyncTx			ON		ON		ON	
inCoverage (in MIB-SL)			TRUE		TRUE		TRUE	
SL resource pool configuration	SL_conf1		shared resource pool if supported by UE1, otherwise dedicated		shared resource pool if supported by UE1, otherwise dedicated		shared resource pool if supported by UE1, otherwise dedicated	
	SL_conf2							
	SL_conf3							
SL-PRS configuration (defined in A.3.21A.2.1)	SL_conf1		N/A	SL PRS.1.3 FR1	N/A	SL PRS.1.3 FR1	N/A	SL PRS.1.4 FR1
	SL_conf2			SL PRS.1.1 FR1		SL PRS.1.1 FR1		SL PRS.1.2 FR1
	SL_conf3			SL PRS.1.3 FR1		SL PRS.1.3 FR1		SL PRS.1.4 FR1
SL-PRS resource slot offset	SL_conf1,2,3	slot	N/A	0	N/A	1 Note 6	N/A	2 Note 6
PSCCH RMC (defined in A.3.21.3)			CC.1A HD	CC.1A HD	CC.1A HD	CC.1A HD	CC.1A HD	CC.1A HD
PSSCH RMC (defined in A.3.21.3)			CD.1A HD	CD.1A HD	CD.1A HD	CD.1A HD	CD.1A HD	CD.1A HD
N_{oc} Note 2,4	SL_conf1	dBm/SCS	-94					
	SL_conf2,3		-91					
N_{oc} Note 2,5	SL_conf1	dBm/SCS	-98					
	SL_conf2,3		-95					
SL-PRS $\hat{E}_s / N_{oc}$ Note 4		dB	- Infinity	0	- Infinity	-3	- Infinity	-3
PSCCH $\hat{E}_s / N_{oc}$ Note 5		dB	N/A	4	N/A	1	N/A	1
Io Note 3,4	SL_conf1	dBm/9.36MHz	N/A	-65.15	N/A	-65.57	N/A	-65.57
	SL_conf2	dBm/8.64MHz		-68.44		-68.89		-68.89

	SL_conf3	dBm/18.36MHz		-65.21		-65.65		-65.65
SL PRS-RSRP Note 3,4	SL_conf1	dBm/SCS	- Infinity	-94	- Infinity	-97	- Infinity	-97
	SL_conf2,3			-91		-94		-94
PSCCH RP Note 3,5	SL_conf1	dBm/SCS	- Infinity	-94	- Infinity	-97	- Infinity	-97
	SL_conf2,3			-91		-94		-94
SL-PRS $\hat{E}_s/I_{ot}$ Note 4		dB	N/A	0	N/A	-3	N/A	-3
PSCCH $\hat{E}_s/I_{ot}$ Note 5		dB	N/A	4	N/A	1	N/A	1
Propagation Condition			AWGN					

NOTE 1: The resources for NR Uu uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other UEs and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SL PRS-RSRP, PSCCH Received Power (RP), and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.
NOTE 4: In symbols containing SL-PRS.
NOTE 5: In symbols containing PSCCH.
NOTE 6: Applicable only when *maxNumOfSlotsWithActiveSL-PRS-Resources* is larger than 2. If UE0 reports that *maxNumOfSlotsWithActiveSL-PRS-Resources* is 1, SL-PRS slot offset for anchor UE2 and anchor UE3 is *minTimeAfterEndofSlotCarryActiveSL-PRS-Resources* for SCS 15kHz and 2**minTimeAfterEndofSlotCarryActiveSL-PRS-Resources* for SCS 30kHz. If UE0 reports that *maxNumOfSlotsWithActiveSL-PRS-Resources* is 2, SL-PRS slot offset is 1 slot for anchor UE2 and *minTimeAfterEndofSlotCarryActiveSL-PRS-Resources* for SCS 15kHz and 2**minTimeAfterEndofSlotCarryActiveSL-PRS-Resources* for SCS 30kHz for anchor UE3.

A.9A.1.1.1.2 Test Requirements

The SL RSTD measurement time fulfils the requirements specified in clause 12A.2.5.

The UE shall perform and report to LMF the SL RSTD measurements for anchor UE 2 and anchor UE 3 with respect to the reference anchor UE 1, within the time duration specified in clause 12A.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each anchor UE observed during repeated tests shall be at least 90%, where the reported SL RSTD measurement for each correct event shall be within the SL RSTD reporting range specified in clause 10.4A.2.1.1, i.e., between SL_RSTD_000000 and SL_RSTD_492513.

A.9A.1.1.2 SL Rx-Tx measurement delay tests

A.9A.1.1.2.1 Test Purpose and Environment

The purpose of the test is to verify that the SL Rx-Tx measurement meets the requirements specified in clause 12A.2 in an environment with AWGN propagation conditions in FR1 in standalone NR scenario, with additionally configured single frequency layer for SL positioning.

This test is applicable for UEs supporting NR Uu and V2X or 5G ProSe operation, which are capable of performing SL Rx-Tx measurements.

The supported NR Uu test configurations in FR1 are shown in table A.9A.1.1.2.1-1.

Table A.9A.1.1.2.1-1: Supported Test Configurations for FR1 NR cell

Configuration	Description
1	NR Uu: 15 kHz SSB SCS, 20 MHz BW, FDD duplex mode
2	NR Uu: 15 kHz SSB SCS, 20 MHz BW, TDD duplex mode

3	NR Uu: 30 kHz SSB SCS, 40 MHz BW, TDD duplex mode
Note 1: The UE is only required to pass in one of the supported test configurations in FR1.	

The supported NR SL test configurations are specified in table A.9A.1.1.2.1-2.

Table A.9A.1.1.2.1-2: Supported test configurations for NR SL UEs

NR SL configuration	Description
SL_conf1	NR SL: 15 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf2	NR SL: 30 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf3	NR SL: 30 kHz SSB SCS, 20 MHz bandwidth, HD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There is one NR active cell (Cell 1) and three active UEs (one target UE and two anchor UEs for SL positioning measurement) in this test. The target UE receives SL-PRS and performs the SL Rx-Tx time difference measurement. The two anchor UEs transmit the SL-PRS for the SL Rx-Tx time difference measurement on NR SL RF channel 2. The target UE and all anchor UEs are in RRC_CONNECTED state, with Cell 1 as their PCell in FR1 on NR Uu RF channel 1.

The test consists of two successive time periods, with time duration of T1 and T2 respectively. Before T2 starts, the UEs have been synchronized to the NR serving cell. And during T2, two anchor UEs transmit SL-PRS for positioning measurements.

The *SL-RTT-ProvideAssistanceData* and *SL-RTT-RequestLocationInformation* as defined in TS 38.355 [37, clause 6.9], shall be provided to the target UE via Cell 1 during T1. The last TTI containing the two messages shall be provided to the target UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the SL RTT assistance data and location information request.

The test parameters are given in table A.9A.1.1.2.1-3, A.9A.1.1.2.1-4, A.9A.1.1.2.1-5 and table A.9A.1.1.2.1-6 below.

Table A.9A.1.1.2.1-3: General Test Parameters for SL Rx-Tx measurement reporting delay

Parameter	Unit	Value	Comment
Serving cell		Cell 1	NR PCell of the target UE and all anchor UEs (anchor UE 1, anchor UE 2), in FR1 on NR Uu RF channel 1. This cell is also the synchronization source for SL operation for all UEs in the test.
CP length		Normal	
DRX		OFF	
Measurement gap		OFF	
Target UE		UE 0	The UE performing SL Rx-Tx measurements based on SL-PRS transmissions from anchor UEs
Other anchor UEs		UE 1 and UE 2	Anchor UE 1 and Anchor UE 2 appear at the first and second places in the anchor UE list SL-RTD-Info in the SL-RTT assistance data.
Number of anchor UEs provided in SL-TDOA assistance data		3	Including the target UE
Sidelink communication configuration		As specified in table A.3.21.2-2	
Target UE antenna configuration		1 x 2	
Timing offset between the anchor UEs at the target UE antenna connector	μs	UE 2 to UE 1: 0 UE 3 to UE 1: 3	Synchronous transmissions
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.9A.1.1.2.1-4: NR Uu specific test parameters for Cell 1

Parameter		Unit	Value	Comment
NR Uu RF channel number			1	RF channel of Cell 1.
SSB configuration	Uu_conf1		SSB.1 FR1	SSB configuration of Cell 1.
	Uu_conf2		SSB.1 FR1	
	Uu_conf3		SSB.2 FR1	
SMTC configuration	Uu_conf1		SMTC.2	SMTC configuration of Cell 1.
	Uu_conf2		SMTC.1	
	Uu_conf3		SMTC.1	
PDSCH RMC configuration	Uu_conf1		SR.1.1 FDD	
	Uu_conf2		SR.1.1 TDD	
	Uu_conf3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Uu_conf1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Uu_conf2		CR.1.1 TDD	
	Uu_conf3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Uu_conf1		CCR.1.1 FDD	
	Uu_conf2		CCR.1.1 TDD	
	Uu_conf3		CCR.2.1 TDD	
Initial BWP configuration	Uu_conf1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Uu_conf1,2,3		DLBWP.1.1	
Active UL BWP configuration	Uu_conf1,2,3		ULBWP.1.1	

Table A.9A.1.1.2.1-5: NR Uu UE-specific test parameters for UE 0, UE 1 and UE 2

Parameter		Unit	Value	Comment
NR Uu RF channel number			1	RF channel of Cell 1.
DRX			OFF	
OCNG Patterns			OP.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-110	
	Config 1, 2	dBm /SCS	-110	
	Config 3		-107	
SSB $\hat{E}_s / N_{oc}$		dB	4.5	

SSB $\hat{E}_s/I_{ot}$		dB	4.5	
SS-RSRP Note3	Config 1,2	dBm /SCS	-105.5	
	Config 3		-102.5	
Io Note3	Config 1,2	dBm /19.08MHz	-73.1	
	Config 3	dBm/ 38.16MHz	-70.1	
Propagation condition			AWGN	

NOTE 1: OCNG shall be used such that cell 1 is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.9A.1.1.2.1-6: Anchor V2X UE specific test parameters for SL Rx-Tx measurement

Parameter		Unit	Anchor UE 1		Anchor UE 2		Comment
			T1	T2	T1	T2	
SL RF Channel number			2		2		
SL DRX			OFF		OFF		
networkControlledSyncTx			ON		ON		
inCoverage (in MIB-SL)			TRUE		TRUE		
SL pool configuration	SL_conf1		shared resource pool if supported by UE1, otherwise dedicated				
	SL_conf2						
	SL_conf3						
SL-PRS configuration	SL_conf1		N/A	SL PRS.1.3 FR1	N/A	SL PRS.1.3 FR1	As specified in table A.3.21A.2.1-1
	SL_conf2			SL PRS.1.1 FR1		SL PRS.1.1 FR1	
	SL_conf3			SL PRS.1.3 FR1		SL PRS.1.3 FR1	
PSCCH RMC (defined in A.3.21.2)			CC.1A HD	CC.1A HD	CC.1A HD	CC.1A HD	
PSSCH RMC (defined in A.3.21.3)			CD.1A HD	CD.1A HD	CD.1A HD	CD.1A HD	
N_{oc} Note 2, 4	SL conf1	dBm/SCS	-94				
	SL conf2, 3		-91				
N_{oc} Note 2, 5	SL conf1		-98				
	SL conf2, 3		-95				
SL-PRS $\hat{E}_s/N_{oc}$ Note 4		dB	-Infinity	0	-Infinity	-3	
PSCCH $\hat{E}_s/N_{oc}$ Note 5		dB	N/A	4	N/A	1	
Io Note 3, 4	SL_conf1	dBm/9.36MHz	N/A	-65.15	N/A	-65.57	
	SL_conf2	dBm/8.64MHz		-68.44		-68.89	
	SL_conf3	dBm/18.36MHz		-65.21		-65.65	
SL PRS-RSRP Note3, 4	SL_conf1	dBm/SCS	-Infinity	-94	-Infinity	-97	
	SL_conf2, 3		-Infinity	-91	-Infinity	-94	
PSCCH RP Note3, 5	SL_conf1		-Infinity	-94	-Infinity	-97	
	SL_conf2, 3		-Infinity	-91	-Infinity	-94	
SL-PRS $\hat{E}_s/I_{ot}$ Note 4		dB	N/A	0	N/A	-3	

PSCCH $\hat{E}_s/I_{ot}$ Note 5	dB	N/A	4	N/A	1	
Propagation Condition		AWGN				

NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SL PRS-RSRP, PSCCH Received Power (RP) and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io level is based on the allocated PRBs for SL PRS symbols.
NOTE 3: The UE is only required to be tested in one of the supported test configurations.
NOTE 4: In symbols containing SL-PRS.
NOTE 5: In symbols containing PSCCH.

A.9A.1.1.2.2 Test Requirements

The SL Rx-Tx time difference measurement time fulfils the requirements specified in clause 12A.4.5.

The UE shall perform and report the SL Rx-Tx time difference measurements for anchor UE 1 and anchor UE 2 within the specified SL Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each anchor UE observed during repeated tests shall be at least 90%, where the reported SL Rx-Tx measurement for each correct event shall be within the SL Rx-Tx reporting range specified in clause 10.4A.4.1.

A.9A.1.1.3 NR SL AoA measurements reporting delay test in FR1 SA

A.9A.1.1.3.1 Test Purpose and Environment

The purpose of the test is to verify that the SL AoA measurement meets the requirements specified in clause 12A.6 in an environment with AWGN propagation conditions in FR1 in NR Uu standalone scenario, when a single frequency layer is configured for SL positioning.

The test is applicable for UEs supporting NR Uu and V2X or 5G ProSe operation, which are capable of performing SL AoA measurements.

The supported NR Uu test configurations are specified in table A.9A.1.1.3.1-1.

The supported NR SL test configurations are specified in table A.9A.1.1.3.1-2.

Table A.9A.1.1.3.1-1: Supported Test Configurations for FR1 NR cell

Configuration	Description
1	NR Uu: 15 kHz SSB SCS, 20 MHz BW, FDD duplex mode
2	NR Uu: 15 kHz SSB SCS, 20 MHz BW, TDD duplex mode
3	NR Uu: 30 kHz SSB SCS, 40 MHz BW, TDD duplex mode
NOTE 1: The UE is only required to pass in one of the supported test configurations in FR1.	

Table A.9A.1.1.3.1-2: Supported test configurations for NR SL UEs

NR SL configuration	Description
SL_conf1	NR SL: 15 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf2	NR SL: 30 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf3	NR SL: 30 kHz SSB SCS, 20 MHz bandwidth, HD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there is one target UE receiving SL-PRS and performing SL AoA measurements and two anchor UEs (anchor UE 1, anchor UE 2) transmitting SL-PRS for the SL AoA measurements. The target UE and all the anchor UEs are in RRC_CONNECTED state, with Cell 1 as their PCell in FR1. Cell 1 is also the synchronization source of the target UE and all anchor UEs in the test.

The test consists of two consecutive time intervals, with the duration of T1 and T2. During the duration T1, the target UE shall not have any timing information of anchor UE 1 and anchor UE 2. All two anchor UEs transmit SL-PRS during T2.

The *SL-AOA-ProvideAssistanceData* and *SL-AOA-RequestLocationInformation* as defined in TS 38.355 [37], shall be provided to the target UE via Cell 1 during T1. The last TTI containing the two messages shall be provided to the target UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *SL-AOA assistance* data and location information request.

The general test parameters are listed in table A.9A.1.1.3.1-3. NR Uu specific test parameters for Cell 1 and NR Uu UE-specific test parameters for all UEs in the test are listed in table A.9A.1.1.3.1-4 and A.9A.1.1.3.1-5, respectively. Anchor UE specific test parameters for SL AoA measurement reporting delay during T1 and T2 are listed in table A.9A.1.1.3.1-6.

Table A.9A.1.1.3.1-3: General test parameters for SL AoA measurement reporting delay

Parameter	Unit	Value	Comment
Serving cell		Cell 1	NR PCell of the target UE and all anchor UEs (anchor UE 1, anchor UE 2), in FR1 on NR Uu RF channel 1. This cell is also the synchronization source for SL operation for all UEs in the test.
CP length		Normal	
DRX		OFF	
Measurement gap		OFF	
Target UE		UE 0	The UE performing SL AoA measurements based on SL-PRS transmissions from anchor UEs
Other anchor UEs		UE 1 and UE 2	Anchor UE 1 and Anchor UE 2 appear at the first and second places in the anchor UE list in the SL-AOA assistance data.
Number of anchor UEs provided in SL-AOA assistance data		3	Including the target UE
Sidelink communication configuration		As specified in table A.3.21.2-2	
Target UE antenna configuration		1 x 2	
Timing offset between the anchor UEs at the target UE antenna connector	μs	UE 1 to UE 0: 0 UE 2 to UE 1: 3	Synchronous transmissions
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.9A.1.1.3.1-4: NR Uu specific test parameters for Cell 1

Parameter		Unit	Value	Comment
NR Uu RF channel number			1	RF channel of Cell 1.
SSB configuration	Uu_conf1		SSB.1 FR1	SSB configuration of Cell 1.

	Uu_conf2		SSB.1 FR1	
	Uu_conf3		SSB.2 FR1	
SMTC configuration	Uu_conf1		SMTC.2	SMTC configuration of Cell 1.
	Uu_conf2		SMTC.1	
	Uu_conf3		SMTC.1	
PDSCH RMC configuration	Uu_conf1		SR.1.1 FDD	
	Uu_conf2		SR.1.1 TDD	
	Uu_conf3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Uu_conf1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Uu_conf2		CR.1.1 TDD	
	Uu_conf3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Uu_conf1		CCR.1.1 FDD	
	Uu_conf2		CCR.1.1 TDD	
	Uu_conf3		CCR.2.1 TDD	
Initial BWP configuration	Uu_conf1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Uu_conf1,2,3		DLBWP.1.1	
Active UL BWP configuration	Uu_conf1,2,3		ULBWP.1.1	

Table A.9A.1.1.3.1-5: NR Uu UE-specific test parameters for UE 0, UE 1, and UE 2

Parameter		Unit	Value	Comment
NR Uu RF channel number			1	RF channel of Cell 1.
DRX			OFF	
OCNG Patterns			OP.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-110	
	Config 1, 2	dBm /SCS	-110	
	Config 3		-107	
SSB $\hat{E}_s / N_{oc}$		dB	4.5	
SSB $\hat{E}_s / I_{ot}$		dB	4.5	
SS-RSRP Note3	Config 1,2	dBm /SCS	-105.5	
	Config 3		-102.5	
Io Note3	Config 1,2	dBm /19.08MHz	-73.1	
	Config 3	dBm/ 38.16MHz	-70.1	
Propagation condition			AWGN	

NOTE 1: OCNG shall be used such that cell 1 is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.9A.1.1.3.1-6: Anchor UE specific test parameters on the SL carrier

Parameter		Unit	Anchor UE 1		Anchor UE 2		Comment
			T1	T2	T1	T2	
SL RF Channel number			2		2		
SL DRX			OFF		OFF		
networkControlledSyncTx			ON		ON		
inCoverage (in MIB-SL)			TRUE		TRUE		
SL pool configuration	SL_conf1		shared resource pool if supported by UE1, otherwise dedicated				
	SL_conf2						
	SL_conf3						
SL-PRS configuration	SL_conf1		N/A	SL PRS.1.3 FR1	N/A	SL PRS.1.3 FR1	As specified in table A.3.21A.2.1-1
	SL_conf2			SL PRS.1.1 FR1		SL PRS.1.1 FR1	
	SL_conf3			SL PRS.1.3 FR1		SL PRS.1.3 FR1	
PSCCH RMC (defined inA.3.21.2)			CC.1A HD	CC.1A HD	CC.1A HD	CC.1A HD	
PSSCH RMC (defined in A.3.21.3)			CD.1A HD	CD.1A HD	CD.1A HD	CD.1A HD	
N_{oc} Note 2, 4	SL conf1	dBm/SCS	-94				
	SL conf2, 3		-91				
N_{oc} Note 2, 5	SL conf1		-98				
	SL conf2, 3		-95				
SL-PRS $\hat{E}_s/N_{oc}$ Note 4		dB	-Infinity	0	-Infinity	-3	
PSCCH $\hat{E}_s/N_{oc}$ Note 5		dB	N/A	4	N/A	1	
Io Note 3, 4	SL_conf1	dBm/9.36MHz	N/A	-65.15	N/A	-65.57	
	SL_conf2	dBm/8.46MHz		-68.44		-68.89	
	SL_conf3	dBm/18.36MHz		-65.21		-65.65	
SL PRS-RSRP Note3	SL conf1	dBm/SCS	-Infinity	-94	-Infinity	-97	
	SL conf2, 3		-Infinity	-91	-Infinity	-94	
PSCCH RP Note3, 5	SL conf1		-Infinity	-94	-Infinity	-97	
	SL conf2, 3		-Infinity	-91	-Infinity	-94	
SL-PRS $\hat{E}_s/I_{ot}$ Note 4		dB	N/A	0	N/A	-3	
PSCCH $\hat{E}_s/I_{ot}$ Note 5		dB	N/A	4	N/A	1	
Propagation Condition			AWGN				

Parameter	Unit	Anchor UE 1		Anchor UE 2		Comment
		T1	T2	T1	T2	
NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 2: SL PRS-RSRP, PSCCH Received Power (RP) and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io level is based on the allocated PRBs for SL PRS symbols.						
NOTE 3: The UE is only required to be tested in one of the supported test configurations.						
NOTE 4: In symbols containing SL-PRS.						
NOTE 5: In symbols containing PSCCH.						

A.9A.1.1.3.2 Test Requirements

The SL AoA measurement time fulfils the requirements specified in clause 12A.6.5.

The UE shall perform and report to LMF the SL AoA measurements for the anchor UE 1 and anchor UE 2, within the time duration specified in clause 12A.6.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each anchor UE observed during repeated tests shall be at least 90%, where the reported SL AoA measurement for each correct event shall be within the SL AoA reporting range specified in clause 10.4A.6.1.1, i.e., between A_AoA_0 and SL_AoA_3599, and between Z_AoA_0 and Z_AoA_1799.

A.9A.1.1.4 NR SL RTOA measurements reporting delay test in FR1 SA

A.9A.1.1.4.1 Test Purpose and Environment

The purpose of the test is to verify that the SL RTOA measurement meets the requirements specified in clause 12A.7 in an environment with AWGN propagation conditions in FR1 in NR Uu standalone scenario, when a single frequency layer is configured for SL positioning.

The test is applicable for UEs supporting NR Uu and V2X or 5G ProSe operation, which are capable of performing SL AoA measurements.

The supported NR Uu test configurations are specified in table A.9A.1.1.4.1-1.

The supported NR SL test configurations are specified in table A.9A.1.1.4.1-2.

Table A.9A.1.1.4.1-1: Supported test configurations for FR1 NR Cell 1

NR Uu configuration	Description
Uu_conf1	NR Uu: 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
Uu_conf2	NR Uu: 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
Uu_conf3	NR Uu: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.9A.1.1.4.1-2: Supported test configurations for NR SL UEs

NR SL configuration	Description
SL_conf1	NR SL: 15 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf2	NR SL: 30 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf3	NR SL: 30 kHz SSB SCS, 20 MHz bandwidth, HD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there is one target UE transmitting SL-PRS and performing SL RTOA measurements and one anchor UE (anchor UE 1) receiving SL-PRS for the SL RTOA measurements. The target UE and all the anchor UEs are in RRC_CONNECTED state, with Cell 1 as their PCell in FR1. Cell 1 is also the synchronization source of the target UE and all anchor UEs in the test.

The test consists of two consecutive time intervals, with the duration of T1 and T2. During the duration T1, the target UE shall not have any timing information of anchor UE 1 and anchor UE 2. All two anchor UEs transmit SL-PRS during T2.

The *SL-TOA-ProvideAssistanceData* and *SL-TOA-RequestLocationInformation* as defined in TS 38.355 [37], shall be provided to the target UE via Cell 1 during T1. The last TTI containing the two messages shall be provided to the target UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *SL-TOA assistance* data and location information request.

The general test parameters are listed in table A.9A.1.1.4.1-3. NR Uu specific test parameters for Cell 1 and NR Uu UE-specific test parameters for all UEs in the test are listed in table A.9A.1.1.4.1-4 and A.9A.1.1.4.1-5, respectively. Anchor UE specific test parameters for SL RTOA measurement reporting delay during T1 and T2 are listed in table A.9A.1.1.4.1-6.

Table A.9A.1.1.4.1-3: General test parameters for SL RTOA measurement reporting delay

Parameter	Unit	Value	Comment
Serving cell		Cell 1	NR PCell of the target UE and all anchor UEs (anchor UE 1), in FR1 on NR Uu RF channel 1. This cell is also the synchronization source for SL operation for all UEs in the test.
CP length		Normal	
DRX		OFF	
Measurement gap		OFF	
Target UE		UE 0	The UE performing SL RTOA measurements based on SL-PRS receiving from anchor UEs
Other anchor UEs		UE 1	Anchor UE 1 appears at the first place in the anchor UE list SL-TOA assistance data.
Number of anchor UEs provided in SL-TOA assistance data		2	Including the target UE
Sidelink communication configuration		As specified in table A.3.21.2-2	
Target UE antenna configuration		1 x 2	
Timing offset between the anchor UEs at the target UE antenna connector	μs	Anchor UE 1 to target UE 1: 0	Synchronous transmissions
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.9A.1.1.4.1-4: NR Uu specific test parameters for Cell 1

Parameter		Unit	Value	Comment
NR Uu RF channel number			1	RF channel of Cell 1.
SSB configuration	Uu_conf1		SSB.1 FR1	SSB configuration of Cell 1.
	Uu_conf2		SSB.1 FR1	
	Uu_conf3		SSB.2 FR1	
SMTC configuration	Uu_conf1		SMTC.2	SMTC configuration of Cell 1.
	Uu_conf2		SMTC.1	

Parameter		Unit	Value	Comment
	Uu_conf3		SMTC.1	
PDSCH RMC configuration	Uu_conf1		SR.1.1 FDD	
	Uu_conf2		SR.1.1 TDD	
	Uu_conf3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Uu_conf1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Uu_conf2		CR.1.1 TDD	
	Uu_conf3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Uu_conf1		CCR.1.1 FDD	
	Uu_conf2		CCR.1.1 TDD	
	Uu_conf3		CCR.2.1 TDD	
Initial BWP configuration	Uu_conf1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Uu_conf1,2,3		DLBWP.1.1	
Active UL BWP configuration	Uu_conf1,2,3		ULBWP.1.1	

Table A.9A.1.1.4.1-5: NR Uu UE-specific test parameters for UE 0 and UE 1

Parameter		Unit	Value	Comment
NR Uu RF channel number			1	RF channel of Cell 1.
DRX			OFF	
OCNG Patterns			OP.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-110	
	Config 1, 2	dBm /SCS	-110	
	Config 3		-107	
SSB $\hat{E}_s / N_{oc}$		dB	4.5	
SSB $\hat{E}_s / I_{ot}$		dB	4.5	
SS-RSRP Note3	Config 1,2	dBm /SCS	-105.5	
	Config 3		-102.5	
Io Note3	Config 1,2	dBm /19.08MHz	-73.1	
	Config 3	dBm/ 38.16MHz	-70.1	
Propagation condition			AWGN	

NOTE 1: OCNG shall be used such that cell 1 is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.9A.1.1.4.1-6: Anchor UE specific test parameters on the SL carrier

Parameter		Unit	Anchor UE 1	
			T1	T2
SL RF Channel number			2	
SL DRX			OFF	
networkControlledSyncTx			ON	
inCoverage (in MIB-SL)			TRUE	
SL pool configuration	SL_conf1		N/A	shared resource pool if supported by UE1, otherwise dedicated
	SL_conf2			
	SL_conf3			
SL-PRS configuration	SL_conf1		N/A	SL PRS.1.3 FR1
	SL_conf2			SL PRS.1.1 FR1
	SL_conf3			SL PRS.1.3 FR1
PSCCH RMC (defined in A.3.21.2)			CC.1A HD	CC.1A HD
PSSCH RMC (defined in A.3.21.3)			CD.1A HD	CD.1A HD
N_{oc} Note 2, 4	SL conf1	dBm/SCS	-94	
	SL conf2, 3		-91	
N_{oc} Note 2, 5	SL conf1		-98	
	SL conf2, 3		-95	
SL-PRS $\hat{E}_s/N_{oc}$ Note 4		dB	-Infinity	0
PSCCH $\hat{E}_s/N_{oc}$ Note 5		dB	N/A	4
Io Note 3	SL_conf1	dBm/9.36MHz	N/A	-65.15
	SL_conf2	dBm/8.64MHz		-68.44
	SL_conf3	dBm/18.36MHz		-65.21
SL PRS-RSRP Note3, 4	SL_conf1	dBm/SCS	-Infinity	-94
	SL_conf2, 3		-Infinity	-91
PSCCH RP Note 3, 5	SL_conf1		-Infinity	-94
	SL_conf2, 3		-Infinity	-91
SL-PRS $\hat{E}_s/I_{ot}$ Note 4		dB	N/A	0
PSCCH $\hat{E}_s/I_{ot}$ Note 5		dB	N/A	4
Propagation Condition			AWGN	

NOTE 1: The resources for NR Uu uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other UEs and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SL PRS-RSRP, PSCCH Received Power (RP) and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.
NOTE 4: In symbols containing SL-PRS.
NOTE 5: In symbols containing PSCCH.

A.9A.1.1.4.2 Test Requirements

The SL RTOA measurement time fulfils the requirements specified in clause 12A.7.5.

The UE shall perform and report to LMF the SL RTOA measurements for the anchor UE 1, within the time duration specified in clause 12A.7.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each anchor UE observed during repeated tests shall be at least 90%, where the reported SL RTOA measurement for each correct event shall be within the SL RTOA reporting range specified in clause 10.4A.7.1.1, i.e., between SL_RTOA_0 and SL_RTOA_985024.

A.9A.1.1.5 NR SL PRS-RSRP measurement reporting delay test case in FR1 SA

A.9A.1.1.5.1 Test Purpose and Environment

The purpose of the test is to verify that the measurement time of both SL PRS PRS-RSRP and SL PRS RSTD measurements meet the requirements specified in clause 12A.3.5and 12A.2.5 respectively in an environment with AWGN propagation conditions in FR1 in standalone NR scenario, with additionally configured single frequency layer for SL positioning.

The test environment and configurations refer to A.9A.1.1.1. And if UE passes this test case, then UE does not need to take the reporting delay test with RSTD measurement only defined in A.9A.1.1.1.

A.9A.1.1.5.2 Test Requirements

The SL PRS-RSRP and SL RSTD measurement times fulfil the requirements specified in clause 12A.3.5 and 12A.2.5 respectively.

The UE shall perform and report to LMF the SL PRS-RSRP measurements for anchor UE 2 and anchor UE 3 within the time duration specified in clause 12A.3.5 starting from the beginning of time interval T2. UE also performs and report to LMF the SL RSTD measurements for anchor UE 2 and anchor UE 3 with respect to the reference anchor UE 1, within the time duration specified in clause 12A.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each anchor UE observed during repeated tests shall be at least 90%, where the reported SL PRS-RSRP measurement for each correct event shall be within the SL PRS-RSRP reporting range specified in clause 10.4A.3.1.1, i.e., between SL_PRS_RSRP_0 and SL_PRS_RSRP_126, and the reported SL RSTD measurement for each correct event shall be within the SL RSTD reporting range specified in clause 10.4A.2.1.1.

A.9A.1.1.6 NR SL PRS-RSRPP measurement reporting delay test case in FR1 SA

A.9A.1.1.6.1 Test Purpose and Environment

The purpose of the test is to verify that the measurement time of both SL PRS PRS-RSRPP and SL Rx-Tx measurements meet the requirements specified in clause 12A.5.5 and 12A.4.5 respectively in an environment with two-tap propagation conditions in FR1 in standalone NR scenario, with additionally configured single frequency layer for SL positioning.

The test environment and configurations refer to A.9A.1.1.2, except that the propagation shall be two-tap channel. And if UE passes this test case, then UE does not need to take the reporting delay test case with SL Rx-Tx measurement only defined in A.9A.1.1.2.

A.9A.1.1.6.2 Test Requirements

The SL PRS-RSRPP and SL Rx-Tx measurement times fulfil the requirements specified in clause 12A.5.5 and 12A.4.5, respectively.

The UE shall perform and report to LMF the SL PRS-RSRPP measurements for anchor UE 2 and anchor UE 3 within the time duration specified in clause 12A.5.5 starting from the beginning of time interval T2. UE also performs and report to LMF the SL Rx-Tx measurements for anchor UE 2 and anchor UE 3 within the time duration specified in clause 12A.4.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each anchor UE observed during repeated tests shall be at least 90%, where the reported SL PRS-RSRPP measurement for each correct event shall be within the SL PRS-RSRPP reporting range specified in clause 10.4A.5.1.1, i.e., between SL_PRS_RSRPP_0 and SL_PRS_RSRPP_126, and the reported SL Rx-Tx measurement for each correct event shall be within the SL Rx-Tx reporting range specified in clause 10.4A.4.1.1.

A.9A.1.2 Measurement Accuracy Tests

A.9A.1.2.1 NR SL RSTD measurement accuracy test case in FR1 SA

A.9A.1.2.1.1 Test Purpose and Environment

The purpose of the test is to verify that the SL RSTD measurement meets the accuracy requirements specified in clause 10.4A.2 in an environment with AWGN propagation conditions in FR1 in standalone NR scenario, with additionally configured single frequency layer for SL positioning.

This test is applicable for UEs supporting NR Uu and V2X or 5G ProSe operation, which are capable of performing SL RSTD measurements.

The supported NR Uu test configurations are specified in table A.9A.1.2.1.1-1.

Table A.9A.1.2.1.1-1: Supported test configurations for FR1 NR Cell 1

NR Uu configuration	Description
Uu_conf1	NR Uu: 15 kHz SSB SCS, 20 MHz bandwidth, FDD duplex mode
Uu_conf2	NR Uu: 15 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
Uu_conf3	NR Uu: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

The supported NR SL test configurations are specified in table A.9A.1.2.1.1-2.

Table A.9A.1.2.1.1-2: Supported test configurations for NR SL UEs

NR SL configuration	Description
SL_conf1	NR SL: 15 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf2	NR SL: 30 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf3	NR SL: 30 kHz SSB SCS, 20 MHz bandwidth, HD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test, there is one target UE receiving SL-PRS and performing SL RSTD measurements and two anchor UEs (anchor UE 1 and anchor UE 2) transmitting SL-PRS for the SL RSTD measurements on NR SL RF channel 2. Anchor UE 1 is the reference anchor UE for the measurements. The target UE and all the anchor UEs are in RRC_CONNECTED state, with Cell 1 as their PCell in FR1 on NR Uu RF channel 1. Cell 1 is also the synchronization source of the target UE and all anchor UEs in the test.

The test consists of two consecutive time intervals, with duration of T1 and T2. Before T2 starts, the UEs have been synchronized to Cell 1. During time duration T1, the target UE shall not have any timing information of anchor UE 2. All two anchor UEs transmit SL-PRS during T2.

The *SL-TDOA-ProvideAssistanceData* and *SL-TDOA-RequestLocationInformation* as defined in TS 38.355 [37, clause 6.9], shall be provided to the target UE via Cell 1 during T1. The last TTI containing the two messages shall be provided to the target UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *SL-TDOA assistance* data and location information request.

The general test parameters are listed in table A.9A.1.2.1.1-3. NR Uu specific test parameters for Cell 1 and NR Uu UE-specific test parameters for all UEs in the test are listed in table A.9A.1.2.1.1-4 and A.9A.1.2.1.1-5, respectively. Anchor UE specific test parameters for SL RSTD measurement accuracy during T1 and T2 are listed in table A.9A.1.2.1.1-6.

Table A.9A.1.2.1.1-3: General test parameters for SL RSTD measurement accuracy test

Parameter	Unit	Value	Comment
Serving cell		Cell 1	NR PCell of the target UE and all anchor UEs (anchor UE 1, anchor UE 2), in FR1 on NR Uu RF channel 1. This cell is also the synchronization source for SL operation for all UEs in the test.
CP length		Normal	
DRX		OFF	
Measurement gap		OFF	
Target UE		UE 0	The UE performing SL RSTD measurements based on SL-PRS transmissions from anchor UEs
Reference anchor UE		UE 1	Reference anchor UE is the UE in the SL-TDOA assistance data with respect to which the SL RSTD measurement is defined, as specified in TS 38.215 [4] and TS 38.355 [37]. The reference anchor UE is UE 1 in this test case.
Other anchor UE		UE 2	Anchor UE 2 appears at the second place in the anchor UE list SL-RTD-Info in the SL-TDOA assistance data.
Number of anchor UEs provided in SL-TDOA assistance data		3	Including the target UE
Sidelink communication configuration		As specified in table A.3.21.2-2	
Target UE antenna configuration		1 x 2	
Timing offset between the anchor UEs at the target UE antenna connector	μs	UE 2 to UE 1: 3	Synchronous transmissions
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.9A.1.2.1.1-4: NR Uu specific test parameters for Cell 1

Parameter		Unit	Value	Comment
NR Uu RF channel number			1	RF channel of Cell 1.
SSB configuration	Uu_conf1		SSB.1 FR1	SSB configuration of Cell 1.
	Uu_conf2		SSB.1 FR1	
	Uu_conf3		SSB.2 FR1	
SMTC configuration	Uu_conf1		SMTC.2	SMTC configuration of Cell 1.
	Uu_conf2		SMTC.1	
	Uu_conf3		SMTC.1	
PDSCH RMC configuration	Uu_conf1		SR.1.1 FDD	
	Uu_conf2		SR.1.1 TDD	

	Uu_conf3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Uu_conf1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Uu_conf2		CR.1.1 TDD	
	Uu_conf3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Uu_conf1		CCR.1.1 FDD	
	Uu_conf2		CCR.1.1 TDD	
	Uu_conf3		CCR.2.1 TDD	
Initial BWP configuration	Uu_conf1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Uu_conf1,2,3		DLBWP.1.1	
Active UL BWP configuration	Uu_conf1,2,3		ULBWP.1.1	

Table A.9A.1.2.1.1-5: NR Uu UE-specific test parameters for UE 0, UE 1, and UE 2

Parameter		Unit	Value	Comment
NR Uu RF channel number			1	RF channel of Cell 1.
DRX			OFF	
OCNG Patterns			OP.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-110	
	Config 1, 2	dBm /SCS	-110	
	Config 3		-107	
SSB $\hat{E}_s / N_{oc}$		dB	4.5	
SSB $\hat{E}_s / I_{ot}$		dB	4.5	
SS-RSRP Note3	Config 1,2	dBm /SCS	-105.5	
	Config 3		-102.5	
Io Note3	Config 1,2	dBm /19.08MHz	-73.1	
	Config 3	dBm/ 38.16MHz	-70.1	
Propagation condition			AWGN	

NOTE 1: OCNG shall be used such that cell 1 is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.9A.1.2.1.1-6: Anchor UE specific test parameters on the SL carrier

Parameter	Unit	Anchor UE 1		Anchor UE 2		Comment
		T1	T2	T1	T2	
SL RF Channel number		2		2		

Parameter		Unit	Anchor UE 1		Anchor UE 2		Comment
			T1	T2	T1	T2	
SL DRX			OFF		OFF		
networkControlledSyncTx			ON		ON		
inCoverage (in MIB-SL)			TRUE		TRUE		
SL pool configuration	SL_conf1		dedicated resource pool if supported by UE1, otherwise shared				
	SL_conf2						
	SL_conf3						
SL-PRS configuration	SL_conf1		N/A	SL PRS.1.3 FR1	N/A	SL PRS.1.3 FR1	As specified in table A.3.21A.2.1-1
	SL_conf2			SL PRS.1.1 FR1		SL PRS.1.1 FR1	
	SL_conf3			SL PRS.1.3 FR1		SL PRS.1.3 FR1	
PSCCH RMC (defined in A3.21.3)			CC.1A HD	CC.1A HD	CC.1A HD	CC.1A HD	
PSSCH RMC (defined in A.3.21.3)			CD.1A HD	CD.1A HD	CD.1A HD	CD.1A HD	
N_{oc} Note 2, 4	SL conf1	dBm/SCS	-94				
	SL conf2, 3		-91				
N_{oc} Note 2, 5	SL conf1		-98				
	SL conf2, 3		-95				
SL-PRS $\hat{E}_s/N_{oc}$ Note 4		dB	-Infinity	0	-Infinity	-3	
PSCCH $\hat{E}_s/N_{oc}$ Note 5		dB	N/A	4	N/A	1	
Io Note 3, 4	SL_conf1	dBm/9.36MHz	N/A	-65.15	N/A	-65.57	
	SL_conf2	dBm/8.64MHz		-68.44		-68.89	
	SL_conf3	dBm/18.36MHz		-65.21		-65.65	
SL PRS-RSRP Note3, 4	SL_conf1	dBm/SCS	-Infinity	-94	-Infinity	-97	
	SL_conf2, 3		-Infinity	-91	-Infinity	-94	
PSCCH RP Note3, 5	SL_conf1		-Infinity	-94	-Infinity	-97	
	SL_conf2, 3		-Infinity	-91	-Infinity	-94	
SL-PRS $\hat{E}_s/I_{ot}$ Note 4		dB	N/A	0	N/A	-3	
PSCCH $\hat{E}_s/I_{ot}$ Note 5		dB	N/A	4	N/A	1	
Propagation Condition			AWGN				

NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: SL PRS-RSRP, PSCCH Received Power (RP) and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io level is based on the allocated PRBs for SL PRS symbols.

NOTE 3: The UE is only required to be tested in one of the supported test configurations.

NOTE 4: In symbols containing SL-PRS.

NOTE 5: In symbols containing PSCCH.

A.9A.1.2.1.2 Test Requirements

In each test, the SL RSTD measurement for anchor UE 2 shall fulfil the absolute accuracy requirement in clause 10.4A.2.2.

A.9A.1.2.2 SL Rx-Tx measurement accuracy test case in FR1

A.9A.1.2.2.1 Test Purpose and Environment

The purpose of the test is to verify that the SL Rx-Tx measurement meets the accuracy requirements specified in clause 10.4A.4 in an environment with AWGN propagation conditions in FR1 in standalone NR scenario, with additionally configured single frequency layer for SL positioning.

This test is applicable for UEs supporting NR Uu and V2X or 5G ProSe operation, which are capable of performing SL Rx-Tx measurements.

The supported NR Uu test configurations in FR1 are shown in table A.9A.1.2.2.1-1.

Table A.9A.1.2.2.1-1: Supported Test Configurations for FR1 NR cell

Configuration	Description
1	NR Uu: 15 kHz SSB SCS, 20 MHz BW, FDD duplex mode
2	NR Uu: 15 kHz SSB SCS, 20 MHz BW, TDD duplex mode
3	NR Uu: 30 kHz SSB SCS, 40 MHz BW, TDD duplex mode
NOTE 1: The UE is only required to pass in one of the supported test configurations in FR1.	

The supported NR SL test configurations are specified in table A.9A.1.2.2.1-2.

Table A.9A.1.2.2.1-2: Supported test configurations for NR SL UEs

NR SL configuration	Description
SL_conf1	NR SL: 15 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf2	NR SL: 30 kHz SSB SCS, 10 MHz bandwidth, HD duplex mode
SL_conf3	NR SL: 30 kHz SSB SCS, 20 MHz bandwidth, HD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There is one NR active cell (Cell 1) and three active UEs (one target UE and two anchor UEs for SL positioning measurement) in this test. The target UE receives SL-PRS and performs the SL Rx-Tx time difference measurement. The two anchor UEs transmit the SL-PRS for the SL Rx-Tx time difference measurement on NR SL RF channel 2. The target UE and all anchor UEs are in RRC_CONNECTED state, with Cell 1 as their PCell in FR1 on NR Uu RF channel 1.

The test consists of two successive time periods, with time duration of T1 and T2 respectively. Before T2 starts, the UEs have been synchronized to the NR serving cell. And during T2, two anchor UEs transmit SL-PRS for positioning measurements.

The *SL-RTT-ProvideAssistanceData* and *SL-RTT-RequestLocationInformation* as defined in TS 38.355 [37, clause 6.9], shall be provided to the target UE via Cell 1 during T1. The last TTI containing the two messages shall be provided to the target UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *SL-RTT assistance* data and location information request.

The test parameters are given in table A.9A.1.2.2.1-3, A.9A.1.2.2.1-4, A.9A.1.2.2.1-5 and table A.9A.1.2.2.1-6 below.

Table A.9A.1.2.2.1-3: General Test Parameters for SL Rx-Tx measurement reporting delay

Parameter	Unit	Value	Comment
Serving cell		Cell 1	NR PCell of the target UE and all anchor UEs (anchor UE 1, anchor UE 2), in FR1 on NR Uu RF channel 1. This cell is also the synchronization source for SL operation for all UEs in the test.
CP length		Normal	
DRX		OFF	
Measurement gap		OFF	

Parameter	Unit	Value	Comment
Target UE		UE 0	The UE performing SL Rx-Tx measurements based on SL-PRS transmissions from anchor UEs
Other anchor UEs		UE 1 and UE 2	Anchor UE 1 and Anchor UE 2 appear at the first and second places in the anchor UE list SL-RTD-Info in the SL-RTT assistance data.
Number of anchor UEs provided in SL-RTT assistance data		3	Including the target UE
Sidelink communication configuration		As specified in table A.3.21.2-2	
Target UE antenna configuration		1 x 2	
Timing offset between the anchor UEs at the target UE antenna connector	μs	UE 2 to UE 1: 3	Synchronous transmissions
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.9A.1.2.2.1-4: NR Uu specific test parameters for Cell 1

Parameter		Unit	Value	Comment
NR Uu RF channel number			1	RF channel of Cell 1.
SSB configuration	Uu_conf1		SSB.1 FR1	SSB configuration of Cell 1.
	Uu_conf2		SSB.1 FR1	
	Uu_conf3		SSB.2 FR1	
SMTC configuration	Uu_conf1		SMTC.2	SMTC configuration of Cell 1.
	Uu_conf2		SMTC.1	
	Uu_conf3		SMTC.1	
PDSCH RMC configuration	Uu_conf1		SR.1.1 FDD	
	Uu_conf2		SR.1.1 TDD	
	Uu_conf3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Uu_conf1		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Uu_conf2		CR.1.1 TDD	
	Uu_conf3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Uu_conf1		CCR.1.1 FDD	
	Uu_conf2		CCR.1.1 TDD	
	Uu_conf3		CCR.2.1 TDD	
Initial BWP configuration	Uu_conf1,2,3		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Uu_conf1,2,3		DLBWP.1.1	
Active UL BWP configuration	Uu_conf1,2,3		ULBWP.1.1	

Table A.9A.1.2.2.1-5: NR Uu UE-specific test parameters for UE 0, UE 1 and UE 2

Parameter		Unit	Value	Comment
NR Uu RF channel number			1	RF channel of Cell 1.
DRX			OFF	
OCNG Patterns			OP.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	Config 1,2,3	dBm/15 kHz	-110	
	Config 1, 2	dBm /SCS	-110	
	Config 3		-107	
SSB $\hat{E}_s / N_{oc}$		dB	4.5	
SSB $\hat{E}_s / I_{ot}$		dB	4.5	
SS-RSRP Note3	Config 1,2	dBm /SCS	-105.5	
	Config 3		-102.5	
Io Note3	Config 1,2	dBm /19.08MHz	-73.1	
	Config 3	dBm/ 38.16MHz	-70.1	
Propagation condition			AWGN	

NOTE 1: OCNG shall be used such that cell 1 is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.9A.1.2.2.1-6: Anchor V2X UE specific test parameters for SL Rx-Tx measurement

Parameter		Unit	Anchor UE 1		Anchor UE 2		Comment
			T1	T2	T1	T2	
SL RF Channel number			2		2		
SL DRX			OFF		OFF		
networkControlledSyncTx			ON		ON		
inCoverage (in MIB-SL)			TRUE		TRUE		
SL pool configuration	SL_conf1		dedicated resource pool if supported by UE1, otherwise shared				
	SL_conf2						
	SL_conf3						
SL-PRS configuration	SL_conf1		N/A	SL PRS.1.3 FR1	N/A	SL PRS.1.4 FR1	As specified in table A.3.21A.2.1-1
	SL_conf2			SL PRS.1.1 FR1		SL PRS.1.2 FR1	
	SL_conf3			SL PRS.1.3 FR1		SL PRS.1.4 FR1	

Parameter		Unit	Anchor UE 1		Anchor UE 2		Comment
			T1	T2	T1	T2	
PSCCH RMC (defined in A3.21.3)			CC.1A HD	CC.1A HD	CC.1A HD	CC.1A HD	
PSSCH RMC (defined in A.3.21.3)			CD.1A HD	CD.1A HD	CD.1A HD	CD.1A HD	
N_{oc} Note 2, 4	SL conf1	dBm/SCS	-94				
	SL conf2, 3		-91				
N_{oc} Note 2, 5	SL conf1		-98				
	SL conf2, 3		-95				
SL-PRS $\hat{E}_s/N_{oc}$ Note 4		dB	-Infinity	0	-Infinity	-3	
PSCCH $\hat{E}_s/N_{oc}$ Note 5		dB	N/A	4	N/A	1	
Io Note 3	SL_conf1	dBm/9.36MHz	N/A	-65.15	N/A	-65.57	
	SL_conf2	dBm/8.64MHz		-68.44		-68.89	
	SL_conf3	dBm/18.36MHz		-65.21		-65.65	
SL PRS-RSRP Note3, 4	SL conf1	dBm/SCS	-Infinity	-94	-Infinity	-97	
	SL conf2, 3		-Infinity	-91	-Infinity	-94	
PSCCH RP Note3, 5	SL conf1		-Infinity	-94	-Infinity	-97	
	SL conf2, 3		-Infinity	-91	-Infinity	-94	
SL-PRS $\hat{E}_s/I_{ot}$ Note 4		dB	N/A	0	N/A	-3	
PSCCH $\hat{E}_s/I_{ot}$ Note 5		dB	N/A	4	N/A	1	
Propagation Condition			AWGN				

NOTE 1: Interference from other UEs and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: SL PRS-RSRP, PSCCH Received Power (RP) and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Io level is based on the allocated PRBs for SL PRS symbols.

NOTE 3: The UE is only required to be tested in one of the supported test configurations.

NOTE 4: In symbols containing SL-PRS.

NOTE 5: In symbols containing PSCCH.

A.9A.1.2.2.2 Test Requirements

The SL Rx-Tx time difference measurement fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.4A.4.2 for both anchor UE 1 and anchor UE 2.

A.9A.1.2.3 NR SL PRS-RSRP measurement accuracy test case in FR1 SA

A.9A.1.2.3.1 Test Purpose and Environment

The purpose of the test is to verify that the SL PRS PRS-RSRP measurement accuracy meets the requirements specified in clause 10.4A.3.2 in an environment with AWGN propagation conditions in FR1 in standalone NR scenario, with additionally configured single frequency layer for SL positioning.

The test environment and configurations refer to A.9A.1.2.1. During the test, both SL RSTD and SL PRS-RSRP measurements are requested by LMF.

A.9A.1.2.3.2 Test Requirements

In each test, the PRS-RSRP measurement accuracies shall fulfil the accuracy requirement defined in clause 10.4A.3.2.

A.9A.1.2.4 NR SL PRS-RSRPP measurement accuracy test case in FR1 SA

A.9A.1.2.4.1 Test Purpose and Environment

The purpose of the test is to verify that the SL PRS PRS-RSRPP measurement accuracy meets the requirements specified in clause 10.4A.5.2 in an environment with two-tap propagation conditions in FR1 in standalone NR scenario, with additionally configured single frequency layer for SL positioning.

The test environment and configurations refer to A.9A.1.2.2, except that the propagation shall be two-tap channel. During the test, both SL Rx-Tx and SL PRS-RSRPP measurements are requested by LMF.

A.9A.1.2.4.2 Test Requirements

In each test, the PRS-RSRPP measurement accuracies shall fulfil the accuracy requirement defined in clause 10.4A.5.2.

A.10 EN-DC Tests with NR PSCell under CCA and Other NR Cells in FR1

Editor's note: Test cases for EN-DC with NR PSCell under CCA and SCell under CCA are also included here.

A.10.1 RRC_CONNECTED state mobility

A.10.1.1 RRC connection mobility control

A.10.1.1.1 Random Access

A.10.1.1.1.1 4-step RA type contention-based random access for NR PSCell with CCA

A.10.1.1.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits when subject to CCA. This test will verify the requirements in clause 6.2.2A.2 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7A.2.1 and Cell 2 configured as PSCell in FR1. Cell 1 is on a licensed band and cell 2 is subjected to CCA. Supported test parameters are shown in table A.10.1.1.1.1.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in table A.10.1.1.1.1.1-2.

Table A.10.1.1.1.1.1-1: Supported test configurations for contention based random access test in FR1 for PSCell with CCA

Config	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.10.1.1.1.1.1-2: General test parameters for contention based random access test in FR1 for PSCell with CCA

Parameter			Unit	Test-1	Comments
SSB Configuration	Note 4, 6	Config 1,2		SSB.1 CCA	As defined in A.3.10A
	Note 5, 6	Config 1,2		SSB.2 CCA	As defined in A.3.10A
DBT Window Configuration		Config 1,2		DBT.1	As specified in A.3.28.1
DL CCA model		Config 1,2		As specified in A.3.26.2.1	
UL CCA model		Config 1,2		As specified in A.3.26.2.2	
Duplex Mode for Cell 2		Config 1,2		TDD	
TDD Configuration		Config 1,2		TDDConf.1.1 CCA	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1,2		SR.1.1 CCA	As defined in A.3.1A.1.
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		

Parameter			Unit	Test-1	Comments
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP		dBm/ SCS	-115	
Io Note 2		Config 1,2	dBm	-62.2/38.16 MHz	For symbols without SSB index 1
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 1 under CCA	As defined in A.3.8A.2.
DL CCA probability		Note 4, 6		0.9375	
P_{CCA_DL}		Note 5, 6		0.75/0.75	
L_{CCA_DL} Note 7				4	
W_{CCA_DL} Note 8				Inf	
UL CCA probability		Note 4, 6		0.87	
P_{CCA_UL}		Note 5, 6		0.75	
L_{CCA_UL} Note 7				5	
W_{CCA_UL} Note 8				Inf	
Semi-static channel access config period Note 4, 6			ms	2	
Propagation Condition			-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic channel occupancy and semi-static channel occupancy configuration.
NOTE 7: L_{CCA_DL} and L_{CCA_UL} are chosen such that preambleTransMax > 5 + L_{CCA_DL} + L_{CCA_UL}.
NOTE 8: A window W_{CCA_DL}=W_{CCA_UL}=Inf is used to indicate that L_{CCA_DL} and L_{CCA_UL} are considered during the entire duration of a test run.

A.10.1.1.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.10.1.1.1.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in clause 6.2.2A.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*, if the UL CCA is successful.

The three requirements below are relevant for all cases of PRACH transmissions described within the whole clause A.10.1.1.1.1.2:

- The System Simulator shall implement the UL CCA model of A.3.26.2 for the RACH occasions where PRACH transmissions are expected. The System Simulator shall monitor the RACH occasions to detect if the UE is transmitting PRACH preambles. If a PRACH transmission is detected on a RACH occasion that is expected to have UL CCA failure, the test is considered as failed.

- In case of CCA DL failure, the test equipment should verify that the UE does not transmit PRACH for semi-static channel access mode; for dynamic channel access mode it is assumed that RACH occasions are always scheduled within a UE-initiated COT.

- In case of UL CCA failure, The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.1.1.1.2.2 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2A.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble. In case of CCA DL failure, the test equipment should delay the transmission of Random Access Response.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble if UL CCA is successful. The System Simulator shall monitor if the UE is transmitting msg3 when CCA UL failure. If a msg3 transmission is detected on a grant expected to have UL CCA failure, the test is considered as failed.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.1.1.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2A.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles. In case of CCA DL failure, the test equipment should delay the transmission of Random Access Response.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.1.1.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2A.2.1.4, the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response if UL CCA is successful. The System Simulator shall monitor if the UE is transmitting msg3 when CCA UL failure. If a msg3 is detected on a grant expected to have UL CCA failure, the test is considered as failed.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.10.1.1.1.1.2.5 Contention Resolution Timer expiry

To test the UE behavior specified in clause 6.2.2A.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.10.1.1.1.2 4-step RA type non-contention based random access for NR PSCell with CCA

A.10.1.1.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits when subject to CCA. This test will verify the requirements in clause 6.2.2A.2 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7A.2.1 and Cell 2 configured as PSCell in FR1. Cell 1 is on a licensed band and cell 2 is subjected to CCA. Supported test parameters are shown in table A.10.1.1.1.2.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in table A.10.1.1.1.2.1-2.

Table A.10.1.1.1.2.1-1: Supported test configurations for non-contention based random access test in FR1 for PSCell with CCA

Config	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.10.1.1.1.2.1-2: General test parameters for non-contention based random access test in FR1 for PSCell with CCA

Parameter			Unit	Test-1	Comments
SSB Configuration	Note 4, 6	Config 1,2		SSB.1 CCA	As defined in A.3.10A
	Note 5, 6	Config 1,2		SSB.2 CCA	As defined in A.3.10A
DBT Window Configuration		Config 1,2		DBT.1	As specified in A.3.28.1
DL CCA model		Config 1,2		As specified in A.3.26.2.1	
UL CCA model		Config 1,2		As specified in A.3.26.2.2	
Duplex Mode for Cell 2		Config 1,2		TDD	
TDD Configuration		Config 1,2		TDDConf.1.1 CCA	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1,2		SR.1.1 CCA	As defined in A.3.1A.1.
NR RF Channel Number				1	

Parameter			Unit	Test-1	Comments
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP		dBm/ SCS	-115	
Io Note 2		Config 1,2	dBm	-62.2/38.16 MHz	For symbols without SSB index 1
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 2 under CCA	As defined in A.3.8A.2.
DL CCA probability P_{CCA_DL}	Note 4, 6			0.9375	
	Note 5, 6			0.75/0.75	
L_{CCA_DL} Note 7				4	
W_{CCA_DL} Note 8				Inf	
UL CCA probability P_{CCA_UL}	Note 4, 6			0.87	
	Note 5, 6			0.75	
L_{CCA_UL} Note 7				5	
W_{CCA_UL} Note 8				Inf	
Semi-static channel access config period Note 4, 6			ms	2	
Propagation Condition			-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic channel occupancy and semi-static channel occupancy configuration.
NOTE 7: L_{CCA_DL} and L_{CCA_UL} are chosen such that preambleTransMax > 5 + L_{CCA_DL} + L_{CCA_UL}.
NOTE 8: A window W_{CCA_DL}=W_{CCA_UL}=Inf is used to indicate that L_{CCA_DL} and L_{CCA_UL} are considered during the entire duration of a test run.

A.10.1.1.1.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.10.1.1.1.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in clause 6.2.2A.2.2.1 for SSB-based Random Access Preamble transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

The three requirements below are relevant for all cases of PRACH transmissions described within the whole clause A.10.1.1.1.2.2:

- The System Simulator shall implement the UL CCA model of A.3.26.2 for the RACH occasions where PRACH transmissions are expected. The System Simulator shall monitor the RACH occasions to detect if the UE is transmitting PRACH preambles. If a PRACH transmission is detected on a RACH occasion that is expected to have UL CCA failure, the test is considered as failed.

- In case of CCA DL failure, the test equipment should verify that the UE does not transmit PRACH for semi-static channel access mode; for dynamic channel access mode it is assumed that RACH occasions are always scheduled within a UE-initiated COT.

- In case of UL CCA failure, The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belong to the PRACH occasions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.1.1.2.2.2 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2A.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble. In case of CCA DL failure, the test equipment should delay the transmission of Random Access Response.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble if UL CCA is successful. The System Simulator shall monitor if the UE is transmitting msg3 when CCA UL failure. If a msg3 is detected on a grant expected to have UL CCA failure, the test is considered as failed.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.1.1.2.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2A.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles. In case of CCA DL failure, the test equipment should delay the transmission of Random Access Response.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.1.1.3 2-step RA type contention-based random access for NR PSCell with CCA

A.10.1.1.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behaviour of the random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits when subject to CCA. This test will verify the requirements in clause 6.2.2A.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7A.2.1 and Cell 2 configured as PSCell in FR1. Cell 1 is on a licensed band and cell 2 is subjected to CCA. Supported test parameters are shown in table A.10.1.1.1.3.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in table A.10.1.1.1.3.1-2.

Table A.10.1.1.1.3.1-1: Supported test configurations for 2-step RA type contention based random access test in FR1 for PSCell with CCA

Config	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.10.1.1.1.3.1-2: General test parameters for 2-step RA type contention based random access test in FR1 for PSCell with CCA

Parameter			Unit	Test-1	Comments
SSB Configuration	Note 4, 6	Config 1,2		SSB.1 CCA	As defined in A.3.10A
	Note 5, 6	Config 1,2		SSB.2 CCA	As defined in A.3.10A
DBT Window Configuration		Config 1,2		DBT.1	As specified in A.3.28.1
DL CCA model		Config 1,2		As specified in A.3.26.2.1	
UL CCA model		Config 1,2		As specified in A.3.26.2.2	
Duplex Mode for Cell 2		Config 1,2		TDD	
TDD Configuration		Config 3,4		TDDConf.1.1 CCA	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1,2		SR.1.1 CCA	As defined in A.3.1A.1.
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-101	

Parameter			Unit	Test-1	Comments
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP Note 2		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP Note 2		dBm/ SCS	-115	
Io		Config 1,2	dBm	-62.2/38.16 MHz	For symbols without SSB index 1
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
MsgA Configuration				FR1 MsgA configuration 1 under CCA	As defined in A.3.20A.2.
msgA-RSRP-ThresholdSSB			dBm	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
DL CCA probability		Note 4, 6		0.9375	
P_{CCA_DL}		Note 5, 6		0.75/0.75	
L_{CCA_DL} Note 7				4	
W_{CCA_DL} Note 8				Inf	
UL CCA probability		Note 4, 6		0.87	
P_{CCA_UL}		Note 5, 6		0.75	
L_{CCA_UL} Note 7				5	
W_{CCA_UL} Note 8				Inf	
Semi-static channel access config period Note 4, 6			ms	2	
Propagation Condition			-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic channel occupancy and semi-static channel occupancy configuration.
NOTE 7: L_{CCA_DL} and L_{CCA_UL} are chosen such that preambleTransMax > 5 + L_{CCA_DL} + L_{CCA_UL}.
NOTE 8: A window W_{CCA_DL}=W_{CCA_UL}=Inf is used to indicate that L_{CCA_DL} and L_{CCA_UL} are considered during the entire duration of a test run.

A.10.1.1.1.3.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.10.1.1.1.3.2.1 MsgA Transmission

To test the UE behaviour specified in clause 6.2.2A.3.1.1 the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB*, if the UL CCA is successful.

below are relevant for all cases of MsgA transmissions described within the clause A.10.1.1.1.3.2:

- The System Simulator shall implement the UL CCA model for the MsgA occasions (i.e. both MsgA PRACH and MsgA PUSCH occasions) where MsgA transmissions are expected. The System Simulator shall monitor the MsgA occasions to detect if the UE is transmitting MsgA. If a MsgA transmission is detected on MsgA occasions that are expected to have UL CCA failure, the test is considered as failed.

- In case of CCA DL failure, the test equipment should verify that the UE does not transmit MsgA for semi-static channel access mode; for dynamic channel access mode it is assumed that MsgA occasions are always scheduled within a UE-initiated COT.

- The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated PRACH transmission power in case of UL CCA failure.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated PRACH transmission power in case of UL CCA failure. In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first MsgA preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.1.1.3.2.2 MsgB Reception

To test the UE behaviour specified in clause 6.2.2A.3.1.2 the System Simulator shall transmit a MsgB with fallbackRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble. In case of CCA DL failure, the test equipment should delay the transmission of MsgB.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble if UL CCA is successful. The System Simulator shall monitor if the UE is transmitting msg3 when CCA UL failure. If a msg3 is detected on a grant expected to have UL CCA failure, the test is considered as failed.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB's contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble .

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first MsgA preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.1.1.3.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2A.3.1.3 the System Simulator shall transmit a MsgB with fallbackRAR containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles. In case of CCA DL failure, the test equipment should delay the transmission of MsgB.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first MsgA preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.1.1.4 2-step RA type non-contention based random access for NR PSCell with CCA

A.10.1.1.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits when subject to CCA. This test will verify the requirements in clause 6.2.2A.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Cell 1 is on a licensed band and cell 2 is subjected to CCA. Supported test parameters are shown in table A.10.1.1.1.4.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in table A.10.1.1.1.4.1-2.

Table A.10.1.1.1.4.1-1: Supported test configurations for non-contention based random access test for 2-step RA type in FR1 for PSCell with CCA

Config	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.10.1.1.1.4.1-2: General test parameters for non-contention based random access test for 2-step RA type in FR1 for PSCell with CCA

Parameter			Unit	Test-1	Comments
SSB Configuration	Note 4, 6	Config 1,2		SSB.1 CCA	As defined in A.3.10A
	Note 5, 6	Config 1,2		SSB.2 CCA	As defined in A.3.10A
DBT Window Configuration		Config 1,2		DBT.1	As specified in A.3.28.1
DL CCA model		Config 1,2		As specified in A.3.26.2.1	
UL CCA model		Config 1,2		As specified in A.3.26.2.2	
Duplex Mode for Cell 2		Config 1,2		TDD	
TDD Configuration		Config 1,2		TDDConf.1.1 CCA	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1,2		SR.1.1 CCA	As defined in A.3.1A.1.
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15 kHz	-101	

Parameter		Unit	Test-1	Comments
	$\hat{E}_s / N_{oc}$	dB	-17	
	SS-RSRP	dBm/ SCS	-115	
Io Note 2	Config 1,2	dBm	-62.2/38.16 MHz	For symbols without SSB index 1
ss-PBCH-BlockPower		dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,f,c}$)		dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
MsgA Configuration			FR1 MsgA configuration 2 under CCA	As defined in A.3.20A.2.
msgA-RSRP-ThresholdSSB		dBm	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
DL CCA probability	Note 4, 6		0.9375	
P_{CCA_DL}	Note 5, 6		0.75/0.75	
L_{CCA_DL} Note 7			4	
W_{CCA_DL} Note 8			Inf	
UL CCA probability	Note 4, 6		0.87	
P_{CCA_UL}	Note 5, 6		0.75	
L_{CCA_UL} Note 7			5	
W_{CCA_UL} Note 8			Inf	
Semi-static channel access config period Note 4, 6		ms	2	
Propagation Condition		-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic channel occupancy and semi-static channel occupancy configuration.
NOTE 7: L_{CCA_DL} and L_{CCA_UL} are chosen such that preambleTransMax > 5 + L_{CCA_DL} + L_{CCA_UL}.
NOTE 8: A window W_{CCA_DL}=W_{CCA_UL}=Inf is used to indicate that L_{CCA_DL} and L_{CCA_UL} are considered during the entire duration of a test run.

A.10.1.1.1.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.10.1.1.1.4.2.1 MsgA Transmission

In Test-1, to test the UE behavior specified in clause 6.2.2A.3.2.1 for MsgA transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belong to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

The three requirements below are relevant for all cases of MsgA transmissions described within the clause A.10.1.1.1.4.2:

- The System Simulator shall implement the UL CCA model for the MsgA occasions (i.e. both MsgA PRACH and MsgA PUSCH occasions) where MsgA transmissions are expected. The System Simulator shall monitor the

MsgA occasions to detect if the UE is transmitting MsgA. If a MsgA transmission is detected on MsgA occasions that are expected to have UL CCA failure, the test is considered as failed.

- In case of CCA DL failure, the test equipment should verify that the UE does not transmit MsgA for semi-static channel access mode; for dynamic channel access mode it is assumed that MsgA occasions are always scheduled within a UE-initiated COT.

- The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated PRACH transmission power in case of UL CCA failure.

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first MsgA preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.1.1.4.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2A.3.2.2 the System Simulator shall transmit a MsgB containing a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble after 5 MsgA transmissions have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble. In case of CCA DL failure, the test equipment should delay the transmission of MsgB.

The UE may stop monitoring for MsgB if the MsgB contains a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated MsgA transmission power if Random Access Responses Reception has not been considered as successful.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2A.3. The power of the first MsgA preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.1.1.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2A.3.2.3 the System Simulator shall transmit a MsgB corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles. In case of CCA DL failure, the test equipment should delay the transmission of MsgB.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA*.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2A.3. The power of the first MsgA preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.10.1.2 Handover with PSCell from EN-DC to EN-DC with known target PSCell using CCA

A.10.1.2.1 Test Purpose and Environment

This test is to verify the requirement for E-UTRA handover with NR PSCell change, where NR PSCell is on carrier with CCA. The requirements for EN-DC HO with PSCell change on CCA are specified in clause 5.9 in E-UTRA RRM specification [15] for the case when the target PSCell is on carrier with CCA. Supported test configurations are shown in table A.10.1.2.1-1.

Table A.10.1.2.1-1 gives general test configurations for Handover with PSCell from EN-DC to EN-DC, table A.10.1.2.1-2 provides general test parameters for Handover from E-UTRA to E-UTRA cell in EN-DC to EN-DC, table A.10.1.2.1-3 provides E-UTRAN cell specific test parameters for Handover with PSCell from EN-DC to EN-DC, table A.10.1.2.1-4 provides general test parameters for PSCell change from FR1 carrier under CCA to FR1 carrier under CCA, table A.10.1.2.1-5 provides cell specific test parameters for PSCell change from FR1 carrier under CCA to FR1 carrier under CCA.

In the test there are four cells: Cell 1 and Cell 2 are PCell and target PCell on E-UTRA carrier, Cell 3 and Cell 4 are PSCell and target PSCell on NR CCA carrier. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. Before the test starts the UE is connected to Cell 1 (E-UTRA PCell) and Cell 3 (NR PSCell) with EN-DC mode.

At the start of time duration T1, the UE do not have any information of cell 2 and cell 4. AT the end of T1, UE is configured with neighbour cell measurements on the Cell 3 and Cell 4 for Event A3 conditional measurement report.

During T2, UE acquires the timing information of Cell 3 and Cell 4 and performs L3-RSRP measurements on the configured neighbour cells. UE sends measurement report to the Cell 1 to indicate the event triggering condition A3 is satisfied for the configured for neighbour cells. By end of T2, E-UTRA PCell (Cell 1) shall send a RRC message implying handover with PSCell change.

The start of T3 is defined as the end of the last TTI containing the RRC message implying handover with PSCell. UE shall complete PRACH transmission to PCell and PSCell by end of T3.

Table A.10.1.2.1-1: General test configurations for Handover with PSCell from EN-DC to EN-DC with CCA on NR Cell

Config	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on the UE capability	

Table A.10.1.2.1-2: General test parameters for Handover from E-UTRA to E-UTRA cell in EN-DC to EN-DC

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	One is E-UTRA RF channel and one is NR RF channel
Initial conditions	Active PCell		Cell 1	On E-UTRA RF channel number 1.
	E-UTRA Neighbouring cell		Cell 2	On E-UTRA RF channel number 1.
Final conditions	Active PCell		Cell 2	
CP length			Normal	Applicable to Cell 1, Cell 2, Cell 3 and Cell 4.
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Continuous monitoring of primary cell
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between same RAT cells		μs	3	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	Tinterrupt is defined in clause 6.1B.1.2

Table A.10.1.2.1-3: E-UTRAN cell specific test parameters for Handover with PSCell from EN-DC to EN-DC

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
Duplex mode		FDD or TDD			FDD or TDD		
TDD special subframe configuration[Note1]		6			6		
TDD uplink-downlink configuration[Note1]		1			1		
$BW_{channel}$		5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100			5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PDSCH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD			5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD			5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns defined in A.3.2.1 (FDD) and in A.3.2.2(TDD) [Note2]		5 MHz: OP.20 FDD 10 MHz: OP.1 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		OP.18 FDD OP.2 FDD OP.14 FDD OP.10 TDD OP.2 TDD OP.8 TDD	5 MHz: OP.18 FDD 10 MHz: OP.2 FDD 20 MHz: OP.14 FDD 5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD		OP.20 FDD OP.1 FDD OP.17 FDD OP.9 TDD OP.1 TDD OP.7 TDD
PRACH configuration		-			4, As specified in table 5.7.1-2 in TS 36.211		
PBCH_RA	dB	0			0		
PBCH_RB	dB						
PSS_RA	dB						
SSS_RA	dB						
PCFICH_RB	dB						
PHICH_RA	dB						
PHICH_RB	dB						
PDCCH_RA	dB						
PDCCH_RB	dB						
PDSCH_RA	dB						
PDSCH_RB	dB						
OCNG_RA[Note3]	dB						
OCNG_RB[Note3]	dB						
N_{oc}[Note4]	dBm/15 kHz	-98					
$\hat{E}_s/N_{oc}$	dB	8	8	8	-infinite	11	11
$\hat{E}_s/I_{ot}$	dB	8	-3.3	-3.3	-infinite	2.36	2.36
RSRP [Note5]	dBm/15 kHz	-90	-90	-90	-infinite	-87	-87
SCH_RP [Note5]	dBm/15 kHz	-90	-90	-90	-infinite	-87	-87
Io [Note5]	dBm/Ch BW	-61.58	-57.23+10log($N_{PRB,c}$/50)		N/A	-57.23+10log($N_{PRB,c}$/50)	
Propagation Condition		AWGN					
Antenna Configuration		1x2					

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211.							
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 respectively.							
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 5: E_s/I_{ot}, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							

Table A.10.1.2.1-4: General test parameters for PSCell change from FR1 carrier under CCA to FR1 carrier under CCA

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 3	On the carrier under CCA
	Neighbouring cell		Cell 4	On the carrier under CCA
Final condition	Active cell		Cell 4	On the carrier under CCA
DL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.20.2.1	
	Semi-static channel access Note 2, 3			
UL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.20.2.2	
	Semi-static channel access Note 2,3			
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T304		ms	500	
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T304	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T304	
T1		s	5	
T2		s	≤ 5	
T3		s	≥ $T_{interrupt}$	$T_{interrupt}$ is defined in clause 6.1B.1.2
NOTE 1: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy.				
NOTE 2: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy.				
NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.10.1.2.1-5: Cell specific test parameters for PSCell change from FR1 carrier under CCA to FR1 carrier under CCA

Parameter		Unit	Cell 3			Cell 4		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			1		
P_{CCA_DL} for dynamic channel access Note 4,6		-	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75			$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		
P_{CCA_DL} for semi-static channel access Note 5,6		-	P_{CCA_DL}=0.9375			P_{CCA_DL}=0.9375		
P_{CCA_UL} for dynamic channel access Note 4,6		-	0.75			0.75		
P_{CCA_UL} for semi-static channel access Note 5,6		-	0.87			0.87		
TDD configuration	Config 1, 2		TDDConf.1.1 CCA					
$BW_{channel}$	Config 1, 2		40: $N_{PRB,c}$ = 106					

Parameter		Unit	Cell 3			Cell 4		
			T1	T2	T3	T1	T2	T3
BWP BW	Config 1, 2		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference	Config 1, 2		SR.1.1 CCA					
CORESET Reference Channel	Config 1, 2		CR.1.1 CCA					
Dedicated CORESET RMC configuration	Config 1, 2		CCR.1.1 CCA					
TRS configuration	Config 1, 2		TRS.1.1 TDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
DBT window configuration	Config 1, 2		DBT.1					
SSB configuration for semi-static channel access Note 4, 6	Config 1, 2		SSB.1 CCA					
SSB configuration for dynamic channel access Note 5, 6	Config 1, 2		SSB.2 CCA					
ssb-PositionQCL	Config 1, 2		[1]					
PDSCH/PDCCH subcarrier spacing	Config 1, 2	kHz	30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1, 2	kHz	30 kHz					
PRACH configuration			FR1 PRACH configuration 1 under CCA					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15 kHz	-98					
N_{oc} Note2	Config 1, 2	dBm/SCS	-95					
$\hat{E}_s / I_{ot}$		dB	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s / N_{oc}$		dB	8	8	8	-Infinity	11	11
SSB_RP	Config 1, 2	dBm/SCS	-87	-87	-87	-Infinity	-84	-84
Io Note3	Config 1, 2	dBm/ 38.16 MHz	-55.31	-50.96	-50.96	-55.31	-50.96	-50.96
Propagation condition		-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.10.1.2.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 60 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover requirements for handover with PSCell for EN-DC is defined in clause 5.9 in [15] as:

$D_{HOwithPSCel_PCell} = T_{RRC_delay} + T_{search} + T_{IU} + T_{processing}$

Where:

T_{RRC_delay} = 20 ms for 'RRC connection reconfiguration (NR SCG establishment/ /modification/release)'.

T_{search} = 0 ms for known cell.

T_{IU} = 15 ms in the test configuration.

$T_{processing}$ = 25 ms for source Cell and target Cell are in the same FR.

This gives a total of 60 ms for handover delay.

The UE shall transmit the PRACH preamble to Cell 4 less than $D_{HOwithPSCell_PSCell}$ from the beginning of time period T3.

NOTE: The PSCell change delay for handover with PSCell for EN-DC is defined in clause 5.8 in [15] as:

$D_{HOwithPSCell_PSCell} = T_{RRC_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{IU_PSCell} + 2$ ms

Where:

T_{RRC_delay} = 20 ms for 'RRC connection reconfiguration (NR SCG establishment/ /modification/release)'.

$T_{processing}$ = 25 ms for source Cell and target Cell are in the same FR.

T_{search} = 0 ms for known cell.

$T_{\Delta} = (1+ L_2) *20$ ms.

$T_{IU} = (1+ L_3) *10 + 10$ ms

L_2 is the number of SMTC occasions not available at the UE during the time tracking period where $L_2 \leq L_{CCA_DL}$, and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure, where $L_3 \leq L_{CCA_UL}$. $L_3 = 0$ for Type 2C UL channel access procedure as defined in TS 37.213 [33]. The interruption time considering the potential extensions caused by L_1, L_2, L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2]. Test equipment should make sure that L_{CCA_DL} and L_{CCA_UL} are not exceeded during a test by monitoring the number of CCA failures and preventing additional CCA failures from happening after L_{CCA_DL} or L_{CCA_UL} is reached.

The rate of correct PSCell addition observed during repeated tests shall be at least 90 %.

A.10.2 Timing

A.10.2.1 UE transmit timing

A.10.2.1.1 UE Transmit Timing Test with PSCell under DL CCA

A.10.2.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb when PSCell is subject to DL CCA and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2. Supported test configurations are shown in table 10.2.1.1.1-1.

Table A.10.2.1.1.1-1: Supported test configurations for UE transmit timing test

Config	Description

1	LTE FDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

The test consists of E-UTRA PCell and NR PSCell, which is subject to DL CCA. The configuration for E-UTRA is given in A.3.7.2.1. Table A.10.2.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.10.2.1.1.1-3.

Table A.10.2.1.1.1-2: Cell Specific Test Parameters for UE Transmit Timing test

Parameter		Unit	Config	Test1	Test2
SSB ARFCN			1,2	Freq1	Freq1
TDD configuration			1,2	TDDConf.1.1 CCA	
$BW_{channel}$		MHz	1,2	40: $N_{PRB,c}$ = 106	
Initial BWP Configuration			1,2	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration			1,2	DLBWP.1.1 ULBWP.1.1	
DRX Cycle		ms	1,2	N/A	DRX.8[Note5]
DL CCA model			1,2	As specified in clause A.3.26.2.1	
UL CCA model			1,2	As specified in clause A.3.26.2.2	
PDSCH Reference			1,2	SR.1.1 CCA	
CORESET Reference			1,2	CR.1.1 CCA	
OCNG Patterns			1,2	OCNG pattern 1	
SSB configuration	Semi- static channel acces		1,2	SSB.1 CCA	
	Dymamic channel acces		1,2	SSB.2 CCA	
SMTC configuration			1,2	SMTC.1 FR1	
TRS configuration			1,2	TRS.1.2 TDD	
DL CCA probability for semi-static channel access (P_{CCA_DL})			1,2	0.9375	0.9375
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_1}$)			1,2	0.75	0.75
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_2}$)			1,2	0.75	0.75
UL CCA probability (P_{CCA_UL})			1,2	1	1
EPRE ratio of PSS to SSS		dB	1,2	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS (Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} [Note2]		dBm/30 kHz	1,2	-95	-95
$\hat{E}_s / I_{ot}$			1,2	3	3
$\hat{E}_s / N_{oc}$			1,2	3	3
SS-RSRP[Note3]		dBm/30 kHz	1,2	-92	-92
Io[Note3]		dBm/38.1 MHz	1,2	-59.2	-59.2
Propagation condition			1,2	AWGN	
SRS Config			1,2	SRSConf.1[Note6]	SRSConf.2[Note6]

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Parameter	Unit	Config	Test1	Test2
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 5: DRX related parameters are given in table A.3.3.8-1				
NOTE 6: SRS configs are given in table A.10.2.1.1.1-3.				
NOTE 7: Parameters P_{CCA_DL}, $P_{CCA_DL_1}$, $P_{CCA_DL_2}$ and P_{CCA_UL} are defined in clause A.3.26.2.				
NOTE 8: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.				

Table A.10.2.1.1.1-3: SRS Configuration for UE transmit timing

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	14 for test configuration 1,2 25 for test configuration 3	25	Matches $N_{PRB,c}$
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl640, 0	Offset to align with DRx periodicity
	sequenceId	0	0	Any 10 bit number

A.10.2.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up E-UTRA PCell according to parameters given in table A.3.7.2.1-1 and setup NR PSCell according to parameters given in table A.10.2.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset})\times T_c \pm T_e$ of the first detected path of DL SSB.

   a. The N_{TA} offset value (in T_c units) is 25600

   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in table A.10.2.1.1.2-1

Table A.10.2.1.1.2-1: Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
30	$+32*64T_c$	$+16*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 Table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

A.10.2.2 UE timing advance

A.10.2.2.1 UE Timing Advance Adjustment Accuracy with PSCell under DL CCA

A.10.2.2.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.10.2.2.1.2 Test Parameters

Supported test configurations are shown in table A.10.2.2.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.10.2.2.1.2-2, A.10.2.2.1.2-3 and A.10.2.2.1.2-4. The configuration of Cell 1 (LTE PCell) is specified in clause A.3.7.2.1.

In all test cases, two cells are used. Cell 1 is the PCell in the primary Timing Advance Group (pTAG) and cell 2 is the PSCell which is subject to DL CCA is in the secondary Timing Advance Group (sTAG). Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands for sTAG are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.10.2.2.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured for PSCell in sTAG.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element for sTAG, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance for sTAG used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value specified in table A.10.2.2.1.2-2. This value shall result in changes of the timing advance for sTAG used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.

Table A.10.2.2.1.2-1: Supported test configurations for timing advance test

Config	Description
1	LTE FDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: The UE supporting EN-DC only on NR band(s) with shared spectrum access is required to be tested	

Table A.10.2.2.1.2-2: General test parameters for timing advance test

Parameter	Unit	Value	Comment
RF channel number		Cell 1: 1 Cell 2: 2	1 for E-UTRAN PCell 2 for NR PSCell
Initial DL BWP		DLBWP.0.1	As specified in table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	*For 30 kHz SCS* $N_{TA_new} = N_{TA_old} + 4096*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.10.2.2.1.2-3: Cell specific test parameters for timing advance test

Parameter			Unit	Test1	
				T1	T2
TDD configuration		Config 1,2		TDDConf.1.1 CCA	
$BW_{channel}$		Config 1,2	MHz	40: $N_{PRB,c}$ = 106	
BWP BW		Config 1,2	MHz	40: $N_{PRB,c}$ = 106	
DRX Cycle		Config 1,2	ms	Not Applicable	
DL CCA model		Config 1,2		As specified in clauseA.3.26.2.1	
UL CCA model		Config 1,2		As specified in clause A.3.26.2.2	
PDSCH Reference		Config 1,2		SR.1.1 CCA	
CORESET Reference		Config 1,2		CR.1.1 CCA	
TRS configuration		Config 1,2		TRS.1.2 TDD	
OCNG Patterns		Config 1,2		OCNG pattern 1	
SSB Configuration	Semi-static channel acces	Config 1,2		SSB.1 CCA	
	Dymamic channel acces	Config 1,2		SSB.2 CCA	
SMTC configuration		Config 1,2		SMTC.1 FR1	
DL CCA probability for semi-static channel access (P_{CCA_DL})		Config 1,2		1	
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_1}$)		Config 1,2		1	
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_2}$)		Config 1,2		1	
UL CCA probability P_{CCA}		Config 1,2		1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2		Config 1,2	dBm/30 kHz	-95	
		Config 3,6		-95	

Parameter		Unit	Test1	
			T1	T2
$\hat{E}_s/I_{ot}$		dB	3	
$\hat{E}_s/N_{oc}$		dB	3	
Io[Note3]	Config 1,2	dBm/38.16 MHz	-62.58	
Propagation condition		-	AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 4: Parameters P_{CCA_DL}, $P_{CCA_DL_1}$, $P_{CCA_DL_2}$ and P_{CCA_UL} are defined in clause A.3.26.2.				
NOTE 5: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.				

Table A.10.2.2.1.2-4: Sounding Reference Symbol Configuration for timing advance test

Field		Value	Comment
c-SRS	Config 1,2	24	Frequency hopping is disabled
b-SRS		0	
b-hop		0	
freqDomainPosition		0	Frequency domain position of SRS
freqDomainShift		0	
groupOrSequenceHopping		neither	No group or sequence hopping
SRS-PeriodicityAndOffset		sl5=4 for SCS 30 kHz	Once every 5 slots
pathlossReferenceRS		ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage		Codebook	Codebook based UL transmission
startPosition		0	resourceMapping setting: SRS on last symbol of slot, and 1symbols for SRS without repetition.
nrofSymbols		n1	
repetitionFactor		n1	
combOffset-n2		0	transmissionComb setting
cyclicShift-n2		0	
nrofSRS-Ports		port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].			

A.10.2.2.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value for PSCell in sTAG to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy for PSCell in sTAG shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.10.3 Signalling characteristics

A.10.3.1 Radio link monitoring

A.10.3.1.1 Introduction

In the test cases specified in clause A.10.3.1, any uplink signal transmitted by the UE is used for detecting the in-/out-of-sync state of the UE. In terms of measurement, the uplink signal is verified based on the UE output power:

- UE output power higher than Transmit OFF power -50 dBm (as defined in TS 38.101-3 [20]) means uplink signal

- UE output power equal to or less than Transmit OFF power -50 dBm (as defined in TS 38.101-3 [20]) means no uplink signal.

For intra-band contiguous carrier aggregation, transmit OFF power is measured as the mean power per component carrier.

For UE with multiple transmit antennas, transmit OFF power is measured as the mean power at each transmit connector.

A.10.3.1.2 Radio link monitoring out-of-sync test for PSCell configured with SSB-based RLM RS in non-DRX mode

A.10.3.1.2.1 Test purpose and environment

The purpose of this test is to verify that the UE properly detects the out-of-sync and in-sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR1 PSCell radio link monitoring requirements in clause 8.1A.

In the test, UE is configured to perform RLM based on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.10.3.1.2.1-1. The test parameters are given in tables A.10.3.1.2.1-2, A.10.3.1.2.1-3, and A.10.3.1.2.1-4 below. There are two cells in the test: Cell 1 is the E-UTRAN PCell, and Cell 2 is the FR1 PSCell which operates on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1.

The test consists of three successive time periods, with time duration of T1, T2 and T3, respectively. Figure A.10.3.1.2.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE transmits according to UL CCA model. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in the test.

Table A.10.3.1.2.1-1: Supported test configurations.

Configuration	Description
1	LTE FDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations above.	

Table A.10.3.1.2.1-2: General test parameters for PSCell out-of-sync testing in non-DRX mode.

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
DL CCA model			As specified in clause A.3.26.2.1
UL CCA model			As specified in clause A.3.26.2.2
Duplex mode	Config 1,2		TDD
$BW_{channel}$	Config 1,2	MHz	40: $N_{PRB,c}$ = 106
DL initial BWP configuration	Config 1,2		DLBWP.0.1
DL dedicated BWP configuration	Config 1,2		DLBWP.1.1
UL initial BWP configuration	Config 1,2		ULBWP.0.1
UL dedicated BWP configuration	Config 1,2		ULBWP.1.1
TDD configuration	Config 1,2		TDDConf.1.1 CCA
CORESET Reference Channel	Config 1,2		CR.1.1 CCA
SSB configuration for semi-static channel access Note 4, 6	Config 1,2		SSB.1 CCA
SSB configuration for dynamic channel access Note 5, 6	Config 1,2		SSB.2 CCA

Parameter		Unit	Value
			Test 1
DBT window configuration	Config 1,2		DBT.1
PDSCH/PDCCH subcarrier spacing	Config 1,2		30 kHz
PRACH Configuration	Config 1,2		FR1 PRACH configuration 1 under CCA
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1,2		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1,2		TRS.1.2 TDD
T1		s	0.2
T2		s	1.04
T3		s	1.04
D1		s	1

NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.
NOTE 3: E-UTRAN is in non-DRX mode under test.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

Table A.10.3.1.2.1-3: Cell-specific test parameters for PSCell out-of-sync testing in non-DRX mode.

Parameter		Unit	Test 1		
			T1	T2	T3
DL CCA probability P_{CCA_DL}	Note 6,8		P_{CCA_DL}=0.9375		
	Note 7,8		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		
UL CCA probability P_{CCA_UL}			1		
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR[Note 3,4] on RLM-RS	Config 1,2	dB	1	[-7]	-15
SNR on other channels and signals	Config 1,2	dB	1		
N_{oc}	Config 1,2	dBm/SCS	-95		

Parameter	Unit	Test 1		
		T1	T2	T3
Propagation condition		TDL-C 300 ns 100 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in slots with RMC burst transmission and is not transmitted during muted slots or during DBT windows.				
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.				
NOTE 3: SNR levels correspond to the signal to noise ratio over the transmitted SSS REs during DBT windows.				
NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3, respectively, in figure A.10.3.1.2.1-1.				
NOTE 5: The SNR values are specified for testing a UE which supports 2 RX on at least one band. For testing of a UE which supports 4 RX on all bands, the SNR during T3 is A.3.6.				
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.				
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.				
NOTE 8: For UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.10.3.1.2.1-4: Measurement gap configuration for PSCell out-of-sync testing in non-DRX mode.

Field	Test 1	
	Value	
gapOffset	0	
NOTE 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned.		
NOTE 2: Ensure that RLM RS is partially overlapped with measurement gap.		

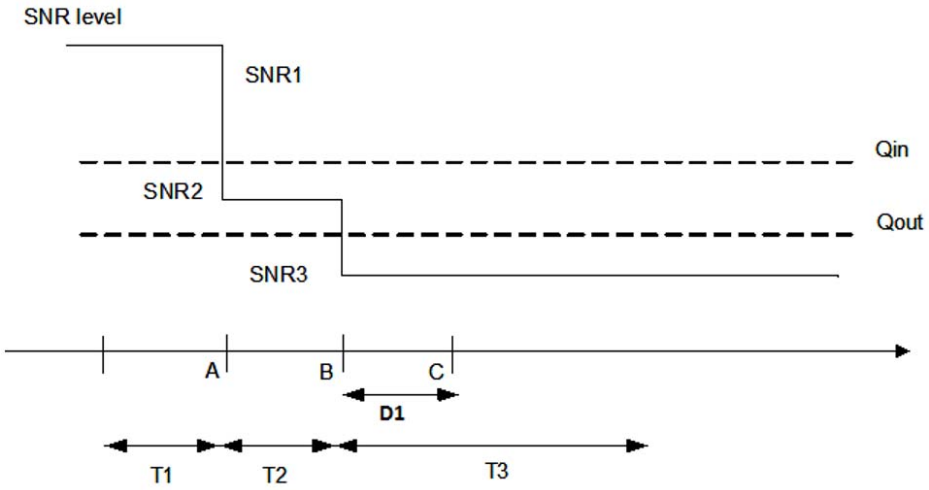


Figure A.10.3.1.2.1-1: SNR variation for out-of-sync testing.

A.10.3.1.2.2 Test requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

- During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.
- The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.10.3.1.3 Radio link monitoring in-sync test for PSCell configured with SSB-based RLM RS in non-DRX mode

A.10.3.1.3.1 Test purpose and environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR1 PSCell radio link monitoring requirements in clause 8.1A.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.10.3.1.3.1-1. The test parameters are given in tables A.10.3.1.3.1-2, and A.10.3.1.3.1-3 below. There are two cells in the test: Cell 1 is the E-UTRAN PCell, and Cell 2 is the FR1 PSCell which operates on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1.

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.10.3.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE transmits according to UL CCA model.

Table A.10.3.1.3.1-1: Supported test configurations.

Configuration	Description
1	LTE FDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations above.	

Table A.10.3.1.3.1-2: General test parameters for PSCell in-sync testing in non-DRX mode.

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
DL CCA model			As specified in clause A.3.26.2.1
UL CCA model			As specified in clause A.3.26.2.2
Duplex mode	Config 1,2		TDD
$BW_{channel}$	Config 1,2	MHz	40: $N_{PRB,c}$ = 106
DL initial BWP configuration	Config 1,2		DLBWP.0.1
DL dedicated BWP configuration	Config 1,2		DLBWP.1.1
UL initial BWP configuration	Config 1,2		ULBWP.0.1
UL dedicated BWP configuration	Config 1,2		ULBWP.1.1
TDD Configuration	Config 1,2		TDDConf.1.1 CCA
CORESET Reference Channel	Config 1,2		CR.1.1 CCA
SSB configuration for semi-static channel access Note 3, 5	Config 1,2		SSB.1 CCA
SSB configuration for dynamic channel access Note 4,5	Config 1,2		SSB.2 CCA
DBT window configuration	Config 1,2		DBT.1
PDSCH/PDCCH subcarrier spacing	Config 1,2		30 kHz
PRACH Configuration	Config 1,2		FR1 PRACH configuration 1 under CCA
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0

Parameter		Unit	Value
			Test 1
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N/A
Layer 3 filtering			*Enabled*
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1,2		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1,2		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.52
T4		s	0.2
T5		s	2.04
D1		s	2

NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.
NOTE 3: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 4: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 5: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

Table A.10.3.1.3.1-3: Cell-specific test parameters for PSCell in-sync testing in non-DRX mode.

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
DL CCA probability P_{CCA_DL}	Note 6,8		P_{CCA_DL}=0.9375				
	Note 7,8		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75				
UL CCA probability P_{CCA_UL}			1				
L_{CCA_DL}			7				
W_{CCA_DL}		ms	$T_{Evaluate_in_SSB,CCA}$ NOTE 9				
EPRE ratio of PDCCH DMRS to SSS		dB	4				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1,2	dB	1	-7	-15	-4.5	1
SNR on other channels and signals	Config 1,2	dB	1				

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
N_{oc}	Config 1,2	dBm/SCS	-95				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in slots with RMC burst transmission and is not transmitted during muted slots or during DBT windows.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 3: SNR levels correspond to the signal to noise ratio over the transmitted SSS REs during DBT windows.
NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.10.3.1.2.1-1.
NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4 RX on all bands, the SNR during T3 and T4 is modified as specified in clause A.3.6.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 8: For UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.
NOTE 9: As defined in table 8.1A.2.2-1.

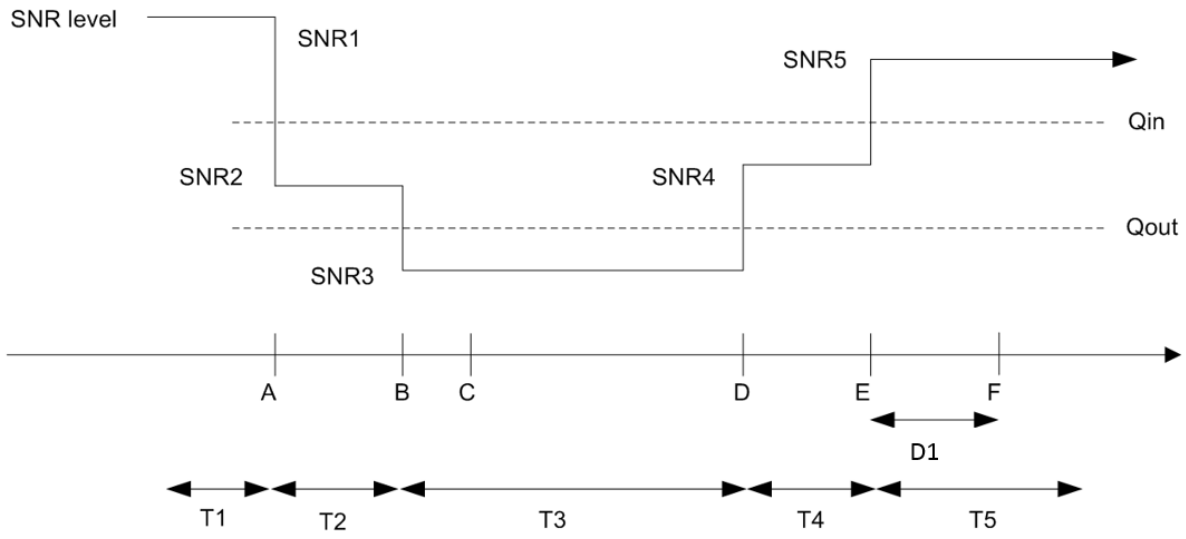


Figure A.10.3.1.2.1-1: SNR variation for in-sync testing.

A.10.3.1.3.2 Test requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.10.3.1.4 Void

A.10.3.1.4.1 Void

A.10.3.1.4.2 Void

A.10.3.1.5 Void

A.10.3.1.5.1 Void

A.10.3.1.5.2 Void

A.10.3.2 Void

A.10.3.3 SCell activation and deactivation delay

A.10.3.3.1 SCell Activation and Deactivation of known NR SCell with NR PSCell and NR SCell under CCA, 160 ms SCell measurement cycle

A.10.3.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that SCell activation and deactivation delays for NR SCell, with NR PSCell and NR SCell both under CCA, are within the requirements stated in clause 8.3A, when the SCell is known by the UE at the time of activation and the configured SCell measurement cycle is 160 ms.

The supported test configurations are shown in table A.10.3.3.1.1-1.

The test parameters are given in table A.10.3.3.1.1-2 and cell-specific parameters for NR cells are provided in table A.10.3.3.1.1-3 below. Cell-specific parameters for EUTRA PCell are provided in clause A.3.7.2.1.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, each with one cell: Cell 1 (PCell) on radio channel 1 (PCC) in E-UTRA, Cell 2 (PSCell) on radio channel 2 (PSCC) in NR, and Cell 3 (SCell) on radio channel 3 (SCC) in NR. Before the test starts the UE is connected to Cell 1 and Cell 2, but is not aware of Cell 3, as the UE is only monitoring PCC and PSCC. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on radio channel 2. The UE now starts monitoring the SCC. At the end of T1, the test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted *m*, defines the start of time period T2. The UE shall be able to report a valid CSI in PSCell for the activated SCell at latest in slot m + (T_{HARQ}+ $T_{activation_time_withCCA}$ + $T_{CSI_Reporting_withCCA}$)/NR_slot_length, as defined in clause 8.3A.2. The UE shall start reporting CSI in PSCell in first available uplink resource for CSI reporting after at least one CSI-RS transmission occasion for channel measurement and reporting following slot $m+ \frac{T_{\mathrm{HARQ}}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption shall fall within the time window specified in clause 8.3A.2.

The point in time at which the MAC message is received by at the UE antenna connector, in a slot # denoted *n*, defines the start of time period T3. The UE shall complete the activation at latest in slot $n + \frac{T_{\mathrm{HARQ}}+3\ ms}{\text{NR slot length}}$. Any PSCell interruption shall fall within the time window specified in clause 8.3A.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received, while taking into account CCA failures on SCC.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.10.3.3.1.1-1: Supported test configurations for SCell Activation and Deactivation of known NR SCell with NR PSCell and SCell under CCA, 160 ms SCell measurement cycle

Configuration	Description
1	PCC: LTE FDD duplex mode; With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

2	PCC: LTE TDD duplex mode; With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.10.3.3.1.1-2: General test parameters for known SCell activation case with NR PSCell and SCell under CCA, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	Three radio channels (1, 2, 3) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1.
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every second subframe
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 3 timing offset to Cell 2	µs	0	
Time alignment error between Cell 3 and Cell 2	µs	≤ TAE as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time PCell and PSCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI_Reporting}$	ms	$10 + 5 \cdot 2^{\mu_{DL}}$	The delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2] μ_{DL} is the subcarrier spacing configuration for DL

Table A.10.3.3.1.1-3: Cell specific test parameters for known SCell activation case with NR PSCell and SCell under CCA, 160 ms SCell measurement cycle

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Duplex mode	Config 1,2		TDD			TDD		
TDD configuration	Config 1,2		TDDConf.1.1 CCA			TDDConf.1.1 CCA		
$BW_{channel}$	Config 1,2	MHz	40: $N_{PRB,c}$ = 106			40: $N_{PRB,c}$ = 106		
DL CCA model			As specified in clause A.3.26.2.1			As specified in clause A.3.26.2.1		
UL CCA model			As specified in clause A.3.26.2.2			As specified in clause A.3.26.2.2		
DL CCA probability for semi-static channel access[Note5,7]	P_{CCA_DL}		0.9375			0.9375		

DL CCA probability for dynamic channel access Note6,7	$P_{CCA_DL_1}$		0.75	0.75
	$P_{CCA_DL_2}$		0.75	0.75
UL CCA probability for semi-static channel access	P_{CCA_UL}		0.87	0.87
UL CCA probability for dynamic channel access	P_{CCA_UL}		0.75	0.75
L_{CCA_DL} Note 8			2	2
W_{CCA_DL} Note 8			$T_{activation_time_withCCA}$	$T_{activation_time_withCCA}$
Initial downlink BWP configuration			DLBWP.0.2	DLBWP.0.2
Initial uplink BWP configuration			ULBWP.0.1	ULBWP.0.1
Dedicated downlink BWP configuration			DLBWP.0.2	DLBWP.0.2
Dedicated uplink BWP configuration			ULBWP.0.1	ULBWP.0.1
TCI state			TCI.State.0	TCI.State.0
TRS Configuration	Config 1,2		TRS.1.2 TDD	TRS.1.2 TDD
PDSCH Reference measurement channel	Config 1,2		SR.1.1 CCA	SR.1.1 CCA
Dedicated CORESET parameters	Config 1,2		CCR.1.3 CCA	CCR.1.3 CCA
RMSI CORESET parameters	Config 1,2		CR.1.1 CCA	CR.1.1 CCA
OCNG Patterns Note1			OP.1	OP.1
SSB Configuration for semi-static channel access Note5,7	Config 1,2		SSB.1 CCA	SSB.1 CCA
SSB Configuration for dynamic channel access Note6,7	Config 1,2		SSB.2 CCA	SSB.2 CCA
SMTC configuration			SMTC.1	SMTC.1
DBT window configuration			DBT.1	DBT.1
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS Note1				
EPRE ratio of OCNG to OCNG DMRS Note1				
N_{oc} Note2	Config 1,2	dBm/15 kHz	-104	-104
N_{oc} Note2	Config 1,2	dBm/SCS	-101	-101
$\hat{E}_s/I_{ot}$		dB	17	17
$\hat{E}_s/N_{oc}$		dB	17	17
SS-RSRP Note3	Config 1,2	dBm/SCS	-84	-84
Io Note3	Config 1,2	dBm/ 38.16 MHz	-52.87	-52.87
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that resources in the cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols in slots with downlink transmission bursts. OCNG is not transmitted during muted slots or during DBT windows.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.
NOTE 8: As specified in clause 8.3A for $L_{1,max}$, $L_{2,1,max}$, $L_{2,2,max}$, $L_{3,1,max}$, and $L_{3,2,max}$

A.10.3.3.1.2 Test Requirements

During T2, starting after at least one CSI-RS transmission occasion for channel measurement and reporting from the slot specified in clause 4.3 of TS 38.213 [3] and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

During T2, the UE shall send the first valid CSI report (non-zero CQI) for the SCell in first available uplink resource for CSI reporting no later than slot m + (T_{HARQ}+ $T_{activation_time_withCCA}$ + $T_{CSI_Reporting_withCCA}$)/NR_slot_length, where $T_{activation_time_withCCA} = T_{FirstSSB} + L_1 * T_{rs}$ + 5 ms, as specified in clause 8.3A.2.

During T3, the UE shall stop sending CSI reports for SCell at latest in slot $n + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3A.3.

During T2, interruption on PSCell shall not occur outside slot m +1+$\frac{T_{HARQ}}{NR\ slot\ length}$ to slot m +1+$\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$ with $T_X = T_{FirstSSB}$.

During T3, interruption on PSCell shall not occur outside slot n +1+T_{HARQ}/NR_slot_length to slot n+1+(T_{HARQ} +3 ms)/NR_slot_length.

The interruption on PSCell shall not be more than specified for EN-DC in clause 8.2.1.2.4.

The rate of correctly observed SCell activation delays and SCell deactivation delays shall for repeated tests be at least 90 %.

A.10.3.3.2 SCell Activation and Deactivation of known NR SCell with NR PSCell and NR SCell under CCA, 640 ms SCell measurement cycle

A.10.3.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that SCell activation and deactivation delays for NR SCell, with NR PSCell and NR SCell both under CCA, are within the requirements stated in clause 8.3A, when the SCell is known by the UE at the time of activation and the configured SCell measurement cycle is 640 ms.

The supported test configurations are same as in table A.10.3.3.1.1-1 above.

The test parameters are same as in table A.10.3.3.1.1-2 above, except for parameters listed below in table A.10.3.3.2.1-1. The cell-specific parameters are same as in table A.10.3.3.1.1-3 above.

The test execution is the same as described in clause A.10.3.3.1 above.

Table A.10.3.3.2.1-1: General test parameters for known NR SCell activation with NR PSCell and SCell under CCA, 640 ms SCell measurement cycle

Parameter	Unit	Value	Comment
SCell measurement cycle (measCycleSCell)	ms	640	

A.10.3.3.2.2 Test Requirements

During T2, starting after at least one CSI-RS transmission occasion for channel measurement and reporting from the slot specified in clause 4.3 of TS 38.213 [3] and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

During T2, the UE shall send the first valid CSI report (non-zero CQI) for the SCell in first available uplink resource for CSI reporting no later than slot m + (T_{HARQ}+ $T_{activation_time_withCCA}$ + $T_{CSI_reporting_withCCA}$)/NR_slot_length, where $T_{activation_time_withCCA} = T_{FirstSSB_MAX} + L_{2,1} * T_{SMTC_MAX} + (1 + L_{2,2}) * T_{rs}$ + 5 ms, as specified in clause 8.3A.2.

During T3, the UE shall stop sending CSI reports for SCell at latest in slot $n + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3A.3.

During T2, interruption on PSCell shall not occur outside slot m +1+$\frac{T_{HARQ}}{NR\ slot\ length}$ to slot m +1+$\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$ with $T_X = T_{FirstSSB_MAX} + L_{2,1} * T_{SMTC_MAX}$.

During T3, interruption on PSCell shall not occur outside slot n +1+T_{HARQ}/NR_slot_length to slot n+1+(T_{HARQ} +3 ms)/NR_slot_length.

The interruption on PSCell shall not be more than specified for EN-DC in clause 8.2.1.2.4.

The rate of correctly observed SCell activation delays and SCell deactivation delays shall for repeated tests be at least 90 %.

A.10.3.3.3 SCell Activation and Deactivation of unknown NR SCell with NR PSCell and NR SCell under CCA

A.10.3.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that SCell activation and deactivation delays for NR SCell, with NR PSCell and NR SCell both under CCA, are within the requirements stated in clause 8.3A, when the SCell is unknown to the UE at the time of activation.

The supported test configurations are same as in table A.10.3.3.1.1-1 above.

The test parameters are same as in table A.10.3.3.1.1-2 above, except for parameters listed below in table A.10.3.3.3.1-1. The cell-specific parameters are same as in table A.10.3.3.1.1-3 above.

The test execution is the same as described in clause A.10.3.3.1 above.

Table A.10.3.3.3.1-1: General test parameters for unknown NR SCell activation with NR PSCell and SCell under CCA

Parameter	Unit	Value	Comment
T1	s	0.1	During this time period PCell and PSCell shall be known and the SCell configured, but not detected.

A.10.3.3.3.2 Test Requirements

During T2, starting after at least one CSI-RS transmission occasion for channel measurement and reporting from the slot specified in clause 4.3 of TS 38.213 [3] and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

During T2, the UE shall send the first valid CSI report (non-zero CQI) for the SCell in first available uplink resource for CSI reporting no later than slot m + (T_{HARQ}+ $T_{activation_time_withCCA}$ + $T_{CSI_reporting_withCCA}$)/NR_slot_length, where $T_{activation_time_withCCA}$ = $T_{FirstSSB_MAX}$ + (1 + $L_{3,1}$)*T_{SMTC_MAX} + (2 + $L_{3,2}$)*T_{rs} + 5 ms, as specified in clause 8.3A.2.

During T3, the UE shall stop sending CSI reports for SCell at latest in slot $n + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3A.3.

During T2, interruption on PSCell shall not occur outside slot m +1+$\frac{T_{HARQ}}{NR\ slot\ length}$ to slot m +1+$\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$ with T_X = $T_{FirstSSB_MAX}$ + $L_{3,1}$* T_{SMTC_MAX}.

During T3, interruption on PSCell shall not occur outside slot n +1+T_{HARQ}/NR_slot_length to slot n+1+(T_{HARQ} +3 ms)/NR_slot_length.

The interruption on PSCell shall not be more than specified for EN-DC in clause 8.2.1.2.4.

The rate of correctly observed SCell activation delays and SCell deactivation delays shall for repeated tests be at least 90 %.

A.10.3.4 Beam failure detection and link recovery procedures

A.10.3.4.1 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with SSB-based BFD and LR in non-DRX mode

A.10.3.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5A.

The test parameters are given in tables A.10.3.4.1.1-1, A.10.3.4.1.1-2, and A.10.3.4.1.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell which operates on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.10.3.4.1.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PSCell to emulate SSB based beam failure. Figure A.10.3.4.1.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. The UE transmits the reporting according to UL CCA model. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test 1.

Table A.10.3.4.1.1-1: Supported test configurations for FR1 PSCell with CCA

Configuration	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.10.3.4.1.1-2: General test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
DL CCA model			As specified in A.3.26.2.1	
UL CCA model			As specified in A.3.26.2.2	
Duplex mode	Config 1, 2		TDD	
BWchannel	Config 1, 2	MHz	40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1	
TDD configuration	Config 1, 2		TDDConf.1.1 CCA	
CORESET Reference Channel	Config 1, 2		CR.1.1 CCA	
SSB Configuration	Config 1, 2		SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access	
DBT Window Configuration	Config 1, 2		DBT.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		30 KHz	
PRACH Configuration	Config 1, 2		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	

Parameter		Unit	Value	Comment
			Test 1	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			gp0	
gapOffset			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1, 2		TRS.1.2 TDD	
SSB Index assigned as RLM RS			0,1	
T310 timer		ms	1000	
N310			2	
T1		s	0.2	During this time the the UE shall be fully synchronized to cell 1
T2		s	0.93	
T3		s	0.52	
T4		s	0	
T5		s	0.45	
D1		s	0.41	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.				

Table A.10.3.4.1.1-3: Cell specific test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
DL CCA probability $P_{CCA,DL}$	Note 10, 12		1.0	0.9375	0.9375	0.9375	0.9375
	Note 11, 12		1.0/1.0	0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability $P_{CCA,UL}$			1.0	1.0	1.0	1.0	1.0
L_{CCA_DL}			N/A	7			
W_{CCA_DL}		ms	N/A	$T_{Evaluate_CBD_SSB_CCA}$ Note 13			
EPRE ratio of PDCCH DMRS to SSS		dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1, 2	dB	5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1, 2	dB	-10	-10	10	10	10
SSB_RP of set q_1	Config 1, 2	dBm/SCS kHz	-105	-105	-85	-85	-85
N_{oc}	Config 1, 2	dBm/15 KHz	-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the transmitted SSS REs during DBT window.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6A.
NOTE 10: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 11: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.
NOTE 12: For UE supporting both semi-static and dynamic cannel access, the UE can be tested under dynamic channel occupancy only.
NOTE 13: As defined in table 8.5A.5.2-1.

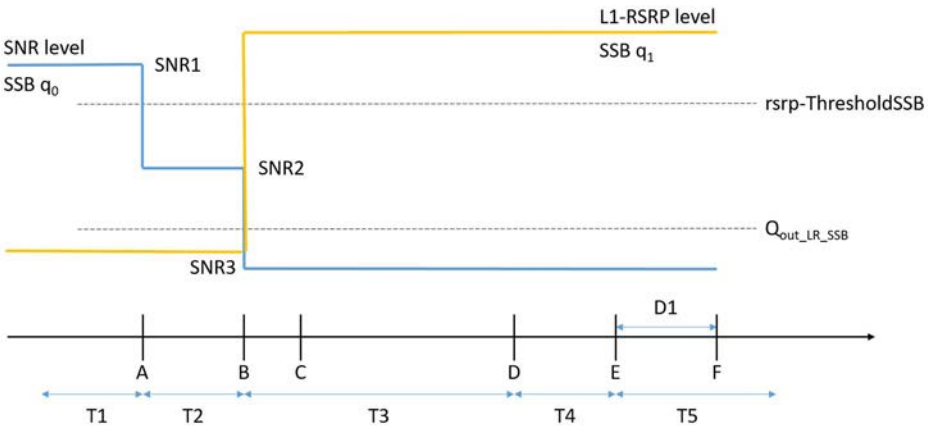


Figure A.10.3.4.1.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.10.3.4.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 410 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.10.3.4.2 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with SSB-based BFD and LR in DRX mode

A.10.3.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5A.

The test parameters are given in tables A.10.3.4.2.1-1, A.10.3.4.2.1-2, and A.4.5.5.2.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell which operates on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.10.3.4.2.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PSCell to emulate SSB based beam failure. Figure A.10.3.4.2.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. The UE transmits the reporting according to UL CCA model. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.10.3.4.2.1-1: Supported test configurations for FR1 PSCell with CCA

Configuration	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.10.3.4.2.1-2: General test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
DL CCA model			As specified in A.3.26.2.1	
UL CCA model			As specified in A.3.26.2.2	
Duplex mode	Config 1, 2		TDD	
BWchannel	Config 1, 2	MHz	40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2		ULBWP.0.1	

Parameter			Unit	Value	Comment
				Test 1	
UL dedicated BWP configuration	Config 1, 2			ULBWP.1.1	
TDD configuration	Config 1, 2			TDDConf.1.1 CCA	
CORESET Reference Channel	Config 1, 2			CR.1.1 CCA	
SSB Configuration	Config 1, 2			SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access	
DBT Window Configuration	Config 1, 2			DBT.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2			30 KHz	
PRACH Configuration	Config 1, 2			Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)				0	
SSB Index assigned as CBD RS (q_1)				1	
OCNG parameters				OP.1	
CP length				Normal	
Correlation Matrix and Antenna Configuration				2x2 Low	
Beam failure detection transmission parameters		DCI format		1-0	
		Number of Control OFDM symbols		2	
		Aggregation level	CCE	8	
		Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0	
		Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0	
		DMRS precoder granularity		REG bundle size	
		REG bundle size		6	
DRX				DRX.7	A.3.3.7
Gap pattern ID				N.A.	
rlmInSyncOutOfSyncThreshold				absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2		dBm/SCS kHz	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS				db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount				n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer				pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	Config 1, 2			CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1, 2			TRS.1.2 TDD	
SSB Index assigned as RLM RS				0,1	
T310 timer			ms	1000	
N310				2	
T1			s	1	During this time the the UE shall be fully synchronized to cell 1
T2			s	9.01	
T3			s	5.16	
T4			s	0	
T5			s	3.89	
D1			s	3.85	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts. NOTE 3: E-UTRAN is in non-DRX mode under test.					

Table A.10.3.4.2.1-3: Cell specific test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
DL CCA probability $P_{CCA,DL}$	Note 10, 12		1.0	0.9375	0.9375	0.9375	0.9375
	Note 11, 12		1.0/1.0	0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability $P_{CCA,UL}$			1.0	1.0	1.0	1.0	1.0
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1, 2	dB	5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1, 2	dB	-10	-10	10	10	10
SSB_RP of set q_1	Config 1, 2	dBm/SCS kHz	-105	-105	-85	-85	-85
N_{oc}	Config 1, 2	dBm/15 KHz	-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the transmitted SSS REs during DBT window.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6A.
NOTE 10: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 11: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.
NOTE 12: For UE supporting both semi-static and dynamic cannel access, the UE can be tested under dynamic channel occupancy only.

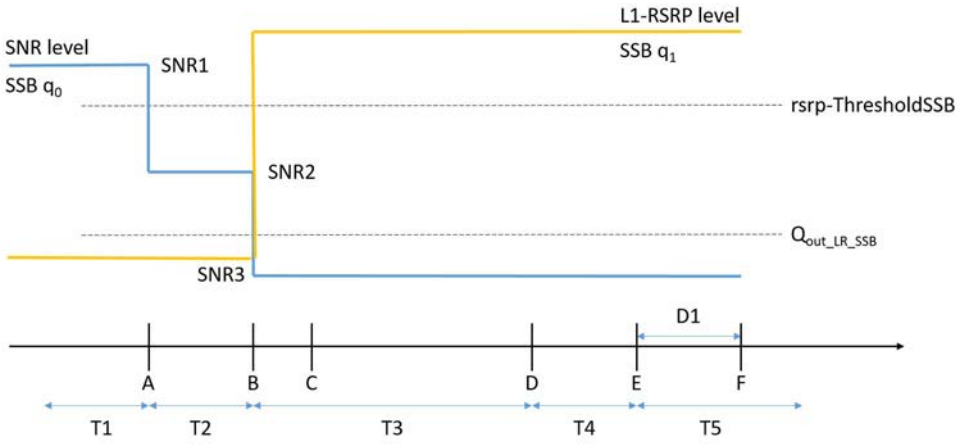


Figure A.10.3.4.2.1-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in DRX mode

A.10.3.4.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 3850 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.10.3.5 Active BWP switching

A.10.3.5.1 UL active BWP switch delay with consistent UL LBT failure on PSCell subject to UL CCA in EN-DC

A.10.3.5.1.1 Test Purpose and Environment

The purpose of this test is to verify the UL BWP switch delay requirement defined in clause 8.6.4.

The supported test configurations are shown in table A.10.3.5.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in A.10.3.5.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in table A.10.3.5.1.1-2. SRS configuration used in the test is specified in table A.10.3.5.1.1-4.

The UE shall be configured with PRACH configuration on UL BWP on which the UE shall switch after the consistent UL LBT failure detection.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1 and Cell 2 on radio channel 2.
- UE is configured with 2 different UE-specific downlink and uplink bandwidth parts on Cell 2: DL BWP-1, DL BWP-2, UL BWP-1 and UL BWP-2 before starting the test. DL BWP-1 and DL BWP-2 always include bandwidth of the initial DL BWP and SSB. UL BWP-1 and UL BWP-2 always include bandwidth of the SRS.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is DL BWP-1.
- UE is indicated in *firstActiveUplinkBWP-Id* that the active UL BWP is UL BWP-1.
- UE is configured with *LBT-FailureRecoveryConfig* parameters for Cell 2.

The cell has constant signal levels throughout the test. The test consists of 2 successive time periods, with durations of T1 and T2, respectively.

During T1,

- Time period T1 starts when the UE has received the SRS configuration for periodic SRS transmission on active UL BWP-1.
- The UE shall perform UL CCA before SRS transmission.

- The parameter UL CCA probability P_{CCA} is set to 0 during T1. This requires the test system to set energy level above the detection level during portion of the UL slot where the UE performs UL CCA. This in turn forces the UE to fail the UL CCA. The UE consistently fails UL CCA during T1 and is therefore unable to transmit SRS.

During T2,

- T2 starts when the UE detects consistent UL LBT failures i.e. when total number of UL LBT failures in Cell 2 on active UL BWP-1 exceeds *lbt-FailureInstanceMaxCount* during *lbt-FailureDetectionTimer.*

- The UE upon detected consistent UL LBT failure starts the LBT recovery mechanism, which requires the UE to switch to active UL BWP-2 in Cell 2 and to send PRACH in the active UL BWP-2.

- Staring from T2, the UE shall be able to send PRACH in the active UL BWP-2 within the delay specified in clause 8.6.4.

Table A.10.3.5.1.1-1: Supported test configurations for UL BWP switch test in EN-DC

Config	Description
1	LTE FDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.10.3.5.1.1-2: General test parameters for UL BWP switch in EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	
lbt-FailureDetectionTimer [2]	ms	80	Parameter configured by IE: *LBT-FailureRecoveryConfig* [1]
lbt-FailureInstanceMaxCount [2]		4	Parameter configured by IE: *LBT-FailureRecoveryConfig* [1]
T1	s	0.1	During T1 consistent LBT failure is detected on active UL BWP-1
T2	s	0.1	During T2 UE sends PRACH on active UL BWP-2

Table A.10.3.5.1.1-3: NR Cell specific test parameters for UL BWP switch test in EN-DC

Parameter			Unit	Cell 2	
				T1	T2
TDD configuration		Config 1, 2		TDDConf.1.1 CCA	
$BW_{channel}$		Config 1, 2		40 MHz: $N_{PRB,c}$ = 106	
DL CCA model		Config 1, 2		As specified in clause A.3.20.2.1	
UL CCA model		Config 1, 2		As specified in clause A.3.20.2.2	
Active BWP ID		Config 1, 2		1, 2	
Initial DL BWP Configuration		Config 1, 2		DLBWP.0.2 Note 4	
Active DL BWP-1 Configuration		Config 1, 2		DLBWP.1.1 Note 4	
Active DL BWP-2 Configuration		Config 1, 2		DLBWP.1.3 Note 4	
Initial UL BWP Configuration		Config 1, 2		ULBWP.0.2 Note 4	
Active UL BWP-1 Configuration		Config 1, 2		ULBWP.1.1 Note 4	
Active UL BWP-2 Configuration		Config 1, 2		ULBWP.1.3 Note 4	
PDSCH Reference measurement channel		Config 1, 2		SR.1.1 CCA	
RMSI CORESET parameters		Config 1, 2		CR.1.1 CCA	
Dedicated CORESET parameters		Config 1, 2		CCR.1.1 CCA	
OCNG Patterns		Config 1, 2		OP.1	
SSB Configuration	Semi- static channel acces	Config 1, 2		SSB.1 CCA	
	Dymamic channel acces	Config 1, 2		SSB.2 CCA	
SMTC Configuration		Config 1, 2		SMTC.1 FR1	
Correlation Matrix and Antenna Configuration		Config 1, 2		1x2 Low	

Parameter		Unit	Cell 2	
			T1	T2
TRS Configuration	Config 1, 2		TRS.1.2 TDD	
DL CCA probability for semi-static channel access (P_{CCA_DL})	Config 1, 2		1	1
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_1}$)	Config 1, 2		1	1
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_2}$)	Config 1, 2		1	1
UL CCA probability (P_{CCA_UL})	Config 1, 2		0	1
PRACH configuration	Config 1, 2		N/A	Configuration #1 in table A.3.8.2.1-1
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2	Config 1, 2	dBm/SCS	-101	
SS-RSRP Note 3	Config 1, 2	dBm/SCS	-84	
$\hat{E}_s/I_{ot}$	Config 1, 2	dB	17	
$\hat{E}_s/N_{oc}$	Config 1, 2	dB	17	
Io Note3	Config 1, 2	dBm/ 38.16 MHz	-52.86	
Propagation Condition			AWGN	

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].
NOTE 5: Parameters P_{CCA_DL}, $P_{CCA_DL_1}$, $P_{CCA_DL_2}$ and P_{CCA_UL} are defined in clause A.3.20.2.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

Table A.10.3.5.1.1-4: Sounding Reference Symbol Configuration for UL BWP Switch Test in EN-DC

Field	Value	Comment
c-SRS	24	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=4 for SCS 30 kHz	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting: SRS on last symbol of slot, and 1symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission

NOTE: For further information see clause 6.3.2 in TS 38.331 [2].

A.10.3.5.1.2 Test Requirements

The UE capable of *bwp-SwitchingDelay type1* [2] shall start to transmit the PRACH on active UL BWP-2 of Cell 2 (PSCell) less than 21.5 ms from the beginning of time period T1.

The UE capable of *bwp-SwitchingDelay type2* [2] shall start to transmit the PRACH on active UL BWP-2 of Cell 2 (PSCell) less than 23 ms from the beginning of time period T1.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The above delay is calculated as follows:'

The active UL BWP switch delay from UL BWP-1 to UL BWP-2 can be expressed as:

$$T_{BWPswitchDelay}*T_{slot} +1*T_{slot} + (1+ L_3)*T_{SSB,RO} + 10 \text{ ms}$$

Where:

- $T_{BWPswitchDelay}$ = 1 ms (2 slots) and 2.5 ms (5 slots) for *bwp-SwitchingDelay* [2] *type1* and *type2* UE capabilities according to clause 8.6.4.
- T_{slot} = It is the slot length. It is 0.5 ms for 30 kHz.
- L3 = It is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. L3= 0 during T2 since P_{CCA} = 1.
- $T_{SSB,RO}$ = 10 ms according to FR1 PRACH configuration 1.

This gives a total of 21.5 ms and 23 ms for *type1* and *type2* UE respectively.

A.10.3.5.2 DCI-based and Timer-based Active BWP Switch

A.10.3.5.2.1 E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in synchronous EN-DC

A.10.3.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in TS38.133 clause 8.6, and interruption requirement for E-UTRA victim cell defined in TS36.133 clause 7.32.2.7. Supported test configurations are shown in table A.10.3.5.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in table A.10.3.5.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in table A.10.3.5.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell no later than at the beginning of the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from the beginning of the DL slot right after DL slot ($i+T_{BWPswitchDelay}$).

The starting time of PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j*, where j is the beginning slot of the DL subframe immediately after the *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell at latest at the beginning of the DL slot right after DL slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after DL slot ($j+T_{BWPswitchDelay}$).

The starting time of PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of PSCell, respectively.

Table A.10.3.5.2.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: A UE which fulfils the requirements in test case A.10.3.5.2.2 can skip the test cases in A.10.3.5.2.1. NOTE 3: The UE supporting EN-DC with only NR band(s) with shared spectrum access is required to be test.	

Table A.10.3.5.2.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
DL CCA model		As specified in clause A.3.26.2.1	
UL CCA model		As specified in clause A.3.26.2.2	
bwp-InactivityTimer	ms	200	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell 2 timing offset to Cell 1	μs	3	Synchronous EN-DC

T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.10.3.5.2.1.1-3.: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter			Unit	Cell 2
Frequency Range				FR1
Duplex mode		Config 1,2		TDD
TDD configuration		Config 1,2		TDDConf.1.1 CCA
$BW_{channel}$		Config 1,2		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID				1, 2
Initial DL BWP Configuration		Config 1,2		DLBWP.0.2 Note 4
Active DL BWP-1 Configuration		Config 1,2		DLBWP.1.1 Note 4
Active DL BWP-2 Configuration		Config 1,2		DLBWP.1.3 Note 4
Initial UL BWP Configuration		Config 1,2		ULBWP.0.2 Note 4
Active UL BWP-1 Configuration		Config 1,2		ULBWP.1.1 Note 4
Active UL BWP-2 Configuration		Config 1,2		ULBWP.1.3 Note 4
PDSCH Reference measurement channel		Config 1,2		SR.1.1 CCA
RMSI CORESET parameters		Config 1,2		CR.1.1 CCA
Dedicated CORESET parameters		Config 1,2		CCR.1.1 CCA
OCNG Patterns		Config 1,2		OP.1
SSB Configuration	Semi- static channel acces	Config 1,2		SSB.1 CCA
	Dymamic channel acces	Config 1,2		SSB.2 CCA
SMTC Configuration		Config 1,2		SMTC.1
TRS Configuration		Config 1,2		TRS.1.2 TDD
DL CCA probability for semi-static channel access (P_{CCA_DL})		Config 1,2		1
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_1}$)		Config 1,2		1
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_2}$)		Config 1,2		1
DL CCA probability for semi-static channel access (P_{CCA_DL})		Config 1,2		1
Correlation Matrix and Antenna Configuration				1x2 Low
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		Config 1,2	dBm/SCS	-101
SS-RSRP Note 3		Config 1,2	dBm/SCS	-84
$\hat{E}_s/I_{ot}$		Config 1,2	dB	17
$\hat{E}_s/N_{oc}$		Config 1,2	dB	17
Io Note3		Config 1,2	dBm/38.16 MHz	-59
Propagation Condition				AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].
NOTE 5: Parameters P_{CCA_DL}, $P_{CCA_DL_1}$, $P_{CCA_DL_2}$ and P_{CCA_UL} are defined in clause A.3.26.2.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.10.3.5.2.1.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell in the DL slot right after DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T1, the start time of PCell interruption during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start time of PCell interruption of during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS36.133 clause 7.32.2.7.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.10.3.5.2.2 E-UTRAN – NR PSCell FR1 DL active BWP switch with FR1 SCell in non-DRX in synchronous EN-DC

A.10.3.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6, and interruption requirements for NR victim cell defined in clause 8.2.1.2.7 and interruption requirement for E-UTRA victim cell defined in clause 7.32.2.7 of TS 36.133 [15]. Supported test configurations are shown in table A.10.3.5.2.2.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and one NR SCell (Cell 3) as given in table A.10.3.5.2.2.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and SCell are specified in table A.10.3.5.2.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) and SCell (Cell 3) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC) and Cell 3 (SCell) on radio channel 3 (SCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for SCell, BWP-0 in Cell 3 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.

- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in SCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}$).

PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

SCell(Cell 3) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j*, where j is the beginning slot of the DL subframe immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell at latest at the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}$).

PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

SCell(Cell 3) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell and NR SCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell and SCell during BWP switch of PSCell, respectively.

Table A.10.3.5.2.2.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: A UE which fulfils the requirements in test case A.10.3.5.2.2 can skip the test cases in A.10.3.5.2.1. NOTE 3: NR configuration is the same for PSCell and SCells. NOTE 4: The UE supporting EN-DC with only NR band(s) with shared spectrum access is required to be tested.	

Table A.10.3.5.2.2.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2, 3	Two NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.

Active PSCell		Cell 2	PSCell on RF channel number 2.
Active SCell		Cell 3	SCell on RF channel number 3.
CP length		Normal	
DRX		OFF	
DL CCA model		As specified in clause A.3.26.2.1	
UL CCA model		As specified in clause A.3.26.2.2	
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for cells on SCC.
Cell 2 timing offset to Cell 1	µs	3	Synchronous EN-DC
Cell 3 timing offset to Cell 2	µs	3	Synchronous cells
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.10.3.5.2.2.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter			Unit	Cell 2	Cell 3
Frequency Range				FR1	
Duplex mode		Config 1,2		TDD	
TDD configuration		Config 1,2		TDDConf.1.1 CCA	
$BW_{channel}$		Config 1,2		40 MHz: $N_{PRB,c}$ = 106	
Active BWP ID				1, 2	0
Initial BWP Configuration		Config 1,2		DLBWP.0.2	DLBWP.0.2
Active BWP-0 Configuration		Config 1,2		NA	DLBWP.0.2
Active BWP-1 Configuration		Config 1,2		DLBWP.1.3	NA
Active BWP-2 Configuration		Config 1,2		DLBWP.1.1	NA
PDSCH Reference measurement channel		Config 1,2		SR.1.1 CCA	
RMSI CORESET parameters		Config 1,2		CR.1.1 CCA	
Dedicated CORESET parameters		Config 1,2		CCR.1.1 CCA	
OCNG Patterns		Config 1,2		OP.1	
SSB Configuration	Semi- static channel acces	Config 1,2		SSB.1 CCA	
	Dymamic channel acces	Config 1,2		SSB.2 CCA	
SMTC Configuration		Config 1,2		SMTC.1	
TRS Configuration		Config 1,2		TRS.1.2 TDD	
DL CCA probability for semi-static channel access (P_{CCA_DL})		Config 1,2		1	1
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_1}$)		Config 1,2		1	1
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_2}$)		Config 1,2		1	1
DL CCA probability for semi-static channel access (P_{CCA_DL})		Config 1,2		1	1
Correlation Matrix and Antenna Configuration				1x2	
Propagation Condition				AWGN	
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note 2		Config 1,2	dBm/SCS kHz	-101	-101
SS-RSRP Note 3		Config 1,2	dBm/SCS kHz	-84	-84
$\hat{E}_s/I_{ot}$		Config 1,2	dB	17	17
$\hat{E}_s/N_{oc}$		Config 1,2	dB	17	17
Io Note3		Config 1,2	dBm/38.16 MHz	-59	-59

Parameter	Unit	Cell 2	Cell 3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			
NOTE 5: Parameters P_{CCA_DL}, $P_{CCA_DL_1}$, $P_{CCA_DL_2}$ and P_{CCA_UL} are defined in clause A.3.26.2.			
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.			

A.10.3.5.2.2.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell in the DL slot right after slot ($j+T_{BWPswitchDelay}+k11$).

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T1, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in clause 7.32.2.7 of TS 36.133 [15].

During T1, the start of the interruption of SCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of SCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.6.2.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

Editor's note: FFS value of k1 for type 1 and type 2 UE.

A.10.3.5.3 RRC-based Active BWP Switch

A.10.3.5.3.1 E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in synchronous EN-DC

A.10.3.5.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6.3. Supported test configurations are shown in table A.10.3.5.3.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1) and one NR PSCell (Cell 2) as given in table A.10.3.5.3.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell are specified in table A.10.3.5.3.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PSCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PSCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

> Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side in PSCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.
>
> The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$) as defined in clause 8.6.3 and be ready for the reception of uplink grant for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$).
>
> $T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in PSCell by counting the time from the time when the RRC Reconfiguration message including updated BWP configurationis sent till the time when RRC Reconfiguration Complete message is received.

Table A.10.3.5.3.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD, With CCA: NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: The UE supporting EN-DC with only NR band(s) with shared spectrum access is required to be tested.	

Table A.10.3.5.3.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	
DL CCA model		As specified in clause A.3.26.2.1	
UL CCA model		As specified in clause A.3.26.2.2	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell 2 timing offset to Cell 1	µs	3	Synchronous EN-DC

T1	s	0.2	

Table A.10.3.5.3.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter			Unit	Cell 2
Frequency Range				**FR1**
Duplex mode		Config 1,2		TDD
TDD configuration		Config 1,2		TDDConf.1.1 CCA
$BW_{channel}$		Config 1,2		40 MHz: $N_{PRB,c}$ = 106
Active DL BWP ID				1, 2
Initial DL BWP Configuration		Config 1,2		DLBWP.0.2
Initial UL BWP Configuration		Config 1,2		ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration	Config 1,2		DLBWP.1.3
Final Condition	Active DL BWP-1 Configuration	Config 1,2		DLBWP.1.1
Initial UL BWP Configuration		Config 1,2		ULBWP.0.2
Active UL BWP-1 Configuration		Config 1,2		ULBWP.1.3
Active UL BWP-2 Configuration		Config 1,2		ULBWP.1.1
PDSCH Reference measurement channel		Config 1,2		SR.1.1 CCA
RMSI CORESET parameters		Config 1,2		CR.1.1 CCA
Dedicated CORESET parameters		Config 1,2		CCR.1.1 CCA
OCNG Patterns		Config 1,2		OP.1
SSB Configuration	Semi- static channel acces	Config 1,2		SSB.1 CCA
	Dymamic channel acces	Config 1,2		SSB.2 CCA
SMTC Configuration		Config 1,2		SMTC.1
TRS Configuration		Config 1,2		TRS.1.2 TDD
DL CCA probability for semi-static channel access (P_{CCA_DL})		Config 1,2		1
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_1}$)		Config 1,2		1
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_2}$)		Config 1,2		1
DL CCA probability for semi-static channel access (P_{CCA_DL})		Config 1,2		1
Antenna Configuration				1x2
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		Config 1,2	dBm/SCS kHz	-101
SS-RSRP Note 3		Config 1,2	dBm/SCS kHz	-84
$\hat{E}_s/I_{ot}$		Config 1,2	dB	17
$\hat{E}_s/N_{oc}$		Config 1,2	dB	17
Io Note3		Config 1,2	dBm/38.16 MHz	-59

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].
NOTE 5: Parameters P_{CCA_DL}, $P_{CCA_DL_1}$, $P_{CCA_DL_2}$ and P_{CCA_UL} are defined in clause A.3.26.2.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.10.3.5.3.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PSCell in the beginning of the DL slot right after slot ($i+ T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$).

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.10.3.6 PSCell addition and release delay

A.10.3.6.1 Addition and Release Delay of known NR PSCell on the carrier under CCA

A.10.3.6.1.1 Test purpose and environment

The purpose of this test is to verify that the NR PSCell addition and release delays on the carrier under CCA under EN-DC are within the requirements stated in clause 7.31A.2 [15] for the case when the PSCell is known by the UE at the time of addition.

Supported test configurations are shown in A.10.3.6.1.1-1. The test parameters for the E-UTRA cell are given in table A.3.7.2.1-1. The E-UTRA cell once set up is not changed across time.

The test parameters for NR cell are given in tables A.10.3.6.1.1-2 and cell-specific parameters in A.10.3.6.1.1-3 below. The test consists of five successive time periods with duration of T1, T2, T3, T4 and T5 respectively. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell 1 is known to the UE.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event B1 is configured for neighbour cell (Cell 2). Before the start of T2 the UE is configured with the measurement gaps (gap pattern Id # 0). The Cell 2 becomes known to the UE during T2. Therefore, during T2 the UE shall report Event B1. The point in time at which the RRC message to release measurement gap is transmitted from the test system defines the start of period T3. During T3, after measurement gap is released, the test system transmits the RRC message to the UE to add PSCell on radio channel 2.

The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added. The point in time at which the RRC message to add PSCell (Cell 2) is received at the UE antenna connector defines the start of period T4.

The test system shall observe the periodic reporting of CSI for PSCell during T5. The point in time at which the UE has sent PRACH to the PSCell (Cell 2) defines the start of period T5.

The test system shall send a RRC message to the UE to release PSCell (Cell 2) on radio channel 2. The RRC message to release PSCell (Cell 2) shall be sent to the UE during period T5, after the UE has sent at least one CQI report with non-zero CQI index for PSCell (Cell 2). The point in time at which the RRC message to release PSCell (Cell 2) is received at the UE antenna connector defines the start of period T6.

Table A.10.3.6.1.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR SCS 30 kHz, BW 40 MHz, TDD
2	LTE TDD, NR SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.10.3.6.1.1-2: General Test Parameters for PSCell Addition and Release

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell on the carrier under CCA
Initial	Active PCell		Cell 1	PCell on RF channel number 1.

Parameter		Unit	Value	Comment
	Neighbour cell		Cell 2	Neighbour cell on RF channel number 2.
Final	Active PCell		Cell 1	PCell on RF channel number 1.
Condition	Neighbour Cell		Cell 2	PSCell released on RF channel number 2.
B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	Threshold RSRP	dBm	-93	Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin.
	Time to Trigger	s	0	
DRX			OFF	Continuous monitoring of primary cell
DL CCA model	Dynamic channel access Note 1, 3			As specified in clause A.3.20.2.1
	Semi-static channel access Note 2, 3			
UL CCA model	Dynamic channel access Note 1, 3			As specified in clause A.3.20.2.2
	Semi-static channel access Note 2,3			
Measurement gap pattern Id			0	Gaps are configured before T2 and released before T3.
PRACH configuration on Cell 2			FR1 PRACH configuration 2	Captured in A.3.8.2.1
CQI/PMI periodicity and offset configuration index on Cell 2			2 ms	CQI reporting for PSCell every uplink subframe
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on carrier frequency of Cell 2.
T304		ms	500	
L_{CCA_DL}			5	
T1		s	1	During this time the PCell shall be known and Cell 2 shall be unknown.
T2		s	≥ $T_{identify_irat_cca_without_index}$	$T_{identify_irat_cca_without_index}$ is defined in clause 8.1.2.4.21A and 8.1.2.4.22A in TS 36.133 During this time the UE shall identify neighbour cell (Cell 2) and report event B1.
T3		s	3	During this time the test system transmit the RRC messages to release measurement gap and add the PSCell
T4		s	≥ $T_{config_PSCell_withCCA}$	During this time the UE adds the PSCell. $T_{config_PSCell_withCCA}$ is defined in clause 7.31A.2
T5		s	0.5	During this time the UE sends CSI reports for PSCell.
T6		s	0.5	During this time the UE releases the PSCell.

NOTE 1: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 2: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

Table A.10.3.6.1.1-3: Cell Specific Parameters for PSCell Addition and Release

Parameter	Unit	Config	Test				
			T1	T2	T3	T4	T5
P_{CCA_DL} for dynamic channel access Note 5,7	-	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75				

Parameter	Unit	Config	Test				
			T1	T2	T3	T4	T5
P_{CCA_DL} for semi-static channel access Note 6,7	-	P_{CCA_DL}=0.9375	P_{CCA_DL}=0.9375				
P_{CCA_UL} for dynamic channel access Note 5,7	-	1	1				
P_{CCA_UL} for semi-static channel access Note 6,7	-	1	1				
E-UTRA RF Channel Number		1,2	1				
NR RF Channel Number		1,2	2				
TDD configuration		1,2	TDDConf.1.1 CCA				
$BW_{channel}$		1,2	40: $N_{PRB,c}$ = 106				
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1				
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1				
PDSCH Reference		1,2	SR1.1 CCA				
RMSI CORESET Reference		1,2	CR1.1 CCA				
Dedicated CORESET Reference		1,2	CCR1.1 CCA				
OCNG Patterns		1,2	OP.1				
DBT window configuration		1, 2	DBT.1				
SSB configuration for semi-static channel access		1, 2	SSB.1 CCA				
SSB configuration for dynamic channel access		1, 2	SSB.2 CCA				
SMTC configuration		1,2	SMTC.1				
TRS Configuration		1,2	TRS.1.2 TDD				
EPRE ratio of PSS to SSS	dB	1,2	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	dBm/15 kHz	1,2	N/A	-85			
N_{oc} Note2	dBm/SCS	1,2	N/A	-82			
$\hat{E}_s / I_{ot}$		1,2	-infinity	0			
$\hat{E}_s / N_{oc}$		1,2	-infinity	0			
SS-RSRP Note3	dBm/SCS	1,2	-infinity	-82			
Io Note3	dBm/38.1 MHz	1,2	N/A	-51			
Propagation condition		1,2	AWGN				

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in slots with RMC burst transmission and is not transmitted during muted slots or during DBT windows.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.

NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.

Parameter	Unit	Config	Test				
			T1	T2	T3	T4	T5
NOTE 7: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.							

A.10.3.6.1.2 Test Requirements

The UE shall transmit the PRACH to PSCell at latest $T_{config_PSCell_withCCA}$ [Note1] into T4.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T5.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T5

The UE shall stop sending CSI reports for PSCell in at latest 20 ms into T6.

All the above test requirements shall be fulfilled in order for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90 %.

NOTE 1: The PSCell addition delay can be expressed as follows as specified in clause 7.31A.2 [15]:

$$T_{config_PSCell_withCCA} = T_{RRC_delay} + T_{processing} + T_{search_withCCA} + T_{\Delta_withCCA} + T_{PSCell_DU_withCCA} + 2 \text{ ms}$$

Where:

T_{RRC_delay} = 20 ms

$T_{processing}$ = 20 ms

$T_{search_withCCA}$ = 0

$T_{\Delta_withCCA}$ = (1+ L_2)*20 ms

$T_{PSCell_DU_withCCA}$ = 20 ms.

L_2 is the number of SMTC occasions not available at the UE for fine time tracking and acquiring full timing information, where $L_2 \leq L_{CCA_DL}$.

A.10.3.7 Void

A.10.4 Measurement procedure

A.10.4.1 Intra-frequency measurements

A.10.4.1.1 Event-triggered reporting tests on PSCC without gaps under non-DRX

A.10.4.1.1.1 Test purpose and environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2A.5.1 and 9.2A.5.2.

A.10.4.1.1.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and two cells on the same carrier frequency with CCA transmitting SSBs in DBT windows according to DL CCA model: PSCell (Cell 2) and a neighbour cell (Cell 3). The test parameters for the three cells are given in table A.10.4.1.1.2-1 and A.10.4.1.1.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time

periods, with time duration of T1 and T2, respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

Table A.10.4.1.1.2-1: Supported test configurations

Configuration	Description
1	LTE FDD; NR: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD; NR: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.10.4.1.1.2-2: General test parameters for intra-frequency event triggered reporting without gaps

Parameter	Unit	Test Configuration	Value	Comment
E-UTRA RF Channel Number		Config 1,2	1	
NR RF Channel Number		Config 1,2	1, 2	
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 with CCA (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 2 with CCA.
Neighbour cell		Config 1,2	NR cell 3	NR cell 3 is on NR RF channel number 2 with CCA.
DL CCA model		Config 1,2	As specified in clause A.3.26.2.1	
UL CCA model		Config 1,2	As specified in clause A.3.26.2.2	
A3-Offset	dB	Config 1,2	-6	
Hysteresis	dB	Config 1,2	0	
CP length		Config 1,2	Normal	
TimeToTrigger	s	Config 1,2	0	
Filter coefficient		Config 1,2	0	L3 filtering is not used
DRX		Config 1,2	OFF	DRX is not used
Time offset between PCell and PSCell		Config 1,2	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3 μs	Synchronous cells.
T1	s	Config 1,2	5	
T2	s	Config 1,2	5	

Table A.10.4.1.1.2-3: Cell-specific test parameters for intra-frequency event-triggered reporting without gaps

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2	2		2	
Duplex mode		Config 1,2	TDD			
$BW_{channel}$	MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
BWP BW	MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
TDD configuration		Config 1,2	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
TRS configuration		Config 1,2	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,2	SR.1.1 CCA		-	
CORESET Reference Channel		Config 1,2	CR.1.1 CCA		-	

Parameter		Unit	Test configuration	Cell 2		Cell 3	
				T1	T2	T1	T2
SSB parameters	Semi-static channel access Note 5,7		Config 1,2	SSB.1 CCA		SSB.1 CCA	
	Dynamic channel access Note 6,7		Config 1,2	SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2	As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration			Config 1,2	SMTC.1		SMTC.4	
PDSCH/PDCCH		kHz	Config 1,2	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2	12		12	
W_{CCA_DL}		ms	Config 1,2	$T_{PSS/SSS_sync_intra_cca}$		$T_{PSS/SSS_sync_intra_cca}$	
EPRE ratio of PSS to SSS			Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$		dB	Config 1,2	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$		dB	Config 1,2	4	4	-Infinity	7
Io Note3		dBm/38.16 MHz	Config 1,2	-58.49	-54.64	-58.49	-54.64
Propagation Condition			Config 1,2	AWGN			

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.						
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.						
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.						

A.10.4.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_intra_without_index_CCA}$ ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

$T_{identify_intra_cca_without_index} = (T_{PSS/SSS_sync_intra_cca} + T_{SSB_measurement_period_intra_cca})$ ms, where

$T_{PSS/SSS_sync_intra_cca}$: it is the time period used in PSS/SSS detection given in table 9.2A.5.1-1.

$T_{SSB_measurement_period_intra_cca}$: equal to a measurement period of SSB based measurement given in table 9.2A.5.2-1.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.1.2 Void

A.10.4.1.3 Void

A.10.4.1.4 Event-triggered reporting tests on PSCC with per-UE gaps under DRX

A.10.4.1.4.1 Test purpose and environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2A.6.1 and 9.2A.6.2.

A.10.4.1.4.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and two cells on the same carrier frequency with CCA transmitting SSBs in DBT windows according to DL CCA model: PSCell (Cell 2) and a neighbour cell (Cell 3). The test parameters for the three cells are given in table A.10.4.1.4.2-1, A.10.4.1.4.2-2 and A.10.4.1.4.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.10.4.1.4.2-1: Supported test configurations

Configuration	Description
1	LTE FDD; NR: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD; NR: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.10.4.1.4.2-2: General test parameters for intra-frequency event triggered reporting with per-UE gaps

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		Config 1,2	1	
NR RF Channel Number		Config 1,2	1, 2	
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 with CCA (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 2 with CCA.
Neighbour cell		Config 1,2	NR cell 3	NR cell 3 is on NR RF channel number 2 with CCA.
DL CCA model		Config 1,2	As specified in clause A.3.26.2.1	
UL CCA model		Config 1,2	As specified in clause A.3.26.2.2	
Measurement gap type		Config 1,2	Per-UE gaps	
Measurement gap repitition periodicity	ms	Config 1,2	40	
Measurement gap length	ms	Config 1,2	6	
Measurement gap offset	ms	Config 1,2	39	
A3-Offset	dB	Config 1,2	-6	
Hysteresis	dB	Config 1,2	0	
CP length		Config 1,2	Normal	
TimeToTrigger	s	Config 1,2	0	
Filter coefficient		Config 1,2	0	L3 filtering is not used
DRX		Config 1,2	DRX.1	
Time offset between PCell and PSCell		Config 1,2	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3 μs	Synchronous cells.
T1	s	Config 1,2	5	
T2	s	Config 1,2	5	

Table A.10.4.1.1.2-3: Cell-specific test parameters for intra-frequency event-triggered reporting without gaps

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2	2		2	
Duplex mode		Config 1,2	TDD			
$BW_{channel}$	MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
BWP BW	MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
TDD configuration		Config 1,2	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	

Parameter		Unit	Test configuration	Cell 2		Cell 3	
				T1	T2	T1	T2
Dedicated UL BWP			Config 1,2	ULBWP.1.1		NA	
TRS configuration			Config 1,2	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2	SR.1.1 CCA		-	
CORESET Reference Channel			Config 1,2	CR.1.1 CCA		-	
SSB parameters	Semi-static channel access Note 5,7		Config 1,2	SSB.1 CCA		SSB.1 CCA	
	Dynamic channel access Note 6,7		Config 1,2	SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2	As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration			Config 1,2	SMTC.1		SMTC.4	
PDSCH/PDCCH		kHz	Config 1,2	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2	12		12	
W_{CCA_DL}		ms	Config 1,2	$T_{PSS/SSS_sync_intra_cca}$		$T_{PSS/SSS_sync_intra_cca}$	
EPRE ratio of PSS to SSS			Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$		dB	Config 1,2	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$		dB	Config 1,2	4	4	-Infinity	7
Io Note3		dBm/38.16 MHz	Config 1,2	-58.49	-54.64	-58.49	-54.64
Propagation Condition			Config 1,2	AWGN			

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.						

A.10.4.1.4.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_intra_without_index_CCA}$ ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

$T_{identify_intra_cca_without_index} = (T_{PSS/SSS_sync_intra_cca} + T_{SSB_measurement_period_intra_cca})$ ms, where

$T_{PSS/SSS_sync_intra_cca}$: it is the time period used in PSS/SSS detection given in table 9.2A.6.1-1.

$T_{SSB_measurement_period_intra_cca}$: equal to a measurement period of SSB based measurement given in table 9.2A.6.2-1.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.1.5 Void

A.10.4.1.6 Void

A.10.4.1.7 Void

A.10.4.1.8 Void

A.10.4.1.9 Void

A.10.4.1.10 Void

A.10.4.1.11 Void

A.10.4.1.12 Void

A.10.4.2 Inter-frequency measurements

A.10.4.2.1 Void

A.10.4.2.2 Void

A.10.4.2.3 EN-DC event triggered reporting tests for FR1 with CCA cell without SSB time index detection when DRX is not used

A.10.4.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 with CCA on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters and configurations are given in tables A.10.4.2.3.1-1, A.10.4.2.3.1-2, and A.10.4.2.3.1-3.

In this test measurement gap pattern configuration # 0 as defined in table A.10.4.2.3.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.10.4.2.3.1-1.

Table A.10.4.2.3.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	E-UTRAN cell: LTE FDD NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	E-UTRAN cell: LTE TDD NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.10.4.2.3.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		Config 1,2	1	One E-UTRAN carrier frequency is used.
NR RF Channel Number		Config 1,2	1, 2	Two FR1 NR carrier frequencies are used. Channels 1 and 2 are with CCA.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 with CCA (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 with CCA is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3	NR cell 3 is on NR RF channel number 2 with CCA.
DL CCA model		Config 1,2	As specified in clause A.3.26.2.1	
UL CCA model		Config 1,2	As specified in clause A.3.26.2.2	
Gap Pattern Id		Config 1,2	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	9	
A3-Offset	dB	Config 1,2	-6	
Hysteresis	dB	Config 1,2	0	
CP length		Config 1,2	Normal	
TimeToTrigger	s	Config 1,2	0	
Filter coefficient		Config 1,2	0	L3 filtering is not used
DRX		Config 1,2	OFF	DRX is not used
Time offset between PCell and PSCell		Config 1,2	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3 μs	Synchronous cells.

Parameter	Unit	Test configuration	Value	Comment
T1	s	Config 1,2	5	
T2	s	Config 1,2	1.7	

Table A.10.4.2.3.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter		Unit	Test configuration	Cell 2		Cell 3	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2	1		2	
Duplex mode			Config 1,2	TDD			
$BW_{channel}$		MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
TDD configuration			Config 1,2	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
Initial DL BWP			Config 1,2	DLBWP.0.1		NA	
Initial UL BWP			Config 1,2	ULBWP.0.1		NA	
Dedicated DL BWP			Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP			Config 1,2	ULBWP.1.1		NA	
TRS configuration			Config 1,2	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2	SR.1.1 CCA		-	
CORESET Reference Channel			Config 1,2	CR.1.1 CCA		-	
SSB parameters	Semi-static channel access Note 5,7		Config 1,2	SSB.1 CCA		SSB.1 CCA	
	Dynamic channel access Note 6,7		Config 1,2	SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2	As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration			Config 1,2	SMTC.1		SMTC.4	
PDSCH/PDCCH		kHz	Config 1,2	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2	12		12	
W_{CCA_DL}		ms	Config 1,2	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
EPRE ratio of PSS to SSS			Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	Config 1,2	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$	dB	Config 1,2	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$	dB	Config 1,2	4	4	-Infinity	7
Io Note3	dBm/38.16 MHz	Config 1,2	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

A.10.4.2.3.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is not required to report SSB time index.

$T_{identify_inter_cca_without_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.2.4 EN-DC event triggered reporting tests for FR1 cell with CCA without SSB time index detection when DRX is used

A.10.4.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 with CCA on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters and configurations are given in tables A.10.4.2.4.1-1, A.10.4.2.4.1-2, and A.10.4.2.4.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.10.4.2.4.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.10.4.2.4.1-1.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.10.4.2.4.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	E-UTRAN cell: LTE FDD NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	E-UTRAN cell: LTE TDD NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.10.4.2.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2	1		One E-UTRAN carrier frequency is used.
NR RF Channel Number		Config 1,2	1, 2		Two FR1 NR carrier frequencies are used. Channels 1 and 2 are with CCA.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 with CCA (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 with CCA is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3		NR cell 3 is on NR RF channel number 2 with CCA.
DL CCA model		Config 1,2	As specified in clause A.3.26.2.1		
UL CCA model		Config 1,2	As specified in clause A.3.26.2.2		
Gap Pattern Id		Config 1,2	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	9		
A3-Offset	dB	Config 1,2	-6		
Hysteresis	dB	Config 1,2	0		
CP length		Config 1,2	Normal		
TimeToTrigger	s	Config 1,2	0		
Filter coefficient		Config 1,2	0		L3 filtering is not used
DRX		Config 1,2	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3 μs		Synchronous cells.
T1	s	Config 1,2	5		
T2	s	Config 1,2	2.5	17	

Table A.10.4.2.4.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter		Unit	Test configuration	Cell 2		Cell 3	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2	1		2	
Duplex mode			Config 1,2	TDD			
$BW_{channel}$		MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
TDD configuration			Config 1,2	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
Initial DL BWP			Config 1,2	DLBWP.0.1		NA	
Initial UL BWP			Config 1,2	ULBWP.0.1		NA	
Dedicated DL BWP			Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP			Config 1,2	ULBWP.1.1		NA	
TRS configuration			Config 1,2	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2	OP.1		OP.1	
PDSCH Reference			Config 1,2	SR.1.1 CCA		-	
CORESET Reference Channel			Config 1,2	CR.1.1 CCA		-	
SSB parameters	Semi-static channel access Note 5,7		Config 1,2	SSB.1 CCA		SSB.1 CCA	
	Dynamic channel access Note 6,7		Config 1,2	SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2	As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration			Config 1,2	SMTC.1		SMTC.4	
PDSCH/PDCCH		kHz	Config 1,2	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2	5		5	
W_{CCA_DL}		ms	Config 1,2	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
EPRE ratio of PSS to SSS			Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$		dB	Config 1,2	4	4	-Infinity	7

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
$\hat{E}_s / N_{oc}$	dB	Config 1,2	4	4	-Infinity	7
Io[Note3]	dBm/38.16 MHz	Config 1,2	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2	AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.						

Table A.10.4.2.4.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test1&3	Test2&4	Comment
	Value	Value	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.10.4.2.4.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.10.4.2.4.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2, the UE is not required to report SSB time index.

$T_{identify_inter_cca_without_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

For test 1, DRX cycle = 40 ms and for test 2, DRX cycle = 640 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.2.5 EN-DC event triggered reporting tests for FR1 cell with CCA with SSB time index detection when DRX is not used

A.10.4.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 with CCA on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters and configurations are given in tables A.10.4.2.5.1-1, A.10.4.2.5.1-2, and A.10.4.2.5.1-3.

In this test, measurement gap pattern configuration # 0 as defined in table A.10.4.2.5.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.10.4.2.5.1-1.

Table A.10.4.2.5.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	E-UTRAN cell: LTE FDD NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	E-UTRAN cell: LTE TDD NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.10.4.2.5.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test Configuration	Value	Comment
E-UTRA RF Channel Number		Config 1,2	1	One E-UTRAN carrier frequency is used.
NR RF Channel Number		Config 1,2	1, 2	Two FR1 NR carrier frequencies are used. Channels 1 and 2 are with CCA.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 with CCA (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 with CCA is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3	NR cell 3 is on NR RF channel number 2 with CCA.
DL CCA model		Config 1,2	As specified in clause A.3.26.2.1	
UL CCA model		Config 1,2	As specified in clause A.3.26.2.2	
Gap Pattern Id		Config 1,2	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	9	
A3-Offset	dB	Config 1,2	-6	
Hysteresis	dB	Config 1,2	0	
CP length		Config 1,2	Normal	

TimeToTrigger	s	Config 1,2	0	
Filter coefficient		Config 1,2	0	L3 filtering is not used
DRX		Config 1,2	OFF	DRX is not used
Time offset between PCell and PSCell		Config 1,2	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3 μs	Synchronous cells.
T1	s	Config 1,2	5	
T2	s	Config 1,2	2	

Table A.10.4.2.5.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter		Unit	Test configuration	Cell 2		Cell 3	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2	1		2	
Duplex mode			Config 1,2	TDD			
$BW_{channel}$		MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
TDD configuration			Config 1,2	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
Initial DL BWP			Config 1,2	DLBWP.0.1		NA	
Initial UL BWP			Config 1,2	ULBWP.0.1		NA	
Dedicated DL BWP			Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP			Config 1,2	ULBWP.1.1		NA	
TRS configuration			Config 1,2	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2	OP.1		OP.1	
PDSCH Reference			Config 1,2	SR.1.1 CCA		-	
CORESET Reference Channel			Config 1,2	CR.1.1 CCA		-	
SSB parameters	Semi-static channel access Note 5,7		Config 1,2	SSB.1 CCA		SSB.1 CCA	
	Dynamic channel access Note 6,7		Config 1,2	SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2	As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration			Config 1,2	SMTC.1		SMTC.4	
PDSCH/PDCCH		kHz	Config 1,2	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2	5		5	
W_{CCA_DL}		ms	Config 1,2	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
EPRE ratio of PSS to SSS			Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	Config 1,2	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$	dB	Config 1,2	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$	dB	Config 1,2	4	4	-Infinity	7
Io Note3	dBm/38.16 MHz	Config 1,2	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

A.10.4.2.5.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1, the UE is required to report SSB time index.

$T_{identify_inter_cca_with_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca} + T_{SSB_time_index_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_time_index_inter_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.2.6 EN-DC event triggered reporting tests for FR1 cell with CCA with SSB time index detection when DRX is used

A.10.4.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 with CCA on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters and configurations are given in tables A.10.4.2.6.1-1, A.10.4.2.6.1-2, and A.10.4.2.6.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.10.4.2.6.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.10.4.2.6.1-1.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.10.4.2.6.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	E-UTRAN cell: LTE FDD NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	E-UTRAN cell: LTE TDD NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.10.4.2.6.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2	1		One E-UTRAN carrier frequency is used.
NR RF Channel Number		Config 1,2	1, 2		Two FR1 NR carrier frequencies are used. Channels 1 and 2 are with CCA.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 with CCA (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 with CCA is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3		NR cell 3 is on NR RF channel number 2 with CCA.
DL CCA model		Config 1,2	As specified in clause A.3.26.2.1		
UL CCA model		Config 1,2	As specified in clause A.3.26.2.2		
Gap Pattern Id		Config 1,2	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	9		
A3-Offset	dB	Config 1,2	-6		
Hysteresis	dB	Config 1,2	0		
CP length		Config 1,2	Normal		
TimeToTrigger	s	Config 1,2	0		
Filter coefficient		Config 1,2	0		L3 filtering is not used
DRX		Config 1,2	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3 μs		Synchronous cells.

T1	s	Config 1,2	5		
T2	s	Config 1,2	3	20	

Table A.10.4.2.6.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter		Unit	Test configuration	Cell 2		Cell 3	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2	1		2	
Duplex mode			Config 1,2	TDD			
$BW_{channel}$		MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	40: $N_{PRB,c}$ = 106			
TDD configuration			Config 1,2	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
Initial DL BWP			Config 1,2	DLBWP.0.1		NA	
Initial UL BWP			Config 1,2	ULBWP.0.1		NA	
Dedicated DL BWP			Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP			Config 1,2	ULBWP.1.1		NA	
TRS configuration			Config 1,2	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2	OP.1		OP.1	
PDSCH Reference			Config 1,2	SR.1.1 CCA		-	
CORESET Reference Channel			Config 1,2	CR.1.1 CCA		-	
SSB parameters	Semi-static channel access Note 5,7		Config 1,2	SSB.1 CCA		SSB.1 CCA	
	Dynamic channel access Note 6,7		Config 1,2	SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2	As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration			Config 1,2	SMTC.1		SMTC.4	
PDSCH/PDCCH		kHz	Config 1,2	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2	P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2	2		2	
W_{CCA_DL}		ms	Config 1,2	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
EPRE ratio of PSS to SSS			Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2	-98		-98	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
N_{oc} Note2	dBm/SCS	Config 1,2	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$	dB	Config 1,2	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$	dB	Config 1,2	4	4	-Infinity	7
Io Note3	dBm/38.16 MHz	Config 1,2	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

Table A.10.4.2.6.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test1 Value	Test2 Value	Comment
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.10.4.2.6.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.10.4.2.6.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_}$from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_}$from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2, the UE is required to report SSB time index.

$T_{identify_inter_cca_with_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca} + T_{SSB_time_index_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_time_index_inter_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

For test 1, DRX cycle = 40 ms and for test 2, DRX cycle = 640 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.2.7 EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is not used

A.10.4.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 with CCA on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in tables A.10.4.2.7.1-1, A.10.4.2.7.1-2, and A.10.4.2.7.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in table A.10.4.2.7.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.10.4.2.7.1-1.

Table A.10.4.2.7.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	E-UTRAN cell: LTE FDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	E-UTRAN cell: LTE FDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	E-UTRAN cell: LTE FDD NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	E-UTRAN cell: LTE TDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
5	E-UTRAN cell: LTE TDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
6	E-UTRAN cell: LTE TDD NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.10.4.2.7.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1	One E-UTRAN carrier frequency is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2	Two FR1 NR carrier frequencies are used. NR RF channel 1 is with CCA.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3	NR cell 3 is on NR RF channel number 2.
DL CCA model		Config 1,2,3,4,5,6	As specified in clause A.3.26.2.1	
UL CCA model		Config 1,2,3,4,5,6	As specified in clause A.3.26.2.2	
Gap Pattern Id		Config 1,2,3,4,5,6	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9	
A3-Offset	dB	Config 1,2,3,4,5,6	-6	
Hysteresis	dB	Config 1,2,3,4,5,6	0	
CP length		Config 1,2,3,4,5,6	Normal	
TimeToTrigger	s	Config 1,2,3,4,5,6	0	
Filter coefficient		Config 1,2,3,4,5,6	0	L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF	DRX is not used
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2,3,4,5,6	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 1,2,3,4,5,6	3 μs	Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5	
T2	s	Config 1,2,3,4,5,6	1.7	

Table A.10.4.2.7.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	TDD		FDD	
		Config 2,3,5,6	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2,4,5	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
		Config 3,6	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW	MHz	Config 1,2,4,5	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
		Config 3,6	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
TDD configuration		Config 1,4	TDDConf.1.1 CCA		NA	
		Config 2,5	TDDConf.1.1 CCA		TDDConf.1.1	
		Config 3,6	TDDConf.1.1 CCA		TDDConf.2.1	

Parameter		Unit	Test configuration	Cell 2		Cell 3	
				T1	T2	T1	T2
Initial DL BWP			Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP			Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP			Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP			Config 1,2,3,4,5,6	ULBWP.1.1		NA	
TRS configuration			Config 1,2,3,4,5,6	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 CCA		SR.1.1 FDD	
			Config 2,5	SR.1.1 CCA		SR.1.1 TDD	
			Config 3,6	SR.1.1 CCA		SR.2.1 TDD	
CORESET Reference Channel			Config 1,4	CR.1.1 CCA		CR.1.1 FDD	
			Config 2,5	CR.1.1 CCA		CR.1.1 TDD	
			Config 3,6	CR.1.1 CCA		CR.2.1 TDD	
SSB parameters	Semi-static channel access Note 5,7		Config 1,4	SSB.1 CCA		SSB.1 FR1	
			Config 2,5	SSB.1 CCA		SSB.1 FR1	
			Config 3,6	SSB.1 CCA		SSB.2 FR1	
	Dynamic channel access Note 6,7		Config 1,4	SSB.2 CCA		SSB.1 FR1	
			Config 2,5	SSB.2 CCA		SSB.1 FR1	
			Config 3,6	SSB.2 CCA		SSB.2 FR1	
DBT window configuration			Config 1,2,3,4,5,6	As defined in A.3.28.1		Not applicable	
SMTC configuration defined in A.3.11			Config 1,4	SMTC.2		SMTC.5	
			Config 2,3,5,6	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,4,5	30		15	
			Config 3,6	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3,4,5,6	P_{CCA_DL}=0.9375		Not applicable	
	Dynamic channel access Note 6,7		Config 1,2,3,4,5,6	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		Not applicable	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3,4,5,6	P_{CCA_UL}=1		Not applicable	
	Dynamic channel access Note 6,7		Config 1,2,3,4,5,6	P_{CCA_UL}=1		Not applicable	
L_{CCA_DL}			Config 1,2,3,4,5,6	12		12	
W_{CCA_DL}		ms	Config 1,2,3,4,5,6	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
EPRE ratio of PSS to SSS			Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
N_{oc} Note2	dBm/15 kHz	Config 1,2,3,4,5,6	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98		-95	
		Config 3,6	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-88
		Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	NR Config 1,2,4,5	-64.59	-64.59	-63.94	-56.15
	dBm/38.16 MHz	NR Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3,4,5,6	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

A.10.4.2.7.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is not required to report SSB time index.

$T_{identify_inter_cca_without_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.2.8 EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is used

A.10.4.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in tables A.10.4.2.8.1-1, A.10.4.2.8.1-2, and A.10.4.2.8.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.10.4.2.8.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.10.4.2.8.1-1.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.10.4.2.8.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	E-UTRAN cell: LTE FDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	E-UTRAN cell: LTE FDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	E-UTRAN cell: LTE FDD NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	E-UTRAN cell: LTE TDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
5	E-UTRAN cell: LTE TDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mod
6	E-UTRAN cell: LTE TDD NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.10.4.2.8.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN carrier frequency is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		Two FR1 NR carrier frequencies are used. NR RF channel 1 is with CCA.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3		NR cell 3 is on NR RF channel number 2.
DL CCA model		Config 1,2,3,4,5,6	As specified in clause A.3.26.2.1		
UL CCA model		Config 1,2,3,4,5,6	As specified in clause A.3.26.2.2		
Gap Pattern Id		Config 1,2,3,4,5,6	0		As specified in clause 9.1.2-1.

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Measurement gap offset		Config 1,2,3,4,5,6	9		
A3-Offset	dB	Config 1,2,3,4,5,6	-6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2,3,4,5,6	3 ms		Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 1,2,3,4,5,6	3 μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	2.5	17	

Table A.10.4.2.8.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	TDD		FDD	
		Config 2,3,5,6	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2,4,5	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
		Config 3,6	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW	MHz	Config 1,2,4,5	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
		Config 3,6	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
TDD configuration		Config 1,4	TDDConf.1.1 CCA		NA	
		Config 2,5	TDDConf.1.1 CCA		TDDConf.1.1	
		Config 3,6	TDDConf.1.1 CCA		TDDConf.2.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
TRS configuration		Config 1,2,3,4,5,6	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 CCA		SR.1.1 FDD	
		Config 2,5	SR.1.1 CCA		SR.1.1 TDD	
		Config 3,6	SR.1.1 CCA		SR.2.1 TDD	
CORESET Reference Channel		Config 1,4	CR.1.1 CCA		CR.1.1 FDD	
		Config 2,5	CR.1.1 CCA		CR.1.1 TDD	
		Config 3,6	CR.1.1 CCA		CR.2.1 TDD	
SSB parameters		Config 1,4	SSB.1 CCA		SSB.1 FR1	
		Config 2,5	SSB.1 CCA		SSB.1 FR1	

Parameter		Unit	Test configuration	Cell 2		Cell 3	
				T1	T2	T1	T2
	Semi-static channel access Note 5,7 Semi-static channel access Note 5,7		Config 3,6	SSB.1 CCA		SSB.2 FR1	
	Dynamic channel access Note 6,7		Config 1,4	SSB.2 CCA		SSB.1 FR1	
			Config 2,5	SSB.2 CCA		SSB.1 FR1	
			Config 3,6	SSB.2 CCA		SSB.2 FR1	
DBT window configuration			Config 1,2,3,4,5,6	As defined in A.3.28.1		Not applicable	
SMTC configuration defined in A.3.11			Config 1,4	SMTC.2		SMTC.5	
			Config 2,3,5,6	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,4,5	30		15	
			Config 3,6	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3,4,5,6	P_{CCA_DL}=0.9375		Not applicable	
	Dynamic channel access Note 6,7		Config 1,2,3,4,5,6	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		Not applicable	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3,4,5,6	P_{CCA_UL}=1		Not applicable	
	Dynamic channel access Note 6,7		Config 1,2,3,4,5,6	P_{CCA_UL}=1		Not applicable	
L_{CCA_DL}			Config 1,2,3,4,5,6	5		5	
W_{CCA_DL}		ms	Config 1,2,3,4,5,6	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
EPRE ratio of PSS to SSS			Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2,3,4,5,6	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2,4,5	-98		-95	
			Config 3,6	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-88
			Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$		dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$		dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	NR Config 1,2,4,5	-64.59	-64.59	-63.94	-56.15
		dBm/38.16 MHz	NR Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1,2,3,4,5,6	AWGN			

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.						

Table A.10.4.2.8.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test 1 Value	Test 2 Value	Comment
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.10.4.2.8.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.10.4.2.8.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2, the UE is not required to report SSB time index.

$T_{identify_inter_cca_without_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

For test 1, DRX cycle = 40 ms and for test 2, DRX cycle = 640 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.2.9 EN-DC event triggered reporting tests for FR1 cell with SSB time index detection when DRX is not used

A.10.4.2.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in tables A.10.4.2.9.1-1, A.10.4.2.9.1-2, and A.10.4.2.9.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in table A.10.4.2.9.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.10.4.2.9.1-1.

Table A.10.4.2.9.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	E-UTRAN cell: LTE FDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	E-UTRAN cell: LTE FDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	E-UTRAN cell: LTE FDD NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	E-UTRAN cell: LTE TDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
5	E-UTRAN cell: LTE TDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mod
6	E-UTRAN cell: LTE TDD NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.10.4.2.9.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1	One E-UTRAN carrier frequency is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2	Two FR1 NR carrier frequencies are used. NR RF channel 1 is with CCA.

Parameter	Unit	Test configuration	Value	Comment
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)	LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3	NR cell 3 is on NR RF channel number 2.
DL CCA model		Config 1,2,3,4,5,6	As specified in clause A.3.26.2.1	
UL CCA model		Config 1,2,3,4,5,6	As specified in clause A.3.26.2.2	
Gap Pattern Id		Config 1,2,3,4,5,6	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9	
A3-Offset	dB	Config 1,2,3,4,5,6	-6	
Hysteresis	dB	Config 1,2,3,4,5,6	0	
CP length		Config 1,2,3,4,5,6	Normal	
TimeToTrigger	s	Config 1,2,3,4,5,6	0	
Filter coefficient		Config 1,2,3,4,5,6	0	L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF	DRX is not used
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2,3,4,5,6	3 ms	Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 1,2,3,4,5,6	3 μs	Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5	
T2	s	Config 1,2,3,4,5,6	2	

Table A.10.4.2.9.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	TDD		FDD	
		Config 2,3,5,6	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2,4,5	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
		Config 3,6	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW	MHz	Config 1,2,4,5	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
		Config 3,6	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
TDD configuration		Config 1,4	TDDConf.1.1 CCA		NA	
		Config 2,5	TDDConf.1.1 CCA		TDDConf.1.1	
		Config 3,6	TDDConf.1.1 CCA		TDDConf.2.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	

Parameter		Unit	Test configuration	Cell 2		Cell 3	
				T1	T2	T1	T2
TRS configuration			Config 1,2,3,4,5,6	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 CCA		SR.1.1 FDD	
			Config 2,5	SR.1.1 CCA		SR.1.1 TDD	
			Config 3,6	SR.1.1 CCA		SR.2.1 TDD	
CORESET Reference Channel			Config 1,4	CR.1.1 CCA		CR.1.1 FDD	
			Config 2,5	CR.1.1 CCA		CR.1.1 TDD	
			Config 3,6	CR.1.1 CCA		CR.2.1 TDD	
SSB parameters	Semi-static channel access Note 5,7		Config 1,4	SSB.1 CCA		SSB.1 FR1	
			Config 2,5	SSB.1 CCA		SSB.1 FR1	
			Config 3,6	SSB.1 CCA		SSB.2 FR1	
	Dynamic channel access Note 6,7		Config 1,4	SSB.2 CCA		SSB.1 FR1	
			Config 2,5	SSB.2 CCA		SSB.1 FR1	
			Config 3,6	SSB.2 CCA		SSB.2 FR1	
DBT window configuration			Config 1,2,3,4,5,6	As defined in A.3.28.1		Not applicable	
SMTC configuration defined in A.3.11			Config 1,4	SMTC.2		SMTC.5	
			Config 2,3,5,6	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,4,5	30		15	
			Config 3,6	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3,4,5,6	P_{CCA_DL}=0.9375		Not applicable	
	Dynamic channel access Note 6,7		Config 1,2,3,4,5,6	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		Not applicable	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3,4,5,6	P_{CCA_UL}=1		Not applicable	
	Dynamic channel access Note 6,7		Config 1,2,3,4,5,6	P_{CCA_UL}=1		Not applicable	
L_{CCA_DL}			Config 1,2,3,4,5,6	5		5	
W_{CCA_DL}		ms	Config 1,2,3,4,5,6	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
EPRE ratio of PSS to SSS			Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2,3,4,5,6	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2,4,5	-98		-95	
			Config 3,6	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-88
			Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3,4,5,6	4	4	-Infinity	7

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
$\hat{E}_s / N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io[Note3]	dBm/9.36 MHz	NR Config 1,2,4,5	-64.59	-64.59	-63.94	-56.15
	dBm/38.16 MHz	NR Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3,4,5,6	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

A.10.4.2.9.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is required to report SSB time index.

$T_{identify_inter_cca_with_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca} + T_{SSB_time_index_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_time_index_inter_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.2.10 EN-DC event triggered reporting tests for FR1 cell with SSB time index detection when DRX is used

A.10.4.2.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in tables A.10.4.2.10.1-1, A.10.4.2.10.1-2, and A.10.4.2.10.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.10.4.2.10.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.10.4.2.10.1-1.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.10.4.2.10.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	E-UTRAN cell: LTE FDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	E-UTRAN cell: LTE FDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	E-UTRAN cell: LTE FDD NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	E-UTRAN cell: LTE TDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
5	E-UTRAN cell: LTE TDD NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mod
6	E-UTRAN cell: LTE TDD NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.10.4.2.10.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN carrier frequency is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		Two FR1 NR carrier frequencies are used. NR RF channel 1 is with CCA.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3		NR cell 3 is on NR RF channel number 2.
DL CCA model		Config 1,2,3,4,5,6	As specified in clause A.3.26.2.1		
UL CCA model		Config 1,2,3,4,5,6	As specified in clause A.3.26.2.2		
Gap Pattern Id		Config 1,2,3,4,5,6	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9		
A3-Offset	dB	Config 1,2,3,4,5,6	-6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2,3,4,5,6	3 ms		Asynchronous cells. The timing of Cell 3 is 3 ms later than the timing of Cell 2.
		Config 1,2,3,4,5,6	3 μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	3	20	

Table A.10.4.2.10.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter		Unit	Test configuration	Cell 2		Cell 3	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3,4,5,6	1		2	
Duplex mode			Config 1,4	TDD		FDD	
			Config 2,3,5,6	TDD		TDD	
$BW_{channel}$		MHz	Config 1,2,4,5	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
			Config 3,6	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2,4,5	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
			Config 3,6	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
TDD configuration			Config 1,4	TDDConf.1.1 CCA		NA	
			Config 2,5	TDDConf.1.1 CCA		TDDConf.1.1	
			Config 3,6	TDDConf.1.1 CCA		TDDConf.2.1	
Initial DL BWP			Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP			Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP			Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP			Config 1,2,3,4,5,6	ULBWP.1.1		NA	
TRS configuration			Config 1,2,3,4,5,6	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 CCA		SR.1.1 FDD	
			Config 2,5	SR.1.1 CCA		SR.1.1 TDD	
			Config 3,6	SR.1.1 CCA		SR.2.1 TDD	
CORESET Reference Channel			Config 1,4	CR.1.1 CCA		CR.1.1 FDD	
			Config 2,5	CR.1.1 CCA		CR.1.1 TDD	
			Config 3,6	CR.1.1 CCA		CR.2.1 TDD	
SSB parameters	Semi-static channel access Note 5,7 Semi-static channel access Note 5,7		Config 1,4	SSB.1 CCA		SSB.1 FR1	
			Config 2,5	SSB.1 CCA		SSB.1 FR1	
			Config 3,6	SSB.1 CCA		SSB.2 FR1	
	Dynamic channel access Note 6,7		Config 1,4	SSB.2 CCA		SSB.1 FR1	
			Config 2,5	SSB.2 CCA		SSB.1 FR1	
			Config 3,6	SSB.2 CCA		SSB.2 FR1	

Parameter		Unit	Test configuration	Cell 2		Cell 3	
				T1	T2	T1	T2
DBT window configuration			Config 1,2,3,4,5,6	As defined in A.3.28.1		Not applicable	
SMTC configuration defined in A.3.11			Config 1,4	SMTC.2		SMTC.5	
			Config 2,3,5,6	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,4,5	30		15	
			Config 3,6	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3,4,5,6	P_{CCA_DL}=0.9375		Not applicable	
	Dynamic channel access Note 6,7		Config 1,2,3,4,5,6	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		Not applicable	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3,4,5,6	P_{CCA_UL}=1		Not applicable	
	Dynamic channel access Note 6,7		Config 1,2,3,4,5,6	P_{CCA_UL}=1		Not applicable	
L_{CCA_DL}			Config 1,2,3,4,5,6	2		2	
W_{CCA_DL}		ms	Config 1,2,3,4,5,6	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
EPRE ratio of PSS to SSS			Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2,3,4,5,6	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2,4,5	-98		-95	
			Config 3,6	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-88
			Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s / I_{ot}$		dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s / N_{oc}$		dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	NR Config 1,2,4,5	-64.59	-64.59	-63.94	-56.15
		dBm/38.16 MHz	NR Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1,2,3,4,5,6	AWGN			

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.						

Table A.10.4.2.10.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test 1 Value	Test 2 Value	Comment
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.10.4.2.10.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.10.4.2.10.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_}$from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_}$from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2, the UE is required to report SSB time index.

$T_{identify_inter_cca_with_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca} + T_{SSB_time_index_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_time_index_inter_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

For test 1, DRX cycle = 40 ms and for test 2, DRX cycle = 640 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.3 L1-RSRP measurements for beam reporting

A.10.4.3.1 SSB based L1-RSRP measurement on PSCC when DRX is not used

A.10.4.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5A.4.1, with the testing configurations for NR cells in table A.10.4.3.1.1-1.

Table A.10.4.3.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.10.4.3.1.2 Test parameters

There are two cells in the test, E-UTRAN Pcell (Cell 1) and FR1 PSCell (Cell 2) which operates on a carrier frequency with CCA and transmits SSBs in DBT window according to DL CCA model. The test parameters and applicability for Cell 1 are defined in A.3.7A.2. The test parameters for the Cell 2 are given in table A.10.4.3.1.2-1 and table A.10.4.3.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The UE transmits the reporting according to UL CCA model. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.10.4.3.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1,2		freq1
DL CCA model	1,2		As specifieed in A.3.20.2.1
UL CCA model	1,2		As specified in A.3.20.2.2
Duplex mode	1,2		TDD
TDD Configuration	1,2		TDDConf.1.1 CCA
$BW_{channel}$	1,2	MHz	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,2		SR.1.1 CCA
RMSI CORESET Reference Channel	1,2		CR.1.1 CCA
Dedicated CORESET Reference Channel	1,2		CCR.1.1 CCA
SSB configuration	1,2		SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access
OCNG Patterns	1,2		OP.1
Initial BWP Configuration	1,2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1,2		DLBWP.1.1 ULBWP.1.1

Parameter	Config	Unit	Value
DBT Window Configuration	1,2		DBT.1
TRS Configuration	1,2		TRS.1.2 TDD
DRX configuration	1,2		Off
reportConfigType	1,2		periodic
reportQuantity	1,2		ssb-Index-RSRP
Number of reported RS	1,2		2
L1-RSRP reporting period	1,2	slot	80
T1	1,2	s	5
T2	1,2	s	1
EPRE ratio of PSS to SSS	1,2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1,2		AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

Table A.10.4.3.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
DL CCA Probability P_{CCA_DL} Note 4,6	1,2		0.9375	0.9375	0.9375	0.9375
DL CCA Probability P_{CCA_DL} Note 4.7	1,2		0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability P_{CCA_UL}	1,2		1.0	1.0	1.0	1.0
N_{oc} Note2	1,2	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2	dBm/SSB SCS	-91.65			
$\hat{E}_s / I_{ot}$	1,2	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1,2	dB	0	0	-Infinity	3

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: DL and UL CCA probabilities apply for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.
NOTE 5: The signal levels apply for SSS Res when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.

A.10.4.3.1.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE shall send L1-RSRP report of both SSB0 and SSB1 in Cell 2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.3.2 SSB based L1-RSRP measurement on PSCC when DRX is used

A.10.4.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5A.4.1, with the testing configurations for NR cells in table A.10.4.3.1.1-1.

Table A.10.4.3.2.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.10.4.3.2.2 Test parameters

There are two cells in the test, E-UTRAN Pcell (Cell 1) and FR1 PSCell (Cell 2) which operates on a carrier frequency with CCA and transmits SSBs in DBT window according to DL CCA model. The test parameters and applicability for Cell 1 are defined in A.3.7A.2. The test parameters for the Cell 2 are given in table A.10.4.3.2.2-1 and table A.10.4.3.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The UE transmits the reporting according to UL CCA model. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.10.4.3.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1,2		freq1
DL CCA model	1,2		As specifieed in A.3.20.2.1
UL CCA model	1,2		As specified in A.3.20.2.2
Duplex mode	1,2		TDD
TDD Configuration	1,2		TDDConf.1.1 CCA
$BW_{channel}$	1,2	MHz	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,2		SR.1.1 CCA
RMSI CORESET Reference Channel	1,2		CR.1.1 CCA
Dedicated CORESET Reference Channel	1,2		CCR.1.1 CCA
SSB configuration	1,2		SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access
OCNG Patterns	1,2		OP.1
Initial BWP Configuration	1,2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1,2		DLBWP.1.1 ULBWP.1.1
DBT Window Configuration	1,2		DBT.1
TRS Configuration	1,2		TRS.1.2 TDD
DRX configuration	1,2		DRX.3

Parameter	Config	Unit	Value
reportConfigType	1,2		periodic
reportQuantity	1,2		ssb-Index-RSRP
Number of reported RS	1,2		2
L1-RSRP reporting period	1,2	slot	80
T1	1,2	s	5
T2	1,2	s	1
EPRE ratio of PSS to SSS	1,2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1,2		AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

Table A.10.4.3.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
DL CCA Probability P_{CCA_DL} Note 4,6	1,2		0.9375	0.9375	0.9375	0.9375
DL CCA Probability P_{CCA_DL} Note 4.7	1,2		0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability P_{CCA_UL}	1,2		1.0	1.0	1.0	1.0
N_{oc} Note2	1,2	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2	dBm/SSB SCS	-91.65			
$\hat{E}_s / I_{ot}$	1,2	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1,2	dB	0	0	-Infinity	3

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: DL and UL CCA probabilities apply for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.

A.10.4.3.2.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE shall send L1-RSRP report of both SSB0 and SSB1 in Cell 2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.3.3 SSB based L1-RSRP measurement on SCC when DRX is not used

A.10.4.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5A.4.1, with the testing configurations for NR cells in table A.10.4.3.1.1-1.

Table A.10.4.3.3.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.10.4.3.3.2 Test parameters

There are three cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2), and FR1 SCell (Cell 3). Cell 2 and Cell 3 operate on a carrier frequency with CCA and transmits SSBs in DBT window according to DL CCA model. The test parameters and applicability for Cell 1 are defined in A.3.7A.2. The test parameters for the Cell 2 and Cell 3 are given in table A.10.4.3.3.2-1 and table A.10.4.3.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The UE transmits the reporting according to UL CCA model. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.10.4.3.3.2-1: General test parameters

Parameter	Config	Unit	Value
Active PScell	1,2		Cell 2
Active Scell	1,2		Cell 3
RF Channel Number	1,2		1: Cell 2 2: Cell 3
DL CCA model	1,2		As specifieed in A.3.20.2.1
UL CCA model	1,2		As specified in A.3.20.2.2
Duplex mode	1,2		TDD
TDD Configuration	1,2		TDDConf.1.1 CCA
$BW_{channel}$	1,2	MHz	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,2		SR.1.1 CCA
RMSI CORESET Reference Channel	1,2		CR.1.1 CCA
Dedicated CORESET Reference Channel	1,2		CCR.1.1 CCA
SSB configuration	1,2		SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access
OCNG Patterns	1,2		OP.1
Initial BWP Configuration	1,2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1,2		DLBWP.1.1 ULBWP.1.1
DBT Window Configuration	1,2		DBT.1
TRS Configuration	1,2		TRS.1.2 TDD

Parameter	Config	Unit	Value
DRX configuration	1,2		Off
reportConfigType	1,2		periodic
reportQuantity	1,2		ssb-Index-RSRP
Number of reported RS	1,2		2
L1-RSRP reporting period	1,2	slot	80
T1	1,2	s	5
T2	1,2	s	1
EPRE ratio of PSS to SSS	1,2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1,2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.			

Table A.10.4.3.3.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
DL CCA Probability P_{CCA_DL} Note 4,6	1, 2		0.9375	0.9375	0.9375	0.9375
DL CCA Probability P_{CCA_DL} Note 4.7	1, 2		0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability P_{CCA_UL}	1, 2		1.0	1.0	1.0	1.0
N_{oc} Note2	1, 2	dBm/15 kHz	-94.65			
N_{oc} Note2	1, 2	dBm/SSB SCS	-91.65			
$\hat{E}_s / I_{ot}$	1, 2	dB	0	0	-Infinity	3
SSB RSRP Note3	1, 2	dBm/SSB SCS	-91.65	-91.65	-Infinity	-88.65
Io Note3	1, 2	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1, 2	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: DL and UL CCA probabilities apply for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.						
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.						
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.						
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.						

A.10.4.3.3.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE shall send L1-RSRP report of both SSB0 and SSB1 in Cell 3.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.3.4 SSB based L1-RSRP measurement on SCC when DRX is used

A.10.4.3.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5A.4.1, with the testing configurations for NR cells in table A.10.4.3.4.1-1.

Table A.10.4.3.4.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.10.4.3.4.2 Test parameters

There are three cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2), and FR1 SCell (Cell 3). Cell 2 and Cell 3 operate on a carrier frequency with CCA and transmits SSBs in DBT window according to DL CCA model. The test parameters and applicability for Cell 1 are defined in A.3.7A.2. The test parameters for the Cell 2 and Cell 3 are given in table A.10.4.3.4.2-1 and table A.10.4.3.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The UE transmits the reporting according to UL CCA model. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.10.4.3.4.2-1: General test parameters

Parameter	Config	Unit	Value
Active PScell	1,2		Cell 2
Active Scell	1,2		Cell 3
RF Channel Number	1,2		1: Cell 2 2: Cell 3
DL CCA model	1,2		As specifieed in A.3.20.2.1
UL CCA model	1,2		As specified in A.3.20.2.2
Duplex mode	1,2		TDD
TDD Configuration	1,2		TDDConf.1.1 CCA
$BW_{channel}$	1,2	MHz	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1,2		SR.1.1 CCA
RMSI CORESET Reference Channel	1,2		CR.1.1 CCA
Dedicated CORESET Reference Channel	1,2		CCR.1.1 CCA
SSB configuration	1,2		SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access
OCNG Patterns	1,2		OP.1
Initial BWP Configuration	1,2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1,2		DLBWP.1.1 ULBWP.1.1
DBT Window Configuration	1,2		DBT.1
TRS Configuration	1,2		TRS.1.2 TDD

Parameter	Config	Unit	Value
DRX configuration	1,2		DRX.3
reportConfigType	1,2		periodic
reportQuantity	1,2		ssb-Index-RSRP
Number of reported RS	1,2		2
L1-RSRP reporting period	1,2	slot	80
T1	1,2	s	5
T2	1,2	s	1
EPRE ratio of PSS to SSS	1,2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1,2		AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

Table A.10.4.3.4.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
DL CCA Probability P_{CCA_DL} Note 4,6	1, 2		0.9375	0.9375	0.9375	0.9375
DL CCA Probability P_{CCA_DL} Note 4.7	1, 2		0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability P_{CCA_UL}	1, 2		1.0	1.0	1.0	1.0
N_{oc} Note2	1, 2	dBm/15 kHz	-94.65			
N_{oc} Note2	1, 2	dBm/SSB SCS	-91.65			
$\hat{E}_s / I_{ot}$	1, 2	dB	0	0	-Infinity	3
SSB RSRP Note3	1, 2	dBm/SSB SCS	-91.65	-91.65	-Infinity	-88.65
Io Note3	1, 2	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1, 2	dB	0	0	-Infinity	3

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: DL and UL CCA probabilities apply for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.

A.10.4.3.4.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE shall send L1-RSRP report of both SSB0 and SSB1 in Cell 3.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.4 E-UTRAN–NR inter-RAT measurements on NR carrier frequency under CCA

A.10.4.4.1 E-UTRA-NR inter-RAT event triggered reporting tests for FR1 without SSB time index detection when DRX is not used

A.10.4.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21A of TS 36.133 [15] for E-UTRAN FDD-NR measurements under CCA and clause 8.1.2.4.22A of TS 36.133 [15] for E-UTRAN TDD-NR measurements under CCA.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 with CCA on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters are given in tables A.10.4.4.1.1-1, A.10.4.4.1.1-2, A.10.4.4.1.1-3 and A.10.4.4.1.1-4. Cell transmits SSBs in DBT windows according to DL CCA model.

In this test, measurement gap pattern configuration # 0 as defined in table A.10.4.4.1.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Table A.10.4.4.1.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
2	LTE TDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.10.4.4.1.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number			1, 2	1	One E-UTRAcarrier frequency is used.
NR RF Chanel Number			1, 2	1,2	Two FR1 NR carrier frequency under CCA is used.
DL CCA model	Dynamic channel access Note 3, 5			As specified in clause A.3.26.2.1	
	Semi-static channel access Note 4, 5				
UL CCA model	Dynamic channel access Note 3, 5			As specified in clause A.3.26.2.2	
	Semi-static channel access Note 4, 5				
L_{CCA_DL}			1, 2	12	

Parameter	Unit	Test configuration	Value	Comment
W_{CCA_DL}	ms	1, 2	$T_{PSS/SSS_sync_irat_cca}$	
Active cell		1, 2	E-UTRA cell 1 (PCell) and NR cell 2 with CCA (PSCell)	E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2	NR cell 3	NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		1, 2	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39	As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2	Note 1	E-UTRA RSRP/RSRQ/SINR threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2	Note 2	SS-RSRP/ SS-RSRQ/ SS-SINR threshold measurement on cell 3 for event B2 [16]
Hysteresis	dB	1, 2	0	
CP length		1, 2	Normal	
TimeToTrigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	DRX is not used
Time offset between serving and neighbour cells		1, 2	3μs	Synchronous cells.
T1	s	1, 2	5	
T2	s	1, 2	$\geq T_{identify_irat_cca_without_index}$	$T_{identify_irat_cca_without_index}$ is defined in clause 8.1.2.4.21A.1 and 8.1.2.4.22A.1 in TS 36.133

NOTE 1: The value of b2-Threshold1 is defined in table A.10.4.4.1.1-3
NOTE 2: The value of b2-Threshold2NR is defined in table A.10.4.4.1.1-4
NOTE 3: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 4: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

Table A.10.4.4.1.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2	1	
Duplex mode		1	FDD	
		2	TDD	
TDD special subframe configuration[Note1]		2	6	
TDD uplink-downlink configuration[Note1]		2	1	
$BW_{channel}$	MHz	1, 2	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		2	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		2	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
		2	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2	-77	
PBCH_RA	dB	1, 2	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15 kHz	1, 2	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2	17	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2	17	17
RSRP Note5	dBm/15 kHz	1, 2	-87	-87
SCH_RP Note5	dBm/15 kHz	1, 2	-87	-87
Io Note5	dBm/9 MHz	1, 2	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.10.4.4.1.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		1, 2	2		3	
TDD configuration		1, 2	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
$BW_{channel}$	MHz	1, 2	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
P_{CCA_DL} for dynamic channel access Note 6,8		1, 2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 7,8		1, 2	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
P_{CCA_UL} for dynamic channel access Note 6,8		1, 2	1		1	
P_{CCA_UL} for semi-static channel access Note 7,8		1, 2	1		1	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1		OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 2	SMTC.1		SMTC.1	
DBT window configuration		1, 2	DBT.1		DBT.1	
SSB configuration for semi-static channel access		1, 2	SSB.1 CCA		SSB.1 CCA	
SSB configuration for dynamic channel access		1, 2	SSB.2 CCA		SSB.2 CCA	

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	30		30	
b2-Threshold2NR	dBm	1, 2	NA		-98	
EPRE ratio of PSS to SSS		1, 2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS (Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	1, 2	-98		-98	
N_{oc} Note2	dBm/SCS	1, 2	-95		-95	
SS-RSRP Note 3,5	dBm/SCS	1, 2	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$ Note 5	dB	1, 2	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$ Note 5	dB	1, 2	4	4	-Infinity	7
Io Note3	dBm/38.16 MHz	1, 2	-58.49	-58.49	-63.95	-56.16
Propagation Condition		1, 2	AWGN		AWGN	
Antenna Configuration and Correlation Matrix		1, 2,	1x2 Low		1x2 Low	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 8: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.10.4.4.1.2 Test Requirements

The UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_without_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is not required to report SSB time index. $T_{identify_irat_cca_without_index}$ is defined in defined in clause 8.1.2.4.21A.1 and 8.1.2.4.22A.1 in TS 36.133.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.4.2 E-UTRA-NR inter-RAT event triggered reporting tests for FR1 without SSB time index detection when DRX is used

A.10.4.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 with CCA on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters are given in tables A.10.4.4.2.1-1, A.10.4.4.2.1-2, A.10.4.4.2.1-3 and A.10.4.4.2.1-4. Cell transmits SSBs in DBT windows according to DL CCA model.

In tests 1 and 2, measurement gap pattern configuration # 0 as defined in table A.10.4.4.2.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Table A.10.4.4.2.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
2	LTE TDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.10.4.4.2.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Value		Comment
				Test 1	Test 2	
E-UTRA RF Channel Number			1, 2	1		One E-UTRAcarrier frequency is used.
NR RF Chanel Number			1, 2	1,2		Two FR1 NR carrier frequency under CCA is used.
Active cell			1, 2	E-UTRA cell 1 (PCell) and NR cell 2 with CCA (PSCell)		E-UTRA cell 1 is on E-UTRA RF channel number 1.
DL CCA model	Dynamic channel access Note 3, 5			As specified in clause A.3.26.2.1		
	Semi-static channel access Note 4, 5					
UL CCA model	Dynamic channel access Note 3, 5			As specified in clause A.3.26.2.2		
	Semi-static channel access Note 4, 5					
L_{CCA_DL}			1, 2	12	5	
W_{CCA_DL}		ms	1, 2	$T_{PSS/SSS_sync_irat_cca}$		
Neighbour cell			1, 2	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id			1, 2	0		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Measurement gap offset		1, 2	39		As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2	Note 1		E-UTRA RSRP threshold for measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2	Note 2		SS-RSRP threshold measurement on cell 3 for event B2 [16]
Hysteresis	dB	1, 2	0		
CP length		1, 2	Normal		
TimeToTrigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	DRX.9	DRX.12	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 2	3μs		Synchronous cells.
T1	s	1, 2	5		
T2	s	1, 2	≥$T_{identify_irat_cca_without_index}$		$T_{identify_irat_cca_without_index}$ is defined in clause 8.1.2.4.21A.1 and 8.1.2.4.22A.1 in TS 36.133
NOTE 1: The value of b2-Threshold1 is defined in table A.10.4.4.1.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.10.4.4.1.1-4 NOTE 3: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 4: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 5: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.					

Table A.10.4.4.2.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2	1	
Duplex mode		1	FDD	
		2	TDD	
TDD special subframe configuration[Note1]		2	6	
TDD uplink-downlink configuration[Note1]		2	1	
$BW_{channel}$	MHz	1, 2	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		2	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		2	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		2	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2	-77	
PBCH_RA	dB	1, 2	0	
PBCH_RB				
PSS_RA				

Parameter	Unit	Configuration	Cell 1	
			T1	T2
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15 kHz	1, 2	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2	17	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2	17	17
RSRP Note5	dBm/15 kHz	1, 2	-87	-87
SCH_RP Note5	dBm/15 kHz	1, 2	-87	-87
Io Note5	dBm/9 MHz	1, 2	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.10.4.4.2.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		1, 2	2		3	
TDD configuration		1, 2	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
$BW_{channel}$	MHz	1, 2	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
P_{CCA_DL} for dynamic channel access Note 6,8		1, 2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 7,8		1, 2	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
P_{CCA_UL} for dynamic channel access Note 6,8		1, 2	1		1	
P_{CCA_UL} for semi-static channel access Note 7,8		1, 2	1		1	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1		OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 2	SMTC.1		SMTC.1	
DBT window configuration		1, 2	DBT.1		DBT.1	
SSB configuration for semi-static channel access		1, 2	SSB.1 CCA		SSB.1 CCA	
SSB configuration for dynamic channel access		1, 2	SSB.2 CCA		SSB.2 CCA	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	30		30	
b2-Threshold2NR	dBm	1, 2	NA		-98	
EPRE ratio of PSS to SSS		1, 2	0		0	
EPRE ratio of PBCH DMRS to SSS						

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS (Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	1, 2	-98		-98	
N_{oc} Note2	dBm/SCS	1, 2	-95		-95	
SS-RSRP Note 3,5	dBm/SCS	1, 2	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$ Note 5	dB	1, 2	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$ Note 5	dB	1, 2	4	4	-Infinity	7
Io Note3	dBm/38.16 MHz	1, 2	-58.49	-58.49	-63.95	-56.16
Propagation Condition		1, 2	AWGN		AWGN	
Antenna Configuration and Correlation Matrix		1, 2,	1x2 Low		1x2 Low	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 8: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.10.4.4.2.2 Test Requirements

In test, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_without_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_without_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1 and 2, the UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.4.3 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection when DRX is not used

A.10.4.4.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 with CCA on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters are given in tables A.10.4.4.3.1-1, A.10.4.4.3.1-2, A.10.4.4.3.1-3 and A.10.4.4.3.1-4. Cell transmits SSBs in DBT windows according to DL CCA model.

In test 1 measurement gap pattern configuration # 0 as defined in table A.10.4.4.3.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Table A.10.4.4.3.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR1

Configuration	Description
1	LTE FDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
2	LTE TDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.10.4.4.3.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection

Parameter		Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number			1, 2	1	One E-UTRAcarrier frequency is used.
NR RF Chanel Number			1, 2	1,2	Two FR1 NR carrier frequency under CCA is used.
DL CCA model	Dynamic channel access Note 3, 5			As specified in clause A.3.26.2.1	
	Semi-static channel access Note 4, 5				
UL CCA model	Dynamic channel access Note 3, 5			As specified in clause A.3.26.2.2	
	Semi-static channel access Note 4, 5				
L_{CCA_DL}			1, 2	12	
W_{CCA_DL}		ms	1, 2	$T_{PSS/SSS_sync_irat_cca}$	
Active cell			1, 2	E-UTRA cell 1 (PCell) and NR cell 2 with CCA (PSCell)	E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell			1, 2	NR cell 3	NR cell 3 is on NR RF channel number 2.
Gap Pattern Id			1, 2	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].

Parameter	Unit	Test configuration	Value	Comment
Measurement gap offset		1, 2	39	As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2	Note 1	E-UTRA RSRP threshold for measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2	Note 2	SS-RSRP threshold measurement on cell 3 for event B2 [16]
Hysteresis	dB	1, 2	0	
CP length		1, 2	Normal	
TimeToTrigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	DRX is not used
Time offset between serving and neighbour cells		1, 2	3μs	Synchronous cells.
T1	s	1, 2	5	
T2	s	1, 2	≥ $T_{identify_irat_cca_with_index}$	$T_{identify_irat_cca_with_index}$ is defined in clause 8.1.2.4.21A.1 and 8.1.2.4.22A.1 in TS 36.133
NOTE 1: The value of b2-Threshold1 is defined in table A.10.4.4.3.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.10.4.4.3.1-4 NOTE 3: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 4: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 5: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.10.4.4.3.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 with SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2	1	
Duplex mode		1	FDD	
		2	TDD	
TDD special subframe configuration[Note1]		2	6	
TDD uplink-downlink configuration[Note1]		2	1	
$BW_{channel}$	MHz	1, 2	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		2	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		2	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		2	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2	-77	
PBCH_RA	dB	1, 2	0	
PBCH_RB				
PSS_RA				

Parameter	Unit	Configuration	Cell 1	
			T1	T2
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15 kHz	1, 2	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2	17	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2	17	17
RSRP Note5	dBm/15 kHz	1, 2	-87	-87
SCH_RP Note5	dBm/15 kHz	1, 2	-87	-87
Io Note5	dBm/9 MHz	1, 2	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.10.4.4.3.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		1, 2	2		3	
TDD configuration		1, 2	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
$BW_{channel}$	MHz	1, 2	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
P_{CCA_DL} for dynamic channel access Note 6,8		1, 2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 7,8		1, 2	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
P_{CCA_UL} for dynamic channel access Note 6,8		1, 2	1		1	
P_{CCA_UL} for semi-static channel access Note 7,8		1, 2	1		1	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1		OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 2	SMTC.1		SMTC.1	
DBT window configuration		1, 2	DBT.1		DBT.1	
SSB configuration for semi-static channel access		1, 2	SSB.1 CCA		SSB.1 CCA	
SSB configuration for dynamic channel access		1, 2	SSB.2 CCA		SSB.2 CCA	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	30		30	
b2-Threshold2NR	dBm	1, 2	NA		-98	
EPRE ratio of PSS to SSS		1, 2	0		0	
EPRE ratio of PBCH DMRS to SSS						

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS (Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	1, 2	-98		-98	
N_{oc} Note2	dBm/SCS	1, 2	-95		-95	
SS-RSRP Note 3,5	dBm/SCS	1, 2	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$ Note 5	dB	1, 2	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$ Note 5	dB	1, 2	4	4	-Infinity	7
Io Note3	dBm/38.16 MHz	1, 2	-58.49	-58.49	-63.95	-56.16
Propagation Condition		1, 2	AWGN		AWGN	
Antenna Configuration and Correlation Matrix		1, 2,	1x2 Low		1x2 Low	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 8: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.10.4.4.3.2 Test Requirements

The UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_with_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.4.4.4 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection when DRX is used

A.10.4.4.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 with CCA on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters are given in tables A.10.4.4.4.1-1, A.10.4.4.4.1-2, A.10.4.4.4.1-3 and A.10.4.4.4.1-4. Cell transmits SSBs in DBT windows according to DL CCA model.

In tests 1 and 2, measurement gap pattern configuration # 0 as defined in table A.10.4.4.4.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Table A.10.4.4.4.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR1

Configuration	Description
1	LTE FDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
2	LTE TDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.10.4.4.4.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection

Parameter		Unit	Test configuration	Value		Comment
				Test 1	Test 2	
E-UTRA RF Channel Number			1, 2	1		One E-UTRAcarrier frequency is used.
NR RF Chanel Number			1, 2	1,2		Two FR1 NR carrier frequency under CCA is used.
DL CCA model	Dynamic channel access Note 3, 5			As specified in clause A.3.26.2.1		
	Semi-static channel access Note 4, 5					
UL CCA model	Dynamic channel access Note 3, 5			As specified in clause A.3.26.2.2		
	Semi-static channel access Note 4, 5					
L_{CCA_DL}			1, 2	12		5
W_{CCA_DL}		ms	1, 2	$T_{PSS/SSS_sync_irat_cca}$		
Active cell			1, 2	E-UTRA cell 1 (PCell) and NR cell 2 with CCA (PSCell)		E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell			1, 2	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id			1, 2	0		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset			1, 2	39		As specified in TS 36.331 [16].
b2-Threshold1		dBm	1, 2	Note 1		E-UTRA RSRP/RSRQ/SINR threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]
b2-Threshold2NR		dBm	1, 2	Note 2		SS-RSRP/ SS-RSRQ/ SS-SINR threshold measurement on cell 3 for event B2 [16]
Hysteresis		dB	1, 2	0		
CP length			1, 2	Normal		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
TimeToTrigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	DRX.9	DRX.12	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 2	3μs		Synchronous cells.
T1	s	1, 2	5		
T2	s	1, 2	≥$T_{identify_irat_cca_with_index}$		$T_{identify_irat_cca_with_index}$ is defined in clause 8.1.2.4.21A.1 and 8.1.2.4.22A.1 in TS 36.133
NOTE 1: The value of b2-Threshold1 is defined in table A.10.4.4.4.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.10.4.4.4.1-4 NOTE 3: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 4: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 5: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.					

Table A.10.4.4.4.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 with SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2	1	
Duplex mode		1	FDD	
		2	TDD	
TDD special subframe configuration[Note1]		2	6	
TDD uplink-downlink configuration[Note1]		2	1	
$BW_{channel}$	MHz	1, 2	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		2	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		2	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		2	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2	-77	
PBCH_RA	dB	1, 2	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				

Parameter	Unit	Configuration	Cell 1	
			T1	T2
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15 kHz	1, 2	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2	17	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2	17	17
RSRP Note5	dBm/15 kHz	1, 2	-87	-87
SCH_RP Note5	dBm/15 kHz	1, 2	-87	-87
Io Note5	dBm/9 MHz	1, 2	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.10.4.4.4.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		1, 2	2		3	
TDD configuration		1, 2	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
$BW_{channel}$	MHz	1, 2	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
P_{CCA_DL} for dynamic channel access Note 6,8		1, 2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 7,8		1, 2	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
P_{CCA_UL} for dynamic channel access Note 6,8		1, 2	1		1	
P_{CCA_UL} for semi-static channel access Note 7,8		1, 2	1		1	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1		OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 2	SMTC.1		SMTC.1	
DBT window configuration		1, 2	DBT.1		DBT.1	
SSB configuration for semi-static channel access		1, 2	SSB.1 CCA		SSB.1 CCA	
SSB configuration for dynamic channel access		1, 2	SSB.2 CCA		SSB.2 CCA	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	30		30	
b2-Threshold2NR	dBm	1, 2	NA		-98	
EPRE ratio of PSS to SSS		1, 2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS (Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	1, 2	-98		-98	
N_{oc} Note2	dBm/SCS	1, 2	-95		-95	
SS-RSRP Note 3,5	dBm/SCS	1, 2	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$ Note 5	dB	1, 2	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$ Note 5	dB	1, 2	4	4	-Infinity	7
Io Note3	dBm/38.16 MHz	1, 2	-58.49	-58.49	-63.95	-56.16
Propagation Condition		1, 2	AWGN		AWGN	
Antenna Configuration and Correlation Matrix		1, 2,	1x2 Low		1x2 Low	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.

A.10.4.4.4.2 Test Requirements

In test 1, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_with_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_with_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1 and 2, the UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.10.5 Measurement performance

A.10.5.1 SS-RSRP

A.10.5.1.1 Intra-frequency measurement accuracy on a CCA serving cell

A.10.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.36.1.1 and 10.1.36.1.2 when the serving cell is subject to CCA.

A.10.5.1.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell under CCA (Cell 2). Cell 2 operates on a carrier frequency with CCA and transmits SSBs in DBT window according to DL CCA model. Supported test configurations are shown in table A.10.5.1.1.1-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in table A.10.5.1.1.1-2. The configuration of cell 1 (E-UTRA PCell) is specified in clause A.3.7A.2.1. In all test cases, Cell 2 is the PSCell, and Cell 3 is the target cell.

Table A.10.5.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Config	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations for each supported band	

Table A.10.5.1.1.2-2: SS-RSRP Intra frequency test parameters

Parameter			Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
Physical cell ID				489	0	489	0
SSB ARFCN				freq1			
Duplex mode		Config 1, 2		TDD			
TDD configuration		Config 1, 2		TDDConf.1.1 CCA			
$BW_{channel}$		Config 1, 2	MHz	40: $N_{PRB,c}$ = 106			
Downlink initial BWP configuration				DLBWP.0.1			
Downlink dedicated BWP configuration				DLBWP.1.1			
Uplink initial BWP configuration				ULBWP.0.1			
Uplink dedicated BWP configuration				ULBWP.1.1			
TRS configuration		Config 1, 2		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel		Config 1, 2		SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel		Config 1, 2		CR.1.1 CCA		CR.1.1 CCA	
Control Channel RMC		Config 1, 2		CCR.1.1 CCA		CCR.1.1 CCA	
DL CCA model				As specified in clause A.3.26.2.1			
UL CCA model				As specified in clause A.3.26.2.2			
P_{CCA_DL} for dynamic channel access Note 7,8		Config 1, 2		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75
P_{CCA_DL} for semi-static channel access Note 6.8		Config 1, 2		P_{CCA_DL}=0.9375	P_{CCA_DL}=0.9375	P_{CCA_DL}=0.9375	P_{CCA_DL}=0.9375
P_{CCA_UL}		Config 1, 2		1	1	1	1
SSB configuration	Semi-static channel access	Config 1, 2		SSB.1 CCA (As defined in A.3.10A)	SSB.1 CCA (As defined in A.3.10A)	SSB.1 CCA (As defined in A.3.10A)	SSB.1 CCA (As defined in A.3.10A)
	Dynamic channel access			SSB.2 CCA (As defined in A.3.10A)	SSB.2 CCA (As defined in A.3.10A)	SSB.2 CCA (As defined in A.3.10A)	SSB.2 CCA (As defined in A.3.10A)
Time offset with Cell 2		Config 1, 2	µs	-	3	-	3
SMTC configuration		Config 1, 2		SMTC.1			
DBT Window Configuration		Config 1, 2		As defined in A.3.28.1			
DL CCA model		Config 1, 2		As specified in clause A.3.26.2.1			
UL CCA model		Config 1, 2		As specified in clause A.3.26.2.2			
OCNG Patterns				OP.1			

Parameter			Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
PDSCH/PDCCH subcarrier spacing	Config 1, 2		kHz	30 kHz			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config 1, 2	NR_CCA_FR1_I	dBm/15KhZ	-94		-110	
		NR_CCA_FR1_J				-109.5	
N_{oc} Note2	Config 1, 2	NR_CCA_FR1_I	dBm/SCS	-91		-107.0	
		NR_CCA_FR1_J				-106.5	
$\hat{E}_s/I_{ot}$			dB	2.46	-5.97	-2.01	-3.54
$\hat{E}_s/N_{oc}$			dB	6	1	1	0
SS-RSRP Note3	Config 1, 2	NR_CCA_FR1_I	dBm/SCS	-85	-90	-106.00	-107.00
		NR_CCA_FR1_J				-105.50	-106.50
Io Note3	Config 1, 2	NR_CCA_FR1_I	dBm/38.16 MHz	-51.99		-70.82	
		NR_CCA_FR1_J				-70.32	
Propagation condition			-	AWGN			
Antenna configuration				1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 5: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.					
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.					
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.					
NOTE 8: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.					

A.10.5.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for cell 2 and cell 3 shall fulfil absolute requirement in clause 10.1.2.1.1 and relative requirement in clause 10.1.36.1.1 and 10.1.36.1.2.

A.10.5.1.2 Inter-frequency measurement accuracy with FR1 CCA serving cell and FR1 CCA target cell

A.10.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.37.1.1 and 10.1.37.1.2 for inter-frequency measurements with the testing configurations in table A.10.5.1.2.1-1.

Table A.10.5.1.2.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test

Config	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations on each supported band	

A.10.5.1.2.2 Test parameters

In this set of test cases there are three cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7A.2.1. The test parameters for the Cell 2 and Cell 3 are given in table A.10.5.1.2.2-1 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in table A.10.5.1.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.10.5.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter		Config	Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		1, 2		freq1	freq2	freq1	freq2
$BW_{channel}$		1, 2	MHz	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
Gap pattern ID				0		0	
Duplex mode		1, 2		TDD		TDD	
TDD configuration		1, 2		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
PDSCH Reference measurement channel		1, 2		SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel		1, 2		CR.1.1 CCA	-	CR.1.1 CCA	-
Dedicated CORESET Reference Channel		1, 2		CCR.1.1 CCA	-	CCR.1.1 CCA	-
SSB configuration	Semi-static channel access	1, 2		SSB.1 CCA (As defined in A.3.10A)		SSB.1 CCA (As defined in A.3.10A)	
	Dynamic channel access			SSB.2 CCA (As defined in A.3.10A)		SSB.2 CCA (As defined in A.3.10A)	
OCNG Patterns		1, 2		OP.1		OP.1	

Parameter		Config	Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
TRS configuration		1, 2		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration		1, 2		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration		1, 2		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 2		1, 2	μs	-	3	-	3
SMTC configuration		1, 2		SMTC.1		SMTC.1	
DBT Window Configuration		1, 2		DBT.1 (As defined in A.3.28.1)		DBT.1 (As defined in A.3.28.1)	
DL CCA model				As specified in clause A.3.26.2.1			
UL CCA model				As specified in clause A.3.26.2.2			
EPRE ratio of PSS to SSS		1, 2	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
N_{oc} Note2	NR_CCA_FR1_I	1, 2	dBm/15 kHz	-94.65		(N_{oc} for Cell 3 +8 dB)	-111
	NR_CCA_FR1_J						-110.5
N_{oc} Note2	NR_CCA_FR1_I	1, 2	dBm/SSB SCS	-91.65		(N_{oc} for C 3 +8 dB)	-109.00
	NR_CCA_FR1_J						-108.50
$\hat{E}_s / I_{ot}$		1, 2	dB	10	10	13	-3
SS-RSRP Note3	NR_CCA_FR1_I	1, 2	dBm/SCS	-81.65		(RSRP for Cell 3 +24 dB)	-111.00
	NR_CCA_FR1_J						-110.50
Io Note3	R_CCA_FR1_I	1, 2	dBm/ 38.16 MHz	-50.19		(Io for Channel 3 +19.45 dB)	-75.19
	NR_CCA_FR1_J						-74.69
$\hat{E}_s / N_{oc}$		1, 2	dB	10	10	13	-3
Propagation condition		1, 2	-	AWGN		AWGN	
Antenna configuration				1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
NOTE 5: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.						

A.10.5.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil the Absolute requirement in clause 10.1.4.1.1 and Relative requirement in clause 10.1.37.1.1 and 10.1.37.1.2.

A.10.5.2 SS-RSRQ

A.10.5.2.1 Intra-frequency measurement accuracy with FR1 CCA serving cell and FR1 CCA target cell

A.10.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.29.1.1.

A.10.5.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.10.5.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in table A.10.5.2.1.2-2. The configuration of cell 1 (E-UTRA PCell) is specified in clause A.3.7A.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.10.5.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Config	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.10.5.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter			Unit	Test 1		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN				freq1			
Duplex mode	Config 1, 2			TDD			
TDD configuration	Config 1, 2			TDDConf.1.1 CCA			
$BW_{channel}$	Config 1, 2		MHz	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP			DLBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1			
	Initial UL BWP			ULBWP.0.1			
	Dedicated UL BWP			ULBWP.1.1			
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel	Config 1, 2			SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel	Config 1, 2			CR.1.1 CCA		CR.1.1 CCA	
Control Channel RMC	Config 1, 2			CCR.1.1 CCA		CCR.1.1 CCA	
TRS configuration	Config 1, 2			TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OP. 1			
SS-RSSI-Measurement				Not Applicable			
Time offset with Cell 2	Config 1, 2		µs	-	3	-	3
SMTC configuration	Config 1, 2			SMTC.1			
SSB configuration	Semi-static channel access			SSB.1 CCA (As defined in A.3.10A)			

Parameter			Unit	Test 1		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3
	Dynamic channel access	Config 1, 2		SSB.2 CCA (As defined in A.3.10A)			
PDSCH/PDCCH subcarrier spacing	Config 1, 2		kHz	30 kHz			
DBT Window Configuration	Config 1, 2			DBT.1 (As defined in A.3.28.1)			
DL CCA model	Config 1, 2			As specified in clause A.3.26.2.1			
UL CCA model	Config 1, 2			As specified in clause A.3.26.2.2			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config1, 2	NR_CCA_FR1_I	Bm/15 kHz	-91		-110	
		NR_CCA_FR1_J				-109.5	
N_{oc} Note2	Config 1, 2	NR_CCA_FR1_I	dBm/SC S	-88		-107	
		NR_CCA_FR1_J				-106.5	
$\hat{E}_s / I_{ot}$			dB	-1.76		-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	3	3	-4	-4
SS-RSRP Note3	Config 1, 2	NR_CCA_FR1_I	dBm/SCS	-85	-85	-111	-111
		NR_CCA_FR1_J				-110.5	-110.5
SS-RSRQ Note3		NR_CCA_FR1_I	dB	-14.77	-14.77	-17.34	-17.34
		NR_CCA_FR1_J					
Io Note3	Config 1, 2	NR_CCA_FR1_I	dBm/ 38.16 MHz	-50			-73.4
		NR_CCA_FR1_J					-72.9
Propagation condition			-	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.10.5.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.29.1.1.

A.10.5.2.2 Inter-frequency measurement accuracy with FR1 CCA serving cell and FR1 CCA target cell

A.10.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limitsThis test will verify the requirements in clause 10.1.30.1.1 and 10.1.30.1.2 for inter-frequency measurements with the testing configurations in table A.10.5.2.2.2-1.

A.10.5.2.2.2 Test Parameters

In this set of test cases there are three cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in table A.4.7.1.2.2-1 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in table A.10.5.2.2.2-2. The inter-frequency measurements are supported by a measurement gap.

Table A.10.5.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Config	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.10.5.2.2.2-2: SS-RSRQ Inter frequency test parameters

Parameter			Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN				freq1	freq2	freq1	freq2
Duplex mode		Config 1, 2		TDD			
TDD configuration		Config 1, 2		TDDConf.1.1 CCA			
$BW_{channel}$		Config 1, 2		40: $N_{RB,c}$ = 106			
BWP BW		Config 1, 2	MHz	40: $N_{RB,c}$ = 106			
Gap pattern ID				0			
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel		Config 1, 2		SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel		Config 1, 2		CR.1.1 CCA		CR.1.1 CCA	
Dedicated CORESET Reference Channel		Config 1, 2		CCR.1.1 CCA		CCR.1.1 CCA	
TRS configuration		Config 1, 2		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OCNG pattern 1			
Time offset with Cell 2		Config 1, 2	µs	-	3	-	3
SMTC configuration		Config 1, 2		SMTC.1			
SSB configuration	Semi-static channel access	Config 1, 2		SSB.1 CCA (As defined in A.3.10A)			
	Dynamic channel access			SSB.2 CCA (As defined in A.3.10A)			
DBT Window Configuration		Config 1, 2		DBT.1 (As defined in A.3.28.1)			
DL CCA model		Config 1, 2		As specified in clause A.3.26.2.1			
UL CCA model		Config 1, 2		As specified in clause A.3.26.2.2			
PDSCH/PDCCH subcarrier spacing		Config 1, 2	kHz	30 kHz			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							

EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config 1, 2	NR_CCA_FR1_I	dBm/15kHz	-86.27	-86.27	-112	-112
		NR_CCA_FR1_J				-111.5	-111.5
N_{oc} Note2	Config 1, 2	NR_CCA_FR1_I	dBm/SCS	-83.27	-83.27	-109	-109
		NR_CCA_FR1_J				-108.5	-108.5
$\hat{E}_s / I_{ot}$			dB	-1.75	-1.75	3	-1.75
$\hat{E}_s / N_{oc}$			dB	-1.75	-1.75	3	-1.75
SS-RSRP Note3	Config 1, 2	NR_CCA_FR1_I	dBm/SCS	-85.02	-85.02	-106	-110.75
		NR_CCA_FR1_J				-105.5	-110.25
SS-RSRQ Note3		NR_CCA_FR1_I	dB	-14.77	-14.77	-12.56	-14.76
		NR_CCA_FR1_J					
Io Note3	Config 1, 2	NR_CCA_FR1_I	dBm/ 38.16MHz	-50	-50	-73.19	-75.23
		NR_CCA_FR1_J				-72.69	-74.73
Propagation condition				AWGN	AWGN	AWGN	AWGN

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in Section 3.5.2.
Note 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.10.5.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.30.1.1 and 10.1.30.1.2.

A.10.5.3 SS-SINR

A.10.5.3.1 Intra-frequency measurement accuracy on PSCC

A.10.5.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.31.1.

A.10.5.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.10.5.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in table A.10.5.3.1.2-2. The configuration of cell 1 (E-UTRA PCell) is specified in clause A.3.7A.2.1. In all test cases, Cell 2 is the PSCell with CCA and Cell 3 is the target cell with CCA. Two sub-tests (Test 1 and Test 2) are provided different N_{oc} on Cells 2 and 3.

Table A.10.5.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Config	Description
1	LTE FDD NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.10.5.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter			Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN				freq1		freq1	
DL CCA model	Config 1,2			As specified in clause A.3.26.2.1			
UL CCA model	Config 1,2			As specified in clause A.3.26.2.2			
UL CCA probability	P_{CCA_UL}			1.0	-	1.0	-
DL CCA probability for semi-static channel access Note 7, 8	P_{CCA_DL}			0.9375	-	0.9375	-
DL CCA probability for dynamic channel access Note 8, 9	$P_{CCA_DL_1}$			0.75	-	0.75	-
	$P_{CCA_DL_2}$			0.75	-	0.75	-
Duplex mode	Config 1,2			TDD			
TDD configuration	Config 1,2			TDDConf.1.1 CCA			
Downlink initial BWP configuration				DLBWP.0.1			
Downlink dedicated BWP configuration				DLBWP.1.1			
Uplink initial BWP configuration				ULBWP.0.1			
Uplink dedicated BWP configuration				ULBWP.1.1			
DRX Cycle configuration			ms	Not Applicable			
TRS Configuration	Config 1,2			TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1,2			SR.1.1 CCA		SR1.1 CCA	
RMSI CORESET Reference Channel	Config 1,2			CR.1.1 CCA		CR.1.1 CCA	
Dedicated CORESET Reference Channel	Config 1,2			CCR.1.1 CCA		CCR.1.1 CCA	
OCNG Patterns				OP.1			
SS-RSSI-Measurement				Not Applicable			
Time offset with Cell 2	Config 1,2		µs	-	3	-	3
DBT Window Configuration	Config 1,2			DBT.1			
SSB configuration	Config 1,2			SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access			
SMTC configuration	Config 1,2			SMTC.1			
PDSCH/PDCCH subcarrier spacing	Config 1,2		kHz	30			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		NR_CCA_FR1_I	dBm/15 kHz	-93		-112	
		NR_CCA_FR1_J				-111.5	
N_{oc} Note2	Config 1,2	NR_CCA_FR1_I	dBm/SCS	-90		-109	
		NR_CCA_FR1_J				-108.5	
$\hat{E}_s / I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	4.54	2.66	-4	-4
SS-RSRP Note3	Config 1,2	NR_CCA_FR1_I	dBm/SCS	-85.46	-87.34	-113	-113
		NR_CCA_FR1_J				-112.5	-112.5
SS-SINR Note3		NR_CCA_FR1_I	dB	0	-3.19	-5.46	-5.46
		NR_CCA_FR1_J					
Io Note3	Config 1,2	NR_CCA_FR1_I	dBm/ 38.16 MHz	-51.41		-75.41	
		NR_CCA_FR1_J				-74.91	
Propagation condition			-	AWGN			
Antenna configuration			-	1x2			

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 5: NR operating band groups are as defined in clause 3.5.2.					
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configuration.					
NOTE 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.					
NOTE 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.					
NOTE 9: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.					

A.10.5.3.1.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.31.1.1.

A.10.5.3.2 Inter-frequency measurement accuracy on PSCC

A.10.5.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.32.1.1 and 10.1.32.1.2 for inter-frequency measurement.

A.10.5.3.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.10.5.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in table A.10.5.3.2.2-2. In all test cases, Cell 2 is the PSCell with CCA and Cell 3 is target cell with CCA. Cell 1 is the E-UTRA cell of which specific test parameters for this test case are specified in table A.3.7A.2.1-1. Three sub-tests (Test 1, Test 2 and Test 3) are provided different N_{oc} on Cells 2 and 3.

Table A.10.5.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Config	Description
1	LTE FDD NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.10.5.3.2.2-2: SS-SINR Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
DL CCA model	Config 1,2		As specified in clause A.3.26.2.1					
UL CCA model	Config 1,2		As specified in clause A.3.26.2.2					
UL CCA probability	P_{CCA_UL}		1.0	-	1.0	-	1.0	-
DL CCA probability for semi-static channel access Note 7, 8	P_{CCA_DL}		0.9375	-	0.9375	-	0.9375	-
DL CCA probability for dynamic channel access Note 8, 9	$P_{CCA_DL_1}$		0.75	-	0.75	-	0.75	-

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
	$P_{CCA_DL_2}$			0.75	-	0.75	-	0.75	-
Duplex mode	Config 1,2			TDD					
TDD configuration	Config 1,2			TDDConf.1.1 CCA					
Downlink initial BWP configuration				DLBWP.0.1					
Downlink dedicated BWP configuration				DLBWP.1.1					
Uplink initial BWP configuration				ULBWP.0.1					
Uplink dedicated BWP configuration				ULBWP.1.1					
DRX Cycle configuration			ms	Not Applicable					
Gap pattern ID				0	-	0	-	0	-
TRS configuration	Config 1,2			TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1,2			SR.1.1 CCA		SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel	Config 1,2			CR.1.1 CCA		CR.1.1 CCA		CR.1.1 CCA	
Dedicated CORESET Reference Channel	Config 1,2			CCR.1.1 CCA		CCR.1.1 CCA		CCR.1.1 CCA	
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 2	Config 1,2		µs	-	3	-	3	-	3
DBT Window configuration	Config 1,2			DBT.1					
SSB configuration	Config 1,2			SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access					
SMTC configuration	Config 1,2			SMTC.1					
PDSCH/PDCCH subcarrier spacing	Config 1,2		kHz	30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		NR_CCA_FR1_I	dBm/15 kHz	-88		-108.5		-115.5	
		NR_CCA_FR1_J						-116	
N_{oc} Note2	Config 1,2	NR_CCA_FR1_I	dBm/SCS	-85		-105.5		-112.5	
		NR_CCA_FR1_J						-113	
$\hat{E}_s / I_{ot}$			dB	-1.75		20		-4.0	
$\hat{E}_s / N_{oc}$			dB	-1.75		20		-4.0	
SS-RSRP Note 3	Config 1,2	NR_CCA_FR1_I		-86.75		-85.5		-116.5	
		NR_CCA_FR1_J						-116	
SS-SINR Note3		NR_CCA_FR1_I	dB	-1.75		20		-4.0	
		NR_CCA_FR1_J							
Io Note3	Config 1,2	NR_CCA_FR1_I	dBm/ 38.16 MHz	-51.73		-54.41		-80	
		NR_CCA_FR1_J						-79.5	
Propagation condition			-	AWGN					
Antenna configuration			-	1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: NR operating band groups are as defined in clause 3.5.2. NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configuration NOTE 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 9: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.							

A.10.5.3.2.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.32.1.1 and 10.1.32.1.2.

A.10.5.3.3 Intra-frequency measurement accuracy on SCC

A.10.5.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.31.1.

A.10.5.3.3.2 Test Parameters

In this test case, Cell 2 (PSCell) is on frequency 1 while Cell 3 (SCell) and Cell 4 (target cell) which are intra-frequency neighbors, are on frequency 2. Supported test configuration are shown in table A.10.5.3.3.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in table A.10.5.3.3.2-2. The configuration of cell 1 (E-UTRA PCell) is specified in clause A.3.7A.2.1. In all test cases, Cell 2 is the PSCell with CCA, Cell 3 is the SCell with CCA, and Cell 4 is the target cell with CCA. Two sub-tests (Test 1 and Test 2) are provided different N_{oc} on Cells 2, 3 and 4.

Table A.10.5.3.3.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Config	Description
1	LTE FDD NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.10.5.3.3.2-2: SS-SINR Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 2 / Cell 3	Cell 4	Cell 2 / Cell 3	Cell 4
SSB ARFCN			freq1 for Cell 2 freq2 for Cell 3	freq2	freq1 for Cell 2 freq2 for Cell 3	freq2
DL CCA model	Config 1,2		As specified in clause A.3.26.2.1			
UL CCA model	Config 1,2		As specified in clause A.3.26.2.2			
UL CCA probability	P_{CCA_UL}		1.0	-	1.0	-
DL CCA probability for semi-static channel access Note 7, 8	P_{CCA_DL}		0.9375	-	0.9375	-
DL CCA probability for dynamic channel access Note 8, 9	$P_{CCA_DL_1}$		0.75	-	0.75	-
	$P_{CCA_DL_2}$		0.75	-	0.75	-
Duplex mode	Config 1,2		TDD			
TDD configuration	Config 1,2		TDDConf.1.1 CCA			

Parameter			Unit	Test 1		Test 2	
				Cell 2 / Cell 3	Cell 4	Cell 2 / Cell 3	Cell 4
Downlink initial BWP configuration				DLBWP.0.1			
Downlink dedicated BWP configuration				DLBWP.1.1			
Uplink initial BWP configuration				ULBWP.0.1			
Uplink dedicated BWP configuration				ULBWP.1.1			
DRX Cycle configuration			ms	Not Applicable			
TRS Configuration		Config 1,2		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel		Config 1,2		SR.1.1 CCA		SR1.1 CCA	
RMSI CORESET Reference Channel		Config 1,2		CR.1.1 CCA		CR.1.1 CCA	
Dedicated CORESET Reference Channel		Config 1,2		CCR.1.1 CCA		CCR.1.1 CCA	
OCNG Patterns				OP.1			
SS-RSSI-Measurement				Not Applicable			
Time offset with Cell 2		Config 1,2	µs	3 (for Cell 3)	3	3 (for Cell 3)	3
DBT Window Configuration		Config 1,2		DBT.1			
SSB configuration		Config 1,2		SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access			
SMTC configuration		Config 1,2		SMTC.1			
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	30			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		NR_CCA_FR1_I	dBm/15 kHz	-93		-112	
		NR_CCA_FR1_J				-111.5	
N_{oc} Note2	Config 1,2	NR_CCA_FR1_I	dBm/SCS	-90		-109	
		NR_CCA_FR1_J				-108.5	
$\hat{E}_s / I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	4.54	2.66	-4	-4
SS-RSRP Note3	Config 1,2	NR_CCA_FR1_I	dBm/SCS	-85.46	-87.34	-113	-113
		NR_CCA_FR1_J				-112.5	-112.5
SS-SINR Note3		NR_CCA_FR1_I	dB	0	-3.19	-5.46	-5.46
		NR_CCA_FR1_J					
Io Note3	Config 1,2	NR_CCA_FR1_I	dBm/ 38.16 MHz	-51.41		-75.41	
		NR_CCA_FR1_J				-74.91	
Propagation condition			-	AWGN			
Antenna configuration			-	1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: NR operating band groups are as defined in clause 3.5.2.

NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configuration

NOTE 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.

NOTE 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.

Parameter	Unit	Test 1		Test 2	
		Cell 2 / Cell 3	Cell 4	Cell 2 / Cell 3	Cell 4
NOTE 9: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.					

A.10.5.3.3.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.31.1.1.

A.10.5.4 L1-RSRP measurement for beam reporting with CCA serving cell

A.10.5.4.1 SSB based L1-RSRP measurement

A.10.5.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.33.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.10.5.4.1.1-1.

Table A.10.5.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

A.10.5.4.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell under CCA (Cell 2). Cell 2 operates on a carrier frequency with CCA and transmits SSBs in DBT window according to DL CCA model.

Two sub-tests (Test 1 and Test 2) are provided with different N_{oc} on Cell 2. The test parameters and applicability for Cell 1 are defined in A.3.7A.2. The test parameters for the Cell 2 are given in table A.10.5.4.1.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.10.5.4.1.2-1.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.10.5.4.1.2-1: FR1 SSB based L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1,2		freq1	freq1
DL CCA model	1,2		As specifieed in A.3.26.2.1	As specifieed in A.3.26.2.1
UL CCA model	1,2		As specified in A.3.26.2.2	As specified in A.3.26.2.2
Duplex mode	1,2		TDD	TDD
TDD Configuration	1,2		TDDConf.1.1 CCA	TDDConf.1.1 CCA
$BW_{channel}$	1,2	MHz	40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
Duplex mode	1,2		TDD	TDD
TDD configuration	1,2		TDDConf.1.1 CCA	TDDConf.1.1 CCA
PDSCH Reference measurement channel	1,2		SR.1.1 CCA	SR.1.1 CCA

Parameter		Config	Unit	Test 1	Test 2
RMSI CORESET Reference Channel		1,2		CR.1.1 CCA	CR.1.1 CCA
Dedicated CORESET Reference Channel		1,2		CCR.1.1 CCA	CCR.1.1 CCA
SSB configuration for Semi-static channel access		1,2		SSB.3 CCA	SSB.3 CCA
SSB configuration for Dynamic channel access		1,2		SSB.4 CCA	SSB.4 CCA
OCNG Patterns		1,2		OP.1	OP.1
TRS configuration		1,2		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration		1,2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration		1,2		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
DBT Window Configuration		1,2		DBT.1	DBT.1
reportConfigType		1,2		periodic	periodic
reportQuantity		1,2		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS		1,2		2	2
L1-RSRP reporting period		1,2		slot80	slot80
EPRE ratio of PSS to SSS		1,2	dB	0	0
EPRE ratio of PBCH DMRS to SSS		1,2			
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_TDD_FR1_I	1,2	dBm/15 kHz	-94.65	-113
N_{oc} Note2	NR_TDD_FR1_I	1,2	dBm/SCS	-91.65	-110
$\hat{E}_s / I_{ot}$		1,2	dB	10	-3
SS-RSRP Note3	NR_TDD_FR1_I	1,2	dBm/SCS	-81.65	-113
Io Note3	NR_TDD_FR1_I	1,2	dBm/ 38.16 MHz	-50.19	-77.19
$\hat{E}_s / N_{oc}$		1,2	dB	10	-3
Propagation condition		1,2		AWGN	AWGN
Antenna configuration		1,2		1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.10.5.4.1.3 Test Requirements

In both Test 1 and Test 2, the L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 2 shall fulfil the requirements in clauses 10.1.33.1.

A.10.5.5 RSSI

A.10.5.5.1 RSSI measurement accuracy on PSCC with CCA

A.10.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the RSSI measurement accuracy is within the specified limits. This test will partially verify the RSSI measurement accuracy requirements in section 10.1.34.1.

A.10.5.5.1.2 Test parameters

In all test cases, Cell 1 is E-UTRAN PCell on a licensed band, and Cell 2 is PSCell operating on a carrier frequency under CCA. RSSI is measured on channel number 1. Supported test configurations are shown in table A.10.5.5.1.2-1. The accuracy of RSSI intra-frequency measurements is tested by using the parameters in A.10.5.5.1.2-2 and A.10.5.5.1.2-3. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1.

Table A.10.5.5.1.2-1: RSSI supported test configurations

Configuration	Description
1	LTE FDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations above.	

Table A.10.5.5.1.2-2: RSSI test parameters

Parameter		Configurations	Unit	Test 1
				Cell 2
RF Channel Number				1
$BW_{channel}$			MHz	40
SSB configuration	Semi-static channel access Note 1, 3	1,2		SSB.1 CCA
	Dynamic channel access Note 2, 3	1,2		SSB.2 CCA
P_{CCA_DL}				0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				As specified in A.3.26.2.1
UL CCA model				As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth
Channel access bandwidth			MHz	20
DRX Cycle configuration			ms	Not Applicable
PDSCH Reference measurement channel				SR.1.1 CCA
RMSI CORESET Reference Channel				CR.1.1 CCA
Dedicated CORESET Reference Channel				CCR.1.1 CCA
OCNG Patterns				OP.1
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-87
$\hat{E}_s / I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)			dB	2.5

Parameter	Configurations	Unit	Test 1
			Cell 2
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)		dB	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-58.96
Propagation condition		-	AWGN
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.			

Table A.10.5.5.1.2-3: RSSI RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.10.5.5.1.3 Test Requirements

The average RSSI measurement accuracy shall fulfil the requirements in sections 10.1.34.1. The nominal RSSI used to evaluate the requirement shall be based on Io in slots corresponding to RSSI measurement time configuration (RMTC).

A.10.5.5.2 RSSI measurement accuracy on SCC with CCA

A.10.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the RSSI measurement accuracy is within the specified limits. This test will partially verify the RSSI measurement accuracy requirements in section 10.1.34.1.

A.10.5.5.2.2 Test parameters

In all test cases, Cell 1 is E-UTRAN PCell on a licensed band, Cell 2 is PSCell operating on a carrier frequency under CCA, Cell 3 is SCell on a carrier frequency under CCA. RSSI is measured on channel number 2. Supported test configurations are shown in table A.10.5.5.2.2-1. The accuracy of RSSI intra-frequency measurements is tested by using the parameters in A.10.5.5.2.2-2 and A.10.5.5.2.2-3. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1.

Table A.10.5.5.2.2-1: RSSI supported test configurations

Configuration	Description
1	LTE FDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations above.	

Table A.10.5.5.2.2-2: RSSI test parameters

Parameter	Configurations	Unit	Test 1	
			Cell 2	Cell 3
RF Channel Number			1	2
$BW_{channel}$		MHz	40	40

Parameter		Configurations	Unit	Test 1	
				Cell 2	Cell 3
SSB configuration	Semi-static channel access Note 1, 3	1,2		SSB.1 CCA	SSB.1 CCA
	Dynamic channel access Note 2, 3	1,2		SSB.2 CCA	SSB.2 CCA
P_{CCA_DL}				1	0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				1	0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				N/A	As specified in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth	
Channel access bandwidth			MHz	20	
DRX Cycle configuration			ms	Not Applicable	
PDSCH Reference measurement channel				SR.1.1 CCA	SR.1.1 CCA
RMSI CORESET Reference Channel				CR.1.1 CCA	CR.1.1 CCA
Dedicated CORESET Reference Channel				CCR.1.1 CCA	CCR.1.1 CCA
OCNG Patterns				OP.1	OP.1
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-87
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)			dB	2.5	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)			dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-103.5	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)				-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/measBW	-77.96	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)			dBm/measBW	-77.96	-58.96
Propagation condition			-	AWGN	
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.					

Parameter	Configurations	Unit	Test 1	
			Cell 2	Cell 3
NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.10.5.5.2.2-3: RSSI RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.10.5.5.2.3 Test Requirements

The average RSSI measurement accuracy shall fulfil the requirements in sections 10.1.34.1. The nominal RSSI used to evaluate the requirement shall be based on Io in slots corresponding to RSSI measurement time configuration (RMTC).

A.10.5.5.3 Inter-frequency RSSI measurement accuracy on a carrier with CCA

A.10.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the RSSI measurement accuracy is within the specified limits. This test will partially verify the RSSI measurement accuracy requirements in section 10.1.34.2.

A.10.5.5.3.2 Test parameters

In all test cases, Cell 1 is E-UTRAN PCell on a licensed band, Cell 2 is PSCell operating on a carrier frequency under CCA, and Cell 3 is the neighbour with CCA. RSSI is measured on channel number 2. Supported test configurations are shown in table A.10.5.5.3.2-1. The accuracy of RSSI inter-frequency measurements is tested by using the parameters in A.10.5.5.3.2-2 and A.10.5.5.3.2-3. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1.

Table A.10.5.5.3.2-1: RSSI supported test configurations

Configuration	Description
1	LTE FDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations above.	

Table A.10.5.5.3.2-2: RSSI test parameters

Parameter		Configurations	Unit	Test 1	
				Cell 2	Cell 3
RF Channel Number				1	2
$BW_{channel}$			MHz	40	40
SSB configuration	Semi-static channel access Note 1, 3	1,2		SSB.1 CCA	SSB.1 CCA
	Dynamic channel access Note 2, 3	1,2		SSB.2 CCA	SSB.2 CCA
P_{CCA_DL}				1	0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				1	0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				N/A	As specified in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth	

Parameter	Configurations	Unit	Test 1	
			Cell 2	Cell 3
Channel access bandwidth		MHz	20	
DRX Cycle configuration		ms	Not Applicable	
PDSCH Reference measurement channel			SR.1.1 TDD	NA
RMSI CORESET Reference Channel			CR.1.1 TDD	NA
Dedicated CORESET Reference Channel			CCR.1.1 TDD	NA
OCNG Patterns			OP.1	NA
EPRE ratio of PSS to SSS		dB	0	NA
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106	-87
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-103.5	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-58.96
Propagation condition		-	AWGN	
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.10.5.5.3.2-3: RSSI RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.10.5.5.3.3 Test Requirements

The average RSSI measurement accuracy shall fulfil the requirements in sections 10.1.34.2. The nominal RSSI used to evaluate the requirement shall be based on Io in slots corresponding to RSSI measurement time configuration (RMTC).

A.10.5.6 Channel occupancy

A.10.5.6.1 Channel occupancy measurement accuracy on PSCC with CCA

A.10.5.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the channel occupancy measurement accuracy is within the specified limits. This test will partially verify the channel occupancy measurement accuracy requirements in section 10.1.35.1.

A.10.5.6.1.2 Test parameters

In all test cases, Cell 1 is E-UTRAN PCell on a licensed band, and Cell 2 is PSCell operating on a carrier frequency under CCA. Channel occupancy is measured on channel number 1. Supported test configurations are shown in table A.10.5.6.1.2-1. The accuracy of channel occupancy intra-frequency measurements is tested by using the parameters in A.10.5.6.1.2-2 and A.10.5.6.1.2-3. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1.

Table A.10.5.6.1.2-1: CO supported test configurations

Configuration	Description
1	LTE FDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations above.	

Table A.10.5.6.1.2-2: CO test parameters

Parameter		Configurations	Unit	Test 1 Cell 2
RF Channel Number				1
$BW_{channel}$			MHz	40
SSB configuration	Semi-static channel access Note 1, 3	1,2		SSB.1 CCA
	Dynamic channel access Note 2, 3	1,2		SSB.2 CCA
P_{CCA_DL}				0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				As specified in A.3.26.2.1
UL CCA model				As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth
Channel access bandwidth			MHz	20
DRX Cycle configuration			ms	Not Applicable
PDSCH Reference measurement channel				SR.1.1 CCA
RMSI CORESET Reference Channel				CR.1.1 CCA
Dedicated CORESET Reference Channel				CCR.1.1 CCA
OCNG Patterns				OP.1
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				

Parameter	Configurations	Unit	Test 1
			Cell 2
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-87
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)		dB	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)		dB	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-58.96
Propagation condition		-	AWGN
channelOccupancyThreshold		dBm	-83
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.			

Table A.10.5.6.1.2-3: CO RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.10.5.6.1.3 Test Requirements

The nominal reported *channelOccupancy* shall be 100 %. At least 90 % of channel occupancy reports made by the UE shall indicate this value.

A.10.5.6.2 Channel occupancy measurement accuracy on SCC with CCA

A.10.5.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the channel occupancy measurement accuracy is within the specified limits. This test will partially verify the channel occupancy measurement accuracy requirements in section 10.1.35.1.

A.10.5.6.2.2 Test parameters

In all test cases, Cell 1 is E-UTRAN PCell on a licensed band, Cell 2 is PSCell operating on a carrier frequency under CCA, Cell 3 is SCell on a carrier frequency under CCA. Channel occupancy is measured on channel number 2. Supported test configurations are shown in table A.10.5.6.2.2-1. The accuracy of channel occupancy intra-frequency measurements is tested by using the parameters in A.10.5.6.2.2-2 and A.10.5.6.2.2-3. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1.

Table A.10.5.6.2.2-1: CO supported test configurations

Configuration	Description

1	LTE FDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations above.	

Table A.10.5.6.2.2-2: CO test parameters

Parameter		Configurations	Unit	Test 1	
				Cell 2	Cell 3
RF Channel Number				1	2
$BW_{channel}$			MHz	40	40
SSB configuration	Semi-static channel access Note 1, 3	1,2		SSB.1 CCA	SSB.1 CCA
	Dynamic channel access Note 2, 3	1,2		SSB.2 CCA	SSB.2 CCA
P_{CCA_DL}				1	0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				1	0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				N/A	As specified in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth	
Channel access bandwidth			MHz	20	
DRX Cycle configuration			ms	Not Applicable	
PDSCH Reference measurement channel				SR.1.1 CCA	SR.1.1 CCA
RMSI CORESET Reference Channel				CR.1.1 CCA	CR.1.1 CCA
Dedicated CORESET Reference Channel				CCR.1.1 CCA	CCR.1.1 CCA
OCNG Patterns				OP.1	OP.1
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-87
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)			dB	2.5	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)			dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-103.5	-103.5

Parameter	Configurations	Unit	Test 1	
			Cell 2	Cell 3
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-58.96
Propagation condition		-	AWGN	
channelOccupancyThreshold		dBm	-83	
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.10.5.6.2.2-3: CO RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.10.5.6.2.3 Test Requirements

The nominal reported *channelOccupancy* shall be 100 %. At least 90 % of channel occupancy reports made by the UE shall indicate this value.

A.10.5.6.3 Inter-frequency channel occupancy measurement accuracy on a carrier with CCA

A.10.5.6.3.1 Test Purpose and Environment

The purpose of this test is to verify that the channel occupancy measurement accuracy is within the specified limits. This test will partially verify the channel occupancy measurement accuracy requirements in section 10.1.35.2.

A.10.5.6.3.2 Test parameters

In all test cases, Cell 1 is E-UTRAN PCell on a licensed band, Cell 2 is PSCell operating on a carrier frequency under CCA, and Cell 3 is the neighbour with CCA. Channel occupancy is measured on channel number 2. Supported test configurations are shown in table A.10.5.6.3.2-1. The accuracy of channel occupancy inter-frequency measurements is tested by using the parameters in A.10.5.6.3.2-2 and A.10.5.6.3.2-3. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1.

Table A.10.5.6.3.2-1: CO supported test configurations

Configuration	Description
1	LTE FDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
2	LTE TDD; NR: TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations above.	

Table A.10.5.5.3.2-2: CO test parameters

Parameter		Configurations	Unit	Test 1	
				Cell 2	Cell 3
RF Channel Number				1	2
$BW_{channel}$			MHz	40	40
SSB configuration	Semi-static channel access Note 1, 3	1,2		SSB.1 CCA	SSB.1 CCA
	Dynamic channel access Note 2, 3	1,2		SSB.2 CCA	SSB.2 CCA
P_{CCA_DL}				1	0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				1	0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				N/A	As specified in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth	
Channel access bandwidth			MHz	20	
DRX Cycle configuration			ms	Not Applicable	
PDSCH Reference measurement channel				SR.1.1 TDD	NA
RMSI CORESET Reference Channel				CR.1.1 TDD	NA
Dedicated CORESET Reference Channel				CCR.1.1 TDD	NA
OCNG Patterns				OP.1	NA
EPRE ratio of PSS to SSS			dB	0	NA
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-87
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)			dB	2.5	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)			dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-103.5	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)				-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/measBW	-77.96	-77.96

Parameter	Configurations	Unit	Test 1	
			Cell 2	Cell 3
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-58.96
Propagation condition		-	AWGN	
channelOccupancyThreshold		dBm	-83	
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.10.5.6.3.2-3: CO RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.10.5.6.3.3 Test Requirements

The nominal reported *channelOccupancy* shall be 100 %. At least 90 % of channel occupancy reports made by the UE shall indicate this value.

A.11 NR Standalone Tests with NR PCell under CCA and Other NR Cells in FR1

Editor's note: Test cases for NR SA with NR PCell under CCA and SCell under CCA are also included here.

A.11.1 RRC_IDLE state mobility

A.11.1.1 Cell re-selection with both source and target NR carrier frequencies under CCA

A.11.1.1.1 Cell reselection to FR1 intra-frequency NR cells when subject to CCA on the serving and target cell

A.11.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements subject to CCA specified in clause 4.2A.2.3. Supported test configurations are shown in table A.11.1.1.1.2-1.

A.11.1.1.1.2 Test Parameters

The test scenario comprises of 1 NR carrier that is subject to CCA and 2 cells as given in tables A.11.1.1.1.2-1, A.11.1.1.1.2-2 and A.11.1.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.11.1.1.1.2-1: Supported test configurations

Configuration	Description
1	With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.1.1.1.2-2: General test parameters for intra frequency NR cell re-selection test case when subject to CCA

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell 1	
	Neighbour cells		1	Cell 2	
T2 end condition	Active cell		1	Cell 2	
	Neighbour cells		1	Cell 1	
Final condition	Active cell		1	Cell 1	
RF Channel Number			1	1	
Time offset between cells			1	3 µs	Synchronous cells
Access Barring Information		-	1	Not Sent	No additional delays in random access procedure.
SSB configuration	Semi-static channel access		1	SSB.1 CCA	(As defined in A.3.10A)
	Dynamic channel access			SSB.2 CCA	
DBT Window Configuration			1	DBT.1	As specified in clause A.3.28.1.
SMTC confituration				SMTC.1	

Parameter	Unit	Test configuration	Value	Comment
DL CCA model		1	As specified in clause A.3.26.2.1	
UL CCA model		1	As specified in clause A.3.26.2.2	
DRX cycle length	s	1	1.28	The value shall be used for all cells in the test.
PRACH configuration index		1	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell		1	Not configured	
T1	s	1	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2	s	1	40	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3	s	1	15	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.11.1.1.1.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case in AWGN when subject to CCA

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	TDDConf.1.1 CCA			TDDConf.1.1 CCA		
DL CCA probability for semi-static channel access (P_{CCA_DL})		1	0.9			0.9		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_1}$)		1	0.75			0.75		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_2}$)		1	0.5			0.5		
UL CCA probability P_{CCA_UL}		1	1			1		
$M_{d,max}$		1	16			16		
$M_{m,max}$		1	4			4		
$M_{e,max}$		1	8			8		
PDSCH RMC		1	SR.1.1 CCA			SR.1.1 CCA		
RMSI CORESET		1	CR.1.1 CCA			CR.1.1 CCA		
Dedicated CORESET		1	CCR.1.1 CCA			CCR.1.1 CCA		
OCNG Pattern		1	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-127			-127		
Pcompensation	dB	1	0			0		
$Qhyst_s$	dB	1	0			0		
$Qoffset_{s,n}$	dB	1	0			0		
Cell_selection_and_ reselection_quality_measurement		1	SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1	16	-3.11	2.79	-infinity	2.79	-3.11
N_{oc} Note2	dBm/SCS	1	-95					

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
N_{oc} Note2	dBm/15 kHz	1	-98					
$\hat{E}_s / N_{oc}$	dB	1	16	13	16	-infinity	16	13
SS-RSRP Note3	dBm/SCS	1	-79	-82	-79	-infinity	-79	-82
Io	dBm/38.16 MHz	1	-47.85	-46.12	-46.12	Same as parameters specified in Cell 1 columns-		
Treselection	s	1	0	0	0	0	0	0
SintrasearchP	dB	1	50			50		
Propagation Condition		1	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.11.1.1.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than $(25 + M_d)*1.28 + T_{SI_CCA}$ s. M_d is the number of DRX cycles with at least one SMTC where there are no SSBs available during the T_{detect,NR_Intra_CCA}. If $M_d > M_{d,max}$ the UE is required to restart the detection of Cell 2.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected cell shall be less than $(5+M_e)*1.28 + T_{SI_CCA}$ s. M_e is the number of DRX cycles with at least one SMTC where there are no SSBs available during the $T_{evaluate,NR_Intra_CCA}$. If $M_e > M_{e,max}$ the UE is required to restart the evaluation of Cell 2.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect,\ NR_Intra_CCA} + T_{SI_CCA}$, and to an already detected cell can be expressed as: $T_{evaluate,\ NR_\ intra_CCA} + T_{SI_CCA}$,

Where:

- $T_{detect,\ NR_Intra_CCA}$ See Table 4.2A.2.3-1 in clause 4.2A.2.3
- $T_{evaluate,\ NR_\ intra_CCA}$ See Table 4.2A.2.3-1 in clause 4.2A.2.3
- T_{SI_CCA} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell.

This gives a total of $(25 + M_d)*1.28 + T_{SI_CCA}$ s for the cell re-selection delay to a newly detectable cell and $(5+M_e)*1.28 + T_{SI_CCA}$ s for the cell re-selection delay to an already detected cell in the test case.

A.11.1.1.2 Cell reselection to FR1 inter-frequency NR case when subject to CCA on the serving and target cell

A.11.1.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements subject to CCA specified in clause 4.2A.2.4. Supported test configurations are shown in table A.11.1.1.2.2-1.

A.11.1.1.2.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers that are subject to CCA respectively as given in tables A.11.1.1.2.2-1, A.11.1.1.2.2-2 and A.11.1.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

Table A.11.1.1.2.2-1: Supported test configurations

Configuration	Description of Cell 1 with CCA	Description of Cell 2 with CCA
1	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.1.1.2.2-2: General test parameters for FR1 inter frequency NR cell re-selection test case when subject to CCA

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell 2	The UE camps on Cell 2 in the initial phase and during T1 period the UE reselects to Cell 1
T1 end condition	Active cell		1	Cell 1	The UE shall perform reselection to Cell 1 during T1
	Neighbour cells		1	Cell 2	
T3 end condition	Active cell		1	Cell 2	The UE shall perform reselection to Cell 2 with higher priority during T3
RF Channel Number			1	1, 2	
Time offset between cells			1	3 μs	Synchronous cells
Access Barring Information		-	1	Not Sent	No additional delays in random access procedure.
SSB configuration	Semi-static channel access		1	SSB.1 CCA (As defined in A.3.10A)	
	Dynamic channel access			SSB.2 CCA (As defined in A.3.10A)	
DBT Window Configuration			1	DBT.1	As specified in clause A.3.28.1.
SMTC configuration			1	SMTC.1	
DL CCA model			1	As specified in clause A.3.26.2.1	
UL CCA model			1	As specified in clause A.3.26.2.2	
DRX cycle length		s	1	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1	Not configured	
T1		s	1	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.

Parameter	Unit	Test configuration	Value	Comment
T2	s	1	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3	s	1	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.11.1.1.2.2-3: Cell specific test parameters for FR1 inter frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	TDDConf.1.1 CCA			TDDConf.1.1 CCA		
DL CCA probability for semi-static channel access (P_{CCA_DL})		1	0.9			0.9		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_1}$)		1	0.75			0.75		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_2}$)		2	0.5			0.5		
UL CCA probability P_{CCA_UL}		1	1			1		
$M_{d,max}$		1	16			16		
$M_{m,max}$		1	4			4		
$M_{e,max}$		1	8			8		
PDSCH RMC		1	SR.1.1 CCA			SR.1.1 CCA		
RMSI CORESET		1	CR.1.1 CCA			CR.1.1 CCA		
Dedicated CORESET		1	CCR.1.1 CCA			CCR.1.1 CCA		
OCNG Pattern		1	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-137			-137		
Pcompensation	dB	1	0			0		
$Qhyst_s$	dB	1	0			0		
$Qoffset_{s,n}$	dB	1	0			0		
Cell_selection_and_ reselection_quality_measurement		1	SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1	14	14	14	-4	-infinity	12
N_{oc} Note2	dBm/SCS	1	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
$\hat{E}_s / N_{oc}$	dB	1	14	14	14	-4	-infinity	12
SS-RSRP Note3	dBm/SCS	1	-81	-81	-81	-99	-infinity	-83
Io	dBm/38.16 MHz	1	-49.79	-49.79	-49.79	-65.50	-infinity	-54.69
Treselection	s	1	0	0	0	0	0	0
SnonintrasearchP	dB	1	50			50		
$Thresh_{x,high}$	dB	1	48			48		
$Thresh_{serving,low}$	dB	1	44			44		
$Thresh_{x,low}$	dB	1	50			50		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Propagation Condition		1	AWGN					
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.								

A.11.1.1.2.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps again on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 60 + 1.28 x (5 + M_e) + T_{SI_CCA} s. M_e is the number of DRX cycles with at least one SMTC where there are no SSBs available during the $T_{evaluate,NR_Intra_CCA}$. If $M_e > M_{e,max}$ the UE is required to restart the evaluation of Cell 2.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to a lower priority cell shall be less than 1.28 x (5 + M_e) + T_{SI_CCA} s. M_e is the number of DRX cycles with at least one SMTC where there are no SSBs available during the $T_{evaluate,NR_Intra_CCA}$. If $M_e > M_{e,max}$ the UE is required to restart the evaluation of Cell 2.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search}$ + $T_{evaluate,\ NR_\ inter_CCA}$ + T_{SI_CCA}, and to a lower priority cell can be expressed as: $T_{evaluate,\ NR_\ inter_CCA}$ + T_{SI_CCA},

Where:

- $T_{higher_priority_search}$ See clause 4.2.2.7
- $T_{evaluate,\ NR_\ inter_CCA}$ See Table 4.2A.2.4-1 in clause 4.2A.2.4
- T_{SI_CCA} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell.

This gives a total of 60 + 1.28 x (5 + M_e) + T_{SI_CCA} s for the cell re-selection delay to a higher priority cell and 1.28 x (5 + M_e) + T_{SI_CCA} s for the cell re-selection delay to a lower priority cell in the test case.

A.11.1.2 Cell re-selection to NR with source NR carrier frequency under CCA

A.11.1.2.1 Cell reselection to FR1 inter-frequency NR case when serving cell is subject to CCA

A.11.1.2.1.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2.2.4 when the serving cell is subject to CCA. Supported test configurations are shown in table A.11.1.2.1.2-1.

A.11.1.2.1.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers where the first carrier is subject to CCA as given in tables A.11.1.2.1.2-1, A.11.1.2.1.2-2 and A.11.1.2.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

Table A.11.1.2.1.2-1: Supported test configurations

Configuration	Description of a cell with CCA	Description of a cell without CCA
1	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.11.1.2.1.2-2: General test parameters for FR1 inter frequency NR cell re-selection test case when serving cell is subject to CCA

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 2	The UE camps on Cell 2 which is subject to CCA in the initial phase and during T1 period the UE reselects to Cell 1 which is an inter-frequency NR cell
T1 end condition	Active cell		1, 2, 3	Cell 1	The UE shall perform reselection to Cell 1 during T1
	Neighbour cells		1, 2, 3	Cell 2	
T3 end condition	Active cell		1, 2, 3	Cell 2	The UE shall perform reselection to Cell 2 with higher priority during T3
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	Cell 1: SSB.1 FR1 Cell 2: SSB.1 CCA for semi-static channel access; Cell 2: SSB.2 CCA for dynamic channel access	
			2	Cell 1: SSB.1 FR1 Cell 2: SSB.1 CCA for semi-static channel access; Cell 2: SSB.2 CCA for dynamic channel access	
			3	Cell 1: SSB.2 FR1 Cell 2: SSB.1 CCA for semi-static channel access; Cell 2: SSB.2 CCA for dynamic channel access	
SMTC configuration			1	Cell 1: SMTC.1 Cell 2: SMTC.1	
			2	Cell 1: SMTC.1 Cell 2: SMTC.1	
			3	Cell 1: SMTC.1 Cell 2: SMTC.1	

Parameter	Unit	Test configuration	Value	Comment
DBT Window Configuration		1, 2, 3	Cell 1: N/A Cell 2: DBT.1	As specified in clause A.3.28.1.
DL CCA model		1, 2, 3	Cell 1: N/A Cell 2: As specified in clause A.3.26.2.1	
UL CCA model		1, 2, 3	Cell 1: N/A Cell 2: As specified in clause A.3.26.2.2	
DRX cycle length	s	1, 2, 3	1.28	The value shall be used for all cells in the test.
PRACH configuration index		1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell		1, 2, 3	Not configured	
T1	s	1, 2, 3	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2	s	1, 2, 3	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3	s	1, 2, 3	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.11.1.2.1.2-3: Cell specific test parameters for FR1 inter frequency NR cell re-selection test case in AWGN when serving cell is subject to CCA

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			TDDConf.1.1.CCA		
		2	TDDConf.1.1			TDDConf.1.1.CCA		
		3	TDDConf.2.1			TDDConf.1.1.CCA		
DL CCA probability for semi-static channel access (P_{CCA_DL})		1, 2, 3	N/A			0.9		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_1}$)		1, 2, 3	N/A			0.75		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_2}$)		1, 2, 3	N/A			0.5		
UL CCA probability P_{CCA_UL}		1, 2, 3	N/A			1		
$M_{d,max}$		1, 2, 3	N/A			16		
$M_{m,max}$		1, 2, 3	N/A			4		
$M_{e,max}$		1, 2, 3	N/A			8		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 CCA		
		2	SR.1.1 TDD			SR.1.1 CCA		
		3	SR.2.1 TDD			SR.1.1 CCA		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 CCA		
		2	CR.1.1 TDD			CR.1.1 CCA		
		3	CR.2.1 TDD			CR.1.1 CCA		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 CCA		
		2	CCR.1.1 TDD			CCR.1.1 CCA		
		3	CCR.2.1 TDD			CCR.1.1 CCA		
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-140			-137		
		3	-137			-137		
Pcompensation	dB	1, 2, 3	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
$\hat{E}_s/I_{ot}$	dB	1	14	14	14	-4	-infinity	12
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98			-95		
		2	-98			-95		
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	14	14	14	-4	-infinity	12
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-84	-84	-84	-99	-infinity	-83
		2	-84	-84	-84	-99	-infinity	-83
		3	-81	-81	-81	-99	-infinity	-83
Io	dBm/9.36 MHz	1	-55.88	-55.88	-55.88	-65.50	-66.96	-54.69
	dBm/9.36 MHz	2	-55.88	-55.88	-55.88	-65.50	-66.96	-54.69
	dBm/38.16 MHz	3	-49.79	-49.79	-49.79	-65.50	-66.96	-54.69
Treselection	s	1, 2, 3	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2, 3	50			50		
$Thresh_{x, highP}$	dB	1, 2, 3	48			48		
$Thresh_{serving, lowP}$	dB	1, 2, 3	44			44		
$Thresh_{x, lowP}$	dB	1, 2, 3	50			50		
Propagation Condition		1, 2, 3	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.11.1.2.1.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps again on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than $60 + 1.28 \times (5 + M_e) + T_{SI_CCA}$ s. M_e is the number of DRX cycles with at least one SMTC where there are no SSBs available during the $T_{evaluate,NR_Intra_CCA}$. If $M_e > M_{e,max}$ the UE is required to restart the evaluation of Cell 2.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate,\ NR_ inter_CCA} + T_{SI_CCA}$, and to a lower priority cell can be expressed as: $T_{evaluate,\ NR_ inter} + T_{SI\text{-}NR}$.

Where:

- $T_{higher_priority_search}$ See clause 4.2.2.7
- $T_{evaluate,\ NR_ inter_CCA}$ See Table 4.2A.2.4-1 in clause 4.2A.2.4
- T_{SI_CCA} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell.
- $T_{evaluate,\ NR_ inter}$ See Table 4.2.2.4-1 in clause 4.2.2.4
- $T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test cases.

This gives a total of $60 + 1.28 \times (5 + M_e) + T_{SI_CCA}$ s for the cell re-selection delay to a higher priority cell and 7.68 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 8 s.

A.11.1.3 Cell re-selection from NR carrier with target NR carrier frequency under CCA

A.11.1.3.1 Cell reselection to FR1 inter-frequency NR case when target cell is subject to CCA

A.11.1.3.1.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2A.2.4 when the target cell is subject to CCA. Supported test configurations are shown in table A. 11.1.3.1.2-1.

A.11.1.3.1.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers where the second carrier is subject to CCA as given in tables A.11.1.3.1.2-1, A.11.1.3.1.2-2 and A.11.1.3.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

Table A.11.1.3.1.2-1: Supported test configurations

Configuration	Description of a cell without CCA	Description of a cell with CCA
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.11.1.3.1.2-2: General test parameters for FR1 inter frequency NR cell re-selection test case when target cell is subject to CCA

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 2	The UE camps on Cell 2 which is an inter-frequency NR cell in the initial phase and during T1 period the UE reselects to Cell 1 which is cell subject to CCA
	Neighbour cell		1, 2, 3	Cell 1	
T1 end condition	Active cell		1, 2, 3	Cell 1	The UE shall perform reselection to Cell 1 during T1
	Neighbour cells		1, 2, 3	Cell 2	
T3 end condition	Active cell		1, 2, 3	Cell 2	The UE shall perform reselection to Cell 2 with higher priority during T3
	Neighbour cell		1, 2, 3	Cell 1	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	Cell 1: SSB.1 CCA for semi-static channel access; Cell 1: SSB.2 CCA for dynamic channel access; Cell 2: SSB.1 FR1	
			2	Cell 1: SSB.1 CCA for semi-static channel access; Cell 1: SSB.2 CCA for dynamic channel access; Cell 2: SSB.1 FR1	
			3	Cell 1: SSB.1 CCA for semi-static channel access; Cell 1: SSB.2 CCA for dynamic channel access; Cell 2: SSB.2 FR1	
SMTC configuration			1	Cell 1: SMTC.1 Cell 2: SMTC.2	
			2	Cell 1: SMTC.1 Cell 2: SMTC.1	
			3	Cell 1: SMTC.1 Cell 2: SMTC.1	
DBT Window Configuration			1, 2, 3	Cell 1: DBT.1 Cell 2: N/A	As specified in clause A.3.28.1.
DL CCA model			1, 2, 3	Cell 1: As specified in clause A.3.26.2.1 Cell 2: N/A	
UL CCA model			1, 2, 3	Cell 1: As specified in clause A.3.26.2.2 Cell 2: N/A	
DRX cycle length		s	1, 2, 3	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2

Parameter	Unit	Test configuration	Value	Comment
rangeToBestCell		1, 2, 3	Not configured	
T1	s	1, 2, 3	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2	s	1, 2, 3	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3	s	1, 2, 3	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.11.1.3.1.2-3: Cell specific test parameters for FR1 inter frequency NR cell re-selection test case in AWGN when target cell is subject to CCA

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	TDDConf.1.1.CCA			N/A		
		2	TDDConf.1.1.CCA			TDDConf.1.1		
		3	TDDConf.1.1.CCA			TDDConf.2.1		
DL CCA probability for semi-static channel access (P_{CCA_DL})		1, 2, 3	0.9			N/A		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_1}$)		1, 2, 3	0.75			N/A		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_2}$)		1, 2, 3	0.5			N/A		
UL CCA probability P_{CCA_UL}		1, 2, 3	1			N/A		
$M_{d,max}$		1, 2, 3	16			N/A		
$M_{m,max}$		1, 2, 3	4			N/A		
$M_{e,max}$		1, 2, 3	8			N/A		
PDSCH RMC configuration		1	SR.1.1 CCA			SR.1.1 FDD		
		2	SR.1.1 CCA			SR.1.1 TDD		
		3	SR.1.1 CCA			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 CCA			CR.1.1 FDD		
		2	CR.1.1 CCA			CR.1.1 TDD		
		3	CR.1.1 CCA			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 CCA			CCR.1.1 FDD		
		2	CCR.1.1 CCA			CCR.1.1 TDD		
		3	CCR.1.1 CCA			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-137			-140		
		3	-137			-137		
Pcompensation	dB	1, 2, 3	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1	14	14	14	-4	-infinity	12
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-95			-98		
		2	-95			-98		
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
		3						
$\hat{E}_s / N_{oc}$	dB	1	14	14	14	-4	-infinity	12
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-81	-81	-81	-102	-infinity	-86
		2	-81	-81	-81	-102	-infinity	-86
		3	-81	-81	-81	-99	-infinity	-83
Io	dBm/9.36 MHz	1	--	--	--	-68.60	-70.05	-57.78
	dBm/9.36 MHz	2	--	--	--	-68.60	-70.05	-57.78
	dBm/38.16 MHz	3	-49.79	-49.79	-49.79	-65.50	-66.96	-54.69
Treselection	s	1, 2, 3	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2, 3	50			50		
$Thresh_{x, highP}$	dB	1, 2, 3	48			48		
$Thresh_{serving, lowP}$	dB	1, 2, 3	44			44		
$Thresh_{x, lowP}$	dB	1, 2, 3	50			50		
Propagation Condition		1, 2, 3	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.11.1.3.1.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps again on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

$1.28 \times (5 + M_e) + T_{SI_CCA}$ s. Me is the number of DRX cycles with at least one SMTC where there are no SSBs available during the $T_{evaluate,NR_Intra_CCA}$. If $M_e > M_{e,max}$ the UE is required to restart the evaluation of Cell 2.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate,\ NR_\ inter} + T_{SI\text{-}NR}$, and to a lower priority cell can be expressed as: $T_{evaluate,\ NR_\ inter} + T_{SI\text{-}NR}$.

Where:

- $T_{higher_priority_search}$ See clause 4.2.2.7
- $T_{evaluate,\ NR_\ inter_CCA}$ See Table 4.2A.2.4-1 in clause 4.2A.2.4
- T_{SI_CCA} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell.
- $T_{evaluate,\ NR_\ inter}$ See Table 4.2.2.4-1 in clause 4.2.2.4

- T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority cell and 1.28 x (5 + M_e) + T_{SI_CCA} s for the cell re-selection delay to a lower priority cell in the test case.

A.11.1.4 Inter-RAT cell re-selection to E-UTRAN with source NR carrier frequency under CCA

A.11.1.4.1 Cell reselection to higher priority E-UTRAN when serving cell is subject to CCA

A.11.1.4.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR cell subject to CCA to E-UTRAN inter-RAT cell reselection requirements specified in clause 4.2A.2.5 when the E-UTRAN cell is of higher priority.

A.11.1.4.1.2 Test Parameters

The test scenario comprises of one NR cell which is subject to CCA and one E-UTRAN cell as given in tables A.11.1.4.1.2-1, A.11.1.4.1.2-2, A.11.1.4.1.2-3 and A.11.1.4.1.2-4. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. NR Cell 1 is already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of higher priority than Cell 1.

Table A.11.1.4.1.2-1: Supported test configurations

Configuration	Description of a cell with CCA	Description of a cell without CCA
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.11.1.4.1.2-2: General test parameters for NR cell subject to CCA to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	The UE camps on Cell 1 in the initial phase and during T2 period the UE reselects to Cell 2.
T2 end condition	Active cell		1, 2	Cell 2	The UE shall perform reselection to cell 2 during T2.
	Neighbour cells		1, 2	Cell 1	
T3 end condition	Active cell		1, 2	Cell 1	The UE shall perform reselection to cell 1 during T3 for iteration of the tests.
	Neighbour cells		1, 2	Cell 2	
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC.1	
DBT Window Configuration			1, 2	DBT.1	As specified in clause A.3.28.1.
SSB configuration				Cell 1: SSB.1 CCA for semi-static channel access; Cell 1: SSB.2 CCA for dynamic channel access;	
DL CCA model			1, 2	As specified in clauseA.3.26.2.1	

Parameter	Unit	Test configuration	Value	Comment
UL CCA model		1, 2	As specified in clause A.3.26.2.2	
DRX cycle length	s	1, 2	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index		1, 2	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index		1	53	As specified in table 5.7.1-2 in TS 36.211 [23]
		2	4	
E-UTRAN PRACH configuration index		1	53	As specified in table 5.7.1-2 in TS 36.211 [23]
		2	4	
T1	s	1, 2	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2.
T2	s	1, 2	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3	s	1, 2	15	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.11.1.4.1.2-3: Cell specific test parameters for NR Cell 1 subject to CCA

Parameter	Unit	Test configuration	Cell 1		
			T1	T2	T3
TDD configuration		1, 2	TDDConf.1.1.CCA		
DL CCA probability for semi-static channel access (P_{CCA_DL})		1, 2	0.9		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_1}$)		1, 2	0.75		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_2}$)		1, 2	0.5		
UL CCA probability P_{CCA_UL}		1, 2	1		
$M_{d,max}$		1, 2	16		
$M_{m,max}$		1, 2	4		
$M_{e,max}$		1, 2	8		
PDSCH parameters		1, 2	SR.1.1 CCA		
RMSI CORESET parameters		1, 2	CR.1.1 CCA		
Dedicated CORESET parameters		1, 2	CCR.1.1 CCA		
SSB parameters		1, 2	SSB.1 CCA for semi-static channel access; SSB.2 CCA for dynamic channel access		
NR SMTC parameters		1, 2	SMTC.1		
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2	DLBWP.0		
Initial UL BWP configuration		1, 2	ULBWP.0		
RLM-RS		1, 2	SSB		
Qrxlevmin	dBm/SCS	1, 2	-137		
N_{oc}	dBm/SCS	1, 2	-95		
N_{oc}	dBm/15 kHz	1, 2	-98		
SS-RSRP		1, 2	-81	-81	-81
$\hat{E}_s / I_{ot}$	dB	1, 2	14	14	14
$\hat{E}_s / N_{oc}$	dB	1, 2	14	14	14
Io	dBm/38.16 MHz	1, 2	-49.79	-49.79	-49.79
Treselection	s	1, 2	0		
Snonintrasearch	dB	1, 2	50		

Parameter	Unit	Test configuration	Cell 1		
			T1	T2	T3
$Thresh_{x, high (Note 2)}$	dB	1, 2	48		
$Thresh_{serving, low}$	dB	1, 2	44		
$Thresh_{x, low}$	dB	1, 2	50		
Propagation Condition		1, 2	AWGN		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell NOTE 3: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.					

Table A.11.1.4.1.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2		
		T1	T2	T3
E-UTRA RF Channel number		1		
$BW_{channel}$	MHz	10		
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6		
PBCH_RA	dB	0		
PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			
PHICH_RA	dB			
PHICH_RB	dB			
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA[Note 1]	dB			
OCNG_RB[Note 1]	dB			
Qrxlevmin	dBm	-140		
N_{oc}	dBm/15 kHz	-98		
RSRP	dBm/15 KHz	-infinity	-86	-102
$\hat{E}_s / I_{ot}$	dB	-infinity	12	-4
$\hat{E}_s / N_{oc}$	dB	-infinity	12	-4
$Treselection_{EUTRAN}$	s	0		
Snonintrasearch	dB	50		
$Thresh_{x, high (Note 2)}$	dB	48		
$Thresh_{serving, low}$	dB	44		
$Thresh_{x, low}$	dB	50		
Propagation Condition		AWGN		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell				

A.11.1.4.1.3 Test Requirements

The cell reselection delay to a higher priority E-UTRAN cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

- $T_{higher_priority_search}$ See clause 4.2.2.7
- $T_{evaluate,\ E\text{-}UTRAN}$ See Table 4.2.2.5-1 in clause 4.2.2.5
- $T_{SI\text{-}E\text{-}UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority E-UTRAN cell.

A.11.1.4.2 Cell reselection to lower priority E-UTRAN when serving cell is subject to CCA

A.11.1.4.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR cell subject to CCA to E-UTRAN inter-RAT cell reselection requirements specified in clause 4.2A.2.5 when the E-UTRAN cell is of lower priority.

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.11.1.4.2.1-1, A.11.1.4.2.1-2, A.11.1.4.2.1-3 and A.11.1.4.2.1-4. The test consists of three successive time periods, with time duration of T1 and T2 respectively. Both NR Cell 1 and E-UTRAN Cell 2 are already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of lower priority than Cell 1.

Table A.11.1.4.2.1-1: Supported test configurations

Configuration	Description of a cell with CCA	Description of a cell without CCA
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.11.1.4.2.1-2: General test parameters for NR cell subject to CCA to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	The UE camps on Cell 1 in the initial phase.
T1 end condition	Active cell		1, 2	Cell 2	The UE shall perform reselection to Cell 2 during T1.
	Neighbour cells		1, 2	Cell 1	
T2 end condition	Active cell		1, 2	Cell 1	The UE shall perform reselection to Cell 1 during T2 for iteration of the tests.
	Neighbour cells		1, 2	Cell 2	
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC.1	
DBT Window Configuration			1, 2	DBT.1	As specified in clause A.3.28.1.
DL CCA model			1, 2	As specified in clause A.3.26.2.1	
UL CCA model			1, 2	As specified in clause A.3.26.2.2	
DRX cycle length		s	1, 2	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			2	4	

Parameter	Unit	Test configuration	Value	Comment
T1	s	1, 2	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2	s	1, 2	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.11.1.4.2.1-3: Cell specific test parameters for NR Cell 1 subject to CCA

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 2	TDDConf.1.1.CCA	
DL CCA probability for semi-static channel access (P_{CCA_DL})		1, 2	0.9	
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_1}$)		1, 2	0.75	
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_2}$)		1, 2	0.5	
UL CCA probability P_{CCA_UL}		1, 2	1	
$M_{d,max}$		1, 2	16	
$M_{m,max}$		1, 2	4	
$M_{e,max}$		1, 2	8	
PDSCH RMC configuration		1, 2	SR.1.1 CCA	
RMSI CORESET RMC Configuration		1, 2	CR.1.1 CCA	
Dedicated CORESET RMC Configuration		1, 2	CCR.1.1 CCA	
SSB configuration		1, 2	SSB.1 CCA for semi-static channel access; SSB.2 CCA for dynamic channel access	
SMTC configuration		1, 2	SMTC.1	
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2	DLBWP.0	
Initial UL BWP configuration		1, 2	ULBWP.0	
RLM-RS		1, 2	SSB	
Qrxlevmin	dBm/SCS	1, 2	-137	
N_{oc}	dBm/SCS	1, 2	-95	
N_{oc}	dBm/15 kHz	1, 2	-98	
SS-RSRP	dBm/SCS	1, 2	-99	-83
$\hat{E}_s / I_{ot}$	dB	1, 2	-4	12
$\hat{E}_s / N_{oc}$	dB	1, 2	-4	12
Io	dBm/38.16 MHz	1, 2	-62.50	-51.69
Treselection	s	1, 2	0	
Snonintrasearch	dB	1, 2	50	
$Thresh_{x, high (Note 2)}$	dB	1, 2	48	
$Thresh_{serving, low}$	dB	1, 2	44	
$Thresh_{x, low}$	dB	1, 2	50	
Propagation Condition		1, 2	AWGN	

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell NOTE 3: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.				

Table A.11.1.4.2.1-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA[Note 1]	dB		
OCNG_RB[Note 1]	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 KHz	-84	-84
$\hat{E}_s / I_{ot}$	dB	14	14
$\hat{E}_s / N_{oc}$	dB	14	14
$Treselection_{EUTRAN}$	s	0	
Snonintrasearch	dB	50	
$Thresh_{x, high (Note 2)}$	dB	48	
$Thresh_{serving, low}$	dB	44	
$Thresh_{x, low}$	dB	50	
Propagation Condition		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell			

A.11.1.4.2.2 Test Requirements

The cell reselection delay to a lower priority E-UTRAN cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

- $T_{evaluate, E-UTRAN}$ See Table 4.2.2.5-1 in clause 4.2.2.5

- $T_{SI\text{-}E\text{-}UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 7.68 s, allow 8 s for the cell re-selection delay to a lower priority E-UTRAN cell.

A.11.2 RRC_CONNECTED state mobility

A.11.2.1 Handover

A.11.2.1.1 Intra-frequency handover from FR1 carrier under CCA to FR1 carrier under CCA; known target cell

A.11.2.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR intra frequency handover requirements from FR1 carrier under CCA to FR1 carrier under CCA specified in clause 6.1B.1.2.

A.11.2.1.1.2 Test Parameters

Supported test configurations are shown in table A.11.2.1.1.2-1. Both handover delay and interruption length are tested by using the parameters in table A.11.2.1.1.2-2, and A.11.2.1.1.2-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2.

NR shall send a RRC message implying handover to Cell 2. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3. T3 is defined as the end of the last TTI containing the RRC message implying handover.

Table A.11.2.1.1.2-1: Intra-frequency handover from FR1 carrier under CCA to FR1 carrier under CCA test configurations

Config	Description
1	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.2.1.1.2-2: General test parameters Intra-frequency handover from FR1 carrier under CCA to FR1 carrier under CCA

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	On the carrier under CCA
	Neighbouring cell		Cell 2	On the carrier under CCA
Final condition	Active cell		Cell 2	On the carrier under CCA
DL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.26.2.1	
	Semi-static channel access Note 2, 3			
UL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.26.2.2	
	Semi-static channel access Note 2,3			
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T304		ms	500	
L_{CCA_DL}			5	

Parameter	Unit	Value	Comment
W_{CCA_DL}	ms	T304	
L_{CCA_UL}		5	
W_{CCA_UL}	ms	T304	
T1	s	5	
T2	s	≤ 5	
T3	s	$\geq T_{interrupt}$	$T_{interrupt}$ is defined in clause 6.1B.1.2
NOTE 1: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 2: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.			

Table A.11.2.1.1.2-3: Cell specific test parameters for NR FR1-FR1 Intra frequency handover test case

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			1		
P_{CCA_DL} for dynamic channel access Note 4,6		-	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75			$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		
P_{CCA_DL} for semi-static channel access Note 5,6		-	P_{CCA_DL}=0.9375			P_{CCA_DL}=0.9375		
P_{CCA_UL} for dynamic channel access Note 4,6		-	0.75			0.75		
P_{CCA_UL} for semi-static channel access Note 5,6		-	0.87			0.87		
TDD configuration	Config 1		TDDConf.1.1 CCA					
$BW_{channel}$	Config 1		40: $N_{PRB,c}$ = 106					
BWP BW	Config 1		40: $N_{PRB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference	Config 1		SR.1.1 CCA					
CORESET Reference Channel	Config 1		CR.1.1 CCA					
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 CCA					
TRS configuration	Config 1		TRS.1.1 TDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
DBT window configuration	Config 1		DBT.1					
SSB configuration for semi-static channel access Note 4, 6	Config 1		SSB.1 CCA					
SSB configuration for dynamic channel access Note 5, 6	Config 1		SSB.2 CCA					
ssb-PositionQCL	Config 1		[1]					
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1	kHz	30 kHz					
PRACH configuration			FR1 PRACH configuration 1 under CCA					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15 kHz	-98					
N_{oc} Note2	Config 1	dBm/SCS	-95					
$\hat{E}_s / I_{ot}$		dB	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s / N_{oc}$		dB	8	8	8	-Infinity	11	11
SSB_RP	Config 1	dBm/SCS	-87	-87	-87	-Infinity	-84	-84
Io Note3	Config 1	dBm/ 38.16 MHz	-55.31	-50.96	-50.96	-55.31	-50.96	-50.96
Propagation condition		-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.11.2.1.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than $T_{interrupt}$ from the beginning of time period T3, where $T_{interrupt}$ is defined in clause 6.1B.1.2
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$

$T_{search} = 0$.

$T_{processing} = 20$ ms.

$T_{margin} = 2$ ms.

$T_{\Delta} = (1+ L_2) *20$ ms.

$T_{IU} = (1+ L_3)*10 + 10$ ms

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2], L_2 is the number of SMTC occasions not available at the UE during the time tracking period where $L_2 \leq L_{CCA_DL}$, and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure, where $L_3 \leq L_{CCA_UL}$. $L_3 = 0$ for Type 2C UL channel access procedure as defined in TS 37.213 [33]. The interruption time considering the potential extensions caused by L_1, L_2 , L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2]. Test equipment should make sure that L_{CCA_DL} and L_{CCA_UL} are not exceeded during a test by monitoring the number of CCA failures and preventing additional CCA failures from happening after L_{CCA_DL} or L_{CCA_UL} is reached.

A.11.2.1.2 Intra-frequency handover from FR1 carrier under CCA to FR1 carrier under CCA; unknown target cell

A.11.2.1.2.1 Test Purpose and Environment

This test is to verify the requirement intra frequency handover requirements from FR1 carrier under CCA to FR1 carrier under CCA specified in clause 6.1B.1.2.

A.11.2.1.2.2 Test Parameters

Supported test configurations are shown in table A.11.2.1.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.11.2.1.2.2-2, and A.11.2.1.2.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.11.2.1.2.2-1: Intra-frequency handover from FR1 carrier under CCA to FR1 carrier under CCA test configurations

Config	Description
1	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.2.1.2.2-2: General test parameters Intra-frequency handover from FR1 carrier under CCA to FR1 carrier under CCA

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	On the carrier under CCA
	Neighbouring cell		Cell 2	On the carrier under CCA
Final condition	Active cell		Cell 2	On the carrier under CCA
DL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.26.2.1	
	Semi-static channel access Note 2, 3			
UL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.26.2.2	
	Semi-static channel access Note 2,3			
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T304		ms	500	
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T304	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T304	
T1		s	5	
T2		s	≥ $T_{interrupt}$	$T_{interrupt}$ is defined in clause 6.1B.1.2
NOTE 1: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 2: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.11.2.1.2.2-3: Cell specific test parameters for NR FR1-FR1 Intra frequency handover test case

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
NR RF Channel Number		1		1	
P_{CCA_DL} for dynamic channel access Note 4,6	-	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 5,6	-	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
P_{CCA_UL} for dynamic channel access Note 4,6	-	0.75		0.75	
P_{CCA_UL} for semi-static channel access Note 5,6	-	0.87		0.87	

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration	Config 1		TDDConf.1.1 CCA			
$BW_{channel}$	Config 1		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference	Config 1		SR.1.1 CCA			
CORESET Reference Channel	Config 1		CR.1.1 CCA			
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 CCA			
TRS configuration	Config 1		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
DBT window configuration	Config 1		DBT.1			
SSB configuration for semi-static channel access Note 4, 6	Config 1		SSB.1 CCA			
SSB configuration for dynamic channel access Note 5, 6	Config 1		SSB.2 CCA			
ssb-PositionQCL	Config 1		[1]			
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1	kHz	30 kHz			
PRACH configuration			FR1 PRACH configuration 1 under CCA			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98			
N_{oc} Note2	Config 1	dBm/SCS	-95			
$\hat{E}_s / I_{ot}$		dB	8	-0.64	-Infinity	-0.64
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	8
SSB_RP	Config 1	dBm/SCS	-87	-87	-Infinity	-87
Io Note3	Config 1	dBm/ 38.16 MHz	-55.31	-52.60	-55.31	-52.60
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.

NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.

NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.11.2.1.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than $T_{interrupt}$ from the beginning of time period T3, where $T_{interrupt}$ is defined in clause 6.1B.1.2
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$

$T_{search} = (1+L_1)* 20$ ms.

$T_{processing} = 20$ ms.

$T_{margin} = 2$ ms.

$T_{\Delta} = (1+ L_2) *20$ ms.

$T_{IU} = (1+ L_3)*10 + 10$ ms

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2], L_1 is the number of SMTC occasions not available at the UE during the intra-frequency detection period, L_2 is the number of SMTC occasions not available at the UE during the time tracking period, where $L_1 + L_2 \leq L_{CCA_DL}$, and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure, where $L_3 \leq L_{CCA_UL}$. $L_3 = 0$ for Type 2C UL channel access procedure as defined in TS 37.213 [33]. The interruption time considering the potential extensions caused by L_1, L_2 , L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer.

A.11.2.1.3 Inter-frequency handover from FR1 carrier under CCA to FR1 carrier under CCA; unknown target cell

A.11.2.1.3.1 Test Purpose and Environment

This test is to verify the requirement for inter frequency handover requirements from FR1 carrier under CCA to FR1 carrier under CCA specified in clause 6.1B.1.2.

A.11.2.1.3.2 Test Parameters

Supported test configurations are shown in table A.11.2.1.3.2-1. Both handover delay and interruption length are tested by using the parameters in table A.11.2.1.3.2-2, and A.11.2.1.3.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.11.2.1.3.2-1: Inter-frequency handover from FR1 carrier under CCA to FR1 carrier under CCA test configurations

Config	Description
1	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.2.1.3.2-2: General test parameters Inter-frequency handover from FR1 carrier under CCA to FR1 carrier under CCA

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	On the carrier under CCA
	Neighbouring cell		Cell 2	On the carrier under CCA
Final condition	Active cell		Cell 2	On the carrier under CCA

Parameter		Unit	Value	Comment
DL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.26.2.1	
	Semi-static channel access Note 2, 3			
UL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.26.2.2	
	Semi-static channel access Note 2,3			
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T304		ms	500	
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T304	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T304	
T1		s	5	
T2		s	$\leq T_{interrupt}$	$T_{interrupt}$ is defined in clause 6.1B.1.2
NOTE 1: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 2: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.11.2.1.3.2-3: Cell specific test parameters for NR FR1-FR1 Inter frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
P_{CCA_DL} for dynamic channel access Note 4,6		-	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 5,6		-	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
P_{CCA_UL} for dynamic channel access Note 4,6		-	0.75		0.75	
P_{CCA_UL} for semi-static channel access Note 5,6		-	0.87		0.87	
TDD configuration	Config 1		TDDConf.1.1 CCA			
$BW_{channel}$	Config 1		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference	Config 1		SR.1.1 CCA			
CORESET Reference Channel	Config 1		CR1.1 CCA			
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 CCA			
TRS configuration	Config 1		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
DBT window configuration	Config 1		DBT.1			
SSB configuration for semi-static channel access Note 4, 6	Config 1		SSB.1 CCA			
SSB configuration for dynamic channel access Note 5, 6	Config 1		SSB.2 CCA			
ssb-PositionQCL	Config 1		[1]			
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1	kHz	30 kHz			
PRACH configuration			FR1 PRACH configuration 1 under CCA			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98			
N_{oc} Note2	Config 1	dBm/SCS	-95			
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.11.2.1.3.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than $T_{interrupt}$ from the beginning of time period T3, where $T_{interrupt}$ is defined in clause 6.1B.1.2
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$

$T_{search} = (3+L_1')* 20$ ms.

$T_{processing} = 20$ ms.

$T_{margin} = 2$ ms.

$T_{\Delta} = (1+ L_2) *20$ ms.

$T_{IU} = (1+ L_3)*10 + 10$ ms

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2], L_1' is the number of SMTC occasions not available at the UE during the inter-frequency detection period, L_2 is the number of SMTC occasions not available at the UE during the time tracking period, where $L_1' + L_2 \leq L_{CCA_DL}$, and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure, where $L_3 \leq L_{CCA_UL}$. $L_3 = 0$ for Type 2C UL channel access procedure as defined in TS 37.213 [33]. The interruption time considering the potential extensions caused by , L_1, L_2 , L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer.

A.11.2.1.4 Inter-frequency handover from FR1 carrier under CCA to FR1; known target cell

A.11.2.1.4.1 Test Purpose and Environment

This test is to verify the requirement for the NR with CCA FR1-NR FR1 handover requirements specified in clause 6.1.1.2.

A.11.2.1.4.2 Test Parameters

Supported test configurations are shown in table A.11.2.1.4.2-1. Both handover delay and interruption length are tested by using the parameters in table A.11.2.1.4.2-2, and A.11.2.1.4.2-3.

The test consists of three successive time periods, with time durations of T1 T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2.

NR with CCA shall send a RRC message implying handover to Cell 2. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3. T3 is defined as the end of the last TTI containing the RRC message implying handover.

Table A.11.2.1.4.2-1: Handover from NR with CCA FR1 to NR FR1 test configuration

Config	Description
1	Source cell: NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.2.1.4.2-2: General test parameters handover from NR with CCA FR1 to NR FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	NR cell with CCA
	Neighbouring cell		Cell 2	NR cell
Final condition	Active cell		Cell 2	
DL CCA model			As specified in clause A.3.26.2.1	
UL CCA model			As specified in clause A.3.26.2.2	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
T304		ms	500	
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T304	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T304	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.11.2.1.4.2-3: Cell specific test parameters for NR with CCA FR1 – NR FR1 handover test case

Parameter		Unit	Test configuration	Cell 1			Cell 2		
				T1	T2	T3	T1	T2	T3
NR RF Channel Number			1,2,3	1			2		
Duplex mode			1	TDD			FDD		
			2	TDD			TDD		
			3	TDD			TDD		
TDD configuration			1	TDDConf.1.1 CCA			Not Applicable		
			2	TDDConf.1.1 CCA			TDDConf.1.1		
			3	TDDConf.1.1 CCA			TDDConf.2.1		
$BW_{channel}$		MHz	1	40: $N_{PRB,c}$ = 106			10: $N_{PRB,c}$ = 52		
			2	40: $N_{PRB,c}$ = 106			10: $N_{PRB,c}$ = 52		
			3	40: $N_{PRB,c}$ = 106			40: $N_{PRB,c}$ = 106		
BWP BW		MHz	1	40: $N_{PRB,c}$ = 106			10: $N_{PRB,c}$ = 52		
			2	40: $N_{PRB,c}$ = 106			10: $N_{PRB,c}$ = 52		
			3	40: $N_{PRB,c}$ = 106			40: $N_{PRB,c}$ = 106		
DRX Cycle		ms	1,2,3	Not Applicable					
PDSCH Reference measurement channel			1	SR.1.1 CCA			SR.1.1 FDD		
			2	SR.1.1 CCA			SR.1.1 TDD		
			3	SR.1.1 CCA			SR2.1 TDD		
CORESET Reference Channel			1	CR1.1 CCA			CR.1.1 FDD		
			2	CR1.1 CCA			CR.1.1 TDD		
			3	CR1.1 CCA			CR2.1 TDD		
Dedicated CORESET RMC configuration			1	CCR.1.1 CCA			CCR.1.1 FDD		
			2	CCR.1.1 CCA			CCR.1.1 TDD		
			3	CCR.1.1 CCA			CCR.2.1 TDD		
DL CCA probability for semi-static channel access (P_{CCA_DL})DL CCA probability P_{CCA_DL}			1,2,3	0.9375			N/A		
DL CCA probability for dynamic channel access ($P_{CCA_DL_1}$)			1,2,3	0.75			N/A		
DL CCA probability for dynamic channel access ($P_{CCA_DL_2}$)			1,2,3	0.75			N/A		
UL CCA probability for semi-static channel access P_{CCA_UL}			1,2,3	0.75			N/A		
UL CCA probability for dynamic static channel access P_{CCA_UL}			1,2,3	0.87					
TRS configuration			1	TRS.1.2 TDD			TRS.1.1 FDD		
			2	TRS.1.2 TDD			TRS.1.1 TDD		
			3	TRS.1.2 TDD			TRS.1.2 TDD		
OCNG Patterns				OP.1					
SMTC Configuration				SMTC.1					
SSB Configuration	Semi-static channel access		1,2	SSB.1 CCA (As defined in A.3.10A)			SSB.1 FR1		
	Dynamic channel access			SSB.2 CCA (As defined in A.3.10A)					
	Semi-static channel access		3	SSB.1 CCA (As defined in A.3.10A)			SSB.2 FR1		
	Dynamic channel access			SSB.2 CCA (As defined in A.3.10A)					
DBT window configuration				As defined in A.3.28.1			Not applicable		
PDSCH/PDCCH subcarrier spacing		kHz	1,2	30 kHz			15 kHz		
			3	30 kHz			30 kHz		

Parameter		Unit	Test configuration	Cell 1			Cell 2		
				T1	T2	T3	T1	T2	T3
PUCCH/PUSCH subcarrier spacing		kHz	1,2	30 kHz			15 kHz		
			3	30 kHz			30 kHz		
PRACH configuration				FR1 PRACH configuration 1 under CCA			FR1 PRACH configuration 1		
BWP configuration	Initial DL BWP		1,2,3	DLBWP.0.1					
	Dedicated DL BWP		1,2,3	DLBWP.1.1					
	Initial UL BWP		1,2,3	ULBWP.0.1					
	Dedicated UL BWP		1,2,3	ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	1,2,3	0					
EPRE ratio of PBCH DMRS to SSS			1,2,3						
EPRE ratio of PBCH to PBCH DMRS			1,2,3						
EPRE ratio of PDCCH DMRS to SSS			1,2,3						
EPRE ratio of PDCCH to PDCCH DMRS			1,2,3						
EPRE ratio of PDSCH DMRS to SSS			1,2,3						
EPRE ratio of PDSCH to PDSCH			1,2,3						
EPRE ratio of OCNG DMRS to SSS[Note1]			1,2,3						
EPRE ratio of OCNG to OCNG DMRS[Note1]			1,2,3						
N_{oc} [Note2]		dBm/15kHz	1,2	-98			-98		
			3	-98			-98		
N_{oc} [Note2]		dBm/SCS	1,2	-95			-98		
			3	-95			-95		
$\hat{E}_s / I_{ot}$		dB	1,2,3	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s / N_{oc}$		dB	1,2,3	8	8	8	-Infinity	11	11
SSB_RP		dBm/SCS	1,2	-87	-87	-87	-Infinity	-87	-87
			3	-87	-87	-87	-Infinity	-84	-84
Io[Note3]		dBm/ChBW	1,2	-55.31	-55.31	-55.31	-70.05	-58.72	-58.72
			3	-55.31	-55.31	-55.31	-63.94	-52.61	-52.61
Propagation condition		-	1,2,3	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.11.2.1.4.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 112 ms from the beginning of time period T3.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 102 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2.

This gives a total of 112 ms.

A.11.2.1.5 Inter-frequency handover from FR1 carrier under CCA to FR1; unknown target cell

A.11.2.1.5.1 Test Purpose and Environment

This test is to verify the requirement for the NR with CCA FR1-NR FR1 handover requirements specified in clause 6.1.1.2.

A.11.2.1.5.2 Test Parameters

Supported test configurations are shown in table A.11.2.1.5.2-1. Both handover delay and interruption length are tested by using the parameters in table A.11.2.1.5.2-2, and A.12.2.1.7.2-3.

The test scenario comprises of two carriers and one cell on each carrier. Cell 1 is the NR with CCA cell and Cell 2 is an NR neighbour cell. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2.

Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.11.2.1.5.2-1: Handover from NR with CCA FR1 to NR FR1 test configuration

Config	Description
1	Source cell: NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.2.1.5.2-2: General test parameters handover from NR with CCA FR1 to NR FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	NR cell with CCA
	Neighbouring cell		Cell 2	NR cell
Final condition	Active cell		Cell 2	
DL CCA model			As specified in clause A.3.26.2.1	
UL CCA model			As specified in clause A.3.26.2.2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T304		ms	500	
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T304	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T304	
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	

Table A.11.2.1.5.2-3: Cell specific test parameters for NR with CCA FR1 – NR FR1 handover test case

Parameter	Unit	Configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number		1, 2, 3	1		2	
Duplex mode		1	TDD		FDD	
		2	TDD		TDD	
		3	TDD		TDD	
DL CCA model		1, 2, 3	As specified in clause A.3.26.2.1		N/A	
UL CCA model		1, 2, 3	As specified in clause A.3.26.2.2			
TDD configuration		1	TDDConf.1.1 CCA		Not Applicable	
		2	TDDConf.1.1 CCA		TDDConf.1.1	
		3	TDDConf.1.1 CCA		TDDConf.2.1	
$BW_{channel}$	MHz	1	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
		2	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
		3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW	MHz	1	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
		2	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
		3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
DRX Cycle	ms		Not Applicable			
PDSCH Reference measurement channel		1	SR.1.1 CCA		SR.1.1 FDD	
		2	SR.1.1 CCA		SR.1.1 TDD	
		3	SR.1.1 CCA		SR2.1 TDD	
CORESET Reference Channel		1	CR2.1 TDD		CR.1.1 FDD	
		2	CR2.1 TDD		CR.1.1 TDD	
		3	CR2.1 TDD		CR2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 CCA		CCR.1.1 FDD	
		2	CCR.1.1 CCA		CCR.1.1 TDD	
		3	CCR.1.1 CCA		CCR.2.1 TDD	
TRS configuration		1	TRS.1.2 TDD		TRS.1.1 FDD	
		2	TRS.1.2 TDD		TRS.1.1 TDD	
		3	TRS.1.2 TDD		TRS.1.2 TDD	
DL CCA probability for semi-static channel access (P_{CCA_DL})DL CCA probability P_{CCA_DL}		1, 2, 3	0.9375		N/A	
DL CCA probability for dynamic channel access ($P_{CCA_DL_1}$)		1, 2, 3	0.75		N/A	
DL CCA probability for dynamic channel access ($P_{CCA_DL_2}$)		1, 2, 3	0.75		N/A	
UL CCA probability for semi-static channel access P_{CCA_UL}		1, 2, 3	0.75		N/A	
UL CCA probability for dynamic static channel access P_{CCA_UL}		1, 2, 3	0.87		N/A	
OCNG Patterns		1, 2, 3	OP.1			
SMTC Configuration		1, 2, 3	SMTC.1			
DBT window configuration		1, 2, 3	As defined in A.3.28.1		N/A	
SSB configuration	Semi-static channel access	1,2	SSB.1 CCA (As defined in A.3.10A)		SSB.1 FR1	
	Dynamic channel access		SSB.2 CCA (As defined in A.3.10A)			
	Semi-static channel access	3	SSB.1 CCA (As defined in A.3.10A)		SSB.2 FR1	
	Dynamic channel access		SSB.2 CCA (As defined in A.3.10A)			
ssb-PositionQCL			1		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1	30 kHz		15 kHz	

Parameter	Unit	Configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		2	30 kHz		15 kHz	
		3	30 kHz		30 kHz	
PUCCH/PUSCH subcarrier spacing	kHz	1	30 kHz		15 kHz	
		2	30 kHz		15 kHz	
		3	30 kHz		30 kHz	
PRACH configuration		1,2,3	FR1 PRACH configuration 1 under CCA		FR1 PRACH configuration 1	
BWP configuration	Initial DL BWP	1,2,3	DLBWP.0.1			
	Dedicated DL BWP	1,2,3	DLBWP.1.1			
	Initial UL BWP	1,2,3	ULBWP.0.1			
	Dedicated UL BWP	1,2,3	ULBWP.1.1			
EPRE ratio of PSS to SSS	dB	1,2,3	0			
EPRE ratio of PBCH DMRS to SSS		1,2,3				
EPRE ratio of PBCH to PBCH DMRS		1,2,3				
EPRE ratio of PDCCH DMRS to SSS		1,2,3				
EPRE ratio of PDCCH to PDCCH DMRS		1,2,3				
EPRE ratio of PDSCH DMRS to SSS		1,2,3				
EPRE ratio of PDSCH to PDSCH		1,2,3				
EPRE ratio of OCNG DMRS to SSS[Note1]		1,2,3				
EPRE ratio of OCNG to OCNG DMRS[Note1]		1,2,3				
N_{oc} [Note2]	dBm/SCS	1,2	-95		-98	
		3	-95		-95	
$\hat{E}_s / I_{ot}$	dB	1,2,3	4	4	- Infinity	5
$\hat{E}_s / N_{oc}$	dB	1,2,3	4	4	- Infinity	5
SSB_RP	dBm/SCS	1,2	-91	-91	- Infinity	-93
		3	-91	-91	- Infinity	-90
Io[Note3]	dBm/ChBW	1,2	-58.49	-58.49	-70.05	-63.85
		3	-58.49	-58.49	-63.94	-57.75
Propagation condition	-	1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.11.2.1.5.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 132 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 122 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2.

This gives a total of 132 ms.

A.11.2.1.6 Inter-frequency handover from FR1 to FR1 carrier under CCA; unknown target cell

A.11.2.1.6.1 Test Purpose and Environment

This test is to verify the requirement for inter frequency handover requirements from FR1 to FR1 carrier under CCA specified in clause 6.1B.1.2.

A.11.2.1.6.2 Test Parameters

Supported test configurations are shown in table A.11.2.1.6.2-1. Both handover delay and interruption length are tested by using the parameters in table A.11.2.1.6.2-2, and A.11.2.1.6.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.11.2.1.6.2-1: Inter-frequency handover from FR1 to FR1 carrier under CCA test configurations

Configuration	Description of a cell with CCA	Description of a cell without CCA
1	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.11.2.1.6.2-2: General test parameters Inter-frequency handover from FR1 to FR1 carrier under CCA

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	On the carrier under CCA
Final condition	Active cell		Cell 2	On the carrier under CCA
DL CCA model			As specified in clause A.3.26.2.1	
UL CCA model			As specified in clause A.3.26.2.2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T304		ms	500	
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T304	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T304	
T1		s	5	
T2		s	$\leq T_{interrupt}$	$T_{interrupt}$ is defined in clause 6.1B.1.2

Table A.11.2.1.6.2-3: Cell specific test parameters for NR FR1-FR1 Inter frequency handover test case

Parameter	Unit	Configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number		1, 2, 3	1		2	
DL CCA probability for semi-static channel access (P_{CCA_DL})DL CCA probability P_{CCA_DL}		1, 2, 3	N/A		0.9375	
DL CCA probability for dynamic channel access ($P_{CCA_DL_1}$)		1, 2, 3	N/A		0.75	

Parameter		Unit	Configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
DL CCA probability for dynamic channel access ($P_{CCA_DL_2}$)			1, 2, 3	N/A		0.75	
UL CCA probability for semi-static channel access P_{CCA_UL}			1, 2, 3	N/A		0.75	
UL CCA probability for dynamic static channel access P_{CCA_UL}			1, 2, 3	N/A		0.87	
TDD configuration			1	N/A		TDDConf.1.1.CCA	
			2	TDDConf.1.1		TDDConf.1.1.CCA	
			3	TDDConf.1.2		TDDConf.1.1.CCA	
$BW_{channel}$			1	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106	
			2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106	
			3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW			1	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106	
			2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106	
			3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
DRX Cycle		ms		Not Applicable			
PDSCH Reference			1	SR.1.1 FDD		SR.1.1 CCA	
			2	SR.1.1 TDD		SR.1.1 CCA	
			3	SR.2.1 TDD		SR.1.1 CCA	
CORESET Reference Channel			1	CR.1.1 FDD		CR.1.1 CCA	
			2	CR.1.1 TDD		CR.1.1 CCA	
			3	CR.2.1 TDD		CR.1.1 CCA	
Dedicated CORESET RMC configuration			1	CCR.1.1 FDD		CCR.1.1 CCA	
			2	CCR.1.1 TDD		CCR.1.1 CCA	
			3	CCR.2.1 TDD		CCR.1.1 CCA	
TRS configuration			1	TRS.1.1 FDD		TRS.1.2 TDD	
			2	TRS.1.1 TDD		TRS.1.2 TDD	
			3	TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns			1, 2, 3	OP.1			
SMTC Configuration			1, 2, 3	SMTC.1			
DBT window configuration			1, 2, 3	N/A		As defined in A.3.28.1	
SSB configuration			1, 2	SSB.1 FR1		SSB.1 CCA for semi-static channel access; SSB.2 CCA for dynamic channel access;	
			3	SSB.2 FR1		SSB.1 CCA for semi-static channel access; SSB.2 CCA for dynamic channel access;	
ssb-PositionQCL				N/A		[1]	
PDSCH/PDCCH subcarrier spacing		kHz	1	15 kHz		30 kHz	
			2	15 kHz		30 kHz	
			3	30 kHz		30 kHz	
PUCCH/PUSCH subcarrier spacing		kHz	1	15 kHz		30 kHz	
			2	15 kHz		30 kHz	
			3	30 kHz		30 kHz	
PRACH configuration				FR1 PRACH configuration 1		FR1 PRACH configuration 1 CCA	
BWP configuration	Initial DL BWP		1, 2, 3	DLBWP.0.1			
	Dedicated DL BWP		1, 2, 3	DLBWP.1.1			
	Initial UL BWP		1, 2, 3	ULBWP.0.1			
	Dedicated UL BWP		1, 2, 3	ULBWP.1.1			
EPRE ratio of PSS to SSS		dB		0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							

Parameter		Unit	Configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz		-98			
N_{oc} Note2		dBm/SCS	1, 2	-98		-95	
			3	-95		-95	
$\hat{E}_s / I_{ot}$		dB		4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB		4	4	-Infinity	5
SSB_RP	Config 1	dBm/SCS	1, 2	-94	-94	-Infinity	-90
			3	-91	-91	-Infinity	-90
Io Note3	Config 1	dBm/ 9.36 MHz	1, 2	-64.59	-64.59	-63.94	-57.75
		dBm/ 38.16 MHz	3	-58.49	-58.49	-63.94	-57.75
Propagation condition		-		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.11.2.1.6.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than $T_{interrupt}$ from the beginning of time period T3, where $T_{interrupt}$ is defined in clause 6.1B.1.2
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$

$T_{search} = (3+L_1')* 20$ ms.

$T_{processing} = 20$ ms.

$T_{margin} = 2$ ms.

$T_{\Delta} = (1+ L_2) *20$ ms.

$T_{IU} = (1+ L_3)*10 + 10$ ms

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2], L_1' is the number of SMTC occasions not available at the UE during the inter-frequency detection period, L_2 is the number of SMTC occasions not available at the UE during the time tracking period, and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. $L_3 = 0$ for Type 2C UL channel access procedure as defined in TS 37.213 [33]. The interruption time considering the potential extensions caused by L_1, L_1´, L_2, L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2].

A.11.2.1.7 SA NR FR1 carrier under CCA - E-UTRAN handover with known target cell

A.11.2.1.7.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1 carrier under CCA. This test shall verify the NR to E-UTRAN handover requirements as specified in clause 6.1.2.1.

The test comprises of one NR carrier under CCA and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in table 9.1.2-1 is configured before T2 begins to enable inter-RAT frequency monitoring.

A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the next instant after the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.11.2.1.7-1. General test parameters are provided in table A.11.2.1.7-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.11.2.1.7-3 and A.11.2.1.7-4 respectively.

Table A.11.2.1.7-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests

Configuration	Description of a cell with CCA	Description of a cell without CCA
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: The UE supporting SA operation only on NR band(s) with shared spectrum access is required to be tested.		

Table A.11.2.1.7-2: General test parameters for SA inter-RAT E-UTRAN handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell on a carrier under CCA
	Neighbouring cell		Cell 2	E-UTRAN cell
Final condition	Active cell		Cell 2	
DL CCA model			As specified in clause A.3.26.2.1	
UL CCA model			As specified in clause A.3.26.2.2	
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
b2-Threshold1		dBm	As specified in table A.11.2.1.7-3	Absolute NR SS-RSRP threshold for event B2
b2-Threshold2EUTRAN		dBm	-98	Absolute E-UTRAN RSRP threshold for event B2
Hysteresis		dB	0	
TimeToTrigger		s	0	
T304		ms	500	
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T304	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T304	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells

Gap pattern configuration Id		0	As specified in table 9.1.2-1 started before T2 starts
T1	s	5	
T2	s	≤5	
T3	s	1	

Table A.11.2.1.7-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2	1		
TDD Configuration			1, 2	TDDConf.1.1.CCA		
DL CCA probability for semi-static channel access (P_{CCA_DL})DL CCA probability P_{CCA_DL}			1, 2	0.9375		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_1}$)			1, 2	0.75		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_2}$)			1, 2	0.75		
UL CCA probability for semi-static channel access P_{CCA_UL}			1, 2	0.75		
UL CCA probability for dynamic static channel access P_{CCA_UL}			1, 2	0.87		
$BW_{channel}$			1, 2	40: $N_{PRB,c}$ = 106 (TDD)		
PDSCH reference measurement channel			1, 2	SR.1.1 CCA		
CORESET reference channel			1, 2	CR.1.1 CCA		
Dedicated CORESET RMC configuration			1, 2	CCR.1.1 CCA		
TRS configuration			1, 2	TRS.1.2 TDD		
OCNG pattern[Note1]			1, 2	OP.1		
BWP	Initial DL BWP		1, 2	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2	SMTC.1		
DBT window configuration			1, 2	As defined in A.3.28.1		
SSB configuration			1, 2	SSB.1 CCA for semi-static channel access; SSB.2 CCA for dynamic channel access;		
b2-Threshold1		dBm	1, 2	-93		
EPRE ratio of PSS to SSS		dB	1, 2	0		
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}[Note2]		dBm/15 KHz	1, 2	-100	-104	-100
N_{oc}[Note2]		dBm/SCS	1, 2	-97	-101	-97

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
$\hat{E}_s/N_{oc}$	dB	1, 2	12	0	0
$\hat{E}_s/I_{ot}$[Note3]	dB	1, 2	12	0	0
SS-RSRP[Note3]	dBm/SCS	1, 2	-85	-101	-97
Io[Note3]	dBm/38.16 MHz	1, 2	-53.68	-66.93	-62.93
Propagation condition		1, 2	AWGN		
Antenna Configuration and Correlation Matrix		1, 2	1x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

Table A.11.2.1.7-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2	2		
Duplex mode		1	FDD		
		2	TDD		
TDD special subframe configuration[Note1]		2	6		
TDD uplink-downlink configuration[Note1]		2	1		
$BW_{channel}$	MHz	1, 2	10 MHz: $N_{PRB,c}$ = 50		
PRACH Configuration[Note2]		1	4		
		2	53		
PDSCH parameters: DL Reference Measurement Channel[Note3]		1	10 MHz: R.3 FDD		
		2	10 MHz: R.0 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1	10 MHz: R.6 FDD		
		2	10 MHz: R.6 TDD		
OCNG Patterns[Note3]		1	10 MHz: OP.10 FDD		
		2	10 MHz: OP.1 TDD		
PBCH_RA	dB	1, 2	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
PDSCH_RA					
PDSCH_RB					
OCNG_RA Note4					
OCNG_RB Note4					
N_{oc} Note5	dBm/15 kHz	1, 2	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2	-Infinity	8	8
$\hat{E}_s/I_{ot}$ Note6	dB	1, 2	-Infinity	8	8
RSRP Note6	dBm/15 kHz	1, 2	-Infinity	-90	-90
SCH_RP Note6	dBm/15 kHz	1, 2	-Infinity	-90	-90
Io Note6	dBm/9 MHz	1, 2	-67.21 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)
Propagation Condition		1, 2	AWGN		
Antenna Configuration and Correlation Matrix Note7		1, 2	1x2 Low		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.11.2.1.7.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 85 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in clause 6.1.2.1.

$T_{interrupt}$ = 35 ms in the test; $T_{interrupt}$ is defined in clause 6.1.2.1.

This gives a total of 85 ms.

A.11.2.1.8 SA NR FR1 carrier under CCA - E-UTRAN handover with unknown target cell

A.11.2.1.8.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1 carrier under CCA. This test shall verify the NR to E-UTRAN handover requirements for the case when the target E-UTRAN cell is unknown as specified in clause 6.1.2.1.

The test comprises of one NR carrier under CCA and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable. No Gap pattern shall be configured.

A RRC message implying handover shall be sent to the UE during period T1. The start of T2 is the next instant after the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.11.2.1.8-1. General test parameters are provided in table A.11.2.1.8-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.11.2.1.8-3 and A.11.2.1.8-4 respectively.

Table A.11.2.1.8-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests

Configuration	Description of a cell with CCA	Description of a cell without CCA
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: The UE supporting SA operation only on NR band(s) with shared spectrum access is required to be tested.		

Table A.11.2.1.8-2: General test parameters for SA inter-RAT E-UTRAN handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell on a carrier under CCA
	Neighbouring cell		Cell 2	E-UTRAN cell
Final condition	Active cell		Cell 2	
DL CCA model			As specified in clause A.3.26.2.1	
UL CCA model			As specified in clause A.3.26.2.2	
NR measurement quantity			SS-RSRP	
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
T304		ms	500	
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T304	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T304	
Time offset between cells			3 ms	Asynchronous cells
T1		s	≤5	
T2		s	1	

Table A.11.2.1.8-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2	1	
DL CCA probability for semi-static channel access (P_{CCA_DL})DL CCA probability P_{CCA_DL}		1, 2	0.9375	
DL CCA probability for dynamic channel access ($P_{CCA_DL_1}$)		1, 2	0.75	
DL CCA probability for dynamic channel access ($P_{CCA_DL_2}$)		1, 2	0.75	
UL CCA probability for semi-static channel access P_{CCA_UL}		1, 2	0.75	
UL CCA probability for dynamic static channel access P_{CCA_UL}		1, 2	0.87	
TDD Configuration		1, 2	TDDConf.1.1.CCA	
$BW_{channel}$	MHz	1, 2	40: $N_{PRB,c}$ = 106 (TDD)	
PDSCH reference measurement channel		1, 2	SR.1.1 CCA	

Parameter		Unit	Configuration	Cell 1	
				T1	T2
CORESET reference channel			1, 2	CR.1.1 CCA	
Dedicated CORESET RMC configuration			1, 2	CCR.1.1 CCA	
TRS configuration			1, 2	TRS.1.2 TDD	
OCNG pattern[Note1]			1, 2	OP.1	
BWP	Initial DL BWP		1, 2	DLBWP.0.1	
	Dedicated DL BWP			DLBWP.1.1	
	Initial UL BWP			ULBWP.0.1	
	Dedicated UL BWP			ULBWP.1.1	
SMTC configuration			1, 2	SMTC.1	
DBT window configuration			1, 2	As defined in A.3.28.1	
SSB configuration			1, 2	SSB.1 CCA for semi-static channel access; SSB.2 CCA for dynamic channel access;	
EPRE ratio of PSS to SSS		dB	1, 2	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2	-98	
N_{oc}[Note2]		dBm/SCS	1, 2	-95	
$\hat{E}_s/N_{oc}$		dB	1, 2	0	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2	0	0
SS-RSRP[Note3]		dBm/SCS	1, 2	-95	-95
Io[Note3]		dBm/38.16 MHz	1, 2	-60.94	-60.94
Propagation condition			1, 2	AWGN	
Antenna Configuration and Correlation Matrix			1, 2	1x2 Low	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

Table A.11.2.1.8-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2	2	
Duplex mode		1	FDD	
		2	TDD	
TDD special subframe configuration[Note1]		2	6	
TDD uplink-downlink configuration[Note1]		2	1	
$BW_{channel}$	MHz	1, 2	10 MHz: $N_{PRB,c}$ = 50	
PRACH Configuration[Note2]		1	4	

Parameter	Unit	Configuration	Cell 2	
			T1	T2
		2	53	
PDSCH parameters: DL Reference Measurement Channel Note3		1	10 MHz: R.3 FDD	
		2	10 MHz: R.0 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel Note3		1	10 MHz: R.6 FDD	
		2	10 MHz: R.6 TDD	
OCNG Patterns Note3		1	10 MHz: OP.10 FDD	
		2	10 MHz: OP.1 TDD	
PBCH_RA	dB	1, 2	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note4				
OCNG_RB Note4				
N_{oc} Note5	dBm/15 kHz	1, 2	-98	
$\hat{E}_s/N_{oc}$	dB	1, 2	-Infinity	7
$\hat{E}_s/I_{ot}$ Note6	dB	1, 2	-Infinity	7
RSRP Note6	dBm/15 kHz	1, 2	-Infinity	-91
SCH_RP Note6	dBm/15 kHz	1, 2	-Infinity	-91
Io Note6	dBm/9 MHz	1, 2	-70.22	-62.43
Propagation Condition		1, 2	AWGN	
Antenna Configuration and Correlation Matrix Note7		1, 2	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.11.2.1.8.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 165 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in clause 6.1.2.1.

$T_{interrupt}$ = 115 ms in the test; $T_{interrupt}$ is defined in clause 6.1.2.1.

This gives a total of 165 ms.

A.11.2.1.9 Handover with PSCell from NR SA to EN-DC with known target PSCell using CCA

A.11.2.1.9.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct SA inter-RAT handover from NR to E-UTRAN with FR1 PSCell addition when operating in standalone (SA) operation with PCell in FR1, for the case where the PSCell is known to the UE at the time of addition and SMTC of target known PSCell is not present in *RRCConnectionReconfiguration*. This test shall verify delay requirements of inter-RAT handover from NR to E-UTRAN and FR1 PSCell carrier with CCA addition as specified in clause 6.1.5.

The test comprises of two NR cells and one E-UTRA cell. Cell 1 is the NR PCell, Cell 2 is an inter-RAT E-UTRAN neighbour cell and Cell 3 is the target NR PSCell, which is on CCA, on radio channel 1 in FR1, radio channel 2 in E-UTRAN and radio channel 3 in FR1 with CCA, respectively.

In this test, inter-RAT handover from NR to E-UTRAN and FR1 PSCell addition are performed in parallel processing. The test consists of successive time periods for inter-RAT handover with time durations of T1, T2 and T3 respectively, and successive time periods for FR1 PSCell addition with time durations of T1', T2', T3'and T4' respectively.

At the start of time duration T1, the UE does not have any timing information of Cell 2, and the UE is only monitoring Cell 1. During T1, only Cell 1 is known to the UE.

Before the start of T2 or T2', the test system shall send measurement control information including measurement gap configuration and event-triggered reporting configuration with event B2 for neighbour Cell 2 and event B1 for Cell 3. Gap pattern configuration with id #0 as specified in table 9.1.2-1 is configured before T2 or T2' begins.

Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

During T3, the UE shall carry out random access (i.e., transmit the PRACH) towards the Cell 2. Reception by the test system of the PRACH preamble defines the end of T3.

Starting T2', the Cell 3 (PSCell-to-be) on radio channel 3 becomes known to the UE at the time of addition. Therefore, during T2' the UE shall report Event B1. After receiving the Event B1, the test system shall send a RRC message to the UE to release the measurement gaps. The test system shall send a RRC message to the UE to add PSCell (Cell 3) on radio channel 3. The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added. The RRC message to add PSCell shall be sent to the UE during period T2', after the measurement gaps are released by the test system. The point in time at which the RRC message to add PSCell (Cell 3) is received at the UE antenna connector defines the start of period T3'.

During T3', the UE shall carry out random access (i.e., transmit the PRACH) towards the Cell 3. Reception by the test system of the PRACH preamble defines the start of period T4'.

During T4', the UE shall send periodic CSI reports in PSCell and the test system shall observe the periodic reporting of CSI for PSCell.

Supported test configurations are shown in table A.11.2.1.9.1-1. General test parameters are provided in table A.11.2.1.9.1-2. Cell specific test parameters for NR Cell 1, E-UTRAN PCell Cell 2 are provided in tables A.11.2.1.9.1-3, A.11.2.1.9.1-4 and A.11.2.1.xn-5 respectively. Table A.11.2.1.9.1-5 provides General test parameters for NR FR1 PSCell carrier with CCA addition, and table A.11.2.1.9.1-6 provides Cell specific test parameters for PSCell addition of FR1 carrier under CCA.

Table A.11.2.1.9.1-1: Supported test configurations for SA inter-RAT E-UTRAN handover with FR1 PSCell addition tests

Config	Description	
	NR PCell and EUTRA PCell	NR PSCell on CCA
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD, LTE FDD,	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD, LTE FDD	

3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD, LTE FDD	
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD, LTE TDD	
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD, LTE TDD	
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD, LTE TDD	
NOTE: The UE is only required to be tested in one of the supported test configurations depending on the UE capability		

Table A.11.2.1.9.1-2: General test parameters for SA inter-RAT E-UTRAN handover with FR1 PSCell addition

Parameter		Unit	Value	Comment
NR RF Channel Number			1, 3	2 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2, 3	E-UTRAN cell and NR cell in FR1
Final condition	Active Pcell		Cell 2	E-UTRAN cell
	Active PSCell		Cell 3	NR cell in FR1
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
Event B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	Threshold RSRP	dBm	-93	Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin.
	Time to Trigger	s	0	
Event B2	Threshold1	dBm	As specified in table A.6.3.1.4-3	Absolute NR SS-RSRP threshold for event B2
	Threshold2EUTRAN	dBm	-98	Absolute E-UTRAN RSRP threshold for event B2
	Hysteresis	dB	0	
	TimeToTrigger	s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between Cell 1 and Cell 2			3 ms	Asynchronous cells
Measurement Gap pattern ID			0	As specified in table 9.1.2-1
T1/T1'		s	1	During this time only Cell 1 is known to UE.
T2		s	≤5	During this time the UE shall identify Cell 2 and report event B2.
T3		s	1	During this time the UE handovers to Cell 2.
T2'		s	≤ 5	During this time the UE shall identify Cell 3 and report event B1.
T3'		s	$\geq T_{interrupt}$	During this time the UE adds the PSCell (Cell 3).
T4'		s	≤ 1	During this time the UE sends CSI reports for PSCell (Cell 3).

Table A.11.2.1.9.1-3: Cell specific test parameters for SA inter-RAT E-UTRA handover with FR1 PSCell addition (NR Cell 1)

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3, 4, 5, 6	1		
Duplex mode			1, 4	FDD		
			2, 3, 5, 6	TDD		
TDD Configuration			2, 5	TDDConf.1.1		
			3, 6	TDDConf.2.1		
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)		
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)		
			3, 6	40: $N_{PRB,c}$ = 106 (TDD)		
PDSCH reference measurement channel			1, 4	SR.1.1 FDD		
			2, 5	SR.1.1 TDD		
			3, 6	SR.2.1 TDD		
CORSET reference channel			1, 4	CR.1.1 FDD		
			2, 5	CR.1.1 TDD		
			3, 6	CR.2.1 TDD		
TRS configuration			1, 4	TRS.1.1 FDD		
			2, 5	TRS.1.1 TDD		
			3, 6	TRS.1.2 TDD		
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1		
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration			1, 2, 4, 5	SSB.1 FR1		
			3, 6	SSB.2 FR1		
b2-Threshold1		dBm	1, 2, 4, 5	-96		
			3, 6	-93		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0		
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6	-100	-104	-100
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-100	-104	-100
			3, 6	-97	-101	-97
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	12	0	-4
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	12	0	-4
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104	-104
			3, 6	-85	-101	-101
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-59.78	-73.04	-70.59
		dBm/38.16 MHz	3, 6	-53.68	-66.9448	-64.49
Propagation condition			1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6	1x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					

Table A.11.2.1.9.1-4: Cell specific test parameters for SA inter-RAT E-UTRA handover with FR1 PSCell addition (E-UTRA Cell 2)

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6	2		
Duplex mode		1, 2, 3	FDD		
		4, 5, 6	TDD		
TDD special subframe configuration[Note1]		4, 5, 6	6		
TDD uplink-downlink configuration[Note1]		4, 5, 6	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PRACH Configuration[Note2]		1, 2, 3	4		
		4, 5, 6	53		
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD		
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note3]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD		
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note4]					
OCNG_RB[Note4]					
N_{oc}[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	8	78
$\hat{E}_s/I_{ot}$[Note6]	dB	1, 2, 3, 4, 5, 6	-Infinity	78	78
RSRP[Note6]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-90	-90

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
SCH_RP Note6	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-90	-90
Io Note6	dBm/9 MHz	1, 2, 3, 4, 5, 6	-67.21 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix Note7		1, 2, 3, 4, 5, 6	1x2 Low		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.11.2.1.9.1-5: General test parameters for NR FR1 PSCell carrier with CCA addition

Parameter		Unit	Value	Comment
Initial condition	Neighbouring cell		Cell 3	On the carrier under CCA
Final condition	Active cell		Cell 3	On the carrier under CCA
DL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.20.2.1	
	Semi-static channel access Note 2, 3			
UL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.20.2.2	
	Semi-static channel access Note 2,3			
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T304		ms	500	
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T304	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T304	
T1’		s	5	
T2’		s	≤ 5	
T3’		s	≥ $T_{interrupt}$	$T_{interrupt}$ is defined in clause 6.1B.1.2
T4’		s	≤ 1	

NOTE 1: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 2: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

Table A.11.2.1.9.1-6: Cell specific test parameters for PSCell addition of FR1 carrier under CCA

Parameter	Unit	Cell 3			
		T1’	T2’	T3’	T4’
NR RF Channel Number		1			
P_{CCA_DL} for dynamic channel access Note 4,6	-	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75			

Parameter		Unit	Cell 3			
			T1'	T2'	T3'	T4'
P_{CCA_DL} for semi-static channel access Note 5,6		-	P_{CCA_DL}=0.9375			
P_{CCA_UL} for dynamic channel access Note 4,6		-	0.75			
P_{CCA_UL} for semi-static channel access Note 5,6		-	0.87			
TDD configuration	Config 1, 2, 3, 4, 5, 6		TDDConf.1.1 CCA			
$BW_{channel}$	Config 1, 2, 3, 4, 5, 6		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1, 2, 3, 4, 5, 6		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference	Config 1, 2, 3, 4, 5, 6		SR.1.1 CCA			
CORESET Reference Channel	Config 1, 2, 3, 4, 5, 6		CR.1.1 CCA			
Dedicated CORESET RMC configuration	Config 1, 2, 3, 4, 5, 6		CCR.1.1 CCA			
TRS configuration	Config 1, 2, 3, 4, 5, 6		TRS.1.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
DBT window configuration	Config 1, 2, 3, 4, 5, 6		DBT.1			
SSB configuration for semi-static channel access Note 4, 6	Config 1, 2, 3, 4, 5, 6		SSB.1 CCA			
SSB configuration for dynamic channel access Note 5, 6	Config 1, 2, 3, 4, 5, 6		SSB.2 CCA			
ssb-PositionQCL	Config 1, 2, 3, 4, 5, 6		1			
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 3, 4, 5, 6	kHz	30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1, 2, 3, 4, 5, 6	kHz	30 kHz			
PRACH configuration			FR1 PRACH configuration 1 under CCA			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98			
N_{oc} Note2	Config 1, 2, 3, 4, 5, 6	dBm/SCS	-95			
$\hat{E}_s / I_{ot}$		dB	-∞	2.36	2.36	2.36
$\hat{E}_s / N_{oc}$		dB	-∞	11	11	11
SSB_RP	Config 1, 2, 3, 4, 5, 6	dBm/SCS	-∞	-84	-84	-84
Io Note3	Config 1, 2, 3, 4, 5, 6	dBm/ 38.16 MHz	-55.31	-50.96	-50.96	-50.96
Propagation condition		-	AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						

Parameter	Unit	Cell 3			
		T1'	T2'	T3'	T4'
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.					
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.					
NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.					

A.11.2.1.9.2 Test Requirements

In this test, the UE shall start to transmit the PRACH to E-UTRA Cell 2 less than 55 ms [Note1] from the beginning of time period T3.

The above test requirements shall be fulfilled in order of T1, T2, T3 for the observed inter-RAT handover delay from NR to E-UTRAN to be counted as correct, and in order of T1, T2′, T3′, T4′ for the observed PSCell addition delay to be counted as correct.

The rate of correct handovers and correct PSCell addition delay during repeated tests shall be at least 90 %.

NOTE1: The handover delay can be expressed as specified in clause 6.1.5.2:

$D_{HOwithPSCell_PCell}$ = RRC procedure delay + $T_{interrupt}$,

Where RRC procedure delay = 50 ms, and

$T_{interrupt} = T_{search_HO} + T_{IU} + T_{processing}$ is defined in clause 6.1.5.2.1, where

T_{search} = 0 ms

T_{IU} = 10 ms,

$T_{processing}$ = 25 ms

$D_{HOwithPSCell_PCell}$ is equal to 85 ms.

The UE shall transmit the PRACH to PSCell no later than $D_{HOwithPSCell_PSCell}$ from the start of T3'. The UE shall send at least one CSI report for PSCell with non-zero CQI index during T4'. The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T4.

The PSCell addition delay can be expressed as follows as specified in clause 6.1.5.5.3:

$D_{HOwithPSCell_PSCell} = T_{RRC_delay} + T_{processing} + T_{search_PCell} + T_{search_PSCell} + T_{\Delta} + T_{IU_PSCell}$ + 2 ms

Where:

T_{RRC_delay} = 20 ms

$T_{processing}$ = 25 ms

T_{search_PCell} = 0

T_{search_PSCell} = 0T_{Δ} = (1+ L_2) *20 ms.

T_{IU_PSCell} = (1+ L_3) *10 + 10 ms

L_2 is the number of SMTC occasions not available at the UE during the time tracking period where $L_2 \leq L_{CCA_DL}$, and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure, where $L_3 \leq L_{CCA_UL}$. L_3 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [33]. The interruption time considering the potential extensions caused by L_1, L_2, L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2]. Test equipment should make sure that L_{CCA_DL} and L_{CCA_UL} are not exceeded during a test by

monitoring the number of CCA failures and preventing additional CCA failures from happening after L_{CCA_DL} or L_{CCA_UL} is reached.

The rate of correct PSCell addition observed during repeated tests shall be at least 90 %.

A.11.2.2 RRC connection mobility control

A.11.2.2.1 RRC re-establishment

A.11.2.2.1.1 Intra-frequency RRC Re-establishment with CCA in FR1

A.11.2.2.1.1.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay with CCA in FR1 with known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1A.

The test parameters are given in table A.11.2.2.1.1.1-1, table A.11.2.2.1.1.1-2 and table A.11.2.2.1.1.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell with CCA, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.11.2.2.1.1.1-1: Supported test configurations

Configuration	Description
1	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.2.2.1.1.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case with CCA

Parameter		Unit	Value	Comment
Initial Condition	Active cell	-	Cell 1	Cell 1 is with CCA.
	Neighbour cells	-	Cell 2	Cell 2 is with CCA.
Final condition	Active cell	-	Cell 2	
RF Channel Number		-	1	
DL CCA model	Dynamic channel access Note 1, 3	-	As specified in clause A.3.26.2.1	
	Semi-static channel access Note 2, 3	-		
UL CCA model	Dynamic channel access Note 1, 3	-	As specified in clause A.3.26.2.2	
	Semi-static channel access Note 2,3	-		
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T311	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T311	
Time offset between cells		-	3 µs	Synchronous cells
N310		-	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	Minimum consecutive in-sync indications from lower layers
T310		ms	0	Radio link failure timer; T310 is disabled
T311		ms	3000	RRC re-establishment timer
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
SSB configuration	Dynamic channel access Note 1, 3	-	SSB.2 CCA	Table A.3.10A.1.2-1
	Semi-static channel access Note 2, 3	-	SSB.1 CCA	Table A.3.10A.1.1-1
DBT window configuration		-	DBT.1	Table A.3.28.1-1

Parameter	Unit	Value	Comment
SMTC configuration	-	SMTC pattern 1	
DRX cycle length	s	OFF	
PRACH configuration	-	FR1 PRACH configuration 1 under CCA	Table A.3.8A.2.1-1
T1	s	5	
T2	ms	520	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1A in TS 38.133, T310 and the period for UE turns off transmitter)
T3	s	2	
NOTE 1: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 2: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.			

Table A.11.2.2.1.1.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case with CCA

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
TDD configuration	-	TDDConf.1.1 CCA			TDDConf.1.1 CCA		
DL CCA probability P_{CCA_DL} for dynamic channel access Note 4,6	-	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75			$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		
DL CCA probability P_{CCA_DL} for semi-static channel access Note 5,6	-	P_{CCA_DL}=0.9375			P_{CCA_DL}=0.9375		
UL CCA probability P_{CCA_UL}	-	1			1		
PDSCH RMC configuration		SR.1.1 CCA			SR.1.1 CCA		
RMSI CORESET RMC configuration		CR.1.1 CCA			CR.1.1 CCA		
Dedicated CORESET RMC configuration		CCR.1.1 CCA			CCR.1.1 CCA		
OCNG Pattern		OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
TRS configuration		TRS.1.2 TDD			N/A		
Initial DL BWP configuration		DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		ULBWP.0.1			ULBWP.0.1		
Active DL BWP confgiuration		DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
RLM-RS		SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1.54	-infinity	-infinity	-3.79	4	4
N_{oc} Note2	dBm/SCS	-95					
N_{oc} Note2	dBm/15 kHz	-98					
$\hat{E}_s/N_{oc}$	dB	7	-infinity	-infinity	4	4	4
SS-RSRP Note3	dBm/SCS	-88	-infinity	-infinity	-91	-91	-91
Io	dBm/38.16 MHz	-54.65	-58.50	-58.50	-54.65	-58.50	-58.50
Propagation Condition		AWGN					

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.							
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy.							
NOTE 5: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy.							
NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.							

A.11.2.2.1.1.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to a known NR intra frequency cell with CCA shall be less than 1350 + MAX (200, $(5+K_1)$ x 20) ms.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re-establish_delay_CCA} = T_{UE_re-establish_delay_CCA} + T_{UL_grant}$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay_CCA} = 50 \text{ ms} + T_{identify_intra_NR_CCA} + \sum_{i=1}^{N_{freq}-1} T_{identify_inter_NR_CCA,i} + T_{SI-NR_CCA} + T_{PRACH_CCA}$$

Where

$N_{freq} = 1$

$T_{identify_intra_NR_CCA}$ = MAX (200 ms, $(5+K_1)$ x T_{SMTC}), where

K_1 is the number of SMTC occasions not available at the UE due to DL CCA failures during RRC re-establishment period on the carrier with CCA.

T_{SMTC} = 20 ms is the SMTC periodicity.

$T_{identify_inter_NR_CCA}$ = 0 ms

T_{SI-NR_CCA} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target intra-frequency NR cell.

T_{PRACH_CCA} = $T_{SSB,RO}$ + 10 ms, where:

- $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined in table 8.1-1 of TS 38.213 [39], which is $T_{SSB,RO}$=10 ms for FR1 PRACH configuration 1 under CCA.

This gives a total of 1350 + MAX (200, $(5+K_1)$ x 20) ms, allow 1870 + MAX (200, $(5+K_1)$ x 20) ms from the beginning of T2 in the test case.

A.11.2.2.1.2 Inter-frequency RRC Re-establishment with CCA in FR1

A.11.2.2.1.2.1 Test Purpose and Environment

The purpose is to verify that the NR inter-frequency RRC re-establishment delay with CCA in FR1 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1A.

The test parameters are given in table A.11.2.2.1.2.1-1, table A.11.2.2.1.2.1-2 and table A.11.2.2.1.2.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell with CCA, becomes inactive. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of Cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of Cell 2 by the end of T1.

Table A.11.2.2.1.2.1-1: Supported test configurations

Configuration	Description
1	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.2.2.1.2.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Value	Comment
Initial Condition	Active cell	-	Cell 1	Cell 1 is with CCA.
	Neighbour cells	-	Cell 2	Cell 2 is with CCA.
Final condition	Active cell	-	Cell 2	
RF Channel Number		-	1, 2	
DL CCA model	Dynamic channel access Note 1, 3	-	As specified in clause A.3.26.2.1	
	Semi-static channel access Note 2, 3	-		
UL CCA model	Dynamic channel access Note 1, 3	-	As specified in clause A.3.26.2.2	
	Semi-static channel access Note 2, 3	-		
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T311	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T311	
Time offset between cells		-	3 μs	Synchronous cells
N310		-	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	Minimum consecutive in-sync indications from lower layers
T310		ms	0	Radio link failure timer; T310 is disabled
T311		ms	3000	RRC re-establishment timer
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
SSB configuration	Dynamic channel access Note 1, 3	-	SSB.2 CCA	Table A.3.10A.1.2-1
	Semi-static channel access Note 2, 3	-	SSB.1 CCA	Table A.3.10A.1.1-1
DBT window configuration		-	DBT.1	Table A.3.28.1-1
SMTC configuration		-	SMTC pattern 1	
DRX cycle length		s	OFF	
PRACH configuration		-	FR1 PRACH configuration 1 under CCA	Table A.3.8A.2.1-1
T1		s	5	
T2		ms	520	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1A in TS

Parameter	Unit	Value	Comment
			38.133, T310 and the period for UE turns off transmitter)
T3	s	2	
NOTE 1: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 2: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic cannel access, the UE can be tested under dynamic channel occupancy only.			

Table A.11.2.2.1.2.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
TDD configuration		TDDConf.1.1 CCA			TDDConf.1.1 CCA		
DL CCA probability P_{CCA_DL} for dynamic channel access Note 4,6	-	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75			$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		
DL CCA probability P_{CCA_DL} for semi-static channel access Note 5,6	-	P_{CCA_DL}=0.9375			P_{CCA_DL}=0.9375		
UL CCA probability P_{CCA_UL}	-	1			1		
PDSCH RMC configuration		SR.1.1 CCA			SR.1.1 CCA		
RMSI CORESET RMC configuration		CR.1.1 CCA			CR.1.1 CCA		
Dedicated CORESET RMC configuration		CCR.1.1 CCA			CCR.1.1 CCA		
OCNG Pattern		OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
TRS configuration		TRS.1.2 TDD			N/A		
Initial DL BWP configuration		DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		ULBWP.0.1			ULBWP.0.1		
Active DL BWP confgiuration		DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
RLM-RS		SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	7	-infinity	-infinity	-infinity	-infinity	4
N_{oc} Note2	dBm/SCS	-95					
N_{oc} Note2	dBm/15 kHz	-98					
$\hat{E}_s/N_{oc}$	dB	7	-infinity	-infinity	-infinity	-infinity	4
SS-RSRP Note3	dBm/SCS	-88	-infinity	-infinity	-infinity	-infinity	-91
Io	dBm/9.36 MHz	-56.15	-63.94	-63.94	-63.94	-63.94	-58.50
Propagation Condition		AWGN					
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 5: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.							

A.11.2.2.1.2.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR inter frequency cell shall be less than $T_{re-establish_{delay_{CCA}}}$.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re-establish_{delay_{CCA}}} = T_{UE_{re-establish_{delay_{CCA}}}} + T_{UL_{grant}}$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay_CCA} = 50 \text{ ms} + T_{identify_intra_NR_CCA} + \sum_{i=1}^{N_{freq}-1} T_{identify_inter_NR_CCA,i} + T_{SI-NR_CCA} + T_{PRACH_CCA}$$

Where

$T_{identify_intra_NR_CCA}$: 0 ms

$T_{identify_inter_NR_CCA,i}$: MAX (200 ms, ([6]+K2,i) x TSMTC, i),

where

K2,i is the number of SMTC not available at the UE during RRC re-establishment period on the “i” th carrier with CCA

$T_{SMTC,i}$: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*.

N_{freq} = 2

T_{SI-NR_CCA} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target inter-frequency NR cell.

T_{PRACH_CCA} = (1+ K_3)*$T_{SSB,RO}$ + 10 ms, where:

- $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined in table 8.1-1 of TS 38.213 [3].
- K_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. K_3 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [33].

This gives a total of $T_{re-establish_{delay_{CCA}}}$ = 50 + MAX (200 ms, (6+K2,1) x TSMTC, 1) + 1280 + (1+ K_3)*$T_{SSB,RO}$ + 10 ms, allow 1860 + MAX (200 ms, (6+K2,1) x TSMTC, 1) + (1+ K_3)*$T_{SSB,RO}$ ms from the beginning of T2 in the test case.

A.11.2.2.1.3 Intra-frequency RRC Re-establishment with CCA in FR1 without serving cell timing

A.11.2.2.1.3.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay with CCA in FR1 without serving cell timing is within the specified limits. These tests will verify the requirements in clause 6.2.1A.

The test parameters are given in table A.11.2.2.1.3.1-1, table A.11.2.2.1.3.1-2 and table A.11.2.2.1.3.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell with CCA, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.11.2.2.1.3.1-1: Supported test configurations

Configuration	Description
1	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.2.2.1.3.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Value	Comment
Initial Condition	Active cell	-	Cell 1	Cell 1 is with CCA.
	Neighbour cells	-	Cell 2	Cell 2 is with CCA.
Final condition	Active cell	-	Cell 2	
RF Channel Number		-	1	
DL CCA model	Dynamic channel access Note 1,3	-	As specified in clause A.3.26.2.1	
	Semi-static channel access Note 2,3	-		
UL CCA model	Dynamic channel access Note 1,3	-	As specified in clause A.3.26.2.2	
	Semi-static channel access Note 2,3	-		
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T311	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T311	
Time offset between cells		-	3 μs	Synchronous cells
N310		-	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	Minimum consecutive in-sync indications from lower layers
T310		ms	0	Radio link failure timer; T310 is disabled
T311		ms	3000	RRC re-establishment timer
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
SSB configuration	Dynamic channel access Note 1, 3	-	SSB.2 CCA	Table A.3.10A.1.2-1
	Semi-static channel access Note 2, 3	-	SSB.1 CCA	Table A.3.10A.1.1-1
DBT window configuration		-	DBT.1	Table A.3.28.1-1
SMTC configuration		-	SMTC pattern 1	
DRX cycle length		s	OFF	
PRACH configuration		-	FR1 PRACH configuration 1	Table A.3.8A.2.1-1
T1		s	5	
T2		ms	520	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1A in TS 38.133, T310 and the period for UE turns off transmitter)
T3		s	≥ $T_{UE_re-establish_delay_CCA}$	As defined in clause 6.2.1A

NOTE 1: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 2: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 3: For a UE supporting both semi-static and dynamic cannel access, the UE can be tested under dynamic channel occupancy only.

Table A.11.2.2.1.3.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
TDD configuration		TDDConf.1.1 CCA			TDDConf.1.1 CCA		

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
DL CCA probability P_{CCA_DL} for dynamic channel access Note 4,6	-	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75			$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		
DL CCA probability P_{CCA_DL} for semi-static channel access Note 5,6	-	P_{CCA_DL}=0.9375			P_{CCA_DL}=0.9375		
UL CCA probability P_{CCA_UL}	-	1			1		
PDSCH RMC configuration		SR.1.1 CCA			SR.1.1 CCA		
RMSI CORESET RMC configuration		CR.1.1 CCA			CR.1.1 CCA		
Dedicated CORESET RMC configuration		CCR.1.1 CCA			CCR.1.1 CCA		
OCNG Pattern		OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
TRS configuration		TRS.1.2 TDD			N/A		
Initial DL BWP configuration		DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		ULBWP.0.1			ULBWP.0.1		
Active DL BWP confgiuration		DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
RLM-RS		SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	4	-infinity	-infinity	-infinity	-infinity	4
N_{oc} Note2	dBm/SCS	-95					
N_{oc} Note2	dBm/15 kHz	-98					
$\hat{E}_s/N_{oc}$	dB	4	-infinity	-infinity	-infinity	-infinity	4
SS-RSRP Note3	dBm/SCS	-91	-infinity	-infinity	-infinity	-infinity	-91
Io	dBm/38.16 MHz	-58.50	-63.94	-63.94	-63.94	-63.94	-58.50
Propagation Condition		AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 5: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.11.2.2.1.3.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR intra frequency cell without serving cell timing shall be less than 1350 + MAX (800 ms, (10+ K_1) x 20) ms.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re-establish_delay_CCA} = T_{UE_re-establish_delay_CCA} + T_{UL_grant}$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay_CCA} = 50 \text{ ms} + T_{identify_intra_NR_CCA} + \sum_{i=1}^{N_{freq}-1} T_{identify_inter_NR_CCA,i} + T_{SI-NR_CCA} + T_{PRACH_CCA}$$

Where,

N_{freq} = 1

$T_{identify_intra_NR}$ = MAX (800 ms, (10+ K_1) x T_{SMTC}), where

K_1 is the number of SMTC occasions not available at the UE due to DL CCA failures during RRC re-establishment period on the carrier with CCA.

T_{SMTC} is the SMTC periodicity which is 20 ms.

$T_{identify_inter_NR_CCA}$ = 0 ms

T_{SI-NR_CCA} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 [2] for the target intra-frequency NR cell.

T_{PRACH_CCA} = (1+ K_3)*$T_{SSB,RO}$ + 10 ms, where:

- $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined in table 8.1-1 of TS 38.213 [39]. It is 10 ms for FR1 PRACH configuration 1 under CCA.
- K_3 = 0.

This gives total $T_{UE_re-establish_delay_CCA}$=1350 + MAX (800 ms, (10+ K_1) x 20) ms, allow 1870 + MAX (800 ms, (10+ K_1) x 20) ms from the beginning of T2 in the test case.

A.11.2.2.1.4 Inter-frequency RRC Re-establishment from NR FR1 carrier without CCA to NR FR1 carrier under CCA

A.11.2.2.1.4.1 Test Purpose and Environment

The purpose is to verify that the NR inter-frequency RRC re-establishment delay requirement for RRC re-establishment from NR FR1 carrier without CCA to NR FR1 inter-frequency carrier under CCA with unknown target cell. These tests will verify the requirements in clause 6.2.1A.

The test parameters are given in table A.11.2.2.1.4.1-1, table A.11.2.2.1.4.1-2 and table A.11.2.2.1.4.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of Cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of Cell 2 by the end of T1.

Table A.11.2.2.1.4.1-1: Supported test configurations inter-frequency RRC re-establishment from NR FR1 without under CCA to NR FR1 inter-frequency carrier under CCA

Configuration	Source cell without CCA	Target cell with CCA
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD	30 kHz SSB SCS, 40 MHz bandwidth, TDD
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD	30 kHz SSB SCS, 40 MHz bandwidth, TDD
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD	30 kHz SSB SCS, 40 MHz bandwidth, TDD
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.11.2.2.1.4.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case from NR FR1 carrier without CCA to NR FR1 inter-frequency carrier under CCA

Parameter		Unit	Value	Comment
Initial condition	Active cell		Cell 1	

	Neighbour cells		Cell 2	
Final condition	Active cell		Cell 2	
RF Channel Number			1, 2	
Time offset between cells			3 μs	Synchronous cells
DL CCA model	Dynamic channel access Note 1,3		As specified in clause A.3.26.2.1	
	Semi-static channel access Note 2,3			
UL CCA model	Dynamic channel access Note 1,3		As specified in clause A.3.26.2.2	
	Semi-static channel access Note 2,3			
L_{CCA_DL}			5	
W_{CCA_DL}		ms	T311	
L_{CCA_UL}			5	
W_{CCA_UL}		ms	T311	
N310		-	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	Minimum consecutive in-sync indications from lower layers
T310		ms	0	Radio link failure timer; T310 is disabled
T311		ms	5000	RRC re-establishment timer
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	OFF	
PRACH configuration			FR1 PRACH configuration 1	Table A.3.8A.2.1-1
T1		s	5	
T2		ms	520	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1A in TS 38.133, T310 and the period for UE turns off transmitter)
T3		s	≥ $T_{UE_re\text{-}establish_delay_CCA}$	As defined in clause 6.2.1A

Table A.11.2.2.1.4.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case from NR FR1 carrier without CCA to NR FR1 inter-frequency carrier under CCA

Parameter		Test config	Unit	Cell 1			Cell 2		
				T1	T2	T3	T1	T2	T3
TDD configuration		1		N/A			TDDConf.1.1.CCA		
		2		TDDConf.1.1			TDDConf.1.1.CCA		
		3		TDDConf.2.1			TDDConf.1.1.CCA		
PDSCH RMC configuration		1		SR.1.1 FDD			SR.1.1 CCA		
		2		SR.1.1 TDD			SR.1.1 CCA		
		3		SR.2.1 TDD			SR.1.1 CCA		
RMSI CORESET RMC configuration		1		CR.1.1 FDD			CR.1.1 CCA		
		2		CR.1.1 TDD			CR.1.1 CCA		
		3		CR.2.1 TDD			CR.1.1 CCA		
Dedicated CORESET RMC configuration		1		CCR.1.1 FDD			CCR.1.1 CCA		
		2		CCR.1.1 TDD			CCR.1.1 CCA		
		3		CCR.2.1 TDD			CCR.1.1 CCA		
OCNG Pattern		1		OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
TRS configuration		1		TRS.1.1 FDD			TRS.1.2 TDD		
		2		TRS.1.1 TDD			TRS.1.2 TDD		
		3		TRS.1.2 TDD			TRS.1.2 TDD		
SMTC configuration		1,2,3		SMTC.1			SMTC.1		
SSB configuration	Semi- static channel acces	1,2		SSB.1 FR1			SSB.1 CCA		

Parameter		Test config	Unit	Cell 1			Cell 2		
				T1	T2	T3	T1	T2	T3
	Semi- static channel acces	3		SSB.2 FR1			SSB.1 CCA		
	Dymamic channel acces	1,2		SSB.1 FR1			SSB.2 CCA		
	Dymamic channel acces	3		SSB.2 FR1			SSB.2 CCA		
Initial DL BWP configuration		1,2,3		DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1,2,3		ULBWP.0.1			ULBWP.0.1		
Active DL BWP confgiuration		1,2,3		DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		1,2,3		ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
DL CCA probability for semi-static channel access (P_{CCA_DL})		1,2,3		N/A	N/A	N/A	1	1	0.9375
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_1}$)		1,2,3		N/A	N/A	N/A	1	1	0.75
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_2}$)		1,2,3		N/A	N/A	N/A	1	1	0.75
UL CCA probability (P_{CCA_UL})		1,2,3		N/A	N/A	N/A	1	1	1
RLM-RS		1,2,3		SSB			SSB		
$\hat{E}_s/I_{ot}$		1,2,3	dB	4	- infinity	- infinity	- infinity	- infinity	7
N_{oc} Note2		1,2,3	dBm/15 KHz	-98					
N_{oc} Note2		1,2	dBm/SCS	-98					
		3		-95					
$\hat{E}_s/N_{oc}$		1,2,3	dB	4	- infinity	- infinity	- infinity	- infinity	7
SS-RSRP Note3		1, 2	dBm/SCS	-94	- infinity	- infinity	- infinity	- infinity	-91
		3		-91	- infinity	- infinity	- infinity	- infinity	-88
Io		1,2	dBm/9.36 MHz	-64.59	-70.05	-70.05	-63.94	-63.94	-56.15
		3	dBm/38.16 MHz	-58.50	-63.94	-63.94	-63.94	-63.94	-56.15
Propagation Condition		1,2,3		AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Parameters P_{CCA_DL}, $P_{CCA_DL_1}$, $P_{CCA_DL_2}$ and P_{CCA_UL} are defined in clause A.3.26.2.
NOTE 5: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.11.2.2.1.4.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR inter frequency cell shall be less $T_{UE_re-establish_delay_CCA}$.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re-establish_delay_CCA} = T_{UE_re-establish_delay_CCA} + T_{UL_grant}$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay_CCA} = 50 \text{ ms} + T_{identify_intra_NR_CCA} + \sum_{i=1}^{N_{freq}-1} T_{identify_inter_NR_CCA,i} + T_{SI-NR_CCA} + T_{PRACH_CCA}$$

N_{freq} = 2

$T_{identify_intra_NR_CCA}$ = MAX (800 ms, (10+ K_1) x 20) ms

$T_{identify_inter_NR_CCA}$ = MAX (800 ms, (13+$K_{2,2}$) x 20) ms

T_{SI-NR_CCA} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target inter-frequency NR cell.

T_{PRACH_CCA} = It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. T_{PRACH_CCA} = (1+ K_3)*$T_{SSB,RO}$ + 10 ms; where K_3=0 and $T_{SSB,RO}$=10 ms for FR1 PRACH configuration 1 under CCA.

K_1 is the number of SMTC occasions not available at the UE due during RRC re-establishment period on the carrier with CCA and with RF channel number # 1.

$K_{2,2}$ is the number of SMTC occasions not available at the UE during RRC re-establishment period on the carrier with CCA and with RF channel number # 2.

This gives total $T_{UE_re-establish_delay_CCA}$=1350+MAX (800 ms, (10+ K_1) x 20) ms+MAX (800 ms, ([13]+$K_{2,2}$) x 20) ms, allow 1870 + MAX (800 ms, (10+ K_1) x 20) ms+MAX (800 ms, ([13]+$K_{2,2}$) x 20) ms from the beginning of T2 in the test case.

A.11.2.2.2 Random Access

A.11.2.2.2.1 4-step RA type contention-based random access for NR PCell with CCA

A.11.2.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits when subject to CCA. This test will verify the requirements in clause 6.2.2A.2 and clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1, which operates on a carrier frequency with CCA. Supported test parameters are shown in table A.11.2.2.2.1.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.11.2.2.2.1.1-2.

Table A.11.2.2.2.1.1-1: Supported test configurations for contention based random access test for FR1 PCell with CCA

Config	Description
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: Void	

Table A.11.2.2.2.1.1-2: General test parameters for contention based random access test for FR1 PCell with CCA

Parameter			Unit	Test-1	Comments
SSB Configuration	Note 4, 6	Config 1		SSB.3 CCA	As defined in A.3.10A
	Note 5, 6	Config 1		SSB.4 CCA	As defined in A.3.10A

Parameter			Unit	Test-1	Comments
DBT Window Configuration		Config 1		DBT.1	As specified in A.3.28.1
DL CCA model		Config 1		As specified in A.3.26.2.1	
UL CCA model		Config 1		As specified in A.3.26.2.2	
Duplex Mode for Cell 2		Config 1		TDD	
TDD Configuration		Config 1		TDDConf.1.1 CCA	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1		SR.1.1 CCA	As defined in A.3.1A.1.
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP		dBm/ SCS	-115	
Io Note 2		Config 1	dBm	-62.2/38.16 MHz	For symbols without SSB index 1
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 1 under CCA	As defined in A.3.8A.2.
DL CCA probability		Note 4, 6		0.9375	
P_{CCA_DL}		Note 5, 6		0.75 / 0.75	
L_{CCA_DL} Note 7				4	
W_{CCA_DL} Note 8				Inf	
UL CCA probability		Note 4, 6		0.87	
P_{CCA_UL}		Note 5, 6		0.75	
L_{CCA_UL} Note 7				5	
W_{CCA_UL} Note 8				Inf	
Semi-static channel access config period Note 4, 6			ms	2	
Propagation Condition			-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic channel occupancy and semi-static channel occupancy configuration.
NOTE 7: L_{CCA_DL} and L_{CCA_UL} are chosen such that preambleTransMax > 5 + L_{CCA_DL} + L_{CCA_UL}.

Parameter	Unit	Test-1	Comments
NOTE 8: A window W_{CCA_DL}=W_{CCA_UL}=Inf is used to indicate that L_{CCA_DL} and L_{CCA_UL} are considered during the entire duration of a test run.			

A.11.2.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.11.2.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in clause 6.2.2A.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*, if the UL CCA is successful.

The three requirements below are relevant for all cases of PRACH transmissions described within the whole clause A.11.2.2.2.1.2:

- The System Simulator shall implement the UL CCA model of A.3.26.2 for the RACH occasions where PRACH transmissions are expected. The System Simulator shall monitor the RACH occasions to detect if the UE is transmitting PRACH preambles. If a PRACH transmission is detected on a RACH occasion that is expected to have UL CCA failure, the test is considered as failed.

- In case of CCA DL failure, the test equipment should verify that the UE does not transmit PRACH for semi-static channel access mode; for dynamic channel access mode it is assumed that RACH occasions are always scheduled within a UE-initiated COT.

- In case of UL CCA failure, The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2A.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble. In case of CCA DL failure, the test equipment should delay the transmission of Random Access Response.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble if UL CCA is successful. The System Simulator shall monitor if the UE is transmitting msg3 when CCA UL failure. If a msg3 transmission is detected on a grant expected to have UL CCA failure, the test is considered as failed.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2A.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles. In case of CCA DL failure, the test equipment should delay the transmission of Random Access Response.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2A.2.1.4 the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response if UL CCA is successful. The System Simulator shall monitor if the UE is transmitting msg3 when CCA UL failure. If a msg3 is detected on a grant expected to have UL CCA failure, the test is considered as failed.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.11.2.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2.2A.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

A.11.2.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2.2A.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

A.11.2.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in clause 6.2.2A.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.11.2.2.2.2 4-step RA type non-contention based random access for NR PSCell with CCA

A.11.2.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits when subject to CCA. This test will verify the requirements in clause 6.2.2A.2 and clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1, which operates on a carrier frequency with CCA. Supported test parameters are shown in table A.11.2.2.2.2.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.11.2.2.2.2.1-2.

Table A.11.2.2.2.2.1-1: Supported test configurations for non-contention based random access test for FR1 PCell with CCA

Config	Description
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: Void	

Table A.11.2.2.2.2.1-2: General test parameters for non-contention based random access test for FR1 PCell with CCA

Parameter			Unit	Test-1	Comments
SSB Configuration	Note 4, 6	Config 1		SSB.3 CCA	As defined in A.3.10A
	Note 5, 6	Config 1		SSB.4 CCA	As defined in A.3.10A
DBT Window Configuration		Config 1		DBT.1	As specified in A.3.28.1
DL CCA model		Config 1		As specified in A.3.26.2.1	
UL CCA model		Config 1		As specified in A.3.26.2.2	
Duplex Mode for Cell 2		Config 1		TDD	
TDD Configuration		Config 1		TDDConf.1.1 CCA	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1		SR.1.1 CCA	As defined in A.3.1A.1.
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP		dBm/ SCS	-115	
Io Note 2		Config 1	dBm	-62.2/38.16 MHz	For symbols without SSB index 1
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\mathrm{CMAX},\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 2 under CCA	As defined in A.3.8A.2.
DL CCA probability	Note 4, 6			0.9375	

Parameter		Unit	Test-1	Comments
P_{CCA_DL}	Note 5, 6		0.75 / 0.75	
L_{CCA_DL} Note 7			4	
W_{CCA_DL} Note 8			Inf	
UL CCA probability	Note 4, 6		0.87	
P_{CCA_UL}	Note 5, 6		0.75	
L_{CCA_UL} Note 7			5	
W_{CCA_UL} Note 8			Inf	
Semi-static channel access config period Note 4, 6		ms	2	
Propagation Condition		-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic channel occupancy and semi-static channel occupancy configuration.
NOTE 7: L_{CCA_DL} and L_{CCA_UL} are chosen such that preambleTransMax > 5 + L_{CCA_DL} + L_{CCA_UL}.
NOTE 8: A window W_{CCA_DL}=W_{CCA_UL}=Inf is used to indicate that L_{CCA_DL} and L_{CCA_UL} are considered during the entire duration of a test run.

A.11.2.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.11.2.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in clause 6.2.2A.2.2.1 for SSB-based Random Access Preamble transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

The three requirements below are relevant for all cases of PRACH transmissions described within the clause A.11.2.2.2.2.2:

- The System Simulator shall implement the UL CCA model of A.3.26.2 for the RACH occasions where PRACH transmissions are expected. The System Simulator shall monitor the RACH occasions to detect if the UE is transmitting PRACH preambles. If a PRACH transmission is detected on a RACH occasion that is expected to have UL CCA failure, the test is considered as failed.

- In case of CCA DL failure, the test equipment should verify that the UE does not transmit PRACH for semi-static channel access mode; for dynamic channel access mode it is assumed that RACH occasions are always scheduled within a UE-initiated COT.

- In case of UL CCA failure The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belong to the PRACH occasions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.2.2.2 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2A.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble. In case of CCA DL failure, the test equipment should delay the transmission of Random Access Response.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble if UL CCA is successful. The System Simulator shall monitor if the UE is transmitting msg3 when CCA UL failure. If a msg3 is detected on a grant expected to have UL CCA failure, the test is considered as failed.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.2.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2A.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles. In case of CCA DL failure, the test equipment should delay the transmission of Random Access Response.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.2. The power of the first preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.2.3 2-step RA type contention-based random access for NR PCell with CCA

A.11.2.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the 2-step RA type random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits when subject to CCA. This test will verify the requirements in clause 6.2.2A.3 and clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1, which operates on a carrier frequency with CCA. Supported test parameters are shown in table A.11.2.2.2.3.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.11.2.2.2.3.1-2.

Table A.11.2.2.2.3.1-1: Supported test configurations for 2-step RA type contention based random access with successRAR test for FR1 PCell with CCA

Config	Description
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: Void	

Table A.11.2.2.2.3.1-2: General test parameters for 2-step RA type contention based random access with successRAR test for FR1 PCell with CCA

Parameter			Unit	Test-1	Comments
SSB Configuration	Note 4, 6	Config 1		SSB.3 CCA	As defined in A.3.10A
	Note 5, 6	Config 1		SSB.4 CCA	As defined in A.3.10A
DBT Window Configuration		Config 1		DBT.1	As specified in A.3.28.1
DL CCA model		Config 1		As specified in A.3.26.2.1	
UL CCA model		Config 1		As specified in A.3.26.2.2	
Duplex Mode for Cell 2		Config 1		TDD	
TDD Configuration		Config 2		TDDConf.1.1 CCA	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1		SR.1.1 CCA	As defined in A.3.1A.1.
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP		dBm/ SCS	-115	
Io Note 2		Config 1	dBm	-62.2/38.16 MHz	For symbols without SSB index 1
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
MsgA Configuration				FR1 MsgA configuration 1 under CCA	As defined in A.3.20A.2.
msgA-RSRP-ThresholdSSB			dBm	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
DL CCA probability	Note 4, 6			0.9375	
P_{CCA_DL}	Note 5, 6			0.75 / 0.75	
L_{CCA_DL} Note 7				4	
W_{CCA_DL} Note 8				Inf	
UL CCA probability	Note 4, 6			0.87	
P_{CCA_UL}	Note 5, 6			0.75	
L_{CCA_UL} Note 7				5	
W_{CCA_UL} Note 8				Inf	
Semi-static channel access config period Note 4, 6			ms	2	
Propagation Condition			-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.

Parameter	Unit	Test-1	Comments
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.			
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.			
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.			
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic channel occupancy and semi-static channel occupancy configuration.			
NOTE 7: L_{CCA_DL} and L_{CCA_UL} are chosen such that preambleTransMax > 5 + L_{CCA_DL} + L_{CCA_UL}.			
NOTE 8: A window W_{CCA_DL}=W_{CCA_UL}=Inf is used to indicate that L_{CCA_DL} and L_{CCA_UL} are considered during the entire duration of a test run.			

A.11.2.2.2.3.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.11.2.2.2.3.2.1 MsgA Transmission

To test the UE behavior specified in clause 6.2.2A.3.1.1 the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB*, if the UL CCA is successful.

The three requirements below are relevant for all cases of MsgA transmissions described within the clause A.11.2.2.2.3.2:

- The System Simulator shall implement the UL CCA model for the MsgA occasions (i.e. both MsgA PRACH and MsgA PUSCH occasions) where MsgA transmissions are expected. The System Simulator shall monitor the MsgA occasions to detect if the UE is transmitting MsgA. If a MsgA transmission is detected on MsgA occasions that are expected to have UL CCA failure, the test is considered as failed.

- In case of CCA DL failure, the test equipment should verify that the UE does not transmit MsgA for semi-static channel access mode; for dynamic channel access mode it is assumed that MsgA occasions are always scheduled within a UE-initiated COT.

- The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated PRACH transmission power in case of UL CCA failure.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2A.3. The power of the first MsgA preamble transmission shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.2.3.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2A.3.1.2 the System Simulator shall transmit a MsgB containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble. In case of CCA DL failure, the test equipment should delay the transmission of MsgB.

The UE may stop monitoring for MsgB(s) and shall transmit an ACK if the MsgB with a successRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble and if the Contention Resolution is successful and if UL CCA is successful. The System Simulator shall monitor if the UE is transmitting ACK in the case of CCA UL failure. If ACK transmission is detected on a grant expected to have UL CCA failure, the test is considered as failed.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble if UL CCA is

successful. The System Simulator shall monitor if the UE is transmitting msg3 when CCA UL failure. If a msg3 is detected on a grant expected to have UL CCA failure, the test is considered as failed.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB(s) contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2A.3. The power of the first MsgA preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.2.3.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2A.3.1.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles. In case of CCA DL failure, the test equipment should delay the transmission of MsgB.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2A.3. The power of the first MsgA preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.2.4 2-step RA type non-contention-based random access for NR PCell with CCA

A.11.2.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits when subject to CCA. This test will verify the requirements in clause 6.2.2A.3 and clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1, which operates on a carrier frequency with CCA. Supported test parameters are shown in table A.11.2.2.2.4.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.11.2.2.2.4.1-2.

Table A.11.2.2.2.4.1-1: Supported test configurations for non-contention based random access test for FR1 PCell with CCA

Config	Description
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: Void	

Table A.11.2.2.2.4.1-2: General test parameters for non-contention based random access test for FR1 PCell with CCA

Parameter			Unit	Test-1	Comments
SSB Configuration	Note 4, 6	Config 1		SSB.3 CCA	As defined in A.3.10A
	Note 5, 6	Config 1		SSB.4 CCA	As defined in A.3.10A

Parameter			Unit	Test-1	Comments
DBT Window Configuration		Config 1		DBT.1	As specified in A.3.28.1
DL CCA model		Config 1		As specified in A.3.26.2.1	
UL CCA model		Config 1		As specified in A.3.26.2.2	
Duplex Mode for Cell 1		Config 1		TDD	
TDD Configuration		Config 1		TDDConf.1.1 CCA	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1		SR.1.1 CCA	As defined in A.3.1A.1.
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
msgA-*RSRP-ThresholdSSB*			dBm	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured msgA-*RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured msgA-*RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15 kHz	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP		dBm/ SCS	-115	
Io Note 2		Config 1	dBm	-62.2/38.16 MHz	For symbols without SSB index 1
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
MsgA Configuration				FR1 MsgA configuration 2 under CCA	As defined in A.3.20A.2.
DL CCA probability	Note 4, 6			0.9375	
P_{CCA_DL}	Note 5, 6			0.75 / 0.75	
L_{CCA_DL} Note 7				4	
W_{CCA_DL} Note 8				Inf	
UL CCA probability	Note 4, 6			0.87	
P_{CCA_UL}	Note 5, 6			0.75	
L_{CCA_UL} Note 7				5	
W_{CCA_UL} Note 8				Inf	
Semi-static channel access config period Note 4, 6			ms	2	
Propagation Condition			-	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.

Parameter	Unit	Test-1	Comments
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic channel occupancy and semi-static channel occupancy configuration.			
NOTE 7: L_{CCA_DL} and L_{CCA_UL} are chosen such that preambleTransMax > 5 + L_{CCA_DL} + L_{CCA_UL}.			
NOTE 8: A window W_{CCA_DL}=W_{CCA_UL}=Inf is used to indicate that L_{CCA_DL} and L_{CCA_UL} are considered during the entire duration of a test run.			

A.11.2.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.11.2.2.2.4.2.1 MsgA Transmission

To test the UE behavior specified in clause 6.2.2A.3.2.1, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA PRACH on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belong to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

The three requirements below are relevant for all cases of MsgA transmissions described within the clause A.11.2.2.2.4.2:

- The System Simulator shall implement the UL CCA model for the MsgA occasions (i.e. both MsgA PRACH and MsgA PUSCH occasions) where MsgA transmissions are expected. The System Simulator shall monitor the MsgA occasions to detect if the UE is transmitting MsgA. If a MsgA transmission is detected on MsgA occasions that are expected to have UL CCA failure, the test is considered as failed.

- In case of CCA DL failure, the test equipment should verify that the UE does not transmit MsgA for semi-static channel access mode; for dynamic channel access mode it is assumed that MsgA occasions are always scheduled within a UE-initiated COT.

- The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated PRACH transmission power in case of UL CCA failure.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.3. The power of the first MsgA preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.2.4.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2A.3.2.2 the System Simulator shall transmit a MsgB containing a fallbackRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble. In case of CCA DL failure, the test equipment should delay the transmission of MsgB.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 containing the payload of MsgA PUSCH if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble if UL CCA is successful. The System Simulator shall monitor if the UE is transmitting msg3 when CCA UL failure. If a msg3 is detected on a grant expected to have UL CCA failure, the test is considered as failed. The UE shall monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the

backoff time expires if all received MsgB's contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

The system simulator shall implement the UL CCA model of A.3.26.2 for the MsgA occasions where MsgA System Simulator transmissions are expected. The System Simulator shall monitor the MsgA occasions to detect if the UE is transmitting MsgA. If a MsgA transmission is detected on a MsgA occasion that is expected to have UL CCA failure, the test is considered as failed.

In case of CCA DL failure, the test equipment should verify that the UE does not transmit MsgA for semi-static channel access mode.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated MsgA transmission power in case UL CCA failure.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2A.3. The power of the first MsgA preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA and msg3 transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.2.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2A.3.2.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles. In case of CCA DL failure, the test equipment should delay the transmission of MsgB.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

The System Simulator shall implement the UL CCA model of A.3.26.2 for the MsgA occasions where MsgA transmissions are expected. The System Simulator shall monitor the MsgA occasions to detect if the UE is transmitting MsgA. If a MsgA transmission is detected on a MsgA occasion that is expected to have UL CCA failure, the test is considered as failed.

In case of CCA DL failure, the test equipment should verify that the UE does not transmit MsgA for semi-static channel access mode.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated MsgA transmission power in case UL CCA failure.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2A.3. The power of the first MsgA preamble shall be -16 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1.2.

A.11.2.2.3 RRC connection release with redirection

A.11.2.2.3.1 Redirection from NR FR1 carrier under CCA to NR FR1 carrier under CCA

A.11.2.2.3.1.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR FR1 carrier under CCA to NR FR1 carrier under CCA specified in clause 6.2.3.2.3.

A.11.2.2.3.1.2 Test Parameters

Supported test configurations are shown in table A.11.2.2.3.1.2-1. The time delay is tested by using the parameters in table A.11.2.2.3.1.2-2, and A.11.2.2.3.1.2-3.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2.

Table A.11.2.2.3.1.2-1: Redirection from NR to NR test configurations

Config	Description
1	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.2.2.3.1.2-2: General test parameters for Redirection from NR to NR test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	On the carrier under CCA
	Neighbouring cell		Cell 2	On the carrier under CCA
Final condition	Active cell		Cell 2	On the carrier under CCA
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
DL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.26.2.1	
	Semi-static channel access Note 2, 3			
UL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.26.2.2	
	Semi-static channel access Note 2,3			
T1		s	5	
T2		s	≥ $T_{connection_release_redirect_NR_CCA}$	$T_{connection_release_redirect_NR_CCA}$ is defined in clause 6.2.3.2.3
NOTE 1: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 2: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.11.2.2.3.1.2-3: Cell specific test parameters for Redirection from NR to NR test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
P_{CCA_DL} for dynamic channel access Note 4,6		-	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 5,6		-	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
P_{CCA_UL} for dynamic channel access Note 4,6		-	1		1	
P_{CCA_UL} for semi-static channel access Note 5,6		-	1		1	
L_{CCA_DL} Note 7			N/A		8	
W_{CCA_DL} Note 7		ms	N/A		$T_{identify\text{-}NR_CCA}$	
TDD configuration	Config 1		TDDConf.1.1 CCA			
$BW_{channel}$	Config 1		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1		40: $N_{PRB,c}$ = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference	Config 1		SR.1.1 CCA			
RMSI CORESET Reference Channel	Config 1		CR.1.1 CCA			
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 CCA			
TRS configuration	Config 1		TRS.1.2 TDD			
OCNG Patterns			OP.1			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
SMTC Configuration			SMTC.1			
DBT configuration			DBT.1			
SSB configuration for semi-static channel access Note 4, 6	Config 1		SSB.1 CCA			
SSB configuration for dynamic channel access Note 5, 6	Config 1		SSB.2 CCA			
ssb-PositionQCL	Config 1		[1]			
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1	kHz	30 kHz			
PRACH configuration			FR1 PRACH configuration 1 under CCA			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98			
N_{oc} Note2	Config 1	dBm/SCS	-95			
$\hat{E}_s / I_{ot}$		dB	4	4	-infinity	4
$\hat{E}_s / N_{oc}$		dB	4	4	-infinity	4
Io Note3	Config 1	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-58.49
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.
NOTE 7: As defined in clause 6.2.3.2.3 for $T_{rs} \leq 40$ ms.

A.11.2.2.3.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than $T_{connection_release_redirect_NR_CCA}$ ms from the beginning of time period T2, where $T_{connection_release_redirect_NR_CCA}$ is defined in clause 6.2.3.2.3.
The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_NR_CCA} = T_{RRC_procedure_delay} + T_{identify\text{-}NR_CCA} + T_{SI\text{-}NR_CCA} + T_{RACH_CCA},$$

where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}NR_CCA}$ = MAX (680 ms, (L_1+11) × 20 ms) in the test.

$T_{SI\text{-}NR}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target NR cell.

T_{RACH_CCA} is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell.

L_1 is the number of SMTC occasions not available at the UE due to DL CCA failures. The test equipment ensure that number of L_1 in target cell does not exceed $L_{1,max}$ using the configured L_{CCA_DL} as in clause A.3.26.2.1;

A.11.2.2.3.2 Redirection from NR FR1 carrier without CCA to NR FR1 carrier with CCA

A.11.2.2.3.2.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR FR1 carrier without CCA to NR FR1 carrier with CCA specified in clause 6.2.3.2.3.

A.11.2.2.3.2.2 Test Parameters

Supported test configurations are shown in table A.11.2.2.3.2.2-1. The time delay is tested by using the parameters in table A.11.2.2.3.2.2-2, and A.11.2.2.3.2.2-3.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2.

Table A.11.2.2.3.2.2-1: Redirection from NR to NR test configurations

Configuration	Source cell without CCA	Target cell with CCA
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD	30 kHz SSB SCS, 40 MHz bandwidth, TDD
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD	30 kHz SSB SCS, 40 MHz bandwidth, TDD
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD	30 kHz SSB SCS, 40 MHz bandwidth, TDD
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.11.2.2.3.2.2-2: General test parameters for Redirection from NR to NR test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	On the carrier without CCA
	Neighbouring cell		Cell 2	On the carrier under CCA
Final condition	Active cell		Cell 2	On the carrier under CCA
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
DL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.26.2.1	
	Semi-static channel access Note 2, 3			
UL CCA model	Dynamic channel access Note 1, 3		As specified in clause A.3.26.2.2	
	Semi-static channel access Note 2,3			
T1		s	5	
T2		s	≥ $T_{connection_release_redirect_NR_CCA}$	$T_{connection_release_redirect_NR_CCA}$ is defined in clause 6.2.3.2.3
NOTE 1: For a UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 2: For a UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.11.2.2.3.2.2-3: Cell specific test parameters for Redirection from NR to NR test case

Parameter			Unit	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number				1		2	
P_{CCA_DL} for dynamic channel access Note 4,6				N/A		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75
P_{CCA_DL} for semi-static channel access Note 5,6				N/A		P_{CCA_DL}=0.9375	P_{CCA_DL}=0.9375
P_{CCA_UL} for dynamic channel access Note 4,6				N/A		1	1
P_{CCA_UL} for semi-static channel access Note 5,6				N/A		1	1
L_{CCA_DL} Note 7				N/A		8	
W_{CCA_DL} Note 7			ms	N/A		$T_{identify\text{-}NR_CCA}$	
Duplex mode		Config 1		FDD		TDD	
		Config 2,3		TDD			
TDD configuration		Config 1		Not Applicable		TDDConf.1.1 CCA	
		Config 2		TDDConf.1.1		TDDConf.1.1 CCA	
		Config 3		TDDConf.2.1		TDDConf.1.1 CCA	
$BW_{channel}$		Config 1	MHz	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106	
		Config 2		10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106	
		Config 3		40: $N_{PRB,c}$ = 106			
BWP BW		Config 1	MHz	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106	
		Config 2		10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106	
		Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD		SR.1.1 CCA	
		Config 2		SR.1.1 TDD		SR.1.1 CCA	
		Config 3		SR2.1 TDD		SR.1.1 CCA	
RMSI CORESET RMC configuration		Config 1		CR.1.1 FDD		CR.1.1 CCA	
		Config 2		CR.1.1 TDD		CR.1.1 CCA	
		Config 3		CR.2.1 TDD		CR.1.1 CCA	
Dedicated CORESET RMC configuration		Config 1		CCR.1.1 FDD		CCR.1.1 CCA	
		Config 2		CCR.1.1 TDD		CCR.1.1 CCA	
		Config 3		CCR.2.1 TDD		CCR.1.1 CCA	
OCNG Patterns				OCNG pattern 1			
SSB Configuration	Semi-static channel acces	Config 1,2		SSB.1 FR1		SSB.1 CCA	
	Dymamic channel acces	Config 3		SSB.2 FR1		SSB.2 CCA	
	Semi-static channel acces	Config 1,2		SSB.1 FR1		SSB.1 CCA	
	Dymamic channel acces	Config 3		SSB.2 FR1		SSB.2 CCA	
SMTC configuration		Config 1,2		SMTC.1 FR1		SMTC.2 FR1	
		Config 3		SMTC.2 FR1			
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15 kHz		30 kHz	
		Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing		Config 1,2	kHz	15 kHz		30 kHz	
		Config 3		30 kHz			
PRACH configuration				FR1 PRACH configuration 1 under CCA in table A.3.8A.2.1-1			
BWP configuration		Initial DL BWP		DLBWP.0.1			
		Dedicated DL BWP		DLBWP.1.1			
		Initial UL BWP		ULBWP.0.1			
		Dedicated UL BWP		ULBWP.1.1			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS (Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-95	
	Config 3		-95			
$\hat{E}_s/I_{ot}$		dB	4	4	-infinity	4
$\hat{E}_s/N_{oc}$		dB	4	4	-infinity	4
Io Note3	Config 1,2	dBm/9.36 MHz	-64.59	-64.59	N/A	N/A
	Config 3	dBm/38.16 MHz	-58.49	-58.49	-63.94	-58.49
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.
NOTE 7: As defined in clause 6.2.3.2.3 for $T_{rs} \leq 40$ ms.

A.11.2.2.3.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than $T_{connection_release_redirect_NR_CCA}$ ms from the beginning of time period T2, where $T_{connection_release_redirect_NR_CCA}$ is defined in clause 6.2.3.2.3.
The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_NR_CCA} = T_{RRC_procedure_delay} + T_{identify\text{-}NR_CCA} + T_{SI\text{-}NR_CCA} + T_{RACH_CCA},$$

where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}NR_CCA}$ = MAX (680 ms, $(L_1+11) \times 20$ ms) in the test.

$T_{SI\text{-}NR_CCA}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target NR cell.

T_{RACH_CCA} is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell.
$T_{RACH_CCA} = (1+L_2) \times T_{SSB,RO} + 10$ ms; where $T_{SSB,RO}$ = 10 ms for FR1 PRACH configuration 1.

L_1 is the number of SMTC occasions not available at the UE due to DL CCA failures. The test equipment shall ensure that L_1 does not exceed $L_{1,max}$. In the test $L_{1,max} = L_{CCA_DL}$ which is defined in clause A.3.26.2.1.

L_2 is the consecutive number of SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failures. L_2 = 0 in the test.

The total delay, $T_{connection_release_redirect_NR_CCA}$, shall be less than 1410 + MAX (680, (L_1+11)×20) ms.

A.11.3 Timing

A.11.3.1 UE transmit timing

A.11.3.1.1 UE Transmit Timing Test with PCell under DL CCA

A.11.3.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb when PCell is subject to DL CCA and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in table 11.3.1.1.1-1

Table A.11.3.1.1.1-1: Supported test configuration for UE transmit timing test

Configuration	Description
1	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz

For this test a single NR cell is used. Table A.11.3.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.11.3.1.1.1-3.

Table A.11.3.1.1.1-2: Cell Specific Test Parameters for UE transmit timing test

Parameter		Unit	Configuration	Test1	Test2
SSB ARFCN			1	1	1
TDD configuration			1	TDDConf.1.1 CCA	
$BW_{channel}$		MHz	1	40: $N_{PRB,c}$ = 106	
Initial BWP Configuration			1	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration			1	DLBWP.1.1 ULBWP.1.1	
DRX Cycle		ms	1	N/A	DRX.8[Note5]
DL CCA model			1	As specified in clause A.3.26.2.1	
UL CCA model			1	As specified in clause A.3.26.2.2	
PDSCH Reference measurement channel			1	SR.1.1 CCA	
RMSI CORESET Reference Channel			1	CR.1.1 CCA	
Dedicated CORESET Reference Channel			1	CCR.1.1 CCA	
OCNG Patterns			1	OP.1	
SSB configuration	Semi- static channel acces		1	SSB.1 CCA	
	Dymamic channel acces		1	SSB.2 CCA	
SMTC Configuration			1	SMTC.1 FR1	
TRS configuration			1	TRS.1.2 TDD	
DL CCA probability for semi-static channel access (P_{CCA_DL})			1	0.9375	0.9375
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_1}$)			1	0.75	0.75
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_2}$)			1	0.75	0.75
UL CCA probability (P_{CCA_UL})			1	1	1
EPRE ratio of PSS to SSS		dB	1	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					

Parameter	Unit	Configuration	Test1	Test2
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/30 KHz	1	-95	-95
$\hat{E}_s / I_{ot}$		1	3	3
$\hat{E}_s / N_{oc}$		1	3	3
SS-RSRP Note3	dBm/30 kHz	1	-92	-92
Io Note3	dBm/38.1 MHz	1	-59.2	-59.2
Propagation condition		1	AWGN	
SRS Config		1	SRSConf.1 Note6	SRSConf.2 Note6

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.11.3.1.1.1-3
NOTE 7: Parameters P_{CCA_DL}, $P_{CCA_DL_1}$, $P_{CCA_DL_2}$ and P_{CCA_UL} are defined in clause A.3.26.2.
NOTE 8: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

Table A.11.3.1.1.1-3: SRS Configuration for UE transmit timing test

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	14 for test configuration 1,2 25 for test configuration 3	25	Matches $N_{PRB,c}$
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl640, 0	Offset to align with DRX periodicity
	sequenceId	0	0	Any 10 bit number

A.11.3.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Setup NR PCell according to parameters given in table A.11.3.1.1.1-1.
2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.
   a. The N_{TA} offset value (in T_c units) is 25600
   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1
3) The test system shall adjust the timing of the DL path by values given in table A.11.3.1.1.2-1

Table A.11.3.1.1.2-1: Adjustment Value for DL Timing

SCS of SSB signals (KHz)	Adjustment Value	
	Test1	Test2
30	$+32*64T_c$	$+16*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 Table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX configured.
5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment

A.11.3.2 UE timing advance

A.11.3.2.1 UE Timing Advance Adjustment Accuracy with PCell under DL CCA

A.11.3.2.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.11.3.2.1.2 Test Parameters

Supported test configurations are shown in table A.11.3.2.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.11.3.2.1.2-2, A.11.3.2.1.2-3 and A.11.3.2.1.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.11.3.2.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.11.3.2.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.11.3.2.1.2-1: Supported test configuration for timing advance test

Config	Description
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE supporting SA operation only on NR band(s) with shared spectrum access is required to be tested	

Table A.11.3.2.1.2-2: General test parameters for timing advance test

Parameter	Unit	Value	Comment
RF channel number		1	
Initial DL BWP		DLBWP.0.1	As specified in table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	For 30 kHz SCS $N_{TA_new} = N_{TA_old} + 4096*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.11.3.2.1.2-3: Cell specific test parameters for timing advance test

Parameter			Unit	Test1	
				T1	T2
TDD configuration		Config 1		TDDConf.1.1 CCA	
$BW_{channel}$		Config 1	MHz	40: $N_{PRB,c}$ = 106	
BWP BW		Config 1	MHz	40: $N_{PRB,c}$ = 106	
DRX Cycle		Config 1	ms	Not Applicable	
DL CCA model		Config 1		As specified in clause A.3.26.2.1	
UL CCA model		Config 1		As specified in clause A.3.26.2.2	
PDSCH Reference measurement channel		Config 1		SR.1.1 CCA	
CORESET Reference Channel		Config 1		CR.1.1 CCA	
TRS configuration		Config 1		TRS.1.2 TDD	
OCNG Patterns		Config 1		OCNG pattern 1	
SMTC configuration		Config 1		SMTC.1 FR1	
SSB configuration	Semi-static channel acces	Config 1		SSB.1 CCA	
	Dymamic channel acces	Config 1		SSB.2 CCA	
DL CCA probability for semi-static channel access (P_{CCA_DL})		Config 1		1	
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_1}$)		Config 1		1	

Parameter		Unit	Test1	
			T1	T2
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_2}$)	Config 1		1	
UL CCA probability P_{CCA}	Config 1		1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	Config 1	dBm/30 kHz	-95	
$\hat{E}_s / I_{ot}$		dB	3	
$\hat{E}_s / N_{oc}$		dB	3	
Io Note3	Config 1	dBm/ 38.16 MHz	-62.58	
Propagation condition		-	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Parameters P_{CCA_DL}, $P_{CCA_DL_1}$, $P_{CCA_DL_2}$ and P_{CCA_UL} are defined in clause A.3.26.2.
NOTE 5: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

Table A.11.3.2.1.2-4: Sounding Reference Symbol Configuration for Timing Advance Accuracy Test

Field	Value	Comment
c-SRS	24	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=4 for SCS 30 kHz	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting: SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.11.3.2.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.11.4 Signalling characteristics

A.11.4.1 Radio link monitoring

A.11.4.1.1 Introduction

In the test cases specified in clause A.11.4.1, any uplink signal transmitted by the UE is used for detecting the in-/out-of-sync state of the UE. In terms of measurement, the uplink signal is verified based on the UE output power:

- UE output power higher than Transmit OFF power -50 dBm (as defined in TS 38.101-1 [18]) means uplink signal.
- UE output power equal to or less than Transmit OFF power -50 dBm (as defined in TS 38.101-1 [18]) means no uplink signal.

For intra-band contiguous carrier aggregation, transmit OFF power is measured as the mean power per component carrier.

For UE with multiple transmit antennas, transmit OFF power is measured as the mean power at each transmit connector.

A.11.4.1.2 Radio link monitoring out-of-sync test for PCell configured with SSB-based RLM RS in non-DRX mode

A.11.4.1.2.1 Test purpose and environment

The purpose of this test is to verify that the UE properly detects the out-of-sync and in-sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 PCell radio link monitoring requirements in clause 8.1A.

In the test, UE is configured to perform RLM based on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.11.4.1.2.1-1. The test parameters are given in tables A.11.4.1.2.1-2, A.11.4.1.2.1-3, and A.11.4.1.2.1-4 below. There is one cell (Cell 1), which is the active NR cell in FR1, in the test. Cell 1 operates on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model.

The test consists of three successive time periods, with time duration of T1, T2 and T3, respectively. Figure A.11.4.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE transmits according to UL CCA model. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in the test.

Table A.11.4.1.2.1-1: Supported test configurations.

Configuration	Description
1	TDD, SSB SCS 30 kHz, data SCS 30 kHz, bandwidth 40 MHz

Table A.11.4.1.2.1-2: General test parameters for PCell out-of-sync testing in non-DRX mode.

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
DL CCA model			As specified in clause A.3.26.2.1
UL CCA model			As specified in clause A.3.26.2.2
Duplex mode	Config 1		TDD
$BW_{channel}$	Config 1	MHz	40: $N_{PRB,c}$ = 106

Parameter			Unit	Value
				Test 1
DL initial BWP configuration		Config 1		DLBWP.0.1
DL dedicated BWP configuration		Config 1		DLBWP.1.1
UL initial BWP configuration		Config 1		ULBWP.0.1
UL dedicated BWP configuration		Config 1		ULBWP.1.1
TDD configuration		Config 1		TDDConf.1.1 CCA
CORESET Reference Channel		Config 1		CR.1.1 CCA
SSB configuration for semi-static channel access Note 3, 5		Config 1		SSB.1 CCA
SSB configuration for dynamic channel access Note 4, 5		Config 1		SSB.2 CCA
DBT window configuration		Config 1		DBT.1
PDSCH/PDCCH subcarrier spacing		Config 1		30 kHz
PRACH Configuration		Config 1		FR1 PRACH configuration 1 under CCA
SSB index assigned as RLM RS				0
OCNG parameters				OP.1
CP length				Normal
Correlation Matrix and Antenna Configuration				2x2 Low
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				OFF
Gap pattern ID				gp0
Layer 3 filtering				Enabled
T310 timer			ms	0
T311 timer			ms	1000
N310				1
N311				1
CSI-RS configuration for CSI reporting		Config 1		CSI-RS.2.1 TDD
CSI-RS for tracking		Config 1		TRS.1.2 TDD
T1			s	0.2
T2			s	1.04
T3			s	1.04
D1			s	1

NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

Table A.11.4.1.2.1-3: Cell-specific test parameters for PCell out-of-sync testing in non-DRX mode.

Parameter		Unit	Test 1		
			T1	T2	T3
DL CCA probability P_{CCA_DL}	Note 6,8		P_{CCA_DL}=0.9375		
	Note 7,8		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		
UL CCA probability P_{CCA_UL}			1		
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR[Note 3,4] on RLM-RS	Config 1	dB	1	-7	-15
SNR on other channels and signals	Config 1	dB	1		
N_{oc}	Config 1	dBm/SCS	-95		
Propagation condition			TDL-C 300 ns 100 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in slots with RMC burst transmission and is not transmitted during muted slots or during DBT windows. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the transmitted SSS REs during DBT windows. NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3, respectively, in figure A.10.4.1.2.1-1. NOTE 5: The SNR values are specified for testing a UE which supports 2 RX on at least one band. For testing of a UE which supports 4 RX on all bands, the SNR during T3 is A.3.6. NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 8: For UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.					

Table A.11.4.1.2.1-4: Measurement gap configuration for PCell out-of-sync testing in non-DRX mode.

Field	Test 1	
	Value	
gapOffset	0	
NOTE: Ensure that RLM RS is partially overlapped with measurement gap0		

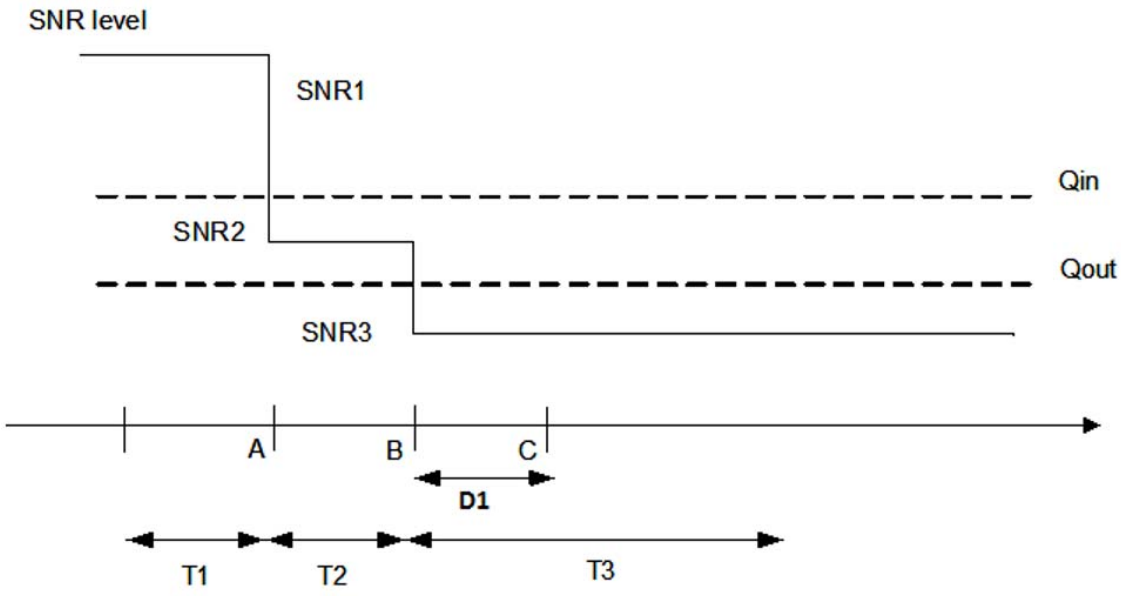


Figure A.11.4.1.2.1-1: SNR variation for out-of-sync testing.

A.11.4.1.2.2 Test requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

- During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.
- The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.11.4.1.3 Radio link monitoring in-sync test for PCell configured with SSB-based RLM RS in non-DRX mode

A.11.4.1.3.1 Test purpose and environment

The purpose of this test is to verify that the UE properly detects the out-of-sync and in-sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 PCell radio link monitoring requirements in clause 8.1A.

In the test, UE is configured to perform RLM based on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.11.4.1.3.1-1. The test parameters are given in tables A.11.4.1.3.1-2, and A.11.4.1.3.1-3 below. There is one cell (Cell 1), which is the active NR cell in FR1, in the test. Cell 1 operates on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model.

The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5, respectively. Figure A.11.4.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE transmits according to UL CCA model.

Table A.11.4.1.3.1-1: Supported test configurations.

Configuration	Description
1	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz

Table A.11.4.1.3.1-2: General test parameters for PCell in-sync testing in non-DRX mode.

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
DL CCA model			As specified in clause A.3.26.2.1
UL CCA model			As specified in clause A.3.26.2.2
Duplex mode	Config 1		TDD
$BW_{channel}$	Config 1	MHz	40: $N_{PRB,c}$ = 106
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
TDD Configuration	Config 1		TDDConf.1.1 CCA
CORESET Reference Channel	Config 1		CR.1.1 CCA
SSB configuration for semi-static channel access Note 3, 5	Config 1		SSB.1 CCA
SSB configuration for dynamic channel access Note 4,5	Config 1		SSB.2 CCA
DBT window configuration	Config 1		DBT.1
PDSCH/PDCCH subcarrier spacing	Config 1		30 kHz

Parameter		Unit	Value
			Test 1
PRACH Configuration	Config 1		FR1 PRACH configuration 1 under CCA
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			N/A
Layer 3 filtering			Enabled
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.52
T4		s	0.2
T5		s	2.04
D1		s	2

NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 6: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

Table A.11.4.1.3.1-3: Cell-specific test parameters for PCell in-sync testing in non-DRX mode.

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
DL CCA probability P_{CCA_DL}	Note 6,8		P_{CCA_DL}=0.9375				
	Note 7,8		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75				

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
UL CCA probability P_{CCA_UL}			1				
L_{CCA_DL}			7				
W_{CCA_DL}		ms	$T_{Evaluate_in_SSB,CCA}$ NOTE 9				
EPRE ratio of PDCCH DMRS to SSS		dB	4				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
SNR on other channels and signals	Config 1	dB	1				
N_{oc}	Config 1	dBm/SCS	-95				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in slots with RMC burst transmission and is not transmitted during muted slots or during DBT windows.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 3: SNR levels correspond to the signal to noise ratio over the transmitted SSS REs during DBT windows.
NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.11.4.1.3.1-1.
NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4 RX on all bands, the SNR during T3 and T4 is modified as specified in clause A.3.6.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 8: For UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.
NOTE 9: As defined in table 8.1A.2.2-1.

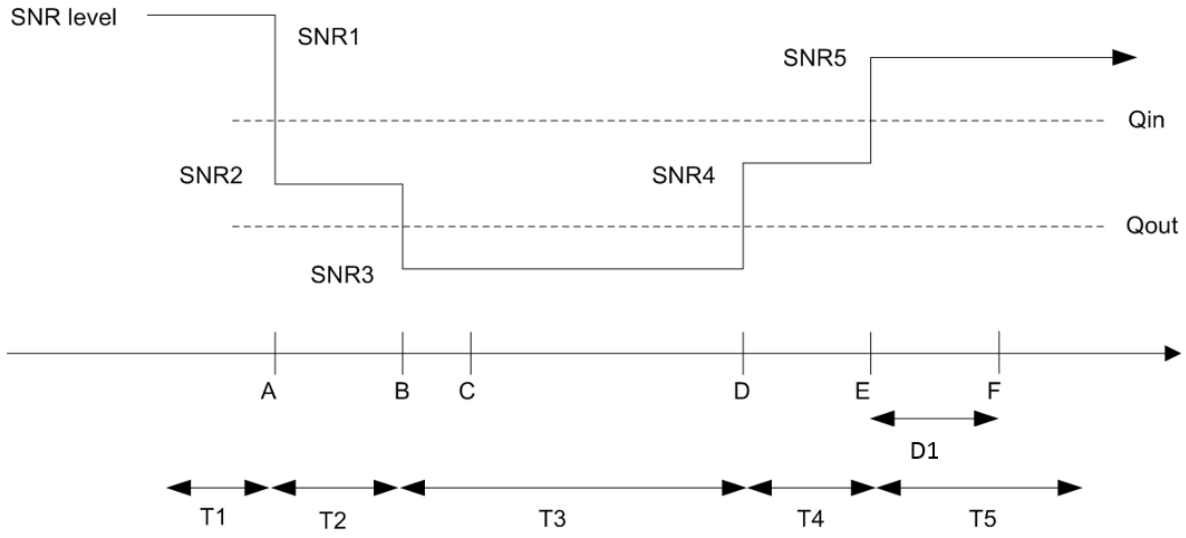


Figure A.11.4.1.3.1-1: SNR variation for in-sync testing.

A.11.4.1.3.2 Test requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

- During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.11.4.1.4 Void

A.11.4.1.4.1 Void

A.11.4.1.4.2 Void

A.11.4.1.5 Void

A.11.4.1.5.1 Void

A.11.4.1.5.2 Void

A.11.4.2 Void

A.11.4.3 SCell activation and deactivation delay

A.11.4.3.1 SCell Activation and Deactivation of known SCell with PCell and SCell under CCA, 160 ms SCell measurement cycle

A.11.4.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that SCell activation and deactivation delays for SCell, with PCell and SCell both under CCA, are within the requirements stated in clause 8.3A, when the SCell is known by the UE at the time of activation and the configured SCell measurement cycle is 160 ms.

The supported test configurations are shown in table A.11.4.3.1.1-1.

The test parameters are given in table A.11.4.3.1.1-2 and cell-specific parameters in table A.11.4.3.1.1-3 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two carriers, each with one cell: Cell 1 (PCell) on radio channel 1 (PCC) in NR with CCA, and Cell 2 (SCell) on radio channel 2 (SCC) in NR with CCA. Before the test starts the UE is connected to Cell 1, but is not aware of Cell 2, as the UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. At the end of T1, the test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted *m*, defines the start of time period T2. The UE shall be able to report a valid CSI in PCell for the activated SCell at latest in slot m + (T_{HARQ}+$T_{activation_time_withCCA}$ + $T_{CSI_Reporting_withCCA}$)/NR_slot_length, as defined in clause 8.3A.2. The UE shall start reporting CSI in PCell in first available uplink resource for CSI reporting after at least one CSI-RS transmission occasion for channel measurement and reporting following slot $m+ \frac{T_{\mathrm{HARQ}}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption shall fall within the time window specified in clause 8.3.2.

The point in time at which the MAC message is received by at the UE antenna connector, in a slot # denoted *n*, defines the start of time period T3. The UE shall complete the activation at latest in slot $n + \frac{T_{\mathrm{HARQ}}+3\ ms}{\text{NR slot length}}$. Any PCell interruption shall fall within the time window specified in clause 8.3A.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received, while taking into account CCA failures on SCC.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.11.4.3.1.1-1: Supported test configurations for SCell Activation and Deactivation of known SCell with PCell and SCell under CCA, 160 ms SCell measurement cycle

Configuration	Description
1	With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.4.3.1.1-2: General test parameters for known SCell activation with PCell and SCell under CCA, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two radio channels (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every second subframe
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to Cell 1	µs	0	
Time alignment error between Cell 2 and Cell 1	µs	≤ TAE as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI_Reporting}$	ms	$10 + 5 \cdot 2^{\mu_{DL}}$	The delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2] μ_{DL} is the subcarrier spacing configuration for DL

Table A.11.4.3.1.1-3: Cell specific test parameters for known SCell activation case with PCell and SCell under CCA, 160 ms SCell measurement cycle

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Duplex mode	Config 1		TDD			TDD		
TDD configuration	Config 1		TDDConf.1.1 CCA			TDDConf.1.1 CCA		
$BW_{channel}$	Config 1	MHz	40: $N_{PRB,c}$ = 106			40: $N_{PRB,c}$ = 106		

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
DL CCA model			As specified in clause A.3.26.2.1			As specified in clause A.3.26.2.1		
UL CCA model			As specified in clause A.3.26.2.2			As specified in clause A.3.26.2.2		
DL CCA probability for semi-static channel access Note5,7	P_{CCA_DL}		0.9375			0.9375		
DL CCA probability for dynamic channel access Note6,7	$P_{CCA_DL_1}$		0.75			0.75		
	$P_{CCA_DL_2}$		0.75			0.75		
UL CCA probability for semi-static channel access	P_{CCA_UL}		0.87			0.87		
UL CCA probability	P_{CCA_UL}		0.75			0.75		
L_{CCA_DL} Note 8			2			2		
W_{CCA_DL} Note 8		ms	$T_{activation_time_withCCA}$			$T_{activation_time_withCCA}$		
Initial downlink BWP configuration			DLBWP.0.2			DLBWP.0.2		
Initial uplink BWP configuration			ULBWP.0.1			ULBWP.0.1		
Dedicated downlink BWP configuration			DLBWP.0.2			DLBWP.0.2		
Dedicated uplink BWP configuration			ULBWP.0.1			ULBWP.0.1		
TCI state			TCI.State.0			TCI.State.0		
TRS Configuration	Config 1		TRS.1.2 TDD			TRS.1.2 TDD		
PDSCH Reference measurement channel	Config 1		SR.1.1 CCA			SR.1.1 CCA		
Dedicated CORESET parameters	Config 1		CCR.1.3 CCA			SR.1.1 CCA		
RMSI CORESET parameters	Config 1		CR.1.1 CCA			SR.1.1 CCA		
OCNG Patterns Note1			OP.1			OP.1		
SSB Configuration for semi-static channel access Note5,7	Config 1		SSB.1 CCA			SSB.1 CCA		
SSB Configuration for dynamic channel access Note6,7	Config 1		SSB.2 CCA			SSB.2 CCA		
SMTC configuration			SMTC.1			SMTC.1		
EPRE ratio of PSS to SSS		dB	0			0		
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS Note1								
EPRE ratio of OCNG to OCNG DMRS Note1								
N_{oc} Note2	Config 1	dBm/15 kHz	-104			-104		
N_{oc} Note2	Config 1	dBm/SCS	-101			-101		
$\hat{E}_s/I_{ot}$		dB	17			17		
$\hat{E}_s/N_{oc}$		dB	17			17		
SS-RSRP Note3	Config 1	dBm/SCS	-84			-84		
Io Note3	Config 1	dBm/ 38.16 MHz	-52.87			-52.87		
Propagation condition		-	AWGN					

NOTE 1: OCNG shall be used such that resources in the cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols in slots with downlink transmission bursts. OCNG is not transmitted during muted slots or during DBT windows.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.
NOTE 8: As specified in clause 8.3A for $L_{1,max}$, $L_{2,1,max}$, $L_{2,2,max}$, $L_{3,1,max}$, and $L_{3,2,max}$

A.11.4.3.1.2 Test Requirements

During T2, starting after at least one CSI-RS transmission occasion for channel measurement and reporting from the slot specified in clause 4.3 of TS 38.213 [3] and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

During T2, the UE shall send the first valid CSI report (non-zero CQI) for the SCell in first available uplink resource for CSI reporting no later than slot m + (T_{HARQ}+$T_{activation_time_withCCA}$ + $T_{CSI_Reporting_withCCA}$)/NR_slot_length, where $T_{activation_time_withCCA}$ = $T_{FirstSSB}$ + L_1*T_{rs} + 5 ms, as specified in clause 8.3A.2.

During T3, the UE shall stop sending CSI reports for SCell at latest in slot $n + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3A.3.

During T2, interruption on PCell shall not occur outside slot m +1+$\frac{T_{HARQ}}{NR\ slot\ length}$ to slot m +1+$\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$ with T_X = $T_{FirstSSB}$.

During T3, interruption on PCell shall not occur outside slot n +1+T_{HARQ}/NR_slot_length to slot n+1+(T_{HARQ} +3 ms)/NR_slot_length.

The interruption on PCell shall not be more than specified for SA in clause 8.2.2.2.2.

The rate of correctly observed SCell activation delays and SCell deactivation delays shall for repeated tests be at least 90 %.

A.11.4.3.2 SCell Activation and Deactivation of known SCell with PCell and SCell under CCA, 640 ms SCell measurement cycle

A.11.4.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that SCell activation and deactivation delays for SCell, with PCell and SCell under CCA, are within the requirements stated in clause 8.3A, when the SCell is known by the UE at the time of activation and the configured SCell measurement cycle is 640 ms.

The supported test configurations are same as in table A.11.4.3.1.1-1 above.

The test parameters are same as in table A.11.4.3.1.1-2 above, except for parameters listed below in table A.11.4.3.2.1-1. The cell-specific parameters are same as in table A.11.4.3.1.1-3 above.

The test execution is the same as described in clause A.11.4.3.1 above.

Table A.11.4.3.2.1-1: General test parameters for known SCell activation with PCell and SCell under CCA, 640 ms SCell measurement cycle

Parameter	Unit	Value	Comment
SCell measurement cycle (measCycleSCell)	ms	640	

A.11.4.3.2.2 Test Requirements

During T2, starting after at least one CSI-RS transmission occasion for channel measurement and reporting from the slot specified in clause 4.3 of TS 38.213 [3] and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

During T2, the UE shall send the first valid CSI report (non-zero CQI) for the SCell in first available uplink resource for CSI reporting no later than slot m + (T_{HARQ}+$T_{activation_time_withCCA}$ + $T_{CSI_Reporting_withCCA}$)/NR_slot_length, where $T_{activation_time_withCCA}$ = $T_{FirstSSB_MAX}$ + $L_{2,1}$*T_{SMTC_MAX} + (1 +$L_{2,2}$)*T_{rs} + 5 ms, as specified in clause 8.3A.2.

During T3, the UE shall stop sending CSI reports for SCell at latest in slot $n + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3A.3.

During T2, interruption on PCell shall not occur outside slot m +1+$\frac{T_{HARQ}}{NR\ slot\ length}$ to slot m +1+$\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$ with T_X = $T_{FirstSSB_MAX}$ + $L_{2,1}$* T_{SMTC_MAX}.

During T3, interruption on PCell shall not occur outside slot n +1+T_{HARQ}/NR_slot_length to slot n+1+(T_{HARQ} +3 ms)/NR_slot_length.

The interruption on PCell shall not be more than specified for SA in clause 8.2.2.2.2.

The rate of correctly observed SCell activation delays and SCell deactivation delays shall for repeated tests be at least 90 %.

A.11.4.3.3 SCell Activation and Deactivation of unknown SCell with PCell and SCell under CCA

A.11.4.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that SCell activation and deactivation delays for SCell, with PCell and SCell under CCA, are within the requirements stated in clause 8.3A, when the SCell is unknown to the UE at the time of activation.

The supported test configurations are same as in table A.11.4.3.1.1-1 above.

The test parameters are same as in table A.11.4.3.1.1-2 above, except for parameters listed below in table A.11.4.3.3.1-1. The cell-specific parameters are same as in table A.11.4.3.1.1-3 above.

The test execution is the same as described in clause A.11.4.3.1 above.

Table A.11.4.3.3.1-1: General test parameters for unknown SCell activation with PCell ans SCell under CCA

Parameter	Unit	Value	Comment
T1	s	0.1	During this time period the PCell shall be known and the SCell configured, but not detected.

A.11.4.3.3.2 Test Requirements

During T2, starting after at least one CSI-RS transmission occasion for channel measurement and reporting from the slot specified in clause 4.3 of TS 38.213 [3] and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

During T2, the UE shall send the first valid CSI report (non-zero CQI) for the SCell in first available uplink resource for CSI reporting no later than slot m + (T_{HARQ}+$T_{activation_time_withCCA}$ + $T_{CSI_Reporting_withCCA}$)/NR_slot_length, where $T_{activation_time_withCCA}$ = $T_{FirstSSB_MAX}$ + (1 + $L_{3,1}$)*T_{SMTC_MAX} + (2 + $L_{3,2}$)*T_{rs} + 5 ms, as specified in clause 8.3A.2.

During T3, the UE shall stop sending CSI reports for SCell at latest in slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3A.3.

During T2, interruption on PCell shall not occur outside slot m +1+$\frac{T_{HARQ}}{NR\ slot\ length}$ to slot m +1+$\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$ with T_X = $T_{FirstSSB_MAX}$ + $L_{3,1}$* T_{SMTC_MAX}.

During T3, interruption on PCell shall not occur outside slot n +1+T_{HARQ}/NR_slot_length to slot n+1+(T_{HARQ} +3 ms)/NR_slot_length.

The interruption on PCell shall not be more than specified for SA in clause 8.2.2.2.2.

The rate of correctly observed SCell activation delays and SCell deactivation delays shall for repeated tests be at least 90 %.

A.11.4.4 Beam failure detection and link recovery procedures

A.11.4.4.1 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in non-DRX mode

A.11.4.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5A.

The test parameters are given in tables A.11.4.4.1.1-1, A.11.4.4.1.1-2, A.11.4.4.1.1-3 and A.11.4.4.1.1-4 below. There is one cell, Cell 1 which is the active cell, in the test. Cell 1 operates on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.11.4.4.1.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.11.4.4.1.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. The UE transmits the reporting according to UL CCA mode. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test 1.

Table A.11.4.4.1.1-1: Supported test configurations for FR1 PCell with CCA

Configuration	Description
1	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth

Table A.11.4.4.1.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value		Comment
			Test 1		
Active PSCell			Cell 1		
RF Channel Number			1		
DL CCA model			As specified in A.3.26.2.1		
UL CCA model			As specified in A.3.26.2.2		
Duplex mode	Config 1		TDD		
BWchannel	Config 1	MHz	40: NRB,c = 106		
DL initial BWP configuration	Config 1		DLBWP.0.1		
DL dedicated BWP configuration	Config 1		DLBWP.1.1		
UL initial BWP configuration	Config 1		ULBWP.0.1		
UL dedicated BWP configuration	Config 1		ULBWP.1.1		
TDD Configuration	Config 1		TDDConf.1.1 CCA		
CORESET Reference Channel	Config 1		CR.1.1 CCA		
SSB Configuration	Config 1		SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access		
DBT Window Configuration	Config 1		DBT.1		
PDSCH/PDCCH subcarrier spacing	Config 1		30 KHz		
PRACH Configuration	Config 1		Table A.3.8A.2.2-1		
SSB Index assigned as BFD RS (q_0)			0		
SSB Index assigned as CBD RS (q_1)			1		

Parameter		Unit	Value		Comment
			Test 1		
OCNG parameters			OP.1		
CP length			Normal		
Correlation Matrix and Antenna Configuration			2x2 Low		
Beam failure detection transmission parameters	DCI format		1-0		
	Number of Control OFDM symbols		2		
	Aggregation level	CCE	8		
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0		
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0		
	DMRS precoder granularity		REG bundle size		
	REG bundle size		6		
DRX			OFF		
Gap pattern ID			gp0		
gapOffset			0		
rlmInSyncOutOfSyncThreshold			absent		When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1	dBm/SCS kHz	-95		Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS			db0		Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1		see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4		see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.2.1 TDD		
CSI-RS for tracking	Config 1		TRS.1.2 TDD		
SSB Index assigned as RLM RS			0, 1		
T310 Timer		ms	1000		
N310			2		
T1		s	0.2		During this time the the UE shall be fully synchronized to Cell 1
T2		s	0.93		
T3		s	0.52		
T4		s	0		
T5		s	0.45		
D1		s	0.41		
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.					

Parameter	Unit	Value		Comment
		Test 1		
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.11.4.4.1.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
DL CCA probability $P_{CCA,DL}$	Note 10, 12		1.0	0.9375	0.9375	0.9375	0.9375
	Note 11, 12		1.0/1.0	0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability $P_{CCA,UL}$			1.0	1.0	1.0	1.0	1.0
L_{CCA_DL}			N/A	7			
W_{CCA_DL}		ms	N/A	$T_{Evaluate_CBD_SSB_CCA}$ Note 13			
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	-10	-10	10	10	10
SSB_RP of set q_1	Config 1	dBm/SCS kHz	-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 KHz	-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio the transmitted SSS REs during DBT window.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6A.
NOTE 10: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 11: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.
NOTE 12: For UE supporting both semi-static and dynamic cannel access, the UE can be tested under dynamic channel occupancy only.
NOTE 13: As defined in table 8.5A.5.2-1.

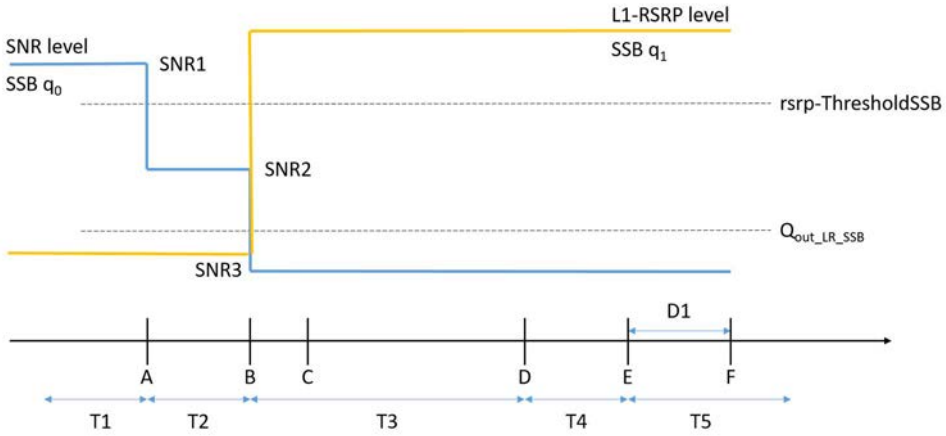


Figure A.11.4.4.1.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.11.4.4.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 410 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.11.4.4.2 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in DRX mode

A.11.4.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5A.

The test parameters are given in tables A.11.4.4.2.1-1, A.11.4.4.2.1-2, and A.11.4.4.2.1-3 below. There is one cell, Cell 1 which is the active cell, in the test. Cell 1 operates on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.11.4.4.2.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.11.4.4.2.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. The UE transmits the reporting according to UL CCA mode. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.11.4.4.2.1-1: Supported test configurations for FR1 PCell with CCA

Configuration	Description
1	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth

Table A.11.4.4.2.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value		Comment
			Test 1		
Active PSCell			Cell 1		
RF Channel Number			1		
DL CCA model			As specifieed in A.3.26.2.1		
UL CCA model			As specified in A.3.26.2.2		
Duplex mode	Config 1		TDD		
BWchannel	Config 1	MHz	40: NRB,c = 106		
DL initial BWP configuration	Config 1		DLBWP.0.1		
DL dedicated BWP configuration	Config 1		DLBWP.1.1		
UL initial BWP configuration	Config 1		ULBWP.0.1		
UL dedicated BWP configuration	Config 1		ULBWP.1.1		
TDD Configuration	Config 1		TDDConf.1.1 CCA		
CORESET Reference Channel	Config 1		CR.1.1 CCA		
SSB Configuration	Config 1		SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access		
DBT Window Configuration	Config 1		DBT.1		
PDSCH/PDCCH subcarrier spacing	Config 1		30 KHz		
PRACH Configuration	Config 1		Table A.3.8A.2.2-1		
SSB Index assigned as BFD RS (q_0)			0		
SSB Index assigned as CBD RS (q_1)			1		
OCNG parameters			OP.1		
CP length			Normal		
Correlation Matrix and Antenna Configuration			2x2 Low		
Beam failure detection transmission parameters	DCI format		1-0		
	Number of Control OFDM symbols		2		
	Aggregation level	CCE	8		
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0		
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0		

Parameter		Unit	Value		Comment
			Test 1		
	DMRS precoder granularity		REG bundle size		
	REG bundle size		6		
DRX			DRX.7		A.3.3.7
Gap pattern ID			N.A.		
rlmInSyncOutOfSyncThreshold			absent		When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1	dBm/SCS kHz	-95		Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS			db0		Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1		see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4		see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.2.1 TDD		
CSI-RS for tracking	Config 1		TRS.1.2 TDD		
SSB Index assigned as RLM RS			0, 1		
T310 Timer		ms	1000		
N310			2		
T1		s	1		During this time the the UE shall be fully synchronized to Cell 1
T2		s	9.01		
T3		s	5.16		
T4		s	0		
T5		s	3.89		
D1		s	3.85		
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.11.4.4.2.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
DL CCA probability P_{CCA}	Note 10, 12		1.0	0.9375	0.9375	0.9375	0.9375
	Note 11, 12		1.0/1.0	0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability P_{CCA}			1.0	1.0	1.0	1.0	1.0
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	-10	-10	10	10	10

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
SSB_RP of set q_1	Config 1	dBm/SCS kHz	-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 KHz	-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio the transmitted SSS REs during DBT window.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6A.
NOTE 10: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 11: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.
NOTE 12: For UE supporting both semi-static and dynamic cannel access, the UE can be tested under dynamic channel occupancy only.

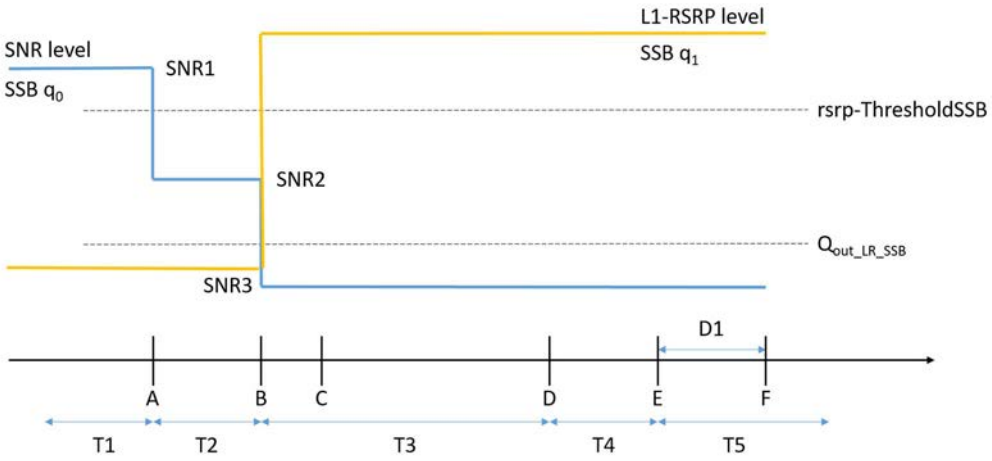


Figure A.11.4.4.2.1-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.11.4.4.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 3850 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.11.4.5 Active BWP switching

A.11.4.5.1 UL active BWP switch delay with consistent UL LBT failure on PCell subject to UL CCA

A.11.4.5.1.1 Test Purpose and Environment

The purpose of this test is to verify the UL BWP switch delay requirement defined in clause 8.6.4.

The supported test configurations are shown in table A.11.4.5.1.1-1. The test scenario comprises of one cell (Cell 1), which is Pcell as given in table A.11.4.5.1.1-2. Cell-specific parameters of the cell are specified in table A.11.4.5.1.1-3 below. SRS configuration used in the test is specified in table A.11.4.5.1.1-4.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with 2 different UE-specific downlink and uplink bandwidth parts: DL BWP-1, DL BWP-2, UL BWP-1 and UL BWP-2 before starting the test. DL BWP-1 and DL BWP-2 always include bandwidth of the initial DL BWP and SSB. UL BWP-1 and UL BWP-2 always include bandwidth of the SRS.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is DL BWP-1.
- UE is indicated in *firstActiveUplinkBWP-Id* that the active UL BWP is UL BWP-1.
- UE is configured with *LBT-FailureRecoveryConfig* parameters for Cell 1.

The cell has constant signal levels throughout the test. The test consists of 2 successive time periods, with durations of T1 and T2, respectively.

During T1,

- Time period T1 starts when the UE has received the SRS configuration for periodic SRS transmission on active UL BWP-1.
- The UE shall perform UL CCA before SRS transmission.
- The parameter UL CCA probability P_{CCA} is set to 0 during T1. This requires the test system to set energy level above the detection level during portion of the UL slot where the UE performs UL CCA. This in turn forces the UE to fail the UL CCA. The UE consistently fails UL CCA during T1 and is therefore unable to transmit SRS.

During T2,

- T2 starts when the UE detects consistent UL LBT failures i.e. when total number of UL LBT failures in Cell 1 on active UL BWP-1 exceeds *lbt-FailureInstanceMaxCount* during *lbt-FailureDetectionTimer*.
- The UE upon detected consistent UL LBT failure starts the LBT recovery mechanism, which requires the UE to switch to active UL BWP-2 in Cell 1 and to send PRACH in the active UL BWP-2.
- Staring from T2, the UE shall be able to send PRACH in the active UL BWP-2 within the delay specified in clause 8.6.4.

Table A.11.4.5.1.1-1: Supported test configurations for UL BWP switch test in SA

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: void	

Table A.11.4.5.1.1-2: General test parameters for UL BWP switch test in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell 1 on RF channel number 1.
CP length		Normal	
DRX		OFF	
lbt-FailureDetectionTimer [2]	ms	80	Parameter configured by IE: *LBT-FailureRecoveryConfig* [1]
lbt-FailureInstanceMaxCount [2]		4	Parameter configured by IE: *LBT-FailureRecoveryConfig* [1]
T1	s	0.1	During T1 consistent LBT failure is detected on active UL BWP-1
T2	s	0.1	During T2 UE sends PRACH on active UL BWP-2

Table A.11.4.5.1.1-3: NR Cell specific test parameters for UL BWP switch test in SA

Parameter			Unit	Cell 1	
				T1	T2
TDD configuration		Config 1		TDDConf.1.1 CCA	
$BW_{channel}$		Config 1		40 MHz: $N_{PRB,c}$ = 106	
DL CCA model		Config 1		As specified in clauseA.3.26.2.1	
UL CCA model		Config 1		As specified in clause A.3.26.2.2	
Active BWP ID		Config 1		1, 2	
Initial DL BWP Configuration		Config 1		DLBWP.0.2 Note 4	
Active DL BWP-1 Configuration		Config 1		DLBWP.1.1 Note 4	
Active DL BWP-2 Configuration		Config 1		DLBWP.1.3 Note 4	
Initial UL BWP Configuration		Config 1		ULBWP.0.2 Note 4	
Active UL BWP-1 Configuration		Config 1		ULBWP.1.1 Note 4	
Active UL BWP-2 Configuration		Config 1		ULBWP.1.3 Note 4	
PDSCH Reference measurement channel		Config 1		SR.1.1 CCA	
RMSI CORESET parameters		Config 1		CR.1.1 CCA	
Dedicated CORESET parameters		Config 1		CCR.1.3 CCA	
OCNG Patterns		Config 1		OP.1	
SSB Configuration	Semi- static channel acces	Config 1		SSB.1 CCA	
	Dymamic channel acces	Config 1		SSB.2 CCA	
SMTC Configuration		Config 1		SMTC.1 FR1	
Correlation Matrix and Antenna Configuration		Config 1		1x2 Low	
TRS Configuration		Config 1		TRS.1.2 TDD	
DL CCA probability for semi-static channel access (P_{CCA_DL})		Config 1		1	1
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_1}$)		Config 1		1	1
DL CCA model probability for dynamic static channel access ($P_{CCA_DL_2}$)		Config 1		1	1
UL CCA probability (P_{CCA_UL})		Config 1		0	1
PRACH configuration		Config 1		N/A	Configuration #1 in table A.3.8.2.1-1
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note 2		Config 1	dBm/SCS	-101	
SS-RSRP Note 3		Config 1	dBm/SCS	-84	
$\hat{E}_s/I_{ot}$		Config 1	dB	17	
$\hat{E}_s/N_{oc}$		Config 1	dB	17	
Io Note3		Config 1	dBm/ 38.16 MHz	-52.86	
Propagation Condition				AWGN	

Parameter	Unit	Cell 1	
		T1	T2
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			
NOTE 5: Parameters P_{CCA_DL}, $P_{CCA_DL_1}$, $P_{CCA_DL_2}$ and P_{CCA_UL} are defined in clause A.3.26.2.			
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.			

Table A.11.4.5.1.1-4: Sounding Reference Symbol Configuration for UL BWP Switch Test

Field	Value	Comment
c-SRS	24	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=4 for SCS 30 kHz	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting: SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.11.4.5.1.2 Test Requirements

The UE capable of *bwp-SwitchingDelay type1* [2] shall start to transmit the PRACH on active UL BWP-2 of Cell 1 (PCell) less than 21.5 ms from the beginning of time period T1.

The UE capable of *bwp-SwitchingDelay type2* [2] shall start to transmit the PRACH on active UL BWP-2 of Cell 1 (PCell) less than 23 ms from the beginning of time period T1.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The above delay is calculated as follows:'

The active UL BWP switch delay from UL BWP-1 to UL BWP-2 can be expressed as:

$$T_{BWPswitchDelay} * T_{slot} + 1 * T_{slot} + (1 + L_3) * T_{SSB,RO} + 10 \text{ ms}$$

Where:

$T_{BWPswitchDelay}$ = 1 ms (2 slots) and 2.5 ms (5 slots) for *bwp-SwitchingDelay* [2] *type1* and *type2* UE capabilities according to clause 8.6.4.

T_{slot} = It is the slot length. It is 0.5 ms for 30 kHz.

L3 = It is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. L3= 0 during T2 since P_{CCA} = 1.

$T_{SSB,RO}$ = 10 ms according to FR1 PRACH configuration 1.

This gives a total of 21.5 ms and 23 ms for *type1* and *type2* UE respectively.

A.11.4.5.2 DCI-based and Timer-based Active BWP Switch

A.11.4.5.2.1 NR FR1- NR FR1 DL active BWP switch of PCell with non-DRX in SA

A.11.4.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6, and interruption requirement on other active serving cell defined in clause 8.2.2.2.5.

The supported test configurations are shown in table A.11.4.5.2.1.1-1 below. The test scenario comprises of one PCell (Cell 1) and one SCell (Cell 2) as given in table A.11.4.5.2.1.1-2. NR Cell-specific parameters are specified in table A.11.4.5.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 1 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for PCell, BWP-1 and BWP-2, in Cell 1 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for SCell, BWP-0 in Cell 2 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in SCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of PCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PCell no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-2 no later than the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).
>
> The starting time of SCell (Cell 2) interruption due to BWP switch on PCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PCell (Cell 1).

During T3,

> The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of PCell's slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-1 no later than the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The starting time of SCell (Cell 2) interruption due to BWP switch of PCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

The test equipment verifies that potential interruption to SCell is carried out in the correct time span by monitoring ACK/NACK sent in SCell during BWP switch of PCell, respectively.

Table A.11.4.5.2.1.1-1: DL BWP switch supported test configurations

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: Void NOTE 2: The UE supporting SA operation with only NR band(s) with shared spectrum access is required to be tested.	

Table A.11.4.5.2.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2	Two NR radio channels are used in this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2	SCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and SCell
DL CCA model		As specified in clause A.3.26.2.1	
UL CCA model		As specified in clauseA.3.26.2.2	
bwp-InactivityTimer	ms	200	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on SCC.
Cell 2 timing offset to Cell 1	µs	3	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.11.4.5.2.1.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1	Cell 2
Frequency Range			FR1	
Duplex mode	Config 1		TDD	
TDD configuration	Config 1		TDDConf.1.1 CCA	
$BW_{channel}$	Config 1		40 MHz: $N_{PRB,c}$ = 106	
Active BWP ID			1, 2	0
Initial DL BWP Configuration			DLBWP.0.2[Note4]	
Initial UL BWP Configuration			ULBWP.0.2[Note4]	
Active DL BWP-0 Configuration			N.A.	DLBWP.0.2[Note4]
Active DL BWP-1 Configuration			DLBWP.1.1[Note4]	N.A.
Active DL BWP-2 Configuration			DLBWP.1.3[Note4]	N.A.
Active UL BWP-0 Configuration			N.A.	ULBWP.0.2[Note4]
Active UL BWP-1 Configuration			ULBWP.1.1[Note4]	N.A.
Active UL BWP-2 Configuration			ULBWP.1.3[Note4]	N.A.
PDSCH Reference measurement channel	Config 1		SR.1.1 CCA	
RMSI CORESET parameters	Config 1		CR.1.1 CCA	
Dedicated CORESET parameters	Config 1		CCR.1.3 CCA	
OCNG Patterns			OP.1	

Parameter			Unit	Cell 1	Cell 2
SSB Configuration	Semi- static channel acces	Config 1		SSB.1 CCA	
	Dymamic channel acces	Config 1		SSB.2 CCA	
SMTC Configuration		Config 1		SMTC.1	
DL CCA probability (P_{CCA_DL})		Config 1		1	1
UL CCA probability (P_{CCA_UL})		Config 1		1	1
Correlation Matrix and Antenna Configuration				1x2 Low	
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note 2		Config 1	dBm/SCS	-101	-101
SS-RSRP Note 3		Config 1	dBm/SCS	-84	-84
$\hat{E}_s/I_{ot}$		Config 1	dB	17	17
$\hat{E}_s/N_{oc}$		Config 1	dB	17	17
Io Note3		Config 1	dBm/38.16 MHz	-52.86	-52.86
Propagation Condition				AWGN	AWGN

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3 SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

A.11.4.5.2.1.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, $k1$ is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

During T1 and T3, the start time of SCell interruption during PCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first DL slot that occurs after the beginning of DL slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.11.4.5.2.2 NR FR1 DL active BWP switch with non-DRX in SA

A.11.4.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6.

The supported test configurations are shown in table A.11.4.5.2.2.1-1. The test scenario comprises of one cell (Cell 1) as given in table A.11.4.5.2.2.1-2. Cell-specific parameters of the cell are specified in table A.11.4.5.2.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with 2 different UE-specific downlink bandwidth parts, BWP-1 and BWP-2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1.
- UE is configured with a *bwp-InactivityTimer* timer value for Cell 1.

The cell has constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for DL BWP switch, sent from the test equipment to the UE, is received at the UE side in Cell 1's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell 1 no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-2 starting from the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

During T2, the test equipment won't transmit DCI format for PDSCH reception on Cell 1.

During T3,

> The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.
>
> The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell 1 at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-1 starting from the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The test equipment verifies the DL BWP switch time by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

Table A.11.4.5.2.2.1-1: DL BWP switch supported test configurations

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: A UE which fulfils the requirements in test case A.11.4.5.2.1 can skip the test cases in A.11.4.5.2.2. NOTE 3: The UE supporting SA operation with only NR band(s) with shared spectrum access is required to be tested.	

Table A.11.4.5.2.2.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment

NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell 1 on RF channel number 1.
CP length		Normal	
DRX		OFF	
DL CCA model		As specified in clause A.3.26.2.1	
UL CCA model		As specified in clause A.3.26.2.2	
bwp-InactivityTimer	ms	200	
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.11.4.5.2.2.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1		TDD
TDD configuration		Config 1		TDDConf.1.1 CCA
$BW_{channel}$		Config 1		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID				1, 2
Initial DL BWP Configuration		Config 1		DLBWP.0.2 Note 4
Active DL BWP-1 Configuration		Config 1		DLBWP.1.1 Note 4
Active DL BWP-2 Configuration		Config 1		DLBWP.1.3 Note 4
Initial UL BWP Configuration		Config 1		ULBWP.0.2 Note 4
Active UL BWP-1 Configuration		Config 1		ULBWP.1.1 Note 4
Active UL BWP-2 Configuration		Config 1		ULBWP.1.3 Note 4
PDSCH Reference measurement channel		Config 1		SR.1.1 CCA
RMSI CORESET parameters		Config 1		CR.1.1 CCA
Dedicated CORESET parameters		Config 1		CCR.1.3 CCA
OCNG Patterns				OP.1
SSB Configuration	Semi- static channel acces	Config 1		SSB.1 CCA
	Dymamic channel acces	Config 1		SSB.2 CCA
SMTC Configuration		Config 1		SMTC.1
Correlation Matrix and Antenna Configuration				1x2 Low
TRS Configuration		Config 1		TRS.1.2 TDD
DL CCA probability (P_{CCA_DL})		Config 1		1
UL CCA probability (P_{CCA_UL})		Config 1		1
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		Config 1	dBm/SCS	-101
SS-RSRP Note 3		Config 1	dBm/SCS	-84
$\hat{E}_s/I_{ot}$		Config 1	dB	17
$\hat{E}_s/N_{oc}$		Config 1	dB	17
Io Note3		Config 1	dBm/38.16 MHz	-52.86
Propagation Condition				AWGN

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

A.11.4.5.2.2.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed Cell 1 active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after beginning of DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.11.4.5.3 RRC-based Active BWP Switch

A.11.4.5.3.1 NR FR1 DL active BWP switch of Cell with non-DRX in SA

A.11.4.5.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6.

The supported test configurations are shown in table A.11.4.5.3.1.1-1. The test scenario comprises of one Cell (Cell 1) as given in table A.11.4.5.3.1.1-2. Cell-specific parameters of Cell are specified in table A.11.4.5.3.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in Cell 1.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}}{\text{NR Slot length}}$ as defined in clause 8.6.3 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}}{\text{NR Slot length}}$ + k1 on BWP-1 of final condition. The UE shall be continuously scheduled on PCell's BWP-1 of final condition starting from the first DL slot right after slot i + $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}}{\text{NR Slot length}}$.

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in Cell by counting the time from the time when the RRC Reconfiguration message including updated BWP configuration is sent till the time when a vaild ACK/NACK is received is received.

Table A.11.4.5.3.1.1-1: DL BWP switch supported test configurations in SA scenario

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: Void NOTE 2: The UE supporting SA operation with only NR band(s) with shared spectrum access is required to be tested.	

Table A.11.4.5.3.1.1-2: General test parameters for DL BWP switch in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DL CCA model		As specified in clause A.3.26.2.1	
UL CCA model		As specified in clause A.3.26.2.2	
DRX		OFF	
T1	s	0.2	

Table A.11.4.5.3.1.1-3: NR Cell specific test parameters for DL BWP switch in SA scenario

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1		TDD
TDD configuration		Config 1		TDDConf.1.1 CCA
$BW_{channel}$		Config 1		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID				1
Initial DL BWP Configuration		Config 1		DLBWP.0.2
Initial UL BWP Configuration		Config 1		ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration	Config 1		DLBWP.1.3
	Active UL BWP-1 Configuration	Config 1		ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration	Config 1		DLBWP.1.1
	Active UL BWP-1 Configuration	Config 1		ULBWP.1.1
PDSCH Reference measurement channel		Config 1		SR.1.1 CCA
RMSI CORESET parameters		Config 1		CR.1.1 CCA
Dedicated CORESET parameters		Config 1		CCR.1.3 CCA
OCNG Patterns				OP.1
SSB Configuration	Semi-static channel acces	Config 1		SSB.1 CCA
	Dymamic channel acces	Config 1		SSB.2 CCA
SMTC Configuration				SMTC.1
TRS Configuration		Config 1		TRS.1.2 TDD
DL CCA probability (P_{CCA_DL})		Config 1		1
UL CCA probability (P_{CCA_UL})		Config 1		1
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		Config 1	dBm/SCS	-101
SS-RSRP Note 3		Config 1	dBm/SCS	-84
$\hat{E}_s/I_{ot}$		Config 1	dB	17
$\hat{E}_s/N_{oc}$		Config 1	dB	17
Io Note3		Config 1	dBm/38.16 MHz	-52.86

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

A.11.4.5.3.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the Cell from the first DL slot that occurs right after the begining of slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed Cell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.11.4.6 Void

A.11.5 Measurement procedure

A.11.5.1 Intra-frequency measurements

A.11.5.1.1 Event-triggered reporting tests on PCC without gaps under non-DRX

A.11.5.1.1.1 Test purpose and environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2A.5.1 and 9.2A.5.2.

A.11.5.1.1.2 Test parameters

Two cells are deployed in the test, which are PCell (Cell 1) and a neighbour cell (Cell 2) on the same carrier frequency with CCA transmitting SSBs in DBT windows according to DL CCA model. The test parameters for the two cells are given in table A.11.5.1.1.2-1 and A.11.5.1.1.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

Table A.11.5.1.1.2-1: Supported test configurations

Configuration	Description
1	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.5.1.1.2-2: General test parameters for intra-frequency event triggered reporting without gaps

Parameter		Unit	Test configuration	Value	Comment
Active cell			1	Cell 1	
Neighbour cell			1	Cell 2	Cell to be identified.
RF Channel Number			1	1: Cell 1 and Cell 2	
DL CCA model			1	As specified in clause A.3.26.2.1	
UL CCA model			1	As specified in clause A.3.26.2.2	
SSB configuration	Semi-static channel access Note 1,3		1	SSB.1 CCA	
	Dynamic channel access Note 2,3		1	SSB.2 CCA	
SMTC configuration			1	SMTC.1	
A3-Offset		dB	1	-4.5	
CP length			1	Normal	
Hysteresis		dB	1	0	
Time To Trigger		s	1	0	
Filter coefficient			1	0	L3 filtering is not used
DRX			1	OFF	DRX is not used
Time offset between serving and neighbour cells			1	3 μs	Synchronous cells
T1		s	1	5	
T2		s	1	5	

NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 3: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

Table A.11.5.1.1.2-3: Cell-specific test parameters for intra-frequency event-triggered reporting without gaps

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
DL CCA probability for semi-static channel access (P_{CCA_DL})		1	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_1}$)		1	$P_{CCA_DL_1}$=0.75		$P_{CCA_DL_1}$=0.75	
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_2}$)		1	$P_{CCA_DL_2}$=0.75		$P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}		1	P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}		1	7		7	
W_{CCA_DL}	ms	1	600		600	
PDSCH RMC configuration		1	SR.1.1 CCA		N/A	
RMSI CORESET RMC configuration		1	CR.1.1 CCA		N/A	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Dedicated CORESET RMC configuration		1	CCR.1.1 CCA		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1	-91	-91	-Infinity	-91
Io	dBm/38.16 MHz	1	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

A.11.5.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 840 ms from the beginning of time period T2.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.1.2 Event-triggered reporting tests on PCC without gaps under DRX

A.11.5.1.2.1 Test purpose and environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2A.5.1 and 9.2A.5.2.

A.11.5.1.2.2 Test parameters

Two cells are deployed in the test, which are PCell (Cell 1) and a neighbour cell (Cell 2) on the same carrier frequency with CCA transmitting SSBs in DBT windows according to DL CCA model. The test parameters for the two cells are given in table A.11.5.1.2.2-1 and A.11.5.1.2.2-2 below. In the measurement control information, a measurement object

is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, the UE is allocated with PUSCH resource at every DRX cycle.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

Table A.11.5.1.2.2-1: Supported test configurations

Configuration	Description
1	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.5.1.2.2-2: General test parameters for intra-frequency event triggered reporting without gaps

Parameter		Unit	Test configuration	Value		Comment
				Test 1	Test	
Active cell			1	Cell 1		
Neighbour cell			1	Cell 2		Cell to be identified.
RF Channel Number			1	1: Cell 1 and Cell 2		
DL CCA model			1	As specified in clause A.3.26.2.1		
UL CCA model			1	As specified in clause A.3.26.2.2		
SSB configuration	Semi-static channel access Note 1,3		1	SSB.1 CCA		
	Dynamic channel access Note 2,3		1	SSB.2 CCA		
SMTC configuration			1	SMTC.1		
A3-Offset		dB	1	-4.5		
CP length			1	Normal		
Hysteresis		dB	1	0		
Time To Trigger		s	1	0		
Filter coefficient			1	0		L3 filtering is not used
DRX			1	DRX.1	DRX.7	
Time offset between serving and neighbour cells			1	3 μs		Synchronous cells
T1		s	1	5		
T2		s	1	5	15	

NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 3: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

Table A.11.5.1.2.2-3: Cell-specific test parameters for intra-frequency event-triggered reporting without gaps

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TDDConf.1.1 CCA		TDDConf.1.1 CCA	
DL CCA probability for semi-static channel access (P_{CCA_DL})		1	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_1}$)		1	$P_{CCA_DL_1}$=0.75		$P_{CCA_DL_1}$=0.75	
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_2}$)		1	$P_{CCA_DL_2}$=0.75		$P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}		1	P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}		1	Test 1: L_{CCA_DL} = 5 Test 2: L_{CCA_DL} = 3		Test 1: L_{CCA_DL} = 5 Test 2: L_{CCA_DL} = 3	
W_{CCA_DL}	ms	1	Test 1: W_{CCA_DL} = 600 Test 2: W_{CCA_DL} = 5120		Test 1: W_{CCA_DL} = 600 Test 2: W_{CCA_DL} = 5120	
PDSCH RMC configuration		1	SR.1.1 CCA		N/A	
RMSI CORESET RMC configuration		1	CR.1.1 CCA		N/A	
Dedicated CORESET RMC configuration		1	CCR.1.1 CCA		N/A	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1	-91	[-91]	-Infinity	-91
Io	dBm/38.16 MHz	1	-58.50	-56.16	[-58.50	-56.16
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

A.11.5.1.2.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report with a measurement reporting delay less than 1200 ms from the beginning of time period T2.

In test 2, the UE shall send one Event A3 triggered measurement report with a measurement reporting delay less than 10240 ms from the beginning of time period T2.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.1.3 Void

A.11.5.1.4 Void

A.11.5.1.5 Void

A.11.5.1.6 Void

A.11.5.1.7 Void

A.11.5.1.8 Void

A.11.5.1.9 Void

A.11.5.1.10 Void

A.11.5.1.11 Void

A.11.5.1.12 Void

A.11.5.2 Inter-frequency measurements

A.11.5.2.1 Void

A.11.5.2.2 Void

A.11.5.2.3 Event triggered reporting tests for FR1 with CCA without SSB time index detection when DRX is not used

A.11.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements for NR cell with CCA in clause 9.3A.4 and 9.3A.5.

In this test, there are two cells: NR Cell 1 with CCA as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters are given in tables A.11.5.2.3.1-1, A.11.5.2.3.1-2 and A.11.5.2.3.1-3.

In this test, measurement gap pattern configuration # 0 as defined in table A.11.5.2.3.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

Table A.11.5.2.3.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.11.5.2.3.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with CCA without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR1 NR carrier frequencies are used. Channels 1 and 2 are with CCA.
Active cells		Config 1	NR Cell 1 with CCA (PCell)	NR Cell 1 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1	NR Cell 2 with CCA	NR Cell 2 is on NR RF channel number 2 with CCA.
DL CCA model		Config 1	As specified in clause A.3.26.2.1	
UL CCA model		Config 1	As specified in clause A.3.26.2.2	
Gap Pattern Id		Config 1	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	9	
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3 μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	1.7	

Table A.11.5.2.3.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with CCA without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD			
TDD configuration			Config 1	TDDConf.1.1 CCA			
$BW_{channel}$		MHz	Config 1	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP	Config 1	Config 1	DLBWP.0.1		NA	
	Initial UL BWP	Config 1		ULBWP.0.1		NA	
	Dedicated DL BWP	Config 1		DLBWP.1.1		NA	
	Dedicated UL BWP	Config 1		ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 CCA			

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
SSB parameters	Semi-static channel access Note 5,7		Config 1	SSB.1 CCA		SSB.1 CCA	
	Dynamic channel access Note 6,7		Config 1	SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1	As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration defined in A.3.11			Config 1	SMTC.1		SMTC.4	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1	P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1	P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1	12		12	
W_{CCA_DL}		ms	Config 1	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	30			
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1	AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.						
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.						
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.						

A.11.5.2.3.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2 UE is not required to report SSB time index.

$T_{identify_inter_cca_without_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.2.4 Event triggered reporting tests for FR1 with CCA without SSB time index detection when DRX is used

A.11.5.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are two cells: NR Cell 1 as PCell in FR1 with CCA on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters are given in tables A.11.5.2.4.1-1, A.11.5.2.4.1-2 and A.11.5.2.4.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.11.5.2.4.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.11.5.2.4.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.11.5.2.4.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with CCA without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1	1, 2		Two FR1 NR carrier frequencies are used. Channels 1 and 2 are with CCA.
Active cells		Config 1	NR Cell 1 with CCA (PCell)		NR Cell 1 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1	NR Cell 2 with CCA		NR Cell 2 is on NR RF channel number 2 with CCA.
DL CCA model		Config 1	As specified in clause A.3.26.2.1		
UL CCA model		Config 1	As specified in clause A.3.26.2.2		
Gap Pattern Id		Config 1	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	9		
A3-Offset	dB	Config 1	-6		
Hysteresis	dB	Config 1	0		
CP length		Config 1	Normal		
TimeToTrigger	s	Config 1	0		
Filter coefficient		Config 1	0		L3 filtering is not used
DRX		Config 1	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3 μs		Synchronous cells.
T1	s	Config 1	5		
T2	s	Config 1	2.5	17	

Table A.11.5.2.4.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with CCA without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD			
TDD configuration			Config 1	TDDConf.1.1 CCA			
$BW_{channel}$		MHz	Config 1	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP	Config 1	Config 1	DLBWP.0.1		NA	
	Initial UL BWP	Config 1		ULBWP.0.1		NA	
	Dedicated DL BWP	Config 1		DLBWP.1.1		NA	
	Dedicated UL BWP	Config 1		ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 CCA			

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
SSB parameters	Semi-static channel access Note 5,7		Config 1	SSB.1 CCA		SSB.1 CCA	
	Dynamic channel access Note 6,7		Config 1	SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1	As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration defined in A.3.11			Config 1	SMTC.1		SMTC.4	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1	P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1	P_{CCA_UL}=1		P_{CCA_UL}=1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	30			
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

Table A.11.5.2.4.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Value		Comment
	Test 1	Test 2	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.11.5.2.4.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.11.5.2.4.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2, the UE is not required to report SSB time index.

$T_{identify_inter_cca_without_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

For test 1, DRX cycle = 40 ms and for test 2, DRX cycle = 640 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.2.5 Event triggered reporting tests for FR1 with CCA with SSB time index detection when DRX is not used

A.11.5.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are two cells: NR Cell 1 as PCell in FR1 with CCA on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters are given in tables A.11.5.2.5.1-1, A.11.5.2.5.1-2 and A.11.5.2.5.1-3.

In this test, measurement gap pattern configuration # 0 as defined in table A.11.5.2.5.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

Table A.11.5.2.5.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.11.5.2.5.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR1 NR carrier frequencies are used. Channels 1 and 2 are with CCA.
Active cells		Config 1	NR Cell 1 with CCA (PCell)	NR Cell 1 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1	NR Cell 2 with CCA	NR Cell 2 is on NR RF channel number 2 with CCA.
DL CCA model		Config 1	As specified in clause A.3.26.2.1	
UL CCA model		Config 1	As specified in clause A.3.26.2.2	
Gap Pattern Id		Config 1	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	9	
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	2	

Table A.11.5.2.5.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD			
TDD configuration			Config 1	TDDConf.1.1 CCA			
$BW_{channel}$		MHz	Config 1	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP	Config 1	Config 1	DLBWP.0.1		NA	
	Initial UL BWP	Config 1		ULBWP.0.1		NA	
	Dedicated DL BWP	Config 1		DLBWP.1.1		NA	
	Dedicated UL BWP	Config 1		ULBWP.1.1		NA	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
TRS configuration			Config 1	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 CCA			
SSB parameters	Semi-static channel access Note 5,7		Config 1	SSB.1 CCA		SSB.1 CCA	
	Semi-static channel access Note 5,7		Config 1	SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1	As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration defined in A.3.11			Config 1	SMTC.1		SMTC.4	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1	P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1	P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1	5		5	
W_{CCA_DL}		ms	Config 1	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	30			
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1	AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.						
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.						
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.						

A.11.5.2.5.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is required to report SSB time index.

$T_{identify_inter_cca_with_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca} + T_{SSB_time_index_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_time_index_inter_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.2.6 Event triggered reporting tests for FR1 with CCA with SSB time index detection when DRX is used

A.11.5.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are two cells: NR Cell 1 as PCell in FR1 with CCA on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 with CCA on NR RF channel 2. The test parameters are given in tables A.11.5.2.6.1-1, A.11.5.2.6.1-2 and A.11.5.2.6.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.11.5.2.6.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.11.5.2.6.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.11.5.2.6.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1	1, 2		Two FR1 NR carrier frequencies are used. Channels 1 and 2 are with CCA.
Active cells		Config 1	NR Cell 1 with CCA (PCell)		NR Cell 1 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1	NR Cell 2 with CCA		NR Cell 2 is on NR RF channel number 2 with CCA.
DL CCA model		Config 1	As specified in clause A.3.26.2.1		
UL CCA model		Config 1	As specified in clause A.3.26.2.2		
Gap Pattern Id		Config 1	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	9		
A3-Offset	dB	Config 1	-6		
Hysteresis	dB	Config 1	0		
CP length		Config 1	Normal		
TimeToTrigger	s	Config 1	0		
Filter coefficient		Config 1	0		L3 filtering is not used
DRX		Config 1	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3µs		Synchronous cells.
T1	s	Config 1	5		
T2	s	Config 1	3	20	

Table A.11.5.2.6.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD			
TDD configuration			Config 1	TDDConf.1.1 CCA			
$BW_{channel}$		MHz	Config 1	40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1	40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP	Config 1	Config 1	DLBWP.0.1		NA	
	Initial UL BWP	Config 1		ULBWP.0.1		NA	
	Dedicated DL BWP	Config 1		DLBWP.1.1		NA	
	Dedicated UL BWP	Config 1		ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
PDSCH Reference measurement channel			Config 1	SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 CCA			
SSB parameters	Semi-static channel access Note 5,7		Config 1	SSB.1 CCA		SSB.1 CCA	
	Semi-static channel access Note 5,7		Config 1	SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1	As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration defined in A.3.11			Config 1	SMTC.1		SMTC.4	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1	P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1	P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1	P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1	2		2	
W_{CCA_DL}		ms	Config 1	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	30			
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1	AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.						
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.						
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.						

Table A.11.5.2.6.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Value		Comment
	Test 1	Test 2	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.11.5.2.6.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.11.5.2.6.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2, UE is required to report SSB time index.

$T_{identify_inter_cca_with_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca} + T_{SSB_time_index_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_time_index_inter_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

For test 1, DRX cycle = 40 ms and for test 2, DRX cycle = 640 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of

A.11.5.2.7 Event triggered reporting tests for FR1 without SSB time index detection when DRX is not used

A.11.5.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements for NR cell with CCA in clause 9.3A.4 and 9.3A.5.

In this test, there are two cells: NR Cell 1 with CCA as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.11.5.2.7.1-1, A.11.5.2.7.1-2 and A.11.5.2.7.1-3.

In this test, measurement gap pattern configuration # 0 as defined in table A.11.5.2.7.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

Table A.11.5.2.7.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.11.5.2.7.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies are used. NR channel 1 is with CCA.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
DL CCA model		Config 1,2,3	As specified in clause A.3.26.2.1	
UL CCA model		Config 1,2,3	As specified in clause A.3.26.2.2	
Gap Pattern Id		Config 1,2,3	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,2,3	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 1,2,3	3 μs	Synchronous cells.
T1	s	Config 1,2,3	5	

Parameter	Unit	Test configuration	Value	Comment
T2	s	Config 1,2,3	1.7	

Table A.11.5.2.7.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	TDD		FDD	
			Config 2,3	TDD		TDD	
TDD configuration			Config 1	TDDConf.1.1 CCA		Not Applicable	
			Config 2	TDDConf.1.1 CCA		TDDConf.1.1	
			Config 3	TDDConf.1.1 CCA		TDDConf.2.1	
$BW_{channel}$		MHz	Config 1,2	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,2,3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2,3	SR.1.1 CCA			
CORESET Reference Channel			Config 1,2,3	CR.1.1 CCA			
SSB parameters	Semi-static channel access Note 5,7		Config 1,2	SSB.1 CCA		SSB.1 FR1	
			Config 3	SSB.1 CCA		SSB.2 FR1	
	Semi-static channel access Note 5,7		Config 1,2	SSB.2 CCA		SSB.1 FR1	
			Config 3	SSB.2 CCA		SSB.2 FR1	
DBT window configuration			Config 1,2,3	As defined in A.3.28.1		Not applicable	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	30		15	
			Config 3	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	P_{CCA_DL}=0.9375		NA	
	Dynamic channel access Note 6,7		Config 1,2,3	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		NA	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	P_{CCA_UL}=1		NA	
	Dynamic channel access Note 6,7		Config 1,2,3	P_{CCA_UL}=1		NA	
L_{CCA_DL}			Config 1,2,3	12		12	
W_{CCA_DL}		ms	Config 1,2,3	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	Config 1,2,3	--98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-95		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-91	-91	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-58.49	-58.49	-70.05	-62.26
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.

NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.

NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

A.11.5.2.7.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is not required to report SSB time index.

$T_{identify_inter_cca_without_index}$ = ($T_{PSS/SSS_sync_inter_cca}$ + $T_{SSB_measurement_period_inter_cca}$) ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.2.8 Event triggered reporting tests for FR1 without SSB time index detection when DRX is used

A.11.5.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are two cells: NR Cell 1 with CCA as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.11.5.2.8.1-1, A.11.5.2.8.1-2 and A.11.5.2.8.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.11.5.2.8.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.11.5.2.8.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.11.5.2.8.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with CCA without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		Two FR1 NR carrier frequencies are used. NR channel 1 is with CCA.
Active cell		Config 1,2,3	NR Cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1,2,3	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
DL CCA model		Config 1,2,3	As specified in clause A.3.26.2.1		
UL CCA model		Config 1,2,3	As specified in clause A.3.26.2.2		
Gap Pattern Id		Config 1,2,3	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9		
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,2,3	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 1,2,3	3µs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	2.5	17	

Table A.11.5.2.8.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with CCA without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	TDD		FDD	
			Config 2,3	TDD		TDD	
TDD configuration			Config 1	TDDConf.1.1 CCA		Not Applicable	
			Config 2	TDDConf.1.1 CCA		TDDConf.1.1	
			Config 3	TDDConf.1.1 CCA		TDDConf.2.1	
$BW_{channel}$		MHz	Config 1,2	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,2,3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2,3	SR.1.1 CCA			
CORESET Reference Channel			Config 1,2,3	CR.1.1 CCA			
SSB parameters	Semi-static channel access Note 5,7		Config 1,2	SSB.1 CCA		SSB.1 FR1	
			Config 3	SSB.1 CCA		SSB.2 FR1	
	Semi-static channel access Note 5,7		Config 1,2	SSB.2 CCA		SSB.1 FR1	
			Config 3	SSB.2 CCA		SSB.2 FR1	
DBT window configuration			Config 1,2,3	As defined in A.3.28.1		Not applicable	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	30		15	
			Config 3	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	P_{CCA_DL}=0.9375		NA	
	Dynamic channel access Note 6,7		Config 1,2,3	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		NA	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	P_{CCA_UL}=1		NA	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
	Dynamic channel access Note 6,7		Config 1,2,3	P_{CCA_UL}=1		NA	
L_{CCA_DL}			Config 1,2,3	5		5	
W_{CCA_DL}		ms	Config 1,2,3	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2,3	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-95		-98	
			Config 3	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-91	-91	-Infinity	-91
			Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2,3	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1,2	-58.49	-58.49	-70.05	-62.26
		dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.

NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.

NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

Table A.11.5.2.8.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Value		Comment
	Test 1	Test 2	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	

drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.11.5.2.8.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.11.5.2.8.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2, the UE is not required to report SSB time index.

$T_{identify_inter_cca_without_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

For test 1, DRX cycle = 40 ms and for test 2, DRX cycle = 640 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.2.9 Event triggered reporting tests for FR1 with SSB time index detection when DRX is not used

A.11.5.2.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are two cells: NR Cell 1 with CCA as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.11.5.2.9.1-1, A.11.5.2.9.1-2 and A.11.5.2.9.1-3.

In this test, measurement gap pattern configuration # 0 as defined in table A.11.5.2.9.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

Table A.11.5.2.9.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

2	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.11.5.2.9.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1, 2	Two FR1 NR carrier frequencies are used. NR channel 1 is with CCA.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
DL CCA model		Config 1,2,3	As specified in clause A.3.26.2.1	
UL CCA model		Config 1,2,3	As specified in clause A.3.26.2.2	
Gap Pattern Id		Config 1,2,3	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,2,3	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 1,2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	2	

Table A.11.5.2.9.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	TDD		FDD	
			Config 2,3	TDD		TDD	
TDD configuration			Config 1	TDDConf.1.1 CCA		Not Applicable	
			Config 2	TDDConf.1.1 CCA		TDDConf.1.1	
			Config 3	TDDConf.1.1 CCA		TDDConf.2.1	
$BW_{channel}$		MHz	Config 1,2	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	40: $N_{PRB,c}$ = 106		10: $N_{PRB,c}$ = 52	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,2,3	TRS.1.2 TDD		NA	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2,3	SR.1.1 CCA			
CORESET Reference Channel			Config 1,2,3	CR.1.1 CCA			
SSB parameters	Semi-static channel access Note 5,7		Config 1,2	SSB.1 CCA		SSB.1 FR1	
			Config 3	SSB.1 CCA		SSB.2 FR1	
	Semi-static channel access Note 5,7		Config 1,2	SSB.2 CCA		SSB.1 FR1	
			Config 3	SSB.2 CCA		SSB.2 FR1	
DBT window configuration			Config 1,2,3	As defined in A.3.28.1		Not applicable	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	30		15	
			Config 3	30		30	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	P_{CCA_DL}=0.9375		NA	
	Dynamic channel access Note 6,7		Config 1,2,3	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		NA	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	P_{CCA_UL}=1		NA	
	Dynamic channel access Note 6,7		Config 1,2,3	P_{CCA_UL}=1		NA	
L_{CCA_DL}			Config 1,2,3	5		5	
W_{CCA_DL}		ms	Config 1,2,3	$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2,3	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-95		-98	
			Config 3	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-91	-91	-Infinity	-91
			Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2,3	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1,2	-58.49	-58.49	-70.05	-62.26
		dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		Config 1,2,3	AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.						
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.						
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.						

A.11.5.2.9.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is required to report SSB time index.

$T_{identify_inter_cca_with_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca} + T_{SSB_time_index_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_time_index_inter_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.2.10 Event triggered reporting tests for FR1 with SSB time index detection when DRX is used

A.11.5.2.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are two cells: NR Cell 1 with CCA as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.11.5.2.10.1-1, A.11.5.2.10.1-2 and A.11.5.2.10.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.11.5.2.10.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.11.5.2.10.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.11.5.2.10.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		Two FR1 NR carrier frequencies are used. NR channel 1 is with CCA.
Active cell		Config 1,2,3	NR Cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1 with CCA.
Neighbour cell		Config 1,2,3	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
DL CCA model		Config 1,2,3	As specified in clause A.3.26.2.1		
UL CCA model		Config 1,2,3	As specified in clause A.3.26.2.2		
Gap Pattern Id		Config 1,2,3	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9		
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,2,3	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 1,2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	3	20	

Table A.11.5.2.10.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter	Unit	Test configuration	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
NR RF Channel Number		Config 1,2,3	1				2			
Duplex mode		Config 1	TDD				FDD			
		Config 2,3	TDD				TDD			

Parameter		Unit	Test configuration	Cell 1				Cell 2			
				T1	T2	T3	T4	T1	T2	T3	T4
TDD configuration			Config 1	TDDConf.1.1 CCA				Not Applicable			
			Config 2	TDDConf.1.1 CCA				TDDConf.1.1			
			Config 3	TDDConf.1.1 CCA				TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	40: $N_{PRB,c}$ = 106				10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106				40: $N_{PRB,c}$ = 106			
BWP BW		MHz	Config 1,2	40: $N_{PRB,c}$ = 106				10: $N_{PRB,c}$ = 52			
			Config 3	40: $N_{PRB,c}$ = 106				40: $N_{PRB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1				NA			
	Initial UL BWP			ULBWP.0.1				NA			
	Dedicated DL BWP			DLBWP.1.1				NA			
	Dedicated UL BWP			ULBWP.1.1				NA			
TRS configuration			Config 1,2,3	TRS.1.2 TDD				NA			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1				OP.1			
PDSCH Reference measurement channel			Config 1,2,3	SR.1.1 CCA							
CORESET Reference Channel			Config 1,2,3	CR.1.1 CCA							
SSB parameters	Semi-static channel access Note 5,7		Config 1,2	SSB.1 CCA				SSB.1 FR1			
			Config 3	SSB.1 CCA				SSB.2 FR1			
	Semi-static channel access Note 5,7		Config 1,2	SSB.2 CCA				SSB.1 FR1			
			Config 3	SSB.2 CCA				SSB.2 FR1			
DBT window configuration			Config 1,2,3	As defined in A.3.28.1				Not applicable			
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.1				SMTC.4			
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	30				15			
			Config 3	30				30			
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	P_{CCA_DL}=0.9375				NA			
	Dynamic channel access Note 6,7		Config 1,2,3	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75				NA			
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	P_{CCA_UL}=1				NA			
	Dynamic channel access Note 6,7		Config 1,2,3	P_{CCA_UL}=1				NA			
L_{CCA_DL}			Config 1,2,3	2				2			
W_{CCA_DL}		ms	Config 1,2,3	$T_{PSS/SSS_sync_inter_cca}$				$T_{PSS/SSS_sync_inter_cca}$			
EPRE ratio of PSS to SSS			Config 1,2,3	0				0			
EPRE ratio of PBCH DMRS to SSS											
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of PDCCH DMRS to SSS											
EPRE ratio of PDCCH to PDCCH DMRS											
EPRE ratio of PDSCH DMRS to SSS											
EPRE ratio of PDSCH to PDSCH											
EPRE ratio of OCNG DMRS to SSS(Note 1)											
EPRE ratio of OCNG to OCNG DMRS (Note 1)											

Parameter	Unit	Test configuration	Cell 1				Cell 2			
			T1	T2	T3	T4	T1	T2	T3	T4
N_{oc} Note2	dBm/15 kHz	Config 1,2,3	-98				-98			
N_{oc} Note2	dBm/SCS	Config 1,2	-95				-98			
		Config 3	-95				-95			
SS-RSRP Note 3	dBm/SCS	Config 1,2	-91		-91		-Infinity		-91	
		Config 3	-91		-91		-Infinity		-88	
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	4		4		-Infinity		7	
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4		4		-Infinity		7	
Io Note3	dBm/9.36 MHz	Config 1,2	-58.49		-58.49		-70.05		-62.26	
	dBm/38.16 MHz	Config 3	-58.49		-58.49		-63.94		-56.15	
Propagation Condition		Config 1,2,3	AWGN				AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. . For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

Table A.11.5.2.10.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Value		Comment
	Test 1	Test 2	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.11.5.2.10.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.11.5.2.10.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement

reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2, the UE is required to report SSB time index.

$T_{identify_inter_cca_with_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca} + T_{SSB_time_index_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_time_index_inter_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

For test 1, DRX cycle = 40 ms and for test 2, DRX cycle = 640 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.3 Inter-RAT E-UTRAN measurements

A.11.5.3.1 SA NR - E-UTRAN event-triggered reporting in non-DRX in FR1

A.11.5.3.1.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in clauses 9.4.2 and 9.4.3.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell on a frequency carrier with CCA and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. In the measurement control information from the PCell it is indictated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are shown in table A.11.5.3.1.1-1. General test parameters are provided in table A.11.5.3.1.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.11.5.3.1.1-3 and A.11.5.3.1.1-4, respectively.

Table A.11.5.3.1.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Configuration	Description
1	NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
2	NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.5.3.1.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		1	1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.11.5.3.1.1-2 and A.11.5.3.1.1-3.	
Active cell		Cell 1	Cell 1 is on RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on RF channel number 2

Gap Pattern Id		0	As specified in clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP	Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP	Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1	SS-RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
b2-Threshold2EUTRA	dBm	-95	E-UTRAN RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	OFF
T1	s	5	
T2	s	5	
NOTE 1: Values are defined in table A.11.5.3.1.1-3			

Table A.11.5.3.1.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
NR RF Channel Number		1, 2	1	
TDD configuration		1, 2	TDDConf.1.1 CCA	
$BW_{channel}$	MHz	1, 2	40: $N_{PRB,c}$ = 106	
P_{CCA_DL} for dynamic channel access Note 6,8		1, 2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 7,8		1, 2	P_{CCA_DL}=0.9375	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 2	SMTC.1	
DBT window configuration		1, 2	DBT.1	
SSB configuration for semi-static channel access		1, 2	SSB.1 CCA	
SSB configuration for dynamic channel access		1, 2	SSB.2 CCA	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	30	
b2-Threshold1	dBm	1	-96	
		2	-93	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1, 2	-106	
N_{oc} Note2	dBm/SCS	1, 2	-103	
SS-RSRP Note 3,5	dBm/SCS	1, 2	-85	-105
$\hat{E}_s/I_{ot}$ Note 5	dB	1, 2	18	-2
$\hat{E}_s/N_{oc}$ Note 5	dB	1, 2	18	-2
Io Note3	dBm/38.16 MHz	1, 2	-53.88	-69.82
Propagation Condition		1, 2	AWGN	

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
Antenna Configuration and Correlation Matrix		1, 2	1x2 Low	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 8: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

Table A.11.5.3.1.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1,2	1	
Duplex mode		1	FDD	
		2	TDD	
TDD special subframe configuration[Note1]		2	6	
TDD uplink-downlink configuration[Note1]		2	1	
$BW_{channel}$	MHz	1,2	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		2	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		2	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		2	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				

Parameter	Unit	Configuration	Cell 2	
			T1	T2
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15 kHz	1, 2	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2	-Infinity	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2	-Infinity	17
RSRP Note5	dBm/15 kHz	1, 2	-Infinity	-87
SCH_RP Note5	dBm/15 kHz	1, 2	-Infinity	-87
Io Note5	dBm/9 MHz	1, 2	-73.21+10log ($N_{PRB,c}$ /50)	-56.12+10log ($N_{PRB,c}$ /50)
Propagation Condition		1, 2	AWGN	
Antenna Configuration and Correlation Matrix		1, 2	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.11.5.3.1.2 Test Requirements

The UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.11.5.3.2 SA NR - E-UTRAN event-triggered reporting in DRX in FR1

A.11.5.3.2.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1 when DRX is used. This test shall partly verify the cell search and measurement requirements in clauses 9.4.2 and 9.4.3. There are two test cases. In test 1 the UE shall be configured with DRX cycle of 40 ms. In test 2 the UE shall be configured with DRX cycle of 640 ms.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell with CCA and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. In the measurement control information from the PCell it is indctated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

In each test the UE shall be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, the UE shall be allocated with PUSCH resource at every DRX cycle.

Supported test configurations are shown in table A.11.5.3.2.1-1. General test parameters are provided in table A.11.5.3.2.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.11.5.3.2.1-3 and A.11.5.3.2.1-4, respectively.

Table A.11.5.3.2.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Configuration	Description
1	NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
2	NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.5.3.2.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Test 1	Test 2	Comment
		Value		
NR RF Channel Number		1		1 NR carrier frequency is used in the test
LTE RF Channel Number		2		1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.11.5.3.2.1-2 and A.11.5.3.2.1-3.		
Active cell		Cell 1		Cell 1 is on RF channel number 1
Neighbour cell		Cell 2		Cell 2 is on RF channel number 2
Gap Pattern Id		0		As specified in clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP		Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP		Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1		SS-RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
b2-Threshold2EUTRA	dBm	-95		E-UTRAN RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
Hysteresis	dB	0		
TimeToTrigger	s	0		
Filter coefficient		0		L3 filtering is not used
DRX		DRX.1	DRX.7	DRX cycle configurations DRX.1 and DRX.7 are defined in table A.3.3.1-1 and table A.3.3.7-1 respectively.
T1	s	5		
T2	s	5	15	
NOTE 1: Values are defined in table A.11.5.3.2.1-3				

Table A.11.5.3.2.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
NR RF Channel Number		1, 2	1	
TDD configuration		1, 2	TDDConf.1.1 CCA	
$BW_{channel}$	MHz	1, 2	40: $N_{PRB,c}$ = 106	
P_{CCA_DL} for dynamic channel access Note 6,8		1, 2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 7,8		1, 2	P_{CCA_DL}=0.9375	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 2	SMTC.1	
DBT window configuration		1, 2	DBT.1	
SSB configuration for semi-static channel access		1, 2	SSB.1 CCA	
SSB configuration for dynamic channel access		1, 2	SSB.2 CCA	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	30	
b2-Threshold1	dBm	1	-96	
		2	-93	

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1, 2	-106	
N_{oc} Note2	dBm/SCS	1, 2	-103	
SS-RSRP Note 3,5	dBm/SCS	1, 2	-85	-105
$\hat{E}_s/I_{ot}$ Note 5	dB	1, 2	18	-2
$\hat{E}_s/N_{oc}$ Note 5	dB	1, 2	18	-2
Io Note3	dBm/38.16 MHz	1, 2	-53.88	-69.82
Propagation Condition		1, 2	AWGN	
Antenna Configuration and Correlation Matrix		1, 2	1x2 Low	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 8: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

Table A.11.5.3.2.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1,2	1	
Duplex mode		1	FDD	
		2	TDD	
TDD special subframe configuration Note1		2	6	
TDD uplink-downlink configuration Note1		2	1	
$BW_{channel}$	MHz	1,2	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel Note2		1	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		2	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	

Parameter	Unit	Configuration	Cell 2	
			T1	T2
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		2	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		2	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2	-Infinity	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2	-Infinity	17
RSRP[Note5]	dBm/15 kHz	1, 2	-Infinity	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2	-Infinity	-87
Io[Note5]	dBm/9 MHz	1, 2	-73.21+10log ($N_{PRB,c}$ /50)	-56.12+10log ($N_{PRB,c}$ /50)
Propagation Condition		1, 2	AWGN	
Antenna Configuration and Correlation Matrix		1, 2	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.11.5.3.2.2 Test Requirements

In test 1, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

In test 2, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 12.8 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.11.5.4 L1-RSRP measurements for beam reporting

A.11.5.4.1 SSB based L1-RSRP measurement when DRX is not used

A.11.5.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5A.4.1, with the testing configurations for NR cells in table A.11.5.4.1.1-1.

Table A.11.5.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.11.5.4.1.2 Test parameters

There is one cell in the test, the FR1 PCell (Cell 1). Cell 1 operates on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model. The test parameters for the Cell 1 are given in table A.11.5.4.1.2-1 and table A.11.5.4.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The UE transmits the reporting according to UL CCA model. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.11.5.4.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1		freq1
DL CCA model	1		As specifieed in A.3.20.2.1
UL CCA model	1		As specified in A.3.20.2.2
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.1.1 CCA
$BW_{channel}$	1	MHz	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 CCA
RMSI CORESET Reference Channel	1		CR.1.1 CCA
Dedicated CORESET Reference Channel	1		CCR.1.1 CCA
SSB configuration	1		SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1
DBT Window Configuration	1		DBT.1
TRS Configuration	1		TRS.1.2 TDD
DRX configuration	1		Off
reportConfigType	1		periodic
reportQuantity	1		ssb-Index-RSRP
Number of reported RS	1		2
L1-RSRP reporting period	1	slot	80
T1	1	s	5

Parameter	Config	Unit	Value
T2	1	s	1
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1		AWGN
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.			

Table A.11.5.4.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
DL CCA Probability P_{CCA_DL} Note 4,6	1		0.9375	0.9375	0.9375	0.9375
DL CCA Probability P_{CCA_DL} Note 4.7	1		0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability P_{CCA_UL}	1		1.0	1.0	1.0	1.0
N_{oc} Note2	1	dBm/15 kHz	-94.65			
N_{oc} Note2	1	dBm/SSB SCS	-91.65			
$\hat{E}_s / I_{ot}$	1	dB	0	0	-Infinity	3
SSB RSRP Note3	1	dBm/SSB SCS	-91.65	-91.65	-Infinity	-88.65
Io Note3	1	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: DL and UL CCA probabilities apply for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.						
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.						
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.						
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.						

A.11.5.4.1.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.4.2 SSB based L1-RSRP measurement when DRX is used

A.11.5.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5A.4.1, with the testing configurations for NR cells in table A.11.5.4.2.1-1.

Table A.11.5.4.2.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.11.5.4.2.2 Test parameters

There is one cell in the test, the FR1 PCell (Cell 1). Cell 1 operates on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model. The test parameters for the Cell 1 are given in table A.11.5.4.2.2-1 and table A.11.5.4.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The UE transmits the reporting according to UL CCA model. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.11.5.4.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1		freq1
DL CCA model	1		As specifieed in A.3.20.2.1
UL CCA model	1		As specified in A.3.20.2.2
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.1.1 CCA
$BW_{channel}$	1	MHz	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 CCA
RMSI CORESET Reference Channel	1		CR.1.1 CCA
Dedicated CORESET Reference Channel	1		CCR.1.1 CCA
SSB configuration	1		SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1
DBT Window Configuration	1		DBT.1
TRS Configuration	1		TRS.1.2 TDD
DRX configuration	1		DRX.3
reportConfigType	1		periodic
reportQuantity	1		ssb-Index-RSRP
Number of reported RS	1		2
L1-RSRP reporting period	1	slot	80
T1	1	s	5
T2	1	s	1
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			

Parameter	Config	Unit	Value
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1		AWGN
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.			

Table A.11.5.4.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
DL CCA Probability P_{CCA_DL} Note 4,6	1		0.9375	0.9375	0.9375	0.9375
DL CCA Probability P_{CCA_DL} Note 4.7	1		0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability P_{CCA_UL}	1		1.0	1.0	1.0	1.0
N_{oc} Note2	1	dBm/15 kHz	-94.65			
N_{oc} Note2	1	dBm/SSB SCS	-91.65			
$\hat{E}_s / I_{ot}$	1	dB	0	0	-Infinity	3
SSB RSRP Note3	1	dBm/SSB SCS	-91.65	-91.65	-Infinity	-88.65
Io Note3	1	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: DL and UL CCA probabilities apply for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy. NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows. NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.						

A.11.5.4.2.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.4.3 SSB based L1-RSRP measurement on SCC when DRX is not used

A.11.5.4.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5A.4.1, with the testing configurations for NR cells in table A.11.5.4.3.1-1.

Table A.11.5.4.3.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.11.5.4.3.2 Test parameters

There are two cells in the test, the FR1 PCell (Cell 1) and FR1 SCell (Cell 2). Both Cell 1 and Cell 2 operate on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model. The test parameters for the Cell 1 are given in table A.11.5.4.3.2-1 and table A.11.5.4.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The UE transmits the reporting according to UL CCA model. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.11.5.4.3.2-1: General test parameters

Parameter	Config	Unit	Value
Active PCell	1		Cell 1
Active SCell	1		Cell 2
RF Channel Number	1		1: Cell 1 2: Cell 2
DL CCA model	1		As specifieed in A.3.20.2.1
UL CCA model	1		As specified in A.3.20.2.2
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.1.1 CCA
$BW_{channel}$	1	MHz	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 CCA
RMSI CORESET Reference Channel	1		CR.1.1 CCA
Dedicated CORESET Reference Channel	1		CCR.1.1 CCA
SSB configuration	1		SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1
DBT Window Configuration	1		DBT.1
TRS Configuration	1		TRS.1.2 TDD
DRX configuration	1		Off
reportConfigType	1		periodic
reportQuantity	1		ssb-Index-RSRP
Number of reported RS	1		2
L1-RSRP reporting period	1	slot	80
T1	1	s	5
T2	1	s	1
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS[Note 1]			

Parameter	Config	Unit	Value
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1		AWGN
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.			

Table A.11.5.4.3.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
DL CCA Probability P_{CCA_DL} Note 4,6	1		0.9375	0.9375	0.9375	0.9375
DL CCA Probability P_{CCA_DL} Note 4,7	1		0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability P_{CCA_UL}	1		1.0	1.0	1.0	1.0
N_{oc} Note2	1	dBm/15 kHz	-94.65			
N_{oc} Note2	1	dBm/SSB SCS	-91.65			
$\hat{E}_s / I_{ot}$	1	dB	0	0	-Infinity	3
SSB RSRP Note3	1	dBm/SSB SCS	-91.65	-91.65	-Infinity	-88.65
Io Note3	1	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1	dB	0	0	-Infinity	3

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: DL and UL CCA probabilities apply for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.

A.11.5.4.3.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE shall send L1-RSRP report of both SSB0 and SSB1 in Cell 2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.5.4.4 SSB based L1-RSRP measurement on SCC when DRX is used

A.11.5.4.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5A.4.1, with the testing configurations for NR cells in table A.11.5.4.4.1-1.

Table A.11.5.4.4.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.11.5.4.4.2 Test parameters

There are two cells in the test, the FR1 PCell (Cell 1) and FR1 SCell (Cell 2). Both Cell 1 and Cell 2 operate on a carrier frequency with CCA and transmits SSBs in DBT windows according to DL CCA model. The test parameters for the Cell 1 are given in table A.11.5.4.4.2-1 and table A.11.5.4.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The UE transmits the reporting according to UL CCA model. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.11.5.4.4.2-1: General test parameters

Parameter	Config	Unit	Value
Active PCell	1		Cell 1
Active SCell	1		Cell 2
RF Channel Number	1		1: Cell 1 2: Cell 2
DL CCA model	1		As specifieed in A.3.20.2.1
UL CCA model	1		As specified in A.3.20.2.2
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.1.1 CCA
$BW_{channel}$	1	MHz	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 CCA
RMSI CORESET Reference Channel	1		CR.1.1 CCA
Dedicated CORESET Reference Channel	1		CCR.1.1 CCA
SSB configuration	1		SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1
DBT Window Configuration	1		DBT.1
TRS Configuration	1		TRS.1.2 TDD
DRX configuration	1		DRX.3
reportConfigType	1		periodic
reportQuantity	1		ssb-Index-RSRP
Number of reported RS	1		2
L1-RSRP reporting period	1	slot	80
T1	1	s	5
T2	1	s	1
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS[Note 1]			

Parameter	Config	Unit	Value
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1		AWGN
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.			

Table A.11.5.4.4.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
DL CCA Probability P_{CCA_DL} Note 4,6	1		0.9375	0.9375	0.9375	0.9375
DL CCA Probability P_{CCA_DL} Note 4,7	1		0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability P_{CCA_UL}	1		1.0	1.0	1.0	1.0
N_{oc} Note2	1	dBm/15 kHz	-94.65			
N_{oc} Note2	1	dBm/SSB SCS	-91.65			
$\hat{E}_s / I_{ot}$	1	dB	0	0	-Infinity	3
SSB RSRP Note3	1	dBm/SSB SCS	-91.65	-91.65	-Infinity	-88.65
Io Note3	1	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1	dB	0	0	-Infinity	3

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: DL and UL CCA probabilities apply for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.

A.11.5.4.4.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE shall send L1-RSRP report of both SSB0 and SSB1 in Cell 2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.11.6 Measurement performance

A.11.6.1 SS-RSRP

A.11.6.1.1 Intra-frequency measurement accuracy on a carrier frequency with CCA

A.11.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy on the carrier frequency with CCA is within the specified limits. This test will verify the requirements in clauses 10.1.36.1.1 and 10.1.36.1.2 for intra-frequency measurements under CCA.

A.11.6.1.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency with CCA and transmit SSBs in DBT windows according to DL CCA model. Supported test configurations are shown in table A.11.6.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in A.11.6.1.1.2-2. In all test cases, Cell 1 is the PCell, and Cell 2 is the target cell.

Table A.11.6.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Config	Description
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.6.1.1.2-2: SS-RSRP Intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0	489	0
SSB ARFCN			freq1		freq1		freq1	
TDD configuration	Config 1		TDDConf.1.1 CCA					
$BW_{channel}$	Config 1	MHz	40: $N_{PRB,c}$ = 106					
BWP BW	Config 1		40: $N_{PRB,c}$ = 106					
DL CCA model			As specified in clause A.3.26.2.1					
UL CCA model			As specified in clause A.3.26.2.2					
P_{CCA_DL} for dynamic channel access Note 7,9			$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75					
P_{CCA_DL} for semi-static channel access Note 8,9			P_{CCA_DL}=0.9375					
P_{CCA_UL}			1					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
TRS configuration	Config 1		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 CCA	-	SR.1.1 CCA	-	SR.1.1 CCA	-
RMSI CORESET Reference Channel	Config 1		CR.1.1 CCA	-	CR.1.1 CCA	-	CR.1.1 CCA	-
Control channel RMC	Config 1		CR.1.1 CCA	-	CR.1.1 CCA	-	CR.1.1 CCA	-
SSB configuration for semi-static channel access	Config 1		SSB.1 CCA	SSB.1 CCA	SSB.1 CCA	SSB.1 CCA	SSB.1 CCA	SSB.1 CCA
SSB configuration for dynamic channel access	Config 1		SSB.2 CCA	SSB.2 CCA	SSB.2 CCA	SSB.2 CCA	SSB.2 CCA	SSB.2 CCA
DBT window configuration	Config 1,2,3		DBT.1	DBT.1	DBT.1	DBT.1	DBT.1	DBT.1
Time offset with Cell 1	Config 1	µs	-	3	-	3	-	3
SMTC configuration	Config 1		SMTC.1					
OCNG Patterns			OCNG pattern 1					
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	30 kHz					

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1	NR_CCA_FR1_I		Not applicable Note 5		-94		-110	
		NR_CCA_FR1_J						-109.5	
N_{oc} Note2	Config 1	NR_CCA_FR1_I	dBm/SCS	Not applicable Note 5		-91		-107.0	
		NR_CCA_FR1_J						-106.5	
$\hat{E}_s/I_{ot}$ Note6			dB	2.46	-5.97	2.46	-5.97	-2.01	-3.54
$\hat{E}_s/N_{oc}$ Note6			dB	6	1	6	1	1	0
SS-RSRP Note3,6	Config 1	NR_CCA_FR1_I	dBm/SCS	Not applicable Note 5	Not applicable Note 5	-85	-90	-106.00	-107.00
		NR_CCA_FR1_J						-105.50	-106.50
Io Note3	Config 1	NR_CCA_FR1_I	dBm/38.16 MHz	Not applicable Note 5		-51.99		-70.82	
		NR_CCA_FR1_J						-70.32	
Propagation condition			-	AWGN					
Antenna configuration				1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Subtest 1 is not used when testing with 30 kHz SSB SCS.
NOTE 6: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 9: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.11.6.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil absolute requirement in clause 10.1.36.1.1 and relative requirement in clause 10.1.36.1.2.

A.11.6.1.2 Intra-frequency measurement accuracy on SCC on a carrier frequency with CCA

A.11.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy on the carrier frequency with CCA is within the specified limits. This test will verify the requirements in clauses 10.1.36.1.1 and 10.1.36.1.2 for intra-frequency measurements under CCA.

A.11.6.1.2.2 Test parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1) on the carrier frequency with CCA, and two cells on the same carrier frequency with CCA and transmit SSBs in DBT windows according to DL CCA model: SCell (Cell 2) and a neighbour cell (Cell 3). Supported test configurations are shown in table A.11.6.1.2.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in A.11.6.1.2.2-2.

Table A.11.6.1.2.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Config	Description
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.11.6.1.2.2-2: SS-RSRP Intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
Cell ID			489	0	489	0	489	0
SSB ARFCN			freq1		freq1		freq1	
TDD configuration	Config 1		TDDConf.1.1 CCA					
$BW_{channel}$	Config 1	MHz	40: $N_{PRB,c}$ = 106					
BWP BW	Config 1		40: $N_{PRB,c}$ = 106					
DL CCA model			As specified in clause A.3.26.2.1					
UL CCA model			As specified in clause A.3.26.2.2					
P_{CCA_DL} for dynamic channel access Note 7,9			$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75					
P_{CCA_DL} for semi-static channel access Note 8,9			P_{CCA_DL}=0.9375					
P_{CCA_UL}			1					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
TRS configuration	Config 1		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 CCA	-	SR.1.1 CCA	-	SR.1.1 CCA	-
RMSI CORESET Reference Channel	Config 1		CR.1.1 CCA	-	CR.1.1 CCA	-	CR.1.1 CCA	-
Control channel RMC	Config 1		CR.1.1 CCA	-	CR.1.1 CCA	-	CR.1.1 CCA	-
SSB configuration for semi-static channel access	Config 1		SSB.1 CCA	SSB.1 CCA	SSB.1 CCA	SSB.1 CCA	SSB.1 CCA	SSB.1 CCA
SSB configuration for dynamic channel access	Config 1		SSB.2 CCA	SSB.2 CCA	SSB.2 CCA	SSB.2 CCA	SSB.2 CCA	SSB.2 CCA
DBT window configuration	Config 1,2,3		DBT.1	DBT.1	DBT.1	DBT.1	DBT.1	DBT.1
Time offset with Cell 1	Config 1	µs	-	3	-	3	-	3
SMTC configuration	Config 1		SMTC.1					
OCNG Patterns			OCNG pattern 1					
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	30 kHz					
EPRE ratio of PSS to SSS		dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1	NR_CCA_FR1_I		Not applicable Note 5		-94		-110	
		NR_CCA_FR1_J						-109.5	
N_{oc} Note2	Config 1	NR_CCA_FR1_I	dBm/SCS	Not applicable Note 5		-91		-107.0	
		NR_CCA_FR1_J						-106.5	
$\hat{E}_s/I_{ot}$ Note6			dB	2.46	-5.97	2.46	-5.97	-2.01	-3.54
$\hat{E}_s/N_{oc}$ Note6			dB	6	1	6	1	1	0
SS-RSRP Note3	Config 1	NR_CCA_FR1_I	dBm/SCS	Not applicable Note 5	Not applicable Note 5	-85	-90	-106.00	-107.00
		NR_CCA_FR1_J						-105.50	-106.50
Io Note3	Config 1	NR_CCA_FR1_I	dBm/ 38.16 MHz	Not applicable Note 5		-51.99		-70.82	
		NR_CCA_FR1_J						-70.32	
Propagation condition			-	AWGN					
Antenna configuration				1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Subtest 1 is not used when testing with 30 kHz SSB SCS.
NOTE 6: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 9: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.11.6.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil absolute requirement in clause 10.1.36.1.1 and relative requirement in clause 10.1.36.1.2.

A.11.6.2 SS-RSRQ

A.11.6.2.1 Intra-frequency measurement accuracy

A.11.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.29.1.1.

A.11.6.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.11.6.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is tested by using the parameters in table A.11.6.2.1.2-2. In all test cases, Cell 1 is the PCell with CCA and Cell 2 is the target cell with CCA. Three sub-tests (Test 1, Test 2, and Test 3) are provided different N_{oc} on Cells 1 and 2.

Table A.11.6.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.6.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter			Unit	Test 1		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN				freq1			
DL CCA model		Config 1		As specified in clause A.3.26.2.1			
UL CCA model		Config 1		As specified in clause A.3.26.2.2			
DL CCA probability for semi-static channel access Note 7, 8		P_{CCA_UL}		1.0	-	1.0	-
		P_{CCA_DL}		0.9375	-	0.9375	-
DL CCA probability for dynamic channel access Note 8, 9		$P_{CCA_DL_1}$		0.75	-	0.75	-
		$P_{CCA_DL_2}$		0.75	-	0.75	-
Duplex mode		Config 1		TDD			
TDD configuration		Config 1		TDDConf.1.1 CCA			
$BW_{channel}$		Config 1	MHz	40: $N_{RB,c}$ = 106			
BWP configuration		Initial DL BWP		DLBWP.0.1			
		Dedicated DL BWP		DLBWP.1.1			
		Initial UL BWP		ULBWP.0.1			
		Dedicated UL BWP		ULBWP.1.1			
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel		Config 1		SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel		Config 1		CR.1.1 CCA		CR.1.1 CCA	
Control Channel RMC		Config 1		CCR.1.1 CCA		CCR.1.1 CCA	
TRS configuration		Config 1		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OP. 1			
SS-RSSI-Measurement				Not Applicable			
Time offset with Cell 1		Config 1	µs	-	3	-	3
DBT Window Configuration		Config 1		DBT.1 (As defined in A.3.28.1)			
SSB configuration		Config 1		SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access			
SMTC configuration		Config 1		SMTC.1			
PDSCH/PDCCH subcarrier spacing		Config 1	kHz	30kHz			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config1	NR_CCA_FR1_I	dBm/15kHz	-91		-110	
		NR_CCA_FR1_J				-109.5	
N_{oc} Note2	Config 1	NR_CCA_FR1_I	dBm/SCS	-88		-107	
		NR_CCA_FR1_J				-106.5	
$\hat{E}_s / I_{ot}$			dB	-1.76		-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	3	3	-4	-4
SS-RSRP Note3	Config 1	NR_CCA_FR1_I	dBm/SCS	-85	-85	-111	-111
		NR_CCA_FR1_J				-110.5	-110.5
SS-RSRQ Note3		NR_CCA_FR1_I	dB	-14.77	-14.77	-17.34	-17.34

		NR_CCA_FR1_J					
Io[Note3]	Config 1	NR_CCA_FR1_I	dBm/ 38.16MHz	-50		-73.4	-73.4
		NR_CCA_FR1_J				-72.9	-72.9
Propagation condition			-	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in clause 3.5.2.
Note 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.
Note 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
Note 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
Note 9: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.11.6.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.29.1.1.

A.11.6.2.2 Inter-frequency measurement accuracy

A.11.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.30.1.1 and 10.1.30.1.2.

A.11.6.2.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.11.6.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in table A.11.6.2.2.2-2. In all test cases, Cell 1 is the PCell with CCA and Cell 2 is target cell with CCA. Two sub-tests (Test 1 and Test 2) are provided different N_{oc} on Cells 1 and 2.

Table A.11.6.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.6.2.2.2-2: SS-RSRQ Inter frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1	freq2	freq1	freq2
DL CCA model	Config 1		As specified in clause A.3.26.2.1			
UL CCA model	Config 1		As specified in clause A.3.26.2.2			

UL CCA probability	P_{CCA_UL}		1.0	-	1.0	-
DL CCA probability for semi-static channel access Note 7, 8	P_{CCA_DL}		0.9375	-	0.9375	-
DL CCA probability for dynamic channel access Note 8, 9	$P_{CCA_DL_1}$		0.75	-	0.75	-
	$P_{CCA_DL_2}$		0.75	-	0.75	-
Duplex mode	Config 1		TDD			
TDD configuration	Config 1		TDDConf.1.1 CCA			
$BW_{channel}$	Config 1	MHz	40: $N_{RB,c}$ = 106			
Gap pattern ID	Config 1		0			
BWP BW	Config 1		40: NRB,c = 106			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel	Config 1		CR.1.1 CCA		CR.1.1 CCA	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 CCA		CCR.1.1 CCA	
TRS Configuration	Config 1		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns			OCNG pattern 1			
Time offset with Cell 1	Config 1	µs	-	3	-	3
DBT Window configuration	Config 1		DBT.1			
SSB configuration	Config 1		SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access			
SMTC configuration	Config 1		SMTC.1			
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	30 kHz			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		NR_CCA_FR1_I	dBm/15kHz	-86.27		-112
		NR_CCA_FR1_J				-111.5
N_{oc} Note2	Config 1	NR_CCA_FR1_I	dBm/SCS	-83.27		-109
		NR_CCA_FR1_J				-108.5
$\hat{E}_s / I_{ot}$			dB	-1.75		3	-1.75
$\hat{E}_s / N_{oc}$			dB	-1.75		3	-1.75
SS-RSRP Note3	Config 1	NR_CCA_FR1_I		-85.02	-85.02	-106	-110.75
		NR_CCA_FR1_J				-105.5	-110-.25
SS-RSRQ Note3		NR_CCA_FR1_I	dB	-14.77	-14.77	12.56	14.76
		NR_CCA_FR1_J					
Io Note3	Config 1	NR_CCA_FR1_I	dBm/SCS	-50		-73.19	-75.73
		NR_CCA_FR1_J				-72.69	-75.23
Propagation condition			-	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5:	NR operating band groups are as defined in clause 3.5.2.
Note 6:	For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configuration.
Note 7:	For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
Note 8:	For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
Note 9:	For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.11.6.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.30.1.1 and 10.1.30.1.2.

A.11.6.2.3 Intra-frequency measurement accuracy on SCC

A.11.6.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.29.1.1.

A.11.6.2.3.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.11.6.2.3.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is tested by using the parameters in table A.11.6.2.3.2-2. In all test cases, Cell 1 is the PCell with CCA, Cell 2 is the SCell with CCA, and Cell 3 is the target cell with CCA. Three sub-tests (Test 1, Test 2, and Test 3) are provided different N_{oc} on Cells 1, 2, and 3.

Table A.11.6.2.3.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.6.2.3.2-2: SS-RSRQ Intra frequency test parameters

Parameter		Unit	Test 1		Test 3	
			Cell 1 / Cell 2	Cell 3	Cell 1 / Cell 2	Cell 3
SSB ARFCN			freq1 for Cell 1 freq2 for Cell 2	freq2	freq1 for Cell 1 freq2 for Cell 2	freq2
DL CCA model	Config 1		As specified in clause A.3.26.2.1			
UL CCA model	Config 1		As specified in clause A.3.26.2.2			
DL CCA probability for semi-static channel access Note 7, 8	P_{CCA_UL}		1.0	-	1.0	-
	P_{CCA_DL}		0.9375	-	0.9375	-
DL CCA probability for dynamic channel access Note 8, 9	$P_{CCA_DL_1}$		0.75	-	0.75	-
	$P_{CCA_DL_2}$		0.75	-	0.75	-
Duplex mode	Config 1		TDD			
TDD configuration	Config 1		TDDConf.1.1 CCA			

$BW_{channel}$		Config 1	MHz	40: $N_{RB,c}$ = 106			
BWP configuration		Initial DL BWP		DLBWP.0.1			
		Dedicated DL BWP		DLBWP.1.1			
		Initial UL BWP		ULBWP.0.1			
		Dedicated UL BWP		ULBWP.1.1			
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel		Config 1		SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel		Config 1		CR.1.1 CCA		CR.1.1 CCA	
Control Channel RMC		Config 1		CCR.1.1 CCA		CCR.1.1 CCA	
TRS configuration		Config 1		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OP. 1			
SS-RSSI-Measurement				Not Applicable			
Time offset with Cell 1		Config 1	µs	-	3	-	3
DBT Window Configuration		Config 1		DBT.1 (As defined in A.3.28.1)			
SSB configuration		Config 1		SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access			
SMTC configuration		Config 1		SMTC.1			
CSI-RS for tracking		Config 1		TRS.1.2 TDD			
PDSCH/PDCCH subcarrier spacing		Config 1	kHz	30kHz			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config1	NR_CCA_FR1_I	dBm/15kHz	-91		-110	
		NR_CCA_FR1_J				-109.5	
N_{oc} Note2	Config 1	NR_CCA_FR1_I	dBm/SCS	-88		-107	
		NR_CCA_FR1_J				-106.5	
$\hat{E}_s / I_{ot}$			dB	-1.76		-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	3	3	-4	-4
SS-RSRP Note3	Config 1	NR_CCA_FR1_I	dBm/SCS	-85	-85	-111	-111
		NR_CCA_FR1_J				-110.5	-110.5
SS-RSRQ Note3		NR_CCA_FR1_I	dB	-14.77	-14.77	-17.34	-17.34
		NR_CCA_FR1_J					
Io Note3	Config 1	NR_CCA_FR1_I	dBm/ 38.16MHz	-50		-73.4	-73.4
		NR_CCA_FR1_J				-72.9	-72.9
Propagation condition			-	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Note 5:	NR operating band groups are as defined in clause 3.5.2.
Note 6:	For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.
Note 7:	For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
Note 8:	For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
Note 9:	For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.11.6.2.3.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.29.1.1.

A.11.6.2.4 Inter-frequency measurement accuracy

A.11.6.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.30.1.1 and 10.1.30.1.2.

A.11.6.2.4.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.11.6.2.4.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in table A.11.6.2.4.2-2 and A.11.6.2.4.2-3. In all test cases, Cell 1 is the PCell and Cell 2 is target cell with CCA. Two sub-tests (Test 1 and Test 2) are provided different N_{oc} on Cells 1 and 2.

Table A.11.6.2.4.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Config	Description
1	Without CCA: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.6.2.4.2-2: SS-RSRQ Inter frequency test parameters

Parameter		Unit	Test 1	Test 2
			Cell 2	Cell 2
SSB ARFCN			freq2	freq2
DL CCA model	Config 1, 2, 3		As specified in clause A.3.26.2.1	
UL CCA model	Config 1, 2, 3		As specified in clause A.3.26.2.2	
UL CCA probability	P_{CCA_UL}		1.0	
DL CCA probability for semi-static channel access Note 7, 8	P_{CCA_DL}		0.9375	
DL CCA probability for dynamic channel access Note 8, 9	$P_{CCA_DL_1}$		0.75	
	$P_{CCA_DL_2}$		0.75	
Duplex mode	Config 1, 2, 3		TDD	
TDD configuration	Config 1, 2, 3		TDDConf.1.1 CCA	
$BW_{channel}$	Config 1, 2, 3	MHz	40: $N_{RB,c}$ = 106	
Gap pattern ID	Config 1, 2, 3		0	
BWP BW	Config 1, 2, 3		40: NRB,c = 106	
DRX Cycle		ms	Not Applicable	
OCNG Patterns			OCNG pattern 1	

Time offset with Cell 1		Config 1, 2, 3	µs	3	
DBT Window configuration		Config 1, 2, 3		DBT.1	
SSB configuration		Config 1, 2, 3		SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access	
SMTC configuration		Config 1, 2, 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing		Config 1, 2, 3	kHz	30 kHz	
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2		NR_CCA_FR1_I	dBm/15kHz	-86.27	-112
		NR_CCA_FR1_J			-111.5
N_{oc} Note2	Config 1, 2, 3	NR_CCA_FR1_I	dBm/SCS	-83.27	-109
		NR_CCA_FR1_J			-108.5
$\hat{E}_s / I_{ot}$			dB	-1.75	-1.75
$\hat{E}_s / N_{oc}$			dB	-1.75	-1.75
SS-RSRP Note3	Config 1, 2, 3	NR_CCA_FR1_I		-85.02	-110.75
		NR_CCA_FR1_J			-110.25
SS-RSRQ Note3		NR_CCA_FR1_I	dB	-14.77	14.76
		NR_CCA_FR1_J			
Io Note3	Config 1, 2, 3	NR_CCA_FR1_I	dBm/SCS	-50	-75.73
		NR_CCA_FR1_J			-75.23
Propagation condition			-	AWGN	AWGN
Antenna configuration				1x2	1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in clause 3.5.2.
Note 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configuration.
Note 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
Note 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
Note 9: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

Table A.11.6.2.4.2-3: SS-RSRQ Intra frequency test parameters for NR PCell

Parameter	Unit	Test 1	Test 2

				Cell 1	Cell 1
SSB ARFCN				freq1	
Duplex mode		Config 1		FDD	
		Config 2,3		TDD	
TDD configuration		Config 1		Not Applicable	
		Config 2		TDDConf.1.1	
		Config 3		TDDConf.2.1	
$BW_{channel}$		Config 1	MHz	10: $N_{RB,c}$ = 52	
		Config 2		10: $N_{RB,c}$ = 52	
		Config 3		40: $N_{RB,c}$ = 106	
Gap Pattern ID				0	
BWP configuration		Initial DL BWP		DLBWP.0.1	
		Dedicated DL BWP		DLBWP.1.1	
		Initial UL BWP		ULBWP.0.1	
		Dedicated UL BWP		ULBWP.1.1	
DRX Cycle			ms	Not Applicable	
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD	
		Config 2		SR.1.1 TDD	
		Config 3		SR2.1 TDD	
RMSI CORESET Reference Channel		Config 1		CR.1.1 FDD	
		Config 2		CR.1.1 TDD	
		Config 3		CR.2.1 TDD	
Control Channel RMC		Config 1		CCR.1.1 FDD	
		Config 2		CCR.1.1 TDD	
		Config 3		CCR.2.1 TDD	
TRS Configuration		Config 1		TRS.1.1 FDD	
		Config 2		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD	
OCNG Patterns				OP. 1	
SS-RSSI-Measurement				Not Applicable	
SMTC configuration		Config 1		SMTC.2	
		Config 2,3		SMTC.1	
SSB configuration		Config 1,2		SSB.1 FR1	
		Config 3		SSB.2 FR1	
CSI-RS for tracking		Config 1		TRS.1.1 FDD	
		Config 2		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD	
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15 kHz	
		Config 3		30 kHz	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A	dBm/15kHz	-85	-114
		NR_FDD_FR1_B			-113.5
		NR_TDD_FR1_C			-113
		NR_FDD_FR1_D, NR_TDD_FR1_D			-112.5

		NR_FDD_FR1_E			-112
	NR_FDD_FR1_G			-111	
		NR_FDD_FR1_H			-110.5
	Config 3	NR_FDD_FR1_A		-91	-114
		NR_FDD_FR1_B			-113.5
		NR_TDD_FR1_C			-113
		NR_FDD_FR1_D, NR_TDD_FR1_D			-112.5
		NR_FDD_FR1_E			-112
		NR_FDD_FR1_G			-111
		NR_FDD_FR1_H			-110.5
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A	dBm/SCS	-85	-114
		NR_FDD_FR1_B			-113.5
		NR_TDD_FR1_C			-113
		NR_FDD_FR1_D, NR_TDD_FR1_D			-112.5
		NR_FDD_FR1_E			-112
		NR_FDD_FR1_G			-111
		NR_FDD_FR1_H			-110.5
	Config 3	NR_FDD_FR1_A		-88	-111
		NR_FDD_FR1_B			-110.5
		NR_TDD_FR1_C			-110
		NR_FDD_FR1_D, NR_TDD_FR1_D			-109.5
		NR_FDD_FR1_E			-109
		NR_FDD_FR1_G			-108
		NR_FDD_FR1_H			-107.5
$\hat{E}_s/I_{ot}$			dB	-1.76	-5.46
$\hat{E}_s/N_{oc}$			dB	3	-4
SS-RSRP Note 3	Config 1,2	NR_FDD_FR1_A	dBm/SCS	-82	-118
		NR_FDD_FR1_B			-117.5
		NR_TDD_FR1_C			-117
		NR_FDD_FR1_D, NR_TDD_FR1_D			-116.5
		NR_FDD_FR1_E,			-116
		NR_FDD_FR1_G			-115
		NR_FDD_FR1_H			-114.5
	Config 3	NR_FDD_FR1_A		-85	-115
		NR_FDD_FR1_B			-114.5
		NR_TDD_FR1_C			-114
		NR_FDD_FR1_D, NR_TDD_FR1_D			-113.5
		NR_FDD_FR1_E			-113
	NR_FDD_FR1_G			-112	
		NR_FDD_FR1_H			-111.5
SS-RSRQ Note3		NR_FDD_FR1_A	dB	-14.77	-17.34
		NR_FDD_FR1_B			
		NR_TDD_FR1_C			
		NR_FDD_FR1_D, NR_TDD_FR1_D			

		NR_FDD_FR1_E			
		NR_FDD_FR1_G			
		NR_FDD_FR1_H			
Io[Note3]	Config 1,2	NR_FDD_FR1_A	dBm/ 9.36MHz	-50	-83.5
		NR_FDD_FR1_B			-83
		NR_TDD_FR1_C			-82.5
		NR_FDD_FR1_D, NR_TDD_FR1_D			-82
		NR_FDD_FR1_E			-81.5
		NR_FDD_FR1_G			-80.5
		NR_FDD_FR1_H			-80
	Config 3	NR_FDD_FR1_A	dBm/ 38.16MHz	-50	-77.4
		NR_FDD_FR1_B			-76.9
		NR_TDD_FR1_C			-76.4
		NR_FDD_FR1_D, NR_TDD_FR1_D			-75.9
		NR_FDD_FR1_E			-75.4
		NR_FDD_FR1_G		-74.4	
		NR_FDD_FR1_H			-73.9
Propagation condition			-	AWGN	AWGN
Antenna configuration				1x2	1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in clause 3.5.2.

A.11.6.2.4.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.30.1.1 and 10.1.30.1.2.

A.11.6.3 SS-SINR

A.11.6.3.1 Intra-frequency measurement accuracy

A.11.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.31.1.1.

A.11.6.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.11.6.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in table A.11.6.3.1.2-2. In all test cases, Cell 1 is the PCell with CCA and Cell 2 is the target cell with CCA. Two sub-tests (Test 1 and Test 2) are provided different N_{oc} on Cells 1 and 2.

Table A.11.6.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.6.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN				freq1		freq1	
DL CCA model		Config 1		As specified in clause A.3.26.2.1			
UL CCA model		Config 1		As specified in clause A.3.26.2.2			
UL CCA probability		P_{CCA_UL}		1.0	-	1.0	-
DL CCA probability for semi-static channel access Note 7, 8		P_{CCA_DL}		0.9375	-	0.9375	-
DL CCA probability for dynamic channel access Note 8, 9		$P_{CCA_DL_1}$		0.75	-	0.75	-
		$P_{CCA_DL_2}$		0.75	-	0.75	-
Duplex mode		Config 1		TDD			
TDD configuration		Config 1		TDDConf.1.1 CCA			
Downlink initial BWP configuration				DLBWP.0.1			
Downlink dedicated BWP configuration				DLBWP.1.1			
Uplink initial BWP configuration				ULBWP.0.1			
Uplink dedicated BWP configuration				ULBWP.1.1			
DRX Cycle configuration			ms	Not Applicable			
TRS configuration		Config 1		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel		Config 1		SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel		Config 1		CR.1.1 CCA		CR.1.1 CCA	
Dedicated CORESET Reference Channel		Config 1		CCR.1.1 CCA		CCR.1.1 CCA	
OCNG Patterns				OP.1			
SS-RSSI-Measurement				Not Applicable			
DBT Window configuration		Config 1		DBT.1			
Time offset with Cell 1		Config 1	µs	-	3	-	3
SSB configuration		Config 1		SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access			
SMTC configuration		Config 1		SMTC.1			
PDSCH/PDCCH subcarrier spacing		Config 1	kHz	30			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		NR_CCA_FR1_I	dBm/15 kHz	-93		-112	
		NR_CCA_FR1_J				-111.5	
N_{oc} Note2	Config 1	NR_CCA_FR1_I	dBm/SCS	-90		-109	
		NR_CCA_FR1_J				-108.5	
$\hat{E}_s / I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	4.54	2.66	-4	-4
SS-RSRP Note3	Config 1	NR_CCA_FR1_I	dBm/SCS	-85.46	-87.34	-113	-113
		NR_CCA_FR1_J				-112.5	-112.5

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
SS-SINR Note3		NR_CCA_FR1_I	dB	0	-3.19	-5.46	-5.46
		NR_CCA_FR1_J					
Io Note3	Config 1	NR_CCA_FR1_I	dBm/ 38.16 MHz	-51.41		-75.41	
		NR_CCA_FR1_J				-74.91	
Propagation condition			-	AWGN			
Antenna configuration			-	1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configuration.
NOTE 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 9: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.11.6.3.1.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.31.1.1.

A.11.6.3.2 Inter-frequency measurement accuracy

A.11.6.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.32.1.1 and 10.1.32.1.2.

A.11.6.3.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.11.6.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in table A.11.6.3.2.2-2. In all test cases, Cell 1 is the PCell with CCA and Cell 2 is target cell with CCA. Three sub-tests (Test 1, Test 2, and Test 3) are provided different N_{oc} on Cells 1 and 2.

Table A.11.6.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.6.3.2.2-2: SS-SINR Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
DL CCA model	Config 1		As specified in clause A.3.26.2.1					
UL CCA model	Config 1		As specified in clause A.3.26.2.2					
UL CCA probability	P_{CCA_UL}		1.0	-	1.0	-	1.0	-
DL CCA probability for semi-static channel access Note 7, 8	P_{CCA_DL}		0.9375	-	0.9375	-	0.9375	-

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
DL CCA probability for dynamic channel access Note 8, 9	$P_{CCA_DL_1}$			0.75	-	0.75	-	0.75	-
	$P_{CCA_DL_2}$			0.75	-	0.75	-	0.75	-
Duplex mode	Config 1			TDD					
TDD configuration	Config 1			TDDConf.1.1 CCA					
Downlink initial BWP configuration				DLBWP.0.1					
Downlink dedicated BWP configuration				DLBWP.1.1					
Uplink initial BWP configuration				ULBWP.0.1					
Uplink dedicated BWP configuration				ULBWP.1.1					
DRX Cycle configuration			ms	Not Applicable					
Gap pattern ID				0	-	0	-	0	-
TRS configuration	Config 1			TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1			SR.1.1 CCA		SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel	Config 1			CR.1.1 CCA		CR.1.1 CCA		CR.1.1 CCA	
Dedicated CORESET Reference Channel	Config 1			CCR.1.1 CCA		CCR.1.1 CCA		CCR.1.1 CCA	
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 1	Config 1		µs	-	3	-	3	-	3
DBT Window configuration	Config 1			DBT.1					
SSB configuration	Config 1			SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access					
SMTC configuration	Config 1			SMTC.1					
PDSCH/PDCCH subcarrier spacing	Config 1		kHz	30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		NR_CCA_FR1_I	dBm/15 kHz	-88		-108.5		-115.5	
		NR_CCA_FR1_J						-115	
N_{oc} Note2	Config 1	NR_CCA_FR1_I	dBm/SCS	-85		-105.5		-112.5	
		NR_CCA_FR1_J						-112	
$\hat{E}_s / I_{ot}$			dB	-1.75	-1.75	20	20	-4.0	-4.0
$\hat{E}_s / N_{oc}$			dB	-1.75		20		-4.0	
SS-RSRP Note3	Config 1	NR_CCA_FR1_I	dBm/SCS	-86.75		-85.5		-116.5	
		NR_CCA_FR1_J						-116	
SS-SINR Note3		NR_CCA_FR1_I	dB	-1.75		20		-4.0	
		NR_CCA_FR1_J							
Io Note3	Config 1	NR_CCA_FR1_I	dBm/ 38.16 MHz	-51.73		-54.41		-80	
		NR_CCA_FR1_J						-79.5	
Propagation condition			-	AWGN					
Antenna configuration			-	1x2					

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 5: NR operating band groups are as defined in clause 3.5.2.							
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configuration.							
NOTE 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.							
NOTE 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.							
NOTE 9: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.							

A.11.6.3.2.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.32.1.1 and 10.1.32.1.2.

A.11.6.3.3 Intra-frequency measurement accuracy on SCC

A.11.6.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.31.1.1.

A.11.6.3.3.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.11.6.3.3.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in table A.11.6.3.3.2-2. In all test cases, Cell 1 is the PCell with CCA, Cell 2 is the SCell with CCA, and Cell 3 is the target cell with CCA. Two sub-tests (Test 1 and Test 2) are provided different N_{oc} on Cells 1, 2, and 3.

Table A.11.6.3.3.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Config	Description
1	With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.6.3.3.2-2: SS-SINR Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1 / Cell 2	Cell 3	Cell 1 / Cell 2	Cell 3
SSB ARFCN			freq1 for Cell 1 freq2 for Cell 2	freq2	freq1 for Cell 1 freq2 for Cell 2	freq2
DL CCA model	Config 1		As specified in clause A.3.26.2.1			
UL CCA model	Config 1		As specified in clause A.3.26.2.2			
UL CCA probability	P_{CCA_UL}		1.0	-	1.0	-
DL CCA probability for semi-static channel access Note 7, 8	P_{CCA_DL}		0.9375	-	0.9375	-
DL CCA probability for dynamic channel access Note 8, 9	$P_{CCA_DL_1}$		0.75	-	0.75	-
	$P_{CCA_DL_2}$		0.75	-	0.75	-

Parameter			Unit	Test 1		Test 2	
				Cell 1 / Cell 2	Cell 3	Cell 1 / Cell 2	Cell 3
Duplex mode		Config 1		TDD			
TDD configuration		Config 1		TDDConf.1.1 CCA			
Downlink initial BWP configuration				DLBWP.0.1			
Downlink dedicated BWP configuration				DLBWP.1.1			
Uplink initial BWP configuration				ULBWP.0.1			
Uplink dedicated BWP configuration				ULBWP.1.1			
DRX Cycle configuration			ms	Not Applicable			
TRS configuration		Config 1		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel		Config 1		SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel		Config 1		CR.1.1 CCA		CR.1.1 CCA	
Dedicated CORESET Reference Channel		Config 1		CCR.1.1 CCA		CCR.1.1 CCA	
OCNG Patterns				OP.1			
SS-RSSI-Measurement				Not Applicable			
DBT Window configuration		Config 1		DBT.1			
Time offset with Cell 1		Config 1	µs	3 (for Cell 2)	3	3 (for Cell 2)	3
SSB configuration		Config 1		SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access			
SMTC configuration		Config 1		SMTC.1			
PDSCH/PDCCH subcarrier spacing		Config 1	kHz	30			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		NR_CCA_FR1_I	dBm/15 kHz	-93		-112	
		NR_CCA_FR1_J				-111.5	
N_{oc} Note2	Config 1	NR_CCA_FR1_I	dBm/SCS	-90		-109	
		NR_CCA_FR1_J				-108.5	
$\hat{E}_s / I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	4.54	2.66	-4	-4
SS-RSRP Note3	Config 1	NR_CCA_FR1_I	dBm/SCS	-85.46	-87.34	-113	-113
		NR_CCA_FR1_J				-112.5	-112.5
SS-SINR Note3		NR_CCA_FR1_I	dB	0	-3.19	-5.46	-5.46
		NR_CCA_FR1_J					
Io Note3	Config 1	NR_CCA_FR1_I	dBm/ 38.16 MHz	-51.41		-75.41	
		NR_CCA_FR1_J				-74.91	
Propagation condition			-	AWGN			
Antenna configuration			-	1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: NR operating band groups are as defined in clause 3.5.2.

NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configuration.

Parameter	Unit	Test 1		Test 2	
		Cell 1 / Cell 2	Cell 3	Cell 1 / Cell 2	Cell 3
NOTE 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 9: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.					

A.11.6.3.3.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.31.1.1.

A.11.6.3.4 Inter-frequency measurement accuracy

A.11.6.3.4.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.32.1.1 and 10.1.32.1.2.

A.11.6.3.4.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.11.6.3.4.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in table A.11.6.3.4.2-2 and table A.11.6.3.4.2-3. In all test cases, Cell 1 is the PCell and Cell 2 is target cell with CCA. Three sub-tests (Test 1, Test 2, and Test 3) are provided different N_{oc} on Cells 1 and 2.

Table A.11.6.3.4.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Config	Description
1	Without CCA: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.11.6.3.4.2-2: SS-SINR Inter frequency test parameters

Parameter		Unit	Test 1	Test 2	Test 3
			Cell 2	Cell 2	Cell 2
SSB ARFCN			freq2	freq2	freq2
DL CCA model	Config 1, 2, 3		As specified in clause A.3.26.2.1		
UL CCA model	Config 1, 2, 3		As specified in clause A.3.26.2.2		
UL CCA probability	P_{CCA_UL}		1.0		
DL CCA probability for semi-static channel access Note 7, 8	P_{CCA_DL}		0.9375		
DL CCA probability for dynamic channel access Note 8, 9	$P_{CCA_DL_1}$		0.75		
	$P_{CCA_DL_2}$		0.75		
Duplex mode	Config 1, 2, 3		TDD		
TDD configuration	Config 1, 2, 3		TDDConf.1.1 CCA		
Downlink initial BWP configuration			DLBWP.0.1		
Downlink dedicated BWP configuration			DLBWP.1.1		
Uplink initial BWP configuration			ULBWP.0.1		
Uplink dedicated BWP configuration			ULBWP.1.1		
DRX Cycle configuration		ms	Not Applicable		
Gap pattern ID			-		

Parameter			Unit	Test 1	Test 2	Test 3
				Cell 2	Cell 2	Cell 2
OCNG Patterns				OP.1		
SS-RSSI-Measurement				Not Applicable		
Time offset with Cell 1		Config 1, 2, 3	µs	3		
DBT Window configuration		Config 1, 2, 3		DBT.1		
SSB configuration		Config 1, 2, 3		SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access		
SMTC configuration		Config 1, 2, 3		SMTC.1		
PDSCH/PDCCH subcarrier spacing		Config 1, 2, 3	kHz	30		
EPRE ratio of PSS to SSS			dB	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		NR_CCA_FR1_I	dBm/15 kHz	-88	-108.5	-115.5
		NR_CCA_FR1_J				-115
N_{oc} Note2	Config 1	NR_CCA_FR1_I	dBm/SCS	-85	-105.5	-112.5
		NR_CCA_FR1_J				-112
$\hat{E}_s / I_{ot}$			dB	-1.75	20	-4.0
$\hat{E}_s / N_{oc}$			dB	-1.75	20	-4.0
SS-RSRP Note3	Config 1	NR_CCA_FR1_I	dBm/SCS	-86.75	-85.5	-116.5
		NR_CCA_FR1_J				-116
SS-SINR Note3		NR_CCA_FR1_I	dB	-1.75	20	-4.0
		NR_CCA_FR1_J				
Io Note3	Config 1	NR_CCA_FR1_I	dBm/ 38.16 MHz	-51.73	-54.41	-80
		NR_CCA_FR1_J				-79.5
Propagation condition			-	AWGN		
Antenna configuration			-	1x2		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configuration.
NOTE 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 9: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

Table A.11.6.3.4.2-3: SS-SINR Inter frequency test parameters for NR PCell

Parameter		Unit	Test 1	Test 2	Test 3
			Cell 1	Cell 1	Cell 1
SSB ARFCN			freq1	freq1	freq1
Duplex mode	Config 1		FDD		
	Config 2,3		TDD		
TDD configuration	Config 1		Not Applicable		

Parameter			Unit	Test 1	Test 2	Test 3
				Cell 1	Cell 1	Cell 1
		Config 2		TDDConf.1.1		
		Config 3		TDDConf.2.1		
Downlink initial BWP configuration				DLBWP.0.1		
Downlink dedicated BWP configuration				DLBWP.1.1		
Uplink initial BWP configuration				ULBWP.0.1		
Uplink dedicated BWP configuration				ULBWP.1.1		
DRX Cycle configuration			ms	Not Applicable		
Gap pattern ID				0		
TRS configuration		Config 1		TRS.1.1 FDD		
		Config 2		TRS.1.1 TDD		
		Config 3		TRS.1.2 TDD		
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD		
		Config 2		SR.1.1 TDD		
		Config 3		SR2.1 TDD		
RMSI CORESET Reference Channel		Config 1		CR.1.1 FDD		
		Config 2		CR.1.1 TDD		
		Config 3		CR2.1 TDD		
Dedicated CORESET Reference Channel		Config 1		CCR.1.1 FDD		
		Config 2		CCR.1.1 TDD		
		Config 3		CCR2.1 TDD		
OCNG Patterns				OP.1		
SS-RSSI-Measurement				Not Applicable		
SMTC configuration		Config 1		SMTC pattern 2		
		Config 2,3		SMTC pattern 1		
SSB configuration		Config 1,2		SSB.1 FR1		
		Config 3		SSB.2 FR1		
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15		
		Config 3		30		
EPRE ratio of PSS to SSS			dB	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A	dBm/15 kHz	-88	-108.5	-119.5
		NR_FDD_FR1_B				-119
		NR_TDD_FR1_C				-118.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-118
		NR_FDD_FR1_E				-117.5
		NR_FDD_FR1_G				-116.5
		NR_FDD_FR1_H				-116
N_{oc} Note2	Config 1,2		dBm/SCS	-88	-108.5	Same as Noc for 15 kHz
	Config 3	NR_FDD_FR1_A		-85	-105.5	-116.5
		NR_FDD_FR1_B				-116
		NR_TDD_FR1_C				-115.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-115
		NR_FDD_FR1_E				-114.5

Parameter			Unit	Test 1	Test 2	Test 3
				Cell 1	Cell 1	Cell 1
		NR_FDD_FR1_F				-114
		NR_FDD_FR1_G				-113.5
		NR_FDD_FR1_H				-113
$\hat{E}_s / I_{ot}$			dB	-1.75	20	-4.0
$\hat{E}_s / N_{oc}$			dB	-1.75	20	-4.0
SS-RSRP Note3	Config 1,2	NR_FDD_FR1_A	dBm/SCS	-89.75	-88.5	-123.5
		NR_FDD_FR1_B				-123
		NR_TDD_FR1_C				-122.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-122
		NR_FDD_FR1_E				-121.5
		NR_FDD_FR1_G				-120.5
		NR_FDD_FR1_H				-120
	Config 3	NR_FDD_FR1_A		-86.75	-85.5	-120.5
		NR_FDD_FR1_B				-120
		NR_TDD_FR1_C				-119.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-119
		NR_FDD_FR1_E				-118.5
		NR_FDD_FR1_G				-117.5
		NR_FDD_FR1_H				-117
SS-SINR Note3		NR_FDD_FR1_A	dB	-1.75	20	-4.0
		NR_FDD_FR1_B				
		NR_TDD_FR1_C				
		NR_FDD_FR1_D NR_TDD_FR1_D				
		NR_FDD_FR1_E				
		NR_FDD_FR1_G				
		NR_FDD_FR1_H				
Io Note3	Config 1,2	NR_FDD_FR1_A	dBm/ 9.36 MHz	-57.83	-60.5	-90.09
		NR_FDD_FR1_B				-89.59
		NR_TDD_FR1_C				-89.09
		NR_FDD_FR1_D NR_TDD_FR1_D				-88.59
		NR_FDD_FR1_E				-88.09
		NR_FDD_FR1_G				-87.09
		NR_FDD_FR1_H				-86.59
	Config 3	NR_FDD_FR1_A	dBm/ 38.16 MHz	-51.73	-54.41	-84
		NR_FDD_FR1_B				-83.5
		NR_TDD_FR1_C				-83
		NR_FDD_FR1_D NR_TDD_FR1_D				-82.5
		NR_FDD_FR1_E				-82
		NR_FDD_FR1_G				-81
		NR_FDD_FR1_H				-80.5
Propagation condition			-	AWGN		
Antenna configuration			-	1x2		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						

Parameter	Unit	Test 1	Test 2	Test 3
		Cell 1	Cell 1	Cell 1
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 5: NR operating band groups are as defined in clause 3.5.2.				

A.11.6.3.4.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.32.1.1 and 10.1.32.1.2.

A.11.6.4 L1-RSRP measurement for beam reporting with CCA serving cell

A.11.6.4.1 SSB based L1-RSRP measurement

A.11.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.33.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.11.6.4.1.1-1.

Table A.11.6.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.11.6.4.1.2 Test parameters

In this set of test cases there one cell in the test, PCell under CCA (Cell 1). Cell 1 operates on a carrier frequency with CCA and transmits SSBs in DBT window according to DL CCA model.

Two sub-tests (Test 1 and Test 2) are provided with different N_{oc} on Cell 1. The test parameters for the Cell 1 are given in table A.11.6.4.1.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.11.6.4.1.2-1.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.11.6.4.1.2-1: FR1 SSB based L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1		freq1	freq1
DL CCA model	1		As specifieed in A.3.20.2.1	As specifieed in A.3.20.2.1
UL CCA model	1		As specified in A.3.20.2.2	As specified in A.3.20.2.2
Duplex mode	1		TDD	TDD
TDD configuration	1		TDDConf.1.1 CCA	TDDConf.1.1 CCA
$BW_{channel}$	1	MHz	40: $N_{PRB,c}$ = 106	40: $N_{PRB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 CCA	SR.1.1 CCA

Parameter		Config	Unit	Test 1	Test 2
RMSI CORESET Reference Channel		1		CR.1.1 CCA	CR.1.1 CCA
Dedicated CORESET Reference Channel		1		CCR.1.1 CCA	CCR.1.1 CCA
SSB configuration Semi-static channel access		1		SSB.3 CCA	SSB.3 CCA
SSB configuration for Dynamic channel access		1		SSB.4 CCA	SSB.4 CCA
OCNG Patterns		1		OP.1	OP.1
Initial BWP Configuration		1		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
TRS configuration		1		TRS.1.2 TDD	TRS.1.2 TDD
Dedicated BWP configuration		1		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
DBT Window Configuration		1		DBT.1	DBT.1
reportConfigType		1		periodic	periodic
reportQuantity		1		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS		1		2	2
L1-RSRP reporting period		1		slot80	slot80
EPRE ratio of PSS to SSS EPRE ratio of PBCH DMRS to SSS EPRE ratio of PBCH to PBCH DMRS EPRE ratio of PDCCH DMRS to SSS EPRE ratio of PDCCH to PDCCH DMRS EPRE ratio of PDSCH DMRS to SSS EPRE ratio of PDSCH to PDSCH DMRS EPRE ratio of OCNG DMRS to SSS Note 1 EPRE ratio of OCNG to OCNG DMRS Note 1		1	dB	0	0
N_{oc} Note2	NR_TDD_FR1_I	1	dBm/15 kHz	-94.65	-113
N_{oc} Note2	NR_TDD_FR1_I	1	dBm/SCS	-91.65	-110
$\hat{E}_s/I_{ot}$		1	dB	10	-3
SS-RSRP Note3	NR_TDD_FR1_I	1	dBm/SCS	-81.65	-113
Io Note3	NR_TDD_FR1_I	1	dBm/ 38.16 MHz	-50.19	-77.19
$\hat{E}_s/N_{oc}$		1	dB	10	-3
Propagation condition		1		AWGN	AWGN
Antenna configuration		1		1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.11.6.4.1.3 Test Requirements

In both Test 1 and Test 2, the L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 1 shall fulfil the requirements in clauses 10.1.33.1.

A.11.6.5 RSSI

A.11.6.5.1 Intra-frequency RSSI measurement accuracy on PCC with CCA

A.11.6.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the RSSI measurement accuracy is within the specified limits. This test will partially verify the RSSI measurement accuracy requirements in section 10.1.34.1.

A.11.6.5.1.2 Test parameters

In all test cases, Cell 1 is the PCell with CCA. RSSI is measured on channel number 1. Supported test configurations are shown in table A.11.6.5.1.2-1. The accuracy of RSSI intra-frequency measurements is tested by using the parameters in A.11.6.5.1.2-2 and A.11.6.5.1.2-3.

Table A.11.6.5.1.2-1: Intra frequency RSSI supported test configurations

Configuration	Description
1	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, bandwidth 40 MHz

Table A.11.6.5.1.2-2: RSSI Intra frequency test parameters

Parameter		Configurations	Unit	Test 1
				Cell 1
RF Channel Number				1
$BW_{channel}$			MHz	40
SSB configuration	Semi-static channel access Note 1, 3	1		SSB.1 CCA
	Dynamic channel access Note 2, 3	1		SSB.2 CCA
P_{CCA_DL}				0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				As specified in A.3.26.2.1
UL CCA model				As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth
Channel access bandwidth			MHz	20
DRX Cycle configuration			ms	Not Applicable
PDSCH Reference measurement channel				SR.1.1 CCA
RMSI CORESET Reference Channel				CR.1.1 CCA
Dedicated CORESET Reference Channel				CCR.1.1 CCA
OCNG Patterns				OP.1
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-87
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)			dB	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)			dB	-Infinity

Parameter	Configurations	Unit	Test 1
			Cell 1
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-58.96
Propagation condition		-	AWGN
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.			

Table A.11.6.5.1.2-3: RSSI RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.11.6.5.1.3 Test Requirements

The average RSSI measurement accuracy shall fulfil the requirements in sections 10.1.34.1. The nominal RSSI used to evaluate the requirement shall be based on Io in slots corresponding to RSSI measurement time configuration (RMTC).

A.11.6.5.2 Intra-frequency RSSI measurement accuracy on SCC with CCA

A.11.6.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the RSSI measurement accuracy is within the specified limits. This test will partially verify the RSSI measurement accuracy requirements in section 10.1.34.1.

A.11.6.5.2.2 Test parameters

In all test cases, Cell 1 which is PCell operating on a carrier frequency under CCA, and Cell 2 which is SCell operating on a carrier frequency under CCA. RSSI is measured on channel number 2. Supported test configurations are shown in table A.11.6.5.2.2-1. The accuracy of RSSI intra-frequency measurements is tested by using the parameters in A.11.6.5.2.2-2 and A.11.6.5.2.2-3.

Table A.11.6.5.2.2-1: Intra frequency RSSI supported test configurations

Configuration	Description
1	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, bandwidth 40 MHz

Table A.11.6.5.2.2-2: RSSI Intra frequency test parameters

Parameter		Configurations	Unit	Test 1	
				Cell 1	Cell 2
RF Channel Number				1	2
$BW_{channel}$			MHz	40	40
SSB configuration	Semi-static channel access Note 1, 3	1		SSB.1 CCA	SSB.1 CCA

Parameter		Configurations	Unit	Test 1	
				Cell 1	Cell 2
	Dynamic channel access Note 2, 3	1		SSB.2 CCA	SSB.2 CCA
P_{CCA_DL}				1	0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				1	0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				N/A	As specified in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth	
Channel access bandwidth			MHz	20	
DRX Cycle configuration			ms	Not Applicable	
PDSCH Reference measurement channel				SR.1.1 CCA	SR.1.1 CCA
RMSI CORESET Reference Channel				CR.1.1 CCA	CR.1.1 CCA
Dedicated CORESET Reference Channel				CCR.1.1 CCA	CCR.1.1 CCA
OCNG Patterns				OP.1	OP.1
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-87
$\hat{E}_s / I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)			dB	2.5	2.5
$\hat{E}_s / I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)			dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-103.5	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)				-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/measBW	-77.96	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)			dBm/measBW	-77.96	-58.96
Propagation condition			-	AWGN	

Parameter	Configurations	Unit	Test 1	
			Cell 1	Cell 2
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.11.6.5.2.2-3: RSSI RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.11.6.5.2.3 Test Requirements

The average RSSI measurement accuracy shall fulfil the requirements in sections 10.1.34.1. The nominal RSSI used to evaluate the requirement shall be based on Io in slots corresponding to RSSI measurement time configuration (RMTC).

A.11.6.5.3 Inter-frequency RSSI measurement accuracy on a carrier with CCA

A.11.6.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the RSSI measurement accuracy is within the specified limits. This test will partially verify the RSSI measurement accuracy requirements in section 10.1.34.2.

A.11.6.5.3.2 Test parameters

In all test cases, Cell 1 which is PCell operating on a carrier frequency under CCA, and Cell 2 which is neighbor cell operating on a carrier frequency under CCA. RSSI is measured on channel number 2. Supported test configurations are shown in table A.11.6.5.3.2-1. The accuracy of RSSI intra-frequency measurements is tested by using the parameters in A.11.6.5.3.2-2 and A.11.6.5.3.2-3.

Table A.11.6.5.3.2-1: Inter frequency RSSI supported test configurations

Configuration	Description
1	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, bandwidth 40 MHz

Table A.11.6.5.3.2-2: RSSI Inter frequency test parameters

Parameter		Configurations	Unit	Test 1	
				Cell 1	Cell 2
RF Channel Number				1	2
$BW_{channel}$			MHz	40	40
SSB configuration	Semi-static channel access Note 1, 3	1		SSB.1 CCA	SSB.1 CCA
	Dynamic channel access Note 2, 3	1		SSB.2 CCA	SSB.2 CCA
P_{CCA_DL}				1	0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				1	0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				N/A	As specified in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2

Parameter	Configurations	Unit	Test 1	
			Cell 1	Cell 2
Measurement bandwidth		n_{PRB}	Same as channel access bandwidth	
Channel access bandwidth		MHz	20	
DRX Cycle configuration		ms	Not Applicable	
PDSCH Reference measurement channel			SR.1.1 CCA	SR.1.1 CCA
RMSI CORESET Reference Channel			CR.1.1 CCA	CR.1.1 CCA
Dedicated CORESET Reference Channel			CCR.1.1 CCA	CCR.1.1 CCA
OCNG Patterns			OP.1	OP.1
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106	-87
$\hat{E}_s / I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	2.5
$\hat{E}_s / I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-103.5	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-58.96
Propagation condition		-	AWGN	
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.11.6.5.3.2-3: RSSI RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20

ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.11.6.5.3.3 Test Requirements

The average RSSI measurement accuracy shall fulfil the requirements in sections 10.1.34.2. The nominal RSSI used to evaluate the requirement shall be based on Io in slots corresponding to RSSI measurement time configuration (RMTC).

A.11.6.6 Channel occupancy

A.11.6.6.1 Intra-frequency channel occupancy measurement accuracy on PCC with CCA

A.11.6.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the channel occupancy measurement accuracy is within the specified limits. This test will partially verify the channel occupancy measurement accuracy requirements in section 10.1.35.1.

A.11.6.6.1.2 Test parameters

In all test cases, Cell 1 is the PCell with CCA. channel occupancy is measured on channel number 1. Supported test configurations are shown in table A.11.6.6.1.2-1. The accuracy of channel occupancy intra-frequency measurements is tested by using the parameters in A.11.6.6.1.2-2 and A.11.6.6.1.2-3.

Table A.11.6.6.1.2-1: Intra frequency CO supported test configurations

Configuration	Description
1	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, bandwidth 40 MHz

Table A.11.6.6.1.2-2: CO Intra frequency test parameters

Parameter		Configurations	Unit	Test 1
				Cell 1
RF Channel Number				1
$BW_{channel}$			MHz	40
SSB configuration	Semi-static channel access Note 1, 3	1		SSB.1 CCA
	Dynamic channel access Note 2, 3	1		SSB.2 CCA
P_{CCA_DL}				0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				As specified in A.3.26.2.1
UL CCA model				As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth
Channel access bandwidth			MHz	20
DRX Cycle configuration			ms	Not Applicable
PDSCH Reference measurement channel				SR.1.1 CCA
RMSI CORESET Reference Channel				CR.1.1 CCA
Dedicated CORESET Reference Channel				CCR.1.1 CCA
OCNG Patterns				OP.1
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				

Parameter	Configurations	Unit	Test 1
			Cell 1
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-87
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)		dB	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)		dB	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-58.96
Propagation condition		-	AWGN
channelOccupancyThreshold		dBm	-83
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.			

Table A.11.6.6.1.2-3: CO RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.11.6.6.1.3 Test Requirements

The nominal reported *channelOccupancy* shall be 100 %. At least 90 % of channel occupancy reports made by the UE shall indicate this value.

A.11.6.6.2 Intra-frequency channel occupancy measurement accuracy on SCC with CCA

A.11.6.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the channel occupancy measurement accuracy is within the specified limits. This test will partially verify the channel occupancy measurement accuracy requirements in section 10.1.35.1.

A.11.6.6.2.2 Test parameters

In all test cases, Cell 1 which is PCell operating on a carrier frequency under CCA, and Cell 2 which is SCell operating on a carrier frequency under CCA. Channel occupancy is measured on channel number 2. Supported test configurations are shown in table A.11.6.6.2.2-1. The accuracy of channel occupancy intra-frequency measurements is tested by using the parameters in A.11.6.6.2.2-2 and A.11.6.6.2.2-3.

Table A.11.6.6.2.2-1: Intra frequency CO supported test configurations

Configuration	Description
1	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, bandwidth 40 MHz

Table A.11.6.6.2.2-2: CO Intra frequency test parameters

Parameter		Configurations	Unit	Test 1	
				Cell 1	Cell 2
RF Channel Number				1	2
$BW_{channel}$			MHz	40	40
SSB configuration	Semi-static channel access Note 1, 3	1		SSB.1 CCA	SSB.1 CCA
	Dynamic channel access Note 2, 3	1		SSB.2 CCA	SSB.2 CCA
P_{CCA_DL}				1	0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				1	0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				N/A	As specified in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth	
Channel access bandwidth			MHz	20	
DRX Cycle configuration			ms	Not Applicable	
PDSCH Reference measurement channel				SR.1.1 CCA	SR.1.1 CCA
RMSI CORESET Reference Channel				CR.1.1 CCA	CR.1.1 CCA
Dedicated CORESET Reference Channel				CCR.1.1 CCA	CCR.1.1 CCA
OCNG Patterns				OP.1	OP.1
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-87

Parameter	Configurations	Unit	Test 1	
			Cell 1	Cell 2
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-103.5	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-58.96
Propagation condition		-	AWGN	
channelOccupancyThreshold		dBm	-83	
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.11.6.6.2.2-3: CO RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.11.6.6.2.3 Test Requirements

The nominal reported *channelOccupancy* shall be 100 %. At least 90 % of channel occupancy reports made by the UE shall indicate this value.

A.11.6.6.3 Inter-frequency channel occupancy measurement accuracy on a carrier with CCA

A.11.6.6.3.1 Test Purpose and Environment

The purpose of this test is to verify that the channel occupancy measurement accuracy is within the specified limits. This test will partially verify the channel occupancy measurement accuracy requirements in section 10.1.35.2.

A.11.6.6.3.2 Test parameters

In all test cases, Cell 1 which is PCell operating on a carrier frequency under CCA, and Cell 2 which is neighbor cell operating on a carrier frequency under CCA. Channel occupancy is measured on channel number 2. Supported test configurations are shown in table A.11.6.6.3.2-1. The accuracy of channel occupancy intra-frequency measurements is tested by using the parameters in A.11.6.6.3.2-2 and A.11.6.6.3.2-3.

Table A.11.6.6.3.2-1: Inter frequency CO supported test configurations

Configuration	Description

1	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, bandwidth 40 MHz

Table A.11.6.6.3.2-2: CO Inter frequency test parameters

Parameter		Configurations	Unit	Test 1	
				Cell 1	Cell 2
RF Channel Number				1	2
$BW_{channel}$			MHz	40	40
SSB configuration	Semi-static channel access Note 1, 3	1		SSB.1 CCA	SSB.1 CCA
	Dynamic channel access Note 2, 3	1		SSB.2 CCA	SSB.2 CCA
P_{CCA_DL}				1	0.9375 (Note 1, 3) 0.75 / 0.75 (Note 2, 3)
P_{CCA_UL}				1	0.87 (Note 1, 3) 0.75 (Note 2, 3)
DL CCA model				N/A	As specified in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth	
Channel access bandwidth			MHz	20	
DRX Cycle configuration			ms	Not Applicable	
PDSCH Reference measurement channel				SR.1.1 CCA	SR.1.1 CCA
RMSI CORESET Reference Channel				CR.1.1 CCA	CR.1.1 CCA
Dedicated CORESET Reference Channel				CCR.1.1 CCA	CCR.1.1 CCA
OCNG Patterns				OP.1	OP.1
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-87
$\hat{E}_s / I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)			dB	2.5	2.5
$\hat{E}_s / I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)			dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-103.5	-103.5

Parameter	Configurations	Unit	Test 1	
			Cell 1	Cell 2
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-58.96
Propagation condition		-	AWGN	
channelOccupancyThreshold		dBm	-83	
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.11.6.6.3.2-3: CO RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.11.6.6.3.3 Test Requirements

The nominal reported *channelOccupancy* shall be 100 %. At least 90 % of channel occupancy reports made by the UE shall indicate this value.

A.11.6.7 E-UTRAN RSRP

A.11.6.8 E-UTRAN RSRQ

A.11.6.9 E-UTRAN SINR

A.12 E-UTRA Standalone Tests with at Least One NR Cell under CCA

A.12.1 RRC_IDLE state mobility

A.12.1.1 Inter-RAT cell re-selection to NR on a carrier frequency with CCA

A.12.1.1.1 E-UTRA Cell reselection to higher priority NR target Cell in FR1 when target cell is subject to CCA

A.12.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the E-UTRAN to NR inter-RAT cell subject to CCA reselection requirements specified in clause 4.2.2.5.7 in TS 36.133 [15].

The test scenario comprises of 1 E-UTRA cell and 1 NR cell subject to CCA as given in tables A.12.1.1.1.1-1, A.8.2.1.1.1-2, A.8.2.1.1.1-3 and A.8.2.1.1.1-4. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. E-UTRA Cell 1 is already identified by the UE prior to the start of the test. Cell 2 is of higher priority than Cell 1.

Table A.12.1.1.1.1-1: Supported test configurations

Configuration	Description of a cell without CCA	Description of a cell with CCA
1	LTE FDD	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.12.1.1.1.1-2: General test parameters for E-UTRA cell re-selection FR1 NR cell subject to CCA test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 2	The UE camps on Cell 2 in the initial phase
	Neighbour cell		1, 2	Cell 1	
T1 end condition	Active cell			Cell 1	During T1 period the UE reselects to Cell 1
	Neighbour cell			Cell 2	
T3 end condition	Active cell		1, 2	Cell 2	The UE shall perform reselection to Cell 2 during T3
	Neighbour cell		1, 2	Cell 1	
RF Channel Number			1, 2	1, 2	E-UTRAN radio channel (1) and NR radio channel (2) are used for this test
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
DBT Window Configuration			1, 2	DBT.1	As specified in clause A.3.28.1.
DL CCA model			1, 2	As specified in clause A.3.26.2.1	DL CCA model
UL CCA model			1, 2	As specified in clause A.3.26.2.2	UL CCA model
DRX cycle length		s	1, 2	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
T1		s	1, 2	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3		s	1, 2	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.12.1.1.1.1-3: Cell specific test parameters for NR Cell 2 subject to CCA

Parameter	Unit	Test configuration	Cell 2		
			T1	T2	T3
TDD configuration		1, 2	TDDConf.1.1.CCA		
DL CCA probability for semi-static channel access (P_{CCA_DL})		1, 2	0.9		

Parameter	Unit	Test configuration	Cell 2		
			T1	T2	T3
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_1}$)		1, 2	0.75		
DL CCA probability for for dynamic static channel access ($P_{CCA_DL_2}$)		1, 2	0.5		
UL CCA probability P_{CCA_UL}		1, 2	1		
$M_{d,max}$		1, 2	16		
$M_{m,max}$		1, 2	4		
$M_{e,max}$		1, 2	8		
PDSCH Reference measurement channel		1, 2	SR.1.1 CCA		
RMSI CORESET Reference Channel		1, 2	CR.1.1 CCA		
RMC CORESET Reference Channel		1, 2	CCR.1.1 CCA		
NR SMTC parameters		1, 2	SMTC.1		
OCNG Patterns		1, 2	OP.1		
SSB configuration		1, 2	SSB.1 CCA Note4 SSB.2 CCA Note5,6		
Initial DL BWP configuration		1, 2	DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1		
RLM-RS		1, 2	SSB		
Qrxlevmin	dBm/SCS	1, 2	-137		
Pcompensation	dB	1, 2	0		
$Qhyst_s$	dB	1, 2	0		
$Qoffset_{s,n}$	dB	1, 2	0		
Cell_selection_and_ reselection_quality_measurement		1, 2	SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1, 2	-4	-infinity	12
N_{oc} Note2	dBm/SCS	1, 2	-95		
N_{oc} Note2	dBm/15 kHz	1, 2	-98		
$\hat{E}_s / N_{oc}$	dB	1, 2	-4	-infinity	12
SS-RSRP Note3	dBm/SCS	1, 2	-99	-infinity	-83
Io	dBm/38.16 MHz	1, 2	-62.50	-63.95	-51.69
Treselection	s	1, 2	0	0	0
SnonintrasearchP	dB	1, 2	50		
$Thresh_{x,highP}$	dB	1, 2	48		
$Thresh_{serving,lowP}$	dB	1, 2	44		
$Thresh_{x,lowP}$	dB	1, 2	50		
Propagation Condition		1, 2	AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. . For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 6: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

Table A.12.1.1.1.1-4: Cell specific test parameters for E-UTRA Cell 1

Parameter	Unit	Cell 1		
		T1	T2	T3
E-UTRA RF Channel number		1		
$BW_{channel}$	MHz	10		
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6		
PBCH_RA	dB	0		
PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			
PHICH_RA	dB			
PHICH_RB	dB			
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA Note 1	dB			
OCNG_RB Note 1	dB			
Qrxlevmin	dBm	-140		
N_{oc} Note 2	dBm/15 kHz	-98		
RSRP Note 3	dBm/15 KHz	-84	-84	-84
$\hat{E}_s/I_{ot}$	dB	14	14	14
$\hat{E}_s/N_{oc}$	dB	14	14	14
$Treselection_{EUTRAN}$	s	0		
SnonintrasearchP	dB	50		
$Thresh_{x, highP}$	dB	48		
$Thresh_{serving, lowP}$	dB	44		
$Thresh_{x, lowP}$	dB	50		
Propagation Condition		AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.12.1.1.1.2 Test Requirements

The cell reselection delay to a higher priority NR cell subject to CCA is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 60 + 1.28 x (5 + M_e) + T_{SI_CCA} s. M_e is the number of DRX cycles with at least one SMTC where there are no SSBs available during the $T_{evaluate,NR_Intra_CCA}$. If $M_e > M_{e,max}$ the UE is required to restart the evaluation of Cell 2.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate,\ NR_inter_CCA} + T_{SI_CCA,}$ and to a lower priority cell can be expressed as: $T_{evaluate,\ NR} + T_{SI\text{-}NR,}$

Where:

$T_{higher_priority_search}$ See clause 4.2.2 in TS 36.133 [15]

$T_{evaluate,\ NR_\ inter_CCA}$ See Table 4.2.2.5.7-1 in clause 4.2.2.5.7

T_{SI_CCA} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell.

$T_{evaluate, NR}$ See Table 4.2.2.5.6-1 in clause 4.2.2.5.6 in TS 36.133 [15]

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority NR cell and 7.68 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 8 s.

A.12.2 RRC_CONNECTED state mobility

A.12.2.1 Handover

A.12.2.1.1 E-UTRAN - NR with CCA handover

A.12.2.1.1.1 Test Purpose and Environment

This test shall verify the E-UTRAN to NR FR1 handover requirements specified in clause 5.3.4A in TS 36.133 [15].

The test comprises of one E-UTRA carrier and one NR carrier with CCA. There are two cells and one cell on each carrier. Cell 1 is the E-UTRAN cell and Cell 2 is an inter-RAT NR neighbour cell with CCA.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in table 8.1.2.1-1 of TS 36.133 [15] is configured before T2 begins to enable inter-RAT frequency monitoring. A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.12.2.1.1-1. General test parameters are provided in table A.12.2.1.1-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.12.2.1.1-3 and A.12.2.1.1-4 respectively.

Table A.12.2.1.1-1: Supported test configurations for E-UTRAN inter-RAT NR handover

Configuration	Description
1	LTE FDD, NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR with CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.12.2.1.1-2: General test parameters for E-UTRAN inter-RAT NR handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency with CCA is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	E-UTRAN cell
	Neighbouring cell		Cell 2	NR cell with CCA
Final condition	Active cell		Cell 2	
DL CCA model			As specified in clause A.3.26.2.1	
UL CCA model			As specified in clause A.3.26.2.2	
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
b2-Threshold1		dBm	-84	Absolute E-UTRAN RSRP threshold for event B2

Parameter	Unit	Value	Comment
b2-Threshold2NR	dBm	As specified in table A.12.2.1.1-4	Absolute NR SS-RSRP threshold for event B2
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	Non-DRX test
Access Barring Information	-	Not sent	No additional delays in random access procedure
Time offset between cells		3 ms	Asynchronous cells
Gap pattern configuration Id		0	As specified in table 8.1.2.1-1 started before T2 starts [15]
T1	s	5	
T2	s	≤5	
T3	s	1	

Table A.12.2.1.1-3: Cell specific test parameters for E-UTRAN inter-RAT NR handover with CCA (Cell 1)

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
RF channel number		1, 2	2		
Duplex mode		1	FDD		
		2	TDD		
TDD special subframe configuration[Note1]		1, 2	6		
TDD uplink-downlink configuration[Note1]		1, 2	1		
$BW_{channel}$	MHz	1, 2	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PRACH Configuration[Note2]		1	4		
		2	53		
PDSCH parameters: DL Reference Measurement Channel[Note3]		1	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD		
		2	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
		2	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note3]		1	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD		
		2	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		
PBCH_RA	dB	1, 2	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note4]					
OCNG_RB[Note4]					

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
N_{oc} Note5	dBm/15 kHz	1, 2	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2	7	7	7
$\hat{E}_s/I_{ot}$ Note6	dB	1, 2	7	7	7
RSRP Note6	dBm/15 kHz	1, 2	-91	-91	-91
SCH_RP Note6	dBm/15 kHz	1, 2	-91	-91	-91
Io Note6	dBm/9 MHz	1, 2	-62.43	-62.43	-62.43
Propagation Condition		1, 2	AWGN		
Antenna Configuration and Correlation Matrix Note7		1, 2	1x2 Low		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.12.2.1.1-4: Cell specific test parameters E-UTRAN inter-RAT NR with CCA handover (Cell 2)

Parameter		Unit	Configuration	Cell 2		
				T1	T2	T3
RF channel number			1, 2	1		
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 4, 6		1, 2	P_{CCA_DL}=0.9375		
	Dynamic channel access Note 5, 6		1, 2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 4, 6		1, 2	P_{CCA_UL}=0.87		
	Dynamic channel access Note 5, 6		1, 2	P_{CCA_UL}=0.75		
L_{CCA_DL}		-	1, 2	5		
W_{CCA_DL}		ms	1, 2	T304		
L_{CCA_UL}		-	1, 2	5		
W_{CCA_UL}		ms	1, 2	T304		
T304		ms	1, 2	500		
Duplex mode			1, 2	TDD		
TDD Configuration			1, 2	TDDConf.1.1 CCA		
$BW_{channel}$		MHz	1, 2	40: $N_{PRB,c}$ = 106 (TDD)		
PDSCH reference measurement channel			1, 2	SR.1.1 CCA		
CORESET reference channel			1, 2	CR.1.1 CCA		
PRACH configuration			1, 2	FR1 PRACH configuration 1 under CCA		
OCNG pattern Note1			1, 2	OP.1		
BWP	Initial DL BWP		1, 2	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2	SMTC.1		

Parameter		Unit	Configuration	Cell 2		
				T1	T2	T3
SSB configuration	Semi-static channel access Note 4, 6		1, 2	SSB.1 CCA		
	Dynamic channel access Note 5, 6		1, 2	SSB.2 CCA		
DBT window configuration				As defined in A.3.28.1		
b2-Threshold2NR		dBm	1	-105		
			2	-103		
EPRE ratio of PSS to SSS		dB	1, 2	0		
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc} Note2		dBm/15 KHz	1, 2	-98		
N_{oc} Note2		dBm/SCS	1, 2	-95		
$\hat{E}_s/N_{oc}$		dB	1, 2	-inifinit	0	0
$\hat{E}_s/I_{ot}$ Note3		dB	1, 2	-inifinit	0	0
SS-RSRP Note3		dBm/SCS	1, 2	-inifinit	-95	-95
Io Note3		dBm/38.16 MHz	1, 2	-63.96	-60.94	-60.94
Propagation condition			1, 2	AWGN		
Antenna Configuration and Correlation Matrix			1, 2	1x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. . For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 5: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.12.2.1.1.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 112 + (L_1´ + L_3)*20 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in TS36.331.

$T_{interrupt}$ = 62 + (L_1´ + L_3) * T_{SMTC}; $T_{interrupt}$ is defined in TS36.133 clause 5.3.4A.3 where

- L_1´ is the number of SMTC occasions not available at the UE during the inter-RAT detection period.

- L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. $L_3 = 0$ for Type 2C UL channel access procedure as defined in TS 37.213 [33].

  T_{SMTC} = 20 ms is the SMTC periodicity ms in the test.

This gives a total of 112 +(L_1´ + L_3)*20 ms.

A.12.3 Void

A.12.4 Measurement procedure

A.12.4.1 E-UTRAN–NR inter-RAT SFTD measurements

A.12.4.1.1 E-UTRA – NR Inter-RAT SFTD Measurement Delay with NR under CCA in non-DRX

A.12.4.1.1.1 Test Purpose and Environment

The purpose of this test is to partly verify that measurement reporting delay for SFTD between E-UTRA PCell and inter-RAT NR neighbour cell under CCA is within the requirements stated in clauses 8.1.2.4.25 and 8.1.2.4.26 of TS 36.133 [15] for E-UTRA FDD and TDD, respectively, when no measurement gaps are provided and no DRX is configured.

The tests consist of a single time period of duration T1. Two carriers are used in the tests: one E-UTRA carrier with the PCell (Cell 1), and one NR carrier under CCA with the NR neighbour cell (Cell 2).

Prior to the start of time duration T1, the UE is connected to Cell 1 and configured to carry out intra-frequency measurements only. The point in time at which the UE receives, at the UE antenna connector(s), a RRC message containing a measurement configuration for SFTD measurements on RF channel 2 defines the start of time duration T1. Following the start of T1 the UE shall detect Cell 2, determine the SFN and frame time difference of Cell 2 relative to Cell 1, and send a measurement report.

The supported test configurations are listed in table A.12.4.1.1.1-1 below. General test parameters and cell-specific parameters for the NR cell are provided in tables A.12.4.1.1.1-2 and A.12.4.1.1.1-3 below, respectively. Cell-specific parameters for the E-UTRA cell are provided in clause A.3.7.2.1.

Table A.12.4.1.1.1-1: Applicable test configurations for inter-RAT SFTD measurement delay test with NR under CCA

Config	Description
1	LTE FDD; NR: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD; NR: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.12.4.1.1.1-2: General test parameters for inter-RAT SFTD measurement delay test with NR under CCA

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2	1		One E-UTRAN carrier frequencies is used.
NR RF Channel Number		Config 1,2	1		One NR carrier frequencies is used.
Active cell		Config 1,2	Cell 1		Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		Config 1,2	Cell 2		Cell 2 is on NR RF channel number 1.
CP length		Config 1,2	Normal		Applicable to both cells.

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
DRX		Config 1,2	OFF		DRX is not used
Frame time offset between serving and neighbour cells	ms	Config 1	3	7	Asynchronous cells. The timing of Cell 2 relative to the timing of Cell 1.
	µs	Config 2	3		Synchronous cells.
SFN offset between serving and neighbour cells		Config 1,2	0	1	SFN of Cell 2 relative to SFN of Cell 1.
SS-RSRP reporting		Config 1,2	No		Only SFTD is reported.
T1	s	Config 1,2	2		T1 shall exceed $T_{measure_SFTD_LBT_max}$ = 56 × SMTC

Table A.12.4.1.1.1-3: Cell specific test parameters for Cell 2 in inter-RAT SFTD measurement delay test with NR under CCA

Parameter		Unit	Cell 2
NR RF Channel Number			1
Duplex mode			TDD
$BW_{channel}$		MHz	40: $N_{PRB,c}$ = 106
TDD configuration			TDDConf.1.1 CCA
DL CCA model			As specified in clause A.3.26.2.1
DL CCA probability for semi-static channel access[Note5,7]	P_{CCA_DL}		0.9375
DL CCA probability for dynamic channel access[Note6,7]	$P_{CCA_DL_1}$		0.75
	$P_{CCA_DL_2}$		0.75
OCNG Pattern defined in A.3.2.1.1[Note 1]			OP.1
SMTC configuration defined in A.3.2.11.1 and A.3.2.11.2			SMTC.2
SSB configuration for semi-static channel access[Note5,7]			SSB.1 CCA
SSB configuration for dynamic channel access[Note6,7]			SSB.2 CCA
DBT window configuration			DBT.1
PDSCH/PDCCH subcarrier spacing		kHz	30
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS		dB	
EPRE ratio of PBCH to PBCH DMRS		dB	
EPRE ratio of OCNG DMRS to SSS [Note 1]		dB	
EPRE ratio of OCNG to OCNG DMRS [Note 1]		dB	
N_{oc} [Note2]		dBm/15 kHz	-98
N_{oc} [Note2]		dBm/SCS	-95
SS-RSRP [Note 3, 4]		dBm/SCS	-91
$\hat{E}_s/I_{ot}$		dB	4
$\hat{E}_s/N_{oc}$		dB	4
Io [Note 3]		dBm/38.16 MHz	-58.50
Propagation Condition			AWGN

Parameter	Unit	Cell 2
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols in slots with downlink transmission bursts. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.		
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.		
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.		
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.		
NOTE 7: For UE supporting both semi-static and dynamic cannel access, the UE can be tested under dynamic channel access only..		

A.12.4.1.1.2 Test Requirements

Following the start of T1, the UE shall detect Cell 2 and determine the relative time difference between Cell 1 and Cell 2. At latest at $T_{RRC_procedure_delay} + T_{measure_SFTD_LBT_max}$ after the beginning of time duration T1, the UE shall send a measurement report on SFTD between Cell 1 and Cell 2.

The observed rate of successful SFTD reports in repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2\times TTI_{DCCH}$ longer than the measurement reporting delays above due to TTI insertion uncertainty of the measurement report in DCCH.

A.12.4.2 E-UTRAN–NR inter-RAT measurements on NR carrier frequency under CCA

A.12.4.2.1 E-UTRA-NR inter-RAT event triggered reporting tests for FR1 without SSB time index detection when DRX is not used

A.12.4.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21A of TS 36.133 [15] for E-UTRAN FDD-NR measurements under CCA and clause 8.1.2.4.22A of TS 36.133 [15] for E-UTRAN TDD-NR measurements under CCA.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 1 on a carrier frequency with CCA. The test parameters are given in tables A.12.4.2.1.1-1, A.12.4.2.1.1-2, A.12.4.2.1.1-3 and A.12.4.2.1.1-4. Cell transmits SSBs in DBT windows according to DL CCA model.

In this test, measurement gap pattern configuration # 0 as defined in table A.12.4.2.1.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.12.4.2.1.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
2	LTE TDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.12.4.2.1.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		1, 2	1	One E-UTRA carrier frequency is used.
NR RF Chanel Number		1, 2	1	One FR1 NR carrier frequency under CCA is used.
DL CCA model			As specified in clause A.3.26.2.1	
UL CCA model			As specified in clause A.3.26.2.2	
L_{CCA_DL}		1, 2	12	
W_{CCA_DL}	ms	1, 2	$T_{PSS/SSS_sync_irat_cca}$	
Active cell		1, 2	E-UTRA Cell 1 (PCell)	E-UTRA Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2	NR Cell 2	NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39	As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2	Note 1	E-UTRA RSRP/RSRQ/SINR threshold for E-UTRA RSRP measurement on Cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2	Note 2	SS-RSRP/ SS-RSRQ/ SS-SINR threshold measurement on Cell 2 for event B2 [16]
Hysteresis	dB	1, 2	0	
CP length		1, 2	Normal	
TimeToTrigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	DRX is not used
Time offset between serving and neighbour cells		1, 2	3μs	Synchronous cells.
T1	s	1, 2	5	
T2	s	1, 2	$\geq T_{identify_irat_cca_without_index}$	$T_{identify_irat_cca_without_index}$ is defined in clause 8.1.2.4.21A.1 and 8.1.2.4.22A.1 in TS 36.133
NOTE 1: The value of b2-Threshold1 is defined in table A.12.4.2.1.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.12.4.2.1.1-4				

Table A.12.4.2.1.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2	1	
Duplex mode		1	FDD	
		2	TDD	
TDD special subframe configuration[Note1]		2	6	
TDD uplink-downlink configuration[Note1]		2	1	
$BW_{channel}$	MHz	1, 2	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		2	5 MHz: R.4 TDD	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
			10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		2	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		2	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2	-77	
PBCH_RA	dB	1, 2	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2	17	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2	17	17
RSRP[Note5]	dBm/15 kHz	1, 2	-87	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2	-87	-87
Io[Note5]	dBm/9 MHz	1, 2	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition[Note6]		1, 2	AWGN	
Antenna Configuration and Correlation Matrix[Note6]		1, 2	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.12.4.2.1.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2	2	
TDD configuration		1, 2	TDDConf.1.1 CCA	
$BW_{channel}$	MHz	1, 2	40: $N_{PRB,c}$ = 106	
P_{CCA_DL} for dynamic channel access [Note 6,8]		1, 2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	

P_{CCA_DL} for semi-static channel access Note 7,8		1, 2	P_{CCA_DL}=0.9375	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 2	SMTC.1	
DBT window configuration		1, 2	DBT.1	
SSB configuration for semi-static channel access		1, 2	SSB.1 CCA	
SSB configuration for dynamic channel access		1, 2	SSB.2 CCA	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	30	
b2-Threshold2NR	dBm	1, 2	-98	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1, 2	-98	
N_{oc} Note2	dBm/SCS	1, 2	-95	
SS-RSRP Note 3,5	dBm/SCS	1, 2	-Infinity	-88
$\hat{E}_s/I_{ot}$ Note 5	dB	1, 2	-Infinity	7
$\hat{E}_s/N_{oc}$ Note 5	dB	1, 2	-Infinity	7
Io Note3	dBm/38.16 MHz	1, 2	-63.95	-56.16
Propagation Condition		1, 2	AWGN	
Antenna Configuration and Correlation Matrix		1, 2	1x2 Low	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 8: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.12.4.2.1.2 Test Requirements

The UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_without_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is not required to report SSB time index. $T_{identify_irat_cca_without_index}$ is defined in defined in clause 8.1.2.4.21A.1 and 8.1.2.4.22A.1 in TS 36.133.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.12.4.2.2 E-UTRA-NR inter-RAT event triggered reporting tests for FR1 without SSB time index detection when DRX is used

A.12.4.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21A of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22A of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 1 on a carrier frequency with CCA. The test parameters are given in tables A.12.4.2.2.1-1, A.12.4.2.2.1-2, A.12.4.2.2.1-3 and A.12.4.2.2.1-4. Cell transmits SSBs in DBT windows according to DL CCA model.

In this test, measurement gap pattern configuration # 0 as defined in table A.12.4.2.2.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.12.4.2.2.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
2	LTE TDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.12.4.2.2.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2	1		One E-UTRAcarrier frequency is used.
NR RF Chanel Number		1, 2	1		One FR1 NR carrier frequency under CCA is used.
Active cell		1, 2	E-UTRA Cell 1 (PCell)		E-UTRA Cell 1 is on E-UTRA RF channel number 1.
DL CCA model			As specified in clause A.3.26.2.1		
UL CCA model			As specified in clause A.3.26.2.2		
L_{CCA_DL}		1, 2	12	5	
W_{CCA_DL}	ms	1, 2	$T_{PSS/SSS_sync_irat_cca}$		
Neighbour cell		1, 2	NR Cell 2		NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39		As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2	Note 1		E-UTRA RSRP threshold for E-UTRA RSRP measurement on Cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2	Note 2		SS-RSRP threshold for measurement on Cell 2 for event B2 [16]
Hysteresis	dB	1, 2	0		
CP length		1, 2	Normal		
TimeToTrigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
DRX		1, 2	DRX.9	DRX.12	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 2	3μs		Synchronous cells.
T1	s	1, 2	5		
T2	s	1, 2	≥$T_{identify_irat_cca_without_index}$		$T_{identify_irat_cca_without_index}$ is defined in clause 8.1.2.4.21A.1 and 8.1.2.4.22A.1 in TS 36.133
NOTE 1: The value of b2-Threshold1 is defined in table A.12.4.2.1.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.12.4.2.1.1-4					

Table A.12.4.2.2.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2	1	
Duplex mode		1	FDD	
		2	TDD	
TDD special subframe configuration[Note1]		2	6	
TDD uplink-downlink configuration[Note1]		2	1	
$BW_{channel}$	MHz	1, 2	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		2	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		2	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		2	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2	-77	
PBCH_RA	dB	1, 2	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2	17	17

Parameter	Unit	Configuration	Cell 1	
			T1	T2
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2	17	17
RSRP Note5	dBm/15 kHz	1, 2	-87	-87
SCH_RP Note5	dBm/15 kHz	1, 2	-87	-87
Io Note5	dBm/9 MHz	1, 2	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.12.4.2.2.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2	1	
TDD configuration		1, 2	TDDConf.1.1 CCA	
$BW_{channel}$	MHz	1, 2	40: $N_{PRB,c}$ = 106	
P_{CCA_DL} for dynamic channel access Note 6,8		1, 2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 7,8		1, 2	P_{CCA_DL}=0.9375	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 2	SMTC.1	
DBT window configuration		1, 2	DBT.1	
SSB configuration for semi-static channel access		1, 2	SSB.1 CCA	
SSB configuration for dynamic channel access		1, 2	SSB.2 CCA	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	30	
b2-Threshold2NR	dBm	1, 2	-98	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1, 2	-98	
N_{oc} Note2	dBm/SCS	1, 2	-95	
SS-RSRP Note 3,5	dBm/SCS	1, 2	-Infinity	-88
$\hat{E}_s/I_{ot}$ Note 5	dB	1, 2	-Infinity	7
$\hat{E}_s/N_{oc}$ Note 5	dB	1, 2	-Infinity	7

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
Io^{Note3}	dBm/38.16 MHz	1, 2	-63.95	-56.16
Propagation Condition		1, 2	AWGN	
Antenna Configuration and Correlation Matrix		1, 2,	1x2 Low	
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows. NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 8: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

A.12.4.2.2.2 Test Requirements

In test 1, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_without_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_without_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1 and 2, the UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.12.4.2.3 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection when DRX is not used

A.12.4.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21A of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22A of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 1 on a carrier frequency with CCA. The test parameters are given in tables A.12.4.2.3.1-1, A.12.4.2.3.1-2, A.12.4.2.3.1-3 and A.12.4.2.3.1-4. Cell transmits SSBs in DBT windows according to DL CCA model.

In this test, measurement gap pattern configuration # 0 as defined in table A.12.4.2.3.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.12.4.2.3.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR1

Configuration	Description
1	LTE FDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
2	LTE TDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.12.4.2.3.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		1, 2	1	One E-UTRAcarrier frequency is used.
NR RF Chanel Number		1, 2	1	One FR1 NR carrier frequency under CCA is used.
DL CCA model			As specified in clause A.3.26.2.1	
UL CCA model			As specified in clause A.3.26.2.2	
L_{CCA_DL}		1, 2	12	
W_{CCA_DL}	ms	1, 2	$T_{PSS/SSS_sync_irat_cca}$	
Active cell		1, 2	E-UTRA Cell 1 (PCell)	E-UTRA Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2	NR Cell 2	NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39	As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2	Note 1	E-UTRA RSRP/RSRQ/SINR threshold for E-UTRA RSRP measurement on Cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2	Note 2	SS-RSRP/ SS-RSRQ/ SS-SINR threshold measurement on Cell 2 for event B2 [16]
Hysteresis	dB	1, 2	0	
CP length		1, 2	Normal	
TimeToTrigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	DRX is not used
Time offset between serving and neighbour cells		1, 2	3μs	Synchronous cells.
T1	s	1, 2	5	
T2	s	1, 2	≥ $T_{identify_irat_cca_with_index}$	$T_{identify_irat_cca_with_index}$ is defined in clause 8.1.2.4.21A.1 and 8.1.2.4.22A.1 in TS 36.133
NOTE 1: The value of b2-Threshold1 is defined in table A.12.4.2.3.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.12.4.2.3.1-4				

Table A.12.4.2.3.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 with SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2	1	
Duplex mode		1	FDD	
		2	TDD	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
TDD special subframe configuration[Note1]		2	6	
TDD uplink-downlink configuration[Note1]		2	1	
$BW_{channel}$	MHz	1, 2	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		2	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		2	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		2	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2	-77	
PBCH_RA	dB	1, 2	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2	17	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2	17	17
RSRP[Note5]	dBm/15 kHz	1, 2	-87	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2	-87	-87
Io[Note5]	dBm/9 MHz	1, 2	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition [Note6]		1, 2	AWGN	
Antenna Configuration and Correlation Matrix [Note6]		1, 2	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.12.4.2.3.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2	1	
TDD configuration		1, 2	TDDConf.1.1 CCA	
$BW_{channel}$	MHz	1, 2	40: $N_{PRB,c}$ = 106	
P_{CCA_DL} for dynamic channel access Note 6,8		1, 2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 7,8		1, 2	P_{CCA_DL}=0.9375	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 2	SMTC.1	
DBT window configuration		1, 2	DBT.1	
SSB configuration for semi-static channel access		1, 2	SSB.1 CCA	
SSB configuration for dynamic channel access		1, 2	SSB.2 CCA	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	30	
b2-Threshold2NR	dBm	1, 2	-98	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1, 2	-98	
N_{oc} Note2	dBm/SCS	1, 2	-95	
SS-RSRP Note 3,5	dBm/SCS	1, 2	-Infinity	-88
$\hat{E}_s/I_{ot}$ Note 5	dB	1, 2	-Infinity	7
$\hat{E}_s/N_{oc}$ Note 5	dB	1, 2	-Infinity	7
Io Note3	dBm/38.16 MHz	1, 2	-63.95	-56.16
Propagation Condition		1, 2	AWGN	
Antenna Configuration and Correlation Matrix		1, 2,	1x2 Low	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 8: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.12.4.2.3.2 Test Requirements

The UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_with_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.12.4.2.4 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection when DRX is used

A.12.4.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21A of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22A of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 1 on a carrier frequency with CCA. The test parameters are given in tables A.12.4.2.4.1-1, A.12.4.2.4.1-2, A.12.4.2.4.1-3 and A.12.4.2.4.1-4. Cell transmits SSBs in DBT windows according to DL CCA model.

In this test, measurement gap pattern configuration # 0 as defined in table A.12.4.2.4.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.12.4.2.4.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR1

Configuration	Description
1	LTE FDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
2	LTE TDD; NR with CCA: SCS 30 kHz, BW 40 MHz, TDD
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.12.4.2.4.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2	1		One E-UTRAcarrier frequency is used.
NR RF Chanel Number		1, 2	1		One FR1 NR carrier frequency under CCA is used.
DL CCA model			As specified in clause A.3.26.2.1		
UL CCA model			As specified in clause A.3.26.2.2		
L_{CCA_DL}		1, 2	12	5	
W_{CCA_DL}	ms	1, 2	$T_{PSS/SSS_sync_irat_cca}$		
Active cell		1, 2	E-UTRA Cell 1 (PCell)		E-UTRA Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2	NR Cell 2		NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Measurement gap offset		1, 2	39		As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2	Note 1		E-UTRA RSRP/RSRQ/SINR threshold for E-UTRA RSRP measurement on Cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2	Note 2		SS-RSRP/ SS-RSRQ/ SS-SINR threshold measurement on Cell 2 for event B2 [16]
Hysteresis	dB	1, 2	0		
CP length		1, 2	Normal		
TimeToTrigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	DRX.9	DRX.12	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 2	3μs		Synchronous cells.
T1	s	1, 2	5		
T2	s	1, 2	$\geq T_{identify_irat_cca_with_index}$		$T_{identify_irat_cca_with_index}$ is defined in clause 8.1.2.4.21A.1 and 8.1.2.4.22A.1 in TS 36.133
NOTE 1: The value of b2-Threshold1 is defined in table A.12.4.2.4.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.12.4.2.4.1-4					

Table A.12.4.2.4.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 with SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2	1	
Duplex mode		1	FDD	
		2	TDD	
TDD special subframe configuration[Note1]		2	6	
TDD uplink-downlink configuration[Note1]		2	1	
$BW_{channel}$	MHz	1, 2	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		2	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		2	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		2	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2	-77	
PBCH_RA	dB	1, 2	0	
PBCH_RB				
PSS_RA				
SSS_RA				

Parameter	Unit	Configuration	Cell 1	
			T1	T2
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15 kHz	1, 2	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2	17	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2	17	17
RSRP Note5	dBm/15 kHz	1, 2	-87	-87
SCH_RP Note5	dBm/15 kHz	1, 2	-87	-87
Io Note5	dBm/9 MHz	1, 2	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.12.4.2.4.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2	1	
TDD configuration		1, 2	TDDConf.1.1 CCA	
$BW_{channel}$	MHz	1, 2	40: $N_{PRB,c}$ = 106	
P_{CCA_DL} for dynamic channel access Note 6,8		1, 2	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
P_{CCA_DL} for semi-static channel access Note 7,8		1, 2	P_{CCA_DL}=0.9375	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 2	SMTC.1	
DBT window configuration		1, 2	DBT.1	
SSB configuration for semi-static channel access		1, 2	SSB.1 CCA	
SSB configuration for dynamic channel access		1, 2	SSB.2 CCA	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	30	
b2-Threshold2NR	dBm	1, 2	-98	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				

Parameter	Unit	Test configuration	Cell 2	
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1, 2	-98	
N_{oc} Note2	dBm/SCS	1, 2	-95	
SS-RSRP Note 3,5	dBm/SCS	1, 2	-Infinity	-88
$\hat{E}_s/I_{ot}$ Note 5	dB	1, 2	-Infinity	7
$\hat{E}_s/N_{oc}$ Note 5	dB	1, 2	-Infinity	7
Io Note3	dBm/38.16 MHz	1, 2	-63.95	-56.16
Propagation Condition		1, 2	AWGN	
Antenna Configuration and Correlation Matrix		1, 2,	1x2 Low	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 8: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.12.4.2.4.2 Test Requirements

In test 1, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_with_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than $T_{identify_irat_cca_with_index}$ ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1 and 2, the UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.12.4.2.5 Void

A.12.4.2.6 Void

A.12.5 Measurement performance

A.12.5.1 E-UTRAN–NR SFTD

A.12.5.1.1 Inter-RAT SFTD accuracy with NR target cell under CCA

A.12.5.1.1.1 Test Purpose

The purpose of this set of tests is to verify that the SFTD measurement accuracy is within the specified limits. This test will verify the requirements as specified in clause 9.1.28 in TS 36.133 [15] for inter-RAT SFTD measurements between E-UTRA PCell and NR target cell under CCA.

A.12.5.1.1.2 Test Environment

Supported test configurations are shown in table A.12.5.1.1.2-1. In this set of test cases there are two cells on different carriers. Cell 1 is E-UTRAN PCell and Cell 2 is inter-RAT NR target cell under CCA. The test parameters of Cell 1 are given in clause A.12.5.1.1.2-2. The test parameters of Cell 2 are given in table A.12.5.1.1.2-3. The SFTD between PCell and NR target cell shall be set by the test equipment to one of the time differences in table A.12.5.1.1.2-4.

Table A.12.5.1.1.2-1: Supported test configurations for SFTD accuracy with NR target cell under CCA

Config	Description
1	LTE FDD NR with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	LTE TDD NR with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.12.5.1.1.2-2: Test parameters for inter-RAT SFTD accuracy with NR target cell under CCA (Cell 1)

Parameter	Unit	Test 1
E-UTRA RF Channel Number		1
Duplex mode		FDD or TDD
TDD special subframe configuration[Note1]		6
TDD uplink-downlink configuration[Note1]		1
$BW_{channel}$		5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100
PDSCH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD
OCNG Patterns[Note2]		5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD
PBCH_RA	dB	0
PBCH_RB	dB	
PSS_RA	dB	
SSS_RA	dB	
PCFICH_RB	dB	
PHICH_RA	dB	
PHICH_RB	dB	
PDCCH_RA	dB	
PDCCH_RB	dB	
PDSCH_RA	dB	
PDSCH_RB	dB	
OCNG_RA[Note3]	dB	
OCNG_RB[Note3]	dB	

Parameter	Unit	Test 1
N_{oc} Note4	dBm/15 kHz	-104
$\hat{E}_s/N_{oc}$	dB	-3
$\hat{E}_s/I_{ot}$	dB	-3
RSRP Note5	dBm/15 kHz	-107
SCH_RP Note5	dBm/15 kHz	-107
Io Note5	dBm/Ch BW	-74.45 +10log ($N_{PRB,c}$ /50)
Propagation Condition		AWGN
Antenna Configuration		1x2
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23]. NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively. NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 5: Es/Iot, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		

Table A.12.5.1.1.2-3: Test parameters for inter-RAT SFTD accuracy with NR target cell under CCA (Cell 2)

Parameter		Unit	Test 1
Duplex mode			TDD
TDD Configuration			TDDConf.1.1 CCA
$BW_{channel}$		MHz	40: $N_{PRB,c}$ = 106
DL CCA model			As specified in clause A.3.26.2.1
DL CCA probability for semi-static channel access Note6,8	P_{CCA}		0.75
DL CCA probability for dynamic channel access Note7,8	$P_{CCA_DL_1}$		0.75
	$P_{CCA_DL_2}$		0.75
SSB configuration for semi-static channel access Note6,8			SSB.1 CCA
SSB configuration for dynamic channel access Note7,8			SSB.2 CCA
SMTC configuration			SMTC.1
DBT window configuration			DBT.1
OCNG Patterns			OP.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} Note2		dBm/15 kHz	-104
N_{oc} Note2		dBm/SSB SCS	-101
$\hat{E}_s/I_{ot}$		dB	-3
$\hat{E}_s/N_{oc}$		dB	-3
SS-RSRP Note3		dBm/SCS	-104
Io Note3		dBm/38.16 MHz	-68.18
Propagation condition			AWGN
Antenna configuration			1x2
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols in slots with downlink transmission bursts. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.			

Parameter	Unit	Test 1
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.		
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification		
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.		
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.		
NOTE 8: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.		

Table A.12.5.1.1.2-4: Timing offsets for inter-RAT SFTD accuracy test with NR target cell under CCA

Configuration	SFN offset between PCell and NR neighbor cell	Frame boundary offset between PCell and NR neighbour cell (Ts)
1	100	-122000
2	300	-60540
3	500	1000
4	700	62540
5	900	124000

A.12.5.1.1.3 Test Requirements

The SFTD reported by the UE consists of 2 elements, SFN offset and frame boundary offset between PCell and inter-RAT NR target cell. The reported SFTD accuracy shall fulfil the requirement in clause 9.1.27 in TS 36.133 [15].

A.12.5.2 Void

A.12.5.3 Void

A.12.5.4 Void

A.12.5.5 Void

A.12.5.6 Void

A.13 NR Standalone Tests with NR SCell under CCA and All Other NR Cells in FR1

A.13.1 Void

A.13.1.1 Void

A.13.1.2 Void

A.13.2 Signalling characteristics

A.13.2.1 Void

A.13.2.2 SCell activation and deactivation delay

A.13.2.2.1 SCell Activation and Deactivation of known SCell under CCA, 160 ms SCell measurement cycle

A.13.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that SCell activation and deactivation delays for SCell on NR-U SCC with CCA are within the requirements stated in clause 8.3A, when the SCell is known by the UE at the time of activation and the configured SCell measurement cycle is 160 ms.

The supported test configurations are shown in table A.13.2.2.1.1-1.

The test parameters are given in table A.13.2.2.1.1-2 and cell-specific parameters in table A.13.2.2.1.1-3 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two carriers, each with one cell: Cell 1 (PCell) on radio channel 1 (PCC) in NR FR1, and Cell 2 (SCell) on radio channel 2 (SCC) in NR with CCA. Before the test starts the UE is connected to Cell 1, but is not aware of Cell 2, as the UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. At the end of T1, the test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted *m*, defines the start of time period T2. The UE shall be able to report a valid CSI in PCell for the activated SCell at latest in slot $m + \frac{T_{\text{HARQ}}+T_{\text{activation_time_withCCA}}+T_{\text{CSI_Reporting_withCCA}}}{\text{NR slot length}}$, as defined in clause 8.3A.2. The UE shall start reporting CSI in PCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $m+ \frac{T_{\text{HARQ}}+3\ ms}{\text{NR slot length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption shall fall within the time window specified in clause 8.3A.2. At the end of T2 the test equipment sends a MAC message for deactivation of the SCell.

The point in time at which the MAC message is received by at the UE antenna connector, in a slot # denoted *n*, defines the start of time period T3. The UE shall complete the activation at latest in slot $n + \frac{T_{\text{HARQ}}+3\ ms}{\text{NR slot length}}$. Any PCell interruption shall fall within the time window specified in clause 8.3A.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received, while taking into account CCA failures on SCC.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.13.2.2.1.1-1: Supported test configurations for SCell Activation and Deactivation of known SCell under CCA, 160 ms SCell measurement cycle

Configuration	Description
1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode; With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.13.2.2.1.1-2: General test parameters for known SCell activation with SCell under CCA, 160 ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two radio channels (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every fourth slot
SCell measurement cycle (measCycleSCell)	ms	160	
Cell 2 timing offset to Cell 1	µs	0	
Time alignment error between Cell 2 and Cell 1	µs	≤ TAE as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI_Reporting}$	ms	$10 + 5 \cdot 2^{\mu_{DL}}$	the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting (clause 5.2.2.5 in TS 38.214) and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2] μ_{DL} is the subcarrier spacing configuration for DL

Table A.13.2.2.1.1-3: Cell specific test parameters for known FR1 SCell activation case with SCell under CCA, 160 ms SCell measurement cycle

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Duplex mode	Config 1		FDD			TDD		
	Config 2,3		TDD					
TDD configuration	Config 1		---			TDDConf.1.1 CCA		
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			40: $N_{PRB,c}$ = 106		
	Config 3		40: $N_{PRB,c}$ = 106					
DL CCA model			---			As specified in clause A.3.26.2.1		
DL CCA probability for semi-static channel access[Note5,7]	P_{CCA_DL}		---			0.9357		
DL CCA probability for dynamic channel access[Note6,7]	$P_{CCA_DL_1}$		---			0.75		
	$P_{CCA_DL_2}$		---			0.75		
P_{CCA_UL}						1		
L_{CCA_DL} [Note 8]						2		
W_{CCA_DL} [Note 8]		ms				$T_{activation_time_withCCA}$		
Initial downlink BWP configuration			DLBWP.0.2			DLBWP.0.2		
Initial uplink BWP configuration			ULBWP.0.1			ULBWP.0.1		
Dedicated downlink BWP configuration			DLBWP.0.2			DLBWP.0.2		
Dedicated uplink BWP configuration			ULBWP.0.1			ULBWP.0.1		
TCI state			TCI.State.0			TCI.State.0		
TRS Configuration	Config 1		TRS.1.1 FDD			TRS.1.2 TDD		
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			SR.1.1 CCA		
	Config 2		SR.1.1 TDD					
	Config 3		SR.2.1 TDD					
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD			CCR.1.3 CCA		
	Config 2		CCR.1.1 TDD					
	Config 3		CCR.2.1 TDD					
RMSI CORESET parameters	Config 1		CR.1.1 FDD			CR.1.1 CCA		
	Config 2		CR.1.1 TDD					
	Config 3		CR.2.1 TDD					
OCNG Patterns [Note1]			OP.1			OP.1		
SSB Configuration for semi-static channel access[Note5,7]	Config 1,2		SSB.1 FR1			SSB.1 CCA		
	Config 3		SSB.2 FR1					
SSB Configuration for dynamic channel access[Note6,7]	Config 1,2		SSB.1 FR1			SSB.2 CCA		
	Config 3		SSB.2 FR1					
SMTC configuration			SMTC.1			SMTC.1		
DBT window configuration			---			DBT.1		
EPRE ratio of PSS to SSS		dB	0			0		
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS[Note1]								
EPRE ratio of OCNG to OCNG DMRS[Note1]								
N_{oc} [Note2]	Config 1,2	dBm/15 kHz	-104			-104		
	Config 3							
N_{oc} [Note2]	Config 1,2	dBm/SCS	-104			-101		
	Config 3		-101					
$\hat{E}_s/I_{ot}$		dB	17			17		
$\hat{E}_s/N_{oc}$		dB	17			17		
SS-RSRP [Note3]	Config 1,2	dBm/SCS	-87			-84		
	Config 3		-84			-84		

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Io^{Note3}	Config 1,2		-58.96			-52.87		
	Config 3		-52.87			-52.87		
Propagation condition		-	AWGN					

NOTE 1: OCNG shall be used such that resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For Cell 2 with CCA model, OCNG is transmitted only in slots with downlink transmission bursts and is not transmitted during muted slots or during DBT windows.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.
NOTE 8: As specified in clause 8.3A for $L_{1,max}$, $L_{2,1,max}$, $L_{2,2,max}$, $L_{3,1,max}$, and $L_{3,2,max}$

A.13.2.2.1.2 Test Requirements

During T2, the UE shall send the first CSI report for SCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $m+1+\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$.

During T2, conditioned on that downlink CCA failures L_1 and $L_{2,2}$ experienced in the SCell fulfill $L_1 \leq L_{1,max}$ and $L_{2,2} \leq L_{2,2,max}$ with $L_{1,max} = 2$ and $L_{2,2,max} = 2$, respectively, the UE shall send the first valid CSI report (non-zero CQI) for the SCell no later than slot m + (T_{HARQ}+$T_{activation_time_withCCA}$ + $T_{CSI_Reporting_withCCA}$)/NR_slot_length, where $T_{activation_time_withCCA}$ = $T_{FirstSSB}$ + L_1*T_{rs} + 5 ms and $T_{CSI_reporting_withCCA}$ = $T_{CSI_reporting}$ + $L_{2,2}$*$T_{CSI\text{-}RS}$ + $T_{CSI_ReportingDelay}$, as specified in clause 8.3A.2.

During T3, the UE shall stop sending CSI reports for SCell at latest in slot $n + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3A.3.

During T2, interruption on PCell shall not occur outside slot m +1+$\frac{T_{HARQ}}{NR\ slot\ length}$ to slot m +1+$\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$ with T_X = $T_{FirstSSB}$.

During T3, interruption on PCell shall not occur outside slot n +1+T_{HARQ}/NR_slot_length to slot n+1+(T_{HARQ} +3 ms)/NR_slot_length.

The interruption on PCell shall not be more than specified for SA in clause 8.2.2.2.2.

The rate of correctly observed SCell activation delays and SCell deactivation delays shall for repeated tests be at least 90 %.

A.13.2.2.2 SCell Activation and Deactivation of known SCell under CCA, 640 ms SCell measurement cycle

A.13.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that SCell activation and deactivation delays for SCell on NR-U SCC with CCA are within the requirements stated in clause 8.3A, when the SCell is known by the UE at the time of activation and the configured SCell measurement cycle is 640 ms.

The supported test configurations are same as in table A.13.2.2.1.1-1 above.

The test parameters are same as in table A.13.2.2.1.1-2 above, except for parameters listed below in table A.13.2.2.2.1-1. The cell-specific parameters are same as in table A.13.2.2.1.1-3 above.

The test execution is the same as described in clause A.13.2.2.1 above, except that downlink CCA failures $L_{2,1}$ and $L_{2,2}$ with limits $L_{2,1} \leq L_{2,1,max}$ and $L_{2,2} \leq L_{2,2,max}$ replace L_1 as described in clause 8.3A.2 for activation of known SCell with a measurement cycle larger than 160 ms.

Table A.13.2.2.2.1-1: General test parameters for known SCell activation with SCell under CCA, 640 ms SCell measurement cycle

Parameter	Unit	Value	Comment
SCell measurement cycle (measCycleSCell)	ms	640	

A.13.2.2.2.2 Test Requirements

During T2, the UE shall send the first CSI report for SCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $m+1+\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$.

During T2, conditioned on that downlink CCA failures $L_{2,1}$ and $L_{2,2}$ experienced in the SCell fulfill $L_{2,1} \leq L_{2,1,max}$ and $L_{2,2} \leq L_{2,2,max}$ with $L_{2,1,max} = 2$ and $L_{2,2,max} = 2$, respectively, the UE shall send the first valid CSI report (non-zero CQI) for the SCell no later than slot m + (T_{HARQ}+$T_{activation_time_withCCA}$ + $T_{CSI_Reporting_withCCA}$)/NR_slot_length, where $T_{activation_time_withCCA} = T_{FirstSSB_MAX} + L_{2,1}*T_{SMTC_MAX} + (1 + L_{2,2})*T_{rs}$ + 5 ms and $T_{CSI_reporting_withCCA} = T_{CSI_reporting}$ + $T_{CSI_ReportingDelay}$, as specified in clause 8.3A.2.

During T3, the UE shall stop sending CSI reports for SCell at latest in slot $n + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3A.3.

During T2, interruption on PCell shall not occur outside slot $m+1+\frac{T_{HARQ}}{NR\ slot\ length}$ to slot $m+1+\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$ with $T_X = T_{FirstSSB}$.

During T3, interruption on PCell shall not occur outside slot n +1+T_{HARQ}/NR_slot_length to slot n+1+(T_{HARQ} +3 ms)/NR_slot_length.

The interruption on PCell shall not be more than specified for SA in clause 8.2.2.2.2.

The rate of correctly observed SCell activation delays and SCell deactivation delays shall for repeated tests be at least 90 %.

A.13.2.2.3 SCell Activation and Deactivation of unknown SCell under CCA

A.13.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that SCell activation and deactivation delays for SCell on NR-U SCC with CCA are within the requirements stated in clause 8.3A, when the SCell is unknown to the UE at the time of activation.

The supported test configurations are same as in table A.13.2.2.1.1-1 above.

The test parameters are same as in table A.13.2.2.1.1-2 above, except for parameters listed below in table A.13.2.2.3.1-1. The cell-specific parameters are same as in table A.13.2.2.1.1-3 above.

The test execution is the same as described in clause A.13.2.2.1 above, except that downlink CCA failures $L_{3,1}$ and $L_{3,2}$ with limits $L_{3,1} \leq L_{3,1,max}$ and $L_{3,2} \leq L_{3,2,max}$ replace L_1 as described in clause 8.3A.2 for activation of unknown SCell.

Table A.13.2.2.3.1-1: General test parameters for unknown SCell activation with SCell under CCA

Parameter	Unit	Value	Comment
T1	s	0.1	During this time period the PCell shall be known and the SCell configured, but not detected.

A.13.2.2.3.2 Test Requirements

During T2, the UE shall send the first CSI report for SCell after at least one CSI-RS transmission occasion for channel measurement and reporting after slot $m+1+\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$.

During T2, conditioned on that downlink CCA failures $L_{3,1}$ and $L_{3,2}$ experienced in the SCell fulfill $L_{3,1} \leq L_{3,1,max}$ and $L_{3,2} \leq L_{3,2,max}$ with $L_{3,1,max} = 2$ and $L_{3,2,max} = 2$, respectively, the UE shall send the first valid CSI report (non-zero CQI) for the SCell no later than slot m + (T_{HARQ}+$T_{activation_time_withCCA}$ + $T_{CSI_Reporting_withCCA}$)/NR_slot_length, where $T_{activation_time_withCCA} = T_{FirstSSB_MAX} + (1 + L_{3,1})*T_{SMTC_MAX} + (2 + L_{3,2})*T_{rs}$ + 5 ms and $T_{CSI_reporting_withCCA} = T_{CSI_reporting} + T_{CSI_ReportingDelay}$, as specified in clause 8.3A.2.

During T3, the UE shall stop sending CSI reports for SCell at latest in slot $n + \frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3A.3.

During T2, interruption on PCell shall not occur outside slot m +1+$\frac{T_{HARQ}}{NR\ slot\ length}$ to slot m +1+$\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$ with $T_X = T_{FirstSSB}$.

During T3, interruption on PCell shall not occur outside slot n +1+T_{HARQ}/NR_slot_length to slot n+1+(T_{HARQ} +3 ms)/NR_slot_length.

The interruption on PCell shall not be more than specified for SA in clause 8.2.2.2.2.

The rate of correctly observed SCell activation delays and SCell deactivation delays shall for repeated tests be at least 90 %.

A.13.2.3 Void

A.13.3 Measurement procedure

A.13.3.1 Intra-frequency measurements

A.13.3.1.1 Event-triggered reporting tests on SCC without gaps under non-DRX

A.13.3.1.1.1 Test purpose and environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2A.5.1 and 9.2A.5.2.

A.13.3.1.1.2 Test parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1), and two cells on the same carrier frequency with CCA and transmit SSBs in DBT windows according to DL CCA model: SCell (Cell 2) and a neighbour cell (Cell 3). The test parameters for the three cells are given in table A.13.3.1.1.2-1 and A.13.3.1.1.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the SCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

Table A.13.3.1.1.2-1: Supported test configurations

Configuration	Description
1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.13.3.1.1.2-2: General test parameters for intra-frequency event triggered reporting without gaps

Paramater	Unit	Test Configuration	Value	Comment
Active PCell		1, 2, 3	Cell 1	
Active SCell		1, 2, 3	Cell 2	
Neighbour cell		1, 2, 3	Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 2: Cell 2 and Cell 3	
DL CCA model			As specified in clause A.3.26.2.1	
UL CCA model			As specified in clause A.3.26.2.2	
DBT window configuration		1, 2, 3	Cell 1: N/A Cell 2,3: DBT.1	
A3-Offset	dB	1, 2, 3	-4.5	
Event A3 measurement quantity			SS-RSRP	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3		OFF
Time offset between Cell 1 and Cell 2		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
deriveSSB-IndexFromCell		1	*False*	
		2	*True*	
		3	*True*	
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	

Table A.13.3.1.1.2-3: Cell-specific test parameters for intra-frequency event-triggered reporting without gaps

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2		2	
Duplex mode			Config 1	FDD		TDD		TDD	
			Config 2,3	TDD		TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 2	TDDConf.1.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 3	TDDConf.2.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2,3	Not Applicable		12		12	
W_{CCA_DL}		ms	Config 1,2,3	Not Applicable		$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		DLBWP.0.1			
	Initial UL BWP			ULBWP.0.1		ULBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1		DLBWP.1.1			
	Dedicated UL BWP			ULBWP.1.1		ULBWP.1.1			
TRS configuration			Config 1	TRS.1.1 FDD		TRS.1.2 TDD			
			Config 2	TRS.1.1 TDD		TRS.1.2 TDD			
			Config 3	TRS.1.2 TDD		TRS.1.2 TDD			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		SR.1.1 CCA			
			Config 2	SR.1.1 TDD		SR.1.1 CCA			
			Config 3	SR2.1 TDD		SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 FDD		CR.1.1 CCA			
			Config 2	CR.1.1 TDD		CR.1.1 CCA			
			Config 3	CR2.1 TDD		CR.1.1 CCA			
SSB parameters	Semi-static channel Note 5,7		Config 1	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 2	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 3	SSB.2 FR1		SSB.1 CCA		SSB.1 CCA	
	Dynamic channel Access Note 6,7		Config 1	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 2	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 3	SSB.2 FR1		SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2,3	Not Applicable		As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.1		SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	15		30		30	
			Config 2	15		30		30	
			Config 3	30		30		30	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		dBm/15 kHz	Config 1,2,3	-98		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-95		-95	
			Config 3	-95		-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-91	-91	-Infinity	-88
			Config 3	-91	-91	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3	4	4	4	-3.79	-Infinity	1.54

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	4	4	-Infinity	7
Io[Note3]	dBm/ChBW	Config 1,2	-64.59	-64.59	-58.49	-54.64	-58.49	-54.64
	dBm/ChBW	Config 3	-58.49	-58.49	-58.49	-54.64	-58.49	-54.64
Propagation Condition		Config 1,2,3	AWGN		AWGN		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.								
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.								
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.								
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.								

A.13.3.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_intra_without_index_CCA}$ ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

$T_{identify_intra_cca_without_index} = (T_{PSS/SSS_sync_intra_cca} + T_{SSB_measurement_period_intra_cca})$ ms, where

$T_{PSS/SSS_sync_intra_cca}$: it is the time period used in PSS/SSS detection given in table 9.2A.5.1-1.

$T_{SSB_measurement_period_intra_cca}$: equal to a measurement period of SSB based measurement given in table 9.2A.5.2-1.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.13.3.1.2 Event-triggered reporting tests on SCC without gaps under DRX

A.13.3.1.2.1 Test purpose and environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2A.5.1 and 9.2A.5.2.

A.13.3.1.2.2 Test parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1), and two cells on the same carrier frequency with CCA and transmit SSBs in DBT windows according to DL CCA model: SCell (Cell 2) and a neighbour cell (Cell 3). The test parameters for the three cells are given in table A.13.3.1.2.2-1 and A.13.3.1.2.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the SCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.13.3.1.2.2-1: Supported test configurations

Configuration	Description

1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.13.3.1.2.2-2: General test parameters for intra-frequency event triggered reporting without gaps with DRX

Parameter	Unit	Test Configuration	Value		Comment
			Test 1	Test 2	
Active PCell		1, 2, 3	Cell 1		
Active SCell		1, 2, 3	Cell 2		
Neighbour cell		1, 2, 3	Cell 3		Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 2: Cell 2 and Cell 3		
DL CCA model			As specified in clause A.3.26.2.1		
UL CCA model			As specified in clause A.3.26.2.2		
DBT window configuration		1, 2, 3	Cell 1: N/A Cell 2,3: DBT.1		
A3-Offset	dB	1, 2, 3	-4.5		
Event A3 measurement quantity			SS-RSRP		
CP length		1, 2, 3	Normal		
Hysteresis	dB	1, 2, 3	0		
Time To Trigger	s	1, 2, 3	0		
Filter coefficient		1, 2, 3	0		L3 filtering is not used
DRX		1, 2, 3	DRX.1	DRX.2	
Time offset between Cell 1 and Cell 2		1	3 ms		Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3 μs		Synchronous cells
		3	3 μs		Synchronous cells
deriveSSB-IndexFromCell		1	*False*		
		2	*True*		
		3	*True*		
T1	s	1, 2, 3	5		
T2	s	1, 2, 3	5	20	

Table A.13.3.1.2.2-3: Cell-specific test parameters for intra-frequency event-triggered reporting without gaps

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2		2	
Duplex mode			Config 1	FDD		TDD		TDD	
			Config 2,3	TDD		TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 2	TDDConf.1.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 3	TDDConf.2.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2,3	Not Applicable		12		12	
W_{CCA_DL}		ms	Config 1,2,3	Not Applicable		$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		DLBWP.0.1			
	Initial UL BWP			ULBWP.0.1		ULBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1		DLBWP.1.1			
	Dedicated UL BWP			ULBWP.1.1		ULBWP.1.1			
TRS configuration			Config 1	TRS.1.1 FDD		TRS.1.2 TDD			
			Config 2	TRS.1.1 TDD		TRS.1.2 TDD			
			Config 3	TRS.1.2 TDD		TRS.1.2 TDD			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		SR.1.1 CCA			
			Config 2	SR.1.1 TDD		SR.1.1 CCA			
			Config 3	SR2.1 TDD		SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 FDD		CR.1.1 CCA			
			Config 2	CR.1.1 TDD		CR.1.1 CCA			
			Config 3	CR2.1 TDD		CR.1.1 CCA			
SSB parameters	Semi-static channel Note 5,7		Config 1	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 2	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 3	SSB.2 FR1		SSB.1 CCA		SSB.1 CCA	
	Dynamic channel Access Note 6,7		Config 1	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 2	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 3	SSB.2 FR1		SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2,3	Not Applicable		As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.1		SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	15		30		30	
			Config 2	15		30		30	
			Config 3	30		30		30	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz	Config 1,2,3	-98		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-95		-95	
		Config 3	-95		-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-91	-91	-Infinity	-88
		Config 3	-91	-91	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	4	4	4	-3.79	-Infinity	1.54
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	4	4	-Infinity	7
Io Note3	dBm/ChBW	Config 1,2	-64.59	-64.59	-58.49	-54.64	-58.49	-54.64
	dBm/ChBW	Config 3	-58.49	-58.49	-58.49	-54.64	-58.49	-54.64
Propagation Condition		Config 1,2,3	AWGN		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

A.13.3.1.2.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_intra_without_index_CCA}$ ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

$T_{identify_intra_cca_without_index} = (T_{PSS/SSS_sync_intra_cca} + T_{SSB_measurement_period_intra_cca})$ ms, where

$T_{PSS/SSS_sync_intra_cca}$: it is the time period used in PSS/SSS detection given in table 9.2A.5.1-1.

$T_{SSB_measurement_period_intra_cca}$: equal to a measurement period of SSB based measurement given in table 9.2A.5.2-1.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.13.3.1.3 Event-triggered reporting tests on SCC with per-UE gaps under non-DRX

A.13.3.1.3.1 Test purpose and environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2A.6.1 and 9.2A.6.2.

A.13.3.1.3.2 Test parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1), and two cells on the same carrier frequency with CCA and transmit SSBs in DBT windows according to DL CCA model: SCell (Cell 2) and a neighbour cell (Cell 3). The test parameters for the three cells are given in table A.13.3.1.3.2-1 and A.13.3.1.3.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the SCell, and it is indicated to the UE that

event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There are two BWPs configured in Cell 1, BWP0 which contains the cell defining SSB, and BWP1 which does not contain any SSB of Cell 1. During the whole test, BWP1 is always scheduled as the active BWP for the UE.

Table A.13.3.1.3.2-1: Supported test configurations

Configuration	Description
1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.13.3.1.3.2-2: General test parameters for intra-frequency event triggered reporting with per-UE gaps

Paramater	Unit	Test Configuration	Value	Comment
Active PCell		1, 2, 3	Cell 1	
Active SCell		1, 2, 3	Cell 2	
Neighbour cell		1, 2, 3	Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 2: Cell 2 and Cell 3	
Measurement gap type		1, 2, 3	Per-UE gaps	
Measurement gap repitition periodicity	ms	1, 2, 3	40	
Measurement gap length	ms	1, 2, 3	6	
Measurement gap offset	ms	1, 2, 3	39	
DL CCA model			As specified in clause A.3.26.2.1	
UL CCA model			As specified in clause A.3.26.2.2	
DBT window configuration		1, 2, 3	Cell 1: N/A Cell 2,3: DBT.1	
CSI-RS parameters in Cell 1		1	CSI-RS.1.2 FDD resource #0	
		2	CSI-RS.1.2 TDD resource #0	
		3	CSI-RS.2.2 TDD resource #0	
A3-Offset	dB	1, 2, 3	-4.5	
Event A3 measurement quantity			SS-RSRP	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3		OFF
Time offset between Cell 1 and Cell 2		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
deriveSSB-IndexFromCell		1	*False*	
		2	*True*	
		3	*True*	
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	

Table A.13.3.1.3.2-3: Cell-specific test parameters for intra-frequency event-triggered reporting without gap

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2		2	
Duplex mode			Config 1	FDD		TDD		TDD	
			Config 2,3	TDD		TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 2	TDDConf.1.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 3	TDDConf.2.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2,3	Not Applicable		12		12	
W_{CCA_DL}		ms	Config 1,2,3	Not Applicable		$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		DLBWP.0.1			
	Initial UL BWP			ULBWP.0.1		ULBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1		DLBWP.1.1			
	Dedicated UL BWP			ULBWP.1.1		ULBWP.1.1			
TRS configuration			Config 1	TRS.1.1 FDD		TRS.1.2 TDD			
			Config 2	TRS.1.1 TDD		TRS.1.2 TDD			
			Config 3	TRS.1.2 TDD		TRS.1.2 TDD			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		SR.1.1 CCA			
			Config 2	SR.1.1 TDD		SR.1.1 CCA			
			Config 3	SR2.1 TDD		SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 FDD		CR.1.1 CCA			
			Config 2	CR.1.1 TDD		CR.1.1 CCA			
			Config 3	CR2.1 TDD		CR.1.1 CCA			
SSB parameters	Semi-static channel Note 5,7		Config 1	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 2	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 3	SSB.2 FR1		SSB.1 CCA		SSB.1 CCA	
	Dynamic channel Access Note 6,7		Config 1	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 2	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 3	SSB.2 FR1		SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2,3	Not Applicable		As defined in A.3.28.1		As defined in A.3.28.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
SMTC configuration defined in A.3.11		Config 1,2,3	SMTC.1		SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1	15		30		30	
		Config 2	15		30		30	
		Config 3	30		30		30	
EPRE ratio of PSS to SSS		Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz	Config 1,2,3	-98		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-95		-95	
		Config 3	-95		-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-91	-91	-Infinity	-88
		Config 3	-91	-91	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	4	4	4	-3.79	-Infinity	1.54
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	4	4	-Infinity	7
Io Note3	dBm/ChBW	Config 1,2	-64.59	-64.59	-58.49	-54.64	-58.49	-54.64
	dBm/ChBW	Config 3	-58.49	-58.49	-58.49	-54.64	-58.49	-54.64
Propagation Condition		Config 1,2,3	AWGN		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

A.13.3.1.3.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_intra_without_index_CCA}$ ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

$T_{identify_intra_cca_without_index} = (T_{PSS/SSS_sync_intra_cca} + T_{SSB_measurement_period_intra_cca})$ ms, where

$T_{PSS/SSS_sync_intra_cca}$: it is the time period used in PSS/SSS detection given in table 9.2A.6.1-1.

$T_{SSB_measurement_period_intra_cca}$: equal to a measurement period of SSB based measurement given in table 9.2A.6.2-1.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.13.3.1.4 Event-triggered reporting tests on SCC with per-UE gaps under DRX

A.13.3.1.4.1 Test purpose and environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2A.6.1 and 9.2A.6.2.

A.13.3.1.4.2 Test parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1), and two cells on the same carrier frequency with CCA and transmit SSBs in DBT windows according to DL CCA model: SCell (Cell 2) and a neighbour cell (Cell 3). The test parameters for the three cells are given in table A.13.3.1.4.2-1 and A.13.3.1.4.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the SCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively. During time duration T1, the UE shall not have any timing information of Cell 3.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There are two BWPs configured in Cell 1, BWP0 which contains the cell defining SSB, and BWP1 which does not contain any SSB of Cell 1. During the whole test, BWP1 is always scheduled as the active BWP for the UE.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.13.3.1.4.2-1: Supported test configurations

Configuration	Description
1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.13.3.1.4.2-2: General test parameters for intra-frequency event triggered reporting without gap with DRX

Parameter	Unit	Test Configuration	Value		Comment
			Test 1	Test 2	
Active PCell		1, 2, 3	Cell 1		
Active SCell		1, 2, 3	Cell 2		
Neighbour cell		1, 2, 3	Cell 3		Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 2: Cell 2 and Cell 3		
Measurement gap type		1, 2, 3	Per-UE gaps		
Measurement gap repitition periodicity	ms	1, 2, 3	40		
Measurement gap length	ms	1, 2, 3	6		
Measurement gap offset	ms	1, 2, 3	39		
DL CCA model			As specified in clause A.3.26.2.1		
UL CCA model			As specified in clause A.3.26.2.2		
DBT window configuration		1, 2, 3	Cell 1: N/A Cell 2,3: DBT.1		
CSI-RS parameters in Cell 1		1	CSI-RS.1.2 FDD resource #0		
		2	CSI-RS.1.2 TDD resource #0		
		3	CSI-RS.2.2 TDD resource #0		

Parameter	Unit	Test Configuration	Value		Comment
			Test 1	Test 2	
A3-Offset	dB	1, 2, 3	-4.5		
Event A3 measurement quantity			SS-RSRP		
CP length		1, 2, 3	Normal		
Hysteresis	dB	1, 2, 3	0		
Time To Trigger	s	1, 2, 3	0		
Filter coefficient		1, 2, 3	0		L3 filtering is not used
DRX		1, 2, 3	DRX.1	DRX.2	
Time offset between Cell 1 and Cell 2		1	3 ms		Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3 µs		Synchronous cells
		3	3 µs		Synchronous cells
deriveSSB-IndexFromCell		1	*False*		
		2	*True*		
		3	*True*		
T1	s	1, 2, 3	5		
T2	s	1, 2, 3	5	20	

Table A.13.3.1.4.2-3: Cell-specific test parameters for intra-frequency event-triggered reporting without gap

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2		2	
Duplex mode			Config 1	FDD		TDD		TDD	
			Config 2,3	TDD		TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 2	TDDConf.1.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 3	TDDConf.2.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2,3	Not Applicable		12		12	
W_{CCA_DL}		ms	Config 1,2,3	Not Applicable		$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		DLBWP.0.1			
	Initial UL BWP			ULBWP.0.1		ULBWP.0.1			

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
	Dedicated DL BWP			DLBWP.1.1		DLBWP.1.1			
	Dedicated UL BWP			ULBWP.1.1		ULBWP.1.1			
TRS configuration			Config 1	TRS.1.1 FDD		TRS.1.2 TDD			
			Config 2	TRS.1.1 TDD		TRS.1.2 TDD			
			Config 3	TRS.1.2 TDD		TRS.1.2 TDD			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		SR.1.1 CCA			
			Config 2	SR.1.1 TDD		SR.1.1 CCA			
			Config 3	SR2.1 TDD		SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 FDD		CR.1.1 CCA			
			Config 2	CR.1.1 TDD		CR.1.1 CCA			
			Config 3	CR2.1 TDD		CR.1.1 CCA			
SSB parameters	Semi-static channel Note 5,7		Config 1	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 2	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 3	SSB.2 FR1		SSB.1 CCA		SSB.1 CCA	
	Dynamic channel Access Note 6,7		Config 1	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 2	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 3	SSB.2 FR1		SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2,3	Not Applicable		As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.1		SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	15		30		30	
			Config 2	15		30		30	
			Config 3	30		30		30	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		dBm/15 kHz	Config 1,2,3	-98		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-95		-95	
			Config 3	-95		-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-91	-91	-Infinity	-88
			Config 3	-91	-91	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3	4	4	4	-3.79	-Infinity	1.54
$\hat{E}_s/N_{oc}$		dB	Config 1,2,3	4	4	4	4	-Infinity	7
Io Note3		dBm/ChBW	Config 1,2	-64.59	-64.59	-58.49	-54.64	-58.49	-54.64
		dBm/ChBW	Config 3	-58.49	-58.49	-58.49	-54.64	-58.49	-54.64
Propagation Condition			Config 1,2,3	AWGN		AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.								

A.13.3.1.4.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_intra_without_index_CCA}$ ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

$T_{identify_intra_cca_without_index} = (T_{PSS/SSS_sync_intra_cca} + T_{SSB_measurement_period_intra_cca})$ ms, where

$T_{PSS/SSS_sync_intra_cca}$: it is the time period used in PSS/SSS detection given in table 9.2A.6.1-1.

$T_{SSB_measurement_period_intra_cca}$: equal to a measurement period of SSB based measurement given in table 9.2A.6.2-1.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.13.3.1.5 Void

A.13.3.1.6 Void

A.13.3.2 Inter-frequency measurements

A.13.3.2.1 Void

A.13.3.2.2 Void

A.13.3.2.3 Event triggered reporting tests for FR1 with CCA without SSB time index detection when DRX is not used

A.13.3.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements for NR cell with CCA in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1, NR Cell 2 as SCell in FR1 with CCA on NR RF channel 2 and NR Cell 3 as neighbour cell in FR1 with CCA on NR RF channel 3. The test parameters are given in tables A.13.3.2.3.1-1, A.13.3.2.3.1-2 and A.13.3.2.3.1-3.

In this test, measurement gap pattern configuration # 0 as defined in table A.13.3.2.3.1-2 is provided

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

Table A.13.3.2.3.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, NR cell without CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.13.3.2.3.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with CCA without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
NR RF Channel Number		Config 1,2,3	1, 2, 3	Three FR1 NR carrier frequencies are used. Channels 2 and 3 are with CCA.
Active cells		Config 1,2,3	NR Cell 1 (PCell), NR Cell 2 with CCA (SCell)	NR Cell 1 is on NR RF channel number 1. NR Cell 2 is on NR RF channel number 2 with CCA.
Neighbour cell		Config 1,2,3	NR Cell 3 with CCA	NR Cell 3 is on NR RF channel number 3 with CCA.
DL CCA model		Config 1,2,3	As specified in clause A.3.26.2.1	
UL CCA model		Config 1,2,3	As specified in clause A.3.26.2.2	
Gap Pattern Id		Config 1,2,3	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1.7	

Table A.13.3.2.3.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with CCA without SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3	1		2		3	
Duplex mode		Config 1	FDD		TDD		TDD	
		Config 2,3	TDD		TDD		TDD	
TDD configuration		Config 1	Not Applicable		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
		Config 2	TDDConf.1.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
		Config 3	TDDConf.2.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2,3	Not Applicable		12		12	
W_{CCA_DL}		ms	Config 1,2,3	Not Applicable		$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		DLBWP.0.1			
	Initial UL BWP			ULBWP.0.1		ULBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1		DLBWP.1.1			
	Dedicated UL BWP			ULBWP.1.1		ULBWP.1.1			
TRS configuration			Config 1	TRS.1.1 FDD		TRS.1.2 TDD			
			Config 2	TRS.1.1 TDD		TRS.1.2 TDD			
			Config 3	TRS.1.2 TDD		TRS.1.2 TDD			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		SR.1.1 CCA			
			Config 2	SR.1.1 TDD		SR.1.1 CCA			
			Config 3	SR2.1 TDD		SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 FDD		CR.1.1 CCA			
			Config 2	CR.1.1 TDD		CR.1.1 CCA			
			Config 3	CR2.1 TDD		CR.1.1 CCA			
SSB parameters	Semi-static channel Note 5,7		Config 1	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 2	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 3	SSB.2 FR1		SSB.1 CCA		SSB.1 CCA	
	Dynamic channel Access Note 6,7		Config 1	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 2	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 3	SSB.2 FR1		SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2,3	Not Applicable		As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.1		SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	15		30		30	
			Config 2	15		30		30	
			Config 3	30		30		30	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS									

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz	Config 1,2,3	-98		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-95		-95	
		Config 3	-95		-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-91	-91	-Infinity	-88
		Config 3	-91	-91	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2	4	4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2	4	4	4	4	-Infinity	7
Io Note3	dBm/ChBW	Config 1,2	-64.59	-64.59	-58.49	-58.49	-63.94	-56.15
	dBm/ChBW	Config 3	-58.49	-58.49	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

A.13.3.2.3.2 Test Requirements

In this test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is not required to report SSB time index.

$T_{identify_inter_cca_without_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

For test 1, MGRP = 40 ms and for test 2 MGRP = 20 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.13.3.2.4 Event triggered reporting tests for FR1 with CCA without SSB time index detection when DRX is used

A.13.3.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1, NR Cell 2 as SCell in FR1 with CCA on NR RF channel 2 and NR Cell 3 as neighbour cell in FR1 with CCA on NR RF channel 3. The test parameters are given in tables A.13.3.2.4.1-1, A.13.3.2.4.1-2 and A.13.3.2.4.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.13.3.2.4.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.13.3.2.4.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, NR cell without CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.13.3.2.4.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with CCA without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2, 3		Three FR1 NR carrier frequencies are used. Channels 2 and 3 are with CCA.
Active cells		Config 1,2,3	NR Cell 1 (PCell), NR Cell 2 with CCA (SCell)		NR Cell 1 is on NR RF channel number 1. NR Cell 2 is on NR RF channel number 2 with CCA.
Neighbour cell		Config 1,2,3	NR Cell 3 with CCA		NR Cell 3 is on NR RF channel number 3 with CCA.
DL CCA model		Config 1,2,3	As specified in clause A.3.26.2.1		
UL CCA model		Config 1,2,3	As specified in clause A.3.26.2.2		
Gap Pattern Id		Config 1,2,3	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9		
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,2,3	3μs		Synchronous cells.

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	2.5	17	

Table A.13.3.2.4.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with CCA without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2		3	
Duplex mode			Config 1	FDD		TDD		TDD	
			Config 2,3	TDD		TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 2	TDDConf.1.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 3	TDDConf.2.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2,3	Not Applicable		5		5	
W_{CCA_DL}		ms	Config 1,2,3	Not Applicable		$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		DLBWP.0.1			
	Initial UL BWP			ULBWP.0.1		ULBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1		DLBWP.1.1			
	Dedicated UL BWP			ULBWP.1.1		ULBWP.1.1			
TRS configuration			Config 1	TRS.1.1 FDD		TRS.1.2 TDD			
			Config 2	TRS.1.1 TDD		TRS.1.2 TDD			
			Config 3	TRS.1.2 TDD		TRS.1.2 TDD			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		SR.1.1 CCA			
			Config 2	SR.1.1 TDD		SR.1.1 CCA			
			Config 3	SR2.1 TDD		SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 FDD		CR.1.1 CCA			
			Config 2	CR.1.1 TDD		CR.1.1 CCA			
			Config 3	CR2.1 TDD		CR.1.1 CCA			
SSB parameters	Semi-static channel Note 5,7		Config 1	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 2	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 3	SSB.2 FR1		SSB.1 CCA		SSB.1 CCA	

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
	Dynamic channel Access Note 6,7		Config 1	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 2	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 3	SSB.2 FR1		SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2,3	Not Applicable		As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.1		SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	15		30		30	
			Config 2	15		30		30	
			Config 3	30		30		30	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		dBm/15 kHz	Config 1,2,3	-98		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-95		-95	
			Config 3	-95		-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-91	-91	-Infinity	-88
			Config 3	-91	-91	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2	4	4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2	4	4	4	4	-Infinity	7
Io Note3		dBm/ChBW	Config 1,2	-64.59	-64.59	-58.49	-58.49	-63.94	-56.15
		dBm/ChBW	Config 3	-58.49	-58.49	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1,2,3	AWGN		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

Table A.13.3.2.4.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test1&3	Test2&4	Comment
	Value	Value	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	

drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.13.3.2.4.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.13.3.2.4.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_without_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2 UE is not required to report SSB time index.

$T_{identify_inter_cca_without_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

For test 1 DRX cycle = 40 ms and for test 2 DRX cycle = 640 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.13.3.2.5 Event triggered reporting tests for FR1 with CCA with SSB time index detection when DRX is not used

A.13.3.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1, NR Cell 2 as SCell in FR1 with CCA on NR RF channel 2 and NR Cell 3 as neighbour cell in FR1 with CCA on NR RF channel 3. The test parameters are given in tables A.13.3.2.5.1-1, A.13.3.2.5.1-2 and A.13.3.2.5.1-3.

Measurement gap pattern configuration # 0 as defined in table A.13.3.2.5.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

Table A.13.3.2.5.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

	NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, NR cell without CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.13.3.2.5.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
NR RF Channel Number		Config 1,2,3	1, 2, 3	Three FR1 NR carrier frequencies are used. Channels 2 and 3 are with CCA.
Active cells		Config 1,2,3	NR Cell 1 (PCell), NR Cell 2 with CCA (SCell)	NR Cell 1 is on NR RF channel number 1. NR Cell 2 is on NR RF channel number 2 with CCA.
Neighbour cell		Config 1,2,3	NR Cell 3 with CCA	NR Cell 3 is on NR RF channel number 3 with CCA.
DL CCA model		Config 1,2,3	As specified in clause A.3.26.2.1	
UL CCA model		Config 1,2,3	As specified in clause A.3.26.2.2	
Gap Pattern Id		Config 1,2,3	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,2,3	3µs	Synchronous cells.
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	2	

Table A.13.3.2.5.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2		3	
Duplex mode			Config 1	FDD		TDD		TDD	
			Config 2,3	TDD		TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 2	TDDConf.1.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 3	TDDConf.2.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2,3	Not Applicable		5		5	
W_{CCA_DL}		ms	Config 1,2,3	Not Applicable		$T_{PSS/SSS_sync_inter_cca}$		$T_{PSS/SSS_sync_inter_cca}$	
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		DLBWP.0.1			
	Initial UL BWP			ULBWP.0.1		ULBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1		DLBWP.1.1			
	Dedicated UL BWP			ULBWP.1.1		ULBWP.1.1			
TRS configuration			Config 1	TRS.1.1 FDD		TRS.1.2 TDD			
			Config 2	TRS.1.1 TDD		TRS.1.2 TDD			
			Config 3	TRS.1.2 TDD		TRS.1.2 TDD			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		SR.1.1 CCA			
			Config 2	SR.1.1 TDD		SR.1.1 CCA			
			Config 3	SR2.1 TDD		SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 FDD		CR.1.1 CCA			
			Config 2	CR.1.1 TDD		CR.1.1 CCA			
			Config 3	CR2.1 TDD		CR.1.1 CCA			
SSB parameters	Semi-static channel Note 5,7		Config 1	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 2	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 3	SSB.2 FR1		SSB.1 CCA		SSB.1 CCA	
	Dynamic channel Access Note 6,7		Config 1	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 2	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 3	SSB.2 FR1		SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2,3	Not Applicable		As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.1		SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	15		30		30	
			Config 2	15		30		30	
			Config 3	30		30		30	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz	Config 1,2,3	-98		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-95		-95	
		Config 3	-95		-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-91	-91	-Infinity	-88
		Config 3	-91	-91	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2	4	4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2	4	4	4	4	-Infinity	7
Io Note3	dBm/ChBW	Config 1,2	-64.59	-64.59	-58.49	-58.49	-63.94	-56.15
	dBm/ChBW	Config 3	-58.49	-58.49	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration

A.13.3.2.5.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In this test UE is required to report SSB time index.

$T_{identify_inter_cca_with_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca} + T_{SSB_time_index_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_time_index_inter_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.13.3.2.6 Event triggered reporting tests for FR1 with CCA with SSB time index detection when DRX is used

A.13.3.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3A.4 and 9.3A.5.

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1, NR Cell 2 as SCell in FR1 with CCA on NR RF channel 2 and NR Cell 3 as neighbour cell in FR1 with CCA on NR RF channel 3. The test parameters are given in tables A.13.3.2.6.1-1, A.13.3.2.6.1-2 and A.13.3.2.6.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.13.3.2.6.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 3.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.13.3.2.6.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1 with CCA

Config	Description
1	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR cell without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR cell with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, NR cell without CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.13.3.2.6.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2, 3		Three FR1 NR carrier frequencies are used. Channels 2 and 3 are with CCA.
Active cells		Config 1,2,3	NR Cell 1 (PCell), NR Cell 2 with CCA (SCell)		NR Cell 1 is on NR RF channel number 1. NR Cell 2 is on NR RF channel number 2 with CCA.
Neighbour cell		Config 1,2,3	NR Cell 3 with CCA		NR Cell 3 is on NR RF channel number 3 with CCA.
DL CCA model		Config 1,2,3	As specified in clause A.3.26.2.1		
UL CCA model		Config 1,2,3	As specified in clause A.3.26.2.2		
Gap Pattern Id		Config 1,2,3	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9		
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	3	20	

Table A.13.3.2.6.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with CCA with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2		3	
Duplex mode			Config 1	FDD		TDD		TDD	
			Config 2,3	TDD		TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 2	TDDConf.1.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
			Config 3	TDDConf.2.1		TDDConf.1.1 CCA		TDDConf.1.1 CCA	
DL CCA probability P_{CCA_DL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_DL}=0.9375		P_{CCA_DL}=0.9375	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75		$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75	
UL CCA probability P_{CCA_UL}	Semi-static channel access Note 5,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
	Dynamic channel access Note 6,7		Config 1,2,3	Not Applicable		P_{CCA_UL}=1		P_{CCA_UL}=1	
L_{CCA_DL}			Config 1,2,3	Not Applicable		2		2	
W_{CCA_DL}		ms	Config 1,2,3	Not Applicable		$T_{PSS/SSS_sync_inter_cc\ a}$		$T_{PSS/SSS_sync_inter_cc\ a}$	
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
			Config 3	40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		DLBWP.0.1			
	Initial UL BWP			ULBWP.0.1		ULBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1		DLBWP.1.1			
	Dedicated UL BWP			ULBWP.1.1		ULBWP.1.1			
TRS configuration			Config 1	TRS.1.1 FDD		TRS.1.2 TDD			
			Config 2	TRS.1.1 TDD		TRS.1.2 TDD			
			Config 3	TRS.1.2 TDD		TRS.1.2 TDD			
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		SR.1.1 CCA			
			Config 2	SR.1.1 TDD		SR.1.1 CCA			
			Config 3	SR2.1 TDD		SR.1.1 CCA			
CORESET Reference Channel			Config 1	CR.1.1 FDD		CR.1.1 CCA			
			Config 2	CR.1.1 TDD		CR.1.1 CCA			
			Config 3	CR2.1 TDD		CR.1.1 CCA			
SSB parameters	Semi-static channel Note 5,7		Config 1	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 2	SSB.1 FR1		SSB.1 CCA		SSB.1 CCA	
			Config 3	SSB.2 FR1		SSB.1 CCA		SSB.1 CCA	
	Dynamic		Config 1	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
	channel Access Note 6,7		Config 2	SSB.1 FR1		SSB.2 CCA		SSB.2 CCA	
			Config 3	SSB.2 FR1		SSB.2 CCA		SSB.2 CCA	
DBT window configuration			Config 1,2,3	Not Applicable		As defined in A.3.28.1		As defined in A.3.28.1	
SMTC configuration defined in A.3.11			Config 1,2,3	SMTC.1		SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	15		30		30	
			Config 2	15		30		30	
			Config 3	30		30		30	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		dBm/15 kHz	Config 1,2,3	-98		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-95		-95	
			Config 3	-95		-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-91	-91	-Infinity	-88
			Config 3	-91	-91	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2	4	4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2	4	4	4	4	-Infinity	7
Io Note3		dBm/ChBW	Config 1,2	-64.59	-64.59	-58.49	-58.49	-63.94	-56.15
		dBm/ChBW	Config 3	-58.49	-58.49	-58.49	-58.49	-63.94	-56.15
Propagation Condition			Config 1,2,3	AWGN		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 6: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 7: For UE supporting both semi-static and dynamic channel access, the UE must be tested under dynamic channel access configuration.

Table A.13.3.2.6.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test1	Test2	Comment
	Value	Value	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	

drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.13.3.2.6.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.13.3.2.6.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than $T_{identify_inter_cca_with_index}$ from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2 UE is required to report SSB time index.

$T_{identify_inter_cca_with_index} = (T_{PSS/SSS_sync_inter_cca} + T_{SSB_measurement_period_inter_cca} + T_{SSB_time_index_inter_cca})$ ms, where

$T_{PSS/SSS_sync_inter_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB_time_index_inter_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2.

$T_{SSB_measurement_period_inter_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.

MGRP = 40 ms.

For test 1 DRX cycle = 40 ms and for test 2 DRX cycle = 640 ms.

SMTC period = 20 ms.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.13.3.3 L1-RSRP measurements for beam reporting

A.13.3.3.1 SSB based L1-RSRP measurement when DRX is not used

A.13.3.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5A.4.1, with the testing configurations for NR cells in table A.13.3.3.1.1-1.

Table A.13.3.3.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.13.3.3.1.2 Test parameters

There are two cells in the tests, FR1 PCell (Cell 1) and FR1 SCell (Cell 2). Cell 2 operates on a carrier frequency with CCA and transmits SSBs in DBT window according to DL CCA model. The test parameters and applicability for Cell 1 and Cell 2 are given in table A.13.3.3.1.2-1 and table A.13.3.3.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The UE transmits the reporting according to UL CCA model. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.13.3.3.1.2-1: General test parameters

Parameter	Configuration	Unit	Value	
			Cell 1	Cell 2
Active PCell/SCell Configuration			PCell	SCell
RF Channel Number			1	2
DL CCA model	1~3		N/A	As specifieed in A.3.26.2.1
UL CCA model	1~3		N/A	As specified in A.3.26.2.2
Duplex mode	1		FDD	TDD
	2		TDD	
	3		TDD	
TDD Configuration	1		N/A	TDDConf.1.1 CCA
	2		TDDConf.1.1	
	3		TDDConf.2.1	
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52	40: $N_{PRB,c}$ = 106
	2		10: $N_{PRB,c}$ = 52	
	3		40: $N_{PRB,c}$ = 106	
PDSCH Reference measurement channel	1		SR.1.1 FDD	SR.1.1 CCA
	2		SR.1.1 TDD	
	3		SR.2.1 TDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	CR.1.1 CCA
	2		CR.1.1 TDD	
	3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	CCR.1.1 CCA
	2		CCR.1.1 TDD	
	3		CCR.2.1 TDD	
SSB configuration	1		SSB.3 FR1	SSB.3 CCA for semi-static channel access
	2		SSB.3 FR1	SSB.4 CCA for dynamic channel access
	3		SSB.4 FR1	
OCNG Patterns	1~3		OP.1	OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1	N/A
DBT Window Configuration	1~3		N/A	DBT.1
TRS Configuration	1		TRS.1.1 FDD	TRS.1.2 TDD
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
DRX configuration	1~3		Off	Off
reportConfigType	1~3		periodic	periodic

Parameter	Configuration	Unit	Value	
			Cell 1	Cell 2
reportQuantity	1~3		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1~3		2	2
L1-RSRP reporting period	1~3	slot	80	80
T1	1~3	s	5	5
T2	1~3	s	1	1
EPRE ratio of PSS to SSS	1~3	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation condition	1~3		AWGN	AWGN
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.				

Table A.13.3.3.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
DL CCA Probability P_{CCA_DL} Note 4,6	1,2,3		0.9375	0.9375	0.9375	0.9375
DL CCA Probability P_{CCA_DL} Note 4,7	1,2,3		0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability P_{CCA_UL}	1,2,3		1.0	1.0	1.0	1.0
N_{oc} Note2	1,2,3	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2,3	dBm/SSB SCS	-91.65			
$\hat{E}_s / I_{ot}$	1,2,3	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2,3	dBm/SSB SCS	-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,3	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s / N_{oc}$	1,2,3	dB	0	0	-Infinity	3

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: DL and UL CCA probabilities apply for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.
NOTE 5: The signal levels apply for SSS Res when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.

A.13.3.3.1.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE shall send L1-RSRP report of both SSB0 and SSB1 in Cell 2.

NOTE: The actual overall delays measured in the test may be up to 2xTTI DCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.13.3.3.2 SSB based L1-RSRP measurement when DRX is used

A.13.3.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5A.4.1, with the testing configurations for NR cells in table A.13.3.3.1.1-1.

Table A.13.3.3.2.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.13.3.3.2.2 Test parameters

There are two cells in the tests, FR1 Pcell (Cell 1) and FR1 Scell (Cell 2). Cell 2 operates on a carrier frequency with CCA and transmits SSBs in DBT window according to DL CCA model. The test parameters and applicability for Cell 1 and Cell 2 are given in table A.13.3.3.2.2-1 and table A.13.3.3.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The UE transmits the reporting according to UL CCA model. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.13.3.3.2.2-1: General test parameters

Parameter	Configuration	Unit	Value	
			Cell 1	Cell 2
Active Pcell/Scell Configuration			Pcell	Scell
RF Channel Number			1	2
DL CCA model	1~3		N/A	As specifieed in A.3.26.2.1
UL CCA model	1~3		N/A	As specified in A.3.26.2.2
Duplex mode	1		FDD	TDD
	2		TDD	
	3		TDD	
TDD Configuration	1		N/A	TDDConf.1.1 CCA
	2		TDDConf.1.1	
	3		TDDConf.2.1	

Parameter	Configuration	Unit	Value	
			Cell 1	Cell 2
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52	40: $N_{PRB,c}$ = 106
	2		10: $N_{PRB,c}$ = 52	
	3		40: $N_{PRB,c}$ = 106	
PDSCH Reference measurement channel	1		SR.1.1 FDD	SR.1.1 CCA
	2		SR.1.1 TDD	
	3		SR.2.1 TDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	CR.1.1 CCA
	2		CR.1.1 TDD	
	3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	CCR.1.1 CCA
	2		CCR.1.1 TDD	
	3		CCR.2.1 TDD	
SSB configuration	1		SSB.3 FR1	SSB.3 CCA for semi-static channel access SSB.4 CCA for dynamic channel access
	2		SSB.3 FR1	
	3		SSB.4 FR1	
OCNG Patterns	1~3		OP.1	OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1	N/A
DBT Window Configuration	1~3		N/A	DBT.1
TRS Configuration	1		TRS.1.1 FDD	TRS.1.2 TDD
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
DRX configuration	1~3		DRX.3	DRX.3
reportConfigType	1~3		periodic	periodic
reportQuantity	1~3		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1~3		2	2
L1-RSRP reporting period	1~3	slot	80	80
T1	1~3	s	5	5
T2	1~3	s	1	1
EPRE ratio of PSS to SSS	1~3	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation condition	1~3		AWGN	AWGN

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

Table A.13.3.3.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
DL CCA Probability P_{CCA_DL} Note 4,6	1,2,3		0.9375	0.9375	0.9375	0.9375

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
DL CCA Probability P_{CCA_DL} Note 4.7	1,2,3		0.75/0.75	0.75/0.75	0.75/0.75	0.75/0.75
UL CCA probability P_{CCA_UL}	1,2,3		1.0	1.0	1.0	1.0
N_{oc} Note2	1,2,3	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2,3	dBm/SSB SCS	-91.65			
$\hat{E}_s/I_{ot}$	1,2,3	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2,3	dBm/SSB SCS	-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,3	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1,2,3	dB	0	0	-Infinity	3

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: DL and UL CCA probabilities apply for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.
NOTE 5: The signal levels apply for SSS Res when the discovery burst is transmitted during DBT windows.
NOTE 6: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 7: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. The first value corresponds P_{CCA_DL1} and the second value corresponds to the P_{CCA_DL2}.

A.13.3.3.2.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE shall send L1-RSRP report of both SSB0 and SSB1 in Cell 2.

NOTE: The actual overall delays measured in the test may be up to 2xTTI DCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.13.4 Measurement performance

A.13.4.1 SS-RSRP

A.13.4.1.1 Intra-frequency measurement accuracy on a carrier frequency with CCA

A.13.4.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy on the carrier frequency with CCA is within the specified limits. This test will verify the requirements in clauses 10.1.36.1.1 and 10.1.36.1.2 for intra-frequency measurements under CCA.

A.13.4.1.1.2 Test parameters

Three cells are deployed in the test, which are FR1 PCell (Cell 1), and two cells on the same carrier frequency with CCA and transmit SSBs in DBT windows according to DL CCA model: SCell (Cell 2) and a neighbour cell (Cell 3). Supported test configurations are shown in table A.13.4.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in A.13.4.1.1.2-2.

Table A.13.4.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Config	Description
1	NR carrier with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR carrier without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR carrier with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR carrier without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR carrier with CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR carrier without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations for each supported band	

Table A.13.4.1.1.2-2: SS-RSRP Intra frequency test parameters

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
Cell ID				489	0	489	0	489	0
SSB ARFCN				freq1		freq1		freq1	
DL CCA model				As specified in clause A.3.26.2.1					
UL CCA model				As specified in clause A.3.26.2.2					
P_{CCA_DL} for dynamic channel access Note 7,9				$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75					
P_{CCA_DL} for semi-static channel access Note 8,9				P_{CCA_DL}=0.9375					
P_{CCA_UL}				1					
TDD configuration	Config 1,2,3			TDDConf.1.1 CCA					
$BW_{channel}$	Config 1,2,3		MHz	40: $N_{PRB,c}$ = 106					
BWP BW	Config 1,2,3			40: $N_{PRB,c}$ = 106					
Downlink initial BWP configuration				DLBWP.0.1					
Downlink dedicated BWP configuration				DLBWP.1.1					
Uplink initial BWP configuration				ULBWP.0.1					
Uplink dedicated BWP configuration				ULBWP.1.1					
TRS configuration	Config 1,2,3			TRS.1.2 TDD	NA	TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,2,3			SR.1.1 CCA	-	SR.1.1 CCA	-	SR.1.1 CCA	-
RMSI CORESET Reference Channel	Config 1,2,3			CR.1.1 CCA	-	CR.1.1 CCA	-	CR.1.1 CCA	-
Control channel RMC	Config 1,2,3			CR.1.1 CCA	-	CR.1.1 CCA	-	CR.1.1 CCA	-
SSB configuration for semi-static channel access	Config 1,2,3			SSB.1 CCA	SSB.1 CCA	SSB.1 CCA	SSB.1 CCA	SSB.1 CCA	SSB.1 CCA
SSB configuration for dynamic channel access	Config 1,2,3			SSB.2 CCA	SSB.2 CCA	SSB.2 CCA	SSB.2 CCA	SSB.2 CCA	SSB.2 CCA
DBT window configuration	Config 1,2,3			DBT.1	DBT.1	DBT.1	DBT.1	DBT.1	DBT.1
Time offset with Cell 1	Config 1,2,3		µs	-	3	-	3	-	3
SMTC configuration	Config 1,2,3			SMTC.1					
OCNG Patterns				OCNG pattern 1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,3		kHz	30 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,3	NR_CCA_FR1_I		Not applicable Note 5		-94		-110	
		NR_CCA_FR1_J						-109.5	
	Config 1,2,3	NR_CCA_FR1_I	dBm/SCS			-91		-107.0	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
N_{oc} Note2				Not applicable Note 5					
		NR_CCA_FR1_J						-106.5	
$\hat{E}_s/I_{ot}$ Note6			dB	2.46	-5.97	2.46	-5.97	-2.01	-3.54
$\hat{E}_s/N_{oc}$ Note6			dB	6	1	6	1	1	0
SS-RSRP Note 3,6	Config 1,2,3	NR_TDD_FR1_I	dBm/SCS	Not applicable Note 5	Not applicable Note 5	-85	-90	-106.00	-107.00
								-105.50	-106.50
Io Note3	Config 1,2,3	NR_CCA_FR1_I	dBm/ 38.16 MHz	Not applicable Note 5		-51.99		-70.82	
		NR_CCA_FR1_J						-70.32	
Propagation condition			-	AWGN					
Antenna configuration				1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Subtest 1 is not used when testing with 30 kHz SSB SCS.
NOTE 6: The signal levels apply for SSS REs when the discovery burst is transmitted during DBT windows.
NOTE 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 9: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

A.13.4.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil absolute requirement in clause 10.1.36.1.1 and relative requirement in clause 10.1.36.1.2.

A.13.4.2 SS-RSRQ

A.13.4.2.1 Intra-frequency measurement accuracy on SCC

A.13.4.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.29.1.1.

A.13.4.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.13.4.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is tested by using the parameters in table A.13.4.2.1.2-2 and table A.13.4.2.1.2-3. In all test cases, Cell 1 is the PCell, Cell 2 is the SCell with CCA, and Cell 3 is the target cell with CCA. Three sub-tests (Test 1, Test 2, and Test 3) are provided different N_{oc} on Cells 1, 2, and 3.

Table A.13.4.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Config	Description
1	Without CCA: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

Table A.13.4.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter			Unit	Test 1		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN				freq2	freq2	freq2	freq2
DL CCA model		Config 1, 2, 3		As specified in clause A.3.26.2.1			
UL CCA model		Config 1, 2, 3		As specified in clause A.3.26.2.2			
DL CCA probability for semi-static channel access Note 7, 8		P_{CCA_UL}		1.0	-	1.0	-
		P_{CCA_DL}		0.9375	-	0.9375	-
DL CCA probability for dynamic channel access Note 8, 9		$P_{CCA_DL_1}$		0.75	-	0.75	-
		$P_{CCA_DL_2}$		0.75	-	0.75	-
Duplex mode		Config 1, 2, 3		TDD			
TDD configuration		Config 1, 2, 3		TDDConf.1.1 CCA			
$BW_{channel}$		Config 1, 2, 3	MHz	40: $N_{RB,c}$ = 106			
BWP configuration		Initial DL BWP		DLBWP.0.1			
		Dedicated DL BWP		DLBWP.1.1			
		Initial UL BWP		ULBWP.0.1			
		Dedicated UL BWP		ULBWP.1.1			
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel		Config 1, 2, 3		SR.1.1 CCA		SR.1.1 CCA	
RMSI CORESET Reference Channel		Config 1, 2, 3		CR.1.1 CCA		CR.1.1 CCA	
Control Channel RMC		Config 1, 2, 3		CCR.1.1 CCA		CCR.1.1 CCA	
TRS configuration		Config 1, 2, 3		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OP. 1			
SS-RSSI-Measurement				Not Applicable			
Time offset with Cell 1		Config 1, 2, 3	µs	3	3	3	3
DBT Window Configuration		Config 1, 2, 3		DBT.1			
SSB configuration		Config 1, 2, 3		SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access			
SMTC configuration		Config 1, 2, 3		SMTC.1			
CSI-RS for tracking		Config 1, 2, 3		TRS.1.2 TDD			
PDSCH/PDCCH subcarrier spacing		Config 1, 2, 3	kHz	30kHz			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config 1, 2, 3	NR_CCA_FR1_I	dBm/15kHz	-91		-110	
		NR_CCA_FR1_J				-109.5	
N_{oc} Note2	Config 1, 2, 3	NR_CCA_FR1_I	dBm/SCS	-88		-107	
		NR_CCA_FR1_J				-106.5	
$\hat{E}_s / I_{ot}$			dB	-1.76		-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	3	3	-4	-4
SS-RSRP Note3	Config 1, 2, 3	NR_CCA_FR1_I	dBm/SCS	-85	-85	-111	-111
		NR_CCA_FR1_J				-110.5	-110.5
SS-RSRQ Note3		NR_CCA_FR1_I	dB	-14.77	-14.77	-17.34	-17.34
		NR_CCA_FR1_J					

Io[Note3]	Config 1, 2, 3	NR_CCA_FR1_I	dBm/ 38.16MHz	-50		-73.4	-73.4
		NR_CCA_FR1_J				-72.9	-72.9
Propagation condition			-	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in clause 3.5.2.
Note 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.
Note 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
Note 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
Note 9: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

Table A.13.4.2.1.2-3: SS-RSRQ Intra frequency test parameters for NR PCell

Parameter		Unit	Test 1	Test 3
			Cell 1	Cell 1
SSB ARFCN			freq1	freq1
Duplex mode	Config 1		FDD	FDD
	Config 2,3		TDD	TDD
TDD configuration	Config 1		Not Applicable	Not Applicable
	Config 2		TDDConf.1.1	TDDConf.1.1
	Config 3		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
	Config 2		10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
	Config 3		40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106
Gap Pattern ID			0	0
Downlink initial BWP configuration			DLBWP.0.1	DLBWP.0.1
Downlink dedicated BWP configuration			DLBWP.1.1	DLBWP.1.1
Uplink initial BWP configuration			ULBWP.0.1	ULBWP.0.1
Uplink dedicated BWP configuration			ULBWP.1.1	ULBWP.1.1
DRX Cycle configuration		ms	Not Applicable	Not Applicable
TRS configuration	Config 1		TRS.1.1 FDD	TRS.1.1 FDD
	Config 2		TRS.1.1 TDD	TRS.1.1 TDD
	Config 3		TRS.1.2 TDD	TRS.1.2 TDD
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.1.1 FDD
	Config 2		SR.1.1 TDD	SR.1.1 TDD
	Config 3		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	CR.1.1 FDD
	Config 2		CR.1.1 TDD	CR.1.1 TDD
	Config 3		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	CCR.1.1 FDD

Parameter			Unit	Test 1	Test 3
				Cell 1	Cell 1
		Config 2		CCR.1.1 TDD	CCR.1.1 TDD
		Config 3		CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns				OP.1	OP.1
SS-RSSI-Measurement				Not Applicable	Not Applicable
SMTC configuration		Config 1 Config 2,3		SMTC.2	SMTC.2
				SMTC.1	SMTC.1
SSB configuration		Config 1,2		SSB.1 FR1	SSB.1 FR1
		Config 3		SSB.2 FR1	SSB.2 FR1
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15	15
		Config 3		30	30
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	Config 1, 2	NR_FDD_FR1_A	dBm/15kHz	-85	-114
		NR_FDD_FR1_B			-113.5
		NR_TDD_FR1_C			-113
		NR_FDD_FR1_D, NR_TDD_FR1_D			-112.5
		NR_FDD_FR1_E			-112
	NR_FDD_FR1_G			-111	
		NR_FDD_FR1_H			-110.5
	Config 3	NR_FDD_FR1_A		-91	-114
		NR_FDD_FR1_B			-113.5
		NR_TDD_FR1_C			-113
		NR_FDD_FR1_D, NR_TDD_FR1_D			-112.5
		NR_FDD_FR1_E			-112
		NR_FDD_FR1_G			-111
		NR_FDD_FR1_H			-110.5
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A	dBm/SCS	-85	-114
		NR_FDD_FR1_B			-113.5
		NR_TDD_FR1_C			-113
		NR_FDD_FR1_D, NR_TDD_FR1_D			-112.5
		NR_FDD_FR1_E			-112
		NR_FDD_FR1_G			-111
		NR_FDD_FR1_H			-110.5
	Config 3	NR_FDD_FR1_A		-88	-111
		NR_FDD_FR1_B			-110.5
		NR_TDD_FR1_C			-110
		NR_FDD_FR1_D, NR_TDD_FR1_D			-109.5
		NR_FDD_FR1_E			-109
		NR_FDD_FR1_G			-108
		NR_FDD_FR1_H			-107.5
$\hat{E}_s / I_{ot}$			dB	-1.76	-5.46
$\hat{E}_s / N_{oc}$			dB	3	-4

Parameter			Unit	Test 1	Test 3
				Cell 1	Cell 1
SS-RSRP[Note3]	Config 1,2	NR_FDD_FR1_A	dBm/SCS	-82	-118
		NR_FDD_FR1_B			-117.5
		NR_TDD_FR1_C			-117
		NR_FDD_FR1_D, NR_TDD_FR1_D			-116.5
		NR_FDD_FR1_E			-116
		NR_FDD_FR1_G			-115
		NR_FDD_FR1_H			-114.5
	Config 3	NR_FDD_FR1_A		-85	-115
		NR_FDD_FR1_B			-114.5
		NR_TDD_FR1_C			-114
		NR_FDD_FR1_D, NR_TDD_FR1_D			-113.5
		NR_FDD_FR1_E			-113
		NR_FDD_FR1_G			-112
		NR_FDD_FR1_H			-111.5
SS-RSRQ [Note3]		NR_FDD_FR1_A	dB	-14.77	-17.34
		NR_FDD_FR1_B			
		NR_TDD_FR1_C			
		NR_FDD_FR1_D, NR_TDD_FR1_D			
		NR_FDD_FR1_E			
		NR_FDD_FR1_G			
		NR_FDD_FR1_H			
Io[Note3]	Config 1,2	NR_FDD_FR1_A	dBm/ 9.36MHz	-50	-83.5
		NR_FDD_FR1_B			-83
		NR_TDD_FR1_C			-82.5
		NR_FDD_FR1_D, NR_TDD_FR1_D			-82
		NR_FDD_FR1_E			-81.5
		NR_FDD_FR1_G			-80.5
		NR_FDD_FR1_H			-80
	Config 3	NR_FDD_FR1_A	dBm/ 38.16MHz	-50	-77.4
		NR_FDD_FR1_B			-76.9
		NR_TDD_FR1_C			-76.4
		NR_FDD_FR1_D, NR_TDD_FR1_D			-75.9
		NR_FDD_FR1_E			-75.4
		NR_FDD_FR1_G			-74.4
		NR_FDD_FR1_H			-73.9
Propagation condition			-	AWGN	AWGN
Antenna configuration			-	1x2	1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Note 5: NR operating band groups are as defined in clause 3.5.2.

Parameter	Unit	Test 1	Test 3
		Cell 1	Cell 1

A.13.4.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.29.1.1.

A.13.4.3 SS-SINR

A.13.4.3.1 Intra-frequency measurement accuracy on SCC

A.13.4.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.31.1.1.

A.13.4.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.13.4.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in table A.13.4.3.1.2-2 and table A.13.4.3.1.2-3. In all test cases, Cell 1 is the PCell, Cell 2 is the SCell with CCA, and Cell 3 is the target cell with CCA. Two sub-tests (Test 1 and Test 2) are provided different N_{oc} on Cells 1, 2, and 3.

Table A.13.4.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Config	Description
1	Without CCA: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.13.4.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN			freq2	freq2	freq2	freq2
DL CCA model	Config 1, 2, 3		As specified in clause A.3.26.2.1			
UL CCA model	Config 1, 2, 3		As specified in clause A.3.26.2.2			
UL CCA probability	P_{CCA_UL}		1.0	-	1.0	-
DL CCA probability for semi-static channel access Note 7, 8	P_{CCA_DL}		0.9375	-	0.9375	-
DL CCA probability for dynamic channel access Note 8, 9	$P_{CCA_DL_1}$		0.75	-	0.75	-
	$P_{CCA_DL_2}$		0.75	-	0.75	-
Duplex mode	Config 1, 2, 3		TDD			
TDD configuration	Config 1, 2, 3		TDDConf.1.1 CCA			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
DRX Cycle configuration		ms	Not Applicable			
TRS configuration	Config 1, 2, 3		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1, 2, 3		SR.1.1 CCA		SR.1.1 CCA	

Parameter			Unit	Test 1		Test 2	
				Cell 2	Cell 3	Cell 2	Cell 3
RMSI CORESET Reference Channel	Config 1, 2, 3			CR.1.1 CCA		CR.1.1 CCA	
Dedicated CORESET Reference Channel	Config 1, 2, 3			CCR.1.1 CCA		CCR.1.1 CCA	
OCNG Patterns				OP.1			
SS-RSSI-Measurement				Not Applicable			
DBT Window configuration	Config 1, 2, 3			DBT.1			
Time offset with Cell 1	Config 1, 2, 3		µs	3 (for Cell 2)	3	3 (for Cell 2)	3
SSB configuration	Config 1, 2, 3			SSB.1 CCA for semi-static channel access SSB.2 CCA for dynamic channel access			
SMTC configuration	Config 1, 2, 3			SMTC.1			
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 3		kHz	30			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		NR_CCA_FR1_I	dBm/15 kHz	-93		-112	
		NR_CCA_FR1_J				-111.5	
N_{oc} Note2	Config 1, 2, 3	NR_CCA_FR1_I	dBm/SCS	-90		-109	
		NR_CCA_FR1_J				-108.5	
$\hat{E}_s / I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	4.54	2.66	-4	-4
SS-RSRP Note3	Config 1, 2, 3	NR_CCA_FR1_I	dBm/SCS	-85.46	-87.34	-113	-113
		NR_CCA_FR1_J				-112.5	-112.5
SS-SINR Note3		NR_CCA_FR1_I	dB	0	-3.19	-5.46	-5.46
		NR_CCA_FR1_J					
Io Note3	Config 1, 2, 3	NR_CCA_FR1_I	dBm/ 38.16 MHz	-51.41		-75.41	
		NR_CCA_FR1_J				-74.91	
Propagation condition			-	AWGN			
Antenna configuration			-	1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: NR operating band groups are as defined in clause 3.5.2.

NOTE 6: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configuration.

NOTE 7: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.

NOTE 8: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.

NOTE 9: For UE supporting both semi-static and dynamic cannel access, the UE must be tested under both dynamic and semi-static channel occupancy configurations.

A.13.4.3.1.2-3: SS-SINR Intra frequency test parameters for NR PCell

Parameter		Unit	Test 1	Test 2
			Cell 1	Cell 1
SSB ARFCN			freq1	freq1
Duplex mode	Config 1		FDD	FDD
	Config 2,3		TDD	TDD
TDD configuration	Config 1		Not Applicable	Not Applicable
	Config 2		TDDConf.1.1	TDDConf.1.1
	Config 3		TDDConf.2.1	TDDConf.2.1
Downlink initial BWP configuration			DLBWP.0.1	DLBWP.0.1
Downlink dedicated BWP configuration			DLBWP.1.1	DLBWP.1.1
Uplink initial BWP configuration			ULBWP.0.1	ULBWP.0.1
Uplink dedicated BWP configuration			ULBWP.1.1	ULBWP.1.1
DRX Cycle configuration		ms	Not Applicable	Not Applicable
TRS configuration	Config 1		TRS.1.1 FDD	TRS.1.1 FDD
	Config 2		TRS.1.1 TDD	TRS.1.1 TDD
	Config 3		TRS.1.2 TDD	TRS.1.2 TDD
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.1.1 FDD
	Config 2		SR.1.1 TDD	SR.1.1 TDD
	Config 3		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	CR.1.1 FDD
	Config 2		CR.1.1 TDD	CR.1.1 TDD
	Config 3		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	CCR.1.1 FDD
	Config 2		CCR.1.1 TDD	CCR.1.1 TDD
	Config 3		CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1
SS-RSSI-Measurement			Not Applicable	Not Applicable
SMTC configuration	Config 1 Config 2,3		SMTC.2	SMTC.2
			SMTC.1	SMTC.1
SSB configuration	Config 1,2		SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.2 FR1	SSB.2 FR1
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15	15
	Config 3		30	30
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	NR_FDD_FR1_A	dBm/15 kHz	-93	-116
	NR_FDD_FR1_B			-115.5
	NR_TDD_FR1_C			-115
	NR_FDD_FR1_D, NR_TDD_FR1_D			-114.5
	NR_FDD_FR1_E			-114
NR_FDD_FR1_G			-113	
	NR_FDD_FR1_H			-112.5

Parameter				Unit	Test 1	Test 2
					Cell 1	Cell 1
N_{oc} Note2	Config 1,2			dBm/SCS	-93	Same as Noc for 15 kHz
	Config 3	NR_FDD_FR1_A			-90	-113
		NR_FDD_FR1_B				-112.5
		NR_TDD_FR1_C				-112
		NR_FDD_FR1_D, NR_TDD_FR1_D				-111.5
		NR_FDD_FR1_E				-111
		NR_FDD_FR1_G				-110
		NR_FDD_FR1_H				-109.5
$\hat{E}_s / I_{ot}$				dB	0	-5.46
$\hat{E}_s / N_{oc}$				dB	4.54	-4
SS-RSRP Note3	Config 1,2	NR_FDD_FR1_A		dBm/SCS	-88.46	-120
		NR_FDD_FR1_B				-119.5
		NR_TDD_FR1_C				-119
		NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
		NR_FDD_FR1_E				-118
		NR_FDD_FR1_G				-117
		NR_FDD_FR1_H				-116.5
Config 3	NR_FDD_FR1_A			-85.46	-117	
		NR_FDD_FR1_B				-116.5
		NR_TDD_FR1_C				-116
		NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
		NR_FDD_FR1_E				-115
	NR_FDD_FR1_G				-114	
		NR_FDD_FR1_H				-113.5
SS-SINR Note3		NR_FDD_FR1_A		dB	0	-5.46
		NR_FDD_FR1_B				
		NR_TDD_FR1_C				
		NR_FDD_FR1_D, NR_TDD_FR1_D				
		NR_FDD_FR1_E				
		NR_FDD_FR1_G				
		NR_FDD_FR1_H				
Io Note3	Config 1,2	NR_FDD_FR1_A		dBm/ 9.36 MHz	-57.5	-85.51
		NR_FDD_FR1_B				-85.01
		NR_TDD_FR1_C				-84.51
		NR_FDD_FR1_D, NR_TDD_FR1_D				-84.01
		NR_FDD_FR1_E				-83.51
		NR_FDD_FR1_G				-82.51
		NR_FDD_FR1_H				-82.01
Config 3	NR_FDD_FR1_A		dBm/ 38.16 MHz	-51.41	-79.41	
		NR_FDD_FR1_B				-78.91
		NR_TDD_FR1_C				-78.41
		NR_FDD_FR1_D, NR_TDD_FR1_D				-77.91
		NR_FDD_FR1_E				-77.41

Parameter	Unit	Test 1	Test 2
		Cell 1	Cell 1
NR_FDD_FR1_G		-76.41	
NR_FDD_FR1_H			-75.91
Propagation condition	-	AWGN	AWGN
Antenna configuration	-	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.

A.13.4.3.1.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.31.1.1.

A.13.4.4 L1-RSRP measurement for beam reporting with CCA serving cell

A.13.4.4.1 SSB based L1-RSRP measurement

A.13.4.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.33.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.13.4.4.1.1-1.

Table A.13.4.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.13.4.4.1.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a SCell under CCA (Cell 2). Cell 2 operates on a carrier frequency with CCA and transmits SSBs in DBT window according to DL CCA model.

Two sub-tests (Test 1 and Test 2) are provided with different N_{oc} on Cell 2. The test parameters for the Cell 1 and Cell 2 are given in table A.13.4.4.1.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.13.4.4.1.2-1.

The same test is applicable for UE supporting any one or both semi-static channel access or dynamic channel access and for network configuring any of semi-static channel occupancy or dynamic channel occupancy.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. On Cell 2, UE is configured to perform L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.13.4.4.1.2-1: FR1 SSB based L1-RSRP test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Active PCell/SCell Configuration	1~3		PCell	SCell	PCell	SCell
SSB ARFCN	1~3		freq1	freq2	freq1	freq2
DL CCA model	1~3		N/A	As specifieed in A.3.26.2.1	N/A	As specifieed in A.3.26.2.1
UL CCA model	1~3		N/A	As specified in A.3.26.2.2	N/A	As specified in A.3.26.2.2
Duplex mode	1		FDD	TDD	FDD	TDD
	2,3		TDD		TDD	
TDD configuration	1		N/A	TDDConf.1.1 CCA	N/A	TDDConf.1.1 CCA
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
$BW_{channel}$	1	MHz	10: $N_{PRB,c}$ = 52	40: $N_{PRB,c}$ = 106	10: $N_{PRB,c}$ = 52	40: $N_{PRB,c}$ = 106
	2		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	3		40: $N_{PRB,c}$ = 106		40: $N_{PRB,c}$ = 106	
PDSCH Reference measurement channel	1		SR.1.1 FDD	SR.1.1 CCA	SR.1.1 FDD	SR.1.1 CCA
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	CR.1.1 CCA	CR.1.1 FDD	CR.1.1 CCA
	2		CR.1.1 TDD		CR.1.1 TDD	
	3		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	CCR.1.1 CCA	CCR.1.1 FDD	CCR.1.1 CCA
	2		CCR.1.1 TDD		CCR.1.1 TDD	
	3		CCR.2.1 TDD		CCR.2.1 TDD	
SSB configuration for Semi-static channel access	1		SSB.3 FR1	SSB.3 CCA	SSB.3 FR1	SSB.3 CCA
	2		SSB.3 FR1		SSB.3 FR1	
	3		SSB.4 FR1		SSB.4 FR1	
SSB configuration for Dynamic channel access	1		SSB.3 FR1	SSB.4 CCA	SSB.3 FR1	SSB.4 CCA
	2		SSB.3 FR1		SSB.3 FR1	
	3		SSB.4 FR1		SSB.4 FR1	
TRS configuration	1		TRS.1.1 FDD	TRS.1.2 TDD	TRS.1.1 FDD	TRS.1.2 TDD
	2		TRS.1.1 TDD		TRS.1.1 TDD	
	3		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns	1~3		OP.1		OP.1	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
SMTC configuration	1~3		SMTC.1	N/A	SMTC.1	N/A
DBT Window Configuration	1~3		N/A	DBT.1	N/A	DBT.1
reportConfigType	1~3		periodic		periodic	
reportQuantity	1~3		ssb-Index-RSRP		ssb-Index-RSRP	
Number of reported RS	1~3		2		2	
L1-RSRP reporting period	1~3		slot80		slot80	
EPRE ratio of PSS to SSS	1~3	dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
N_{oc} Note2 NR_FDD_FR1_A	1~3	dBm/15 kHz	-94.65		-94.65	-
NR_FDD_FR1_B						-
NR_TDD_FR1_C						-

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
	NR_FDD_FR1_D, NR_TDD_FR1_D						-
	NR_FDD_FR1_E						-
							-
	NR_FDD_FR1_G						-
	NR_FDD_FR1_H						-
							-
						-	-113
N_{oc} Note2	NR_FDD_FR1_A	1~3	dBm/SSB SCS	-91.65		-91.65	-
	NR_FDD_FR1_B						-
	NR_TDD_FR1_C						-
	NR_FDD_FR1_D, NR_TDD_FR1_D						-
	NR_FDD_FR1_E						-
							-
	NR_FDD_FR1_G						-
	NR_FDD_FR1_H						-
							-
						-	-110
$\hat{E}_s/I_{ot}$		1~3	dB	10		10	-3
SS-RSRP Note3	NR_FDD_FR1_A	1~3	dBm/SCS	-81.65		-81.65	-
	NR_FDD_FR1_B						-
	NR_TDD_FR1_C						-
	NR_FDD_FR1_D, NR_TDD_FR1_D						-
	NR_FDD_FR1_E						-
							-
	NR_FDD_FR1_G						-
	NR_FDD_FR1_H						-
							-
						-	-113
Io Note3	NR_FDD_FR1_A	1~3	dBm/ 38.16 MHz	-50.19		-50.19	-
	NR_FDD_FR1_B						-
	NR_TDD_FR1_C						-
	NR_FDD_FR1_D, NR_TDD_FR1_D						-
	NR_FDD_FR1_E						-
							-
	NR_FDD_FR1_G						-
	NR_FDD_FR1_H						-
							-
						-	-77.19
$\hat{E}_s/N_{oc}$		1~3	dB	10		10	-3
Propagation condition		1~3		AWGN		AWGN	
Antenna configuration		1~3		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. For cells with CCA model, OCNG is transmitted only in the slots with downlink transmission burst and is not transmitted during the muted slots or during DBT window.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.13.4.4.1.3 Test Requirements

In both Test 1 and Test 2, the L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 2 shall fulfil the requirements in clauses 10.1.33.1.

A.13.4.5 RSSI

A.13.4.5.1 Intra-frequency RSSI measurement accuracy on a carrier with CCA

A.13.4.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the RSSI measurement accuracy is within the specified limits. This test will partially verify the RSSI measurement accuracy requirements in section 10.1.34.1.

A.13.4.5.1.2 Test parameters

In all test cases, Cell 1 is the PCell on a licensed FR1 band and Cell 2 is the SCell with CCA. RSSI is measured on channel number 2. Supported test configurations are shown in table A.13.4.5.1.2-1. The accuracy of RSSI intra-frequency measurements is tested by using the parameters in A.13.4.5.1.2-2 and A.13.4.5.1.2-3.

Table A.13.4.5.1.2-1: Intra frequency RSSI supported test configurations

Configuration	Description
1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.13.4.5.1.2-2: RSSI Intra frequency test parameters

Parameter		Configurations	Unit	Test 1	
				Cell 1	Cell 2
RF Channel Number				1	2
$BW_{channel}$			MHz	40	40
SSB configuration	Semi-static channel access Note 1, 3	1,2,3		Configuration 1,2: SSB.1 FR1 Configuration 3: SSB.2 FR1	SSB.1 CCA
	Dynamic channel access Note 2, 3	1,2,3		Configuration 1,2: SSB.1 FR1 Configuration 3: SSB.2 FR1	SSB.2 CCA
P_{CCA_DL} for dynamic channel access Note 1,3		1,2,3		1	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75
P_{CCA_DL} for semi-static channel access Note 2,3		1,2,3		1	P_{CCA_DL}=0.9375
P_{CCA_UL}				1	1
DL CCA model				N/A	As specifieed in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth	
Channel access bandwidth			MHz	20	
DRX Cycle configuration			ms	Not Applicable	
PDSCH Reference measurement channel		1		SR.1.1 FDD	SR.1.1 CCA
		2,3		SR.1.1 TDD	
RMSI CORESET Reference Channel		1		CR.1.1 FDD	CR.1.1 CCA
		2,3		CR.1.1 TDD	
Dedicated CORESET Reference Channel		1		CCR.1.1 FDD	CCR.1.1 CCA
		2,3		CCR.1.1 TDD	
OCNG Patterns				OP.1	OP.1

Parameter	Configurations	Unit	Test 1	
			Cell 1	Cell 2
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106	-87
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-103.5	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-58.96
Propagation condition		-	AWGN	

NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy.
NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy.
NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.

Table A.13.4.5.1.2-3: RSSI RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.13.4.5.1.3 Test Requirements

The average RSSI measurement accuracy shall fulfil the requirements in sections 10.1.34.1. The nominal RSSI used to evaluate the requirement shall be based on Io in slots corresponding to RSSI measurement time configuration (RMTC).

A.13.4.5.2 Inter-frequency RSSI measurement accuracy on a carrier with CCA

A.13.4.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the RSSI measurement accuracy is within the specified limits. This test will partially verify the RSSI measurement accuracy requirements in section 10.1.34.2.

A.13.4.5.2.2 Test parameters

In all test cases, Cell 1 is the PCell on a licensed FR1 band and Cell 2 is the neighbour with CCA. RSSI is measured on channel number 2. Supported test configurations are shown in table A.13.4.5.2.2-1. The accuracy of RSSI inter-frequency measurements is tested by using the parameters in A.13.4.5.2.2-2 and A.13.4.5.2.3.

Table A.13.4.5.2.2-1: Inter frequency RSSI supported test configurations

Configuration	Description
1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.13.4.5.2.2-2: RSSI Inter frequency test parameters

Parameter		Configurations	Unit	Test 1	
				Cell 1	Cell 2
RF Channel Number				1	2
$BW_{channel}$			MHz	40	40
SSB configuration	Semi-static channel access Note 1, 3	1,2,3		Configuration 1,2: SSB.1 FR1 Configuration 3: SSB.2 FR1	SSB.1 CCA
	Dynamic channel access Note 2, 3	1,2,3		Configuration 1,2: SSB.1 FR1 Configuration 3: SSB.2 FR1	SSB.2 CCA
P_{CCA_DL} for dynamic channel access Note 1,3		1,2,3		1	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75
P_{CCA_DL} for semi-static channel access Note 2,3		1,2,3		1	P_{CCA_DL}=0.9375
P_{CCA_UL}				1	1
DL CCA model				N/A	As specifieed in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth	
Channel access bandwidth			MHz	20	
DRX Cycle configuration			ms	Not Applicable	
PDSCH Reference measurement channel		1		SR.1.1 FDD	NA
		2,3		SR.1.1 TDD	
RMSI CORESET Reference Channel		1		CR.1.1 FDD	NA
		2,3		CR.1.1 TDD	
Dedicated CORESET Reference Channel		1		CCR.1.1 FDD	NA
		2,3		CCR.1.1 TDD	
OCNG Patterns				OP.1	NA
EPRE ratio of PSS to SSS			dB	0	NA
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					

Parameter	Configurations	Unit	Test 1	
			Cell 1	Cell 2
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106	-87
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-103.5	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-58.96
Propagation condition		-	AWGN	
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.13.4.5.2.2-3: RSSI RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.13.4.5.2.3 Test Requirements

The average RSSI measurement accuracy shall fulfil the requirements in sections 10.1.34.2. The nominal RSSI used to evaluate the requirement shall be based on Io in slots corresponding to RSSI measurement time configuration (RMTC).

A.13.4.6 Channel occupancy

A.13.4.6.1 Intra-frequency channel occupancy measurement accuracy on SCC with CCA

A.13.4.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the channel occupancy measurement accuracy is within the specified limits. This test will partially verify the channel occupancy measurement accuracy requirements in section 10.1.35.1.

A.13.4.6.1.2 Test parameters

In all test cases, Cell 1 is the PCell on a licensed FR1 band and Cell 2 is the SCell with CCA. Channel occupancy is measured on channel number 2. Supported test configurations are shown in table A.13.4.6.1.2-1. The accuracy of channel occupancy intra-frequency measurements is tested by using the parameters in A.13.4.6.1.2-2 and A.13.4.6.1.2-3.

Table A.13.4.6.1.2-1: Intra frequency CO supported test configurations

Configuration	Description
1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.13.4.6.1.2-2: CO Intra frequency test parameters

Parameter		Configurations	Unit	Test 1	
				Cell 1	Cell 2
RF Channel Number				1	2
$BW_{channel}$			MHz	40	40
SSB configuration	Semi-static channel access Note 1, 3	1,2,3		Configuration 1,2: SSB.1 FR1 Configuration 3: SSB.2 FR1	SSB.1 CCA
	Dynamic channel access Note 2, 3	1,2,3		Configuration 1,2: SSB.1 FR1 Configuration 3: SSB.2 FR1	SSB.2 CCA
P_{CCA_DL} for dynamic channel access Note 1,3		1,2,3		1	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75
P_{CCA_DL} for semi-static channel access Note 2,3		1,2,3		1	P_{CCA_DL}=0.9375
P_{CCA_UL}				1	1
DL CCA model				N/A	As specifieed in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth	
Channel access bandwidth			MHz	20	
DRX Cycle configuration			ms	Not Applicable	
PDSCH Reference measurement channel		1		SR.1.1 FDD	SR.1.1 CCA
		2,3		SR.1.1 TDD	
RMSI CORESET Reference Channel		1		CR.1.1 FDD	CR.1.1 CCA
		2,3		CR.1.1 TDD	
Dedicated CORESET Reference Channel		1		CCR.1.1 FDD	CCR.1.1 CCA
		2,3		CCR.1.1 TDD	
OCNG Patterns				OP.1	OP.1
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					

Parameter	Configurations	Unit	Test 1	
			Cell 1	Cell 2
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106	-106
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106	-87
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-103.5	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-58.96
Propagation condition		-	AWGN	
channelOccupancyThreshold		dBm	-83	
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.13.4.6.1.2-3: CO RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.13.4.6.1.3 Test Requirements

The nominal reported *channelOccupancy* shall be 100 %. At least 90 % of channel occupancy reports made by the UE shall indicate this value.

A.13.4.6.2 Inter-frequency channel occupancy measurement accuracy on a carrier with CCA

A.13.4.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the channel occupancy measurement accuracy is within the specified limits. This test will partially verify the channel occupancy measurement accuracy requirements in section 10.1.35.2.

A.13.4.6.2.2 Test parameters

In all test cases, Cell 1 is the PCell on a licensed FR1 band and Cell 2 is the neighbour with CCA. Channel occupancy is measured on channel number 2. Supported test configurations are shown in table A.13.4.6.2.2-1. The accuracy of channel occupancy inter-frequency measurements is tested by using the parameters in A.13.4.6.2.2-2 and A.13.4.6.2.3.

Table A.13.4.6.2.2-1: Inter frequency CO supported test configurations

Configuration	Description
1	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
2	Without CCA: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
3	Without CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode With CCA: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.13.4.6.2.2-2: CO Inter frequency test parameters

Parameter		Configurations	Unit	Test 1	
				Cell 1	Cell 2
RF Channel Number				1	2
$BW_{channel}$			MHz	40	40
SSB configuration	Semi-static channel access Note 1, 3	1,2,3		Configuration 1,2: SSB.1 FR1 Configuration 3: SSB.2 FR1	SSB.1 CCA
	Dynamic channel access Note 2, 3	1,2,3		Configuration 1,2: SSB.1 FR1 Configuration 3: SSB.2 FR1	SSB.2 CCA
P_{CCA_DL} for dynamic channel access Note 1,3		1,2,3		1	$P_{CCA_DL_1}$=0.75 $P_{CCA_DL_2}$=0.75
P_{CCA_DL} for semi-static channel access Note 2,3		1,2,3		1	P_{CCA_DL}=0.9375
P_{CCA_UL}				1	1
DL CCA model				N/A	As specified in A.3.26.2.1
UL CCA model				N/A	As specified in A.3.26.2.2
Measurement bandwidth			n_{PRB}	Same as channel access bandwidth	
Channel access bandwidth			MHz	20	
DRX Cycle configuration			ms	Not Applicable	
PDSCH Reference measurement channel		1		SR.1.1 FDD	NA
		2,3		SR.1.1 TDD	
RMSI CORESET Reference Channel		1		CR.1.1 FDD	NA
		2,3		CR.1.1 TDD	
Dedicated CORESET Reference Channel		1		CCR.1.1 FDD	NA
		2,3		CCR.1.1 TDD	
OCNG Patterns				OP.1	NA
EPRE ratio of PSS to SSS			dB	0	NA
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} in slots not corresponding to RSSI measurement time configuration (RMTC)			dBm/SCS	-106	-106

Parameter	Configurations	Unit	Test 1	
			Cell 1	Cell 2
N_{oc} in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-106	-87
$\hat{E}_s/I_{ot}$ in slots not corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	2.5
$\hat{E}_s/I_{ot}$ in slots corresponding to RSSI measurement time configuration (RMTC)		dB	2.5	-Infinity
SS-RSRP in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/SCS	-103.5	-103.5
SS-RSRP in slots corresponding to RSSI measurement time configuration (RMTC)			-103.5	-Infinity
Io within measurement bandwidth in slots not corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-77.96
Io within measurement bandwidth in slots corresponding to RSSI measurement time configuration (RMTC)		dBm/measBW	-77.96	-58.96
Propagation condition		-	AWGN	
channelOccupancyThreshold		dBm	-83	
NOTE 1: For UE supporting semi-static channel access and network configuring semi-static channel occupancy. NOTE 2: For UE supporting dynamic channel access and network configuring dynamic channel occupancy. NOTE 3: For a UE supporting both semi-static and dynamic channel access, the UE can be tested under dynamic channel occupancy only.				

Table A.13.4.6.2.2-3: CO RMTC parameters

measDurationSymbols-r16	sym14or12
rmtc-Periodicity-r16	ms40
rmtc-SubframeOffset-r16	20
ref-SCS-CP-r16	kHz15
ReportInterval	ms120

A.13.4.6.2.3 Test Requirements

The nominal reported *channelOccupancy* shall be 100 %. At least 90 % of channel occupancy reports made by the UE shall indicate this value.

A.14 NR standalone tests for Satellite access

A.14.1 RRC_IDLE state mobility

A.14.1.1 Cell reselection to FR1 intra-frequency NR case

A.14.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for satellite access specified in clause 4.2C.2.3.

A.14.1.1.2 Test Parameters

The test scenario comprises of 2 cells on 1 NR carrier configured each in a different satellite as given in tables A.14.1.1.2-1, A.14.1.1.2-2 and A.14.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.14.1.1.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.1.1.2-2: General test parameters for intra frequency NR cell re-selection test case

Parameter		Unit	Value	Comment
Initial condition	Active cell		Cell 1	
T2 end condition	Active cell		Cell 2	
	Neighbour cells		Cell 1	
Final condition	Active cell		Cell 1	
	Neighbour cells		Cell 2	
RF Channel Number			1	
Time offset between cells			3 ms	Asynchronous cells
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1.28	The value shall be used for all cells in the test.
PRACH configuration index			102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell			Not configured	
T1		s	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	40 (NOTE 1)	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3		s	15 (NOTE 1)	T3 needs to be defined so that cell re-selection reaction time is taken into account.
NOTE 1: If the test is performed in a NGSO configuration, and the scaling factor K_{multi_SMTC} defined in clause 4.2C.2.3 is greater than 1, according to UE capabilities, the duration of times T2 and T3 shall be scaled for the same factor to allow the UE to complete the cell reselection within the duration of the test case.				

Table A.14.1.1.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
Satellite information		SSC.1 for Config 1 SSC.2 for Config 2			NSC.1 for Config 1 NSC.2 for Config 2		
PDSCH RMC configuration		SR.1.1 FDD			SR.1.1 FDD		
RMSI CORESET configuration		CR.1.1 FDD			CR.1.1 FDD		
Dedicated CORESET configuration		CCR.1.1 FDD			CCR.1.1 FDD		
OCNG Pattern		OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		ULBWP.0.1			ULBWP.0.1		
SSB configuration		SSB.1 FR1			SSB.5 FR1		

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
SMTC configuration		#1: SMTC.2 for Cell 1 #2: SMTC.5 for Cell 2			#1: SMTC.6 for Cell 1 #2: SMTC.2 for Cell 2		
RLM-RS		SSB			SSB		
Qrxlevmin	dBm/SCS	-130			-130		
Pcompensation	dB	0			0		
$Qhyst_s$	dB	0			0		
$Qoffset_{s,n}$	dB	0			0		
Cell_selection_and_ reselection_quality_measurement		SS-RSRP			SS-RSRP		
$\hat{E}_s/I_{ot}$	dB	16	-3.11	2.79	-infinity	2.79	-3.11
N_{oc} Note2	dBm/SCS	-98					
N_{oc} Note2	dBm/15 kHz	-98					
$\hat{E}_s/N_{oc}$	dB	16	13	16	-infinity	16	13
SS-RSRP Note3	dBm/SCS	-82	-85	-82	-infinity	-82	-85
Io	dBm/9.36 MHz	-53.94	-52.21	-52.21	Same as parameters specified in Cell 1 columns-		
Treselection	s	0	0	0	0	0	0
SintrasearchP	dB	60			60		
Propagation Condition		AWGN					

A.14.1.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than:

34 s if K_{multi_SMTC} is equal to 1 (see note on Table A.14.1.1.2-2); or

66 s if K_{multi_SMTC} is equal to 2.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to an already detected cell shall be less than:

8 s if K_{multi_SMTC} is equal to 1 (see note on Table A.14.1.1.2-2); or

14.5 s if K_{multi_SMTC} is equal to 2.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $K_{multi_SMTC} * T_{detect,\ NR_Intra} + T_{SI-NR}$, and to an already detected cell can be expressed as: $K_{multi_SMTC} * T_{evaluate,\ NR_intra} + T_{SI-NR}$,

Where:

$T_{detect,\ NR_Intra}$ See Table 4.2C.2.3-1 in clause 4.2C.2.3

$T_{evaluate,\ NR_intra}$ See Table 4.2C.2.3-1 in clause 4.2C.2.3

K_{multi_SMTC} is described in clause 4.2C.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case provided that SIB1 and SIB19 are scheduled with 20 ms period and 80 ms period, respectively.

If K_{multi_SMTC} = 1, K_{multi_SMTC} *$T_{evaluate, NR_Intra}$ + T_{SI-NR} = 7.68 s; allow 8 s. And K_{multi_SMTC} *$T_{detect, NR_ intra}$ + T_{SI-NR} = 33.28 s, allow 34 s.

If K_multi_SMTC = 2, K_{multi_SMTC} *$T_{evaluate, NR_Intra}$ + T_{SI-NR} = 14.08 s; allow 14.5 s. And K_{multi_SMTC} *$T_{detect, NR_ intra}$ + T_{SI-NR} = 65.28 s, allow 66 s.

A.14.1.2 Cell reselection to FR1 intra-frequency NR cell for UE configured with the feature for enhanced requirements

A.14.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for satellite access specified in clause 4.2C.2.3.

A.14.1.2.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.14.1.2.2-1, A.14.1.2.2-2 and A.14.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. The flag *enhancedMeasurementNGSO-r17* should be set.

Table A.14.1.2.2-1: Supported test configurations

Configuration	Description
1	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz

Table A.14.1.2.2-2: General test parameters for intra frequency NR cell re-selection test case

Parameter		Unit	Value	Comment
Initial condition	Active cell		Cell 1	
T2 end condition	Active cell		Cell 2	
	Neighbour cells		Cell 1	
Final condition	Active cell		Cell 1	
	Neighbour cells		Cell 2	
RF Channel Number			1	
Time offset between cells			3 ms	Asynchronous cells
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1.28	The value shall be used for all cells in the test.
PRACH configuration index			102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell			Not configured	
T1		s	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	40 (NOTE 1)	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3		s	15 (NOTE 1)	T3 needs to be defined so that cell re-selection reaction time is taken into account.
NOTE 1: If the test is performed in a NGSO configuration, and the scaling factor K_{multi_SMTC} defined in clause 4.2C.2.3 is greater than 1, according to UE capabilities, the duration of times T2 and T3 shall be scaled for the same factor to allow the UE to complete the cell reselection within the duration of the test case.				

Table A.14.1.2.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
Satellite information		SSC.2 for Config 1			NSC.2 for Config 1		
PDSCH RMC configuration		SR.1.1 FDD			SR.1.1 FDD		
RMSI CORESET configuration		CR.1.1 FDD			CR.1.1 FDD		
Dedicated CORESET configuration		CCR.1.1 FDD			CCR.1.1 FDD		
OCNG Pattern		OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		ULBWP.0.1			ULBWP.0.1		
SSB configuration		SSB.1 FR1			SSB.5 FR1		
SMTC configuration		#1: SMTC.2 for Cell 1 #2: SMTC.5 for Cell 2			#1: SMTC.6 for Cell 1 #2: SMTC.2 for Cell 2		
RLM-RS		SSB			SSB		
Qrxlevmin	dBm/SCS	-130			-130		
Pcompensation	dB	0			0		
$Qhyst_s$	dB	0			0		
$Qoffset_{s,n}$	dB	0			0		
Cell_selection_and_ reselection_quality_measurement		SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	16	-3.11	2.79	-infinity	2.79	-3.11
N_{oc} Note2	dBm/SCS	-98					
N_{oc} Note2	dBm/15 kHz	-98					
$\hat{E}_s / N_{oc}$	dB	16	13	16	-infinity	16	13
SS-RSRP Note3	dBm/SCS	-82	-85	-82	-infinity	-82	-85
Io	dBm/9.36 MHz	-53.94	-52.21	-52.21	Same as parameters specified in Cell 1 columns-		
Treselection	s	0	0	0	0	0	0
SintrasearchP	dB	60			60		
Propagation Condition		AWGN					

A.14.1.2.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than:

11 s if K_{multi_SMTC} is equal to 1 (see note on Table A.14.1.2.2-2); or

20 s if K_{multi_SMTC} is equal to 2.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to an already detected cell shall be less than:

6 s if K_{multi_SMTC} is equal to 1 (see note on Table A.14.1.2.2-2); or

9 s if K_{multi_SMTC} is equal to 2.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $K_{multi_SMTC} * T_{detect,\ NR_Intra_enh} + T_{SI\text{-}NR}$, and to an already detected cell can be expressed as: $K_{multi_SMTC} * T_{evaluate,\ NR_intra_enh} + T_{SI\text{-}NR}$,

Where:

T_{detect, NR_Intra_enh} See Table 4.2C.2.3-2 in clause 4.2C.2.3

$T_{evaluate, NR_Intra_enh}$ See Table 4.2C.2.3-2 in clause 4.2C.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case provided that SIB1 and SIB19 are scheduled with 20 ms period and 80 ms period, respectively.

If $K_{multi_SMTC} = 1$, $K_{multi_SMTC} * T_{evaluate, NR_Intra_enh} + T_{SI-NR} = 5.12$ s; allow 6 s. And $K_{multi_SMTC} * T_{detect, NR_Intra_enh} + T_{SI-NR} = 10.24$ s, allow 11 s.

If K_multi_SMTC = 2, $K_{multi_SMTC} * T_{evaluate, NR_Intra_enh} + T_{SI-NR} = 8.96$ s; allow 9 s. And $K_{multi_SMTC} * T_{detect, NR_Intra_enh} + T_{SI-NR} = 19.2$ s, allow 20 s.

A.14.1.3 Time-based measurement initiation to FR1 intra-frequency NR cell reselection

A.14.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for satellite access specified in clause 4.2C.2.3.

A.14.1.3.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.14.1.a3.2-1, A.14.1.a3.2-2 and A.14.1.a3.2-3. The test consists of two successive time periods, with time duration of T1 and T2, respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. t-Service broadcasted in SIB19 of Cell 1 is set to the time point that is 36 s after start of T2.

Table A.14.1.3.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.1.3.2-2: General test parameters for intra frequency NR cell re-selection test case

Parameter		Unit	Value	Comment
Initial condition	Active cell		Cell 1	
T2 end condition	Active cell		Cell 2	
	Neighbour cells		Cell 1	
RF Channel Number			1	
Time offset between cells			3 ms	Asynchronous cells
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1.28	The value shall be used for all cells in the test.
PRACH configuration index			102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell			Not configured	
T1		s	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	40 (NOTE 1)	T2 needs to be defined so that cell re-selection reaction time is taken into account.

NOTE 1: If the test is performed in a NGSO configuration, and the scaling factor K_{multi_SMTC} defined in clause 4.2C.2.3 is greater than 1, according to UE capabilities, the duration of time T2 shall be scaled for the same factor to allow the UE to complete the cell reselection within the duration of the test case.

Table A.14.1.3.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
Satellite information		SSC.1 for Config 1 SSC.2 for Config 2		NSC.1 for Config 1c NSC.2 for Config 2	
PDSCH RMC configuration		SR.1.1 FDD		SR.1.1 FDD	
RMSI CORESET configuration		CR.1.1 FDD		CR.1.1 FDD	
Dedicated CORESET configuration		CCR.1.1 FDD		CCR.1.1 FDD	
OCNG Pattern		OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		ULBWP.0.1		ULBWP.0.1	
SSB configuration		SSB.1 FR1		SSB.1 FR1	
SMTC configuration		#1: SMTC.2 for Cell 1 and Cell 2		#1: SMTC.6 for Cell 1 and Cell 2	
RLM-RS		SSB		SSB	
Qrxlevmin	dBm/SCS	-130		-130	
Pcompensation	dB	0		0	
$Qhyst_s$	dB	0		0	
$Qoffset_{s,n}$	dB	0		0	
Cell_selection_and_ reselection_quality_measurement		SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	16	-3.11	-infinity	2.79
N_{oc} Note2	dBm/SCS	-98			
N_{oc} Note2	dBm/15 kHz	-98			
$\hat{E}_s / N_{oc}$	dB	16	13	-infinity	16
SS-RSRP Note3	dBm/SCS	-82	-85	-infinity	-82
Io	dBm/9.36 MHz	-53.94	-52.21	Same as parameters specified in Cell 1 columns-	
Treselection	s	0	0	0	0
SintrasearchP	dB	40		40	
Propagation Condition		AWGN			

A.14.1.3.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than :

36 s if K_{multi_SMTC} is equal to 1 (see note on Table A.14.1.3.2-2); or

66 s if K_{multi_SMTC} is equal to 2.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $K_{multi_SMTC} * T_{detect,\ NR_Intra} + T_{SI-NR}$,

Where:

$T_{detect,\ NR_Intra}$ See Table 4.2C.2.3-1 in clause 4.2C.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case provided that SIB1 and SIB19 are scheduled with 20 ms period and 80 ms period, respectively.

If $K_{multi_SMTC} = 1$, $K_{multi_SMTC} * T_{detect, NR_ intra} + T_{SI-NR} = 33.28$ s, allow 34 s.

If $K_{multi_SMTC} = 2$, $K_{multi_SMTC} * T_{detect, NR_ intra} + T_{SI-NR} = 65.28$ s, allow 66 s.

A.14.1.4 Location-based measurement initiation to FR1 intra-frequency NR cell reselection

A.14.1.4.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for satellite access specified in clause 4.2C.2.3.

A.14.1.4.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.14.1.a4.2-1, A.14.1.a4.2-2 and A.14.1.a4.2-3. The test consists of two successive time periods, with time duration of T1 and T2, respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

At 4 s after the start of T2, the UE location is changed such that the distance to the reference location broadcasted in SIB19 of Cell 1 is exceeded by the configured value in *distanceThresh* plus 50m.

Table A.14.1.4.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.1.4.2-2: General test parameters for intra frequency NR cell re-selection test case

Parameter		Unit	Value	Comment
Initial condition	Active cell		Cell 1	
T2 end condition	Active cell		Cell 2	
	Neighbour cells		Cell 1	
RF Channel Number			1	
Time offset between cells			3 ms	Asynchronous cells
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1.28	The value shall be used for all cells in the test.
PRACH configuration index			102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell			Not configured	
T1		s	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	40 (NOTE 1)	T2 needs to be defined so that cell re-selection reaction time is taken into account.
NOTE 1: If the test is performed in a NGSO configuration, and the scaling factor K_{multi_SMTC} defined in clause 4.2C.2.3 is greater than 1, according to UE capabilities, the duration of time T2 shall be scaled for the same factor to allow the UE to complete the cell reselection within the duration of the test case.				

Table A.14.1.4.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
Satellite information		SSC.1 for Config 1 SSC.2 for Config 2		NSC.1 for Config 1 NSC.2 for Config 2	
PDSCH RMC configuration		SR.1.1 FDD		SR.1.1 FDD	
RMSI CORESET configuration		CR.1.1 FDD		CR.1.1 FDD	
Dedicated CORESET configuration		CCR.1.1 FDD		CCR.1.1 FDD	
OCNG Pattern		OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		ULBWP.0.1		ULBWP.0.1	
SSB configuration		SSB.1 FR1		SSB.1 FR1	
SMTC configuration		#1: SMTC.2 for Cell 1 and Cell 2		#1: SMTC.6 for Cell 1 and Cell 2	
RLM-RS		SSB		SSB	
Qrxlevmin	dBm/SCS	-130		-130	
Pcompensation	dB	0		0	
$Qhyst_s$	dB	0		0	
$Qoffset_{s,n}$	dB	0		0	
Cell_selection_and_ reselection_quality_measurement		SS-RSRP		SS-RSRP	
$\hat{E}_s/I_{ot}$	dB	16	-3.11	-infinity	2.79
N_{oc} Note2	dBm/SCS	-98			
N_{oc} Note2	dBm/15 kHz	-98			
$\hat{E}_s/N_{oc}$	dB	16	13	-infinity	16
SS-RSRP Note3	dBm/SCS	-82	-85	-infinity	-82
Io	dBm/9.36 MHz	-53.94	-52.21	Same as parameters specified in Cell 1 columns-	
Treselection	s	0	0	0	0
SintrasearchP	dB	40		40	
Propagation Condition		AWGN			

A.14.1.4.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than:

34 s if K_{multi_SMTC} is equal to 1 (see note on Table A.14.1.3.2-2); or

66 s if K_{multi_SMTC} is equal to 2.

The UE starts searching for the cell only after 4 s after the start of T2 when the UE location is changed such that the distance to the reference location broadcasted in SIB19 of Cell 1 is exceeded by the configured value in *distanceThresh* plus 50m. Consideing that the cell re-selection delay to a newly detectable cell shall be less than 38 s if K_{multi_SMTC} is equal to 1 or 70 s if K_{multi_SMTC} is equal to 2.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $K_{multi_SMTC} * T_{detect,\ NR_Intra} + T_{SI-NR}$, and to an already detected cell can be expressed as: $K_{multi_SMTC} * T_{evaluate,\ NR_intra} + T_{SI-NR}$,

Where:

$T_{detect,\ NR_Intra}$ See Table 4.2C.2.3-1 in clause 4.2C.2.3

$T_{evaluate,\ NR_intra}$ See Table 4.2C.2.3-1 in clause 4.2C.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case provided that SIB1 and SIB19 are scheduled with 20 ms period and 80 ms period, respectively.

If $K_{multi_SMTC} = 1$, $K_{multi_SMTC} * T_{detect,\ NR_\ intra} + T_{SI-NR} = 33.28$ s, allow 34 s.

If $K_{multi_SMTC} = 2$, $K_{multi_SMTC} * T_{detect,\ NR_\ intra} + T_{SI-NR} = 65.28$ s, allow 66 s.

A.14.1.5 Cell reselection to FR1 inter-frequency NR case

A.14.1.5.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements for satellite access specified in clause 4.2C.2.4.

A.14.1.5.2 Test Parameters

The test scenario comprises of 2 NR carriers and 2 cells as given in tables A.14.1.5.2-1, A.14.1.5.2-2 and A.14.1.5.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.14.1.5.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.1.5.2-2: General test parameters for inter frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 2	The UE camps on Cell 2 in the initial phase and during T1 period the UE reselects to Cell 1
	Neighbour cell		1, 2	Cell 1	
T1 end condition	Active cell		1, 2	Cell 1	The UE shall perform reselection to Cell 1 during T1
	Neighbour cells		1, 2	Cell 2	
T3 end condition	Active cell		1, 2	Cell 2	The UE shall perform reselection to Cell 2 during T3
	Neighbour cells		1, 2	Cell 1	
RF Channel Number			1, 2	1	
Time offset between cells			1, 2	3 ms	Asynchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SSB configuration			1, 2	SSB.1 FR1	
SMTC configuration#1			1, 2	SMTC.2	Configured in SIB2 of Cell 1
				SMTC.6	Configured in SIB2 of Cell 2
SMTC configuration#2			1, 2	SMTC.2	Configured in SIB2 of Cell 1
				SMTC.6	Configured in SIB2 of Cell 2
DRX cycle length		s	1, 2	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	

Parameter	Unit	Test configuration	Value	Comment
T1	s	1, 2	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2	s	1, 2	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3	s	1, 2	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.14.1.5.2-3: Cell specific test parameters for inter frequency NR cell re-selection test case

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Satellite information		1	SSC.1			SSC.1		
		2	SSC.2			SSC.2		
PDSCH RMC configuration		1, 2	SR.1.1 FDD			SR.1.1 FDD		
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD			CR.1.1 FDD		
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD			CCR.1.1 FDD		
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-140			-140		
Pcompensation	dB	1, 2	0			0		
$Qhyst_s$	dB	1, 2	0			0		
$Qoffset_{s,n}$	dB	1, 2	0			0		
Cell_selection_and_reselection_quality_measurement		1, 2	SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1, 2	14	14	14	-4	-infinity	12
N_{oc} Note2	dBm/SCS	1, 2	-98					
N_{oc} Note2	dBm/15 kHz	1, 2	-98					
$\hat{E}_s / N_{oc}$	dB	1, 2	14	14	14	-4	-infinity	12
SS-RSRP Note3	dBm/SCS	1, 2	-84	-84	-84	-102	-infinity	86
Io	dBm/9.36 MHz	1, 2	-55.88	-55.88	-55.88	-68.60	-70.05	-57.78
Treselection	s	1, 2	0	0	0	0	0	0
$S_{nonIntraSearchP}$	dB	1, 2	50			50		
$Thresh_{x,highP}$	dB	1, 2	48			48		
$Thresh_{serving,lowP}$	dB	1, 2	44			44		
$Thresh_{x,lowP}$	dB	1, 2	50			50		
Propagation Condition		1, 2	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.1.5.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps again on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate,\ NR_\ inter} + T_{SI\text{-}NR}$, and to a lower priority cell can be expressed as: $T_{evaluate,\ NR_\ inter} + T_{SI\text{-}NR}$,

Where:

$T_{higher_priority_search}$ See clause 4.2C.2.9

$T_{evaluate,\ NR_\ inter}$ See tables 4.2C.2.4-1 in clause 4.2C.2.4

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority

A.14.1.6 Cell re-selection to FR1 inter-frequency NR cell for UE configured with feature for enhanced requirements

A.14.1.6.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell re-selection requirements for satellite access specified in clause 4.2C.2.4.

A.14.1.6.2 Test Parameters

The test scenario comprises of 2 NR carriers and 2 cells as given in tables A.14.1.6.2-1, A.14.1.6.2-2 and A.14.1.6.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3, respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1. Furthermore, UE has not registered with network for the tracking area containing cell 2. The flag *enhancedMeasurementNGSO-r17* should be set.

Table A.14.1.6.2-1: Supported test configurations

Configuration	Description
1	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz

Table A.14.1.6.2-2: General test parameters for inter frequency NR cell re-selection test case

Parameter		Unit	Value	Comment
Initial condition	Active cell		Cell 1	
T2 end condition	Active cell		Cell 2	
	Neighbour cells		Cell 1	
Final condition	Active cell		Cell 1	
	Neighbour cells		Cell 2	
RF Channel Number			1, 2	

Parameter	Unit	Value	Comment
Time offset between cells		3 ms	Asynchronous cells
Access Barring Information	-	Not Sent	No additional delays in random access procedure.
SSB configuration		SSB.1 FR1	
SMTC configuration#1		SMTC.2	Configured in SIB2 of Cell 1
		SMTC.6	Configured in SIB2 of Cell 2
SMTC configuration#2		SMTC.2	Configured in SIB2 of Cell 1
		SMTC.6	Configured in SIB2 of Cell 2
DRX cycle length	s	1.28	The value shall be used for all cells in the test.
PRACH configuration index		102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell		Not configured	
T1	s	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2	s	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3	s	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.14.1.6.2-3: Cell specific test parameters for inter frequency NR cell re-selection test case

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
Satellite information		SSC.2 for Config 1			SSC.2 for Config 1		
PDSCH RMC configuration		SR.1.1 FDD			SR.1.1 FDD		
RMSI CORESET RMC configuration		CR.1.1 FDD			CR.1.1 FDD		
Dedicated CORESET RMC configuration		CCR.1.1 FDD			CCR.1.1 FDD		
OCNG Pattern		OP.1			OP.1		
Initial DL BWP configuration		DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		ULBWP.0.1			ULBWP.0.1		
RLM-RS		SSB			SSB		
Qrxlevmin	dBm/SCS	-130			-130		
Pcompensation	dB	0			0		
$Qhyst_s$	dB	0			0		
$Qoffset_{s,n}$	dB	0			0		
Cell_selection_and_ reselection_quality_measurement		SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	14	14	14	-4	-infinity	12
N_{oc} Note2	dBm/SCS	-98					
N_{oc} Note2	dBm/15 kHz	-98					
$\hat{E}_s / N_{oc}$	dB	14	14	14	-4	-infinity	12
SS-RSRP Note3	dBm/SCS	-84	-84	-84	-102	-infinity	-86
Io	dBm/9.36 MHz	-55.88	-55.88	-55.88	-68.60	-70.05	-57.78
Treselection	s	0	0	0	0	0	0
$S_{nonIntrasearchP}$	dB	50			50		
$Thresh_{x,highP}$	dB	48			48		
$Thresh_{serving,lowP}$	dB	44			44		
$Thresh_{x,lowP}$	dB	50			50		
Propagation Condition		AWGN					

Parameter	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							

A.14.1.6.3 Test Requirements

The cell re-selection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps again on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 66 s.

The cell re-selection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to a lower priority cell shall be less than 6 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate,\ NR_inter_enh} + T_{SI\text{-}NR}$, and to a lower priority cell can be expressed as: $T_{evaluate,\ NR_inter_enh} + T_{SI\text{-}NR}$,

Where:

$T_{higher_priority_search}$ See clause 4.2C.9

$T_{evaluate,\ NR_inter_enh}$ See tables 4.2C.2.4-2 in clause 4.2C.2.4

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 65.12 s, allow 66 s for the cell re-selection delay to a higher priority

A.14.1.7 Time-based measurement initiation to FR1 inter-frequency cell reselection

A.14.1.7.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements for satellite access specified in clause 4.2C.2.4.

A.14.1.7.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.14.1.7.2-1, A.14.1.7.2-2 and A.14.1.7.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. t-Service broadcasted in SIB19 of Cell 1 is set to the time point that is 36 s after start of T2.

Table A.14.1.7.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz

Note:	If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.

Table A.14.1.7.2-2: General test parameters for inter frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	
T2 end condition	Active cell		1, 2	Cell 2	
	Neighbour cells		1, 2	Cell 1	
RF Channel Number			1, 21	1	
Time offset between cells			1, 2	3 ms	Asynchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	1, 2	40	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.14.1.7.2-3: Cell specific test parameters for inter frequency NR cell re-selection test case

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
Satellite information		SSC.1 for Config 1 SSC.2 for Config 2		NSC.1 for Config 1 NSC.2 for Config 2	
PDSCH RMC configuration		SR.1.1 FDD		SR.1.1 FDD	
RMSI CORESET configuration		CR.1.1 FDD		CR.1.1 FDD	
Dedicated CORESET configuration		CCR.1.1 FDD		CCR.1.1 FDD	
OCNG Pattern		OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		ULBWP.0.1		ULBWP.0.1	
SSB configuration		SSB.1 FR1		SSB.1 FR1	
SMTC configuration		#1: SMTC.2 for Cell 1 #2: SMTC.6 for Cell 2		#1: SMTC.2 for Cell 1 #2: SMTC.6 for Cell 2	
RLM-RS		SSB		SSB	
Qrxlevmin	dBm/SCS	-130		-130	
Pcompensation	dB	0		0	
$Qhyst_s$	dB	0		0	
$Qoffset_{s,n}$	dB	0		0	
Cell_selection_and_ reselection_quality_measurement		SS-RSRP		SS-RSRP	
$\hat{E}_s/I_{ot}$	dB	16	13	-infinity	16
N_{oc} Note2	dBm/SCS	-98			
N_{oc} Note2	dBm/15 kHz	-98			
$\hat{E}_s/N_{oc}$	dB	16	13	-infinity	16
SS-RSRP Note3	dBm/SCS	-82	-85	-infinity	-82
Io	dBm/9.36 MHz	-53.94	-56.84	-70.05	-53.94
Treselection	s	0	0	0	0

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
$S_{nonIntrasearchP}$	dB	50		50	
$Thresh_{x, highP}$	dB	48		48	
$Thresh_{serving, lowP}$	dB	54		44	
$Thresh_{x, lowP}$	dB	50		40	
Propagation Condition		AWGN			

A.14.1.7.3 Test Requirements

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a lower priority cell shall be less than 36 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, NR_ inter} + T_{SI-NR}$,

Where:

$T_{evaluate, NR_ inter}$ See Table 4.2C.2.4-1 in clause 4.2C.2.4

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case provided that SIB1 and SIB19 are scheduled with 80 ms period.

A.14.1.8 Location-based measurement initiation to FR1 inter-frequency NR cell reselection

A.14.1.8.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements for satellite access specified in clause 4.2C.2.4.

A.14.1.8.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.14.1.8.2-1, A.14.1.8.2-2 and A.14.1.8.2-3. The test consists of two successive time periods, with time duration of T1and T2, respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.At 4 s after the start of T2, the UE location is changed such that the distance to the reference location broadcasted in SIB19 of Cell 1 is exceeded by the configured value in *distanceThresh* plus 50m.

Table A.14.1.8.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.1.8.2-2: General test parameters for inter frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	
T2 end condition	Active cell		1, 2	Cell 2	

Neighbour cells		1, 2	Cell 1	
RF Channel Number		1, 2	1	
Time offset between cells		1, 2	3 ms	Asynchronous cells
Access Barring Information	-	1, 2	Not Sent	No additional delays in random access procedure.
DRX cycle length	s	1, 2	1.28	The value shall be used for all cells in the test.
PRACH configuration index		1, 2	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell		1, 2	Not configured	
T1	s	1, 2	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2	s	1, 2	40	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.14.1.8.2-3: Cell specific test parameters for inter frequency NR cell re-selection test case

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
Satellite information		SSC.1 for Config 1 SSC.2 for Config 2		NSC.1 for Config 1 NSC.2 for Config 2	
PDSCH RMC configuration		SR.1.1 FDD		SR.1.1 FDD	
RMSI CORESET configuration		CR.1.1 FDD		CR.1.1 FDD	
Dedicated CORESET configuration		CCR.1.1 FDD		CCR.1.1 FDD	
OCNG Pattern		OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		ULBWP.0.1		ULBWP.0.1	
SSB configuration		SSB.1 FR1		SSB.1 FR1	
SMTC configuration		#1: SMTC.2 for Cell 1 #2: SMTC.6 for Cell 2		#1: SMTC.2 for Cell 1 #2: SMTC.6 for Cell 2	
RLM-RS		SSB		SSB	
Qrxlevmin	dBm/SCS	-130		-130	
Pcompensation	dB	0		0	
$Qhyst_s$	dB	0		0	
$Qoffset_{s,n}$	dB	0		0	
Cell_selection_and_ reselection_quality_measurement		SS-RSRP		SS-RSRP	
$\hat{E}_s/I_{ot}$	dB	16	13	-infinity	16
N_{oc} Note2	dBm/SCS	-98			
N_{oc} Note2	dBm/15 kHz	-98			
$\hat{E}_s/N_{oc}$	dB	16	13	-infinity	16
SS-RSRP Note3	dBm/SCS	-82	-85	-infinity	-82
Io	dBm/9.36 MHz	-53.94	-56.84	-70.05	-53.94
Treselection	s	0	0	0	0
$S_{nonIntrasearchP}$	dB	50		50	
$Thresh_{x,highP}$	dB	48		48	
$Thresh_{serving,lowP}$	dB	54		44	
$Thresh_{x,lowP}$	dB	50		40	
Propagation Condition		AWGN			

A.14.1.8.3 Test Requirements

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a lower priority cell shall be less than 36 s.The UE starts searching for the cell only after 4 s after the start of T2 when the UE location is changed such that the distance to the reference location broadcasted in SIB19 of Cell 1 is exceeded by the configured value in *distanceThresh* plus 50m. Consideing that the cell re-selection delay to a newly detectable cell shall be less than 40 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, NR_ inter} + T_{SI-NR}$,

Where:

$T_{evaluate, NR_ inter}$ See Table 4.2C.2.4-1 in clause 4.2C.2.4

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case provided that SIB1 and SIB19 are scheduled with 80 ms period.

A.14.1.9 Cell reselection to FR1 inter-frequency NR case for UE fulfilling low mobility relaxed measurement criterion

A.14.1.9.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2C.2.8, for UEs that support *Relaxed cell reselection on GSO feature*, as defined in clause 5.4 in 38.306 [14], and fulfilling low mobility relaxed measurement criterion.

A.14.1.9.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.14.1.9.2-1, A.14.1.9.2-2 and A.14.1.9.2-3. The test consists of two successive time periods, with time duration of T1 and T2, respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

As specified in the Test Purpose, the UE is configured with the relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in TS 38.304 [1]. So, Cell 2 and Cell 1 configure the UE as follows:

lowMobilityEvalutation TS 38.331 [2] criterion is configured according to the parameters listed in table A.14.1.9.2-3;

cellEdgeEvaluation TS 38.331 [2] criterion is not configured;

combineRelaxedMeasCondition TS 38.331 [2] is not configured;

Table A.14.1.9.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz

Table A.14.1.9.2-2: General test parameters for FR1 inter frequency NR cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell 2	The UE camps on Cell 2 in the initial phase, it fulfills Low Mobility relaxation measurements criterion, and during T1 period the UE reselects to Cell 1
	Neighbour cells		1	Cell 1	
T1 end condition	Active cell		1	Cell 1	The UE shall perform reselection to Cell 1 during T1
	Neighbour cells		1	Cell 2	
T2 end condition	Active cell		1	Cell 2	The UE shall perform reselection to Cell 2 with higher priority during T2
	Neighbour cells		1	Cell 1	

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		1	1, 2	
Time offset between cells		1	3 ms	Asynchronous cells
Access Barring Information	-	1	Not Sent	No additional delays in random access procedure.
SSB Configuration		1	SSB.1 FR1	
SMTC configuration		1	SMTC pattern 2	Configured in SIB4 of Cell 1
			SMTC pattern 6	Configured in SIB4 of Cell 2
DRX cycle length	s	1	0.64	The value shall be used for all cells in the test.
PRACH configuration index		1	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell		1	Not configured	
T1	s	1	25 s	T1 is defined so that cell re-selection reaction time is taken into account.
T2	s	1	25 s	T2 is defined so that cell re-selection reaction time is taken into account.

Table A.14.1.9.2-3: Cell specific test parameters for FR1 inter frequency NR cell re-selection test case in AWGN for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	SSC.1		NSC.1	
PDSCH RMC configuration		1	SR.1.1 FDD		SR.1.1 FDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
OCNG Pattern		1	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
Pcompensation	dB	1	0		0	
$Qhyst_s$	dB	1	0		0	
$Qoffset_{s,n}$	dB	1	0		0	
Cell_selection_and_ reselection_quality_measurement		1	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1	14	14	-4	12
N_{oc} Note2	dBm/SCS	1	-98			
N_{oc} Note2	dBm/15 kHz	1	-98			
$\hat{E}_s / N_{oc}$	dB	1	14	14	-4	12
SS-RSRP Note3	dBm/SCS	1	-84	-84	-102	-86
Io	dBm/9.36 MHz	1	-55.88	-55.88	-68.60	-57.78
Treselection	s	1	0	0	0	0
SnonintersearchP	dB	1	Not sent		Not sent	
$Thresh_{x,highP}$	dB	1	48		48	
$Thresh_{serving,lowP}$	dB	1	44		44	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$Thresh_{x, lowP}$	dB	1	50		50	
$S_{SearchDeltaP}$	dB	1	3		3	
$T_{SearchDeltaP}$	s	1	5		5	
Propagation Condition		1	AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.14.1.9.3 Test Requirements

The cell reselection delay to an already detected lower priority cell for UE fulfilling low mobility relaxed measurements is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to a lower priority cell for UE fulfilling low mobility relaxed measurements shall be less than 17 s.

The cell reselection delay to an already detected higher priority cell for UE fulfilling low mobility relaxed measurements is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the RRCSetupRequest message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected higher priority cell for UE fulfilling low mobility relaxed measurements shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a known lower priority cell can be expressed as: $T_{evaluate, NR_ inter} + T_{SI-NR}$,

Where:

$T_{evaluate, NR_ inter}$ See Table 4.2.2.10.2-1 in clause 4.2.2.10.2

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 16.64 s, allow 17 s for the cell re-selection delay to an already detected lower priority cell and 16.64 s for the cell re-selection delay to an already detected higher priority cell, which we allow 17 s for UE fulfilling low mobility relaxed measurements in the test case.

A.14.1.10 Cell reselection to FR1 inter-frequency NR case for UE fulfilling not-at-cell edge relaxed measurement criterion

A.14.1.10.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2C.2.8, for UEs that support *Relaxed cell reselection on GSO feature*, as defined in clause 5.4 in 38.306 [14], and fulfilling not-at-cell edge relaxed measurement criterion.

A.14.1.10.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.14.1.10.2-1, A.14.1.10.2-2 and A.14.1.10.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

As specified in the Test Purpose, the UE is configured with the relaxed measurement criterion for UE not-at-cell edge as defined in clause 5.2.4.9.2 in TS 38.304 [1]. So, Cell 2 and Cell 1configures the UE as follows:

cellEdgeEvaluation TS 38.331 [2] criterion is configured according to the parameters listed in table A.14.1.9.2-3;

lowMobilityEvalutation TS 38.331 [2] criterion is not configured;

combineRelaxedMeasCondition TS 38.331 [2] is not configured;

Table A.14.1.10.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz

Table A.14.1.10.2-2: General test parameters for FR1 inter frequency NR cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell 2	The UE camps on Cell 2 in the initial phase, it fulfills Not-at-cell edge relaxation measurements criterion, and during T1 period the UE reselects to Cell 1
	Neighbour cells		1	Cell 1	
T1 end condition	Active cell		1	Cell 1	The UE shall perform reselection to Cell 1 during T1
	Neighbour cells		1	Cell 2	
T2 end condition	Active cell		1	Cell 2	The UE shall perform reselection to Cell 2 with higher priority during T2
	Neighbour cells		1	Cell 1	
RF Channel Number			1	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
Access Barring Information		-	1	Not Sent	No additional delays in random access procedure.
SSB Configuration			1	SSB.1 FR1	
SMTC configuration			1	SMTC pattern 2	Configured in SIB4 of Cell 1
				SMTC pattern 6	Configured in SIB4 of Cell 2
DRX cycle length		s	1	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell			1	Not configured	
T1		s	1	20 s	T1 is defined so that cell re-selection reaction time is taken into account.
T2		s	1	20 s	T2 is defined so that cell re-selection reaction time is taken into account.

Table A.14.1.10.2-3: Cell specific test parameters for FR1 inter frequency NR cell re-selection test case in AWGN for UE fulfilling not-at-cell edge criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	SSC.1		NSC.1	
PDSCH RMC configuration		1	SR.1.1 FDD		SR.1.1 FDD	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
OCNG Pattern		1	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
Pcompensation	dB	1	0		0	
$Qhyst_s$	dB	1	0		0	
$Qoffset_{s,n}$	dB	1	0		0	
Cell_selection_and_ reselection_quality_measurement		1	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1	14	14	-4	12
N_{oc} Note2	dBm/SCS	1	-98			
N_{oc} Note2	dBm/15 kHz	1	-98			
$\hat{E}_s / N_{oc}$	dB	1	14	14	-4	12
SS-RSRP Note3	dBm/SCS	1	-84	-84	-102	-86
Io	dBm/9.36 MHz	1	-55.88	-55.88	-68.60	-57.78
Treselection	s	1	0	0	0	0
SnonintersearchP	dB	1	Not sent		Not sent	
$Thresh_{x,highP}$	dB	1	48		48	
$Thresh_{serving,lowP}$	dB	1	44		44	
$Thresh_{x,lowP}$	dB	1	50		50	
$S_{SearchThresholdP}$	dB	1	50		50	
$S_{SearchThresholdQ}$	s	1	Not Configured			
Propagation Condition		1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.1.10.3 Test Requirements

The cell reselection delay to an already detected lower priority cell for UE fulfilling not-at-cell edge relaxed measurements is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected lower priority cell for UE fulfilling not-at-cell edge relaxed measurements shall be less than 17 s.

The cell reselection delay to an already detected higher priority cell for UE fulfilling not-at-cell-edge relaxed measurements is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the RRCSetupRequest message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected higher priority cell for UE fulfilling not-at-cell-edge relaxed measurements shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, NR_ inter} + T_{SI-NR}$,

Where:

$T_{evaluate, NR_ inter}$ See Table 4.2.2.10.3-1 in clause 4.2.2.10

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 16.64 s, allow 17 s for the cell re-selection delay to an already detected lower priority cell and 16.64 s for the cell re-selection delay to an already higher priority cell, which we allow 17 s for UE fulfilling not-at-cell edge relaxed measurements in the test case.

A.14.1.11 Cell reselection to FR1 inter-RAT for NR NTN carrier

A.14.1.11.1 Test purpose and Environment

This test is to verify the requirement for the NR NTN to E-UTRAN TN inter-RAT cell reselection requirements specified in clause 4.2C.2.11 when the E-UTRAN cell is of higher priority.

A.14.1.11.2 Test parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.14.1.11.2-1, A.14.1.11.2-2, A.14.1.11.2-3 and A.14.1.11.2-4. The test consists of two successive time periods, with time duration of T1 and T2, respectively. NR Cell 1 is already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of higher priority than Cell 1.

A.14.1.11.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz	LTE 10 MHz bandwidth, TDD duplex mode
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz	LTE 10 MHz bandwidth, TDD duplex mode
3	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz	LTE 10 MHz bandwidth, FDD duplex mode
4	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases, and the UE is only required to be tested in one of the supported test configurations of the applicable scenario (GSO or NGSO).		

Table A.14.1.11.2-2: General test parameters for NR to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1-4	Cell 1	The UE camps on Cell 1 in the initial phase and during T2 period the UE reselects to Cell 2.
T2 end condition	Active cell		1-4	Cell 2	The UE shall perform reselection to cell 2 during T2.
	Neighbour cell		1-4	Cell 1	
Access Barring Information		-	1-4	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1-4	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1-4	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
E-UTRAN PRACH configuration index			1-4	53	As specified in table 5.7.1-2 in TS 36.211 [23]

Parameter	Unit	Test configuration	Value	Comment
T1	s	1-4	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2.
T2	s	1-4	70	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.14.1.11.2-3: Cell specific test parameters for NR Cell 1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
Satellite information		1,3	SSC.1	
		2,4	SSC.2	
TDD configuration		1-4	N/A	
PDSCH parameters		1-4	SR.1.1 FDD	
RMSI CORESET parameters		1-4	CR.1.1 FDD	
Dedicated CORESET parameters		1-4	CCR.1.1 FDD	
SSB parameters		1-4	SSB.1 FR1	
NR SMTC parameters		1-4	SMTC.2	
OCNG Pattern		1-4	OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1-4	DLBWP.0.1	
Initial UL BWP configuration		1-4	ULBWP.0.1	
RLM-RS		1-4	SSB	
Qrxlevmin	dBm/SCS	1-4	-140	
N_{oc}	dBm/SCS	1-4	-98	
N_{oc}	dBm/15 kHz	1-4	-98	
SS-RSRP	dBm/SCS	1-4	-84	-84
$\hat{E}_s / I_{ot}$	dB	1-4	14	14
$\hat{E}_s / N_{oc}$	dB	1-4	14	14
Io	dBm/9.36 MHz	1-4	-55.88	-55.88
Treselection	s	1-4	0	
SnonintrasearchP	dB	1-4	50	
$Thresh_{x, highP}$ (Note 2)	dB	1-4	48	
$Thresh_{serving, lowP}$	dB	1-4	44	
$Thresh_{x, lowP}$	dB	1-4	50	
Propagation Condition		1-4	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell

Table A.14.1.11.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2 OP.2 FDD for test configuration 3, 4	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		

Parameter	Unit	Cell 2	
		T1	T2
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 KHz	-infinity	-86
$\hat{E}_s / I_{ot}$	dB	-infinity	12
$\hat{E}_s / N_{oc}$	dB	-infinity	12
$Treselection_{EUTRAN}$	s	0	
SnonintrasearchP	dB	Not sent	
$Thresh_{x, highP}$	dB	48	
$Thresh_{serving, lowP}$	dB	44	
$Thresh_{x, lowP}$ (Note 2)	dB	50	
Propagation Condition		AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: This refers to the value of $Thresh_{x, Low}$ which is included in E-UTRA system information, and is a threshold for the NR target cell			

A.14.1.11.3 Test requirements

The cell reselection delay to a higher priority E-UTRAN cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate, E\text{-}UTRAN} + T_{SI\text{-}E\text{-}UTRA}$,

Where:

$T_{higher_priority_search}$ See clause 4.2C.2.9

$T_{evaluate, NR_inter}$ See clause 4.2C.2.11

$T_{SI\text{-}E\text{-}UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority E-UTRAN cell.

A.14.1.12 Cell re-selection to FR1 inter-frequency NR case with TN carrier

A.14.1.12.1 Test purpose and Environment

This test is to verify the requirement for the inter frequency NR NTN to TN cell re-selection requirements specified in clause 4.2C.2.11.

A.14.1.12.2 Test parameters

The test scenario comprises of 2 cells on 2 different NR carriers, including NR NTN cell 1 on RF channel 1 and NR TN cell 2 on RF channel 2, respectively as given in tables A.14.1.12.2-1, A.14.1.12.2-2 and A.14.1.12.3-3. The test consists of two successive time periods, with time duration of T1 and T2, respectively. Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

Table A.14.1.12.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases, and the UE is only required to be tested in one of the supported test configurations of the applicable scenario (GSO or NGSO).		

TableA.14.1.12.2-2: General test parameters for inter frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1-6	Cell 1	
T2 end condition	Active cell		1-6	Cell 2	
	Neighbour cells		1-6	Cell 1	
RF Channel Number			1-6	1,2	Cell 1 is on RF channel 1 Cell 2 is on RF channel 2
Time offset between cells			1-6	3 ms	Asynchronous cells
Access Barring Information		-	1-6	Not Sent	No additional delays in random access procedure.
SSB configuration			1-6	SSB.1 FR1	
SMTC configuration			1-6	SMTC.6	Configured in SIB4 for Cell 1 and Cell 2
DRX cycle length		s	1-6	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1-6	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell			1-6	Not configured	
Ephemeris information			1-6	Note 1	The detailed configuration is specified in SIB19
T1		s	1-6	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	1-6	70	T2 needs to be defined so that cell re-selection reaction time is taken into account.
Note 1: Detailed ephemeris information is provided in TS 38.508-1 [38]					

Table A.14.1.12.3-3: Cell specific test parameters for inter frequency NR cell re-selection test case

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1,2,3	SSC.1		N/A	
		4,5,6	SSC.2			
TDD configuration		1,4	N/A		N/A	
		2,5			TDDConf.1.1	
		3,6			TDDConf.2.1	
PDSCH RMC		1,4	SR.1.1 FDD		SR.1.1 FDD	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
configuration		2,5			SR.1.1 TDD	
		3,6			SR.2.1 TDD	
RMSI CORESET RMC configuration		1,4	CR.1.1 FDD		CR.1.1 FDD	
		2,5			CR.1.1 TDD	
		3,6			CR.2.1 TDD	
Dedicated CORESET RMC configuration		1,4	CCR.1.1 FDD		CCR.1.1 FDD	
		2,5			CCR.1.1 TDD	
		3,6			CCR.2.1 TDD	
OCNG Pattern		1-6	OP.1 defined in clause A.3.2.1		OP.1 defined in clause A.3.2.1	
Initial DL BWP configuration		1-6	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1-6	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1-6	SSB		SSB	
Qrxlevmin	dBm/SCS	1,2,4,5	-140		-140	
		3,6			-137	
Pcompensation	dB	1-6	0		0	
Cell_selection_and_ reselection_quality_measurement		1-6	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1-6	14	14	-infinity	12
N_{oc} Note2	dBm/SCS	1,2,4,5	-98		-98	
		3,6			-95	
N_{oc} Note2	dBm/15 kHz	1-6	-98			
$\hat{E}_s / N_{oc}$	dB	1-6	14	14	-infinity	12
SS-RSRP Note3	dBm/SCS	1,2,4,5	-84	-84	-infinity	-86
		3,6			-infinity	-83
Io	dBm/Ch BW	1,2,4,5	-55.88	-55.88	-70.05	-57.78
		3,6			-63.96	-51.69
Treselection	s	1-6	0	0	0	0
SnonintrasearchP	dB	1-6	50		50	
$Thresh_{x, highP}$	dB	1-6	48		48	
$Thresh_{serving, lowP}$	dB	1-6	44		44	
$Thresh_{x, lowP}$	dB	1-6	50		50	
Propagation Condition		1-6	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.1.12.3 Test requirements

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate, NR_inter_TN} + T_{SI\text{-}NR}$

Where:

$T_{higher_priority_search}$ See clause 4.2C.2.9

$T_{evaluate, NR_ inter_TN}$ See clause 4.2C.2.10

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority

A.14.2 RRC_CONNECTED state mobility

A.14.2.1 Handover

A.14.2.1.1 Intra-frequency SAN Handover from FR1 to FR1

A.14.2.1.1.1 Test Purpose and Environment

This test is to verify the requirement for Intra-frequency SAN Handover from FR1 to FR1 specified in clause 6.1C.1.

A.14.2.1.1.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells as given in table A.14.2.1.1.2-1, A.14.2.1.1.2-2, and A.14.2.1.1.2-3. Both handover delay and interruption length are tested.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, the UE is configured to measure intra-frequency neighbour cell with Event A3 report.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1. The RRC message implying handover to Cell 2 shall be sent to the UE during period T2, after the UE has reported Event A3. The start of T3 is defined as the end of the last TTI containing the RRC message implying handover.

Table A.14.2.1.1.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
2	NGSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.1.1.2-2: General test parameters Intra-frequency SAN handover from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1	One NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
UE position (L,B, H)			(0, 0, 0)	Set by any pre-configured means (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.14.2.1.1.2-3: Cell specific test parameters for Intra frequency SAN handover test case

Parameter		Test configuration	Unit	Cell 1			Cell 2		
				T1	T2	T3	T1	T2	T3
Satellite information		Config 1		SSC.1			NSC.1		
		Config 2		SSC.2			NSC.2		
NR RF Channel Number		Config 1,2		1			1		
$BW_{channel}$			MHz	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52		
BWP BW			MHz	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52		
TA_{Common}		Config 1,2	s	0			0		
$TA_{CommonDrift}$			s	0			0		
$TA_{CommonDriftVariation}$			s	0			0		
K_{offset}		Config 1	ms	239			239		
		Config 2		4			4		
K_{mac}		Config 1,2	ms	0			0		
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel				SR.1.1 FDD					
CORESET Reference Channel				CR.1.1 FDD					
TRS configuration				TRS.1.1 FDD					
OCNG Patterns				OP.1					
SMTC Configuration				SMTC.1					
SSB Configuration				SSB.1 FR1					
PDSCH/PDCCH subcarrier spacing			kHz	15 kHz					
PUCCH/PUSCH subcarrier spacing			kHz	15 kHz					
PRACH configuration				FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP	Config 1,2		DLBWP.0.1					
	Dedicated DL BWP			DLBWP.1.1					
	Initial UL BWP			ULBWP.0.1					
	Dedicated UL BWP			ULBWP.1.1					
EPRE ratio of PSS to SSS		Config 1,2	dB	0					
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		Config 1,2	dBm/ 15 kHz	-98					
N_{oc} Note2			dBm/ SCS	-98					
$\hat{E}_s / I_{ot}$			dB	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s / N_{oc}$			dB	8	8	8	-Infinity	11	11
SSB_RP			dBm/ SCS	-90	-90	-90	-Infinity	-87	-87
Io Note3			dBm/ 9.36 MHz	-61.41	-57.06	-57.06	-61.41	-57.06	-57.06
Propagation condition			-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.2.1.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2]. $T_{interrupt}$ is defined in clause 6.1C.1.2.2.

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Here: T_{search} = 0; T_{IU} = 20 ms; $T_{processing}$ = 20 ms; T_{Δ} = 20 ms; T_{margin} = 2 ms.

This gives a total of 72 ms.

A.14.2.1.2 Inter-frequency SAN Handover from FR1 to FR1

A.14.2.1.2.1 Test Purpose and Environment

This test is to verify the requirement for Inter-frequency SAN Handover from FR1 to FR1 specified in clause 6.1C.1.

A.14.2.1.2.2 Test Parameters

The test scenario comprises of 2 NR FDD carriers and one cell on each carrier as given in table A.14.2.1.2.2-1, A.14.2.1.2.2-2 and A.14.2.1.2.2-3. Both handover delay and interruption length are tested.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, the UE is configured to measure inter frequency neighbour cell with Event A3 report and Gap Pattern 0 is configured in the test case.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1. The RRC message implying handover to Cell 2 shall be sent to the UE during period T2, after the UE has reported Event A3. The start of T3 is defined as the end of the last TTI containing the RRC message implying handover.

Table A.14.2.1.2.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
2	NGSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.1.2.2-2: General test parameters Inter-frequency SAN handover from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
UE position (L,B, H)			(0, 0, 0)	Set by any pre-configured means (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
Gap Pattern Id			0	
Measurement gap offset			9	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	

T2	s	≤5	
T3	s	1	

Table A.14.2.1.2.2-3: Cell specific test parameters for Inter frequency SAN handover test case

Parameter		Test configuration	Unit	Cell 1			Cell 2		
				T1	T2	T3	T1	T2	T3
Satellite information		Config 1		SSC.1			NSC.1		
		Config 2		SSC.2			NSC.2		
NR RF Channel Number		Config 1,2		1			2		
$BW_{channel}$			MHz	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52		
BWP BW			MHz	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52		
TA_{Common}		Config 1,2	s	0			0		
$TA_{CommonDrift}$			s	0			0		
$TA_{CommonDriftVariation}$			s	0			0		
K_{offset}		Config 1	ms	239			239		
		Config 2		4			4		
K_{mac}		Config 1,2	ms	0			0		
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel				SR.1.1 FDD					
CORESET Reference Channel				CR.1.1 FDD					
TRS configuration				TRS.1.1 FDD					
OCNG Patterns				OP.1					
SMTC Configuration				SMTC.2			SMTC.5		
SSB Configuration				SSB.1 FR1			SSB.5 FR1		
PDSCH/PDCCH subcarrier spacing			kHz	15 kHz					
PUCCH/PUSCH subcarrier spacing			kHz	15 kHz					
PRACH configuration				FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP	Config 1,2		DLBWP.0.1					
	Dedicated DL BWP			DLBWP.1.1					
	Initial UL BWP			ULBWP.0.1					
	Dedicated UL BWP			ULBWP.1.1					
EPRE ratio of PSS to SSS		Config 1,2	dB	0					
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		Config 1,2	dBm/ 15 kHz	-98					
N_{oc} Note2			dBm/ SCS	-98					
$\hat{E}_s / I_{ot}$			dB	4	4	4	-Infinity	9	9
$\hat{E}_s / N_{oc}$			dB	4	4	4	-Infinity	9	9
SSB_RP			dBm/ SCS	-94	-94	-94	-Infinity	-89	-89
Io Note3			dBm/ 9.36 MHz	-64.59	-64.59	-64.59	-70.05	-60.53	-60.53
Propagation condition			-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Test configuration	Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

A.14.2.1.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2]. $T_{interrupt}$ is defined in clause 6.1C.1.2.2.

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Here: T_{search} = 0; T_{IU} = 20 ms; $T_{processing}$ = 20 ms; T_{Δ} = 20 ms; T_{margin} = 2 ms.

This gives a total of 72 ms.

A.14.2.1.3 Intra-frequency SAN time-based conditional Handover from FR1 to FR1

A.14.2.1.3.1 Test Purpose and Environment

This test is to verify the requirement for intra-frequency SAN time-based conditional handover from FR1 to FR1 specified in clause 6.1C.2.

A.14.2.1.3.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells as given in table A.14.2.1.3.2-1, and A.14.2.1.3.2-2. Both handover delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. Immediately before the start of T1, the UE is configured to measure intra-frequency neighbour cell with a time-based handover trigger to Cell 2 with Event CondEvent T1 shall be sent to UE.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1 and time condition event t1-Threshold-r17 is fulfilled.

Table A.14.2.1.3.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
2	NGSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.1.3.2-2: General test parameters for Intra-frequency SAN time-based conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1	One NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	FDD duplex mode cell
	Neighbouring cell		Cell 2	FDD duplex mode cell
Final condition	Active cell		Cell 2	
UE position (L,B, H)			(0, 0, 0)	Set by any pre-configured means (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.

t1-Threshold-r17.condEventT1-r17	s	T1	Entering condition at start of T2 (end of T1)
duration-r17.condEventT1-r17	slot	1000	Give 1 s search duration
A3-Offset in condition	dB	0	
Hysteresis	dB	0	
Time To Trigger	s	0	
Filter coefficient		0	L3 filtering is not used
Access Barring Information	-	Not Sent	No additional delays in random access procedure.
Time offset between cells		3 μs	Synchronous cells
T1	s	5	
T2	s	≤ 2	

Table A.14.2.1.3.2-3: Cell specific test parameters for Intra-frequency SAN time-based conditional handover from FR1 to FR1

Parameter		Test configuration	Unit	Cell 1		Cell 2	
				T1	T2	T1	T2
Satellite information		Config 1		SSC.1		NSC.1	
		Config 2		SSC.2		NSC.2	
NR RF Channel Number		Config 1,2		1		1	
$BW_{channel}$			MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
BWP BW			MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
TA_{Common}		Config 1,2	s	0		0	
$TA_{CommonDrift}$			s	0		0	
$TA_{CommonDriftVariation}$			s	0		0	
K_{offset}		Config 1	ms	239		239	
		Config 2	ms	4		4	
K_{mac}		Config 1,2	ms	0		0	
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel				SR.1.1 FDD			
CORESET Reference Channel				CR.1.1 FDD			
TRS configuration				TRS.1.1 FDD			
OCNG Patterns				OP.1			
SMTC Configuration				SMTC.1			
SSB Configuration				SSB.1 FR1			
PDSCH/PDCCH subcarrier spacing			kHz	15 kHz			
PUCCH/PUSCH subcarrier spacing			kHz	15 kHz			
PRACH configuration				FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP	Config 1,2		DLBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1			
	Initial UL BWP			ULBWP.0.1			
	Dedicated UL BWP			ULBWP.1.1			
EPRE ratio of PSS to SSS		Config 1,2	dB	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		Config 1,2	dBm/ 15 kHz	-98			
N_{oc} Note2			dBm/ SCS	-98			
$\hat{E}_s / I_{ot}$			dB	8	-3.3	-Infinity	2.36
$\hat{E}_s / N_{oc}$			dB	8	8	-Infinity	11
SSB_RP			dBm/ SCS	-90	-90	-Infinity	-87

Parameter	Test configuration	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Io[Note3]		dBm/ 9.36 MHz	-61.41	-57.06	-61.41	-57.06
Propagation condition		-	AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.14.2.1.3.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 872 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay is defined in clause 6.1C.2, can be expressed as:

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{interrupt} + T_{CHO_execution}$$

where:

RRC procedure delay T_{RRC} = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{Event_DU} = start of T2

$T_{measure}$ = 600 + 200 ms; $T_{interrupt}$ = 62 ms; $T_{CHO_execution}$ = 10 ms.

This gives a total of 872 ms.

A.14.2.1.4 Inter-frequency SAN time-based conditional Handover from FR1 to FR1

A.14.2.1.4.1 Test Purpose and Environment

This test is to verify the requirement for inter -frequency SAN time-based conditional handover from FR1 to FR1 specified in clause 6.1C.2.

A.14.2.1.4.2 Test Parameters

The test scenario comprises of 2 NR FDD carrier and one cell on each carrier as given in table A.14.2.1.4.2-1, and A.14.2.1.4.2-2. Both handover delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. Immediately before the start of T1, the UE is configured to measure inter-frequency neighbour cell with Gap pattern ID gp0 and time-based handover trigger to Cell 2 with Event CondEvent T1.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1 and after 1000 ms of T2, time condition event t1-Threshold-r17 is fulfilled.

Table A.14.2.1.4.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
2	NGSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.1.4.2-2: General test parameters for Inter-frequency SAN time-based conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	FDD duplex mode cell
	Neighbouring cell		Cell 2	FDD duplex mode cell
Final condition	Active cell		Cell 2	
UE position (L,B, H)			(0, 0, 0)	Set by any pre-configured means (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
t1-Threshold-r17.condEventT1-r17		s	T1+1	Entering condition 1000ms after the start of T2
duration-r17.condEventT1-r17		slot	1000	Give 1 s search duration
Gap Pattern Id			0	
Measurement gap offset			9	
A3-Offset in condition		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤ 2	

Table A.14.2.1.4.2-3: Cell specific test parameters for Inter-frequency SAN time-based conditional handover from FR1 to FR1

Parameter		Test configuration	Unit	Cell 1		Cell 2	
				T1	T2	T1	T2
Satellite information		Config 1		SSC.1		NSC.1	
		Config 2		SSC.2		NSC.2	
NR RF Channel Number		Config 1, 2		1		2	
$BW_{channel}$			MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
BWP BW			MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
TA_{Common}		Config 1, 2	s	0		0	
$TA_{CommonDrift}$			s	0		0	
$TA_{CommonDriftVariation}$			s	0		0	
K_{offset}		Config 1	ms	239		239	
		Config 2	ms	4		4	
K_{mac}		Config 1, 2	ms	0		0	
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel				SR.1.1 FDD			
CORESET Reference Channel				CR.1.1 FDD			
TRS configuration				TRS.1.1 FDD			
OCNG Patterns				OP.1			
SMTC Configuration				SMTC.2		SMTC.5	
SSB Configuration				SSB.1 FR1		SSB.5 FR1	
PDSCH/PDCCH subcarrier spacing			kHz	15 kHz			
PUCCH/PUSCH subcarrier spacing			kHz	15 kHz			
PRACH configuration				FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP	Config 1, 2		DLBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1			
	Initial UL BWP			ULBWP.0.1			
	Dedicated UL BWP			ULBWP.1.1			
EPRE ratio of PSS to SSS		Config 1, 2	dB	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							

Parameter	Test configuration	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	Config 1, 2	dBm/ 15 kHz	-98			
N_{oc} Note2		dBm/ SCS	-98			
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	9
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	9
SSB_RP		dBm/ SCS	-94	-94	-Infinity	-89
Io Note3		dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-60.53
Propagation condition		-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.2.1.4.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 later than 1000 ms and less than 1072 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay is defined in clause 6.1C.2, can be expressed as:

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{interrupt} + T_{CHO_execution}$$

where:

RRC procedure delay T_{RRC} = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{Event_DU} = start of T2

$T_{measure}$ = max(600 + 200, 1000) ms; $T_{interrupt}$ = 62 ms; $T_{CHO_execution}$ = 10 ms.

This gives a total of 1072 ms.

A.14.2.1.5 Intra-frequency SAN distance-based conditional Handover from FR1 to FR1

A.14.2.1.5.1 Test Purpose and Environment

This test is to verify the requirement for intra-frequency SAN distance-based conditional handover from FR1 to FR1 specified in clause 6.1C.2.

A.14.2.1.5.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells as given in table A.14.2.1.5.2-1, and A.14.2.1.5.2-2. Both handover delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, the UE is configured to measure intra-frequency neighbour cell. The RRC message implying distance-based handover to Cell 2 with Event D1 shall be sent to UE, at a time earlier than T_{RRC} (10 ms) before the beginning of T2.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1 and location condition event condEventD1-r17 is fulfilled.

Table A.14.2.1.5.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
2	NGSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.1.5.2-2: General test parameters for Intra-frequency SAN distance-based conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1	One NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	FDD duplex mode cell
	Neighbouring cell		Cell 2	FDD duplex mode cell
Final condition	Active cell		Cell 2	
UE position (L,B, H) at T1 start			(0, 0, 0)	Set by any pre-configured means (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
UE moving speed		km/h	(108, 0, 0)	Set by any pre-configured means
referenceLocation1-r17.condEventD1-r17		m	(-700, 0, 0)	Reference location for serving cell
referenceLocation2-r17.condEventD1-r17		m	(1300, 0, 0)	Reference location for target cell
distanceThreshFromReference1-r17.condEventD1-r17		50m	20	D1-1 Location condition is fulfilled at T2
distanceThreshFromReference2-r17.condEventD1-r17		50m	20	D1-2 Location condition is fulfilled at T2
hysteresis-r17.condEventD1-r17		10m	0	
timeToTrigger-r17.condEventD1-r17		s	0	
A3-Offset in condition		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	12	
T2		s	≤ 6	

Table A.14.2.1.5.2-3: Cell specific test parameters for Intra-frequency SAN distance-based conditional handover from FR1 to FR1

Parameter	Test configuration	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information	Config 1		SSC.1		NSC.1	
	Config 2		SSC.2		NSC.2	
NR RF Channel Number	Config 1, 2		1		1	
$BW_{channel}$		MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
BWP BW		MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
TA_{Common}	Config 1, 2	s	0		0	
$TA_{CommonDrift}$		s	0		0	
$TA_{CommonDriftVariation}$		s	0		0	
K_{offset}	Config 1	ms	239		239	
	Config 2	ms	4		4	
K_{mac}	Config 1, 2	ms	0		0	
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR.1.1 FDD			
CORESET Reference Channel			CR.1.1 FDD			

Parameter		Test configuration	Unit	Cell 1		Cell 2	
				T1	T2	T1	T2
TRS configuration				TRS.1.1 FDD			
OCNG Patterns				OP.1			
SMTC Configuration				SMTC.1			
SSB Configuration				SSB.1 FR1			
PDSCH/PDCCH subcarrier spacing			kHz	15 kHz			
PUCCH/PUSCH subcarrier spacing			kHz	15 kHz			
PRACH configuration				FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP	Config 1, 2		DLBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1			
	Initial UL BWP			ULBWP.0.1			
	Dedicated UL BWP			ULBWP.1.1			
EPRE ratio of PSS to SSS		Config 1, 2	dB	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		Config 1, 2	dBm/ 15 kHz	-98			
N_{oc} Note2			dBm/ SCS	-98			
$\hat{E}_s / I_{ot}$			dB	8	-3.3	-Infinity	2.36
$\hat{E}_s / N_{oc}$			dB	8	8	-Infinity	11
SSB_RP			dBm/ SCS	-90	-90	-Infinity	-87
Io Note3			dBm/ 9.36 MHz	-61.41	-57.06	-61.41	-57.06
Propagation condition			-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.2.1.5.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 872 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay is defined in clause 6.1C.2, can be expressed as:

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{interrupt} + T_{CHO_execution}$$

where:

RRC procedure delay T_{RRC} = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{Event_DU} = start of T2

UE moving speed, v = (108km/h*1000/3600) = 30m/s.

At start of T2,

distance to source cell reference location is 30 m/s * 12 s – (-700)m = 1060m, and D1-1 = 1000m

distance to target cell reference location is 30 m/s * 12 s – 1300m = -940m, and D1-2 = 1000m

i.e. D1-1 and D1-2 conditions are fulfilled at start of T2 with >=50m location margin.

$T_{measure}$ = max(600 + 200 ms, 0) = 800 ms;

$T_{interrupt}$ = 62 ms; $T_{CHO_execution}$ = 10 ms.

This gives a total of 800 ms + 62 ms + 10 ms = 872 ms.

A.14.2.1.6 Inter-frequency SAN distance-based conditional Handover from FR1 to FR1

A.14.2.1.6.1 Test Purpose and Environment

This test is to verify the requirement for inter -frequency SAN distance-based conditional handover from FR1 to FR1 specified in clause 6.1C.2.

A.14.2.1.6.2 Test Parameters

The test scenario comprises of 2 NR FDD carrier and one cell on each carrier as given in table A.14.2.1.6.2-1, and A.14.2.1.6.2-2. Both handover delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, the UE is configured to measure inter-frequency neighbour cell and Gap pattern ID gp0. The RRC message implying distance-based handover to Cell 2 with Event D1 shall be sent to UE, at a time earlier than T_{RRC} (10 ms) before the beginning of T2.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1 and after 11670 ms of T2, location condition event condEventD1-r17 is fulfilled.

Table A.14.2.1.6.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
2	NGSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.1.6.2-2: General test parameters for Inter -frequency SAN distance-based conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	FDD duplex mode cell
	Neighbouring cell		Cell 2	FDD duplex mode cell
Final condition	Active cell		Cell 2	
UE position (L,B, H) at T1 start			[(0, 0, 0)]	Set by any pre-configured means (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
UE moving speed		km/h	(108, 0, 0)	Set by any pre-configured means
referenceLocation1-r17.condEventD1-r17		m	(-700, 0, 0)	Reference location for serving cell
referenceLocation2-r17.condEventD1-r17		m	(1300, 0, 0)	Reference location for target cell
distanceThreshFromReference1-r17.condEventD1-r17		50m	20	D1-1 Location condition is fulfilled at T2
distanceThreshFromReference2-r17.condEventD1-r17		50m	20	D1-2 Location condition is fulfilled at T2
hysteresis-r17.condEventD1-r17		10m	0	
timeToTrigger-r17.condEventD1-r17		s	0	
Gap Pattern Id			0	
Measurement gap offset			9	
A3-Offset in condition		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used

Parameter	Unit	Value	Comment
Access Barring Information	-	Not Sent	No additional delays in random access procedure.
Time offset between cells		3 μs	Synchronous cells
T1	s	1	
T2	s	12	

Table A.14.2.1.6.2-3: Cell specific test parameters for Inter-frequency SAN distance-based conditional handover from FR1 to FR1

Parameter		Test configuration	Unit	Cell 1		Cell 2	
				T1	T2	T1	T2
Satellite information		Config 1		SSC.1		NSC.1	
		Config 2		SSC.2		NSC.2	
NR RF Channel Number		Config 1, 2		1		2	
$BW_{channel}$			MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
BWP BW			MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
TA_{Common}		Config 1, 2	s	0		0	
$TA_{CommonDrift}$			s	0		0	
$TA_{CommonDriftVariation}$			s	0		0	
K_{offset}		Config 1	ms	239		239	
		Config 2	ms	4		4	
K_{mac}		Config 1, 2	ms	0		0	
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel				SR.1.1 FDD			
CORESET Reference Channel				CR.1.1 FDD			
TRS configuration				TRS.1.1 FDD			
OCNG Patterns				OP.1			
SMTC Configuration				SMTC.2		SMTC.5	
SSB Configuration				SSB.1 FR1		SSB.5 FR1	
PDSCH/PDCCH subcarrier spacing			kHz	15 kHz			
PUCCH/PUSCH subcarrier spacing			kHz	15 kHz			
PRACH configuration				FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP	Config 1, 2		DLBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1			
	Initial UL BWP			ULBWP.0.1			
	Dedicated UL BWP			ULBWP.1.1			
EPRE ratio of PSS to SSS		Config 1, 2	dB	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		Config 1, 2	dBm/ 15 kHz	-98			
N_{oc} Note2			dBm/ SCS	-98			
$\hat{E}_s / I_{ot}$			dB	4	4	-Infinity	9
$\hat{E}_s / N_{oc}$			dB	4	4	-Infinity	9
SSB_RP			dBm/ SCS	-94	-94	-Infinity	-89
Io Note3			dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-60.53
Propagation condition			-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Test configuration	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.14.2.1.6.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 later than 11670ms and less than 11742 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay is defined in clause 6.1C.2, can be expressed as:

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{interrupt} + T_{CHO_execution}$$

where:

RRC procedure delay T_{RRC} = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{Event_DU} = start of T2

UE moving speed, v = (108km/h*1000/3600) = 30m/s.

At 11670 ms after start of T2,

distance to source cell reference location is 30 m/s * 11.67 s – (-700)m = 1050m, and D1-1 = 1000m

distance to target cell reference location is 30 m/s * 11.67 s – 1300m = -950m, and D1-2 = 1000m

i.e. D1-1 and D1-2 conditions are fulfilled at T2 + 11670 ms with >=50m location margin.

$T_{measure}$ = max(600 + 200 ms, 11670 ms) = 11670 ms;

$T_{interrupt}$ = 62 ms; $T_{CHO_execution}$ = 10 ms.

This gives a total of 11670ms + 62ms + 10ms = 11742 ms.

A.14.2.1.7 Intra-frequency intra-satellite Handover from FR2-NTN to FR2-NTN

A.14.2.1.7.1 Test Purpose and Environment

This test is to verify the requirement for intra-frequency intra-satellite handover from FR2-NTN to FR2-NTN specified in clause 6.1C.3.

A.14.2.1.7.2 Test Parameters

The test scenario comprises of one NR FDD carrier and 2 cells as given in table A.14.2.1.7.2-1, A.14.2.1.7.2-2, and A.14.2.1.7.2-3. Both handover delay and interruption length are tested.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, the UE is configured to measure intra-frequency neighbour cell with Event A3 report. Starting T2, Cell 2 becomes detectable and offset better than Cell 1. The RRC message implying handover to Cell 2 shall be sent to the UE during period T2, after the UE has reported Event A3. The start of T3 is defined as the end of the last TTI containing the RRC message implying handover.

Table A.14.2.1.7.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 120 kHz SSB SCS, 100 MHz BW
2	NGSO, NR FDD, 120 kHz SSB SCS, 100 MHz BW
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.1.7.2-2: General test parameters Intra-frequency intra-satellite handover from FR2-NTN to FR2-NTN

Parameter		Unit	Value	Comment
RF Channel Number			1	One NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
UE position (L,B, H)			(0, 0, 0)	Set by any pre-configured means (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			0 μs	Synchronous cells belonging to the same satellite
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.14.2.1.7.2-3: Cell specific test parameters for intra-frequency intra-satellite handover from FR2-NTN to FR2-NTN

Parameter		Test configuration	Unit	Cell 1			Cell 2		
				T1	T2	T3	T1	T2	T3
Satellite information		Config 1		SSC.1			NSC.1		
		Config 2		SSC.2			NSC.2		
Assumption for UE beams[Note4]				Rough			Rough		
AoA setup				Setup 1 as defined in A.3.15					
NR RF Channel Number		Config 1,2		1			1		
Duplex mode				FDD					
$BW_{channel}$			MHz	10: $N_{PRB,c}$ = 66			10: $N_{PRB,c}$ = 66		
BWP BW			MHz	10: $N_{PRB,c}$ = 66			10: $N_{PRB,c}$ = 66		
Data PRBs allocated				66					
TA_{Common}		Config 1,2	s	0			0		
$TA_{CommonDrift}$			s	0			0		
$TA_{CommonDriftVariation}$			s	0			0		
K_{offset}		Config 1	ms	[239]			[239]		
		Config 2		[4]			[4]		
K_{mac}		Config 1,2	ms	0			0		
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel				SR3.1 TDD					
CORESET Reference Channel				CR3.1 TDD					
TRS configuration				TRS.2.1 TDD					
OCNG Patterns				OP.1					
SMTC Configuration				SMTC.1					
SSB Configuration				SSB. 3 FR2					
PDSCH/PDCCH subcarrier spacing			kHz	120 kHz					
PUCCH/PUSCH subcarrier spacing			kHz	120 kHz					
PRACH configuration				FR2 PRACH configuration 1					
BWP configuration	Initial DL BWP	Config 1,2		DLBWP.0.1					
	Dedicated DL BWP			DLBWP.1.1					
	Initial UL BWP			ULBWP.0.1					
	Dedicated UL BWP			ULBWP.1.1					
EPRE ratio of PSS to SSS		Config 1,2	dB	0					
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									

Parameter	Test configuration	Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	Config 1,2	dBm/ 15 kHz	-104.7					
N_{oc} Note2		dBm/ SCS	-95.7					
$\hat{E}_s / I_{ot}$		dB	6	-1.8	-1.8	-Infinity	0	0
$\hat{E}_s / N_{oc}$		dB	6	6	6	-Infinity	7	7
Io Note3		dBm/ 9.36 MHz	-59.7	-56.7	-56.7	-61.41	-59.7	-56.7
Propagation condition		-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in [B.2.1.3], and does not limit UE implementation or test system implementation.

A.14.2.1.7.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 no later than 72 ms from the beginning of T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2]. $T_{interrupt}$ is defined in clause 6.1C.1.3.2.

$$T_{interrupt_inter_sat} = T_{search} + T_{IU} + T_{processing} + T_{sat_beam} + T_{\Delta} + T_{margin}\ \text{ms}$$

Here: T_{search} = 0; T_{IU} = 20 ms; $T_{processing}$ = 20 ms; T_{sat_beam} = 0; T_{Δ} = 20 ms; T_{margin} = 2 ms.

This gives a total of 72 ms.

A.14.2.1.8 Intra-frequency SAN Handover from FR1 to FR1

A.14.2.1.8.1 Test Purpose and Environment

This test is to verify the requirement for Intra-frequency SAN RACH-less Handover from FR1 to FR1 specified in clause 6.1C.1.1.

A.14.2.1.8.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells as given in table A.14.2.1.8.2-1, A.14.2.1.8.2-2, and A.14.2.1.8.2-3. Both handover delay and interruption length are tested.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, the UE is configured to measure intra-frequency neighbour cell with Event A3 report.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1. The RRC message implying handover to Cell 2 shall be sent to the UE during period T2, after the UE has reported Event A3. The start of T3 is defined as the end of the last TTI containing the RRC message implying handover. During T3, Cell 2 continuously schedules PUSCH for the UE.

Table A.14.2.1.8.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
2	NGSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.1.8.2-2: General test parameters Intra-frequency SAN handover from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1	One NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
UE position (L,B, H)			(0, 0, 0)	Set by any pre-configured means (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.14.2.1.8.2-3: Cell specific test parameters for Intra frequency SAN handover test case

Parameter	Test configuration	Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Satellite information	Config 1		SSC.1			NSC.1		
	Config 2		SSC.2			NSC.2		
NR RF Channel Number	Config 1,2		1			1		
$BW_{channel}$		MHz	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52		
BWP BW		MHz	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52		
TA_{Common}		s	0			0		
$TA_{CommonDrift}$		s	0			0		
$TA_{CommonDriftVariation}$		s	0			0		
K_{offset}	Config 1	ms	258			258		
	Config 2		14			14		
K_{mac}		ms	0			0		
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel			SR.1.1 FDD					
CORESET Reference Channel			CR.1.1 FDD					
TRS configuration			TRS.1.1 FDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
SSB Configuration			SSB.1 FR1					
PDSCH/PDCCH subcarrier spacing		kHz	15 kHz					
PUCCH/PUSCH subcarrier spacing		kHz	15 kHz					
Initial DL BWP	Config 1,2		DLBWP.0.1					

Parameter		Test configuration	Unit	Cell 1			Cell 2		
				T1	T2	T3	T1	T2	T3
BWP configuration	Dedicated DL BWP			DLBWP.1.1					
	Initial UL BWP			ULBWP.0.1					
	Dedicated UL BWP			ULBWP.1.1					
EPRE ratio of PSS to SSS		Config 1,2	dB	0					
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		Config 1,2	dBm/ 15 kHz	-98					
N_{oc} Note2			dBm/ SCS	-98					
$\hat{E}_s / I_{ot}$			dB	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s / N_{oc}$			dB	8	8	8	-Infinity	11	11
SSB_RP			dBm/ SCS	-90	-90	-90	-Infinity	-87	-87
Io Note3			dBm/ 9.36 MHz	-61.41	-57.06	-57.06	-61.41	-57.06	-57.06
Propagation condition			-	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.2.1.8.3 Test Requirements

The UE shall start to transmit the PUSCH to Cell 2 less than 52 + T_{IU} ms from the beginning of time period T3. The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2]. $T_{interrupt}$ is defined in clause 6.1C.1.2.2.2.

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Here: T_{search} = 0; T_{IU} is the interruption uncertainty in acquiring the first UL transmission resource for PUSCH, which is scheduled by Cell 2 at the fist DL slot not earlier than 52 ms after the beginning of T3; $T_{processing}$ = 20 ms; T_{Δ} = 20 ms; T_{margin} = 2 ms.

This gives a total of 52 + T_{IU} ms.

A.14.2.1.9 Intra-frequency inter-satellite handover from FR2-NTN to FR2-NTN

A.14.2.1.9.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NTN – NR FR2-NTN intra-frequency handover requirements specified in clause 6.1C.1.3.

A.14.2.1.9.2 Test Parameters

The test consists two sub-tests. Sub-test 1 is applicable for UE indicating 'electronic' via *ntn-VSAT-AntennaType-r18*, and sub-test 2 is applicable for UE indicating 'mechanical' via *ntn-VSAT-AntennaType-r18*. The test configurations are same for the two sub-tests unless specified otherwise.

Supported test configurations are shown in table A.14.2.1.9.2-1. Both handover delay and interruption length are tested by using the parameters in table A.14.2.1.9.2-2, and A.14.2.1.9.2-3.

The test scenario comprises of one carrier and two cells on the carrier. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network to handover from Cell 1 to Cell 2. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.14.2.1.9.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 120 kHz SSB SCS, 100 MHz BW
2	NGSO, NR FDD, 120 kHz SSB SCS, 100 MHz BW
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.1.9.2-2: General test parameters

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
UE position (L,B,H)			(0, 0, 0)	Set by any pre-configured means (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Time offset between cells		μs	3	Synchronous cells
T1		s	5	
T2		s	1 for sub-test 1 TBD for sub-test 2	

Table A.14.2.1.9.2-3: Cell specific test parameters for NR FR2-FR2 Intra frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup			Setup X1 for sub-test 1 Setup X2 for sub-test 1			
Satellite information	Config 1		SSC.1		NSC.1	
	Config 2		SSC.2		NSC.2	
NR RF Channel Number			1		1	
Duplex mode			FDD			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
TA_{Common}		s	0			
$TA_{CommonDrift}$		s	0			
$TA_{CommonDriftVariation}$		s	0			
K_{offset}	Config 1	ms	239			

	Config 2	ms	4			
K_{mac}		ms	0			
Data PRBs allocated			66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 FDD			
RMSI CORESET Reference Channel			CR3.1 FDD			
Control Channel RMC			CCR.3.1 FDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration			SSB.3 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
PDSCH/PDCCH TCI state			TCI.State.2			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-104.7			
N_{oc} Note2		dBm/SCS	-95.7			
$\hat{E}_s / I_{ot}$		dB	6	-1.8	-Infinity	0
$\hat{E}_s / N_{oc}$		dB	6	6	-Infinity	7
Io Note3		dBm/ BW	-59.7	-56.7	-59.7	-56.7
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone

A.14.2.1.9.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than X ms from the beginning of time period T2.

X = 152 ms for sub-test 1, and

X = TBD ms for sub-test 2, and

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 142 ms in sub-test 1 and TBD in sub-test 2. $T_{interrupt}$ is defined in clause 6.1C.1.3.2.

This gives a total of 152 ms sub-test 1 and TBD in sub-test 2.

A.14.2.1.10 Intra-frequency SAN Handover from FR1 to FR1 for UE operating on a cell with less than 5 MHz BWA.14.2.1.10.1 Test Purpose and Environment

This test is to verify the requirement for NR FR1 NTN- NR FR1 NTN intra-frequency SAN handover requirements for unknown target cell operating with 12 PRB SSB bandwidth specified in clause 6.1C.1.

A.14.2.1.10.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells as given in table A.14.2.1.10.2-1, A.14.2.1.10.2-2, and A.14.X.1.1.2-3. Both handover delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1, UE receives a RRC handover command from the network. The start of T2 is defined as the end of the last TTI containing the RRC message implying handover.

Table A.14.2.1.10.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 15 kHz SSB SCS, 3 MHz BW
2	NGSO, NR FDD, 15 kHz SSB SCS, 3 MHz BW
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.1.10.2-2: General test parameters Intra-frequency SAN handover from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1	One NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	Unknown target cell operating with 12PRB SSB bandwidth
Final condition	Active cell		Cell 2	Unknown target cell operating with 12PRB SSB bandwidth
UE position (N,S, H)			(0, 0, 0)	Set by any pre-configured means
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	

Table A.14.2.1.10.2-3: Cell specific test parameters for Intra frequency SAN handover test case

Parameter	Test configuration	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information	Config 1		SSC.1		NSC.1	
	Config 2		SSC.2		NSC.2	
NR RF Channel Number	Config 1,2		1		1	
$BW_{channel}$		MHz	3: $N_{PRB,c}$ = 15		3: $N_{PRB,c}$ = 15	
BWP BW		MHz	3: $N_{PRB,c}$ = 15		3: $N_{PRB,c}$ = 15	
TA_{Common}	Config 1,2	s	0		0	
$TA_{CommonDrift}$		s	0		0	
$TA_{CommonDriftVariation}$		s	0		0	
K_{offset}	Config 1	ms	239		239	
	Config 2		4		4	
K_{mac}	Config 1,2	ms	0		0	

Parameter		Test configuration	Unit	Cell 1		Cell 2	
				T1	T2	T1	T2
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel				SR.1.3 FDD			
CORESET Reference Channel				CR.1.2 FDD			
TRS configuration				TRS.1.1 FDD			
OCNG Patterns				OP.1			
SMTC Configuration				SMTC.1			
SSB Configuration				SSB.13 FR1			
PDSCH/PDCCH subcarrier spacing			kHz	15 kHz			
PUCCH/PUSCH subcarrier spacing			kHz	15 kHz			
PRACH configuration				FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP	Config 1,2		DLBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1			
	Initial UL BWP			ULBWP.0.1			
	Dedicated UL BWP			ULBWP.1.1			
EPRE ratio of PSS to SSS		Config 1,2	dB	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		Config 1,2	dBm/ 15 kHz	-98			
N_{oc} Note2			dBm/ SCS	-98			
$\hat{E}_s / I_{ot}$			dB	8	-3.3	2.36	2.36
$\hat{E}_s / N_{oc}$			dB	8	8	11	11
SSB_RP			dBm/ SCS	-90	-90	-87	-87
Io Note3			dBm/ 2.7 MHz	- 62.46	-62.46	-62.46	-62.46
Propagation condition			-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.2.1.10.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 132 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2]. $T_{interrupt}$ is defined in clause 6.1C.1.2.2.

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Here: T_{search} = 20ms; T_{IU} = 20 ms; $T_{processing}$ = 20 ms; T_{Δ} = 60 ms; T_{margin} = 2 ms.

This gives a total of 132 ms.

A.14.2.1.11 Intra-frequency SAN time-based conditional Handover from FR1 to FR1 for UE operating on a cell with less than 5 MHz BW

A.14.2. 11.1 Test Purpose and Environment

This test is to verify the requirement for intra-frequency SAN time-based conditional handover from FR1 to FR1 specified in clause 6.1C.2.2.

A.14.2. 11.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells as given in table A.14.2. 11.2-1, and A.14.2.1.11.2-2. Both handover delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. Immediately before the start of T1, the UE is configured to measure intra-frequency neighbour cell with a time-based handover trigger to Cell 2 with Event CondEvent T1 shall be sent to UE.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1 and time condition event t1-Threshold-r17 is fulfilled.

Table A.14.2. 11.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 15 kHz SSB SCS, 3 MHz BW
2	NGSO, NR FDD, 15 kHz SSB SCS, 3 MHz BW
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.1.11.2-2: General test parameters for Intra-frequency SAN time-based conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1	One NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	FDD duplex mode cell
	Neighbouring cell		Cell 2	FDD duplex mode cell
Final condition	Active cell		Cell 2	
UE position (N,S, H)			(0, 0, 0)	Set by any pre-configured means
t1-Threshold-r17.condEventT1-r17		s	T1	Entering condition at start of T2 (end of T1)
duration-r17.condEventT1-r17		slot	1000	Give 1 s search duration
A3-Offset in condition		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤ 2	

Table A.14.2. 11.2-3: Cell specific test parameters for Intra-frequency SAN time-based conditional handover from FR1 to FR1

Parameter	Test configuration	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information	Config 1		SSC.1		NSC.1	
	Config 2		SSC.2		NSC.2	

Parameter		Test configuration	Unit	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number		Config 1,2		1		1	
$BW_{channel}$			MHz	3: $N_{PRB,c}$ = 15		3: $N_{PRB,c}$ = 15	
BWP BW			MHz	3: $N_{PRB,c}$ = 15		3: $N_{PRB,c}$ = 15	
TA_{Common}		Config 1,2	s	0		0	
$TA_{CommonDrift}$			s	0		0	
$TA_{CommonDriftVariation}$			s	0		0	
K_{offset}		Config 1	ms	239		239	
		Config 2	ms	4		4	
K_{mac}		Config 1,2	ms	0		0	
DRX Cycle			ms	Not Applicable			
PDSCH Reference measurement channel				SR.1.2 FDD			
CORESET Reference Channel				CR.1.3 FDD			
TRS configuration				TRS.1.1 FDD			
OCNG Patterns				OP.1			
SMTC Configuration				SMTC.1			
SSB Configuration				SSB.13 FR1			
PDSCH/PDCCH subcarrier spacing			kHz	15 kHz			
PUCCH/PUSCH subcarrier spacing			kHz	15 kHz			
PRACH configuration				FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP	Config 1,2		DLBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1			
	Initial UL BWP			ULBWP.0.1			
	Dedicated UL BWP			ULBWP.1.1			
EPRE ratio of PSS to SSS		Config 1,2	dB	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		Config 1,2	dBm/ 15 kHz	-98			
N_{oc} Note2			dBm/ SCS	-98			
$\hat{E}_s / I_{ot}$			dB	8	-3.3	-Infinity	2.36
$\hat{E}_s / N_{oc}$			dB	8	8	-Infinity	11
SSB_RP			dBm/ SCS	-90	-90	-Infinity	-87
Io Note3			dBm/ 2.7 MHz	-66.81	-62.46	-66.81	-62.46
Propagation condition			-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.2. 11.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 892 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay is defined in clause 6.1C.2, can be expressed as:

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{interrupt} + T_{CHO_execution}$$

where:

RRC procedure delay T_{RRC} = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{Event_DU} = start of T2

$T_{measure}$ = 600 + 200 ms; $T_{interrupt}$ = 82 ms; $T_{CHO_execution}$ = 10 ms.

This gives a total of 892 ms.

A.14.2.2 RRC Connection Mobility Control

A.14.2.2.1 SA: RRC Re-establishment for SAN

A.14.2.2.1.1 Intra-frequency RRC Re-establishment in FR1

A.14.2.2.1.1.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR1 with known target cell is within the specified limits. These tests will verify the requirements in clause 6.2C.1.

The test parameters are given in table A.14.2.2.1.1.1-1, table A.14.2.2.1.1.1-2 and table A.14.2.2.1.1.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

Table A.14.2.2.1.1.1-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.2.1.1.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	
	Neighbour cells		1, 2	Cell 2	
Final condition	Active cell		1, 2	Cell 2	
RF Channel Number			1, 2	1	
Time offset between cells			1	3 ms	Asynchronous cells
N310		-	1, 2	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2	0	Radio link failure timer;
T311		ms	1, 2	3000	RRC re-establishment timer
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC.2	
DRX cycle length		s	1, 2	OFF	
PRACH configuration			1, 2	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2	5	

Parameter	Unit	Test configuration	Value	Comment
T2	ms	1, 2	640	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1C in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1C.5 in TS 38.133)
T3	s	1, 2	2	

Table A.14.2.2.1.1.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Satellite information		1	SSC.1			NSC.1		
		2	SSC.2			NSC.2		
PDSCH RMC configuration		1, 2	SR.1.1 FDD			SR.1.1 FDD		
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD			CR.1.1 FDD		
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD			CCR.1.1 FDD		
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
TRS configuration		1, 2	TRS.1.1 FDD			TRS.1.1 FDD		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		
Active DL BWP confgiuration		1, 2	DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		1, 2	ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
SSB configuration		1, 2	SSB.1 FR1			SSB.1 FR1		
RLM-RS		1, 2	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1, 2	1.54	-infinity	-infinity	-3.79	4	4
N_{oc} Note2	dBm/SCS	1, 2	-98					
N_{oc} Note2	dBm/15 kHz	1, 2	-98					
$\hat{E}_s / N_{oc}$	dB	1, 2	7	-infinity	-infinity	4	4	4
SS-RSRP Note3	dBm/SCS	1, 2	-91	-infinity	-infinity	-94	-94	-94
Io	dBm/9.36 MHz	1, 2	-60.74	-64.59	-64.59	-60.74	-64.59	-64.59
Propagation Condition		1, 2	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.2.2.1.1.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to a known NR intra frequency cell shall be less than 1.6 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 1$

$T_{identify_intra_NR}$ = 200 ms

T_{SI} = 1280 ms, provided that SIB1 and SIB19 are scheduled with 20 ms period; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 1545 ms, allow 1.6 s in the test case.

A.14.2.2.1.2 Inter-frequency RRC Re-establishment in FR1

A.14.2.2.1.2.1 Test Purpose and Environment

The purpose is to verify that the NR inter-frequency RRC re-establishment delay in FR1 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2C.1.

The test parameters are given in table A.14.2.2.1.2.1-1, table A.14.2.2.1.2.1-2 and table A.14.2.2.1.2.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of Cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of Cell 2 by the end of T1.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

Table A.14.2.2.1.2.1-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.2.1.2.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	
	Neighbour cells		1, 2	Cell 2	
Final condition	Active cell		1, 2	Cell 2	
RF Channel Number			1, 2	1, 2	
Time offset between cells			1, 2	3 ms	Asynchronous cells
N310		-	1, 2	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2	0	Radio link failure timer;
T311		ms	1, 2	5000	RRC re-establishment timer

Parameter	Unit	Test configuration	Value	Comment
Access Barring Information	-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration		1, 2	SMTC.2	
DRX cycle length	s	1, 2	OFF	
PRACH configuration		1, 2	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1	s	1, 2	5	
T2	ms	1, 2	640	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1C in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1C.5 in TS 38.133)
T3	s	1, 2	5	

Table A.14.2.2.1.2.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Satellite information		1	SSC.1			NSC.1		
		2	SSC.2			NSC.2		
RF Channel Number		1, 2	1			2		
PDSCH RMC configuration		1, 2	SR.1.1 FDD			SR.1.1 FDD		
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD			CR.1.1 FDD		
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD			CCR.1.1 FDD		
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
TRS configuration		1, 2	TRS.1.1 FDD			TRS.1.1 FDD		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		
Active DL BWP confgiuration		1, 2	DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		1, 2	ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
SSB configuration		1, 2	SSB.1 FR1			SSB.1 FR1		
RLM-RS		1, 2	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-infinity	-infinity	-infinity	-infinity	7
N_{oc} Note2	dBm/SCS	1, 2	-98					
N_{oc} Note2	dBm/15 kHz	1, 2	-98					
$\hat{E}_s/N_{oc}$	dB	1, 2	4	-infinity	-infinity	-infinity	-infinity	7
SS-RSRP Note3	dBm/SCS	1, 2	-94	-infinity	-infinity	-infinity	-infinity	-91
Io	dBm/9.36 MHz	1, 2	-64.59	-70. 05	-70. 05	-70. 05	-70. 05	-62.26
Propagation Condition		1, 2	AWGN					

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

A.14.2.2.1.2.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR inter frequency cell shall be less than 3 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50\ ms + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 2$

$T_{identify_intra_NR}$ = 800 ms

$T_{identify_inter_NR}$ = 800 ms

T_{SI} = 1280 ms, provided that SIB1 and SIB19 are scheduled with 20 ms period; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target inter-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 2945 ms, allow 3 s in the test case.

A.14.2.2.2 Random Access

A.14.2.2.2.1 4-step RA type contention based random access test in FR1 for NR standalone

A.14.2.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2C.2.2 and clause 7.1C.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.14.2.2.2.1.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.14.2.2.2.1.1-2.

Table A.14.2.2.2.1.1-1: Supported test configurations for contention based random access test for satellite access

Configuration	Description

1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.2.2.1.1-2: General test parameters for contention based random access test for satellite access

Parameter			Unit	Test-1	Comments
SSB Configuration		Config 1		SSB.1 FR1	As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
		Config 2		SSB.1 FR1	
Number of SSBs per SS-burst				2	Different from the definition in A.3.10
SS/PBCH block index				0,1	Different from the definition in A.3.10
Duplex Mode for Cell 1		Config 1		FDD	
		Config 2		FDD	
CSI-RS for tracking		Config 1, 2		TRS.1.1 FDD	
OCNG Pattern Note 1				OP.1	As defined in A.3.2.1.
PDSCH parameters Note 4		Config 1, 2		SR.1.1 FDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel		Config 1, 2		CR.1.1 FDD	
Dedicated CORESET Reference Channel		Config 1, 2		CCR.1.1 FDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1, 2	dBm/15 kHz	-98	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP Note 3		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1, 2	dBm/15 kHz	-98	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	
Io Note 2		Config 1, 2	dBm	-65.3/9.36 MHz	For symbols without SSB index 1
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\mathrm{CMAX},\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 1	As defined in A.3.8.
Propagation Condition			-	AWGN	

Parameter	Unit	Test-1	Comments
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.			
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.			
NOTE 3: Void			
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.			

A.14.2.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.14.2.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in clause 6.2C.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2C.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1C.2.

A.14.2.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in clause 6.2C.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2C.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1C.2.

A.14.2.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2C.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2C.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1C.2.

A.14.2.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2C.2.2.1.4 the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.14.2.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2C.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

A.14.2.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2C.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

A.14.2.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in clause 6.2C.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.14.2.2.2.2 4-step RA type non-contention based random access test in FR1 for NR standalone

A.14.2.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2C.2.2 and clause 7.1C.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.14.2.2.2.2.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.14.2.2.2.2.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports csi-RSRP-AndRSRQ-MeasWithSSB or csi-RSRP-AndRSRQ-MeasWithoutSSB.

Table A.14.2.2.2.2.1-1: Supported test configurations for non-contention based random access test for satellite access

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.2.2.2.1-2: General test parameters for non-contention based random access test satellite access

Parameter		Unit	Test-1	Test-2	Comments
SSB Configuration	Config 1		SSB.1 FR1	SSB.1 FR1	As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 2		SSB.1 FR1	SSB.1 FR1	
Number of SSBs per SS-burst			2	2	Different from the definition in A.3.10
SS/PBCH block index			0,1	0,1	Different from the definition in A.3.10
CSI-RS Configuration	Config 1, 2		N/A	CSI-RS.1.1 FDD	As defined in A.3.1.4
Duplex Mode for Cell 1	Config 1, 2		FDD	FDD	
CSI-RS for tracking	Config 1, 2		TRS.1.1 FDD	TRS.1.1 FDD	
OCNG Pattern Note 1			OP.1	OP.1	As defined in A.3.2.1.
PDSCH parameters Note 4	Config 1, 2		SR.1.1 FDD	SR.1.1 FDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1, 2		CR.1.1 FDD	CR.1.1 FDD	
Dedicated CORESET Reference Channel	Config 1, 2		CCR.1.1 FDD	CCR.1.1 FDD	
NR RF Channel Number			1	1	
EPRE ratio of PSS to SSS		dB	0	0	
EPRE ratio of PBCH_DMRS to SSS		dB			
EPRE ratio of PBCH to PBCH_DMRS		dB			
EPRE ratio of PDCCH_DMRS to SSS		dB			
EPRE ratio of PDCCH to PDCCH_DMRS		dB			
EPRE ratio of PDSCH_DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH_DMRS		dB			
SSB with index 0	$\hat{E}_s / I_{ot}$	dB	3	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc} Config 1, 2	dBm/15 kHz	-98	-98	
	$\hat{E}_s / N_{oc}$	dB	3	3	
	SS-RSRP Note 3	dBm/ SCS	-95	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$	dB	-17	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc} Config 1, 2	dBm/15 kHz	-98	-98	
	$\hat{E}_s / N_{oc}$	dB	-17	-17	
	SS-RSRP Note 3	dBm/ SCS	-115	-115	
Io Note 2	Config 1, 2	dBm	-65.3/9.36 MHz	-65.3/9.36 MHz	For symbols without SSB index 1
ss-PBCH-BlockPower		dBm/ SCS	-5	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)		dBm	23	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration			FR1 PRACH configuration 2	FR1 PRACH configuration 3	As defined in A.3.8.2.
Propagation Condition		-	AWGN	AWGN	

Parameter	Unit	Test-1	Test-2	Comments
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.				
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.				
NOTE 3: Void				
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.				

A.14.2.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.14.2.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in clause 6.2C.2.2.2.1 for SSB-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2C.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1C.2.

A.14.2.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in clause 6.2C.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2C.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1C.2.

A.14.2.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in clause 6.2C.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2C.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1C.2.

A.14.2.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2C.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2C.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1C.2.

A.14.2.2.3 RRC Connection Release with Redirection

A.14.2.2.3.1 Redirection from NR in FR1 to NR in FR1

A.14.2.2.3.1.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to NR requirements specified in clause 6.2C.3.2.1.

A.14.2.2.3.1.2 Test Parameters

Supported test configurations are shown in table A.14.2.2.3.1.2-1. The time delay is tested by using the parameters in table A.14.2.2.3.1.2-2, and A.14.2.2.3.1.2-3.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2. Cell 1 and Cell 2 belong to different tracking areas.

Table A.14.2.2.3.1.2-1: Redirection from NR to NR test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.2.2.3.1.2-2: General test parameters for Redirection from NR to NR test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	2.3	

Table A.14.2.2.3.1.2-3: Cell specific test parameters for Redirection from NR to NR test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		Config 1			SSC.1	
		Config 2			SSC.2	
NR RF Channel Number			1		2	
Duplex mode	Config 1, 2		FDD			
SSB Configuration	Config 1, 2		SSB.1 FR1			
CSI-RS for tracking	Config 1, 2		TRS.1.1 FDD			
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
DRx Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1, 2		SR.1.1 FDD			
CORESET Reference Channel	Config 1, 2		CR.1.1 FDD			
OCNG Patterns			OCNG pattern 1			
SMTC configuration	Config 1,2		SMTC.1 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
$\hat{E}_s / I_{ot}$		dB	4	4	-infinity	4
$\hat{E}_s / N_{oc}$		dB	4	4	-infinity	4
Io Note3	Config 1,2	dBm/ 9.36MHz	-64.59	-64.59	-70.05	-64.59
Propagation condition		-	AWGN			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.2.2.3.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 2240 ms from the beginning of time period T2.

The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_NR} = T_{RRC_procedure_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH},$$

Where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}NR}$ = 680 ms in the test.

$T_{SI\text{-}NR}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target NR cell.

T_{RACH} = 170 ms in the test.

This gives a total of 2240 ms.

A.14.2.2.4 RACH-based Hard Satellite switching with re-synchronization from FR1 to FR1

A.14.2.2.4.1 Test Purpose and Environment

This test is to verify the requirement for RACH-based hard satellite switching with re-synchronization from SAN FR1 to SAN FR1 specified in clause 6.1C.3.

A.14.2.2.4.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells with same PCI as given in table A.14.2.2.4.2-1, A.14.2.2.4.2-2, A.14.2.2.4.2-3 and A.14.2.2.4.2-4. Both satellite switching delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively.

At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, The SIB19 implying *t-service-r17* and target satellite configuration *SatSwitchWithReSync-r18* shall be sent to UE. The target satellite configuration is in table A.14.2.2.4.2-3.

At the start of time duration T2, Cell 2 becomes detectable and *t-service-r17* of Cell 1 is fulfilled.

Table A.14.2.2.4.2-1: Supported test configurations

Configuration	Description
1	NGSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW

Table A.14.2.2.4.2-2: General test parameters for RACH-based Hard Satellite switching with re-synchronization from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1	One NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	
Final condition	Active cell		Cell 2	
UE position (L,B, H)			(0, 0, 0)	Set by any pre-configured means. (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
Access Barring Information		-	Not barred	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	

Table A.14.2.2.4.2-3: Target Satellite configuration pattern for hard satellite switching scenario

Parameter	TSC.1
Interval between adjacent epoch time	2.56 s
ntn-UlSyncValidityDuration	5 s
cellSpecificKoffset	14 slots
ta-Common	0
ta-CommonDrift	0
ta-CommonDriftVariant	0
ntn-PolarizationDL	linear
ntn-PolarizationUL	linear
ephemerisInfo	Detailed ephemeris information is provided in TS 38.508-1 [38]
ssb-TimeOffset	0

Table A.14.2.2.4.2-4: Cell specific test parameters for RACH-based Hard Satellite switching with re-synchronization from FR1 to FR1 test case

Parameter		Unit	Cell 1 Note1		Cell 2 Note1	
			T1	T2	T1	T2
Satellite configuration Note2			SSC.2	N/A	N/A	SSC.2
$BW_{channel}$		MHz	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52
BWP BW		MHz	10: $N_{PRB,c}$ = 52			10: $N_{PRB,c}$ = 52
K_{mac}		ms	0			0
DRX Cycle		ms	Not Applicable			Not Applicable
PDSCH Reference measurement channel			SR.1.1 FDD			SR.1.1 FDD
CORESET Reference Channel			CR.1.1 FDD			CR.1.1 FDD
TRS configuration			TRS.1.1 FDD			TRS.1.1 FDD
OCNG Patterns			OP.1			OP.1
SMTC Configuration			SMTC.1			SMTC.1
SSB Configuration			SSB.1 FR1			SSB.1 FR1
PDSCH/PDCCH subcarrier spacing		kHz	15 kHz			15 kHz
PUCCH/PUSCH subcarrier spacing		kHz	15 kHz			15 kHz
PRACH configuration			FR1 PRACH configuration 1			FR1 PRACH configuration 1
BWP configuration	Initial DL BWP		DLBWP.0.1			DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1			DLBWP.1.1
	Initial UL BWP		ULBWP.0.1			ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1			ULBWP.1.1
EPRE ratio of PSS to SSS		dB	0			0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note3		dBm/ 15 kHz	-98			
N_{oc} Note3		dBm/ SCS	-98			
$\hat{E}_s / I_{ot}$		dB	8	-Infinity	-Infinity	8
$\hat{E}_s / N_{oc}$		dB	8	-Infinity	-Infinity	8
SSB_RP		dBm/ SCS	-90	-Infinity	-Infinity	-90
Io Note4		dBm/ 9.36 MHz	-61.41	-61.41	-61.41	-61.41
Propagation condition		-	AWGN			

NOTE 1: Cell 1 and Cell 2 have same PCI. Satellite serving for Cell 1 and Satellite serving for Cell 2 are two different NGSO satellites.

Parameter	Unit	Cell 1[Note1]		Cell 2[Note1]	
		T1	T2	T1	T2
NOTE 2: SSB transmit timing from TE should fit the SSB-timeOffset and the nominal propagation delay difference between serving satellite and target satellite. The nominal propagation delay is counted from the SSB-TimeOffset reference point to UE, which based on satellite locations and UE location known to the TE in this test case.					
NOTE 3: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 4: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 5: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

A.14.2.2.4.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 52.5 ms from the beginning of time period T2.

The rate of correct satellite switch observed during repeated tests shall be at least 90 %.

NOTE: The hard satellite switch with re-sync delay $D_{switch_unchangedPCI}$ can be expressed as: $T_{interrupt}$, where:

$T_{interrupt}$ is defined in clause 6.1C.3.2.2.

$$D_{switch_unchangedPCI} = T_{interrupt} = T_{search} + T_{processing} + T_{\Delta} + T_{margin}\ \text{ms}$$

Here: $T_{search} = T_{first_SSB} = 0.5$ms; $T_{processing} = 10$ms; $T_{\Delta} = 20$ms; $T_{margin} = 2$ms.

Besides, interruption uncertainty $T_{IU} = 20$ms in acquiring the first PRACH transmission resource is needed.

This gives a total of 52.5 ms.

A.14.2.2.5 RACH-less Soft Satellite switching with re-synchronization from FR1 to FR1

A.14.2.2.5.1 Test Purpose and Environment

This test is to verify the requirement for RACH-less soft satellite switching with re-synchronization from SAN FR1 to SAN FR1 specified in clause 6.1C.3.

A.14.2.2.5.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells with same PCI as given in tables A.14.2.2.5.2-1, A.14.2.2.5.2-2, A.14.2.2.5.2-3 and A.14.2.2.5.2-4. Satellite switching delay is tested.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively.

At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, The SIB19 implying *t-service-r17* and target satellite configuration *SatSwitchWithReSync-r18* shall be sent to UE. The target satellite configuration is in table A.14.2.2.5.2-3. The configured grant PUSCH transmission in the Cell 2 is configured in the RRC message from Cell 1.

At the start of time duration T2, Cell 2 becomes detectable and *t-ServiceStart-r18* is fulfilled.

At the start of time duration T3, *t-service-r17* of Cell 1 is fulfilled.

Table A.14.2.2.5.2-1: Supported test configurations

Configuration	Description
1	NGSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW

Table A.14.2.2.5.2-2: General test parameters for RACH-less Soft Satellite switching with re-synchronization from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1	One NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	
Final condition	Active cell		Cell 2	
UE position (L,B, H)			(0, 0, 0)	Set by any pre-configured means. (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
Access Barring Information		-	Not barred	No additional delays in random access procedure.
timeDomainOffset			0	
timeDomainAllocation			0	PUSCH MappingType A *startSymbol S=0* *Length* L=14
timeReferenceSFN-r16			sfn512	
Periodcity			sym10x14	
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		ms	100	
T3		s	≤5	

Table A.14.2.2.5.2-3: Target Satellite configuration pattern for soft satellite switching scenario

Parameter	TSC.2
Interval between adjacent epoch time	2.56 s
ntn-UlSyncValidityDuration	5 s
cellSpecificKoffset	14 slots
ta-Common	0
ta-CommonDrift	0
ta-CommonDriftVariant	0
ntn-PolarizationDL	linear
ntn-PolarizationUL	linear
ephemerisInfo	Detailed ephemeris information is provided in TS 38.508-1 [38]
ssb-TimeOffset	10
t-ServiceStart	T2

Table A.14.2.2.5.2-4: Cell specific test parameters for Inter frequency SAN handover test case

Parameter		Unit	Cell 1[Note1]			Cell 2[Note1]		
			T1	T2	T3	T1	T2	T3
Satellite configuration[Note2]			SSC.2		N/A	N/A	SSC.2	
$BW_{channel}$		MHz	10: $N_{PRB,c}$ = 52				10: $N_{PRB,c}$ = 52	
BWP BW		MHz	10: $N_{PRB,c}$ = 52				10: $N_{PRB,c}$ = 52	
K_{mac}		ms	0				0	
DRX Cycle		ms	Not Applicable				Not Applicable	
PDSCH Reference measurement channel			SR.1.1 FDD				SR.1.1 FDD	
CORESET Reference Channel			CR.1.1 FDD				CR.1.1 FDD	
TRS configuration			TRS.1.1 FDD				TRS.1.1 FDD	
OCNG Patterns			OP.1				OP.1	
SMTC Configuration			SMTC.1				SMTC.5	
SSB Configuration			SSB.1 FR1				SSB.5 FR1	
PDSCH/PDCCH subcarrier spacing		kHz	15 kHz				15 kHz	
PUCCH/PUSCH subcarrier spacing		kHz	15 kHz				15 kHz	
PRACH configuration			FR1 PRACH configuration 1				N/A	
BWP configuration	Initial DL BWP		DLBWP.0.1				DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1				DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1				ULBWP.0.1	

Parameter		Unit	Cell 1[Note1]			Cell 2[Note1]		
			T1	T2	T3	T1	T2	T3
	Dedicated UL BWP		ULBWP.1.1				ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0				0	
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/ 15 kHz	-98					
N_{oc} Note2		dBm/ SCS	-98					
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	-Infinity	9	9
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	-Infinity	9	9
SSB_RP		dBm/ SCS	-94	-94	-Infinity	-Infinity	-89	-89
Io[Note3]		dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-70.05	-60.53	-60.53
Propagation condition		-	AWGN					

NOTE 1: Cell 1 and Cell 2 have same PCI. Satellite serving for Cell 1 and Satellite serving for Cell 2 are two different NGSO satellites.
NOTE 2: SSB transmit timing from TE should fit the SSB-timeOffset and the nominal propagation delay difference between serving satellite and target satellite. The nominal propagation delay is counted from the SSB-TimeOffset reference point to UE, which based on satellite locations and UE location known to the TE in this test case.
NOTE 3: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 5: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

A.14.2.2.5.3 Test Requirements

The UE shall start to transmit the PUSCH to Cell 2 less than 130 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The satellite switch with re-sync delay $D_{switch_unchangedPCI}$ can be expressed as: T_{soft_switch}, where:

$$T_{soft_switch} = \max(t\text{-}service\text{-}t\text{-}seviceStart, T_{search} + T_{\Delta} + T_{margin}) + T_{IU} + T_{processing} \text{ ms}$$

Here: *t-service-t-seviceStart*= 100ms; T_{search} = 10.5ms; T_{Δ} = 20ms; T_{margin} = 2ms, $T_{processing}$ = 10ms.

Besides, interruption uncertainty T_{IU} = 20ms in acquiring the first configured grant based PUSCH transmission resource is needed.

This gives a total of 130 ms.

A.14.2.2.6 RACH-based hard Satellite switching with re-synchronization from FR1 to FR1 for less than 5MHz with NTN

A.14.2.2.6.1 Test Purpose and Environment

This test is to verify the requirement for RACH-based hard satellite switching with re-synchronization from SAN FR1 to SAN FR1 for unknown target cell operating with 12 PRB SSB bandwidth specified in clause 6.1C.3.

A.14.2.2.6.2 Test Parameters

Supported test configurations are shown in table A.14.2.2.6.2-1. General test parameters as specified in table A.14.2.2.6.2-2 apply except those specified in table A.14.2.2.4.2-2. Target Satellite configuration pattern specified in table A.14.2.2.4.2-3 shall apply. Cell specific test parameters as specified in table A.14.2.2.6.2-4 apply except those specified in table A.14.2.2.4.2-4.

The test procedure specified in clause A.14.2.2.4.2 applies to this test. The Cell 2 is the unknown target cell operating with 12 PRB SSB bandwidth.

Table A.14.2.2.6.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, 15 kHz SSB SCS, 3 MHz BW
2	NGSO, NR FDD, 15 kHz SSB SCS, 3 MHz BW

Table A.14.2.2.6.2-2: General test parameters for RACH-based hard Satellite switching with re-synchronization from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
Final condition	Active cell		Cell 2	unknown target cell operating with 12 PRB SSB bandwidth

Table A.14.2.2.6.2-3: Cell specific test parameters for RACH-based Hard Satellite switching with re-synchronization from FR1 to FR1 test case

Parameter		Unit	Cell 1[Note1]		Cell 2[Note1]	
			T1	T2	T1	T2
$BW_{channel}$	Config 1,2	MHz	3: $N_{PRB,c}$ = 15			3: $N_{PRB,c}$ = 15
BWP BW		MHz	3: $N_{PRB,c}$ = 15			3: $N_{PRB,c}$ = 15
PDSCH Reference measurement channel			SR.1.2 FDD			SR.1.2 FDD
CORESET Reference Channel			CR.1.3 FDD			CR.1.3 FDD
SSB Configuration			SSB.13 FR1			SSB.13 FR1
Io^{Note1}	Config 1, 2	dBm/ 2.7 MHz	-66.81	-66.81	-66.81	-66.81
NOTE 1: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.14.2.2.6.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 52.5 ms from the beginning of time period T2.

The rate of correct satellite switch observed during repeated tests shall be at least 90 %.

NOTE: The hard satellite switch with re-sync delay $D_{switch_unchangedPCI}$ can be expressed as: $T_{interrupt}$, where:

$T_{interrupt}$ is defined in clause 6.1C.3.2.2.

$$D_{switch_unchangedPCI} = T_{interrupt} = T_{search} + T_{processing} + T_{\Delta} + T_{margin}\ \text{ms}$$

Here: $T_{search} = T_{first_SSB} = 0.5\text{ms}$; $T_{processing} = 10\text{ms}$; $T_{\Delta} = 20\text{ms}$; $T_{margin} = 2\text{ms}$.

This gives a total of 52.5 ms.

A.14.2.3 Intra-frequency SAN time-based conditional Handover without L3 measurement criteria from FR1 to FR1

A.14.2.3.1 Test Purpose and Environment

This test is to verify the requirement for intra-frequency SAN time-based conditional handover without L3 measurement criteria from FR1 to FR1 specified in clause 6.1C.2.3.

A.14.2.3.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells as given in table A.14.2.3.2-1, and A.14.2.3.2-2. Both handover delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, the UE is configured to measure intra-frequency neighbour cell. The RRC message implying time-based handover to Cell 2 with Event CondEvent T1 shall be sent to UE, at a time earlier than T_{RRC} (10 ms) before the beginning of T2.

Starting T2, Cell 2 becomes detectable and time condition event t1-Threshold-r17 is fulfilled.

Table A.14.2.3.2-1: Supported test configurations

Configuration	Description
1	NGSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW

Table A.14.2.3.2-2: General test parameters for Intra-frequency SAN time-based conditional handover without L3 measurement criteria from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1	One NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	FDD duplex mode cell
	Neighbouring cell		Cell 2	FDD duplex mode cell
Final condition	Active cell		Cell 2	
Satellite configuration	Config 1		RMC in [A.x]	For NGSO satellite configuration
UE position (L,B, H)			(0, 0, 0)	Set by any pre-configured means. (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
t1-Threshold-r17.condEventT1-r17		s	T2	Entering condition
duration-r17.condEventT1-r17		slot	1000	Give 1 s search duration
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤ 2	

Table A.14.2.3.2-3: Cell specific test parameters for Intra-frequency SAN time-based conditional handover without L3 measurement criteria from FR1 to FR1

Parameter	Test configuration	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number	Config 1		1		1	
$BW_{channel}$		MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
BWP BW		MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
TA_{Common}	Config 1	s	0		0	
$TA_{CommonDrift}$		s	0		0	
$TA_{CommonDriftVariation}$		s	0		0	
K_{offset}	Config 1	ms	[4]		[4]	
K_{mac}	Config 1	ms	0		0	
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR.1.1 FDD			
CORESET Reference Channel			CR.1.1 FDD			
TRS configuration			TRS.1.1 FDD			

Parameter		Test configuration	Unit	Cell 1		Cell 2	
				T1	T2	T1	T2
OCNG Patterns				OP.1			
SMTC Configuration				SMTC.1			
SSB Configuration				SSB.1 FR1			
PDSCH/PDCCH subcarrier spacing			kHz	15 kHz			
PUCCH/PUSCH subcarrier spacing			kHz	15 kHz			
PRACH configuration				FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP	Config 1		DLBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1			
	Initial UL BWP			ULBWP.0.1			
	Dedicated UL BWP			ULBWP.1.1			
EPRE ratio of PSS to SSS		Config 1	dB	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		Config 1	dBm/ 15 kHz	-98			
N_{oc} Note2			dBm/ SCS	-98			
$\hat{E}_s / I_{ot}$			dB	8	-3.3	-Infinity	2.36
$\hat{E}_s / N_{oc}$			dB	8	8	-Infinity	11
SSB_RP			dBm/ SCS	-90	-90	-Infinity	-87
Io Note3			dBm/ 9.36 MHz	-61.41	-57.06	-61.41	-57.06
Propagation condition			-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.2.3.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 92 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay is defined in clause 6.1C.2.3, can be expressed as:

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{interrupt} + T_{CHO_execution}$$

where:

RRC procedure delay T_{RRC} = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{Event_DU} = start of T2

$T_{interrupt}$ = 82 ms; $T_{CHO_execution}$ = 10 ms.

This gives a total of 92 ms.

A.14.2.4 Inter-frequency SAN time-based conditional Handover without L3 measurement criteria from FR1 to FR1

A.14.2.4.1 Test Purpose and Environment

This test is to verify the requirement for inter -frequency SAN time-based conditional handover without L3 measurement criteria from FR1 to FR1 specified in clause 6.1C.2.

A.14.2.4.2 Test Parameters

The test scenario comprises of 2 NR FDD carrier and one cell on each carrier as given in table A.14.2.4.2-1, and A.14.2.4.2-2. Both handover delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, the UE is configured to measure inter-frequency neighbour cell and Gap pattern ID gp0. The RRC message implying time-based handover to Cell 2 with Event CondEvent T1 shall be sent to UE, at a time earlier than T_{RRC} (10 ms) before the beginning of T2.

Starting T2, Cell 2 becomes detectable and time condition event t1-Threshold-r17 is fulfilled.

Table A.14.2.4.2-1: Supported test configurations

Configuration	Description
1	NGSO, NR FDD, 15 kHz SSB SCS, 10 MHz BW

Table A.14.2.4.2-2: General test parameters for Inter-frequency SAN time-based conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two NR NTN satellite RF channel
Initial conditions	Active cell		Cell 1	FDD duplex mode cell
	Neighbouring cell		Cell 2	FDD duplex mode cell
Final condition	Active cell		Cell 2	
Satellite configuration	Config 1		RMC in [A.x]	For NGSO satellite configuration
UE position (L,B, H)			(0, 0, 0)	Set by any pre-configured means. (L,B,H) is Geodetic coordinate, where L is latitude, B is longitude, and H is height.
t1-Threshold-r17.condEventT1-r17		s	T2	Entering condition
duration-r17.condEventT1-r17		slot	1000	Give 1 s search duration
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤ 2	

Table A.14.2.4.2-3: Cell specific test parameters for Inter-frequency SAN time-based conditional handover from FR1 to FR1

Parameter	Test configuration	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number	Config 1		1		2	
$BW_{channel}$		MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
BWP BW		MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
TA_{Common}	Config 1	s	0		0	
$TA_{CommonDrift}$		s	0		0	
$TA_{CommonDriftVariation}$		s	0		0	
K_{offset}	Config 1	ms	[4]		[4]	
K_{mac}	Config 1	ms	0		0	
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR.1.1 FDD			
CORESET Reference Channel			CR.1.1 FDD			
TRS configuration			TRS.1.1 FDD			

Parameter		Test configuration	Unit	Cell 1		Cell 2	
				T1	T2	T1	T2
OCNG Patterns				OP.1			
SMTC Configuration				SMTC.1			
SSB Configuration				SSB.1 FR1			
PDSCH/PDCCH subcarrier spacing			kHz	15 kHz			
PUCCH/PUSCH subcarrier spacing			kHz	15 kHz			
PRACH configuration				FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP	Config 1		DLBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1			
	Initial UL BWP			ULBWP.0.1			
	Dedicated UL BWP			ULBWP.1.1			
EPRE ratio of PSS to SSS		Config 1	dB	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		Config 1	dBm/ 15 kHz	-98			
N_{oc} Note2			dBm/ SCS	-98			
$\hat{E}_s / I_{ot}$			dB	4	4	-Infinity	9
$\hat{E}_s / N_{oc}$			dB	4	4	-Infinity	9
SSB_RP			dBm/ SCS	-94	-94	-Infinity	-89
Io Note3			dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-60.53
Propagation condition			-	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.2.4.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 132 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay is defined in clause 6.1C.2.3, can be expressed as:

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{interrupt} + T_{CHO_execution}$$

where:

RRC procedure delay T_{RRC} = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{Event_DU} = start of T2

$T_{interrupt}$ = 122 ms; $T_{CHO_execution}$ = 10 ms.

This gives a total of 132 ms.

A.14.3 Timing for Satellite Access

A.14.3.1 UE transmit timing for Satellite Access

A.14.3.1.1 NR UE Transmit Timing Test for FR1

A.14.3.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the reference cell and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1C.2. Supported test configurations are shown in table A.14.3.1.1.1-1.

Table A.14.3.1.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE:	If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.

The test consists a single NR cell (PCell). Table A.14.3.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.14.3.1.1.1-3.

Table A.14.3.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2
SSB ARFCN		1,2	1	1
Serving satellite configuration		1	SSC.1	
		2	SSC.2	
$BW_{channel}$	MHz	1,2	10: $N_{PRB,c}$ = 52	
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1	
DRX Cycle	ms	1,2	N/A	DRX.8[Note5]
PDSCH Reference measurement channel		1,2	SR.1.1 FDD	
RMSI CORESET Reference Channel		1,2	CR.1.1 FDD	
Dedicated CORESET Reference Channel		1,2	CCR.1.1 FDD	
OCNG Patterns		1,2	OP.1	
SSB configuration		1,2	SSB.1 FR1	
SMTC Configuration		1,2	SMTC.1	
TRS configuration		1,2	TRS.1.1 FDD	
EPRE ratio of PSS to SSS	dB	1,2	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} [Note2]	dBm/15 kHz	1,2	-98	-98
N_{oc} [Note2]	dBm/SCS	1,2	-98	-98
$\hat{E}_s / I_{ot}$		1,2	3	3
$\hat{E}_s / N_{oc}$		1,2	3	3
SS-RSRP[Note3]	dBm/SCS	1,2	-95	-95

Parameter	Unit	Config	Test1	Test2
Io[Note3]	dBm/9.36 MHz	1,2	-65.2	-65.2
Propagation condition		1,2	AWGN	
SRS Config		1,2	SRSConf.1[Note6]	SRSConf.2[Note6]

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.14.3.1.1.1-3

Table A.14.3.1.1.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	14	14	Matches $N_{PRB,c}$
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl320, 3	Offset to align with DRX periodicity
	sequenceId	0	0	Any 10 bit number

A.14.3.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up PCell according to parameters given in table A.14.3.1.1.1-2.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\text{-}offset}} + N_{\mathrm{TA,adj}}^{\mathrm{common}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}} \pm \left(T_{\mathrm{e_NTN}} - T_{\mathrm{GNSS_margin}}\right)$ of the first detected path of DL SSB.

   a. The N_{TA_offset} value (in T_c units) is 25600

b. The $N_{\mathrm{TA,adj}}^{\mathrm{common}}$ value is derived from the higher-layer parameters *TACommon*, *TACommonDrift*, and *TACommonDriftVariation*.

c. The $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$ value is computed by the UE based on UE position and serving-satellite-ephemeris-related higher-layers parameters.

d. The $T_{\mathrm{e_NTN}}$ values depend on the DL and UL SCS for which the test is being run and are given in table 7.1C.2-1

e. The $T_{\mathrm{GNSS_margin}}$ counts for the margin for the GNSS position definition error considered in the core requirement, which needs to be substracted for the test requirement, due to the usage of AT commands or any other pre-configured means in the test. $T_{\mathrm{GNSS_margin}} = 327{,}68 \times T_{\mathrm{c}}$

3) If the NTN parameters are configured as GSO scenario, the test system shall adjust the timing of the DL path by values given in table A.14.3.1.1.2-1. If the NTN parameters are configured as NGSO scenario, the test system shall adjust the timing of the DL path according to the serving-satellite-ephemeris-related higher-layers parameters.

Table A.14.3.1.1.2-1: Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
15	+64*64T_c	+32*64T_c

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1C.2 Table 7.1C.2.1-1 until the UE transmit timing offset is within $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\text{-}offset}} + N_{\mathrm{TA,adj}}^{\mathrm{common}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}} \pm (T_{\mathrm{e_NTN}} - T_{\mathrm{GNSS_margin}})$ respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\text{-}offset}} + N_{\mathrm{TA,adj}}^{\mathrm{common}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}} \pm (T_{\mathrm{e_NTN}} - T_{\mathrm{GNSS_margin}})$ of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

A.14.3.1.2 NR UE Transmit Timing Test for FR2-NTN

A.14.3.1.2.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the reference cell and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1C.2. Supported test configurations are shown in table A.14.3.1.2.1-1.

Table A.14.3.1.2.1-1: Supported test configurations for FR2-NTN PCell

Configuration	Description
1	GSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NGSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
3	GSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
NOTE: For mobile VSAT UE type, it is only requied to pass test config 3.	

The test consists a single NR cell (PCell). Table A.14.3.1.2.1-2 and A.14.3.1.2.1-2A defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.14.3.1.2.1-3.

Table A.14.3.1.2.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2
SSB ARFCN		1,2,3	Freq1	Freq1
Serving satellite configuration		1	SSC.1.	
		2	SSC.2	

		3	SSC.1	
$BW_{channel}$	MHz	1,2,3	100: $N_{PRB,c}$ = 66	
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1	
DRX Cycle	ms	1,2,3	N/A	DRX.8[Note5]
PDSCH Reference measurement channel		1,2,3	SR.3.1 TDD	
RMSI CORESET Reference Channel		1,2,3	CR.3.1 TDD	
Dedicated CORESET Reference Channel		1,2,3	CCR.2.1 TDD	
OCNG Patterns		1,2,3	OP.1	
SSB configuration		1,2,3	SSB.1 FR2	
SMTC Configuration		1,2,3	SMTC.1	
TRS configuration		1,2,3	TRS.2.1 FDD	
EPRE ratio of PSS to SSS	dB	1,2,3	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation condition		1,2,3	AWGN	
SRS Config		1,2,3	SRSConf.1[Note6]	SRSConf.2[Note6]

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.14.3.1.2.1-3

Table A.14.3.1.2.1-2A: OTA related test parameters

Parameter	Unit	Test 1	Test 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams[Note 6]		Fine (For electronic steering antenna type) RX beam of RX beam peak direction (For mechanical steering antenna type)	
N_{oc} [Note1]	dBm/15 kHz[Note4]	-112	
N_{oc} [Note1]	dBm/SCS[Note3]	-103	
$\hat{E}_s / N_{oc}$	dB	4	
SS-RSRP[Note2]	dBm/SCS [Note4]	-96	
$\hat{E}_s / I_{ot}$	dB	4	
Io[Note2]	dBm/95.04 MHz [Note4]	-68.5	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.14.3.1.2.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	17	17	Matches $N_{PRB,c}$
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	Sl2560, 4	Offset to align with DRX periodicity
	sequenceId	0	0	Any 10 bit number

A.14.3.1.2.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up PCell according to parameters given in table A.14.3.1.2.1-2.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\text{-}offset}} + N_{\mathrm{TA,adj}}^{\mathrm{common}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}} \pm \left(T_{\mathrm{e_NTN}} - T_{\mathrm{GNSS_margin}}\right)$ of the first detected path of DL SSB.

   a. The $N_{\mathrm{TA_offset}}$ value (in T_c units) is 0

   b. The $N_{\mathrm{TA,adj}}^{\mathrm{common}}$ value is derived from the higher-layer parameters *TACommon*, *TACommonDrift*, and *TACommonDriftVariation*.

   c. The $N_{\mathrm{TA,adj}}^{\mathrm{UE}}$ value is computed by the UE based on UE position and serving-satellite-ephemeris-related higher-layers parameters.

   d. The $T_{\mathrm{e_NTN}}$ values depend on the DL and UL SCS for which the test is being run and are given in table 7.1C.2-2 and 7.1C.2-3

   e. The $T_{\mathrm{GNSS_margin}}$ counts for the margin for the GNSS position definition error considered in the core requirement, which needs to be subtracted for the test requirement, due to the usage of AT commands or any pre-configured means in the test. $T_{\mathrm{GNSS_margin}} = 98.304 \times T_{\mathrm{c}}$

3) If the NTN parameters are configured as GSO scenario, the test system shall adjust the timing of the DL path by values given in table A.14.3.1.2.2-1. If the NTN parameters are configured as NGSO scenario, the test system shall adjust the timing of the DL path according to the serving-satellite-ephemeris-related higher-layers parameters.

Table A.14.3.1.2.2-1: Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
120	+[8]*64T_c	+[4]*64T_c

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1C.2 Table 7.1C.2.1-1 until the UE transmit timing offset is within $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\text{-}offset}} + N_{\mathrm{TA,adj}}^{\mathrm{common}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}} \pm \left(T_{\mathrm{e_NTN}} - T_{\mathrm{GNSS_margin}}\right)$ respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within $\left(N_{\mathrm{TA}} + N_{\mathrm{TA\text{-}offset}} + N_{\mathrm{TA,adj}}^{\mathrm{common}} + N_{\mathrm{TA,adj}}^{\mathrm{UE}}\right) \times T_{\mathrm{c}} \pm \left(T_{\mathrm{e_NTN}} - T_{\mathrm{GNSS_margin}}\right)$ of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

A.14.3.2 Timing advance for satellite access

A.14.3.2.1 SA FR1 timing advance adjustment accuracy

A.14.3.2.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3C.

A.14.3.2.1.2 Test Parameters

Supported test configurations are shown in table A.14.3.2.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.14.3.2.1.2-2, A.14.3.2.1.2-3 and A.14.3.2.1.2-4.

In all test cases, single cell served by SAN is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.14.3.2.1.2-4, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

The UE shall be provided with the valid information about the SAN serving cell before the test.During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.14.3.2.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3C.2.1, the UE adjusts its uplink timing at slot n+k+$1+2^{\mu}\cdot K_{\mathrm{offset}}$ for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.14.3.2.1.2-1: Timing advance supported test configurations

Config	Description
1	GSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NGSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.3.2.1.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		1	
Initial DL BWP		DLBWP.0.1	As specified in table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	For 15 kHz SCS $N_{TA_new} = N_{TA_old} + 8192*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.14.3.2.1.2-3: Cell specific test parameters for timing advance

Parameter		Unit	Test1	
			T1	T2
Duplex mode	Config 1,2		FDD	
Satellite information	Config 1		SSC.1	
	Config 2		SSC.2	
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52	
BWP BW	Config 1,2	MHz	10: $N_{PRB,c}$ = 52	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,2		SR.1.1 FDD	
RMSI CORESET Reference Channel	Config 1,2		CR.1.1 FDD	
Dedicated CORESET Reference Channel	Config 1,2		CCR.1.1 FDD	
TRS configuration	Config 1,2		TRS.1.1 FDD	
OCNG Patterns			OCNG pattern 1	
SMTC configuration	Config 1,2		SMTC.1 FR1	
SSB configuration	Config 1,2		SSB.1 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98	
$\hat{E}_s / I_{ot}$		dB	3	
$\hat{E}_s / N_{oc}$		dB	3	
Io Note3	Config 1,2	dBm/	-67.57	

Parameter	Unit	Test1	
		T1	T2
	9.36 MHz		
Propagation condition	-	AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

Table A.14.3.2.1.2-4: Sounding Reference Symbol Configuration for timing advance

Field	Value	Comment
c-SRS Config 1,2	12	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=2 for SCS 15 kHz	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.14.3.2.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. k+*1+2*$^{\mu}$$\cdot K_{\text{offset}}$ slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3C.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.14.3.2.3 SA FR2-NTN timing advance adjustment accuracy

A.14.3.2.3.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3C.

A.14.3.2.3.2 Test Parameters

Supported test configurations are shown in table A.14.3.2.3.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.14.3.2.3.2-2, A.14.3.2.3.2-3 and A.14.3.2.3.2-4.

In all test cases, single cell served by SAN is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.14.3.2.3.2-4, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

The UE shall be provided with the valid information about the SAN serving cell before the test. During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.14.3.2.3.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3C.2.1, the UE adjusts its uplink timing at slot n+k+$1+2^{\mu}\cdot K_{\text{offset}}$ for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.14.3.2.3.2-1: Timing advance supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NGSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
3	GSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
NOTE: For mobile VSAT UE type, it is only requied to pass test config 3.	

Table A.14.3.2.3.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		1	
Initial DL BWP		DLBWP.0.1	As specified in table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	For 120 kHz SCS $N_{TA_new} = N_{TA_old}$ + $1024*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.14.3.2.3.2-3: Cell specific test parameters for timing advance

Parameter		Unit	Test1	
			T1	T2
Duplex mode	Config 1,2,3		FDD	
Satellite information	Config 1		SSC.1	
	Config 2		SSC.2	
	Config 3		SSC.1	

Parameter		Unit	Test1	
			T1	T2
$BW_{channel}$	Config 1,2,3	MHz	100: $N_{PRB,c}$ = 66	
BWP BW	Config 1,2,3	MHz	100: $N_{PRB,c}$ = 66	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,2,3		SR.X.X FDD	
RMSI CORESET Reference Channel	Config 1,2,3		CR.X.X FDD	
Dedicated CORESET Reference Channel	Config 1,2,3		CCR.X.X FDD	
TRS configuration	Config 1,2,3		TRS.2.1 FDD	
OCNG Patterns			OCNG pattern 1	
SMTC configuration	Config 1,2,3		SMTC.1	
SSB configuration	Config 1,2,3		SSB.1 FR2	
PDSCH/PDCCH subcarrier spacing	Config 1,2,3	kHz	120 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,3	kHz	120 kHz	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation condition	Config 1, 2, 3	-	AWGN	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Void NOTE 3: Void				

Table A.14.3.2.3.2-3A: OTA related test parameters

Parameter	Unit	Test 1	
		T1	T2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams[Note 6]		Fine (For electronic steering antenna type) RX beam of RX beam peak direction (For mechanical steering antenna type)	
N_{oc} [Note1]	dBm/15 kHz[Note4]	-112	
N_{oc} [Note1]	dBm/SCS[Note3]	-103	
$\hat{E}_s / N_{oc}$	dB	4	
SS-RSRP[Note2]	dBm/SCS [Note4]	-99	
$\hat{E}_s / I_{ot}$	dB	4	
Io[Note2]	dBm/95.04 MHz [Note4]	-68.5	

Parameter	Unit	Test 1	
		T1	T2
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone			
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone			
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			

Table A.14.3.2.3.2-4: Sounding Reference Symbol Configuration for timing advance

Field	Value	Comment
c-SRS	16	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=4 for SCS 120 kHz	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.14.3.2.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. k+*1*+*2*$^{\mu}$· K_{offset} slots after the reception of the timing advance command, where k=11.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3C.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.14.4 Signalling characteristics

A.14.4.1 Radio link Monitoring

A.14.4.1.1 Radio Link Monitoring Out-of-sync Test for FR1 SAN PCell configured with SSB-based RLM RS in non-DRX mode

A.14.4.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the SAN PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1C.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.14.4.1.1.1-1. The test parameters are given in tables A.14.4.1.1.1-2, A.14.4.1.1.1-3, and A.14.4.1.1.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.14.4.1.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

Table A.14.4.1.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.1.1.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
$BW_{channel}$	Config 1, 2	MHz	10: $N_{PRB,c}$ = 52
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 2		CR.1.1 FDD
Dedicated CORESET Reference Channel	Config 1, 2		CCR.1.3 FDD
SSB Configuration	Config 1, 2		SSB.1 FR1
SMTC Configuration	Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6

Parameter		Unit	Value
			Test 1
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.1.1 FDD
CSI-RS for tracking	Config 1, 2		TRS.1.1 FDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.14.4.1.1.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
N_{oc}	Config 1	dBm/15 kHz	-98		
	Config 2		-98		
N_{oc}	Config 1	dBm/SCS	-98		
	Config 2		-98		
Propagation condition			NTN-TDLC5-200		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1C.1.1-1. NOTE 5: Void.					

Table A.14.4.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE: Ensure that RLM RS is partially overlapped with measurement gap	

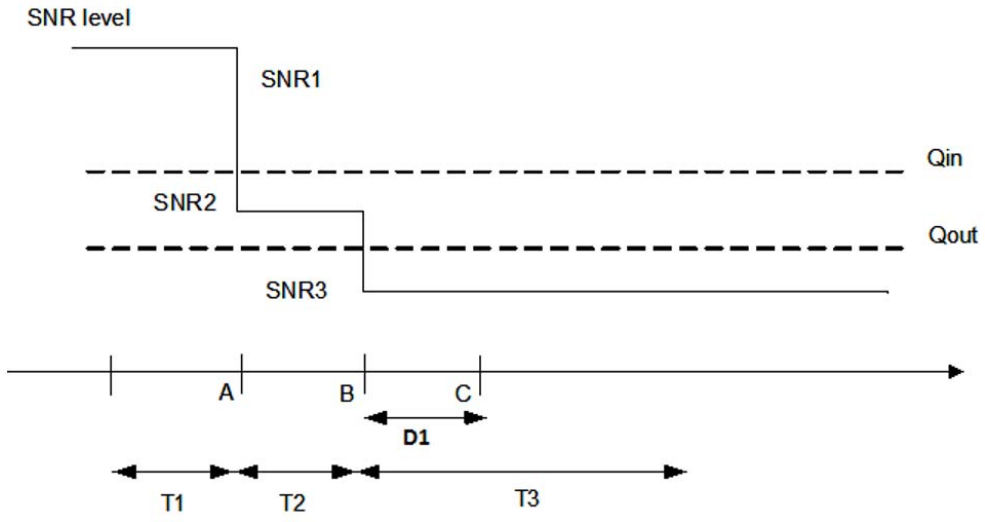


Figure A.14.4.1.1.1-1: SNR variation for out-of-sync testing

A.14.4.1.1.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.1.2 Radio Link Monitoring In-sync Test for FR1 SAN PCell configured with SSB-based RLM RS in non-DRX mode

A.14.4.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the SAN PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1C.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.14.4.1.2.1-1. The test parameters are given in tables A.14.4.1.2.1-2, and A.14.4.1.2.1-3 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.14.4.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

Table A.14.4.1.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.1.2.1-2: General test parameters for FR1 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
$BW_{channel}$	Config 1, 2	MHz	10: $N_{PRB,c}$ = 52
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 2		CR.1.1 FDD
Dedicated CORESET Reference Channel	Config 1, 2		CCR.1.1 FDD
SSB Configuration	Config 1, 2		SSB.1 FR1
SMTC Configuration	Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.1.1 FDD
CSI-RS for tracking	Config 1, 2		TRS.1.1 FDD
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.14.4.1.2.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
N_{oc}	Config 1	dBm/SCS	-98				
	Config 2		-98				
Propagation condition			NTN-TDLC5-200				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.6.5.1C.2.1-1. NOTE 5: Void.								

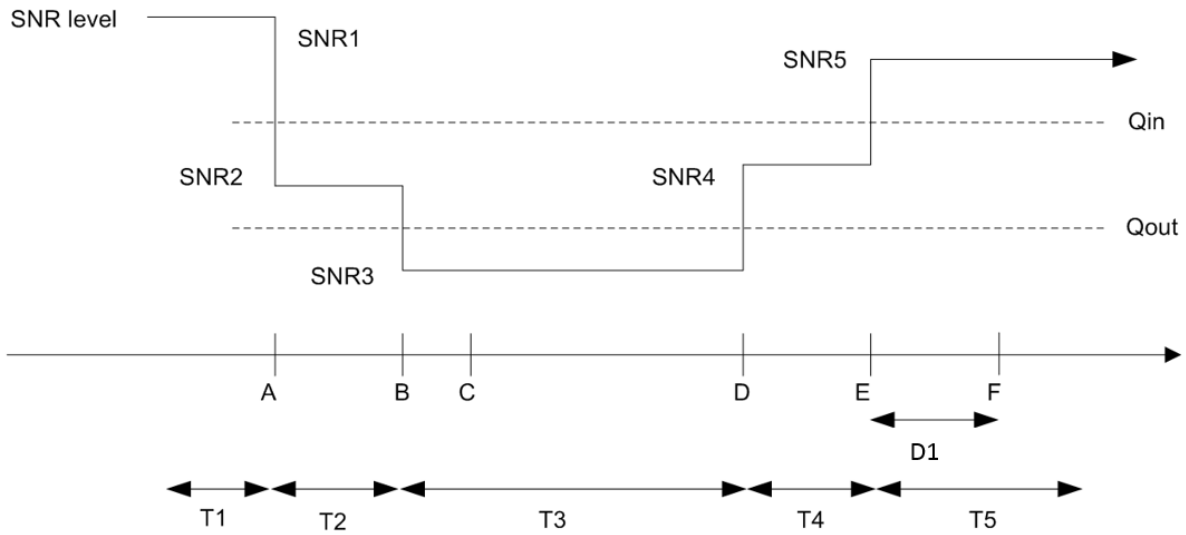


Figure A.14.4.1.2.1-1: SNR variation for in-sync testing

A.14.4.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.1.3 Radio Link Monitoring Out-of-sync Test for FR1 SAN PCell configured with SSB-based RLM RS in DRX mode

A.14.4.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the SAN PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1C.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.14.4.1.3.1-1. The test parameters are given in tables A.14.4.1.3.1-2, and A.14.4.1.3.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.14.4.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

Table A.14.4.1.3.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.1.3.1-2: General test parameters for FR1 out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
$BW_{channel}$	Config 1, 2	MHz	10: $N_{PRB,c}$ = 52
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 2		CR.1.1 FDD
Dedicated CORESET Reference Channel	Config 1, 2		CCR.1.3 FDD
SSB Configuration	Config 1, 2		SSB.1 FR1
SMTC Configuration	Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0

Parameter		Unit	Value
			Test 1
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.1.1 FDD
CSI-RS for tracking	Config 1, 2		TRS.1.1 FDD
T1		s	0.2
T2		s	0.68
T3		s	0.68
D1		s	0.64
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.14.4.1.3.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
N_{oc}	Config 1	dBm/15 kHz	-98		
	Config 2		-98		
N_{oc}	Config 1	dBm/SCS	-98		
	Config 2		-98		
Propagation condition			NTN-TDLC5-200		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1C.3.1-1. NOTE 5: Void.					

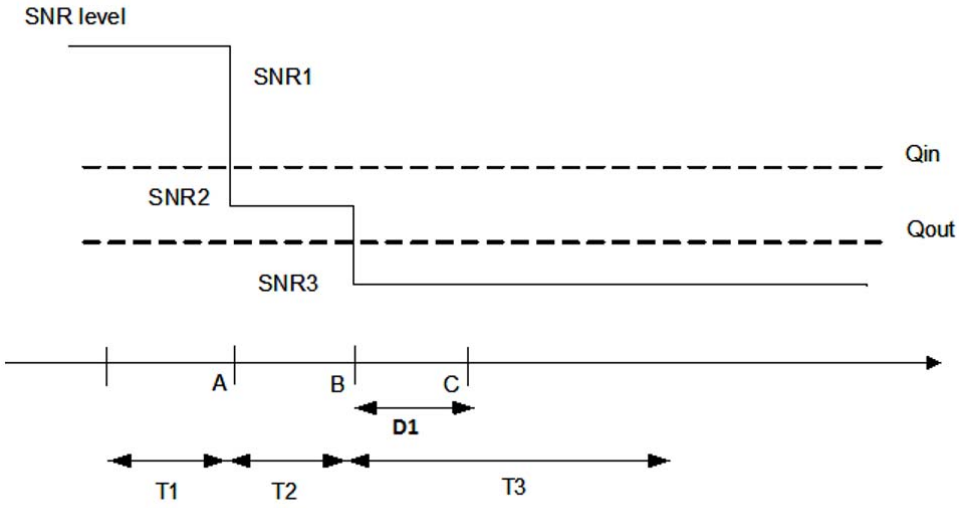


Figure A.14.4.1.3.1-1: SNR variation for out-of-sync testing

A.14.4.1.3.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.1.4 Radio Link Monitoring In-sync Test for FR1 SAN PCell configured with SSB-based RLM RS in DRX mode

A.14.4.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the SAN PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1C.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.14.4.1.4.1-1. The test parameters are given in tables A.14.4.1.4.1-2, and A.14.4.1.4.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.14.4.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

Table A.14.4.1.4.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz

NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.

Table A.14.4.1.4.1-2: General test parameters for FR1 in-sync testing in DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
$BW_{channel}$		Config 1	MHz	10: $N_{PRB,c}$ = 52
DL initial BWP configuration		Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2		DLBWP.1.1
UL initial BWP configuration		Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel		Config 1		CR.1.1 FDD
Dedicated CORESET Reference Channel		Config 1		CCR.1.1 FDD
SSB Configuration		Config 1		SSB.1 FR1
SMTC Configuration		Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1, 2		15 kHz
PRACH Configuration		Config 1, 2		Table A.3.8.2.1-1
SSB index assigned as RLM RS				0
OCNG parameters				OP.1
CP length				Normal
Correlation Matrix and Antenna Configuration				2x2 Low
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	0
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX Configuration				DRX.3
Gap pattern ID				N.A.
Layer 3 filtering				*Enabled*
T310 timer			ms	2000
T311 timer			ms	1000
N310				1
N311				1
CSI-RS configuration for CSI reporting		Config 1		CSI-RS.1.1 FDD
CSI-RS for tracking		Config 1		TRS.1.1 FDD
T1			s	0.2
T2			s	0.2

Parameter	Unit	Value
		Test 1
T3	s	0.64
T4	s	0.2
T5	s	0.88
D1	s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.		

Table A.14.4.1.4.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
N_{oc}	Config 1	dBm/SCS	-98				
	Config 2		-98				
Propagation condition			NTN-TDLC5-200				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.6.5.1C.4.1-1. NOTE 5: Void.							

Table A.6.5.1C.4.1-4: Void

Table A.6.5.1C.4.1-5: Void

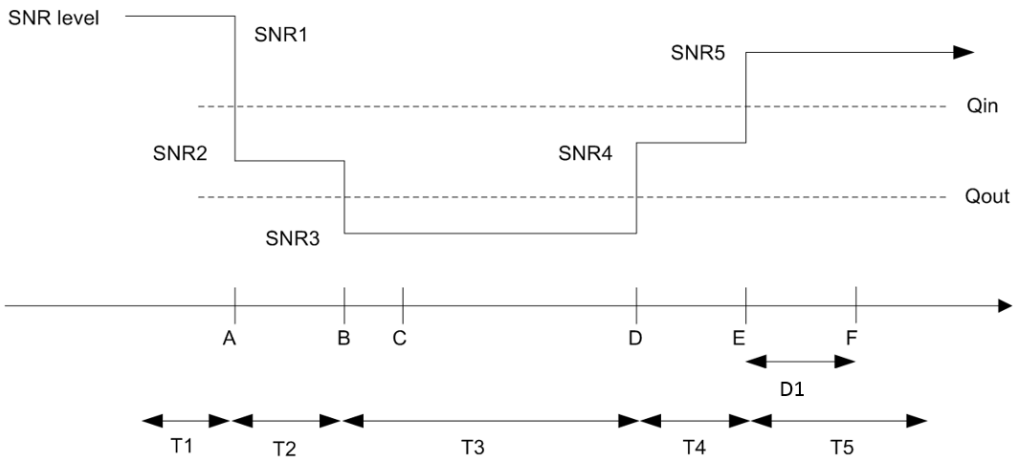


Figure A.14.4.1.4.1-1: SNR variation for in-sync testing.

A.14.4.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.1.5 Radio Link Monitoring Out-of-sync Test for FR1 SAN PCell configured with CSI-RS-based RLM in non-DRX mode

A.14.4.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the SAN PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1C.

The test parameters are given in tables A.14.4.1.5.1-1, A.14.4.1.5.1-2, A.14.4.1.5.1-3, and A.14.4.1.5.1-3A below. There is one cell, Cell 1 which is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.14.4.1.5.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test. In the test, SSB0 is configured as the BFD-RS.

The UE shall be provided with the valid information about the SAN serving cells before the test.

Table A.14.4.1.5.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	GSO, FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	NGSO, FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.4.1.5.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Satellite information	Config 1		SSC.1
	Config 2		SSC.2
Duplex mode	Config 1, 2		FDD
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 2		CR.1.1 FDD
Dedicated CORESET Reference Channel	Config 1, 2		CCR.1.3 FDD
SSB Configuration	Config 1, 2		SSB.1 FR1

Parameter		Unit	Value
			Test 1
SMTC Configuration	Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
TRS configuration	Config 1, 2		TRS.1.1 FDD
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.1.1 FDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.1.1 FDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.14.4.1.5.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4		
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta		dB			
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB	0		
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB			
EPRE ratio of PSS to SSSSSS_beta		dB			
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 2	dB	1	-7	-15
N_{oc}	Config 1, 2	dBm/15 kHz	-98		
Propagation condition			NTN-TDLC5-200		

Parameter	Unit	Test 1		
		T1	T2	T3
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.				
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.				
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.				
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.				
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.				
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.				
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.14.4.1.5.1-1.				
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.				

Table A.14.4.1.5.1-3A: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: Void	

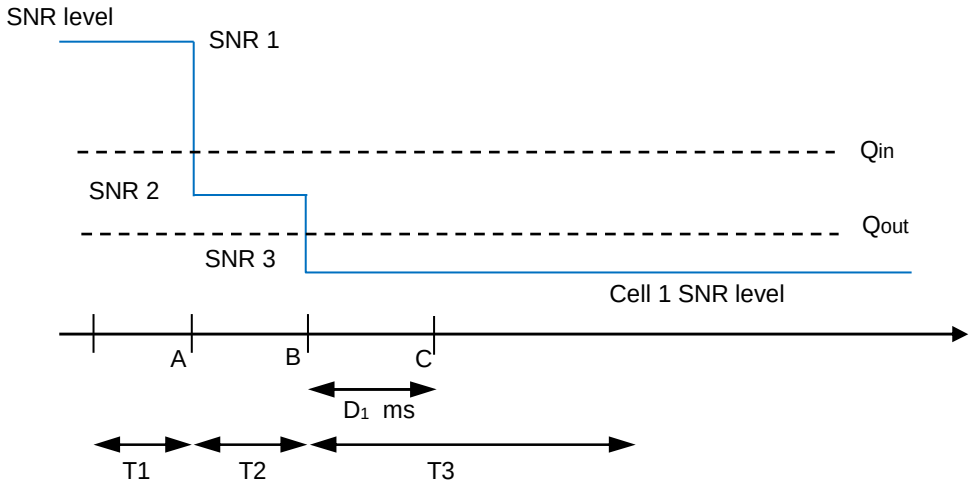


Figure A.14.4.1.5.1-1: SNR variation for CSI-RS out-of-sync testing

A.14.4.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.1.6 Radio Link Monitoring In-sync Test for FR1 SAN PCell configured with CSI-RS-based RLM in non-DRX mode

A.14.4.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the SAN PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1C.

The test parameters are given in tables A.14.4.1.6.1-1, A.14.4.1.6.1-2, and A.14.4.1.6.1-3 below. There is one cells, Cell 1 which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.14.4.1.6.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. In the test, SSB0 is configured as the BFD-RS.

The UE shall be provided with the valid information about the SAN serving cells before the test.

Table A.14.4.1.6.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	GSO, FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	NGSO, FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.4.1.6.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Satellite information	Config 1		SSC.1
	Config 2		SSC.2
Duplex mode	Config 1, 2		FDD
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 2		CR.1.1 FDD
Dedicated CORESET Reference Channel	Config 1, 2		CCR.1.1 FDD
SSB Configuration	Config 1, 2		SSB.1 FR1
SMTC Configuration	Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
TRS configuration	Config 1, 2		TRS.1.1 FDD
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.1.1 FDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6

Parameter		Unit	Value
			Test 1
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.1.1 FDD
T1		s	0.2
T2		s	0.2
T3		s	0.44
T4		s	0.2
T5		s	0.88
T6		s	0.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.14.4.1.6.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4				
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta		dB					
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB	0				
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB					
EPRE ratio of PSS to SSSSSS_beta		dB					
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1, 2	dB	1	-7	-15	-4.5	1
N_{oc}	Config 1, 2	dBm/15 kHz	-98				
Propagation condition			NTN-TDLC5-200				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.14.4.1.6.1-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.						

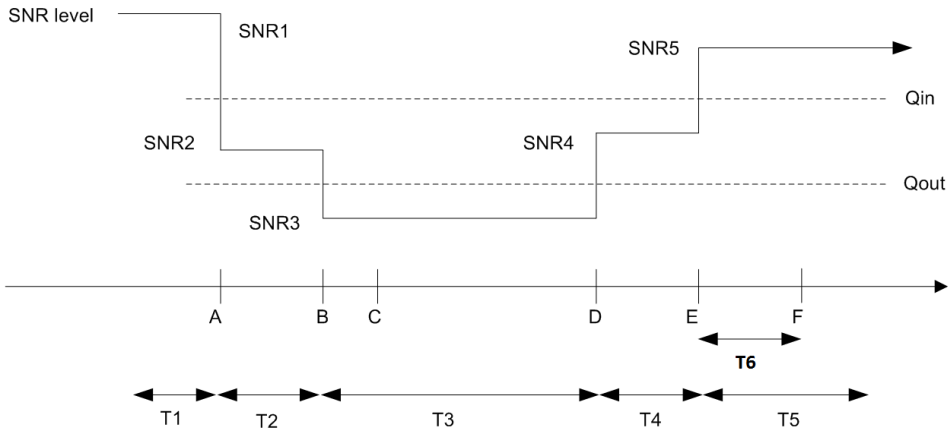


Figure A.14.4.1.6.1-1: SNR variation for CSI-RS in-sync testing

A.14.4.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.1.7 Radio Link Monitoring Out-of-sync Test for FR1 SAN PCell configured with CSI-RS-based RLM in DRX mode

A.14.4.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the SAN PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1C.

The test parameters are given in tables A.14.4.1.7.1-1, A.14.4.1.7.1-2, and A.6.5.1.7C.1-3 below. There is one cell, Cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.14.4.1.7.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. In the test, SSB0 is configured as the BFD-RS.

The UE shall be provided with the valid information about the SAN serving cells before the test.

Table A.14.4.1.7.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	GSO, FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	NGSO, FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.4.1.7.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Satellite information	Config 1		SSC.1
	Config 2		SSC.2
Duplex mode	Config 1, 2		FDD
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 2		CR.1.1 FDD
Dedicated CORESET Reference Channel	Config 1, 2		CCR.1.3 FDD
SSB Configuration	Config 1, 2		SSB.1 FR1
SMTC Configuration	Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
TRS configuration	Config 1, 2		TRS.1.1 FDD
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.1.1 FDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.1.1 FDD
T1		s	0.2

T2	s	1.28
T3	s	1.28
D1	s	1.24
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.		

Table A.14.4.1.7.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4		
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta		dB	4		
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB	0		
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB			
EPRE ratio of PSS to SSSSSS_beta		dB			
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 2	dB	1	-7	-15
N_{oc}	Config 1, 2	dBm/15 kHz	-98		
Propagation condition			NTN-TDLC5-200		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.14.4.1.7.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.

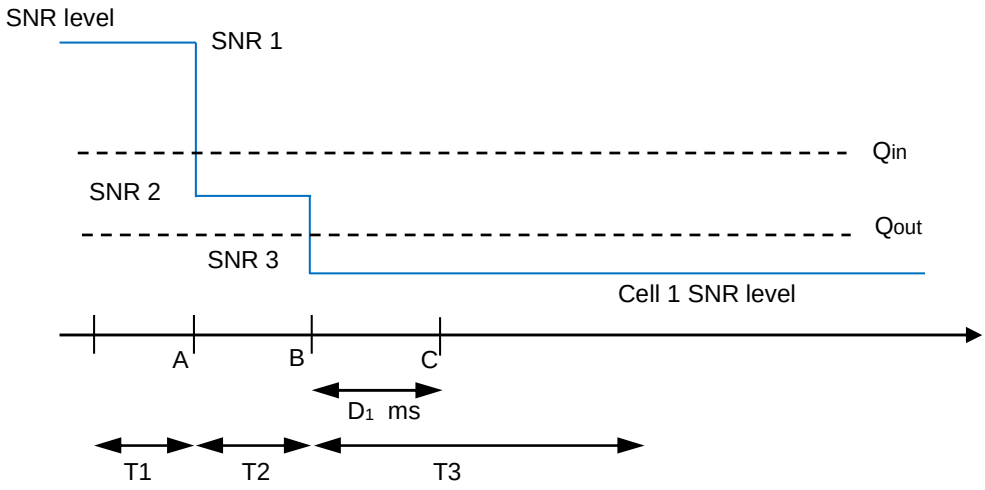


Figure A.14.4.1.7.1-1: SNR variation for CSI-RS out-of-sync testing

A.14.4.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.1.8 Radio Link Monitoring In-sync Test for FR1 SAN PCell configured with CSI-RS-based RLM in DRX mode

A.14.4.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the SAN PCell when DRX is used. This test will partly verify the FR1 Pcell CSI-RS In-sync radio link monitoring requirements in clause 8.1C.

The test parameters are given in tables A.14.4.1.8.1-1, A.14.4.1.8.1-2, A.14.4.1.8.1-3 and A.14.4.1.8.1-3A below. There is one cells, Cell 1 which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.14.4.1.8.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test. In the test, SSB0 is configured as the BFD-RS.

The UE shall be provided with the valid information about the SAN serving cells before the test.

Table A.14.4.1.8.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	GSO, FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	NGSO, FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.4.1.8.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Satellite information	Config 1		SSC.1
	Config 2		SSC.2
Duplex mode	Config 1, 2		FDD
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 2		CR.1.1 FDD
Dedicated CORESET Reference Channel	Config 1, 2		CCR.1.1 FDD
SSB Configuration	Config 1, 2		SSB.1 FR1
SMTC Configuration	Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
TRS configuration	Config 1, 2		TRS.1.1 FDD
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.1.1 FDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.1.1 FDD

Parameter	Unit	Value
		Test 1
T1	s	0.2
T2	s	0.2
T3	s	1.24
T4	s	0.2
T5	s	1.88
T6	s	1.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.		

Table A.14.4.1.8.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4				
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta		dB					
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB	0				
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB					
EPRE ratio of PSS to SSSSSS_beta		dB					
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1, 2	dB	1	-7	-15	-4.5	1
N_{oc}	Config 1, 2	dBm/15 kHz	-98				
Propagation condition			NTN-TDLC5-200				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.14.4.1.8.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.

Table A.6.5.1.8.1-3A: Measurement gap configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: Void	

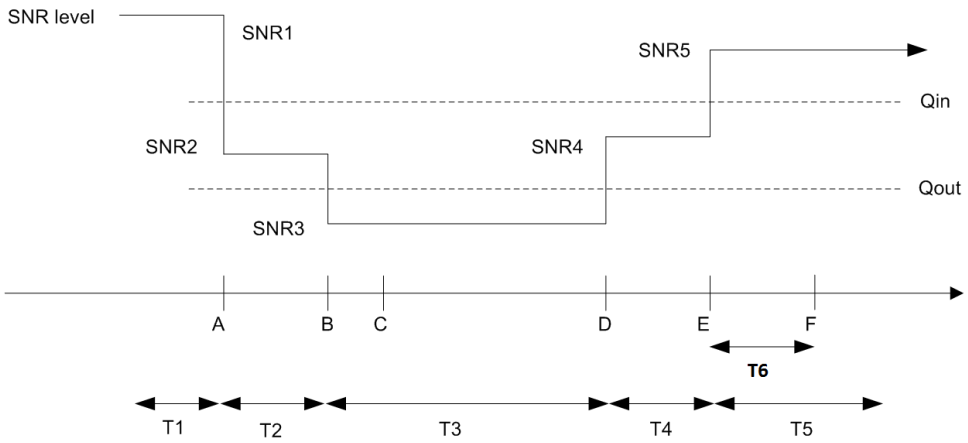


Figure A.14.4.1.8.1-1: SNR variation for CSI-RS in-sync testing

A.14.4.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.1.9 Radio Link Monitoring Out-of-sync Test for FR2 SAN PCell configured with SSB-based RLM RS in non-DRX mode

A.14.4.1.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the SAN PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1C.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.14.4.1.9.1-1. The test parameters are given in tables A.14.4.1.9.1-2, A.14.4.1.9.1-3, and A.14.4.1.9.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.14.4.1.9.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

The UE shall be provided with the valid information about the SAN serving each cell in the test before the test.

Table A.14.4.1.9.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	GSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NGSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.1.9.1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode

Parameter	Unit	Value
		Test 1
Active PCell		Cell 1

Parameter		Unit	Value
			Test 1
RF Channel Number			1
$BW_{channel}$	Config 1, 2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1		24
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 2		[CR.2.1 FDD]
Dedicated CORESET Reference Channel	Config 1, 2		[CCR.2.1 FDD]
SSB Configuration	Config 1, 2		SSB.1 FR2
SMTC Configuration	Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.3.1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 2		[CSI-RS.2.1 FDD]
CSI-RS for tracking	Config 1, 2		[TRS.2.1 FDD]
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.14.4.1.9.1-3: Cell specific test parameters for FR2 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
AoA setup			TBD		
Assumption for UE beams			TBD		
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1	dB	2	-6	-15

Parameter		Unit	Test 1		
			T1	T2	T3
	Config 2		2	-6	-15
N_{oc}	Config 1	dBm/15 kHz	-92.1		
	Config 2		-92.1		
Propagation condition			TBD		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1C.1.1-1.					

Table A.14.4.1.9.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0

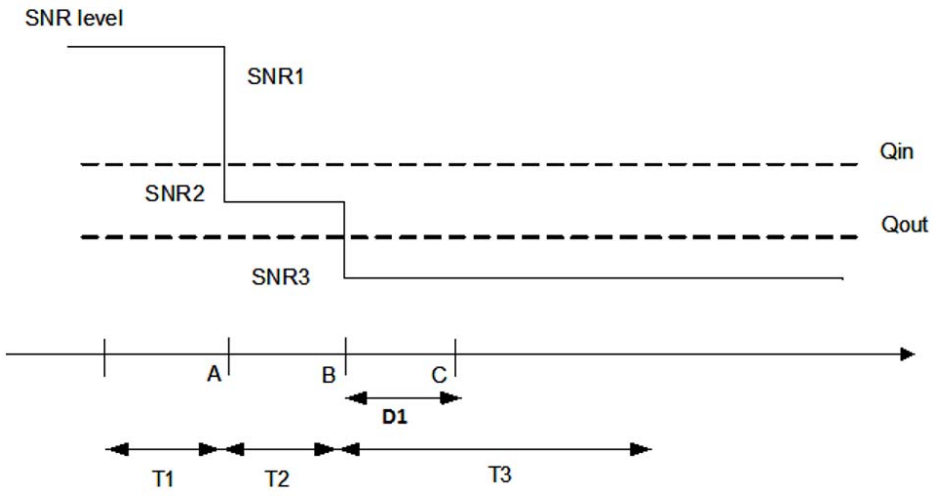


Figure A.14.4.1.9.1-1: SNR variation for out-of-sync testing

A.14.4.1.9.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.1.10 Radio Link Monitoring In-sync Test for FR2 SAN PCell configured with SSB-based RLM RS in non-DRX mode

A.14.4.1.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the SAN PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1C.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.14.4.1.10.1-1. The test parameters are given in tables A.14.4.1.10.1-2, and A.14.4.1.10.1-3 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.14.4.1.10.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

Table A.14.4.1.10.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	GSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NGSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.1.10.1-2: General test parameters for FR2 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
$BW_{channel}$	Config 1, 2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1		24
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 2		[CR.2.1 FDD]
Dedicated CORESET Reference Channel	Config 1, 2		[CCR.2.1 fDD]
SSB Configuration	Config 1, 2		SSB.1 FR2
SMTC Configuration	Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8

Parameter		Unit	Value
			Test 1
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 2		[CSI-RS.2.1 FDD]
CSI-RS for tracking	Config 1, 2		[TRS.2.1 FDD]
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.14.4.1.10.1-3: Cell specific test parameters for FR2 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			TBD				
Assumption for UE beams			TBD				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	2	-6	-15	-4.5	2
	Config 2		2	-6	-15	-4.5	2
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
N_{oc}	Config 1	dBm/SCS	-98				
	Config 2		-98				
Propagation condition			TBD				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.6.5.1C.2.1-1.							

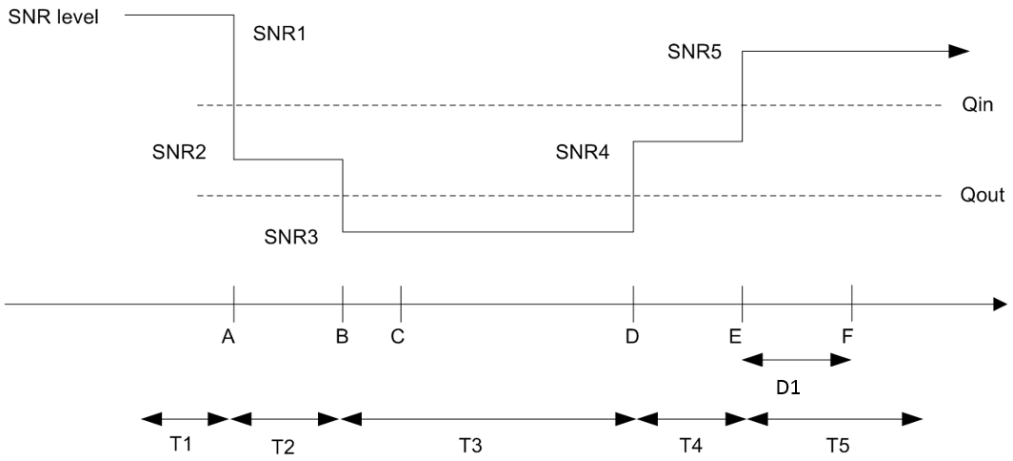


Figure A.14.4.1.10.1-1: SNR variation for in-sync testing

A.14.4.1.10.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.1.11 Radio Link Monitoring Out-of-sync Test for FR1 SAN PCell configured with SSB-based RLM RS in non-DRX mode

A.14.4.1.11.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *support-3MHz-ChannelBW-r18* properly detects the out of sync for the purpose of monitoring downlink radio link quality of the PCell operating on a 3 MHz channel bandwidth. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1C.

Supported test configurations are specified in table A.14.4.1.11.1-1. General test parameters as specified in table A.14.4.1.1.1-2 with config 1 apply except those specified in table A.14.4.1.11.1-2. Cell specific test parameters as specified in table A.14.4.1.1.1-3 apply except those specified in table A.14.4.1.11.1-3.

The test procedure specified in clause A.14.4.1.1.1 applies to this test.

Table A.14.4.1.11.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 3 MHz bandwidth

Table A.14.4.1.11.1-2: General test parameters for FR1 OOS 15 PRB in non-DRX mode

Parameter		Unit	Value
			Test 1
$BW_{channel}$	Config 1	MHz	3: $N_{PRB,c}$ = 15
RMSI CORESET Reference Channel	Config 1		CR.1.3 FDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.7 FDD
SSB Configuration	Config 1		SSB.13 FR1
	DCI format		1-0

In sync transmission parameters	Number of Control OFDM symbols		3
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
Out of sync transmission parameters	Number of Control OFDM symbols		3
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	REG bundle size		6
	CP length		Normal
	Mapping from REG to CCE		Non-Distributed

Table A.14.4.1.11.1-3: Cell specific test parameters for FR1 PCell

Parameter		Unit	Test 1		
			T1	T2	T3
SNR_SSB of set q_0	Config 1	dB	2	-6	-14

A.14.4.1.11.2 Test Requirements

Test requirements specified in clause A.14.4.1.1.2 apply to this test.

A.14.4.1.12 Radio Link Monitoring In-sync Test for FR1 SAN PCell configured with SSB-based RLM RS in DRX mode for less than 5 MHz BW

A.14.4.1.12.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *support-3MHz-ChannelBW-r18* properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell operating on a 3 MHz channel bandwidth. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1C.

Supported test configurations are specified in table A.14.4.1.12.1-1. General test parameters as specified in table A.14.4.1.4.1-2 with config 1 apply to this test, except those specified in table A.14.4.1.12.1-2. Cell specific test parameters as specified in table A.14.4.1.4.1-3 apply except those specified in table A.14.4.1.12.1-3.

The test procedure specified in clause A.14.4.1.4.1 applies to this test.

Table A.14.4.1.12.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 3 MHz (15PRB)
NOTE: The UE is required to pass the test with configuration 1 for every supported 3 MHz band in FR1.	

Table A.14.4.1.12.1-2: General test parameters for FR1 in-sync testing in DRX mode

Parameter	Unit	Value
Parameter	Unit	Value
		Test 1

$BW_{channel}$	Config 1	MHz	3: $N_{RB,c}$ = 15
RMSI CORESET Reference Channel	Config 1		CR.1.3 FDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.7 FDD
SSB Configuration	Config 1		SSB.13 FR1
In sync transmission parameters	Number of Control OFDM symbols, Config 1		3
	Aggregation level, Config 1	CCE	4
	Mapping from REG to CCE, Config 1	Config 1	Non-Distributed
Out of sync transmission parameters	Number of Control OFDM symbols, Config 1		3
	Aggregation level, Config 1	CCE	8
	Mapping from REG to CCE, Config 1	Config 1	Non-Distributed

Table A.14.4.1.12.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
SNR on RLM-RS	Config 1	dB	2	-6	-14	-2.5	3

A.14.4.1.12.2 Test Requirements

Test requirements specified in clause A.14.4.1.4.2 apply to this test.

A.14.4.2 Beam Failure Detection and Link recovery procedures for satellite access

A.14.4.2.1 Beam Failure Detection and Link Recovery Test for FR1 PCell for satellite access configured with SSB-based BFD and LR in non-DRX mode

A.14.4.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q0 configured for a serving cell which is served by satellite access node (SAN) and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.14.4.2.1.1-1, A.14.4.2.1.1-2, A.14.4.2.1.1-3 and A.14.4.2.1.1-4 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.14.4.2.1.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.14.4.2.1.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test 1.

Table A.14.4.2.1.1-1: Supported test configurations for FR1 Pcell

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.2.1.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
NTN reference Serving satellite configuration	Config 1		SSC.1	
	Config 2		SSC.2	
Active PSCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1,2		FDD	
BWchannel	Config 1,2	MHz	10: NRB,c = 52	
DL initial BWP configuration	Config 1,2		DLBWP.0.1	
DL dedicated BWP configuration	Config 1,2		DLBWP.1.1	
UL initial BWP configuration	Config 1,2		ULBWP.0.1	
UL dedicated BWP configuration	Config 1,2		ULBWP.1.1	
TDD Configuration	Config 1,2		Not Applicable	
RMSI CORESET Reference Channel	Config 1,2		CR.1.1 FDD	
Dedicated CORESET Reference Channel	Config 1,2		CCR.1.1 FDD	
SSB Configuration	Config 1,2		SSB.3 FR1	
SMTC Configuration	Config 1,2		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1,2		15 KHz	
PRACH Configuration	Config 1,2		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			gp0	
gapOffset			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE

Parameter		Unit	Value	Comment
			Test 1	
				applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1,2		CSI-RS.1.1 FDD	
CSI-RS for tracking	Config 1,2		TRS.1.1 FDD	
SSB Index assigned as RLM RS			0, 1	
T310 Timer		ms	1000	
N310			2	
T1		s	0.2	During this time the the UE shall be fully synchronized to Cell 1
T2		s	0.37	
T3		s	0.24	
T4		s	0	
T5		s	0.17	
D1		s	0.13	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.14.4.2.1.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1,2	dB	5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1,2	dB	-10	-10	10	10	10
SSB_RP of set q_1	Config 1,2	dBm/SCS kHz	-108	-108	-88	-88	-88
N_{oc}	Config 1,2	dBm/15 KHz	-98				
Propagation condition			NTN-TDLC5-200				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.						
NOTE 9: Void.						

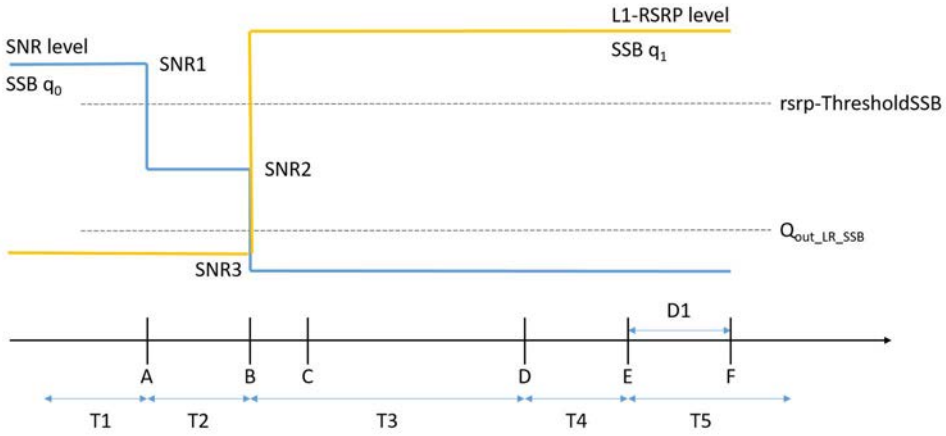


Figure A.14.4.2.1.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.14.4.2.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.2.2 Beam Failure Detection and Link Recovery Test for FR1 PCell for satellite access configured with SSB-based BFD and LR in DRX mode

A.14.4.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell which is served by satellite access node (SAN) and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the

UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.14.4.2.2.1-1, A.14.4.2.2.1-2, A.14.4.2.2.1-3, A.14.4.2.2.1-4 and A.14.4.2.2.1-5 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.14.4.2.2.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.14.4.2.2.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.14.4.2.2.1-1: Supported test configurations for FR1 Pcell

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.2.2.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
NTN reference Serving satellite configuration	Config 1		SSC.1	
	Config 2		SSC.2	
Active PSCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1,2		FDD	
BWchannel	Config 1,2	MHz	10: NRB,c = 52	
DL initial BWP configuration	Config 1,2		DLBWP.0.1	
DL dedicated BWP configuration	Config 1,2		DLBWP.1.1	
UL initial BWP configuration	Config 1,2		ULBWP.0.1	
UL dedicated BWP configuration	Config 1,2		ULBWP.1.1	
TDD Configuration	Config 1,2		Not Applicable	
RMSI CORESET Reference Channel	Config 1,2		CR.1.1 FDD	
Dedicated CORESET Reference Channel	Config 1,2		CCR.1.1 FDD	
SSB Configuration	Config 1,2		SSB.3 FR1	
SMTC Configuration	Config 1,2		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1,2		15 KHz	
PRACH Configuration	Config 1,2		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0	

Parameter		Unit	Value	Comment
			Test 1	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
rlmInSyncOutOfSyncThreshold			Absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1,2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1,2		CSI-RS.1.1 FDD	
CSI-RS for tracking	Config 1,2		TRS.1.1 FDD	
SSB Index assigned as RLM RS			0, 1	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to Cell 1
T2		s	5.17	
T3		s	3.24	
T4		s	0	
T5		s	1.97	
D1		s	1.93	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.14.4.2.2.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1,2	dB	5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1,2	dB	-10	-10	10	10	10
SSB_RP of set q_1	Config 1,2	dBm/SCS kHz	-108	-108	-88	-88	-88
N_{oc}	Config 1,2	dBm/15 KHz	-98				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
Propagation condition		NTN-TDLC5-200				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Void						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.						
NOTE 9: Void.						

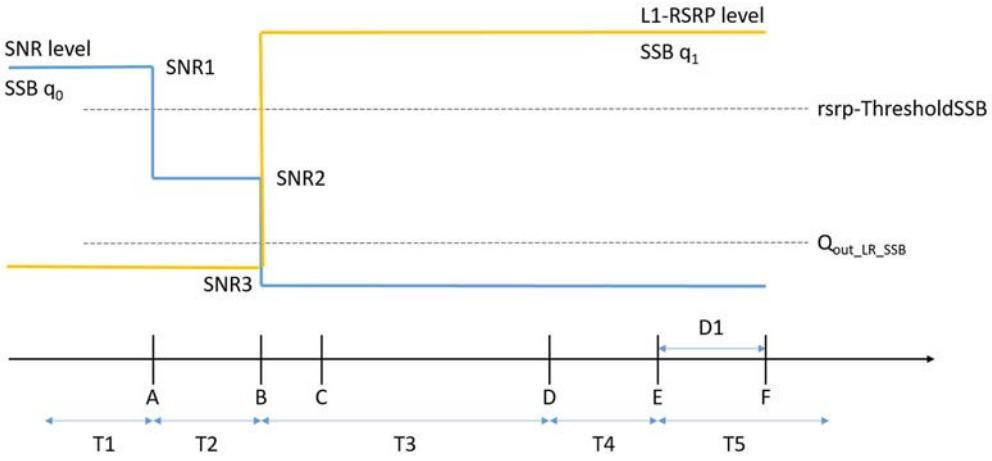


Figure A.14.4.2.2.1-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.14.4.2.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.2.3 Beam Failure Detection and Link Recovery Test for FR1 PCell for satellite access configured with CSI-RS-based BFD and LR in non-DRX mode

A.14.4.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell which is served by satellite access node (SAN) and that the UE performs correct CSI-RS-based link

recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.14.4.2.3.1-1, A.14.4.2.3.1-2, and below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.14.4.2.3.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.14.4.2.3.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.14.4.2.3.1-1: Supported test configurations for FR1 Pcell

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.2.3.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
NTN reference Serving satellite configuration	Config 1		SSC.1	
	Config 2		SSC.2	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1,2		FDD	
TDD Configuration	Config 1,2		Not Applicable	
RMSI CORESET Reference Channel	Config 1,2		CR.1.1 FDD	A.3.1.2
Dedicated CORESET Reference Channel	Config 1,2		CCR.1.1 FDD	A.3.1.3
SSB Configuration	Config 1,2		SSB.3 FR1	A.3.10
SSB Configuration	Config 1,2		SSB. 3 FR1	A.3.10
SMTC Configuration	Config 1,2		SMTC.1	A.3.11
PDSCH/PDCCH subcarrier spacing	Config 1,2		15 KHz	
PRACH Configuration	Config 1,2		FR1 PRACH configuration 4	A.3.8.2
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	

Parameter			Unit	Value	Comment
				Test 1	
	DMRS precoder granularity			REG bundle size	
	REG bundle size			6	
DRX				OFF	
Gap pattern ID				N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1				1	N
rlmInSyncOutOfSyncThreshold				absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1,2		dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS				db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount				n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer				pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1		Config 1,2		CSI-RS.1.2 FDD	A.3.14
CSI-RS configuration for CSI reporting		Config 1,2		CSI-RS.1.1 FDD	A.3.14
TRS configuration		Config 1,2		TRS.1.1 FDD	
CSI-RS-Index assigned as RLM RS		Config 1,2		CSI-RS.1.2 FDD	A.3.14
T310 Timer			ms	1000	
N310				2	
T1			s	0.2	During this time the the UE shall be fully synchronized to Cell 1
T2			s	0.18	
T3			s	0.14	
T4			s	0	
T5			s	0.08	
D1			s	0.04	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.14.4.2.3.1-3 Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1,2	dB	5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1,2	dB	-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1,2	dBm/SCS kHz	-108	-108	-88	-88	-88
N_{oc}	Config 1,2	dBm/15 KHz	-98				
Propagation condition			NTN-TDLC5-200				

NOTE 1:	OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2:	The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3:	NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4:	Void
NOTE 5:	The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6:	The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7:	SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8:	The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9:	Void.

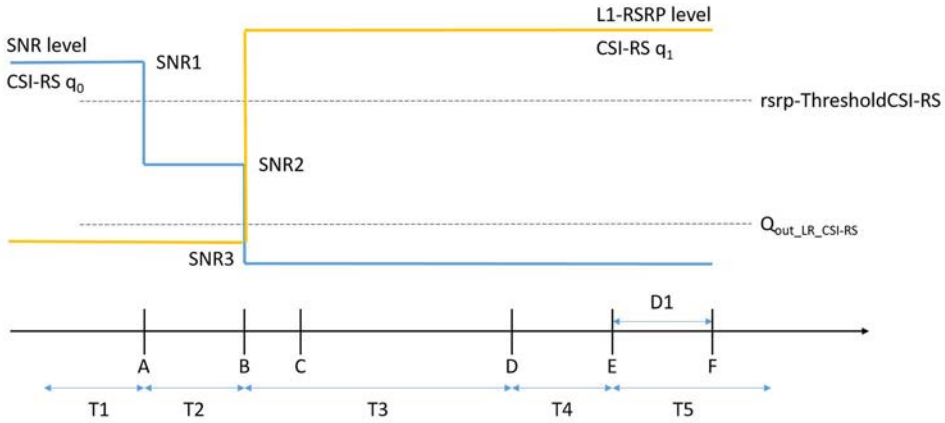


Figure A.14.4.2.3.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

A.14.4.2.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 30+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.2.4 Beam Failure Detection and Link Recovery Test for FR1 PCell for satellite access configured with CSI-RS-based BFD and LR in DRX mode

A.14.4.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell which is served by satellite access node (SAN) and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will

partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in tables A.14.4.2.4.1-1, A.14.4.2.4.1-2, A.14.4.2.4.1-3, and A.14.4.2.4.1-4 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.14.4.2.4.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.14.4.2.4.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.14.4.2.4.1-1: Supported test configurations for FR1 Pcell

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.2.4.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
NTN reference Serving satellite configuration	Config 1		SSC.1	
	Config 2		SSC.2	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1,2		FDD	
TDD Configuration	Config 1,2		Not Applicable	
RMSI CORESET Reference Channel	Config 1,2		CR.1.1 FDD	A.3.1.2
Dedicated CORESET Reference Channel	Config 1,2		CCR.1.1 FDD	A.3.1.3
SSB Configuration	Config 1,2		SSB. 3 FR1	A.3.10
SMTC Configuration	Config 1,2		SMTC.1	A.3.11
PDSCH/PDCCH subcarrier spacing	Config 1,2		15 KHz	
PRACH Configuration	Config 1,2		FR1 PRACH configuration 4	A.3.8.2
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	

Parameter		Unit	Value	Comment
			Test 1	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1,2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1	Config 1,2		CSI-RS.1.2 FDD	A.3.14 .1
CSI-RS configuration for CSI reporting	Config 1,2		CSI-RS.1.1 FDD	A.3.14.1
TRS configuration	Config 1,2		TRS.1.1 FDD	
CSI-RS-Index assigned as RLM RS	Config 1,2		CSI-RS.1.2 FDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to Cell 1
T2		s	8.37	
T3		s	6.44	
T4		s	0	
T5		s	1.97	
D1		s	1.93	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.14.4.2.4.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1	dB/SCS kHz	-108	-108	-88	-88	-88
N_{oc}	Config 1	dBm/15 KHz	-98				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
Propagation condition		NTN-TDLC5-200				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9: Void.

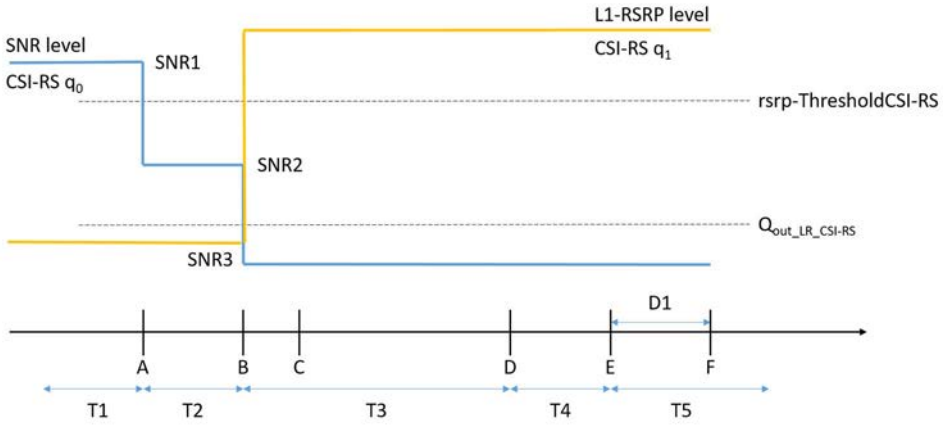


Figure A.14.4.2.4.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

A.14.4.2.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.2.5 Void

A.14.4.2.6 Void

A.14.4.2.7 Beam Failure Detection and Link Recovery Test for FR1 PCell for satellite access configured with SSB-based BFD and LR in non-DRX mode for a UE operating on a cell with less than 5 MHz BW

A.14.4.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE supporting *support-3MHz-ChannelBW-r18* properly detects SSB-based beam failure in the set q_0 configured for a serving cell which is served by satellite access node (SAN) and operatw on a less than 5 MHz bandwidth, and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell which is served by satellite access node (SAN) requirements in clause 8.5C for a UE operating on a cell with less than 5 MHz BW.

Supported test configurations are specified in table A.14.4.2.7.1-1. General test parameters as specified in table A.14.4.2.2.1-2 with config 1 apply except those specified in table A.14.4.2.7.1-2. Cell specific test parameters as specified in table A.14.4.2.2.1-3 apply except those specified in table A.14.4.2.7.1-3.

The test procedure specified in clause A.14.4.2.2.1 applies to this test.

Table A.14.4.2.7.1-1: Supported test configurations for FR1 Pcell with less than 5 MHz BW

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.2.7.1-2: General test parameters for FR1 PCell with less than 5 MHz BW

Parameter			Unit	Value	Comment
				Test 1	
BWchannel		Config 1	MHz	3: $N_{PRB,c}$ = 15	
SSB Configuration		Config 1		SSB.13 FR1	
PRACH Configuration		Config 1		1	
Beam failure detection transmission parameters	Number of Control OFDM symbols			3	
	Aggregation level		CCE	8	
	Mapping from REG to CCE			Non-Distributed	
T1			s	1	During this time the the UE shall be fully synchronized to Cell 1
T2			s	5.17	
T3			s	3.24	
T4			s	0	
T5			s	1.97	
D1			s	1.94	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.14.4.2.7.1-3: Cell specific test parameters for FR1 PCell with less than 5 MHz BW

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
SNR_SSB of set q_0	Config 1	dB	6	-2	-11	-11	-11

A.14.4.2.7.2 Test Requirements

Test requirements specified in clause A.14.4.2.2.1 apply to this test.

A.14.4.3 Active BWP switch for satellite access

A.14.4.3.1 DCI-based and Timer-based Active BWP Switch

A.14.4.3.1.1 NR FR1 DL active BWP switch with non-DRX in SA

A.14.4.3.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6C.

The supported test configurations are shown in table A.14.4.3.1.1.1-1. The test scenario comprises of one cell (Cell 1) as given in table A.14.4.3.1.1.1-2. Cell-specific parameters of the cell are specified in table A.14.4.3.1.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with 2 different UE-specific downlink bandwidth parts, BWP-1 and BWP-2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1.
- UE is configured with a *bwp-InactivityTimer* timer value for Cell 1.

The cell has constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for DL BWP switch, sent from the test equipment to the UE, is received at the UE side in Cell 1's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6C and starts to report valid ACK/NACK for the Cell 1 no later than the first UL slot that occurs after the beginning of slot ($i + T_{BWPswitchDelay} + k1 + 2^{\mu-\mu_{K_{offset}}} K_{offset}$). The UE shall be continuously scheduled on Cell 1's BWP-2 starting from the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

During T2, the test equipment won't transmit DCI format for PDSCH reception on Cell 1.

During T3,

> The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.
>
> The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6C and starts to report valid ACK/NACK for the Cell 1 at latest on the first UL slot that occurs after the beginning of slot ($j + T_{BWPswitchDelay} + k1 + 2^{\mu-\mu_{K_{offset}}} K_{offset}$). The UE

shall be continuously scheduled on Cell 1's BWP-1 starting from the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The test equipment verifies the DL BWP switch time by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

Table A.14.4.3.1.1.1-1: DL BWP switch supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.3.1.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell 1 on RF channel number 1.
CP length		Normal	
DRX		OFF	
bwp-InactivityTimer	ms	200	
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.14.4.3.1.1.1-3 : NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1, 2		FDD
$BW_{channel}$	Config 1, 2		10 MHz: $N_{PRB,c}$ = 52
Satellite information	Config 1		SSC.1
	Config 2		SSC.2
Active BWP ID			1, 2
Initial DL BWP Configuration	Config 1, 2		DLBWP.0.2 Note 4
Active DL BWP-1 Configuration	Config 1, 2		DLBWP.1.1 Note 4
Active DL BWP-2 Configuration	Config 1, 2		DLBWP.1.3 Note 4
Initial UL BWP Configuration	Config 1, 2		ULBWP.0.2 Note 4
Active UL BWP-1 Configuration	Config 1, 2		ULBWP.1.1 Note 4
Active UL BWP-2 Configuration	Config 1, 2		N/A
PDSCH Reference measurement channel	Config 1, 2		SR.1.1 FDD
RMSI CORESET parameters	Config 1, 2		CR.1.1 FDD
Dedicated CORESET parameters	Config 1, 2		CCR.1.2 FDD
OCNG Patterns			OP.1
SSB Configuration	Config 1, 2		SSB.1 FR1
SMTC Configuration	Config 1, 2		SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
TRS Configuration	Config 1, 2		TRS.1.1 FDD
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1, 2	dBm/SCS	-104
N_{oc} Note 2		dBm/15 kHz	-104

Parameter		Unit	Cell 1
SS-RSRP Note 3	Config 1, 2	dBm/SCS	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1, 2	dBm/ 9.36 MHz	-58.96
Propagation Condition			AWGN
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

A.14.4.3.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i + T_{BWPswitchDelay} + k1 + 2^{\mu-\mu_{K_{offset}}} K_{offset}$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j + T_{BWPswitchDelay} + k1 + 2^{\mu-\mu_{K_{offset}}} K_{offset}$.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6C.2-1.

All of the above test requirements shall be fulfilled in order for the observed Cell 1 active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.3.2 RRC-based Active BWP Switch

A.14.4.3.2.1 NR FR1 DL active BWP switch of Cell with non-DRX in SA

A.14.4.3.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6C.

The supported test configurations are shown in table A.14.4.3.2.1.1-1. The test scenario comprises of one Cell (Cell 1) as given in table A.14.4.3.2.1.1-2. Cell-specific parameters of Cell are specified in table A.14.4.3.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in Cell 1.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot ($i + \frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$) as defined in clause 8.6C.3 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot ($i + \frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}} + k1 + 2^{\mu-\mu_{K_{offset}}}K_{offset}$) on BWP-1 of final condition. The UE shall be continuously scheduled on PCell's BWP-1 of final condition starting from the first DL slot right after slot ($i + \frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$).

$T_{\text{RRCprocessingDelay}}$ and $T_{\text{BWPswitchDelayRRC}}$ are defined in clause 8.6C.3.

The test equipment verifies the DL BWP switch time in Cell by counting the time from the time when the RRC Reconfiguration message including updated BWP configuration is sent till the time when a vaild ACK/NACK is received is received.

Table A.14.4.3.2.1.1-1: DL BWP switch supported test configurations in SA scenario

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.3.2.1.1-2: General test parameters for DL BWP switch in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	

Table A.14.4.3.2.1.1-3: NR Cell specific test parameters for DL BWP switch in SA scenario

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1, 2		FDD
$BW_{channel}$		Config 1, 2		10 MHz: $N_{PRB,c}$ = 52
Satellite information		Config 1		SSC.1
		Config 2		SSC.2
Active BWP ID				1
Initial DL BWP Configuration		Config 1, 2		DLBWP.0.2
Initial UL BWP Configuration		Config 1, 2		ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration	Config 1, 2		DLBWP.1.3
	Active UL BWP-1 Configuration	Config 1, 2		ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration	Config 1, 2		DLBWP.1.1
	Active UL BWP-1 Configuration	Config 1, 2		ULBWP.1.1
PDSCH Reference measurement channel		Config 1, 2		SR.1.1 FDD
RMSI CORESET parameters		Config 1, 2		CR.1.1 FDD
Dedicated CORESET parameters		Config 1, 2		CCR.1.2 FDD
OCNG Patterns				OP.1
SSB Configuration		Config 1, 2		SSB.1 FR1
SMTC Configuration				SMTC.1

Parameter		Unit	Cell 1
TRS Configuration	Config 1, 2		TRS.1.1 FDD
Antenna Configuration			1x2 Low
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS(Note 1)			
N_{oc} Note 2	Config 1, 2	dBm/SCS	-104
SS-RSRP Note 3	Config 1, 2	dBm/SCS	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1, 2	dBm/ 9.36 MHz	-58.96
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

A.14.4.3.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the Cell from the first DL slot that occurs right after the begining of slot (i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$) and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i + \frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}} + k1 + 2^{\mu-\mu_{K_{offset}}} K_{offset}$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed Cell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.4 UE specific CBW change for satellite access

A.14.4.4.1 UE specific CBW change on PCell in FR1 in non-DRX

A.14.4.4.1.1 Test Purpose and Environment

The purpose of this test is to verify the UE specific CBW change delay requirement defined in clause 8.13C.

The supported test configurations are shown in table A.14.4.4.1.1-1. The test scenario comprises of one Cell (Cell 1), which is PCell as given in table A.14.4.4.1.1-2. Cell-specific parameters are specified in table A.14.4.4.1.1-3.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE sends ACK/NACK during the test.

Before the test starts:

UE is connected to Cell 1 (PCell) on radio channel 1.

UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell).

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PCell.

UE has been configured with UE specific CBW (CBW-1).

UE is indicated in *SCS-SpecificCarrier* [2] that the UE specific CBW is CBW-1 as the initial condition in Cell 1 (PCell).

Cell 1 (PCell) has constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* containing *SCS-SpecificCarrier* with updated UE specific CBW, sent from the test equipment to the UE, is completely received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its UE specific CBW with the updated CBW-2 for the final condition.

The UE shall be able to receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot $(i + \frac{T_{RRCprocessing\,Delay} + T_{CBWchangeDelayRRC}}{NR\,Slot\,length})$ as defined in clause 8.13C and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot $(i + \frac{T_{RRCprocessing\,Delay} + T_{CBWchangeDelayRRC}}{NR\,Slot\,length} + k1 + 2^{\mu - \mu_{K_{offset}}} K_{offset})$ on the PCell's BWP-1 on CBW-2 for the final condition. The UE shall be continuously scheduled on the PCell's BWP-1 on CBW-2 for the final condition starting from the first DL slot right after slot $(i + \frac{T_{RRCprocessing\,Delay} + T_{CBWchangeDelayRRC}}{NR\,Slot\,length})$.

$T_{RRCprocessing\,Delay}$ and $T_{CBWchangeDelayRRC}$ are defined in clause 8.13C.

The test equipment verifies the UE specific CBW switching delay in PCell by estimating the time from the moment the RRC Reconfiguration message including updated UE specific CBW configuration is sent until the moment a vaild ACK/NACK is received.

Table A.14.4.4.1.1-1: Supported test configurations for UE specific CBW change in SA scenario

1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note:	If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.

Table A.14.4.4.1.1-2: General test parameters for UE specific CBW change in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	

Table A.14.4.4.1.1-3: NR Cell specific test parameters for UE specific CBW change in SA scenario

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1, 2		FDD
$BW_{channel}$		Config 1, 2		10 MHz: $N_{PRB,c}$ = 52
Satellite information		Config 1		SSC.1
		Config 2		SSC.2
Active DL BWP ID		Config 1, 2		1
Initial DL BWP Configuration (BWP-1)		Config 1, 2		DLBWP.0.2
Initial UL BWP Configuration		Config 1, 2		ULBWP.0.2
Initial Condition	Active DLCBW-1 Configureation	Config 1, 2		DLCBW.1.1

Parameter			Unit	Cell 1
	Active UL CBW-1 Configuration	Config 1, 2		ULCBW.1.1
Final Condition	Active DLCBW-1 Configureation	Config 1, 2		DLCBW.1.2
	Active UL CBW-1 Configuration	Config 1, 2		ULCBW.1.2
PDSCH Reference measurement channel		Config 1, 2		SR.1.1 FDD
RMSI CORESET parameters		Config 1, 2		CR.1.1 FDD
Dedicated CORESET parameters		Config 1, 2		CCR.1.1 FDD
OCNG Patterns				OP.1
SSB Configuration		Config 1, 2		SSB.1 FR1
SMTC Configuration				SMTC.1
TRS Configuration		Config 1, 2		TRS.1.1 FDD
Antenna Configuration				1x2 Low
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		Config 1, 2	dBm/SCS	-104
SS-RSRP Note 3		Config 1, 2	dBm/SCS	-87
$\hat{E}_s/I_{ot}$			dB	17
$\hat{E}_s/N_{oc}$			dB	17
Io Note3		Config 1, 2	dBm/ 9.36 MHz	-58.96

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.4.4.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the PCell from the first DL slot that occurs right after the begining of slot ($i + \frac{T_{RRC processing Delay} + T_{CBW change Delay RRC}}{NR\ Slot\ length}$) and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i + \frac{T_{RRC processing Delay} + T_{CBW change Delay RRC}}{NR\ Slot\ length} + k1 + 2^{\mu - \mu_{K_{offset}}} K_{offset}$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed UE specific CBW change delay on the PCell to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.4.5 Pathloss reference signal switching delay

A.14.4.5.1 MAC-CE based pathloss reference signal switch delay

A.14.4.5.1.1 Test Purpose and Environment

The purpose of this test is to verify the MAC-CE based pathloss reference signal switch delay requirement defined in clause 8.14C.

The supported test configurations are shown in table A.14.4.5.1.1-1. The test scenario comprises of one cell (Cell 1) as given in table A.14.4.5.1.1-2. Cell-specific parameters of the cell are specified in table A.14.4.5.1.1-3 below.

The test consists of 3 successive time periods, with duration of T1, T2 and T3, respectively.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 on radio channel 1.
- UE shall be fully synchronized to SSB #0.

During T1,

- The UE shall track SSB #1 so that SSB #1 as a pathloss reference signal is known to the UE.

Time period T2 starts when the UE is configured of the power headroom reporting functionality by upper layers by the test equipment and the UE shall transmit a PHR during T2.

During T2,

- UE is configured with a *phr-ProhibitTimer* timer value for Cell 1.
- UE is configured with a *phr-Tx-PowerFactorChange* value for Cell 1.

During T3,

Time period T3 starts when a PDSCH carrying MAC-CE activation for pathloss reference signal switch, sent from the test equipment to the UE to swicth the pathloss reference signal from SSB 0 to SSB 1, is received at the UE side in Cell 1's slot # denoted *i*. The UE shall switch its pathloss reference signal to the target one and send PHR.

The UE shall be able to apply the target pathloss reference signal of the serving cell on which pathloss reference signal switch occurs no later than the slot $i + T_{HARQ} + \left\lceil \frac{3\text{ ms} + 5 * T_{target_PL-RS} + 2\text{ ms}}{NR\ slot\ length} \right\rceil$ as defined in clause 8.14. The UE shall be able to apply old pathloss reference signals until the slot $i + T_{HARQ} + 3\text{N}_{\text{slot}}^{\text{subframe},\mu}$ as defined in clause 8.14.

The test equipment verifies the pathloss RS switch time by counting the slots from the time when the pathloss RS switch command is transmitted till a PHR is received during T3.

Table A.14.4.5.1.1-1: MAC-CE based pathloss reference signal switch supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.4.5.1.1-2: General test parameters for MAC-CE based pathloss reference signal switch

Parameter		Unit	Value	Comment
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1, 2		FDD	
Satellite information	Config 1		SSC.1	
	Config 2		SSC.2	
DL initial BWP configuration	Config 1, 2		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1	

Parameter		Unit	Value	Comment
UL initial BWP configuration	Config 1, 2		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1	
CORESET Reference Channel	Config 1, 2		CR.1.1 FDD	
SSB Configuration	Config 1, 2		SSB.1 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz	
SSB index assigned as pathloss RS			0 in T1, 0 in T2, 1 in T3	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			1x2 Low	
DRX			OFF	
Gap pattern ID			gp0	
phr-ProhibitTimer		sub frame	0	
phr-Tx-PowerFactorChange		dB	5	
phr-PeriodicTimer		sub frame	infinity	
Filter coefficient			0	L3 filtering is not used
T1		s	2	
T2		s	2	
T3		s	0.2	

Table A.14.4.5.1.1-3: NR Cell specific test parameters for MAC-CE based pathloss reference signal switch

Parameter			Unit	Test 1		
				T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS			dB	4		
EPRE ratio of PDCCH to PDCCH DMRS			dB	0		
EPRE ratio of PBCH DMRS to SSS			dB	0		
EPRE ratio of PBCH to PBCH DMRS			dB			
EPRE ratio of PSS to SSS			dB			
EPRE ratio of PDSCH DMRS to SSS			dB			
EPRE ratio of PDSCH to PDSCH DMRS			dB			
EPRE ratio of OCNG DMRS to SSS			dB			
EPRE ratio of OCNG to OCNG DMRS			dB			
SSB with index 0	$\hat{E}_s/I_{ot}$		dB	7		
	N_{oc}	Config 1, 2	-101	-101		
	$\hat{E}_s/N_{oc}$		dB	7		
	SS-RSRP Note 4	Config 1	-94	-94		
		Config 2	-94	-94		
SSB with index 1	$\hat{E}_s/I_{ot}$		dB	-3		
	N_{oc}	Config 1, 2	-101	-101		
	$\hat{E}_s/N_{oc}$		dB	-3		
	SS-RSRP Note 4	Config 1	-104	-104		
		Config 2		-104		
Io Note 5	Config 1		dBm	-65.3/9.36MHz		
	Config 2			-65.3/9.36MHz		
Propagation condition				AWGN		

Parameter	Unit	Test 1		
		T1	T2	T3
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.				
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.				
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.				
NOTE 5: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.				

A.14.4.5.1.2 Test Requirements

During T3, the UE shall start to send the PHR for PCell no later than the slot $i + T_{HARQ} + \left\lceil \frac{3\text{ ms} + 5 * T_{target_PL-RS} + 2\text{ ms}}{NR\ slot\ length} \right\rceil$.

During T3, the UE shall start to send the PHR for PCell no earlier than the slot $i + T_{HARQ} + 3\text{N}_{\text{slot}}^{\text{subframe},\mu}$.

Where, T_{HARQ} is the timing between pathloss reference MAC-CE activation command and acknowledgement as specified in [7], T_{target_PL-RS} is the periodicity of the target pathloss reference signal which is SSB in this test.

During T3, UE shall send L1-RSRP report with measurement results for both SSB0 and SSB1.

All of the above test requirements shall be fulfilled in order for the observed pathloss RS switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The UE shall be given proper uplink transmission grant during T2 and T3.

A.14.5 Measurement procedure

A.14.5.1 Intra-frequency Measurements

A.14.5.1.1 SA event triggered reporting tests without gap under non-DRX

A.14.5.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2C.5.1 and 9.2C.5.2.

A.14.5.1.1.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.14.5.1.1.2-1 and A.14.5.1.1.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

UE is configured with 2 non-overlapping SMTCs for the intra-frequency measurement. The SMTC periodicity is 20 ms, and SMTC1 is associated with Cell 1 with offset 0, and SMTC2 is associated with Cell 2 with offset 10 ms.

Table A.14.5.1.1.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz

NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.

Table A.14.5.1.1.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	Cell 1	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	
SMTC1 configuration		1, 2	SMTC.1	Period: 20 ms, offset: 0
SMTC2 configuration		1, 2	SMTC.4	Period: 20 ms, offset: 10 ms
A3-Offset	dB	1, 2	-4.5	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2		OFF
Time offset between serving and neighbour cells		1, 2	10 ms	Asynchronous cells. The timing of Cell 2 is 10 ms later than the timing of Cell 1.
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.14.5.1.1.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	SSC.1		NSC.1	
		2	SSC.2		NSC.2	
SSB configuration		1, 2	SSB.1 FR1		SSB.1 FR1	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS Configuration		1, 2	TRS.1.1 FDD		N/A	
IInitial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	--64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.5.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.1.2 SA event triggered reporting tests without gap under DRX

A.14.5.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2C.5.1 and 9.2C.5.2.

A.14.5.1.2.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.14.5.1.2.2-1, A.14.5.1.2.2-2 and A.14.5.1.2.2-3 below. In the measurement controlinformation, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

The UE shall be provided with the valid information about the SAN serving cell in the test before the test.

UE is configured with 1 SMTC for the intra-frequency measurement. Both Cell 1 and Cell 2 are associated with the configured SMTC.

Table A.14.5.1.2.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.5.1.2.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2	Cell 1		
Neighbour cell		1, 2	Cell 2		Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2		
SMTC configuration		1, 2	SMTC.2		
A3-Offset	dB	1, 2	-4.5		
CP length		1, 2	Normal		
Hysteresis	dB	1, 2	0		
Time To Trigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
DRX		1, 2	DRX.1	DRX. 7	
Time offset between serving and neighbour cells		1, 2	3 μs		Synchronous cells
T1	s	1, 2	5		
T2	s	1, 2	5	10	

Table A.14.5.1.2.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	SSC.1		NSC.1	
		2	SSC.2		NSC.2	
SSB configuration		1, 2	SSB.1 FR1		SSB.1 FR1	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
IInitial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.5.1.2.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test. X=1280 for test configuration 2 and if UE indicates 'n1' for *maxNumber-NGSO-SatellitesWithinOneSMTC* and supports *parallelMeasurementWithoutRestriction-r17*, X=1920 for test configuration 2 and if UE indicates 'n1' for *maxNumber-NGSO-SatellitesWithinOneSMTC* and not supports *parallelMeasurementWithoutRestriction-r17*, X=1080 for test configuration 2 and if UE indicates other than 'n1' for *maxNumber-NGSO-SatellitesWithinOneSMTC* and not supports *parallelMeasurementWithoutRestriction-r17*, otherwise X=920.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than Y ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test. Y=12800 for test configuration 2 and if UE indicates 'n1' for *maxNumber-NGSO-SatellitesWithinOneSMTC* and supports *parallelMeasurementWithoutRestriction-r17*, Y=20480 for test configuration 2 and if UE indicates 'n1' for

maxNumber-NGSO-SatellitesWithinOneSMTC and not supports *parallelMeasurementWithoutRestriction-r17*, Y=10240 for test configuration 2 and if UE indicates other than 'n1' for *maxNumber-NGSO-SatellitesWithinOneSMTC* and not supports *parallelMeasurementWithoutRestriction-r17*, otherwise Y=6400.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.1.3 SA event triggered reporting tests without gap under non-DRX with SSB index reading

A.14.5.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2C.5.1 and 9.2C.5.2.

A.14.5.1.3.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cell are given in table A.14.5.1.3.2-1 and A.14.5.1.3.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

UE is configured with 2 overlapping SMTC for the intra-frequency measurement. The SMTC periodicity is 20 ms, and SMTC1 is associated with Cell 1 with offset 0, and SMTC2 is associated with Cell 2 with offset 17 ms.

Table A.14.5.1.3.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.5.1.3.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	Cell 1	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	
SSB configuration		1, 2	SSB.1 FR1	
SMTC1 configuration		1, 2	SMTC.2	
SMTC2 configuration		1, 2	SMTC.6	
A3-Offset	dB	1, 2	-4.5	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX	ms	1, 2		OFF
Time offset between serving and neighbour cells		1, 2	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms earlier than the timing of Cell 1.
T1	s	1, 2	5	

Parameter	Unit	Test configuration	Value	Comment
T2	s	1, 2	5	

Table A.14.5.1.3.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	SSC.1		NSC.1	
		2	SSC.2		NSC.2	
SSB configuration		1, 2	SSB.1 FR1		SSB.1 FR1	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
IInitial BWP configuration		1, 2	DLBWP.0,1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.5.1.3.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test. X=920 for test configuration 2 and if UE indicates 'n1' for *maxNumber-NGSO-SatellitesWithinOneSMTC*, otherwise X=800.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.1.4 SA event triggered reporting tests with single measurement gap under non-DRX for satellite access

A.14.5.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2C.6.1 and 9.2C.6.2.

A.14.5.1.4.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters are given in table A.14.5.1.4.2-1 and A.14.5.1.4.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP0 which contains the cell defining SSB, and BWP1 which does not contain any SSB of Cell 1. During the whole test, BWP1 is always scheduled as the active BWP for the UE.

The UE shall be provided with the valid information about the SAN serving each cell before the test.

UE is configured with 1 SMTC for the intra-frequency measurement. Both Cell 1 and Cell 2 are associated with the configured SMTC.

Table A.14.5.1.4.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.5.1.4.2-2: General test parameters for SA intra-frequency event triggered reporting with single measurement gap for PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	Cell 1	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	
Measurement gap type		1, 2	Per-UE gaps	
Gap Pattern ID		1, 2	0	As specified in clause 9.1.2-1.
Measurement gap repetition periodicity	ms	1, 2	40	
Measurement gap length	ms	1, 2	6	
Measurement gap offset	ms	1, 2	39	
A3-Offset	dB	1, 2	-4.5	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX	ms	1, 2		OFF
Time offset between serving and neighbour cells		1,2	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.14.5.1.4.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with single measurement gap for PCell in FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	SSC.1		NSC.1	
		2	SSC.2		NSC.2	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
SSB configuration		1, 2	SSB.1 FR1		SSB.1 FR1	
SMTC configuration		1, 2	SMTC.2		SMTC.2	
CSI-RS parameters		1, 2	CSI-RS.1.2 FDD resource #0		N/A	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.2 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.5.1.4.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test. X=1600 for test configuration 2 and if UE indicates 'n1' for *maxNumber-NGSO-SatellitesWithinOneSMTC*, otherwise X=1000.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.1.5 SA event triggered reporting tests with FNO concurrent gaps under DRX for satellite access

A.14.5.1.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2C.6.1 and 9.2C.6.2.

A.14.5.1.5.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters are given in table A.14.5.1.5.2-1, A. 14.5.1.5.2-2 and A. 14.5.1.5.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3.

There are two BWPs configured in Cell 1, BWP0 which contains the cell defining SSB, and BWP1 which does not contain any SSB of Cell 1. During the whole test, BWP1 is always scheduled as the active BWP for the UE.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

The UE shall be provided with the valid information about the SAN serving each cell before the test.

The UE is configured with 2 FNO concurrent measurement gaps for the intra-frequency measurement. Serving Cell 1 is expected to be measured within MeasGapId #0 and Neighbour Cell 2 is expected to be measured within MeasGapId #1.

Table A.14.5.1.5.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.5.1.5.2-2: General test parameters for SA intra-frequency event triggered reporting with FNO concurrent gaps for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2	Cell 1		
Neighbour cell		1, 2	Cell 2		Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2		
Measurement gap type		1, 2	Per-UE gap		
Gap Pattern ID		1	0		As specified in clause 9.1.2-1.
Measurement gap repetition periodicity	ms	1, 2	40		
Measurement gap length	ms	1, 2	6		
Measurement gap offset	ms	1, 2	19 for MeasGapId #0 4 for MeasGapId #1		
A3-Offset	dB	1, 2	-4.5		
CP length		1, 2	Normal		
Hysteresis	dB	1, 2	0		
Time To Trigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	DRX.1	DRX. 7	
Time offset between serving and neighbour cells		1, 2	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	1, 2	5		
T2	s	1, 2	5	10	

Table A.14.5.1.5.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with FNO concurrent gaps for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	SSC.1		NSC.1	
		2	SSC.2		NSC.2	
SSB configuration		1, 2	SSB.1 FR1		SSB.7 FR1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
SMTC configuration		1, 2	SMTC.2		SMTC.12	
CSI-RS parameters		1, 2	CSI-RS.1.2 FDD resource #0		N/A	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.2 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.14.5.1.5.2-4: Void

Table A.14.5.1.5.2-5: Void

A.15.5.1.5.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 6400 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.1.6 SA event triggered reporting tests with PPO concurrent gaps under non-DRX with SSB index reading for satellite access

A.14.5.1.6.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2C.6.1 and 9.2C.6.2.

A.14.5.1.6.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cells are given in table A.14.5.1.6.2-1 and A.14.5.1.6.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP0 which contains the cell defining SSB, and BWP1 which does not contain any SSB of Cell 1. During the whole test, BWP1 is always scheduled as the active BWP for the UE.

The UE shall be provided with the valid information about the SAN serving each cell before the test.

The UE is configured with 2 PPO concurrent measurement gaps for the intra-frequency measurement. Serving Cell 1 is expected to be measured within MeasGapId #0 and Neighbour Cell 2 is expected to be measured within MeasGapId #1. And the priority for MeasGapId #1 is higher than the priority for MeasGapId #0.

Table A.14.5.1.6.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.5.1.6.2-2: General test parameters for SA intra-frequency event triggered reporting with PPO concurrent gaps for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	Cell 1	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	
Measurement gap type		1, 2	Per-UE gap	
Gap Pattern ID		1, 2	0 for MeasGapId #1 1 for MeasGapId #2	As specified in clause 9.1.2-1.
Measurement gap repetition periodicity	ms	1, 2	40 ms for MeasGapId #1 80 ms for MeasGapId #2	
Measurement gap length	ms	1, 2	6	
Measurement gap offset	ms	1, 2	39 for MeasGapId #1 4 for MeasGapId #2	
A3-Offset	dB	1, 2	-4.5	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX	ms	1, 2		OFF
Time offset between serving and neighbour cells		1, 2	5 ms	Asynchronous cells. The timing of Cell 2 is 5 ms later than the timing of serving Cell 1.
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.14.5.1.6.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with PPO concurrent gaps for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	SSC.1		NSC.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		2	SSC.2		NSC.2	
SSB configuration		1, 2	SSB.1 FR1		SSB.1 FR1	
SMTC configuration		1, 2	SMTC.2		SMTC.12	
CSI-RS parameters		1, 2	CSI-RS.1.2 FDD resource #0		N/A	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.2 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.5.1.6.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1240 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.1.7 SA event triggered reporting test with SSB time index reading without gap under non-DRX for FR2-NTN

A.14.5.1.7.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in FR2-NTN in clause 9.2C.7.1 and 9.2C.7.2.

A.14.5.1.7.2 Test parameters

Two cells are deployed in the test, which are FR2 PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cell are given in table A.14.5.1.7.2-1 and A.14.5.1.7.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

UE is configured with 1 SMTC for the intra-frequency measurement. Both Cell 1 and Cell 2 are associated with the configured SMTC.

Table A.14.5.1.7.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NGSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.5.1.7.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR2-NTN with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	Cell 1	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	
SMTC configuration		1, 2	SMTC.2	
A3-Offset	dB	1, 2	-11	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX	ms	1, 2		OFF
Time offset between serving and neighbour cells		1, 2	3 μs	Synchronous cells
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.14.5.1.7.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR2-NTN with SSB index reading

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
FDD configuration		1, 2	TBD		TBD	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
		2	48		48	
Intial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
PDSCH RMC configuration		1	TBD		N/A	
		2	TBD			
RMSI CORESET RMC configuration		1	TBD		N/A	
		2	TBD		N/A	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Dedicated CORESET RMC configuration		1	TBD		N/A	
		2	TBD		N/A	
TRS configuration		1, 2	TBD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.5		N/A	
cellIndividualOffset	dB	1~2	N/A		16	
SSB		1	SSB.1 FR2		SSB.7 FR2	
		2	SSB.2 FR2		SSB.8 FR2	
Propagation Condition		1, 2	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [40].						

Table 14.5.1.X.2-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with FDD PCell in FR2-NTN without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	[SSC.1]		[NSC.1]	
		2	[SSC.2]		[NSC.2]	
AoA setup		1, 2	TBD			
Beam assumption[Note 4]		1,2	TBD		TBD	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1	-64.41	-64.41	-Infinity	-64.41
		2	-61.41	-61.41	-Infinity	-61.41
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Void						
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

A.14.5.1.7.3 Test Requirements

For both UE indicating [Type 1] and [Type 2] via UE capability [Beam steering], the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.1.8 SA event triggered reporting tests without gap under non-DRX with SSB index reading under less 5MHz BW

A.14.5.1.8.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2C.5.1 and 9.2C.5.2.

A.14.5.1.8.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cell are given in table A.14.5.1.8.2-1 and A.14.5.1.8.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

UE is configured with 2 overlapping SMTC for the intra-frequency measurement. The SMTC periodicity is 20 ms, and SMTC1 is associated with Cell 1 with offset 0, and SMTC2 is associated with Cell 2 with offset 17 ms.

Table A.14.5.1.8.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 3 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 3 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.5.1.8.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	Cell 1	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	
SSB configuration		1, 2	SSB.13 FR1	
SMTC1 configuration		1, 2	SMTC.2	
SMTC2 configuration		1, 2	SMTC.6	
A3-Offset	dB	1, 2	-4.5	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX	ms	1, 2		OFF
Time offset between serving and neighbour cells		1, 2	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms earlier than the timing of Cell 1.
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.14.5.1.8.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	SSC.1		NSC.1	
		2	SSC.2		NSC.2	
SSB configuration		1, 2	SSB.13 FR1		SSB.13 FR1	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
RMSI CORESET RMC configuration		1, 2	CR.1.3 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.7 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
IInitial BWP configuration		1, 2	DLBWP.0,1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/2.7 MHz	1, 2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.5.1.8.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test. X=1000 for test configuration 2 and if UE indicates 'n1' for *maxNumber-NGSO-SatellitesWithinOneSMTC*, otherwise X=880.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.2 Inter-frequency Measurements

A.14.5.2.1 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is not used with single gap for satellite access

A.14.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3C.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.14.5.2.1.1-1, A.14.5.2.1.1-2 and A.14.5.2.1.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in table A.14.5.2.1.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.14.5.2.1.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	GSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NGSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
NOTE 1: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2. NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.14.5.2.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
NR RF Channel Number		Config 1,2	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2	NR Cell 1 (Pcell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	9	
A3-Offset	dB	Config 1,2	-6	
Hysteresis	dB	Config 1,2	0	
CP length		Config 1,2	Normal	
TimeToTrigger	s	Config 1,2	0	
Filter coefficient		Config 1,2	0	L3 filtering is not used
DRX		Config 1,2	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,2	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	Config 1,2	5	
T2	s	Config 1,2	1	

Table A.14.5.2.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2	1		2	
Satellite information			Config 1	SSC.1		NSC.1	
			Config 2	SSC.2		NSC.2	
Duplex mode			Config 1,2	FDD			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
BWP configuration	Initial DL BWP	Config 1	Config 1,2	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,2	TRS.1.1 FDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2	SR.1.1 FDD			
RMSI CORESET Reference Channel			Config 1,2	CR.1.1 FDD			
Dedicated CORESET Reference Channel			Config 1,2	CCR.1.1 FDD			
SSB parameters			Config 1,2	SSB.1 FR1		SSB.5 FR1	
SMTC configuration defined in A.3.11			Config 1,2	SMTC.2		SMTC.5	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
EPRE ratio of PSS to SSS			Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-98	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
$\hat{E}_s/I_{ot}$		dB	Config 1,2	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
Propagation Condition			Config 1,2	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.14.5.2.1.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.2.2 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is used with single gap for satellite access

A.14.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3C.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.14.5.2.2.1-1, A.14.5.2.2.1-2 and A.14.5.2.2.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in table A.14.5.2.2.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.14.5.2.2.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	GSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NGSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
NOTE 1: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2. NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.14.5.2.2.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2	NR Cell 1 (Pcell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	9		
A3-Offset	dB	Config 1,2	-6		
Hysteresis	dB	Config 1,2	0		
CP length		Config 1,2	Normal		
TimeToTrigger	s	Config 1,2	0		
Filter coefficient		Config 1,2	0		L3 filtering is not used
DRX		Config 1,2	DRX.1	DRX. 7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,2	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	Config 1,2	5		
T2	s	Config 1,2	1.1	11	

Table A.14.5.2.2.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2	1		2	
Satellite information			Config 1	SSC.1		NSC.1	
			Config 2	SSC.2		NSC.2	
Duplex mode			Config 1,2	FDD			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
BWP configuration	Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,2	TRS.1.1 FDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2	SR.1.1 FDD			
RMSI CORESET Reference Channel			Config 1,2	CR.1.1 FDD			
Dedicated CORESET Reference Channel			Config 1,2	CCR.1.1 FDD			
SSB parameters			Config 1,2	SSB.1 FR1		SSB.5 FR1	
SMTC configuration defined in A.3.11			Config 1,2	SMTC.2		SMTC.5	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
EPRE ratio of PSS to SSS			Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-98	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
$\hat{E}_s/I_{ot}$		dB	Config 1,2	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2	4	4	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.2
Propagation Condition			Config 1,2	AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

Table A.14.5.2.2.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test1	Test2	Comment
	Value	Value	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.14.5.2.2.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.14.5.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.2.3 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is not used with single gap for satellite access

A.14.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3C.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.14.5.2.3.1-1, A.14.5.2.3.1-2 and A.14.5.2.3.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in table A.14.5.2.3.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.14.5.2.3.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1

Config	Description
1	GSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NGSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
NOTE 1: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2. NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.14.5.2.3.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
NR RF Channel Number		Config 1,2	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2	NR Cell 1 (Pcell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	9	
A3-Offset	dB	Config 1,2	-6	
Hysteresis	dB	Config 1,2	0	
CP length		Config 1,2	Normal	
TimeToTrigger	s	Config 1,2	0	
Filter coefficient		Config 1,2	0	L3 filtering is not used
DRX		Config 1,2	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,2	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	Config 1,2	5	
T2	s	Config 1,2	1.1	

Table A.14.5.2.3.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2	1		2	
Satellite information			Config 1	SSC.1			
			Config 2	SSC.2			
Duplex mode			Config 1,2	FDD			
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
BWP configuration	Initial DL BWP	Config 1	Config 1,2	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,2	TRS.1.1 FDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2	OP.1		OP.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
PDSCH Reference measurement channel		Config 1,2	SR.1.1 FDD			
RMSI CORESET Reference Channel		Config 1,2	CR.1.1 FDD			
Dedicated CORESET Reference Channel		Config 1,2	CCR.1.1 FDD			
SSB parameters		Config 1,2	SSB.1 FR1		SSB.5 FR1	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.2		SMTC.5	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	15			
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	Config 1,2	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
$\hat{E}_s/I_{ot}$	dB	Config 1,2	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.2
Propagation Condition		Config 1,2	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.14.5.2.3.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1040 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.2.4 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is not used with two gaps in fully non-overlapped for satellite access

A.14.5.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the multiple gaps capable UE makes correct reporting of events. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3C.4.

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2, and NR Cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.14.5.2.4.1-1, A.14.5.2.4.1-2 and A.14.5.2.4.1-3.

In this test measurement gap pattern configuration # 0 as defined in table A.14.5.2.4.1-2 is provided.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2 and NR Cell 3.

Table A.14.5.2.4.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	GSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NGSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
NOTE 1: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2. NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.14.5.2.4.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2	NR Cell 1 (Pcell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 2 and NR Cell 3	NR Cell 2 and NR Cell 3 are on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0 for MeasGapId #1 0 for MeasGapId #2	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	9 for MeasGapId #1 19 for MeasGapId #2	
A3-Offset	dB	Config 1,2	-6	
Hysteresis	dB	Config 1,2	0	
CP length		Config 1,2	Normal	
TimeToTrigger	s	Config 1,2	0	
Filter coefficient		Config 1,2	0	L3 filtering is not used
DRX		Config 1,2	OFF	DRX is not used
Time offset between serving and neighbour Cell 2,3		Config 1,2	3 ms	Asynchronous cells. The timing of Cell 2 and Cell 3 is 3 ms later than the timing of Cell 1.
T1	s	Config 1,2	5	
T2	s	Config 1,2	1	

Table A.14.5.2.4.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2	1		2		2	
Satellite information			Config 1	SSC.1		NSC.1			
			Config 2	SSC.2		NSC.2			
Duplex mode			Config 1,2	FDD					
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
BWP configuration	Initial DL BWP		Config 1,2	DLBWP.0.1		NA		NA	
	Initial UL BWP			ULBWP.0.1		NA		NA	
	Dedicated DL BWP			DLBWP.1.1		NA		NA	
	Dedicated UL BWP			ULBWP.1.1		NA		NA	
TRS configuration			Config 1,2	TRS.1.1 FDD		NA		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2	SR.1.1 FDD					
RMSI CORESET Reference Channel			Config 1,2	CR.1.1 FDD					
Dedicated CORESET Reference Channel			Config 1,2	CCR.1.1 FDD					
SSB parameters			Config 1,2	SSB.1 FR1		SSB.5 FR1		SSB.1 FR1	
SMTC configuration defined in A.3.11			Config 1,2	SMTC.2		SMTC.5		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15					
EPRE ratio of PSS to SSS			Config 1,2	0		0		0	
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2		dBm/15 kHz	Config 1,2	-98		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2	-98		-98		-98	
SS-RSRP Note 3		dBm/SCS	Config 1,2	-94	-94	-Infinity	-91	-Infinity	-91
$\hat{E}_s/I_{ot}$		dB	Config 1,2	4	4	-Infinity	7	-Infinity	7
$\hat{E}_s/N_{oc}$		dB	Config 1,2	4	4	-Infinity	7	-Infinity	7
Io Note3		dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26	-70.05	-62.26
Propagation Condition			Config 1,2	AWGN		AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.								

A.14.5.2.4.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.2.5 void

A.14.5.2.5.1 void

A.14.5.2.5.2 void

A.14.5.2.6 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is not used with two gaps in partially partial overalpping for satellite access

A.14.5.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the multiple gaps capable UE makes correct reporting of events. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3C.4.

In this test, there are three cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2, and NR Cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.14.5.2.6.1-1, A.14.5.2.6.1-2 and A.14.5.2.6.1-3.

In test 1 measurement gap pattern configuration # 0 and #1 as defined in table A.14.5.2.6.1-2 are provided. MeasGapId #2 is configured with a higher priority than MeasGapId #1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2 and NR Cell 3.

Table A.14.5.2.6.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	GSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NGSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
NOTE 1: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2. NOTE 2: target NR cells have the same SCS, BW and duplex mode as NR serving cell	

Table A.14.5.2.6.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2	NR Cell 1 (Pcell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 2 and NR Cell 3	NR Cell 2 and NR Cell 3 are on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0 for MeasGapId #1 1 for MeasGapId #2	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	39 for MeasGapId #1 4 for MeasGapId #2	
A3-Offset	dB	Config 1,2	-6	
Hysteresis	dB	Config 1,2	0	
CP length		Config 1,2	Normal	
TimeToTrigger	s	Config 1,2	0	
Filter coefficient		Config 1,2	0	L3 filtering is not used
DRX		Config 1,2	OFF	DRX is not used
Time offset between serving and neighbour Cell 1		Config 1,2	3μs	Synchronous.
Time offset between serving and neighbour Cell 2		Config 1,2	5 ms	Asynchronous. The timing of Cell 3 is 5 ms later than the timing of Cell 1.
T1	s	Config 1,2	5	
T2	s	Config 1,2	1.5	

Table A.14.5.2.6.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2		Cell 3	
				T1	T2	T1	T2	T1	T2
NR RF Channel Number			Config 1,2	1		2		2	
Satellite information			Config 1	SSC.1		NSC.1			
			Config 2	SSC.2		NSC.2			
Duplex mode			Config 1,2	FDD					
$BW_{channel}$		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52					
BWP configuration	Initial DL BWP		Config 1,2	DLBWP.0.1		NA		NA	
	Initial UL BWP			ULBWP.0.1		NA		NA	
	Dedicated DL BWP			DLBWP.1.1		NA		NA	
	Dedicated UL BWP			ULBWP.1.1		NA		NA	
TRS configuration			Config 1,2	TRS.1.1 FDD		NA		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2	OP.1		OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2	SR.1.1 FDD					
RMSI CORESET Reference Channel			Config 1,2	CR.1.1 FDD					
Dedicated CORESET Reference Channel			Config 1,2	CCR.1.1 FDD					
SSB parameters			Config 1,2	SSB.1 FR1		SSB.1 FR1		SSB.1 FR1	
SMTC configuration defined in A.3.11			Config 1,2	SMTC.2		SMTC.2		SMTC.12	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15					
EPRE ratio of PSS to SSS			Config 1,2	0		0		0	

Parameter	Unit	Test configuration	Cell 1		Cell 2		Cell 3	
			T1	T2	T1	T2	T1	T2
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	dBm/15 kHz	Config 1,2	-98		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98		-98	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91	-Infinity	-91
$\hat{E}_s/I_{ot}$	dB	Config 1,2	4	4	-Infinity	7	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2	4	4	-Infinity	7	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26	-70.05	-62.26
Propagation Condition		Config 1,2	AWGN		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.14.5.2.6.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.2.7 Event triggered reporting test without gap under non-DRX

A.14.5.2.7.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the inter-frequency cell search requirements in clauses 9.3C.7.

A.14.5.2.7.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) on NR RF channel 1 and a FR1 neighbour cell (Cell 2) on NR RF channel 2. The test parameters for PCell and neighbour cell are given in table A.14.5.2.7.2-1, A.14.5.2.7.2-2 and A.14.5.2.7.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

UE is configured with 2 non-overlapping SMTCs for the inter-frequency measurement. The SMTC periodicity is 40 ms, and SMTC1 is associated with Cell 1 with offset 0, and SMTC2 is associated with Cell 2 with offset 20 ms.

Table A.14.5.2.7.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.5.2.7.2-2: General test parameters for inter-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	Cell 1	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	
SMTC1 configuration		1	SMTC.1	Period: 20 ms, offset: 0
SMTC2 configuration		2	SMTC.4	Period: 20 ms, offset: 10 ms
A3-Offset	dB	1, 2	-4.5	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2		OFF
Time offset between serving and neighbour cells		1, 2	20 ms	Asynchronous cells. The timing of Cell 2 is 20 ms later than the timing of Cell 1.
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.14.5.2.7.2-3: NR Cell specific test parameters for inter-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	SSC.1		NSC.1	
		2	SSC.2		NSC.2	
SSB configuration		1, 2	SSB.1 FR1		SSB.1 FR1	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS Configuration		1, 2	TRS.1.1 FDD		N/A	
IInitial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	--64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.14.5.2.7.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.2.8 Event triggered reporting tests without gap under DRX

A.14.5.2.8.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the inter-frequency cell search requirements in clauses 9.3C.7.

A.14.5.2.8.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) on NR RF channel 1 and a FR1 neighbour cell (Cell 2) on NR RF channel 2. The test parameters for PCell are given in table A.14.5.2.8.2-1, A.14.5.2.8.2-2 and A.14.5.2.8.2-3 below. In the measurement controlinformation, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

The UE shall be provided with the valid information about the SAN serving each cell in the test before the test.

UE is configured with 1 SMTC for the inter-frequency measurement. Both Cell 1 and Cell 2 are associated with the configured SMTC.

Table A.14.5.2.8.2-1: Supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.5.2.8.2-2: General test parameters for inter-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2	Cell 1		
Neighbour cell		1, 2	Cell 2		Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2		
SMTC configuration		1, 2	SMTC.2		
A3-Offset	dB	1, 2	-4.5		
CP length		1, 2	Normal		
Hysteresis	dB	1, 2	0		
Time To Trigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	DRX.1	DRX. 7	
Time offset between serving and neighbour cells		1, 2	3 μs		Synchronous cells
T1	s	1, 2	5		
T2	s	1, 2	5	10	

Table A.14.5.2.8.2-3: NR Cell specific test parameters for inter-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Satellite information		1	SSC.1		NSC.1	
		2	SSC.2		NSC.2	
SSB configuration		1, 2	SSB.1 FR1		SSB.1 FR1	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
IInitial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	--64.60	-62.25

Propagation Condition		1, 2	AWGN
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

A.14.5.2.8.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test. X=1280 for test configuration 2 and if UE indicates 'n1' for *maxNumber-NGSO-SatellitesWithinOneSMTC*, otherwise X=920.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than Y ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test. Y=12800 for test configuration 2 and if UE indicates 'n1' for *maxNumber-NGSO-SatellitesWithinOneSMTC*, otherwise Y=6400.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.2.9 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is used with single gap for 3 MHz channel bandwidth in satellite access

A.14.5.2.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3C.4. This test is applicable for UEs that support less than 5 MHz operation.

The test procedure in clause A.14.5.2.3 applies for this test. Supported test configurations are specified in Table A.14.5.2.9.1-1. The list of general and NR specific test configuration reuse those in test clause A.14.5.2.3, except for those provided in Tables A.14.5.2.9.1-2 and A.14.5.2.9.1-3.

Table A.14.5.2.9.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1

Config	Description
1	GSO, NR 15 kHz SSB SCS, 3 MHz bandwidth, FDD duplex mode
2	NGSO, NR 15 kHz SSB SCS, 3 MHz bandwidth, FDD duplex mode
NOTE 1: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2. NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.14.5.2.9.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection in operation with 3 MHz Channel Bandwith

Parameter	Unit	Test configuration	Value		Comment
NR RF Channel Number		Config 1,2	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2	NR Cell 1 (Pcell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	9		
A3-Offset	dB	Config 1,2	-6		
Hysteresis	dB	Config 1,2	0		
CP length		Config 1,2	Normal		
TimeToTrigger	s	Config 1,2	0		
Filter coefficient		Config 1,2	0		L3 filtering is not used
DRX		Config 1,2	DRX.1	DRX. 7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,2	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	Config 1,2	5		
T2	s	Config 1,2	1.1	11	

Table A.14.5.2.9.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection in operation with 3 MHz Channel Bandwith

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
PDSCH Reference measurement channel		Config 1,2	SR.1.2FDD			
RMSI CORESET Reference Channel		Config 1,2	CR.1.3 FDD			
Dedicated CORESET Reference Channel		Config 1,2	CCR.1.7 FDD			
SSB parameters		Config 1,2	SSB.13 FR1		SSB.13 FR1	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.2		SMTC.2	
N_{oc} Note2	dBm/15 kHz	Config 1,2	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
$\hat{E}_s/I_{ot}$	dB	Config 1,2	4	4	-Infinity	7

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$\hat{E}_s/N_{oc}$	dB	Config 1,2	4	4	-Infinity	7
Io[Note3]	dBm/2.7 MHz	Config 1,2	-69.99	-69.99	-75.44	-67.60

A.14.5.2.9.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1440 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.3 L1-RSRP measurement for beam reporting for satellite access

A.14.5.3.1 SSB based L1-RSRP measurement for satellite access when DRX is not used

A.14.5.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4C.1, with the testing configurations for NR cells served by satellite access node (SAN) in Table A.14.5.3.1.1-1.

Table A.14.5.3.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test for satellite access

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

A.14.5.3.1.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1) which is served by satellite access node (SAN). The test parameters for the Cell 1 are given in table A.14.5.3.1.2-1 and table A.14.5.3.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.14.5.3.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1, 2		freq1
Duplex mode	1, 2		FDD
TDD Configuration	1, 2		N/A

$BW_{channel}$	1, 2	MHz	10: $N_{PRB,c}$ = 52
Satellite information	1		SSC.1
	2		SSC.2
PDSCH Reference measurement channel	1, 2		SR.1.1 FDD
RMSI CORESET Reference Channel	1, 2		CR.1.1 FDD
Dedicated CORESET Reference Channel	1, 2		CCR.1.1 FDD
SSB configuration	1, 2		SSB.3 FR1
OCNG Patterns	1, 2		OP.1
Initial BWP Configuration	1, 2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1, 2		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1, 2		SMTC.1
TRS Configuration	1, 2		TRS.1.1 FDD
DRX configuration	1, 2		Off
reportConfigType	1, 2		periodic
reportQuantity	1, 2		ssb-Index-RSRP
Number of reported RS	1, 2		2
L1-RSRP reporting period	1, 2	slot	80
T1	1, 2	s	5
T2	1, 2	s	1
EPRE ratio of PSS to SSS	1, 2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1, 2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.14.5.3.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1, 2	dBm/15 kHz	-94.65			
N_{oc} Note2	1, 2	dBm/SSB SCS	-94.65			
$\hat{E}_s / I_{ot}$	1, 2	dB	0	0	-Infinity	3
SSB RSRP Note3	1, 2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
Io Note3	1, 2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
$\hat{E}_s / N_{oc}$	1, 2	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.14.5.3.1.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19C.1.1 and relative accuracy requirement in clause 10.1.19C.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.3.2 SSB based L1-RSRP measurement for satellite access when DRX is used

A.14.5.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells served by satellite access node (SAN)in table A.14.5.3.2.1-1.

Table A.14.5.3.2.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test for satellite access

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

A.14.5.3.2.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1) which is served by satellite access node (SAN). The test parameters for the Cell 1 are given in table A.14.5.3.2.2-1 and table A.14.5.3.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.14.5.3.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1, 2		freq1
Duplex mode	1, 2		FDD
TDD Configuration	1, 2		N/A
$BW_{channel}$	1, 2	MHz	10: $N_{PRB,c}$ = 52
Satellite information	1		SSC.1
	2		SSC.2
PDSCH Reference measurement channel	1, 2		SR.1.1 FDD
RMSI CORESET Reference Channel	1, 2		CR.1.1 FDD

Parameter	Config	Unit	Value
Dedicated CORESET Reference Channel	1, 2		CCR.1.1 FDD
SSB configuration	1, 2		SSB.3 FR1
OCNG Patterns	1, 2		OP.1
Initial BWP Configuration	1, 2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1, 2		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1, 2		SMTC.1
TRS Configuration	1, 2		TRS.1.1 FDD
DRX configuration	1, 2		DRX.3
reportConfigType	1, 2		periodic
reportQuantity	1, 2		ssb-Index-RSRP
Number of reported RS	1, 2		2
L1-RSRP reporting period	1, 2	slot	80
T1	1, 2	s	5
T2	1, 2	s	1
EPRE ratio of PSS to SSS	1, 2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1, 2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.14.5.3.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1, 2	dBm/15 kHz	-94.65			
N_{oc} Note2	1, 2	dBm/SSB SCS	-94.65			
$\hat{E}_s / I_{ot}$	1, 2	dB	0	0	-Infinity	3
SSB RSRP Note3	1, 2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
Io Note3	1, 2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
$\hat{E}_s / N_{oc}$	1, 2	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.14.5.3.2.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy

requirement in clause 10.1.19C.1.1 and relative accuracy requirement in clause 10.1.19C.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.3.3 CSI-RS based L1-RSRP measurement for satellite access when DRX is not used

A.14.5.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells served by satellite access node (SAN) in table A.14.5.3.3.1-1.

Table A.14.5.3.3.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test for satellite access

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

A.14.5.3.3.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1) which is served by satellite access node (SAN). The test parameters for the Cell 1 are given in table A.14.5.3.3.2-1 and table A.14.5.3.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (0 for Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.14.5.3.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.14.5.3.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1, 2		freq1
Duplex mode	1, 2		FDD
TDD Configuration	1, 2		N/A
$BW_{channel}$	1, 2	MHz	10: $N_{RB,c}$ = 52
Satellite information	1		SSC.1
	2		SSC.2
PDSCH Reference measurement channel	1, 2		SR.1.1 FDD
RMSI CORESET Reference Channel	1, 2		CR.1.1 FDD
Dedicated CORESET Reference Channel	1, 2		CCR.1.1 FDD
SSB configuration	1, 2		SSB.3 FR1
CSI-RS configuration	1, 2		CSI-RS 1.3 FDD
OCNG Patterns	1, 2		OP.1
TRS Configuration	1, 2		TRS.1.1 FDD
Initial BWP Configuration	1, 2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1, 2		DLBWP.1.1 ULBWP.1.1

SMTC configuration	1, 2		SMTC.1
DRX configuration	1, 2		Off
reportConfigType	1, 2		aperiodic
reportQuantity	1, 2		cri-RSRP
Number of reported RS	1, 2		2
qcl-Info	1, 2		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1, 2	slots	8
T1	1, 2	s	5
EPRE ratio of PSS to SSS	1, 2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1, 2		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.14.5.3.3.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1, 2	dBm/15 kHz	-94.65	
N_{oc} Note1	1, 2	dBm/SSB SCS	-94.65	
$\hat{E}_s/I_{ot}$	1, 2	dB	0	3
CSI-RS RSRP Note2	1, 2 1, 2	dBm/SSB SCS	-94.65	-91.65
Io Note2	1, 2 1, 2	dBm/9.36 MHz	-63.69	-61.93
$\hat{E}_s/N_{oc}$	1, 2	dB	0	3
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.14.5.3.3.3 Test Requirements

After 80ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.19C.1.1 and relative accuracy requirement in clause 10.1.19C.1.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.3.4 CSI-RS based L1-RSRP measurement for satellite access when DRX is used

A.14.5.3.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells served by satellite access node (SAN) in table A.14.5.3.4.1-1.

Table A.14.5.3.4.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test for satellite access

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

A.14.5.3.4.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1) which is served by satellite access node (SAN). The test parameters for the Cell 1 are given in table A.14.5.3.4.2-1 and table A.14.5.3.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (0 for Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.14.5.3.4.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.14.5.3.4.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1, 2		freq1
Duplex mode	1, 2		FDD
TDD Configuration	1, 2		N/A
$BW_{channel}$	1, 2	MHz	10: $N_{PRB,c}$ = 52
Satellite information	1		SSC.1
	2		SSC.2
PDSCH Reference measurement channel	1, 2		SR.1.1 FDD
RMSI CORESET Reference Channel	1, 2		CR.1.1 FDD
Dedicated CORESET Reference Channel	1, 2		CCR.1.1 FDD
SSB configuration	1, 2		SSB.3 FR1
CSI-RS configuration	1, 2		CSI-RS 1.3 FDD
OCNG Patterns	1, 2		OP.1
TRS Configuration	1, 2		TRS.1.1 FDD

Parameter	Config	Unit	Value
Initial BWP Configuration	1, 2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1, 2		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1, 2		SMTC.1
DRX configuration	1, 2		DRX.3
reportConfigType	1, 2		aperiodic
reportQuantity	1, 2		cri-RSRP
Number of reported RS	1, 2		2
qcl-Info	1, 2		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1, 2	slots	8
T1	1, 2	s	5
EPRE ratio of PSS to SSS	1, 2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1, 2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.14.5.3.4.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1, 2	dBm/15 kHz	-94.65	
N_{oc} Note1	1, 2	dBm/SSB SCS	-94.65	
$\hat{E}_s / I_{ot}$	1, 2	dB	0	3
CSI-RS RSRP Note2	1, 2	dBm/SSB SCS	-94.65	-91.65
Io Note2	1, 2	dBm/9.36 MHz	-63.69	-61.93
$\hat{E}_s / N_{oc}$	1, 2	dB	0	3
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.14.5.3.4.3 Test Requirements

After 80ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.19C.1.1 and relative accuracy requirement in clause 10.1.19C.1.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.14.5.3.5 SSB based L1-RSRP measurement when DRX is not used in FR2-NTN

A.14.5.3.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5C.4.1, with the testing configurations for NR cells in table A.14.5.3.5.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15C.1.

Table A.14.5.3.5.1-1: Applicable NR configurations for FR2-NTN SSB based L1-RSRP test

Configuration	Description
1	GSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NGSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

A.14.5.3.5.2 Test parameters

There is one cells in the test, the FR2-NTN PCell (Cell 1). The test parameters for the Cell 1 are given in table A.14.5.3.5.2-1 and table A.14.5.3.5.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.14.5.3.5.2-1: General test parameters

Parameter	Config	Unit	Value
Satellite configuration	1		SSC.1
	2		SSC.2
SSB ARFCN	1~2		freq1
Duplex mode	1~2		FDD
FDD Configuration	1~2		TBD
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~4		66
PDSCH Reference measurement channel	1		TBD
	2		TBD
RMSI CORESET Reference Channel	1		TBD
	2		TBD
Dedicated CORESET Reference Channel	1		TBD
	2		TBD
SSB configuration	1		SSB.1 FR2
	2		SSB.1 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TBD
PDCCH/PDSCH TCI Configuration	1~2		TBD
DRX configuration	1~2		Off
reportConfigType	1~2		periodic
reportQuantity	1~2		ssb-Index-RSRP
Number of reported RS	1~2		2
L1-RSRP reporting period	1~2	slot	320
T1	1~2	s	5
T2	1~2	s	2
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			

EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.14.5.3.5.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam Assumption Note 4	1,2		Rough			
N_{oc} Note2	1,2	dBm/15 kHz	-103.2			
N_{oc} Note2	1,2	dBm/SSB SCS	-94.2			
$\hat{E}_s / I_{ot}$	1,2	dB	0	0	-Infinity	9
SSB_RP Note3	1,2	dBm/SSB SCS	-94.2	-94.2	-Infinity	-85.2
$\hat{E}_s / N_{oc}$	1~2	dB	0	0	-Infinity	9
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. The N_{oc} is calculated using -145 dBm/Hz (clause 11.1.3.4.2 in [42]) NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in TBD, and does not limit UE implementation or test system implementation						

A.14.5.3.5.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than 1200 ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20C.1

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.14.6 Measurement Performance requirements

A.14.6.1 SS-RSRP for SAN

A.14.6.1.1 SA: intra-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.14.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.2C.1.1 and 10.1.2C.1.2 for intra-frequency measurements.

A.14.6.1.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.14.6.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in A.14.6.1.1.2-2. In all test cases, Cell 1 is the PCell, and Cell 2 is the target cell.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

Table A.14.6.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.6.1.1.2-2: SS-RSRP Intra frequency test parameters

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Cell ID				489	0	489	0	489	0
SSB ARFCN				freq1		freq1		freq1	
$BW_{channel}$	Config 1,2		MHz	10: $N_{PRB,c}$ = 52					
BWP BW	Config 1,2			10: $N_{PRB,c}$ = 52					
Downlink initial BWP configuration				DLBWP.0.1					
Downlink dedicated BWP configuration				DLBWP.1.1					
Uplink initial BWP configuration				ULBWP.0.1					
Uplink dedicated BWP configuration				ULBWP.1.1					
Satellite information	Config 1			SSC.1	NSC.1	SSC.1	NSC.1	SSC.1	NSC.1
	Config 2			SSC.2	NSC.2	SSC.2	NSC.2	SSC.2	NSC.2
TRS configuration	Config 1,2			TRS.1.1 FDD	NA	TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
DRX Cycle	Config 1,2		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,2			SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
RMSI CORESET Reference Channel	Config 1,2			CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
Control channel RMC	Config 1,2			CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
SSB configuration	Config 1,2			SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
Time offset with Cell 1	Config 1,2		ms	-	3	-	3	-	3
SMTC configuration	Config 1,2			SMTC.2					
OCNG Patterns				OCNG pattern 1					
PDSCH/PDCCH subcarrier spacing	Config 1,2		kHz	15 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	R_FDD_SAB_FR1_A	dBm/15Khz	-106		-88		-114	
N_{oc} Note2	Config 1,2		dBm/SCS	-106		-88		Same as Noc/15 kHz	
$\hat{E}_s/I_{ot}$			dB	2.46	-5.97	2.46	-5.97	-0.01	-4.76
$\hat{E}_s/N_{oc}$			dB	6	1	6	1	3	0
SS-RSRP Note3	Config 1,2	NR_FDD_SAB_FR1_A	dBm/SCS	-100	-105	-82	-87	-111.00	-114.00

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Io[Note3]	Config 1,2	NR_FDD_SAB_FR1_A	dBm/ 9.36 MHz	-70.09		-52.09		-80.03	
Propagation condition			-	AWGN					
Antenna configuration				1x2					
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.									
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.									
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.									
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.									

A.14.6.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil absolute requirement in clause 10.1.2C.1.1 and relative requirement in clause 10.1.2C.1.2.

A.14.6.1.2 SA inter-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.14.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.4C.1.1 and 10.1.4C.1.2 for inter-frequency measurements with the testing configurations for NR cells in table A.14.6.1.2.1-1.

The UE shall be provided with the valid information about the SAN serving the each cell in the test before the test.

Table A.14.6.1.2.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

A.14.6.1.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.14.6.1.2.2-1 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in table A.14.6.1.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.14.6.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN	1, 2		freq1	freq2	freq1	freq2
$BW_{channel}$	1, 2	MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
PDSCH Reference measurement channel	1, 2		SR.1.1 FDD	-	SR.1.1 FDD	-
RMSI CORESET Reference Channel	1, 2		CR.1.1 FDD	-	CR.1.1 FDD	-
Dedicated CORESET Reference Channel	1, 2		CCR.1.1 FDD	-	CCR.1.1 FDD	-
SSB configuration	1, 2		SSB.1 FR1		SSB.1 FR1	
OCNG Patterns	1, 2		OP.1		OP.1	

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
TRS configuration		1, 2		TRS.1.1 FDD	-	TRS.1.1 FDD	
Initial BWP Configuration		1, 2		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration		1, 2		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Satellite information		1		SSC.1	NSC.1	SSC.1	NSC.1
		2		SSC.2	NSC.2	SSC.2	NSC.2
Time offset with Cell 1		1, 2	ms	-	3	-	3
SMTC configuration		1, 2		SMTC.2		SMTC.2	
EPRE ratio of PSS to SSS		1, 2	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
N_{oc} Note2	NR_FDD_SAB_FR1_A	1,2	dBm/15 kHz	-94.65		(N_{oc} for Channel 2 +8 dB)	-115
N_{oc} Note2	NR_FDD_SAB_FR1_A	1,2	dBm/SSB SCS	-94.65		(N_{oc} for Channel 2 +8 dB)	-115
$\hat{E}_s/I_{ot}$		1,2	dB	10	10	13	-3
SS-RSRP Note3	NR_FDD_SAB_FR1_A	1,2	dBm/SCS	-84.65		(RSRP for Cell 2 +25 dB)	-118.00
Io Note3	NR_FDD_SAB_FR1_A	1,2	dBm/ 9.36 MHz	-56.28		(Io for Channel 2 +19.75 dB)	-85.28
$\hat{E}_s/N_{oc}$		1,2	dB	10	10	13	-3
Propagation condition		1,2	-	AWGN		AWGN	
Antenna configuration		1,2		1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.14.6.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirement in clause 10.1.4C.1.1 and relative requirement in clause 10.1.4C.1.2.

A.14.6.1.3 SA intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.14.6.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.3C.1.1 and 10.1.3C.1.2 for intra-frequency measurements.

A.14.6.1.3.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.14.6.1.3.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in table A.14.6.1.3.2-2 and A.14.6.1.3.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell. The TCI status for Cell 1 is defined in table [TBD] and TRS configuration for Cell 1 is defined in [TBD]. The test consists of two time phases T1 and T2.

Table A.14.6.1.3.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
2	NGSO, NR FDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

Table A.14.6.1.3.2-2: SS-RSRP Intra frequency general test parameters

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		1		1	
Duplex mode		FDD		FDD	
FDD configuration		TBD		TBD	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		24		24	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
TRS configuration		TBD	-	TBD	-
TCI state		TBD	-	TBD	-
PDSCH Reference measurement channel		TBD	-	TBD	-
RMSI CORESET Reference Channel		TBD	-	TBD	-
Dedicated CORESET Reference channel		TBD	-	TBD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.14.6.1.3.2-3: SS-RSRP Intra frequency OTA related test parameters

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
Satellite Configuration	1	SSC.1	SSC.1	NSC.1	NSC.1
	2	SSC.2	SSC.2	NSC.1	NSC.2
Angle of arrival configuration		TBD			
Assumption for UE beams Note 3		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note2	-103.2		N/A	
N_{oc} Note1	dBm/SCS Note2	-94.2		N/A	
$\hat{E}_s / N_{oc}$	dB	6.0	1.0	N/A	N/A
E_s	dBm/SCS Note2			(clause B.2.17 Rx Beam Peak +2.1 dB) NOTE 4	(clause B.2.17 Rx Beam Peak +2.1 dB) NOTE 4
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. The N_{oc} is calculated using -145 dBm/Hz (clause 11.1.3.4.2 in [42]) NOTE 2: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone NOTE 3: Information about types of UE beam is given in TBD, and does not limit UE implementation or test system implementation NOTE 4: The actual calculation depends on the actual band and VSAT Type and UE Refsens.					

A.14.6.1.3.3 Test Requirements

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.3.1.1 and relative accuracy requirements in clause 10.1.3.1.2. The following requirements are to be verified:

During T1:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.14.6.1.3.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3C.1.2-1.

During T2:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.14.6.1.3.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3C.1.2-1.

During T1 and T2:

Relative accuracy of Cell 1 during T2 compared with Cell 1 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3C.1.2-1.

Relative accuracy of Cell 2 during T2 compared with Cell 2 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1.3C.1.2-1.

Table A.14.6.1.3.3-1: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 1	$SSB_RP1 - \delta + G_{min} - NTN_{margin}/2 \le$ Reported RSRP(dBm) $\le SSB_RP1 + \delta + G_{max} + NTN_{margin}/2$
Cell 2	$SSB_RP2 - \delta + G_{min} - NTN_{margin}/2 \le$ Reported RSRP(dBm) $\le SSB_RP2 + \delta + G_{max} + NTN_{margin}/2$
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.3.1.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from table B.2.1.8.1-1, selected according to the UE power class	
NOTE 4: NTN_{margin} is the relaxation margin for FR2-NTN and equals 1 dB.	

A.14.6.2 SS-RSRQ

A.14.6.2.1 SA: Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell for satellite access

A.14.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.7C.

A.14.6.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.14.6.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is tested by using the parameters in table A.14.6.2.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.14.6.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Config	Description
1	GSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NGSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.6.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1,2		FDD					
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c} = 52$					
Gap Pattern ID			0					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
DRX Cycle		ms	Not Applicable					
Satellite information	Config 1		SSC.1	NSC.1	SSC.1	NSC.1	SSC.1	NSC.1
	Config 2		SSC.2	NSC.2	SSC.2	NSC.2	SSC.2	NSC.2
PDSCH Reference measurement channel	Config 1,2		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
RMSI CORESET Reference Channel	Config 1,2			CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
Control Channel RMC	Config 1,2			CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
TRS Configuration	Config 1,2			TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
OCNG Patterns				OP. 1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 1	Config 1,2		ms	-	3	-	3	-	3
SMTC configuration	Config 1,2			SMTC.2					
SSB configuration	Config 1,2			SSB.1 FR1					
CSI-RS for tracking	Config 1,2			TRS.1.1 FDD					
PDSCH/PDCCH subcarrier spacing	Config 1,2		kHz	15 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	NR_FDD_SAB_FR1_A	dBm/15 kHz	-85		-101		-114	
N_{oc} Note2	Config 1,2	NR_FDD_SAB_FR1_A	dBm/SCS	-85		-101		-114	
$\hat{E}_s/I_{ot}$			dB	-1.76		-4.7		-5..46	-5.46
$\hat{E}_s/N_{oc}$			dB	3	3	-2.9	-2.9	-4	-4
SS-RSRP Note3	Config 1,2	NR_FDD_SAB_FR1_A	dBm/SCS	-82	-82	-103.9	-103.9	-118	-118
SS-RSRQ Note3		NR_FDD_SAB_FR1_A	dB	-14.84	-14.84	-14.84	-16.76	-16.76	-17.34
Io Note3	Config 1,2	NR_FDD_SAB_FR1_A	dBm/ 9.36 MHz	-50		-70		-83.5	
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: void

A.14.6.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.7C.1.1.

A.14.6.2.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell for satellite access

A.14.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.7C.

A.14.6.2.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.14.6.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in table A.14.6.2.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.14.6.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Config	Description
1	GSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NGSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.6.2.2.2-2: SS-RSRQ Inter frequency test parameters

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN				freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode		Config 1,2		FDD					
$BW_{channel}$		Config 1,2	MHz	10: $N_{PRB,c}$ = 52					
Gap pattern ID		Config 1,2		0					
BWP BW		Config 1,2		10: $N_{PRB,c}$ = 52					
DRX Cycle			ms	Not Applicable					
Satellite information		Config 1		SSC.1	NSC.1	SSC.1	NSC.1	SSC.1	NSC.1
		Config 2		SSC.2	NSC.2	SSC.2	NSC.2	SSC.2	NSC.2
PDSCH Reference measurement channel		Config 1,2		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
RMSI CORESET Reference Channel		Config 1,2		CR.1.1 FDD	-	R.1.1 FDD	-	CR.1.1 FDD	
Dedicated CORESET Reference Channel		Config 1,2		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
TRS Configuration		Config 1,2		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
OCNG Patterns				OCNG pattern 1					
Time offset with Cell 1		Config 1,2	ms	-	3	-	3	-	3
SMTC configuration		Config 1,2		SMTC pattern 2					
SSB configuration		Config 1,2		SSB pattern 1 in FR1					
CSI-RS for tracking		Config 1,2		TRS.1.1 FDD					
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	NR_FDD_SAB_FR1_A	dBm/15 kHz	-80.18		-106		-116	
N_{oc} Note2	Config 1,2	NR_FDD_SAB_FR1_A	dBm/15 kHz	-80.18		-106		-116	
$\hat{E}_s / I_{ot}$			dB	-1.75		-1.75		3	-1.75
$\hat{E}_s / N_{oc}$			dB	-1.75		-1.75		3	-1.75
SS-RSRP Note3	Config 1,2	NR_FDD_SAB_FR1_A	dBm/SCS	-81.93	-81.93	-107.75	-107.75	-113	-117.75
SS-RSRQ Note3		NR_FDD_SAB_FR1_A	dB	-14.77	-14.77	-14.76	-14.76	-12.56	-14.76
Io Note3	Config 1,2	NR_FDD_SAB_FR1_A	dBm/9.36 MHz	-50		-75.83		-83.28	-85.83
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 5: NR operating band groups are as defined in clause 3.5.2.							

A.14.6.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.9C.1.1 and 10.1.9C.1.2.

A.14.6.3 SS-SINR

A.14.6.3.1 SA intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.14.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.12C.1.1.

A.14.6.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.14.6.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in table A.14.6.3.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.14.6.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.6.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1, 2		FDD			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
DRX Cycle configuration		ms	Not Applicable			
Satellite information	Config 1		SSC.1	NSC.1	SSC.1	NSC.1
	Config 2		SSC.2	NSC.2	SSC.2	NSC.2
TRS configuration	Config 1, 2		TRS.1.1 FDD		TRS.1.1 FDD	
PDSCH Reference measurement channel	Config 1, 2		SR.1.1 FDD	-	SR.1.1 FDD	-
RMSI CORESET Reference Channel	Config 1, 2		CR.1.1 FDD	-	CR.1.1 FDD	

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
Dedicated CORESET Reference Channel	Config 1, 2			CCR.1.1 FDD	-	CCR.1.1 FDD	-
OCNG Patterns				OP.1			
SS-RSSI-Measurement				Not Applicable			
SMTC configuration	Config 1, 2			SMTC.2			
Time offset with Cell 1	Config 1, 2		ms	-	3	-	3
SSB configuration	Config 1, 2			SSB.1 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1, 2		kHz	15			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		NR_FDD_SAB_FR1_A	dBm/15 kHz	-93		-116	
N_{oc} Note2	Config 1, 2		dBm/SCS	-93		Same as Noc for 15 kHz	
$\hat{E}_s / I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	4.54	2.66	-4	-4
SS-RSRP Note3	Config 1, 2	NR_FDD_SAB_FR1_A	dBm/SCS	-88.46	-90.34	-120	-120
SS-SINR Note3		NR_FDD_SAB_FR1_A	dB	0	-3.19	-5.46	-5.46
Io Note3	Config 1, 2	NR_FDD_SAB_FR1_A	dBm/ 9.36 MHz	-57.5		-85.51	
Propagation condition			-	AWGN			
Antenna configuration			-	1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.

A.14.6.3.1.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.12C.1.1.

A.14.6.3.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.14.6.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.14C.1.1 and 10.1.14C.1.2.

A.14.6.3.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.14.6.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in table A.14.6.3.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.14.6.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

Table A.14.6.3.2.2-2: SS-SINR Inter frequency test parameters

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN				freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1, 2			FDD					
Downlink initial BWP configuration				DLBWP.0.1					
Downlink dedicated BWP configuration				DLBWP.1.1					
Uplink initial BWP configuration				ULBWP.0.1					
Uplink dedicated BWP configuration				ULBWP.1.1					
DRX Cycle configuration			ms	Not Applicable					
Satellite information	Config 1			SSC.1	NSC.1	SSC.1	NSC.1	SSC.1	NSC.1
	Config 2			SSC.2	NSC.2	SSC.2	NSC.2	SSC.2	NSC.2
Gap pattern ID				0	-	0	-	0	-
TRS configuration	Config 1, 2			TRS.1.1 FDD		TRS.1.1 FDD		TRS.1.1 FDD	
PDSCH Reference measurement channel	Config 1, 2			SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
RMSI CORESET Reference Channel	Config 1, 2			CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
Dedicated CORESET Reference Channel	Config 1, 2			CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 1	Config 1, 2		ms	-	3	-	3	-	3
SMTC configuration	Config 1, 2			SMTC pattern 2					
SSB configuration	Config 1, 2			SSB.1 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1, 2		kHz	15					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1, 2	NR_FDD_SAB_FR1_A	dBm/15 kHz	-88		-108.5		-119.5	
N_{oc} Note2	Config 1, 2		dBm/SCS	-88		-108.5		Same as Noc for 15 kHz	
$\hat{E}_s / I_{ot}$			dB	-1.75	-1.75	20	20	-4.0	-4.0
$\hat{E}_s / N_{oc}$			dB	-1.75		20		-4.0	
SS-RSRP Note3	Config 1, 2	NR_FDD_SAB_FR1_A	dBm/SCS	-89.75		-88.5		-123.5	
SS-SINR Note3		NR_FDD_SAB_FR1_A	dB	-1.75		20		-4.0	
Io Note3	Config 1, 2	NR_FDD_SAB_FR1_A	dBm/	-57.83		-60.5		-90.09	

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
	9.36 MHz						
Propagation condition	-	AWGN					
Antenna configuration	-	1x2					
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 5: NR operating band groups are as defined in clause 3.5.2.							

A.14.6.3.2.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.14C.1.1 and 10.1.14C.1.2.

A.14.6.4 L1-RSRP measurement for beam reporting

A.14.6.4.1 SSB based L1-RSRP measurement

A.14.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.5C.4 and clause 10.1.19C.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.14.6.4.1.1-1.

Table A.14.6.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

A.14.6.4.1.2 Test parameters

In this set of test cases there one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.14.6.4.1.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.14.6.4.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.14.6.4.1.2-1: FR1 SSB based L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1, 2		freq1	freq1
Duplex mode	1, 2		FDD	FDD
TDD Configuration	1, 2		N/A	N/A
$BW_{channel}$	1, 2	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
Satellite information	1		SSC.1	NSC.1
	2		SSC.2	NSC.2
PDSCH Reference measurement channel	1, 2		SR.1.1 FDD	SR.1.1 FDD
RMSI CORESET Reference Channel	1, 2		CR.1.1 FDD	CR.1.1 FDD
Dedicated CORESET Reference Channel	1, 2		CCR.1.1 FDD	CCR.1.1 FDD
SSB configuration	1, 2		SSB.3 FR1	SSB.3 FR1

Parameter		Config	Unit	Test 1	Test 2
OCNG Patterns		1, 2		OP.1	OP.1
Initial BWP Configuration		1, 2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
TRS configuration		1, 2		TRS.1.1 FDD	TRS.1.1 FDD
Dedicated BWP configuration		1, 2		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration		1, 2		SMTC.1	SMTC.1
reportConfigType		1, 2		periodic	periodic
reportQuantity		1, 2		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS		1, 2		2	2
L1-RSRP reporting period		1, 2		slot80	slot80
EPRE ratio of PSS to SSS		1, 2	dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_SAB_FR1_A	1, 2	dBm/15 kHz	-94.65	-117
N_{oc} Note2	NR_FDD_SAB_FR1_A	1, 2	dBm/SSB SCS	-94.65	-117
$\hat{E}_s/I_{ot}$		1, 2	dB	10	-3
SSB RSRP Note3	NR_FDD_SAB_FR1_A	1, 2	dBm/SSB SCS	-84.65	-120
Io Note3	NR_FDD_SAB_FR1_A	1, 2	dBm/9.36 MHz	-56.28	-87.28
$\hat{E}_s/N_{oc}$		1, 2	dB	10	-3
Propagation condition		1, 2		AWGN	AWGN
Antenna configuration		1, 2		1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.14.6.4.1.3 Test Requirements

The L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 2 shall fulfil the requirements in clauses 10.1.19C.1.

A.14.6.4.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.14.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.5C.4 and clause 10.1.19C.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in table A.14.6.4.2.1-1.

Table A.14.6.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Configuration	Description
1	GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.	

A.14.6.4.2.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.14.6.4.2.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.14.6.4.2.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.14.6.4.2.2-1: FR1 CSI-RS based L1-RSRP test parameters

Parameter		Config	Unit	Test 1	Test 2
SSB ARFCN		1, 2		freq1	freq1
Duplex mode		1, 2		FDD	FDD
TDD Configuration		1, 2		N/A	N/A
$BW_{channel}$		1, 2	MHz	10: $N_{PRB,C}$ = 52	10: $N_{PRB,C}$ = 52
Satellite information		1		SSC.1	NSC.1
		2		SSC.2	NSC.2
PDSCH Reference measurement channel		1, 2		SR.1.1 FDD	SR.1.1 FDD
RMSI CORESET Reference Channel		1, 2		CR.1.1 FDD	CR.1.1 FDD
Dedicated CORESET Reference Channel		1, 2		CCR.1.1 FDD	CCR.1.1 FDD
SSB configuration		1, 2		SSB.3 FR1	SSB.3 FR1
OCNG Patterns		1, 2		OP.1	OP.1
TRS configuration		1, 2		TRS.1.1 FDD	TRS.1.1 FDD
Initial BWP Configuration		1, 2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration		1, 2		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration		1, 2		SMTC.1	SMTC.1
CSI-RS		1, 2		CSI-RS 1.2 FDD	CSI-RS 1.2 FDD
reportConfigType		1, 2		periodic	periodic
reportQuantity		1, 2		cri-RSRP	cri-RSRP
Number of reported RS		1, 2		2	2
L1-RSRP reporting period		1, 2		slot80	slot80
EPRE ratio of PSS to SSS		1, 2	dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_SAB_FR1_A	1, 2	dBm/15 kHz	-94.65	-117
N_{oc} Note2	NR_FDD_SAB_FR1_A	1, 2	dBm/CSI-RS SCS	-94.65	-117
$\hat{E}_s/I_{ot}$		1, 2	dB	10	-3
CSI-RS RSRP Note3	NR_FDD_SAB_FR1_A	1, 2	dBm/CSI-RS SCS	-84.65	-120

Parameter		Config	Unit	Test 1	Test 2
Io Note3	NR_FDD_SAB_FR1_A	1, 2	dBm/9.36 MHz	-56.28	-87.28
$\hat{E}_s/N_{oc}$		1, 2	dB	10	-3
Propagation condition		1, 2		AWGN	AWGN
Antenna configuration		1, 2		1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					

A.14.6.4.2.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 1 shall fulfil the requirements in clause 10.1.19C.2.

A.14.6.4.3 SSB based L1-RSRP measurement for VSAT UE in FR2-NTN when DRX is not used

A.14.6.4.3.1 Test Purpose and Environment

The purpose of this test is to verify that the VSAT UE makes correct reporting of L1-RSRP measurement in FR2-NTN. This test will partly verify the L1-RSRP measurement requirements in clause 9.5C.4.1, with the testing configurations for NR cells in table A.14.6.4.3.1-1.

The AoA setup for this test is [TBD] as defined in [clause TBD].

Table A.14.6.4.3.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test for VSAT UE

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, FDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, FDD duplex mode
NOTE: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.	

A.14.6.4.3.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.14.6.4.3.2-1 and table A.14.6.4.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.14.6.4.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~2		freq1
Duplex mode	1~2		FDD
FDD Configuration	1~2		TBD
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66
Data PRBs allocated	1~4		66

Parameter	Config	Unit	Value
PDSCH Reference measurement channel	1		TBD
	2		TBD
RMSI CORESET Reference Channel	1		TBD
	2		TBD
Dedicated CORESET Reference Channel	1		TBD
	2		TBD
SSB configuration	1		SSB.1 FR2
	2		SSB.2 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TBD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		Off
reportConfigType	1~2		periodic
reportQuantity	1~2		ssb-Index-RSRP
Number of reported RS	1~2		2
L1-RSRP reporting period	1~2	slot	320
T1	1~2	s	5
T2	1~2	s	2
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.14.6.4.3.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			TBD			
Beam Assumption Note 4	1-2		TBD			
N_{oc} Note2	1~2	dBm/15 kHz	-105			
N_{oc} Note2	1	dBm/SSB SCS	-96			
	2		-93			
$\hat{E}_s / I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB_RP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84
Io Note3	1	dBm/95.04 MHz	-63.97	-63.97	-66.98	-57.47
	2		-63.97	-63.97	-66.98	-57.47
$\hat{E}_s / N_{oc}$	1~2	dB	0	0	-Infinity	9

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in [TBD], and does not limit UE implementation or test system implementation

A.14.6.4.3.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than 640 ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in [clause TBD].

The reported L1-RSRP value shall include the Rx antenna gain in the range of table B.2.1.8.1-1.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.15 NR standalone tests with one or more NR cells in FR2-2

A.15.1 SA: RRC_IDLE state mobility

A.15.1.1 Cell re-selection to NR

A.15.1.1.1 Cell re-selection to FR2-2 intra-frequency NR case

A.15.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell re-selection requirements specified in clause 4.2.2.3.

A.15.1.1.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.15.1.1.1.2-1, A.15.1.1.1.2-2 and A.15.1.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.15.1.1.1.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.15.1.1.1.2-2: General test parameters for intra-frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	
T2 end condition	Active cell		1, 2, 3	Cell 2	
	Neighbour cell		1, 2, 3	Cell 1	
Final condition	Active cell		1, 2, 3	Cell 1	
	Neighbour cell		1, 2, 3	Cell 2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1, 2, 3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2, 3	SMTC.1	
DRX cycle length		s	1, 2, 3	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2

Parameter	Unit	Test configuration	Value	Comment
T2	s	1, 2, 3	386	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3	s	1, 2, 3	78	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.15.1.1.1.2-3: Cell specific test parameters for intra-frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 2, 3	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1	SR.3.1 TDD			SR.3.1 TDD		
		2	SR.3.1 TDD			SR.3.1 TDD		
		3	SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
		2	CR.3.1 TDD			CR.3.1 TDD		
		3	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
		2	CCR.3.1 TDD			CCR.3.1 TDD		
		3	CCR.3.1 TDD			CCR.3.1 TDD		
SSB configuration		1	SSB.3 FR2			SSB.7 FR2		
		2	SSB.13 FR2			SSB.17 FR2		
		3	SSB.14 FR2			SSB.18 FR2		
OCNG Pattern		1, 2, 3	OP.4			OP.4		
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
		2	400: $N_{PRB,c}$ = 66			400: $N_{PRB,c}$ = 66		
		3	400: $N_{PRB,c}$ = 33			400: $N_{PRB,c}$ = 33		
Data PRBs allocated		1, 2, 3	66			66		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-138			-138		
		2	-132			-132		
		3	-129			-129		
Pcompensation	dB	1, 2, 3	0			0		
$Qhyst_s$	dB	1, 2, 3	0			0		
$Qoffset_{s,n}$	dB	1, 2, 3	0			0		
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
AoA setup		1, 2, 3	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
$\hat{E}_s / I_{ot}$	dB	1, 2, 3	8	-3	1.5	-infinity	1.5	-3
Beam assumption[Note 4]		1, 2, 3	Rough					
N_{oc} [Note2]	dBm/SCS	1	-93					
		2	-93					
		3	-90					
N_{oc} [Note2]	dBm/15 kHz	1	-102					
		2						
		3						
$\hat{E}_s / N_{oc}$	dB	1, 2, 3	8	-3	1.5	-infinity	1.5	-3
SS-RSRP [Note3]	dBm/SCS	1	-85	-96	-91.5	-infinity	-91.5	-96

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
		2	-85	-96	-91.5	-infinity	-91.5	-96
		3	-82	-93	-88.5	-infinity	-88.5	-93
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-55.37	-63.25	-60.19	-64.01	-60.19	-63.25
	dBm/380.16 MHz	2	-55.37	-63.25	-60.19	-64.01	-60.19	-63.25
	dBm/380.16 MHz	3	-55.38	-63.26	-60.20	-64.02	-60.20	-63.26
Tre-selection	s	1, 2, 3	0	0	0	0	0	0
SintrasearchP	dB	1, 2, 3	50			50		
Propagation Condition		1, 2, 3	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.15.1.1.1.3 Test Requirements

The cell re-selection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration updateon Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 386 s.

The cell re-selection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration updateon Cell 1.

The cell re-selection delay to an already detected cell shall be less than 78 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI\text{-}NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR_intra} + T_{SI\text{-}NR}$,

Where:

T_{detect, NR_Intra} See table 4.2.2.3-1 in clause 4.2.2.3

$T_{evaluate, NR_intra}$ See table 4.2.2.3-1 in clause 4.2.2.3

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 385.28 s, allow 386 s for the cell re-selection delay to a newly detectable cell and 78.08 s for the cell re-selection delay to an already detected cell in the test case, which we allow 78 s.

A.15.1.2 Cell re-selection to FR2-2 inter-frequency NR case

A.15.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the inter-frequency NR cell re-selection requirements specified in clause 4.2.2.4.

A.15.1.2.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.15.1.2.2-1, A.15.1.2.2-2 and A.15.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.15.1.2.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.15.1.2.2-2: General test parameters for FR2-2 inter-frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 2	The UE camps on Cell 2 in the initial phase and during T1 period the UE reselects to Cell 1
	Neighbour cell		1, 2, 3	Cell 1	
T1 end condition	Active cell		1, 2, 3	Cell 1	The UE shall perform re-selection to Cell 1 during T1
	Neighbour cells		1, 2, 3	Cell 2	
T3 end condition	Active cell		1, 2, 3	Cell 2	The UE shall perform re-selection to Cell 2 with higher priority during T3
	Neighbour cell		1, 2, 3	Cell 1	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1, 2, 3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.3 FR2	
			2	SSB.13 FR2	
			3	SSB.14 FR2	
SMTC configuration			1, 2, 3	SMTC.1	
DRX cycle length		s	1, 2, 3	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	78	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3		s	1, 2, 3	138	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.15.1.2.2-3: Cell specific test parameters for FR2-2 inter-frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 2, 3	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1, 2, 3	SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET parameters		1, 2, 3	CR.3.1 TDD			CR.3.1 TDD		
RMSI CORESET RMC configuration		1, 2, 3	CCR.3.1 TDD			CCR.3.1 TDD		
OCNG Pattern		1, 2, 3	OP.1			OP.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-140			-140		
		2	-134			-134		
		3	-131			-131		
Pcompensation	dB	1, 2, 3	0			0		
$Qhyst_s$	dB	1, 2, 3	0			0		
$Qoffset_{s,n}$	dB	1, 2, 3	0			0		
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
AoA setup		1, 2, 3	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
Beam assumption[Note 4]		1, 2, 3	Rough			Rough		
$\hat{E}_s/I_{ot}$	dB	1	10.5	10.5	8	-10.5	-infinity	8.5
		2						
		3						
N_{oc} [Note2]	dBm/SCS	1	-93			-93		
		2	-93			-93		
		3	-90			-90		
N_{oc} [Note2]	dBm/15 kHz	1, 2, 3	-102			-102		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3	10.5	10.5	8	-10.5	-infinity	8.5
SS-RSRP [Note3]	dBm/SCS	1	-83.5	-83.5	-85	-103.5	-infinity	-84.5
		2	-83.5	-83.5	-85	-103.5	-infinity	-84.5
		3	-80.5	-80.5	-82.5	-100.5	-infinity	-81.5
Io	dBm/95.04 MHz	1	-51.97	-51.97	-55.46	-63.64	-64.01	-55.46
	dBm/380.16 MHz	2, 3	-51.99	-51.99	-55.48	-63.66	-64.03	-55.48
Tre-selection	s	1, 2, 3	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2, 3	50			50		
$Thresh_{x,highP}$	dB	1, 2, 3	48			48		
$Thresh_{serving,lowP}$	dB	1, 2, 3	44			44		
$Thresh_{x,lowP}$	dB	1, 2, 3	50			50		
Propagation Condition		1, 2, 3	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.15.1.2.3 Test Requirements

The cell re-selection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration updateon Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 138 s.

The cell re-selection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to a lower priority cell shall be less than 78 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search} + T_{evaluate,\ NR_\ inter} + T_{SI\text{-}NR}$, and to a lower priority cell can be expressed as: $T_{evaluate,\ NR_\ inter} + T_{SI\text{-}NR}$,

Where:

$T_{higher_priority_search}$ See clause 4.2.2.7

$T_{evaluate,\ NR_\ inter}$ See table 4.2.2.4-1 in clause 4.2.2.4

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 138.08 s, allow 138 s for the cell re-selection delay to a higher priority cell and 78.08 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 78 s.

A.15.1.3 Cell re-selection to FR2-2 intra-frequency NR case for UE fulfilling low mobility relaxed measurement criterion

A.15.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell re-selection requirements for UE configured with relaxed measurement criterion specified in clause 4.2.2.9.2.

A.15.1.3.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.15.1.3.2-1, A.15.1.3.2-2 and A.15.1.3.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. During T1 and T2, only criteria *lowMobilityEvalutation* is configured and fulfilled, where $(Srxlev_{Ref} - Srxlev) < S_{SearchDeltaP}$. UE has not registered with network for the tracking area containing Cell 2.

Table A.15.1.3.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.15.1.3.2-2: General test parameters for FR2-2 intra-frequency NR cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	The UE camps on Cell 1 in the initial phase
	Neighbour cells		1, 2, 3	Cell 2	

T1 end condition	Active cell		1, 2, 3	Cell 2	The UE reselects to Cell 2 during T1 period
	Neighbour cells		1, 2, 3	Cell 1	
Final condition	Active cell		1, 2, 3	Cell 1	The UE reselects to Cell 1 during T2 period
	Neighbour cells		1, 2, 3	Cell 2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1, 2, 3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2, 3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	240	
T2		s	1, 2, 3	240	

Table A.15.1.3.2-3: Cell specific test parameters for FR2-2 intra-frequency NR cell re-selection test case in AWGN for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2, 3	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		SR.3.1 TDD	
		2	SR.3.1 TDD		SR.3.1 TDD	
		3	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	
		2	CR.3.1 TDD		CR.3.1 TDD	
		3	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		CCR.3.1 TDD	
		2	CCR.3.1 TDD		CCR.3.1 TDD	
		3	CCR.3.1 TDD		CCR.3.1 TDD	
SSB configuration		1	SSB.3 FR2		SSB.7 FR2	
		2	SSB.13 FR2		SSB.17 FR2	
		3	SSB.14 FR2		SSB.18 FR2	
OCNG Pattern		1, 2, 3	OP.4		OP.4	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-134		-134	
		3	-131		-131	
$S_{SearchDeltaP}$	dB	1, 2, 3	6		6	
$T_{SearchDeltaP}$	s	1, 2, 3	5		5	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
AoA setup		1, 2, 3	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption[Note 4]		1, 2, 3	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1, 2, 3	-3	1.5	1.5	-3
N_{oc} [Note2]	dBm/SCS	1	-93			
		2	-93			
		3	-90			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note2	dBm/15 kHz	1, 2, 3	-102			
$\hat{E}_s / N_{oc}$	dB	1, 2, 3	-3	1.5	1.5	-3
SS-RSRP Note3	dBm/SCS	1	-96	-91.5	-91.5	-96
		2	-96	-91.5	-91.5	-96
		3	-93	-88.5	-88.5	-93
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-62.45	-60.19	-60.19	-62.45
	dBm/380.16 MHz	2	-62.45	-60.19	-60.19	-62.45
	dBm/380.16 MHz	3	-62.46	-60.20	-60.20	-62.46
Tre-selection	s	1, 2, 3	0	0	0	0
SintrasearchP	dB	1, 2, 3	50		50	
Propagation Condition		1, 2, 3	AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.15.1.3.3 Test Requirements

The cell re-selection delay to an already detected cell for UE fulfilling low mobility relaxed criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected cell shall be less than 232 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to an already detectable cell can be expressed as: $T_{evaluate, NR_Intra} + T_{SI\text{-}NR}$,

Where:

$T_{evaluate, NR_Intra}$ See table 4.2.2.9.2-1 in clause 4.2.2.9,

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 231.68 s, allow 232 s for the cell re-selection delay to an already detected cell for UE fulfilling low mobility criterion in the test case.

A.15.1.4 Cell re-selection to FR2-2 intra-frequency NR case for UE fulfilling not-at-cell edge relaxed measurement criterion

A.15.1.4.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell re-selection requirements for UE configured with relaxed measurement criterion specified in clause 4.2.2.9.3.

A.15.1.4.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.15.1.4.2-1, A.15.1.4.2-2 and A.15.1.4.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. During T1 and T2, only criteria *cellEdgeEvaluation* is configured and fulfilled, where Srxlev> $S_{SearchThresholdP}$. UE has not registered with network for the tracking area containing Cell 2.

Table A.15.1.4.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.15.1.4.2-2: General test parameters for FR2-2 intra-frequency NR cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	The UE camps on Cell 1 in the initial phase
	Neighbour cells		1, 2, 3	Cell 2	
T1 end condition	Active cell		1, 2, 3	Cell 2	The UE reselects to Cell 2 during T1 period
	Neighbour cells		1, 2, 3	Cell 1	
Final condition	Active cell		1, 2, 3	Cell 1	
	Neighbour cells		1, 2, 3	Cell 2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1, 2, 3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2, 3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	240	
T2		s	1, 2, 3	240	

Table A.15.1.4.2-3: Cell specific test parameters for FR2-2 intra-frequency NR cell re-selection test case in AWGN for UE fulfilling not-at-cell edge criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2, 3	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		SR.3.1 TDD	
		2	SR.3.1 TDD		SR.3.1 TDD	
		3	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	
		2	CR.3.1 TDD		CR.3.1 TDD	
		3	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		CCR.3.1 TDD	
		2	CCR.3.1 TDD		CCR.3.1 TDD	
		3	CCR.3.1 TDD		CCR.3.1 TDD	
SSB configuration		1	SSB.3 FR2		SSB.7 FR2	
		2	SSB.13 FR2		SSB.17 FR2	
		3	SSB.14 FR2		SSB.18 FR2	
OCNG Pattern		1, 2, 3	OP.4		OP.4	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-134		-134	
		3	-131		-131	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
AoA setup		1, 2, 3	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption[Note 4]		1, 2, 3	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1, 2, 3	-3	1.5	1.5	-3
N_{oc} [Note2]	dBm/SCS	1	-93			
		2	-93			
		3	-90			
N_{oc} [Note2]	dBm/15 kHz	1, 2, 3	-102			
$\hat{E}_s/N_{oc}$	dB	1, 2, 3	-3	1.5	1.5	-3
SS-RSRP [Note3]	dBm/SCS	1	-96	-91.5	-91.5	-96
		2	-96	-91.5	-91.5	-96
		3	-93	-88.5	-88.5	-93
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-62.25	-60.19	-60.19	-62.25
	dBm/380.16 MHz	2	-62.25	-60.19	-60.19	-62.25
	dBm/380.16 MHz	3	-62.27	-60.21	-60.21	-62.27
Tre-selection	s	1, 2, 3	0	0	0	0
$S_{SearchThresholdP}$		1, 2, 3	35	35	35	35
SintrasearchP	dB	1, 2, 3	50		50	
Propagation Condition		1, 2, 3	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.15.1.4.3 Test Requirements

The cell re-selection delay to an already detected cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 232 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to an already detected cell can be expressed as: $T_{evaluate,\ NR_Intra} + T_{SI\text{-}NR}$,

Where:

$T_{evaluate, NR_Intra}$ See table 4.2.2.9.3-1 in clause 4.2.2.9,

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 231.68 s, allow 232 s for the cell re-selection delay to an already detected cell for UE fulfilling not-at-cell edge criterion in the test case.

A.15.1.5 Cell re-selection to FR2-2 inter-frequency NR case for UE fulfilling low mobility relaxed measurement criterion

A.15.1.5.1 Test Purpose and Environment

This test is to verify the requirement for the inter-frequency NR cell re-selection requirements for UE fulfilling low mobility criterion specified in clause 4.2.2.10.2.

A.15.1.5.2 Test Parameters

The test scenario comprises of 2 cells (Cell 1 and Cell 2) on 2 different NR carriers respectively as given in tables A.15.1.5.2-1, A.15.1.5.2-2 and A.15.1.5.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. Cell 2 is of higher priority than Cell 1. The UE is configured with l*owMobilityEvalutation* criterion [2].

Table A.15.1.5.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.15.1.5.2-2: General test parameters for FR2-2 inter-frequency NR cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 2	The UE camps on Cell 2 and fulfils low mobility (*lowMobilityEvalutation* [2]) criterion.
	Neighbour cell		1, 2, 3	Cell 1	
T1 final condition	Active cell		1, 2, 3	Cell 1	The UE reselects to low priority Cell 1 during T1
	Neighbour cell		1, 2, 3	Cell 2	
T2 final condition	Active cell		1, 2, 3	Cell 2	The UE reselects to high priority Cell 2 during T2
	Neighbour cell			Cell 1	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1, 2, 3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.3 FR2	
			2	SSB.13 FR2	
			3	SSB.14 FR2	
SMTC configuration			1, 2, 3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.64	The value shall be used for all cells in the test.

Parameter	Unit	Test configuration	Value	Comment
PRACH configuration index		1, 2, 3	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell		1, 2, 3	Not configured	
T1	s	1, 2, 3	240	T1 needs to be long enough to allow cell re-selection to already known Cell 1
T2	s	1, 2, 3	240	T2 needs to be long enough to allow cell re-selection to already known Cell 2

Table A.15.1.5.2-3: Cell specific test parameters for FR2-2 inter-frequency NR cell re-selection test case in AWGN for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2, 3	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1, 2, 3	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET parameters		1, 2, 3	CR.3.1 TDD		CR.3.1 TDD	
RMSI CORESET RMC configuration		1, 2, 3	CCR.3.1 TDD		CCR.3.1 TDD	
OCNG Pattern		1, 2, 3	OP.1		OP.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-137		-137	
		3				
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
Cell_selection_and_re-selection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
AoA setup		1, 2, 3	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption[Note 4]		1, 2, 3	Rough		Rough	
$\hat{E}_s / I_{ot}$	dB	1, 2, 3	10.5	8	-10.5	-8.5
N_{oc} [Note2]	dBm/SCS	1	-93		-93	
		2	-93		-93	
		3	-90		-90	
N_{oc} [Note2]	dBm/15 kHz	1, 2, 3	-102		-102	
$\hat{E}_s / N_{oc}$	dB	1, 2, 3	10.5	8	-10.5	8.5
SS-RSRP [Note3]	dBm/SCS	1	-82.5	-85	-103.5	-84.5
		2	-82.5	-85	-103.5	-84.5
		3	-79.5	-82	-100.5	-81.5
Io	dBm/95.04 MHz	1	-53.14	-55.37	-55.37	-53.14
	dBm/380.16 MHz	2	-53.14	-55.37	-55.37	-53.14
	dBm/380.16 MHz	3	-53.17	-55.39	-55.39	-53.16
Tre-selectionNR	s	1, 2, 3	0		0	
SnonintrasearchP	dB	1, 2, 3	50		Not sent	
$S_{SearchDeltaP}$	dB	1, 2, 3	6		6	
$T_{SearchDeltaP}$	s	1, 2, 3	5		5	
$Thresh_{x,highP}$	dB	1, 2, 3	48		48	
$Thresh_{serving,lowP}$	dB	1, 2, 3	44		44	
$Thresh_{x,lowP}$	dB	1, 2, 3	50		50	
Propagation Condition		1, 2, 3	AWGN		AWGN	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.15.1.5.3 Test Requirements

The cell re-selection delay to an already detected low priority cell (Cell 1) for UE fulfilling low mobility criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected low priority cell, Cell 1, shall be less than 232 s.

The cell re-selection delay to an already detected high priority cell (Cell 2) for UE fulfilling low mobility criterion is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected high priority cell, Cell 2, shall be less than 232 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE 1: The cell re-selection delay to an already detected low priority cell can be expressed as: $T_{evaluate,\ NR_\ inter}$ + $T_{SI\text{-}NR}$

NOTE 2: The cell re-selection delay to an already detected higher priority cell can be expressed as: $T_{evaluate,\ NR_\ inter}$ + $T_{SI\text{-}NR}$

Where:

$T_{evaluate,\ NR_\ inter}$ See table 4.2.2.10.2-1 in clause 4.2.2.10.2

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 231.68 s, allow 232 s for the cell re-selection delay to an already detected low priority cell for UE fulfilling low mobility criterion in the test case.

This gives a total of 231.68 s, allow 232 s for the cell re-selection delay to an already detected high priority cell for UE fulfilling low mobility criterion in the test case.

A.15.1.6 Cell re-selection to FR2-2 inter-frequency NR case for UE fulfilling not-at-cell edge relaxed measurement criterion

A.15.1.6.1 Test Purpose and Environment

This test is to verify the requirement for the inter-frequency NR cell re-selection requirements for UE fulfilling not-at-cell edge criterion specified in clause 4.2.2.10.3.

A.15.1.6.2 Test Parameters

The test scenario comprises of 2 cells (Cell 1 and Cell 2) on 2 different NR carriers respectively as given in tables A.15.1.6.2-1, A.15.1.6.2-2 and A.15.1.6.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell

2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. Cell 2 is of higher priority than Cell 1. The UE is configured with *cellEdgeEvaluation* criterion [2].

Table A.15.1.6.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.15.1.6.2-2: General test parameters for FR2-2 inter-frequency NR cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 2	The UE camps on Cell 2 and fulfils not-at-cell edge (*cellEdgeEvaluation* [2]) criterion.
	Neighbour cell		1, 2, 3	Cell 1	
T1 final condition	Active cell		1, 2, 3	Cell 1	The UE reselects to low priority Cell 1 during T1
	Neighbour cell		1, 2, 3	Cell 2	
T2 final condition	Active cell		1, 2, 3	Cell 2	The UE reselects to high priority Cell 2 during T2
	Neighbour cell		1, 2, 3	Cell 1	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1, 2, 3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.3 FR2	
			2	SSB.13 FR2	
			3	SSB.14 FR2	
SMTC configuration			1, 2, 3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	240	T1 needs to be long enough to allow cell re-selection to already known cell.
T2		s	1, 2, 3	240	T2 needs to be long enough to allow cell re-selection to already known cell.

Table A.15.1.6.2-3: Cell specific test parameters for FR2-2 inter-frequency NR cell re-selection test case in AWGN for UE fulfilling not-at-cell edge criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2, 3	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1, 2, 3	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET parameters		1, 2, 3	CR.3.1 TDD		CR.3.1 TDD	
RMSI CORESET RMC configuration		1, 2, 3	CCR.3.1 TDD		CCR.3.1 TDD	
OCNG Pattern		1, 2, 3	OP.1		OP.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-134		-134	
		3	-131		-131	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
AoA setup		1, 2, 3	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption Note 4		1, 2, 3	Rough		Rough	
$\hat{E}_s / I_{ot}$	dB	1, 2, 3	10.5	8	-10.5	8.5
N_{oc} Note2	dBm/SCS	1	-93		-93	
		2	-93		-93	
		3	-90		-90	
N_{oc} Note2	dBm/15 kHz	1, 2, 3	-102		-102	
$\hat{E}_s / N_{oc}$	dB	1, 2, 3	10.5	8	-10.5	8.5
SS-RSRP Note3	dBm/SCS	1	-82.5	-85	-103.5	-84.5
		2	-82.5	-85	-103.5	-84.5
		3	-79.5	-82	-100.5	-81.5
Io	dBm/95.04 MHz	1	-53.14	-55.37	-55.37	-53.14
	dBm/380.16 MHz	2	-53.14	-55.37	-55.37	-53.14
	dBm/380.16 MHz	3	-53.16	-55.38	-55.38	-53.16
$S_{SearchThresholdP}$		1, 2, 3	35	35	29	29
Tre-selectionNR	s	1, 2, 3	0		0	
SnonintrasearchP	dB	1, 2, 3	50		Not sent	
$Thresh_{x, highP}$	dB	1, 2, 3	48		48	
$Thresh_{serving, lowP}$	dB	1, 2, 3	44		44	
$Thresh_{x, lowP}$	dB	1, 2, 3	50		50	
Propagation Condition		1, 2, 3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.15.1.6.3 Test Requirements

The cell re-selection delay to an already detected low priority cell (Cell 1) for UE fulfilling not-at-cell edge criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected low priority cell, Cell 1, shall be less than 232 s.

The cell re-selection delay to an already detected high priority cell (Cell 2) for UE fulfilling not-at-cell edge criterion is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected high priority cell, Cell 2, shall be less than 232 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE 1: The cell re-selection delay to an already detected low priority cell can be expressed as: $T_{evaluate, NR_ inter} + T_{SI-NR}$

NOTE 2: The cell re-selection delay to an already detected higher priority cell can be expressed as: $T_{evaluate, NR_ inter} + T_{SI-NR}$

Where:

$T_{evaluate, NR_ inter}$ See table 4.2.2.10.3-1 in clause 4.2.2.10.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 231.68 s, allow 232 s for the cell re-selection delay to an already detected low priority cell for UE fulfilling not-at-cell edge criterion in the test case.

This gives a total of 231.68 s, allow 232 s for the cell re-selection delay to an already detected high priority cell for UE fulfilling not-at-cell edge criterion in the test case.

A.15.2 Signaling characteristics

A.15.2.1 SCell Activation and Deactivation Delay

A.15.2.1.1 SCell Activation and deactivation for SCell in FR2-2 intra-band in non-DRX

A.15.2.1.1.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.6.5.3.1.1 except the PCell and SCell are in FR2-2 intra-band.

The supported test configurations are shown in table A.15.2.1.1.1-1 below. The general test parameters are the same as defined in table A.6.5.3.1.1-2 except those described in tables A.14.X.3.1.1-2, and cell specific test parameters are described in tables A.15.2.1.1.1-3. OTA related test parameters are shown in table A.15.2.1.1.1-4 below.

Table A.15.2.1.1.1-1: Supported test configurations for FR2-2 SCell activation case

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	NR 960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.15.2.1.1.1-2: General test parameters for FR2-2 SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channels are used for this test, Cell 1 and Cell 2 use RF channel 1 and 2, respectively.

Table A.15.2.1.1.1-3: Cell specific test parameters for FR2-2 SCell activation case

Parameter[Note 5]		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2		
Duplex mode	Config 1, 2, 3		TDD					
TDD configuration	Config 1, 2, 3		TDDConf.3.1					
Downlink initial BWP Configuration	Config 1, 2, 3		DLBWP.0.1					
Downlink dedicated BWP Configuration	Config 1, 2, 3		DLBWP.1.1					

Parameter[Note 5]		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Uplink initial BWP configuration	Config 1, 2, 3		ULBWP.0.1					
Uplink dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1					
TRS configuration	Config 1, 2, 3		TRS.2.1 TDD					
TCI state	Config 1, 2, 3		TCI.State.0					
$BW_{channel}$	Config 1, 2, 3	MHz	100: $N_{PRB,c}$ = 66					
Data PRBs allocated	Config 1, 2, 3		66	66		66		
PDSCH Reference measurement channel	Config 1, 2, 3		SR.3.1 TDD			-		
RMSI CORESET Parameters	Config 1, 2, 3		CR.3.1 TDD			-		
Dedicated CORESET Parameters	Config 1, 2, 3		CCR.3.1 TDD			-		
OCNG Patterns	Config 1, 2, 3		OP.1					
SSB Configuration	Config 1, 2, 3		SSB.1 FR2-2					
SMTC Configuration	Config 1, 2, 3		SMTC.1					
CSI-RS configuration for CSI reporting	Config 1, 2, 3		CSI-RS.3.1 TDD					
reportConfigType	Config 1, 2, 3		periodic			N/A		
reportQuantity	Config 1, 2, 3		cri-RI-PMI-CQI			N/A		
CSI reporting periodicity	Config 1, 2, 3	slot	40			N/A		
CSI reporting offset	Config 1, 2, 3	slot	4			N/A		
EPRE ratio of PSS to SSS	Config 1, 2, 3	dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS[Note 1]								
EPRE ratio of OCNG to OCNG DMRS [Note 1]								
Propagation conditions	Config 1, 2, 3		AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void

Table A.15.2.1.1.1-4: OTA related test parameters for FR2-2 SCell activation case

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration	Config 1, 2 ,3		Setup 1 according to table A.3.15.1			Setup 1 according to table A.3.15.1		
Assumption for UE beams [Note 4]	Config 1, 2 ,3		Rough			Rough		
N_{oc} [Note1]		dBm/15 kHz[Note3]	-104.7			-104.7		
N_{oc} [Note1]	Config 1	dBm/SCS	-95.7			-95.7		
	Config 2		-95.7			-95.7		
	Config 3		-92.7			-92.7		
$\hat{E}_s / N_{oc}$		dB	7			7		

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
SSB_RP Note2	Config 1	dBm/SCS Note4	-88.7			-88.7		
	Config 2		-88.7			-88.7		
	Config 3		-85.7			-85.7		
$\hat{E}_s / I_{ot}$		dB	7			7		
Io Note2	Config 1	dBm/95.04 MHz Note3	-58.92			-58.92		
	Config 2	dBm/380.16 MHz	-58.92			-58.92		
	Config 3	dBm/380.16 MHz	-58.93			-58.93		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 4: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

A.15.2.1.1.2 Test Requirements

The test requirements defined in clause A.6.5.3.1.2 shall apply to this test case, except $T_{activation_time}$ will be replaced with the value $T_{FirstSSB}$ + 5 ms as defined in clause 8.3.

A.15.2.1.2 SCell Activation and deactivation for FR1+FR2-2 inter-band with target SCell in FR2-2

A.15.2.1.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.15.2.1.1.1 except the PCell is in FR1 and SCell is in FR2-2.

The supported test configurations are defined in table A.15.2.1.2.1-1. The general test parameters are the same as defined in table A.15.2.1.1.1-2 except that the length of T2 is 2 s. And cell specific test parameters are described in table A.15.2.1.2.1-2. OTA related test parameters are defined in table A.15.2.1.2.1-3.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment 100 ms after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2.

During T2, the test equipment monitors the L1-RSRP measurement reporting for the SCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot $m+T_{L1\text{-}RSRP}$. In the next DL slot after slot $m+T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PCell during activation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell 1 deactivation command is sent until CSI reporting for SCell 1 is discontinued.

Table A.15.2.1.2.1-1: Supported test configurations for FR2-2 SCell activation case

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	PCell: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target SCell: 480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
5	PCell: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target SCell: 960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to pass in one of the supported test configurations	

Table A.15.2.1.2.1-2: Cell specific test parameters for FR2-2 SCell activation case

Parameter[Note 5]		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			Freq1			Freq2		
Duplex mode	Config 1		FDD			TDD		
	Config 2,3,4,5		TDD					
TDD configuration	Config 1		Not Applicable		TDDConf.3.1			
	Config 2		TDDConf.1.1					
	Config 3,4,5		TDDConf.2.1					
Downlink initial BWP Configuration	Config 1,2,3,4,5		DLBWP.0.1					
Downlink dedicated BWP Configuration	Config 1,2,3,4,5		DLBWP.1.1					
Uplink initial BWP configuration	Config 1,2,3,4,5		ULBWP.0.1					
Uplink dedicated BWP configuration	Config 1,2,3,4,5		ULBWP.1.1					
TRS configuration	Config 1,2,3,4,5		N/A			TRS.2.1 TDD		
TCI state	Config 1,2,3,4,5		TCI.State.0					
$BW_{channel}$	Config 1,2	MHz	10: $N_{PRB,c}$ = 52			100: $N_{PRB,c}$ = 66		
	Config 1,2		40: $N_{PRB,c}$ = 106					
	Config 3		40: $N_{PRB,c}$ = 106			400: $N_{PRB,c}$ = 66		
	Config 4		40: $N_{PRB,c}$ = 106			400: $N_{PRB,c}$ = 33		
Data PRBs allocated	Config 1,2		52	66	52	66	52	66
	Config 3,4		106		106		106	
	Config 5		106	33	106	33	106	33
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			-		
	Config 2		SR.1.1 TDD					
	Config 3,4,5		SR.2.1 TDD					
RMSI CORESET Parameters	Config 1		CR.1.1 FDD			-		
	Config 2		CR.1.1 TDD					
	Config 3,4,5		CR.2.1 TDD					
Dedicated CORESET Parameters	Config 1		CCR.1.1 FDD			-		
	Config 2		CCR.1.1 TDD					
	Config 3,4,5		CCR.2.1 TDD					
OCNG Patterns			OP.1					
SSB configuration	Config 1,2		SSB.1 FR1			SSB.3 FR2		
	Config 3		SSB.2 FR1			SSB.3 FR2		
	Config 4					SSB.13 FR2		
	Config 5					SSB.14 FR2		
CSI-RS configuration for CSI reporting	Config 1,2,3,4,5		N/A			N/A	CSI-RS.3.1 TDD [Note 6]	CSI-RS.3.1 TDD
reportConfigType for CSI reporting			periodic			N/A		
reportConfigType for L1-RSRP			periodic			N/A		

Parameter[Note 5]		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
reportQuantity for CSI reporting			cri-RI-PMI-CQI			N/A		
reportQuantity for L1-RSRP			ssb-Index-RSRP			N/A		
CSI reporting periodicity	Config 1,2	slot	5			N/A		
	Config 3,4,5		10					
L1-RSRP reporting periodicity [Note 7]	Config 1,2	slot	5			N/A		
	Config 3,4,5		10					
CSI reporting offset	Config 1,2	slot	2			N/A		
	Config 3,4,5		4					
L1-RSRP reporting offset	Config 1,2	slot	2			N/A		
	Config 3,4,5		4					
SMTC configuration			SMTC.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH_DMRS to SSS								
EPRE ratio of PBCH to PBCH_DMRS								
EPRE ratio of PDCCH_DMRS to SSS								
EPRE ratio of PDCCH to PDCCH_DMRS								
EPRE ratio of PDSCH_DMRS to SSS								
EPRE ratio of PDSCH to PDSCH_DMRS								
EPRE ratio of OCNG DMRS to SSS[Note 1]								
EPRE ratio of OCNG to OCNG DMRS [Note 1]								
Propagation conditions			N/A Link only, see clause A.3.7A			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: All parameters apply for configuration 1, 2 and 3
NOTE 6: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
NOTE 7: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.15.2.1.2.1-3: OTA related test parameters for FR1 PCell activation case with FR2-2 SCell

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			N/A			According to clause A.3.15.1		
Assumption for UE beams [Note 7]			N/A			Rough		
N_{oc} [Note 1]	Config 1,2,3	dBm/15 kHz	Link only, see clause A.3.7A			-104.7		
N_{oc} [Note 1]	Config 1,2,3	dBm/SCS				-95.7		
	Config 4					-95.7		
	Config 5					-92.7		
$\hat{E}_s / N_{oc}$	Config 1,2,3,4,5	dB				-∞	7	7
[illegible]	Config 1,2,3,4,5	dB				-∞	7	7
SSB_RP[Note 2, Note 4]	Config 1,2,3	dBm/SCS				-∞	-88.7	-88.7
	Config 4					-∞	-88.7	-88.7
	Config 5					-∞	-85.7	-85.7
Io[Note 2, Note 4]	Config 1,2,3	dBm/95.04 MHz				-66.71	-58.92	-58.92
		dBm/380.16 MHz				-66.71	-58.92	-58.92
		dBm/380.16 MHz				-66.72	-58.93	-58.93

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2:	Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3:	Void
NOTE 4:	Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5:	Void
NOTE 6:	Void
NOTE 7:	Information about types of UE beam is given in B.2.1.3 and does not imit UE implementation or test system implementation.

A.15.2.1.2.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PCell in the slot.

During T2 the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than

3 ms + $T_{FirstSSB_MAX}$ + 23*T_{SMTC_MAX} + 12*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$

as defined in clause 8.3.2. For this test case, $T_{FirstSSB_MAX}$=T_{SMTC_MAX}=T_{rs}=20 ms; $T_{L1\text{-}RSRP,\ measure}$=240 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ [980] ms.

During T2 the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in table A.5.5.3.1.1-2
- $T_{activation_time}$ = 3 ms + $T_{FirstSSB_MAX}$ + 23*T_{SMTC_MAX} + 12*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows [1100] ms
- $T_{CSI_Reporting}$ = 10 ms
- NR slot length is 0.125 ms for this test case.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot n + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{HARQ}+3\ ms+T_X}{\text{NR slot length}}$, as defined in clause 8.3, where T_X =20 ms.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot n + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{HARQ}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption of PCell due to activation of SCell shall not be more than the values specified for SA in clause 8.2.2.2.7.

A.15.2.1.3 SCell Activation and deactivation for SCell in FR2-2 inter-band in non-DRX

A.15.2.1.3.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.15.2.1.1.1 except the PCell and SCell are in FR2-2 inter-band.

The supported test configurations are shown in table A.15.2.1.3.1-1 below. The general test parameters are described in tables A.15.2.1.3.1-2, and cell specific test parameters are described in tables A.15.2.1.3.1-3. OTA related test parameters are shown in table A.15.2.1.3.1-4 below.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell. A MAC message for activation of SCell is sent by the test equipment 100 ms after the RRC message, in a slot # denoted m.

The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2. Immediately at beginning of T2 the transmission power of Cell 2 is increased to same level as for Cell 2. During T2, the test equipment monitors the L1-RSRP measurement reporting for the SCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot $m+T_{L1\text{-}RSRP}$. In the next DL slot after slot $m+T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during activation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell 1 deactivation command is sent until CSI reporting for SCell 1 is discontinued.

Table A.15.2.1.3.1-1: Supported test configurations for FR2-2 SCell activation in FR2-2 inter-band

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	NR 960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.15.2.1.3.1-2: General test parameters for FR2-2 SCell activation in FR2-2 inter-band

Parameter		Unit	Value	Comment
RF Channel Number			1,2	Two NR radio channels are used for this test. RF channel number 1 is in band 1 and RF channel number 2 is in band 2, where bands 1 and 2 are inter-band CA operating bands in FR2-2 as specified in table 5.2A.2-1 in TS38.101-2.
Active PCell	Config 1,2,3		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell	Config 1,2,3		Cell 2	Configured deactivated secondary cell on NR RF channel number 2.
CP length	Config 1,2,3		Normal	
DRX	Config 1,2,3		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index	Config 1,2,3		0	CQI reporting for SCell every second subframe
Cell-individual offset for cells on NR channel number	Config 1,2,3	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	Config 1,2,3	ms	160	
Cell 2 timing offset to Cell 1	Config 1,2,3	µs	≤8	A random value from 0µs to 8µs
T1	Config 1,2,3	s	7	During this time the PCell shall be known and the SCell configured and detected.
T2	Config 1,2,3	s	2	During this time the UE shall activate the SCell.
T3	Config 1,2,3	s	1	During this time the UE shall deactivate the SCell.

T_{HARQ}	Config 1,2,3	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI_Reporting}$	Config 1,2,3	ms	2	the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.15.2.1.3.1-3: Cell specific test parameters for FR2-2 SCell activation in FR2-2 inter-band

Parameter Note 5		Unit	T1		T2		T3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1,2,3		TDD		TDD		TDD	
TDD configuration	Config 1,2,3		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1		DLBWP.0.1		DLBWP.0.1	
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1		DLBWP.1.1		DLBWP.1.1	
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1		ULBWP.0.1		ULBWP.0.1	
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1		ULBWP.1.1		ULBWP.1.1	
TRS configuration	Config 1,2,3		TRS.2.1 TDD		TRS.2.1 TDD		TRS.2.1 TDD	
TCI state	Config 1,2,3		TCI.State.0		TCI.State.0		TCI.State.0	
$BW_{channel}$	Config 1,2,3	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
PDSCH Reference measurement channel	Config 1,2,3		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Parameters	Config 1,2,3		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Parameters	Config 1,2,3		CCR.3.1 TDD	-	CCR.3.1 TDD	-	CCR.3.1 TDD	-
CSI-RS configuration	Config 1,2,3		NA	NA	NA	CSI-RS.3.1 TDD Note 2	NA	CSI-RS.3.1 TDD
CSI reporting periodicity Note 3	Config 1,2,3		NA	5	NA	5	NA	5
OCNG Patterns	Config 1,2,3		OP.1					
SSB Configuration	Config 1,2,3		[SSB.x FR2-2]					
SMTC Configuration	Config 1,2,3		SMTC.1					
EPRE ratio of PSS to SSS	Config 1,2,3	dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS Note 1								
EPRE ratio of OCNG to OCNG DMRS Note 1								
Propagation conditions	Config 1,2,3		AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
NOTE 3: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.15.2.1.3.1-4: OTA related test parameters for FR2-2 SCell activation in FR2-2 inter-band

Parameter[Note 6]		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
AoA setup	Config 1,2,3		Setup 3 as specified in clause A.3.15					
			AoA1			AoA2		
Assumption for UE beams [Note 7]	Config 1,2,3		Rough			Rough		
N_{oc} [Note1]	Config 1,2,3	dBm/15 kHz[Note4]	-92.1			-92.1		
N_{oc} [Note1]	Config 1	dBm/SCS[Note3]	-83.1			-83.1		
	Config 2		-83.1			-83.1		
	Config 3		-80.1			-80.1		
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB	0			0		
SS-RSRP[Note2]	Config 1	dBm/SCS [Note4]	-83.1			-83.1		
	Config 2		-83.1			-83.1		
	Config 3		-80.1			-80.1		
$\hat{E}_s / I_{ot}$	Config 1,2,3	dB	0			0		
Io[Note2]	Config 1	dBm/95.04 MHz [Note4]	-51.10			-51.10		
	Config 2	dBm/380.16 MHz	-51.10			-51.10		
	Config 3	dBm/380.16 MHz	-51.12			-51.12		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: All parameters apply for configuration 1
NOTE 7: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

A.15.2.1.3.2 Test Requirements

During T2 the UE shall start sending CSI report for the SCell in the configured slots for CSI reporting after at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k). UE shall send the first CSI report for SCell after receiving at least one CSI-RS transmission occasion for channel measurement and reporting after slot (m+k), or in the next available uplink resource for CSI reporting if the slot was subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PCell in the slot.

During T2, the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than 3 ms + $T_{FirstSSB_MAX}$ + 23*T_{SMTC_MAX} +12*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ as defined in clause 8.3.2. For this test case, $T_{FirstSSB_MAX}$=T_{SMTC_MAX}=T_{rs}=20 ms; $T_{L1\text{-}RSRP,\ measure}$=480 ms and $T_{L1\text{-}RSRP,\ report}$=5 ms, which allows $T_{L1\text{-}RSRP}$ =1480 ms.

During T2, the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{T_{HARQ}+T_{activtion_time}+T_{CSI_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in table A.14.X.3.3.1-2
- $T_{activation_time}$ = 3 ms + $T_{FirstSSB_MAX}$ + 23*T_{SMTC_MAX} + 12*T_{rs} + $T_{L1\text{-}RSRP,\ measure}$ + $T_{L1\text{-}RSRP,\ report}$ + max {(T_{HARQ} + $T_{uncertainty_MAC}$ + 5 ms + $T_{FineTiming}$), ($T_{uncertainty_RRC}$ + T_{RRC_delay})}, which allows 1510 ms
- $T_{CSI_Reporting}$ = 10 ms
- NR slot length is 0.125 ms for this test case.

During T2, the interruption of PCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{\text{HARQ}}}{\text{NR slot length}}$ to $m + 1 + \frac{T_{\text{HARQ}}+3\ ms+T_{\text{X}}}{\text{NR slot length}}$, where T_X =20 ms.

During T3, the UE shall stop sending CSI reports for SCell no later than slot n + $\frac{T_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During T3, the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot n + 1 + $\frac{T_{\text{HARQ}}}{NR\ slot\ length}$ to n + 1 + $\frac{T_{\text{HARQ}}+3\ ms}{NR\ slot\ length}$ as defined in clause 8.3.

A.15.2.1.4 Direct SCell activation at SCell addition of known SCell in FR2-2

A.15.2.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the delay and interruption for direct SCell activation delay at SCell addition are within the requirements stated in clause 8.3.4.

The supported test configurations are shown in table A.15.2.1.4.1-1 below. The general test parameters are given in table A.15.2.1.4.1-2 and cell-specific test parameters in table A.15.2.1.4.1-3. OTA related test parameters are shown in table A.15.2.1.4.1-4.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two FR2-2 carriers and two NR cells. Before the test starts the UE is connected to Cell 1 (PCell) on carrier #1, but is not aware of Cell 2 on NR carrier #2. Cell 1 and Cell 2 have constant signal levels throughout the test. The UE is monitoring the PCell. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the Cell 2 is monitored by the UE. During T1, Cell 2 should be detected and measured by the UE such that it meets the condition for known cell defined in clause 8.3.4 for direct SCell activation.

Time period T2 starts when the *RRCReconfiguration* message for the configuration and activation of Cell 2 (the SCell), which is sent from the test equipment, is received at the UE antenna connector in a slot # denoted m. The test equipment shall set the parameter *sCellState* to *activated* for the SCell, which causes Cell 2 to become configured and activated.

Time period T3 starts at ($m + N_{direct}$), at which point UE shall be reporting a valid CQI for both PCell and SCell.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during the activation of SCell. The test equipment verifies the activation time by counting the slots from the time when the SCell activation message is sent until a CQI report with other than CQI index 0 is received.

Table A.15.2.1.4.1-1: Supported test configurations

Configuration	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	NR 960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.15.2.1.4.1-2: General test parameters

Parameter		Unit	Value	Comment
RF Channel Number			1,2	Two NR radio channels (1,2) in FR2-2 are used for this test
Active PCell	Config 1, 2 ,3		Cell 1	Primary cell on NR RF channel number 1.
Configured and activated SCell	Config 1, 2 ,3		Cell 2	Configured and activated SCell on NR RF channel number 2.
CP length	Config 1, 2 ,3		Normal	
DRX	Config 1, 2 ,3		OFF	Continuous monitoring of primary cell
SCell measurement cycle (measCycleSCell)	Config 1, 2 ,3	ms	160	

Parameter		Unit	Value	Comment
T1	Config 1, 2 ,3	s	7	During this time the measurement for Cell 2 is configured, and Cell 2 is detected.
T2	Config 1, 2 ,3	s	N_{direct}	During this time the UE shall configure and activate Cell 2 as SCell.
T3	Config 1, 2 ,3	ms	100	During this time the UE shall report valid CQI for both PCell and SCell.
T_{HARQ}	Config 1, 2 ,3	ms	k_1×NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
k	Config 1, 2 ,3	slot	$k_1 + 3 \cdot N_{slot}^{subframe,\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A.15.2.1.4.1-3: Cell specific test parameters

Parameter		Unit	Cell 1		Cell 2			
			T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2		
Duplex mode	Config 1, 2, 3		TDD					
TDD configuration	Config 1, 2, 3		TDDConf.3.1					
$BW_{channel}$	Config 1, 2, 3	MHz	100: $N_{PRB,c}$ = 66					
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1					
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1					
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1					
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1					
Timing offset to Cell 1		ms	Not Applicable			0		
PDSCH Reference measurement channel	Config 1, 2, 3		SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET Reference Channel	Config 1, 2, 3		CR.3.1 TDD			CR.3.1 TDD		
RMC CORESET Reference Channel	Config 1, 2, 3		CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration	Config 1, 2, 3		TRS.2.1 TDD			TRS.2.1 TDD		
CSI-RS configuration	Config 1, 2, 3		CSI-RS.3.1 TDD			CSI-RS.3.1 TDD		
CSI reporting periodicity	Config 1, 2, 3	ms	5			5		
OCNG Patterns			OP.1					
SMTC configuration			SMTC.1					
SSB configuration	Config 1, 2, 3		[SSB.x FR2-2]			[SSB.x FR2-2]		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH DMRS								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
Propagation condition		-	AWGN					
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								

Table A.15.2.1.4.1-4: OTA related test parameters

Parameter[Note 6]		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration	Config 1, 2, 3		Setup 1 according to A.3.15.1					
Assumption for UE beams[Note 7]	Config 1, 2, 3		Rough			Rough		
N_{oc} [Note1]	Config 1, 2, 3	dBm/15 kHz[Note4]	-112			-112		

Parameter[Note 6]		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
N_{oc} [Note1]	Config 1	dBm/SCS[Note3]	-102.97			-102.97		
	Config 2		-102.97			-102.97		
	Config 3		-99.97			-99.97		
$\hat{E}_s / N_{oc}$	Config 1, 2, 3	dB	14			14		
SS-RSRP[Note2]	Config 1	dBm/SCS [Note4]	-88.97			-88.97		
	Config 2		-88.97			-88.97		
	Config 3		-85.97			-85.97		
$\hat{E}_s / I_{ot}$	Config 1, 2, 3	dB	14			14		
Io[Note2]	Config 1	dBm/95.04 MHz [Note4]	-59.81			-59.81		
	Config 2	dBm/380.16 MHz	-59.81			-59.81		
	Config 3	dBm/380.16 MHz	-59.83			-59.83		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: All parameters apply for configuration 1
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.15.2.1.4.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PCell in the slot.

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot m + $\frac{N_{direct}}{NR\ slot\ length}$, where

$$N_{direct} = T_{RRC_Process} + T_1 + T_{activation_time} + T_{CSI_Reporting} - 3\ ms,$$

- $T_{RRC_Process}$ = 16 ms, which is the RRC procedure delay defined for SCell addition in clause 12 of TS 38.331 [2],

- T_1 is the delay from slot m + $T_{RRC_Process}$ until the transmission of *RRCReconfigurationComplete* message,

- $T_{activation_time} = T_{FirstSSB}$ + 5 ms = 25 ms,

- $T_{CSI_Reporting}$ = 10 ms

This gives a total of N_{direct} = 16 + T_1 + 25 + 10 - 3 = (48 + T_1) ms, and NR slot length is 0.125 ms.

During T3 the UE shall send CSI reports for SCell with non-zero CQI index and continue to send CSI reports for SCell with non-zero CQI index until the end of T3.

During T2 interruption of PSCell during SCell activation shall not happen outside the window from slot *m*+1 to slot $m+1+\frac{T_{RRC_Process}+T_1+T_X}{NR\ slot\ length}$ as defined in clause 8.3.4, where T_X =20 ms.

The interruption of PCell due to activation of SCell shall not be more than the values specified for NR SA in clause 8.2.2.2.11.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot m + $\frac{N_{direct}}{NR\ slot\ length}$ as defined in clause 8.3.4 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.15.2.1.5 Direct SCell activation at handover with known SCell in FR2-2

A.15.2.1.5.1 Test Purpose and Environment

This test is to verify the requirements specified in sub clause 8.3.5 for the FR2-2 handover with direct SCell activation.

The test scenario comprises of three FR2-2 cells, one source PCell (Cell 1), one target PCell (Cell 2) and one SCell (Cell 3). The test consists of three successive time periods, with time durations of T1, T2, and T3 respectively.

At the start of time duration T1, the UE is in connected mode with PCell (Cell 1). Both Cell 2 and Cell 3 are known to UE and UE is reporting CQI for all Cell 1.

Time period T2 starts when UE receives a handover command that initiate handover of UE to Cell 2 and also activates Cell 3. This is done using an *RRCConnectionReconfiguration* message with parameter *sCellState* set to *activated* for the Cell 3. The message is sent from the test equipment to the UE and is received in a slot number n at the UE antenna connector. The UE shall accomplish the handover, addition and activation of the SCell no later than slot (n + $\frac{N_{direct}}{NR\ slot\ length}$).

Time period T3 starts at (n + $\frac{N_{direct}}{NR\ slot\ length}$), at which point UE shall be reporting a valid CSI for both Cell 2 and Cell 3 as given in tables A.15.2.1.5.1-1 and A.15.2.1.5.1-2.

Table A.15.2.1.5.1-1: Supported test configurations for FR2-2 handover with direct SCell activation case

Configuration	Description
1	SCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	SCell: NR 480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode Source cell: NR 480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode Target cell: NR 480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	SCell: NR 960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode Source cell: NR 960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode Target cell: NR 960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.15.2.1.5.1-2: General test parameters for FR2-2 handover with direct SCell activation case

Parameter			Unit	Value	Comment
RF Channel Number		Config 1,2,3		1, 2, 3	Three NR radio channels are used for this test, Cell 1, Cell 2 and Cell 3 use RF channel 1, 2 and 3 respectively.
A4-Offset		Config 1,2,3	dBm	-120	
Time offset between cells		Config 1,2,3		3 μs	Synchronous cells
Initial conditions	Source cell	Config 1,2,3		Cell 1	Source Cell
	Target cell			Cell 2	Neighbour cell
	SCell			Cell 3	SCell is not added and activated
Final condition	Source cell	Config 1,2,3		Cell 2	Cell 2 is Source cell after handover
	Neighbour cell			Cell 1	Neighbour cell
	SCell			Cell 3	SCell is added and activated

Table A.15.2.1.5.1-3: Cell specific test parameters for FR2-2 SCell activation case

Parameter[Note 5]		Unit	T1			T2			T3		
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3
SSB ARFCN	Config 1,2,3		freq1	freq2	freq 3	freq1	freq2	freq 3	freq1	freq2	freq3
Duplex mode	Config 1,2,3		TDD			TDD			TDD		
TDD configuration	Config 1,2,3		TDDConf.3.1			TDDConf.3.1			TDDConf.3.1		
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1			DLBWP.0.1			DLBWP.0.1		
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1			DLBWP.1.1			DLBWP.1.1		
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1			ULBWP.0.1			ULBWP.0.1		
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1			ULBWP.1.1			ULBWP.1.1		
TRS configuration	Config 1,2,3		TRS.2.1 TDD			TRS.2.1 TDD			TRS.2.1 TDD		
TCI state	Config 1,2,3		TCI.State.0			TCI.State.0			TCI.State.0		
$BW_{channel}$	Config 1,2,3	MHz	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
PDSCH Reference measurement channel	Config 1,2,3		SR.3.1 TDD	-		SR.3.1 TDD	-		SR.3.1 TDD		
RMSI CORESET Parameters	Config 1,2,3		CR.3.1 TDD	-		CR.3.1 TDD	-		CR.3.1 TDD		
Dedicated CORESET Parameters	Config 1,2,3		CCR.3.1 TDD	-		CCR.3.1 TDD	-		CCR.3.1 TDD		
OCNG Patterns	Config 1,2,3		OP.1								
SSB Configuration	Config 1,2,3		[SSB.xFR2-2]								
SMTC Configuration	Config 1,2,3		SMTC.1								
PRACH configuration	Config 1,2,3		FR2-2 PRACH configuration 1								
EPRE ratio of PSS to SSS		dB	0								
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of PDCCH DMRS to SSS											
EPRE ratio of PDCCH to PDCCH DMRS											
EPRE ratio of PDSCH DMRS to SSS											
EPRE ratio of PDSCH to PDSCH DMRS											
EPRE ratio of PBCH to PBCH DMRS											
EPRE ratio of OCNG DMRS to SSS[Note 1]											
EPRE ratio of OCNG to OCNG DMRS[Note 1]											
Propagation conditions			AWGN								

Parameter[Note 5]	Unit	T1			T2			T3		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Void

Table A.15.2.1.5.1-4: OTA related test parameters for FR2-2 SCell activation case

Parameter[Note 6]		Unit	Cell 1			Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3	T1	T2	T3
Angle of arrival configuration	Config 1,2,3		Setup 1 according to table A.3.15.1			Setup 1 according to table A.3.15.1			Setup 1 according to table A.3.15.1		
Assumption for UE beams [Note 7]	Config 1,2,3		Rough			Rough			Rough		
N_{oc} [Note1]	Config 1,2,3	dBm/15 kHz[Note4]	-112			-112			-112		
N_{oc} [Note1]	Config 1	dBm/SCS[Note3]	-102.97			-102.97			-102.97		
	Config 2		*-102.97*			*-102.97*			*-102.97*		
	Config 3		-99.97			-99.97			-99.97		
$\hat{E}_s / N_{oc}$	Config 1,2,3	dB	14			14			14		
SS-RSRP[Note2]	Config 1	dBm/SCS [Note4]	-88.97			-88.97			-88.97		
	Config 2		-88.97			-88.97			-88.97		
	Config 3		-85.97			-85.97			-85.97		
$\hat{E}_s / I_{ot}$	Config 1,2,3	dB	14			14			14		
Io[Note2]	Config 1	dBm/95.04 MHz [Note4]	-59.81			-59.81			-59.81		
	Config 2		-59.81			-59.81			-59.81		
	Config 3		-59.84			-59.84			-59.84		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Void
NOTE 7: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

A.15.2.1.5.2 Test Requirements

The UE shall be capable to transmit valid CSI report for PCell (Cell 2) and to the directly activated SCell 1 no later than in slot n+ N_{direct}.

The SCell activation delay, N_{direct}, can be expressed as: $N_{direct} = T_{RRC_process} + T_{interrupt} + T_2 + T_3 + T_{activation_time} + T_{CSI_Reporting}$ - 3 ms; Where:

- $T_{RRC_Process}$: RRC procedure delay defined in clause 12 of TS 38.331 and it is equal to 16 ms,
- $T_{interrupt}$: Interruption time during handover as specified in clause 6.1.1. The value to be verified in the test is 52 ms ($T_{interrupt}$ = 0 ms for T_{search} + 10 ms for T_{IU} + 20 ms for $T_{processing}$ + 20 ms for T_{Δ} + 2 ms for T_{margin} ms) by assuming known SCell and SMTC.1 configuration.

- T_2: Delay from slot $n + \frac{T_{RRC_Process} + T_{Interrupt}}{\text{NR slot length}}$ until UE has obtained a valid TA command for the target PCell,

- T_3: Delay for applying the received TA for uplink transmission in the target PCell, and greater than or equal to k+1 slot, where k is defined in clause 4.2 in TS 38.213,

- $T_{activation_time}$ and $T_{CSI_Reporting}$ are specified in clause 8.3.2, where the following definitions of $T_{FirstSSB}$ and $T_{FirstSSB_MAX}$ as defined in clause 8.3.5 shall apply:

During time period T2 of the test, the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot n + $\frac{T_{HARQ} + T_{activtion_time} + T_{CSI_Reporting}}{NR\ slot\ length}$, $T_{activation_time} = T_{SMTC_SCell}$ + 5 ms, as defined in clause 8.3.

During time period T3 of the test, the UE shall stop sending CSI reports for SCell at latest in a slot m + $\frac{T_{HARQ} + 3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

During time period T2 of the test, interruption of PCell / PSCell during SCell activation shall not happen outside the slot $n + 1 + \frac{T_{HARQ}}{\text{NR slot length}}$ to $n + 1 + \frac{T_{HARQ} + 3\ ms + T_X}{\text{NR slot length}} + N_{interruption}$, as defined in clause 8.3.

During time period T3 of the test, the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot m + 1 + $\frac{T_{HARQ}}{NR\ slot\ length}$ to m + 1 + $\frac{T_{HARQ} + 3\ ms}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90 %.

NOTE: During time period T2 of the test, if there are no uplink resources for reporting the valid CSI in a slot $\frac{T_{HARQ} + T_{activtion_time} + T_{CSI_Reporting}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.15.3 RRC_CONNECTED state mobility

A.15.3.1 Handover

A.15.3.1.1 Intra-frequency handover from FR2-2 carrier with CCA to FR2-2 carrier with CCA; unknown target cell

A.15.3.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-2-NR FR2-2 intra-frequency handover on carrier with CCA requirements specified in clause 6.1.1.4.

A.15.3.1.1.2 Test Parameters

Supported test configurations are shown in table A.15.3.1.1.2-1. Both handover delay and interruption length are tested by using the parameters in tables A.15.3.1.1.2-2, and A.15.3.1.1.2-3.

The test scenario comprises of 1 carrier and two cells on the carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.15.3.1.1.2-1: Intra-frequency handover from FR2-2 carrier with CCA to FR2-2 carrier with CCA test configurations

Configuration	Description
1	NR TDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz

2	NR TDD, SSB SCS 480 kHz, data SCS 480 kHz, BW 400 MHz
3	NR TDD, SSB SCS 960 kHz, data SCS 960 kHz, BW 400 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.15.3.1.1.2-2: General test parameters for Intra-frequency handover from FR2-2 carrier with CCA to FR2-2 carrier with CCA

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	On the carrier under CCA
	Neighbouring cell		Cell 2	On the carrier under CCA
Final condition	Active cell		Cell 2	On the carrier under CCA
A4-Offset		dBm	-120	
DL CCA model			A.3.26.2.1	
UL CCA model			A.3.26.2.2	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.15.3.1.1.2-3: Cell specific test parameters for Intra-frequency handover from FR2-2 carrier with CCA to FR2-2 carrier with CCA

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]		1,2,3	Rough		Rough	
AoA setup		1,2,3	Setup 1 as defined in A.3.15			
NR RF Channel Number		1,2,3	1		1	
P_{CCA_DL}		1,2,3	0.93		0.93	
P_{CCA_UL}		1,2,3	1		1	
Duplex mode		1,2,3	TDD			
TDD configuration		1	TBD			
		2	TBD			
		3	TBD			
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66			
		2	400: $N_{PRB,c}$ = 66			
		3	400: $N_{PRB,c}$ = 33			
Data PRBs allocated		1	66			
		2	66			
		3	33			
DRX Cycle	ms	1,2,3	Not Applicable			
PDSCH Reference measurement channel		1	SR3.1 TDD			
		2	TBD			
		3	TBD			
RMSI CORESET Reference Channel		1	CR3.1 TDD			
		2	TBD			
		3	TBD			
Control Channel RMC		1	CCR.3.1 TDD			
		2	TBD			
		3	TBD			
OCNG Patterns		1,2,3	O P. 1			
SMTC Configuration		1,2,3	SMTC pattern 1			
SSB Configuration		1	SSB. 3 FR2			
		2	SSB.13 FR2			
		3	SSB.14 FR2			
PDSCH/PDCCH subcarrier spacing	kHz	1	120			
		2	480			
		3	960			
PUCCH/PUSCH subcarrier spacing	kHz	1	120			
		2	480			

Parameter		Unit	Config	Cell 1		Cell 2	
				T1	T2	T1	T2
			3	960			
PRACH configuration			1,2,3	FR2 PRACH configuration 1			
TRS configuration			1	TRS.2.1 TDD			
			2	TBD			
			3	TBD			
PDSCH/PDCCH TCI state			1,2,3	TCI.State.2			
BWP configuraiton	Initial DL BWP		1,2,3	DLBWP.0.1			
	Dedicated DL BWP		1,2,3	DLBWP.1.1			
	Initial UL BWP		1,2,3	ULBWP.0.1			
	Dedicated UL BWP		1,2,3	ULBWP.1.1			
EPRE ratio of PSS to SSS		dB		0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz		-104.7			
N_{oc} Note2		dBm/SCS	1	-95.7			
			2	-89.7			
			3	-86.7			
$\hat{E}_s / I_{ot}$		dB		6	-1.8	-Infinity	0
$\hat{E}_s / N_{oc}$		dB		6	6	-Infinity	7
Io Note3		dBm/95.04 MHz Note4		-59.7	-56.7	-59.7	-56.7
		dBm/380.16 MHz Note4		-53.7	-50.7	-53.7	-50.7
Propagation condition		-		AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.15.3.1.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than RRC procedure delay + $T_{interrupt}$ from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ is defined in clause 6.1B.1.3.2.

A.15.3.1.2 Inter-frequency handover from FR1 to FR2-2 carrier with CCA; unknown target cell

A.15.3.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR2-2 inter frequency handover on carrier with CCA requirements specified in clause 6.1.1.4.

A.15.3.1.2.2 Test Parameters

Supported test configurations are shown in table A.15.3.1.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.15.3.1.2.2-2, and A.15.3.1.2.2-3.

The test scenario comprises of 2 carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.15.3.1.2.2-1: Inter-frequency handover from FR1 to FR2-2 carrier with CCA test configurations

Configuration	Description for target cell	Description for serving cell
1	NR TDD, SSB SCS 120 kHz, data SCS 120 kHz, BW 100 MHz	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR TDD, SSB SCS 480 kHz, data SCS 480 kHz, BW 400 MHz	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR TDD, SSB SCS 960 kHz, data SCS 960 kHz, BW 400 MHz	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations		

Table A.15.3.1.2.2-2: General test parameters Inter-frequency handover from FR1 to FR2-2 carrier with CCA

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	On carrier with CCA
Final condition	Active cell		Cell 2	On carrier with CCA
A4-Offset		dBm	-120	
DL CCA model			A.3.26.2.1	
UL CCA model			A.3.26.2.2	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.15.3.1.2.2-3: Cell specific test parameters for NR FR1-FR2-2 carrier with CCA Inter frequency handover test case

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]		1,2,3	-		Rough	

Parameter		Unit	Config	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			1,2,3	-		Setup 1 as defined in A.3.15	
NR RF Channel Number			1,2,3	1		2	
P_{CCA_DL}			1,2,3	-		0.93	
P_{CCA_UL}			1,2,3	-		1	
Duplex mode			1	FDD		TDD	
			2,3	TDD		TDD	
TDD configuration			1	-		TBD	
			2	TDDConf.1.1		TBD	
			3	TDDConf.2.1		TBD	
$BW_{channel}$		MHz	1	10: $N_{PRB,c}$ = 52		100: $N_{PRB,c}$ = 66	
			2	10: $N_{PRB,c}$ = 52		400: $N_{PRB,c}$ = 66	
			3	40: $N_{PRB,c}$ = 106		400: $N_{PRB,c}$ = 33	
Data PRBs allocated			1	52		66	
			2	52		66	
			3	106		33	
DRX Cycle		ms	1,2,3	Not Applicable		Not Applicable	
PDSCH Reference measurement channel			1	SR.1.1 FDD		SR3.1 TDD	
			2	SR.1.1 TDD		TBD	
			3	SR2.1 TDD		TBD	
RMSI CORESET Reference Channel			1	CR.1.1 FDD		CR3.1 TDD	
			2	CR.1.1 TDD		TBD	
			3	CR2.1 TDD		TBD	
Control Channel RMC			1	CCR.1.1 FDD		CCR.3.1 TDD	
			2	CCR.1.1 TDD		TBD	
			3	CCR.2.1 TDD		TBD	
OCNG Patterns			1,2,3	O P. 1		O P. 1	
SMTC Configuration			1	SMTC.1		SMTC pattern 1	
			2,3	SMTC.2		SMTC pattern 1	
SSB Configuration			1	SSB.1 FR1		SSB. 3 FR2	
			2	SSB.1 FR1		SSB.13 FR2	
			3	SSB.2 FR1		SSB.14 FR2	
PDSCH/PDCCH subcarrier spacing		kHz	1	15		120	
			2	30		480	
			3	30		960	
PUCCH/PUSCH subcarrier spacing		kHz	1	15		120	
			2	30		480	
			3	30		960	
PRACH configuration			1,2,3	FR1 PRACH configuration 1		FR2 PRACH configuration 1	
TRS configuration			1	TRS.1.1 FDD		TRS.2.1 TDD	
			2	TRS.1.1 TDD		TBD	
			3	TRS.1.2 TDD		TBD	
PDSCH/PDCCH TCI state			1,2,3	-		TCI.State.2	
BWP configuraiton	Initial DL BWP		1,2,3	DLBWP.0.1		DLBWP.0.1	
	Dedicated DL BWP		1,2,3	LBWP.1.1		DLBWP.1.1	
	Initial UL BWP		1,2,3	ULBWP.0.1		ULBWP.0.1	
	Dedicated UL BWP		1,2,3	ULBWP.1.1		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB		0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		Link only, see clause A.3.7A		-104.7	
N_{oc} Note2	dBm/SCS	1			-95.7	
		2			-89.7	
		3			-86.7	
$\hat{E}_s / I_{ot}$	dB				-Infinity	7
$\hat{E}_s / N_{oc}$	dB				-Infinity	7
Io Note3	dBm/95.04 MHz Note4				-58.9	-58.9
	dBm/380.16 MHz Note4				-52.9	-52.9
Propagation condition	-				AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.15.3.1.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than RRC procedure delay + $T_{interrupt}$ from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ is defined in clause 6.1B.1.4.2.

A.15.4 Measurement procedure

A.15.4.1 Intra-frequency Measurements

A.15.4.1.1 SA event triggered reporting test without gap under non-DRX for FR2-2 with CCA

A.15.4.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2A.5.1 and 9.2A.5.2. Supported test configurations are shown in table A.15.4.1.1.1-1.

Table A.15.4.1.1.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2-2 neighbour cell (Cell 2) on the same frequency as the PCell with CCA transmitting SSBs according to DL CCA model. The test parameters for the Cell 1 and Cell 2 are given in table A.15.4.1.1.1-2, A.15.4.1.1.1-3 and A.15.4.1.1.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.15.4.1.1.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1,2,3	PCell (Cell 1)	
Neighbour cell		1,2,3	Cell 2	Cell to be identified.
RF Channel Number		1,2,3	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration		1,2,3	SMTC.1	
A3-Offset	dB	1,2,3	-11	
CP length		1,2,3	Normal	
Hysteresis	dB	1,2,3	0	
Time To Trigger	s	1,2,3	0	
Filter coefficient		1,2,3	0	L3 filtering is not used
DRX		1,2,3	OFF	
Time offset between Cell 1 and Cell 2		1,2,3	3 μs	Synchronous cells
T1	s	1,2,3	5	
T2	s	1,2,3	5	

Table A.15.4.1.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1,2,3	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
		2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
		3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
DL CCA model		1,2,3	As specified in clause TBD		As specified in clause TBD	
DL CCA probability		1,2,3	TBD		TBD	
Data PRBs allocated		1	66		66	
		2	66		66	
		3	33		33	
Intial BWP configuration		1,2,3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1,2,3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1,2,3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1,2,3	SSB		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2,3	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2,3	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2,3	CCR.3.7 TDD		N/A	
TRS configuration		1,2,3	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1,2,3	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1,2,3	120		120	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
OCNG Patterns		1,2,3	OP.5		N/A	
cellIndividualOffset	dB	1,2,3	N/A		16	
SSB		1	SSB.1 FR2		SSB.7 FR2	
		2	SSB.9 FR2		SSB.15 FR2	
		3	SSB.10 FR2		SSB.16 FR2	
Propagation Condition		1, 2,3	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].						

Table A.15.4.1.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2-2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1,2,3	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam assumption[Note 4]		1,2,3	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-83	-83	-Infinity	-83
		3	-80	-80	-Infinity	-80
$\hat{E}_s / I_{ot}$ BB Note 5	dB	1, 2,3	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-83	-83	-Infinity	-83
		3	-80	-80	-Infinity	-80
Io	dBm/95.04 MHz	1,2,3	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1, 2,3	Defined in figure A.7.6.1.1.1-1			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Void
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

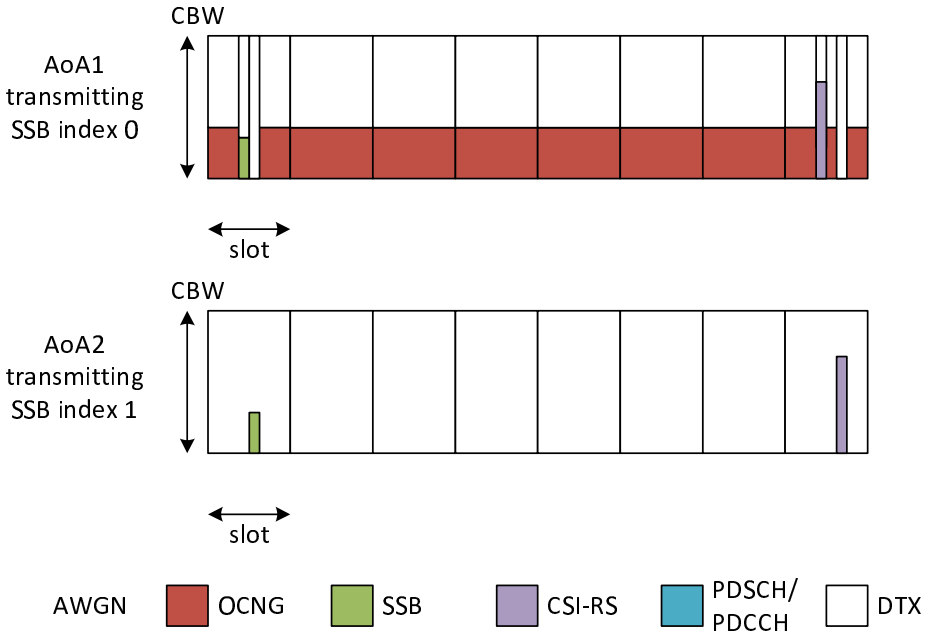


Figure A.15.4.1.1.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.15.4.1.1.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,

- TBD for a UE supporting power class 1,
- TBD for a UE supporting power class 2 and 3

For Configuration 2,

- TBD for a UE supporting power class 1,
- TBD for a UE supporting power class 2 and 3

For Configuration 3,

- TBD for a UE supporting power class 1,
- TBD for a UE supporting power class 2 and 3

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.15.4.2 Inter-frequency Measurements

A.15.4.2.1 SA event triggered reporting tests for FR2-2 with CCA without SSB time index detection when DRX is not used (PCell in FR2-2)

A.15.4.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3A.4.

In this test, there are two cells: NR Cell 1 as PCell in FR2-2 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR2-2 on NR RF channel 2 with CCA transmitting SSBs according to DL CCA model. The test parameters and configurations are given in tables A.15.4.2.1.1-1, A.15.4.2.1.1-2, and A.15.4.2.1.1-3.

Measurement gap pattern configuration # 13 as defined in table A.15.4.2.1.1-2 is provided for UE that does not support per-FR gap and for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Supported test configurations are shown in table A.15.4.2.1.1-1.

Table A.15.4.2.1.1-1 SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	480 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
3	960 kHz SSB SCS, 400 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.15.4.2.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2-2 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3	1	Two FR2-2 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
		Config 2	SSB.13 FR2	
		Config 3	SSB.14 FR2	
offsetMO	dB	Config 1,2,3	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	Config 1,2,3	-11	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3	5	

Parameter	Unit	Test configuration	Value	Comment
T2	s	Config 1,2,3	5.2 for PC1; 3.5 for other PC	

Table A.15.4.2.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2-2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam Assumption[Note 7]			1,2,3	Rough		Rough	
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1,2,3	TDD		TDD	
TDD configuration			Config 1,2,3	TDDConf.3.1		TDDConf.3.1	
DL CCA model			Config 1,2,3	As specified in clause TBD		As specified in clause TBD	
DL CCA probability			Config 1,2,3	TBD		TBD	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
			Config 2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
			Config 3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
Data PRBs allocated			Config 1	66		66	
			Config 2	66		66	
			Config 3	33		33	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
			Config 2	400: $N_{PRB,c}$ = 66		400: $N_{PRB,c}$ = 66	
			Config 3	400: $N_{PRB,c}$ = 33		400: $N_{PRB,c}$ = 33	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,2,3	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1,2,3	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1,2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,3	120		120	
TRS configuration			Config 1,2,3	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1,2,3	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
$\hat{E}_s$	dBm/SCS	Config 1	-87	-87	-Infinity	-87
		Config 2	-81	-81	-Infinity	-81
		Config 3	-78	-78	-Infinity	-78
SSBRP Note 3	dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87
		Config 2	-81	-81	-Infinity	-81
		Config 3	-78	-78	-Infinity	-78
$\hat{E}_s / I_{ot}$ BB Note 8	dB	Config 1,2,3	1.89	1.89	-Infinity	1.89
Io Note3	dBm/95.04 MHz Note5	Config 1,2,3	-58.01	-58.01	-Infinity	-58.01
Propagation Condition		Config 1,2,3	No external noise (Note 9)		No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: VoidNOTE 3: SSBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].

A.15.4.2.1.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

For Configuration 1,

TBD for UE supporting power class 1, or

TBD for UE supporting other power class.

For Configuration 2,

TBD for UE supporting power class 1, or

TBD for UE supporting other power class.

For Configuration 3,

TBD for UE supporting power class 1, or

TBD for UE supporting other power class.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16 NR standalone tests with all NR cells in FR1 for RedCap

A.16.1 SA: RRC_IDLE state mobility for RedCap

A.16.1.1 Cell re-selection to NR

A.16.1.1.1 Cell re-selection to FR1 intra-frequency NR case for 1 Rx UE

A.16.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequencyintra-frequency NR cell re-selection requirements specified in clause 4.2B.2.3.

A.16.1.1.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.16.1.1.1.2-1, A.16.1.1.1.2-2 and A.16.1.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.16.1.1.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.1.1.1.2-2: General test parameters for intra-frequencyintra-frequency NR cell re-selection test case for 1 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 1	
T2 end condition	Active cell		1, 2, 3, 4	Cell 2	
	Neighbour cells		1, 2, 3, 4	Cell 1	
Final condition	Active cell		1, 2, 3, 4	Cell 1	
	Neighbour cells		1, 2, 3, 4	Cell 2	
RF Channel Number			1, 2, 3, 4	1	
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1, 4	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
SMTC configuration			1, 4	SMTC.2	Configured in SIB2 of Cell 1
				SMTC.6	Configured in SIB2 of Cell 2
			2	SMTC.1	
			3	SMTC.1	

Parameter	Unit	Test configuration	Value	Comment
DRX cycle length	s	1, 2, 3, 4	1.28	The value shall be used for all cells in the test.
PRACH configuration index		1, 2, 3, 4	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell		1, 2, 3, 4	Not configured	
T1	s	1, 2, 3, 4	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2	s	1, 2, 3, 4	40	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3	s	1, 2, 3, 4	15	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.16.1.1.1.2-3: Cell specific test parameters for intra-frequency NR cell re-selection test case in AWGN for 1 Rx UE

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 4	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1, 4	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1, , 4	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3, 4	OP.1			OP.1		
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3, 4	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2, 4	-130			-130		
		3	-127			-127		
Pcompensation	dB	1, 2, 3, 4	0			0		
$Qhyst_s$	dB	1, 2, 3, 4	0			0		
$Qoffset_{s,n}$	dB	1, 2, 3, 4	0			0		
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3, 4	SS-RSRP			SS-RSRP		
$\hat{E}_s/I_{ot}$	dB	1, 4	16	-3.11	2.79	-infinity	2.79	-3.11
		2						
		3						
N_{oc} Note2	dBm/SCS	1, 4	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1, 4	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1, 4	16	13	16	-infinity	16	13
		2						

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
		3						
SS-RSRP Note3	dBm/SCS	1, 4	-82	-85	-82	-infinity	-82	-85
		2	-82	-85	-82	-infinity	-82	-85
		3	-79	-82	-79	-infinity	-79	-82
Io	dBm/9.36 MHz	1, 4	-53.94	-52.21	-52.21	Same as parameters specified in Cell 1 columns-		
	dBm/9.36 MHz	2	-53.94	-52.21	-52.21			
	dBm/18.36 MHz	3	-51.02	-49.30	-49.30			
Tre-selection	s	1, 2, 3, 4	0	0	0	0	0	0
SintrasearchP	dB	1, 2, 3, 4	60			60		
Propagation Condition		1, 2, 3, 4	AWGN					
Antenna Configuration			1x1					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.1.1.1.3 Test Requirements

The cell re-selection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 34 s.

The cell re-selection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 8 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect,NR_Intra_RedCap} + T_{SI\text{-}NR}$, and to an already detected cell can be expressed as: $T_{evaluate,NR_Intra_RedCap} + T_{SI\text{-}NR}$,

Where:

$T_{detect,NR_Intra_RedCap}$ See table 4.2B.2.3-1 in clause 4.2B.2.3

$T_{evaluate,NR_Intra_RedCap}$ See table 4.2B.2.3-1 in clause 4.2B.2.3

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280ms is assumed in this test case.

This gives a total of 33.28 s, allow 34 s for the cell re-selection delay to a newly detectable cell and 7.68 s for the cell re-selection delay to an already detected cell in the test case, which we allow 8 s.

A.16.1.1.2 Cell re-selection to FR1 intra-frequency NR case for 2 Rx UE

A.16.1.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell re-selection requirements specified in clause 4.2B.2.3.

A.16.1.1.2.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.16.1.1.2.2-1, A.16.1.1.2.2-2 and A.16.1.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.16.1.1.2.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.1.1.2.2-2: General test parameters for intra-frequency NR cell re-selection test case for 2 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 1	
T2 end condition	Active cell		1, 2, 3, 4	Cell 2	
	Neighbour cells		1, 2, 3, 4	Cell 1	
Final condition	Active cell		1, 2, 3, 4	Cell 1	
	Neighbour cells		1, 2, 3, 4	Cell 2	
RF Channel Number			1, 2, 3, 4	1	
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1, 4	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
SMTC configuration			1, 4	SMTC.2	Configured in SIB2 of Cell 1
				SMTC.6	Configured in SIB2 of Cell 2
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3, 4	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3, 4	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3, 4	Not configured	
T1		s	1, 2, 3, 4	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	1, 2, 3, 4	40	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3		s	1, 2, 3, 4	15	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.16.1.1.2.2-3: Cell specific test parameters for intra-frequency NR cell re-selection test case in AWGN for 2 Rx UE

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 4	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1, 4	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3, 4	OP.1			OP.1		
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3, 4	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2, 4	-130			-130		
		3	-127			-127		
Pcompensation	dB	1, 2, 3, 4	0			0		
$Qhyst_s$	dB	1, 2, 3	0			0		
$Qoffset_{s,n}$	dB	1, 2, 3, 4	0			0		
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3, 4	SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1, 4	16	-3.11	2.79	-infinity	2.79	-3.11
		2						
		3						
N_{oc} Note2	dBm/SCS	1, 4	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1, 4	-98					
		2						
		3						
$\hat{E}_s / N_{oc}$	dB	1, 4	16	13	16	-infinity	16	13
		2						
		3						
SS-RSRP Note3	dBm/SCS	1, 4	-82	-85	-82	-infinity	-82	-85
		2	-82	-85	-82	-infinity	-82	-85
		3	-79	-82	-79	-infinity	-79	-82
Io	dBm/9.36 MHz	1, 4	-53.94	-52.21	-52.21	Same as parameters specified in Cell 1 columns-		
	dBm/9.36 MHz	2	-53.94	-52.21	-52.21			
	dBm/18.36 MHz	3	-51.01	-49.30	-49.30			
Tre-selection	s	1, 2, 3, 4	0	0	0	0	0	0
SintrasearchP	dB	1, 2, 3, 4	60			60		
Propagation Condition		1, 2, 3, 4	AWGN					
Antenna Configuration			1x2					

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

A.16.1.1.2.3 Test Requirements

The cell re-selection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 34 s.

The cell re-selection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 8 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI-NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR_ intra} + T_{SI-NR}$,

Where:

T_{detect, NR_Intra} See table 4.2.2.3-1 in clause 4.2.2.3

$T_{evaluate, NR_ intra}$ See table 4.2.2.3-1 in clause 4.2.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 33.28 s, allow 34 s for the cell re-selection delay to a newly detectable cell and 7.68 s for the cell re-selection delay to an already detected cell in the test case, which we allow 8 s.

A.16.1.1.3 Cell re-selection to FR1 inter-frequency NR case for 1 Rx UE

A.16.1.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the inter-frequency NR cell re-selection requirements specified in clause 4.2B.2.4.

A.16.1.1.3.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.16.1.1.3.2-1, A.16.1.1.3.2-2 and A.16.1.1.3.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

Table A.16.1.1.3.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode

3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.16.1.1.3.2-2: General test parameters for FR1 inter-frequency NR cell re-selection test case for 1 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 2	The UE camps on Cell 2 in the initial phase and during T1 period the UE reselects to Cell 1
	Neighbour cell		1, 2, 3, 4	Cell 1	
T1 end condition	Active cell		1, 2, 3, 4	Cell 1	The UE shall perform re-selection to Cell 1 during T1
	Neighbour cells		1, 2, 3, 4	Cell 2	
T3 end condition	Active cell		1, 2, 3, 4	Cell 2	The UE shall perform re-selection to Cell 2 with higher priority during T3
	Neighbour cell		1, 2, 3, 4	Cell 1	
RF Channel Number			1, 2, 3, 4	1, 2	
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1, 4	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
SMTC configuration			1, 4	SMTC.2	Configured in SIB4 of Cell 1
				SMTC.6	Configured in SIB4 of Cell 2
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3, 4	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3, 4	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3, 4	Not configured	
T1		s	1, 2, 3, 4	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3		s	1, 2, 3, 4	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.16.1.1.3.2-3: Cell specific test parameters for FR1 inter-frequency NR cell re-selection test case in AWGN for 1 Rx UE

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 4	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1, 4	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3, 4	OP.1			OP.1		
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3, 4	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2, 4	-140			-140		
		3	-137			-137		
Pcompensation	dB	1, 2, 3, 4	0			0		
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3, 4	SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1, 4	14	14	14	-4	-infinity	12
		2						
		3						
N_{oc} Note2	dBm/SCS	1, 4	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1, 4	-98					
		2						
		3						
$\hat{E}_s / N_{oc}$	dB	1, 4	14	14	14	-4	-infinity	12
		2						
		3						
SS-RSRP Note3	dBm/SCS	1, 4	-84	-84	-84	-102	-infinity	-86
		2	-84	-84	-84	-102	-infinity	-86
		3	-81	-81	-81	-99	-infinity	-83
Io	dBm/9.36 MHz	1, 4	-55.88	-55.88	-55.88	-68.60	-70.05	-57.78
	dBm/9.36 MHz	2	-55.88	-55.88	-55.88	-68.60	-70.05	-57.78
	dBm/18.36 MHz	3	-52.95	-52.95	-52.95	-65.67	-67.13	-54.86
Tre-selection	s	1, 2, 3, 4	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2, 3, 4	50			50		
$Thresh_{x, highP}$	dB	1, 2, 3, 4	48			48		
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4	44			44		
$Thresh_{x, lowP}$	dB	1, 2, 3, 4	50			50		
Propagation Condition		1, 2, 3, 4	AWGN					
Antenna Configuration			1x1					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.1.1.3.3 Test Requirements

The cell re-selection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps again on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The cell re-selection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search}$ + $T_{evaluate,NR_Inter_RedCap}$ + T_{SI-NR}, and to a lower priority cell can be expressed as: $T_{evaluate,NR_Inter_RedCap}$ + T_{SI-NR},

Where:

$T_{higher_priority_search}$ See clause 4.2B.2.7

$T_{evaluate,NR_Inter_RedCap}$ See table 4.2B.2.4-1 in clause 4.2B.2.4

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority cell and 7.68 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 8 s.

A.16.1.1.4 Cell re-selection to FR1 inter-frequency NR case for 2 Rx UE

A.16.1.1.4.1 Test Purpose and Environment

This test is to verify the requirement for the inter-frequency NR cell re-selection requirements specified in clause 4.2B.2.4.

A.16.1.1.4.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.16.1.1.4.2-1, A.16.1.1.4.2-2 and A.16.1.1.4.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

Table A.16.1.1.4.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.16.1.1.4.2-2: General test parameters for FR1 inter-frequency NR cell re-selection test case for 2 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 2	The UE camps on Cell 2 in the initial phase and during T1 period the UE reselects to Cell 1
	Neighbour cell		1, 2, 3, 4	Cell 1	
T1 end condition	Active cell		1, 2, 3, 4	Cell 1	The UE shall perform re-selection to Cell 1 during T1
	Neighbour cells		1, 2, 3, 4	Cell 2	
T3 end condition	Active cell		1, 2, 3, 4	Cell 2	The UE shall perform re-selection to Cell 2 with higher priority during T3
	Neighbour cell		1, 2, 3, 4	Cell 1	
RF Channel Number			1, 2, 3, 4	1, 2	
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1, 4	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
SMTC configuration			1, 4	SMTC.2	Configured in SIB4 of Cell 1
				SMTC.6	Configured in SIB4 of Cell 2
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3, 4	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3, 4	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3, 4	Not configured	
T1		s	1, 2, 3, 4	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3		s	1, 2, 3, 4	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.16.1.1.4.2-3: Cell specific test parameters for FR1 inter-frequency NR cell re-selection test case in AWGN for 2 Rx UE

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 4	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1, 4	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
OCNG Pattern		1, 2, 3, 4	OP.1			OP.1		
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3, 4	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2, 4	-140			-140		
		3	-137			-137		
Pcompensation	dB	1, 2, 3, 4	0			0		
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3, 4	SS-RSRP			SS-RSRP		
$\hat{E}_s/I_{ot}$	dB	1, 4	14	14	14	-4	-infinity	12
		2						
		3						
N_{oc} Note2	dBm/SCS	1, 4	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1, 4	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1, 4	14	14	14	-4	-infinity	12
		2						
		3						
SS-RSRP Note3	dBm/SCS	1, 4	-84	-84	-84	-102	-infinity	-86
		2	-84	-84	-84	-102	-infinity	-86
		3	-81	-81	-81	-99	-infinity	-83
Io	dBm/9.36 MHz	1, 4	-55.88	-55.88	-55.88	-68.60	-70.05	-57.78
	dBm/9.36 MHz	2	-55.88	-55.88	-55.88	-68.60	-70.05	-57.78
	dBm/18.36 MHz	3	-52.95	-52.95	-52.95	-65.67	-67.12	-54.85
Tre-selection	s	1, 2, 3, 4	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2, 3, 4	50			50		
$Thresh_{x, highP}$	dB	1, 2, 3, 4	48			48		
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4	44			44		
$Thresh_{x, lowP}$	dB	1, 2, 3, 4	50			50		
Propagation Condition		1, 2, 3, 4	AWGN					
Antenna Configuration			1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.1.1.4.3 Test Requirements

The cell re-selection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps again on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The cell re-selection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search}$ + $T_{evaluate,NR_Inter_RedCap}$ + T_{SI-NR}, and to a lower priority cell can be expressed as: $T_{evaluate,NR_Inter_RedCap}$ + T_{SI-NR},

Where:

$T_{higher_priority_search}$ See clause 4.2B.2.7

$T_{evaluate,NR_Inter_RedCap}$ See table 4.2B.2.4-1 in clause 4.2B.2.4

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority cell and 7.68 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 8 s.

A.16.1.1.5 Cell re-selection to FR1 intra-frequency NR case for UE fulfilling stationary relaxed measurement criterion for 1 Rx UE

A.16.1.1.5.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell re-selection requirements for UE fulfilling stationary relaxed measurement criterion specified in clause 4.2B.2.9.2.

A.16.1.1.5.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.16.1.1.5.2-1, A.16.1.1.5.2-2 and A.16.1.1.5.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.16.1.1.5.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.1.1.5.2-2: General test parameters for FR1 intra-frequency NR cell re-selection test case for UE fulfilling stationary relaxed measurement criterion for 1 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 1	The UE camps on Cell 1 in the initial phase
	Neighbour cells		1, 2, 3, 4	Cell 2	
T1 end condition	Active cell		1, 2, 3, 4	Cell 2	The UE reselects to Cell 2 during T1 period
	Neighbour cells		1, 2, 3, 4	Cell 1	
Final condition	Active cell		1, 2, 3, 4	Cell 1	The UE reselects to Cell 1 during T2 period

Parameter		Unit	Test configuration	Value	Comment
	Neighbour cells		1, 2, 3, 4	Cell 2	
RF Channel Number			1, 2, 3, 4	1	
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1, 4	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
SMTC configuration			1, 4	SMTC.2	Configured in SIB2 of Cell 1
				SMTC.6	Configured in SIB2 of Cell 2
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3, 4	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3, 4	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3, 4	Not configured	
T1		s	1, 2, 3, 4	[25]	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4	[25]	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.16.1.1.5.2-3: Cell specific test parameters for FR1 intra-frequency NR cell re-selection test case in AWGN for UE fulfilling stationary relaxed measurement criterion for 1 Rx UE

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		SR.1.1 FDD SR.1.1 TDD SR.2.1 TDD	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3, 4	OP.1		OP.1	
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3, 4	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2, 4	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3, 4	0		0	
$Qhyst_s$	dB	1, 2, 3, 4	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3, 4	0		0	
$S_{SearchDeltaP-Stationary}$	dB	1, 2, 3, 4	3		3	
$T_{SearchDeltaP-Stationary}$	s	1, 2, 3, 4	5		5	
Cell_selection_and_re-selection_quality_measurement		1, 2, 3, 4	SS-RSRP		SS-RSRP	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$\hat{E}_s / I_{ot}$	dB	1, 2, 3, 4	-3.11	2.79	2.79	-3.11
N_{oc} Note2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1, 2, 3, 4	-98			
$\hat{E}_s / N_{oc}$	dB	1, 2, 3, 4	13	16	16	13
SS-RSRP Note3	dBm/SCS	1, 4	-85	-82	-82	-85
		2	-85	-82	-82	-85
		3	-82	-79	-79	-82
Io	dBm/9.36 MHz	1, 4	-52.21	-52.21	specified in Cell 1 columns-	
	dBm/9.36 MHz	2	-52.21	-52.21		
	dBm/18.36 MHz	3	-49.28	-49.28		
Tre-selection	s	1, 2, 3, 4	0	0	0	0
SintrasearchP	dB	1, 2, 3, 4	60		60	
Propagation Condition		1, 2, 3, 4	AWGN			
Antenna Configuration			1x1			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.1.1.5.3 Test Requirements

The cell re-selection delay to an already detected cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected cell shall be less than 32 s.

The cell re-selection delay to an already detected cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 32 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to an already detected cell can be expressed as: $T_{evaluate,NR_Intra_RedCap_Relax} + T_{SI-NR}$,

Where:

$T_{evaluate,NR_Intra_RedCap_Relax}$ See table 4.2B.2.9.2-1 in clause 4.2B.2.9.2 for re-selection to Cell 2 during T1 with UE fulfilling stationary criterion, 30.72 s.

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 32 s for the cell re-selection delay to an already detected cell for UE fulfilling stationary criterion in the test case.

A.16.1.1.6 Cell re-selection to FR1 intra-frequency NR case for UE fulfilling stationary relaxed measurement criterion for 2 Rx UE

A.16.1.1.6.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell re-selection requirements for UE fulfilling stationary relaxed measurement criterion specified in clause 4.2B.2.9.2.

A.16.1.1.6.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.16.1.1.6.2-1, A.16.1.1.6.2-2 and A.16.1.1.6.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.16.1.1.6.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.1.1.6.2-2: General test parameters for FR1 intra-frequency NR cell re-selection test case for UE fulfilling stationary relaxed measurement criterion for 2 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 1	The UE camps on Cell 1 in the initial phase
	Neighbour cells		1, 2, 3, 4	Cell 2	
T1 end condition	Active cell		1, 2, 3, 4	Cell 2	The UE reselects to Cell 2 during T1 period
	Neighbour cells		1, 2, 3, 4	Cell 1	
Final condition	Active cell		1, 2, 3, 4	Cell 1	The UE reselects to Cell 1 during T2 period
	Neighbour cells		1, 2, 3, 4	Cell 2	
RF Channel Number			1, 2, 3, 4	1	
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1, 4	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
SMTC configuration			1, 4	SMTC.2	Configured in SIB2 of Cell 1
				SMTC.6	Configured in SIB2 of Cell 2
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3, 4	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3, 4	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3, 4	Not configured	
T1		s	1, 2, 3, 4	[25]	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4	[25]	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.16.1.1.6.2-3: Cell specific test parameters for FR1 intra-frequency NR cell re-selection test case in AWGN for UE fulfilling stationary relaxed measurement criterion for 2 Rx UE

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		SR.1.1 FDD SR.1.1 TDD SR.2.1 TDD	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3, 4	OP.1		OP.1	
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3, 4	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2, 4	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3, 4	0		0	
$Qhyst_s$	dB	1, 2, 3, 4	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3, 4	0		0	
$S_{SearchDeltaP-Stationary}$	dB	1, 2, 3, 4	3		3	
$T_{SearchDeltaP-Stationary}$	s	1, 2, 3, 4	5		5	
Cell_selection_and_re-selection_quality_measurement		1, 2, 3, 4	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1, 2, 3, 4	-3.11	2.79	2.79	-3.11
N_{oc} Note2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1, 2, 3, 4	-98			
$\hat{E}_s / N_{oc}$	dB	1, 2, 3, 4	13	16	16	13
SS-RSRP Note3	dBm/SCS	1, 4	-85	-82	-82	-85
		2	-85	-82	-82	-85
		3	-82	-79	-79	-82
Io	dBm/9.36 MHz	1, 4	-52.21	-52.21	specified in Cell 1 columns-	
	dBm/9.36 MHz	2	-52.21	-52.21		
	dBm/18.36 MHz	3	-49.28	-49.28		
Tre-selection	s	1, 2, 3, 4	0	0	0	0
SintrasearchP	dB	1, 2, 3, 4	60		60	
Propagation Condition		1, 2, 3, 4	AWGN			
Antenna Configuration			1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.1.1.6.3 Test Requirements

The cell re-selection delay to an already detected cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected cell shall be less than 32 s.

The cell re-selection delay to an already detected cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 32 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to an already detected cell can be expressed as: $T_{evaluate,NR_Intra_RedCap_Relax} + T_{SI-NR}$,

Where:

$T_{evaluate,NR_Intra_RedCap_Relax}$ See table 4.2B.2.9.2-2 in clause 4.2B.2.9.2 for re-selection to Cell 2 during T1 with UE fulfilling stationary criterion, 30.72 s.

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 32 s for the cell re-selection delay to an already detected cell for UE fulfilling stationary criterion in the test case.

A.16.1.1.7 Cell re-selection to FR1 inter-frequency NR case for UE fulfilling stationary relaxed measurement criterion for 1 Rx UE

A.16.1.1.7.1 Test Purpose and Environment

This test is to verify the requirement for the inter-frequency NR cell re-selection requirements specified in clause 4.2B.2.10.2, for UE fulfilling stationary relaxed measurement criterion.

A.16.1.1.7.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.16.1.1.7.2-1, A.16.1.1.7.2-2 and A.16.1.1.7.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

As specified in the Test Purpose, the UE is configured with the stationary relaxed measurement criterion for UE defined in clause 5.2.4.9.1 in [1]. So, Cell 2 and Cell 1 configure the UE as follows:

- *stationaryMobilityEvaluation* [2] criterion is configured according to the parameters listed in table A.16.1.1.7.2-3;
- *cellEdgeEvaluationWhileStationary* [2] criterion is not configured;
- *combineRelaxedMeasCondition2* [2] is not configured;

Table A.16.1.1.7.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations.

Table A.16.1.1.7.2-2: General test parameters for FR1 inter-frequency NR cell re-selection test case for UE fulfilling stationary relaxed measurement criterion for 1 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 2	The UE camps on Cell 2 in the initial phase, it fulfills stationary relaxation measurements criterion, and during T1 period the UE reselects to Cell 1
	Neighbour cells		1, 2, 3, 4	Cell 1	
T1 end condition	Active cell		1, 2, 3, 4	Cell 1	The UE shall perform re-selection to Cell 1 during T1
	Neighbour cells		1, 2, 3, 4	Cell 2	
T2 end condition	Active cell		1, 2, 3, 4	Cell 2	The UE shall perform re-selection to Cell 2 with higher priority during T2
	Neighbour cells		1, 2, 3, 4	Cell 1	
RF Channel Number			1, 2, 3, 4	1, 2	
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB Configuration			1, 4	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
SMTC configuration			1, 4	SMTC.2	Configured in SIB4 of Cell 1
				SMTC.6	Configured in SIB4 of Cell 2
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3, 4	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3, 4	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3, 4	Not configured	
T1		s	1, 2, 3, 4	25 s	T1 is defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4	25 s	T2 is defined so that cell re-selection reaction time is taken into account.

Table A.16.1.1.7.2-3: Cell specific test parameters for FR1 inter-frequency NR cell re-selection test case in AWGN for UE fulfilling stationary relaxed measurement criterion for 1 Rx UE

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		SR.1.1 FDD	
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3, 4	OP.1		OP.1	
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1		ULBWP.0.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
RLM-RS		1, 2, 3, 4	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2, 4	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3, 4	0		0	
$Qhyst_s$	dB	1, 2, 3, 4	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3, 4	0		0	
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3, 4	SS-RSRP		SS-RSRP	
$\hat{E}_s/I_{ot}$	dB	1, 4	14	14	-4	12
		2				
		3				
N_{oc} Note2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1, 4	14	14	-4	12
		2				
		3				
SS-RSRP Note3	dBm/SCS	1, 4	-84	-84	-102	-86
		2	-84	-84	-102	-86
		3	-81	-81	-99	-83
Io	dBm/9.36 MHz	1, 4	-55.88	-55.88	-68.60	-57.78
	dBm/9.36 MHz	2	-55.88	-55.88	-68.60	-57.78
	dBm/18.36 MHz	3	-52.96	-52.96	-65.67	-54.85
Tre-selection	s	1, 2, 3, 4	0	0	0	0
SnonintrasearchP	dB	1, 2, 3, 4	Not sent		Not sent	
$Thresh_{x,highP}$	dB	1, 2, 3, 4	48		48	
$Thresh_{serving,lowP}$	dB	1, 2, 3, 4	44		44	
$Thresh_{x,lowP}$	dB	1, 2, 3, 4	50		50	
$S_{SearchDeltaP-Stationary}$	dB	1, 2, 3	3		3	
$T_{SearchDeltaP-Stationary}$	s	1, 2, 3	5		5	
Propagation Condition		1, 2, 3	AWGN			
Antenna Configuration			1x1			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.1.1.7.3 Test Requirements

The cell re-selection delay to an already detected lower priority cell for UE fulfilling stationary relaxed measurements is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to a lower priority cell for UE fulfilling stationary relaxed measurements shall be less than 32 s.

The cell re-selection delay to an already detected higher priority cell for UE fulfilling stationary relaxed measurements is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the RRCSetupRequest message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected higher priority cell for UE fulfilling stationary relaxed measurements shall be less than 32 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a known lower priority cell can be expressed as: $T_{evaluate,NR_Inter_RedCap_Relax}$ + T_{SI-NR},

Where:

$T_{evaluate,NR_Inter_RedCap_Relax}$ See table 4.2B.2.10.2-1 in clause 4.2B.2.10.2

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 32 s for the cell re-selection delay to an already detected lower priority cell and 32 s for the cell re-selection delay to an already detected higher priority cell, for UE fulfilling stationary relaxed measurements in the test case.

A.16.1.1.8 Cell re-selection to FR1 inter-frequency NR case for UE fulfilling stationary relaxed measurement criterion for 2 Rx UE

A.16.1.1.8.1 Test Purpose and Environment

This test is to verify the requirement for the inter-frequency NR cell re-selection requirements specified in clause 4.2B.2.10.2, for UE fulfilling stationary relaxed measurement criterion.

A.16.1.1.8.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.16.1.1.8.2-1, A.16.1.1.8.2-2 and A.16.1.1.8.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1.

As specified in the Test Purpose, the UE is configured with the stationary relaxed measurement criterion for UE defined in clause 5.2.4.9.1 in [1]. So, Cell 2 and Cell 1 configure the UE as follows:

- *stationaryMobilityEvaluation* [2] criterion is configured according to the parameters listed in table A.16.1.1.8.2-3;
- *cellEdgeEvaluationWhileStationary* [2] criterion is not configured;
- *combineRelaxedMeasCondition2* [2] is not configured;

Table A.16.1.1.8.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.16.1.1.8.2-2: General test parameters for FR1 inter-frequency NR cell re-selection test case for UE fulfilling stationary relaxed measurement criterion for 2 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 2	The UE camps on Cell 2 in the initial phase, it fulfills stationary relaxation measurements criterion, and during T1 period the UE reselects to Cell 1
	Neighbour cells		1, 2, 3, 4	Cell 1	
T1 end condition	Active cell		1, 2, 3, 4	Cell 1	The UE shall perform re-selection to Cell 1 during T1
	Neighbour cells		1, 2, 3, 4	Cell 2	
T2 end condition	Active cell		1, 2, 3, 4	Cell 2	The UE shall perform re-selection to Cell 2 with higher priority during T2
	Neighbour cells		1, 2, 3, 4	Cell 1	
RF Channel Number			1, 2, 3, 4	1, 2	
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB Configuration			1, 4	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
SMTC configuration			1, 4	SMTC.2	Configured in SIB4 of Cell 1
				SMTC.6	Configured in SIB4 of Cell 2
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3, 4	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3, 4	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3, 4	Not configured	
T1		s	1, 2, 3, 4	25 s	T1 is defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4	25 s	T2 is defined so that cell re-selection reaction time is taken into account.

Table A.16.1.1.8.2-3: Cell specific test parameters for FR1 inter-frequency NR cell re-selection test case in AWGN for UE fulfilling stationary relaxed measurement criterion for 2 Rx UE

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		SR.1.1 FDD	
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3, 4	OP.1		OP.1	
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1		ULBWP.0.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
RLM-RS		1, 2, 3, 4	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2, 4	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3, 4	0		0	
$Qhyst_s$	dB	1, 2, 3, 4	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3, 4	0		0	
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3, 4	SS-RSRP		SS-RSRP	
$\hat{E}_s/I_{ot}$	dB	1, 4	14	14	-4	12
		2				
		3				
N_{oc} Note2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1, 4	14	14	-4	12
		2				
		3				
SS-RSRP Note3	dBm/SCS	1, 4	-84	-84	-102	-86
		2	-84	-84	-102	-86
		3	-81	-81	-99	-83
Io	dBm/9.36 MHz	1, 4	-55.88	-55.88	-68.60	-57.78
	dBm/9.36 MHz	2	-55.88	-55.88	-68.60	-57.78
	dBm/18.36 MHz	3	-52.95	-52.95	-65.67	-54.86
Tre-selection	s	1, 2, 3, 4	0	0	0	0
SnonintrasearchP	dB	1, 2, 3, 4	Not sent		Not sent	
$Thresh_{x,highP}$	dB	1, 2, 3, 4	48		48	
$Thresh_{serving,lowP}$	dB	1, 2, 3, 4	44		44	
$Thresh_{x,lowP}$	dB	1, 2, 3, 4	50		50	
$S_{SearchDeltaP-Stationary}$	dB	1, 2, 3, 4	3		3	
$T_{SearchDeltaP-Stationary}$	s	1, 2, 3, 4	5		5	
Propagation Condition		1, 2, 3, 4	AWGN			
Antenna Configuration			1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.1.1.8.3 Test Requirements

The cell re-selection delay to an already detected lower priority cell for UE fulfilling stationary relaxed measurements is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to a lower priority cell for UE fulfilling stationary relaxed measurements shall be less than 32 s.

The cell re-selection delay to an already detected higher priority cell for UE fulfilling stationary relaxed measurements is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the RRCSetupRequest message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected higher priority cell for UE fulfilling stationary relaxed measurements shall be less than 32 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a known lower priority cell can be expressed as: $T_{evaluate,NR_Inter_RedCap_Relax}$ + T_{SI-NR},

Where:

$T_{evaluate,NR_Inter_RedCap_Relax}$ See table 4.2B.2.10.2-2 in clause 4.2B.2.10.2

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 32 s for the cell re-selection delay to an already detected lower priority cell and 32 s for the cell re-selection delay to an already detected higher priority cell, for UE fulfilling stationary relaxed measurements in the test case.

A.16.1.2 Inter-RAT E-UTRAN cell re-selection for RedCap

A.16.1.2.1 Cell re-selection to higher priority E-UTRAN for 1 RX

A.16.1.2.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell re-selection requirements specified in clause 4.2B.2.5 when the E-UTRAN cell is of higher priority.

A.16.1.2.1.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.16.1.2.1.2-1, A.16.1.2.1.2-2, A.16.1.2.1.2-3 and A.16.1.2.1.2-4. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. NR Cell 1 is already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of higher priority than Cell 1.

Table A.16.1.2.1.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.16.1.2.1.2-2: General test parameters for NR to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE camps on Cell 1 in the initial phase and during T2 period the UE reselects to Cell 2.
T2 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	The UE shall perform re-selection to cell 2 during T2.
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	
T3 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE shall perform re-selection to cell 1 during T3 for iteration of the tests.
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	
Access Barring Information		-	1, 2, 3, 4, 5, 6, 7, 8	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6, 7, 8	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6, 7, 8	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3, 7	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6, 8	4	
E-UTRAN PRACH			1, 2, 3	53	As specified in table 5.7.1-2 in TS 36.211 [23]
configuration index			4, 5, 6	4	
T1		s	1, 2, 3, 4, 5, 6, 7, 8	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2.
T2		s	1, 2, 3, 4, 5, 6, 7, 8	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3		s	1, 2, 3, 4, 5, 6, 7, 8	15	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.16.1.2.1.2-3: Cell specific test parameters for NR Cell 1

Parameter	Unit	Test configuration	Cell 1		
			T1	T2	T3
TDD configuration		1, 4, 7, 8	N/A		
		2, 5	TDDConf.1.1		
		3, 6	TDDConf.2.1		
PDSCH parameters		1, 4, 7, 8	SR.1.1 FDD		
		2, 5	SR.1.1 TDD		
		3, 6	SR.2.1 TDD		
RMSI CORESET parameters		1, 4, 7, 8	CR.1.1 FDD		
		2, 5	CR.1.1 TDD		
		3, 6	CR.2.1 TDD		
Dedicated CORESET parameters		1, 4, 7, 8	CCR.1.1 FDD		
		2, 5	CCR.1.1 TDD		
		3, 6	CCR.2.1 TDD		
SSB parameters		1, 4, 7, 8	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.1 RedCap FR1		
NR SMTC parameters		1, 4, 7, 8	SMTC.2		
		2, 5	SMTC.1		
		3, 6	SMTC.1		
OCNG Pattern		1, 2, 3, 4, 5, 6, 7, 8	OP.1		
Initial DL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.0.1		

Parameter	Unit	Test configuration	Cell 1		
			T1	T2	T3
RLM-RS		1, 2, 3, 4, 5, 6, 7, 8	SSB		
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140		
		3, 6	-137		
N_{oc}	dBm/SCS	1, 4, 7, 8	-98		
		2, 5	-98		
		3, 6	-95		
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98		
SS-RSRP	dBm/SCS	1, 4, 7, 8	-84	-84	-84
		2, 5	-84	-84	-84
		3, 6	-81	-81	-81
$\hat{E}_s / I_{ot}$	dB	1, 4, 7, 8	14	14	14
		2, 5			
		3, 6			
$\hat{E}_s / N_{oc}$	dB	1, 4, 7, 8	14	14	14
		2, 5			
		3, 6			
Io	dBm/9.36 MHz	1, 4, 7, 8	-55.88	-55.88	-55.88
	dBm/9.36 MHz	2, 5	-55.88	-55.88	-55.88
	dBm/18.36 MHz	3, 6	-52.95	-52.95	-52.95
Tre-selection	s	1, 2, 3, 4, 5, 6, 7, 8	0		
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6, 7, 8	50		
$Thresh_{x, highP}$ (Note 2)	dB	1, 2, 3, 4, 5, 6, 7, 8	48		
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	44		
$Thresh_{x, lowP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	50		
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN		
Antenna Configuration			1x1		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell					

Table A.16.1.2.1.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2		
		T1	T2	T3
E-UTRA RF Channel number		1		
$BW_{channel}$	MHz	10		
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6		
PBCH_RA	dB	0		
PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			
PHICH_RA	dB			
PHICH_RB	dB			
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA[Note 1]	dB			
OCNG_RB[Note 1]	dB			
Qrxlevmin	dBm	-140		
N_{oc}	dBm/15 kHz	-98		
RSRP	dBm/15 KHz	-infinity	-86	-102

Parameter	Unit	Cell 2		
		T1	T2	T3
$\hat{E}_s / I_{ot}$	dB	-infinity	12	-4
$\hat{E}_s / N_{oc}$	dB	-infinity	12	-4
Tre-selection$_{EUTRAN}$	s	0		
SnonintrasearchP	dB	Not sent		
Thresh$_{x, highP}$	dB	48		
Thresh$_{serving, lowP}$	dB	44		
Thresh$_{x, lowP}$ (Note 2)	dB	50		
Propagation Condition		AWGN		
Antenna Configuration		1x1		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of Thresh$_{x, Low}$ which is included in E-UTRA system information, and is a threshold for the NR target cell				

A.16.1.2.1.3 Test Requirements

The cell re-selection delay to a higher priority E-UTRAN cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search_RedCap} + T_{evaluate, E-UTRAN_RedCap} + T_{SI-E-UTRA}$,

Where:

$T_{higher_priority_search_RedCap}$ See clause 4.2B.2.7

$T_{evaluate, E-UTRAN_RedCap}$ See table 4.2B.2.5-1 in clause 4.2B.2.5

$T_{SI-E-UTRA_}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority E-UTRAN cell.

A.16.1.2.2 Cell re-selection to higher priority E-UTRAN for 2 RX

A.16.1.2.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell re-selection requirements specified in clause 4.2.2.5 when the E-UTRAN cell is of higher priority.

A.16.1.2.2.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.16.1.2.2.2-1, A. 16.1.2.2.2-2, A. 16.1.2.2.2-3 and A. 16.1.2.2.2-4. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. NR Cell 1 is already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of higher priority than Cell 1.

Table A.16.1.2.2.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode

3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A. 16.1.2.2.2-2: General test parameters for NR to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE camps on Cell 1 in the initial phase and during T2 period the UE reselects to Cell 2.
T2 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	The UE shall perform re-selection to cell 2 during T2.
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	
T3 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE shall perform re-selection to cell 1 during T3 for iteration of the tests.
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	
Access Barring Information		-	1, 2, 3, 4, 5, 6, 7, 8	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6, 7, 8	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6, 7, 8	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3, 7	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6, 8	4	
E-UTRAN PRACH configuration index			1, 2, 3	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6	4	
T1		s	1, 2, 3, 4, 5, 6, 7, 8	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2.
T2		s	1, 2, 3, 4, 5, 6, 7, 8	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3		s	1, 2, 3, 4, 5, 6, 7, 8	15	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A. 16.1.2.2.2-3: Cell specific test parameters for NR Cell 1

Parameter	Unit	Test configuration	Cell 1		
			T1	T2	T3
TDD configuration		1, 4, 7, 8	N/A		
		2, 5	TDDConf.1.1		
		3, 6	TDDConf.2.1		
PDSCH parameters		1, 4, 7, 8	SR.1.1 FDD		
		2, 5	SR.1.1 TDD		
		3, 6	SR.2.1 TDD		
RMSI CORESET parameters		1, 4, 7, 8	CR.1.1 FDD		
		2, 5	CR.1.1 TDD		

Parameter	Unit	Test configuration	Cell 1		
			T1	T2	T3
		3, 6	CR.2.1 TDD		
Dedicated CORESET parameters		1, 4, 7, 8	CCR.1.1 FDD		
		2, 5	CCR.1.1 TDD		
		3, 6	CCR.2.1 TDD		
SSB parameters		1, 4, 7, 8	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.1 RedCap FR1		
NR SMTC parameters		1, 4, 7, 8	SMTC.2		
		2, 5	SMTC.1		
		3, 6	SMTC.1		
OCNG Pattern		1, 2, 3, 4, 5, 6, 7, 8	OP.1		
Initial DL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.0.1		
RLM-RS		1, 2, 3, 4, 5, 6, 7, 8	SSB		
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140		
		3, 6	-137		
N_{oc}	dBm/SCS	1, 4, 7, 8	-98		
		2, 5	-98		
		3, 6	-95		
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98		
SS-RSRP	dBm/SCS	1, 4, 7, 8	-84	-84	-84
		2, 5	-84	-84	-84
		3, 6	-81	-81	-81
$\hat{E}_s/I_{ot}$	dB	1, 4, 7, 8	14	14	14
		2, 5			
		3, 6			
$\hat{E}_s/N_{oc}$	dB	1, 4, 7, 8	14	14	14
		2, 5			
		3, 6			
Io	dBm/9.36 MHz	1, 4, 7, 8	-55.88	-55.88	-55.88
	dBm/9.36 MHz	2, 5	-55.88	-55.88	-55.88
	dBm/18.36 MHz	3, 6	-52.95	-52.95	-52.95
Tre-selection	s	1, 2, 3, 4, 5, 6, 7, 8	0		
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6, 7, 8	50		
$Thresh_{x, highP}$ (Note 2)	dB	1, 2, 3, 4, 5, 6, 7, 8	48		
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	44		
$Thresh_{x, lowP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	50		
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN		
Antenna Configuration			1x2		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell

Table A. 16.1.2.2.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2		
		T1	T2	T3
E-UTRA RF Channel number		1		
$BW_{channel}$	MHz	10		
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6		
PBCH_RA	dB	0		
PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			
PHICH_RA	dB			
PHICH_RB	dB			

Parameter	Unit	Cell 2		
		T1	T2	T3
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA Note 1	dB			
OCNG_RB Note 1	dB			
Qrxlevmin	dBm	-140		
N_{oc}	dBm/15 kHz	-98		
RSRP	dBm/15 KHz	-infinity	-86	-102
$\hat{E}_s / I_{ot}$	dB	-infinity	12	-4
$\hat{E}_s / N_{oc}$	dB	-infinity	12	-4
$Tre\text{-}selection_{EUTRAN}$	s	0		
SnonintrasearchP	dB	Not sent		
$Thresh_{x, highP}$	dB	48		
$Thresh_{serving, lowP}$	dB	44		
$Thresh_{x, lowP (Note 2)}$	dB	50		
Propagation Condition		AWGN		
Antenna Configuration		1x2		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: This refers to the value of $Thresh_{x, Low}$ which is included in E-UTRA system information, and is a threshold for the NR target cell				

A.16.1.2.2.3 Test Requirements

The cell re-selection delay to a higher priority E-UTRAN cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search_RedCap} + T_{evaluate, E\text{-}UTRAN_RedCap} + T_{SI\text{-}E\text{-}UTRA}$,

Where:

$T_{higher_priority_search_RedCap}$ See clause 4.2B.2.7

$T_{evaluate, E\text{-}UTRAN_RedCap}$ See table 4.2B.2.5-1 in clause 4.2B.2.5

$T_{SI\text{-}E\text{-}UTRA_}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority E-UTRAN cell.

A.16.1.2.3 Cell re-selection to lower priority E-UTRAN for 1 RX

A.16.1.2.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell re-selection requirements specified in clause 4.2B.2.5 when the E-UTRAN cell is of lower priority.

A. 16.1.2.3.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A16.1.2.3.2-1, A16.1.2.3.2-2, A16.1.2.3.2-3 and A16.1.2.3.2-4. The test consists of two successive time periods, with time duration of T1 and T2

respectively. Both NR Cell 1 and E-UTRAN Cell 2 are already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of lower priority than Cell 1.

Table A.16.1.2.3.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.16.1.2.3.2-2: General test parameters for NR to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE camps on Cell 1 in the initial phase.
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	
T1 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	The UE shall perform re-selection to Cell 2 during T1.
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE shall perform re-selection to Cell 1 during T2 for iteration of the tests.
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	
Access Barring Information		-	1, 2, 3, 4, 5, 6, 7, 8	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6, 7, 8	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6, 7, 8	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3, 7	534	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6, 8		
T1		s	1, 2, 3, 4, 5, 6, 7, 8	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6, 7, 8	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A. 16.1.2.3.2-3: Cell specific test parameters for NR Cell 1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 4, 7, 8	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4, 7, 8	SR.1.1 FDD	

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4, 7, 8	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4, 7, 8	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4, 7, 8	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.1 RedCap FR1	
SMTC configuration		1, 4, 7, 8	SMTC.2	
		2, 5	SMTC.1	
		3, 6	SMTC.1	
OCNG Pattern		1, 2, 3, 4, 5, 6, 7, 8	OP.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6, 7, 8	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4, 7, 8	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98	
SS-RSRP	dBm/SCS	1, 4, 7, 8	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s/I_{ot}$	dB	1, 4, 7, 8	-4	12
		2, 5		
		3, 6		
$\hat{E}_s/N_{oc}$	dB	1, 4, 7, 8	-4	12
		2, 5		
		3, 6		
Io	dBm/9.36 MHz	1, 4, 7, 8	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/18.36 MHz	3, 6	-65.67	-54.85
Tre-selection	s	1, 2, 3, 4, 5, 6, 7, 8	0	
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6, 7, 8	Not sent	
$Thresh_{x, highP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	48	
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	44	
$Thresh_{x, lowP (Note 2)}$	dB	1, 2, 3, 4, 5, 6, 7, 8	50	
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration			1x1	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell				

Table A.16.1.2.3.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		

Parameter	Unit	Cell 2	
		T1	T2
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 KHz	-84	-84
$\hat{E}_s / I_{ot}$	dB	14	14
$\hat{E}_s / N_{oc}$	dB	14	14
Tre-selection$_{EUTRAN}$	s	0	
SnonintrasearchP	dB	Not sent	
Thresh$_{x, highP}$ (Note 2)	dB	48	
Thresh$_{serving, lowP}$	dB	44	
Thresh$_{x, lowP}$	dB	50	
Propagation Condition		AWGN	
Antenna Configuration		1x1	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of Thresh$_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell			

A.16.1.2.3.3 Test Requirements

The cell re-selection delay to a lower priority E-UTRAN cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

$T_{higher_priority_search_RedCap}$ See clause 4.2B.2.7

$T_{evaluate, E-UTRAN_RedCap}$ See table 4.2B.2.5-1 in clause 4.2B.2.5

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 7.68 s, allow 8 s for the cell re-selection delay to a lower priority E-UTRAN cell.

A.16.1.2.4 Cell re-selection to lower priority E-UTRAN for 2 RX

A.16.1.2.4.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell re-selection requirements specified in clause 4.2B.2.5 when the E-UTRAN cell is of lower priority.

A.16.1.2.4.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A16.1.2.4.2-1, A16.1.2.4.2-2, A16.1.2.4.2-3 and A16.1.2.4.2-4. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both NR Cell 1 and E-UTRAN Cell 2 are already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of lower priority than Cell 1.

Table A.16.1.2.4.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A. 16.1.2.4.2-2: General test parameters for NR to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE camps on Cell 1 in the initial phase.
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	
T1 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	The UE shall perform re-selection to Cell 2 during T1.
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE shall perform re-selection to Cell 1 during T2 for iteration of the tests.
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	
Access Barring Information		-	1, 2, 3, 4, 5, 6, 7, 8	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6, 7, 8	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6, 7, 8	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3, 7	534	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6, 8		
T1		s	1, 2, 3, 4, 5, 6, 7, 8	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6, 7, 8	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A. 16.1.2.4.2-3: Cell specific test parameters for NR Cell 1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 4, 7, 8	N/A	
		2, 5	TDDConf.1.1	

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4, 7, 8	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4, 7, 8	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4, 7, 8	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4, 7, 8	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.1 RedCap FR1	
SMTC configuration		1, 4, 7, 8	SMTC.2	
		2, 5	SMTC.1	
		3, 6	SMTC.1	
OCNG Pattern		1, 2, 3, 4, 5, 6, 7, 8	OP.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6, 7, 8	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5, 7, 8	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4, 7, 8	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98	
SS-RSRP	dBm/SCS	1, 4, 7, 8	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s/I_{ot}$	dB	1, 4, 7, 8	-4	12
		2, 5		
		3, 6		
$\hat{E}_s/N_{oc}$	dB	1, 4, 7, 8	-4	12
		2, 5		
		3, 6		
Io	dBm/9.36 MHz	1, 4, 7, 8	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/18.36 MHz	3, 6	-65.67	-54.85
Tre-selection	s	1, 2, 3, 4, 5, 6, 7, 8	0	
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6, 7, 8	Not sent	
$Thresh_{x, highP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	48	
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	44	
$Thresh_{x, lowP (Note 2)}$	dB	1, 2, 3, 4, 5, 6, 7, 8	50	
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration			1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell

Table A. 16.1.2.4.2-4: Cell specific test parameters for E-UTRA Cell 2

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	

Parameter	Unit	Cell 2	
		T1	T2
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 KHz	-84	-84
$\hat{E}_s / I_{ot}$	dB	14	14
$\hat{E}_s / N_{oc}$	dB	14	14
Tre-selection$_{EUTRAN}$	s	0	
SnonintrasearchP	dB	Not sent	
Thresh$_{x, highP}$ (Note 2)	dB	48	
Thresh$_{serving, lowP}$	dB	44	
Thresh$_{x, lowP}$	dB	50	
Propagation Condition		AWGN	
Antenna Configuration		1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of Thresh$_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell			

A.16.1.3.1.3 Test Requirements

The cell re-selection delay to a lower priority E-UTRAN cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

$T_{higher_priority_search_RedCap}$ See clause 4.2B.2.7

$T_{evaluate, E-UTRAN_RedCap}$ See table 4.2B.2.5-1 in clause 4.2B.2.5

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 7.68 s, allow 8 s for the cell re-selection delay to a lower priority E-UTRAN cell.

A.16.1.2.5 Cell re-selection to lower priority E-UTRAN for UE fulfilling stationary relaxed measurement criterion for 1 Rx UE

A.16.1.2.5.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell re-selection when UE fulfills the stationary relaxed measurement criterion specified in clause 4.2B.2.11.2 and the E-UTRAN cell is of lower priority.

A.16.1.2.5.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.16.1.2.5.2-1, A.16.1.2.5.2-2, A.16.1.2.5.2-3 and A.16.1.2.5.2-4. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both NR Cell 1 and E-UTRAN Cell 2 are already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of lower priority than Cell 1.

As specified in the Test Purpose, the UE is configured with the stationary relaxed measurement criterion defined in clause 5.2.4.9.1 in [1]. So, Cell 1 configures the UE as follows:

- *stationaryMobilityEvaluation* [2] criterion is configured according to the parameters listed in table A.16.1.1.8.2-3;
- *cellEdgeEvaluationWhileStationary* [2] criterion is not configured;
- *combineRelaxedMeasCondition2* [2] is not configured;

Table A.16.1.2.5.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.16.1.2.5.2-2: General test parameters for NR to E-UTRAN cell re-selection test case for UE fulfilling stationary criterion for 1 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE camps on Cell 1 in the initial phase, it fulfills stationary criterion, and during T1 period the UE reselects to Cell 2
	Neighbour cells		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	
T1 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	The UE shall perform re-selection to Cell 2 during T1
	Neighbour cells		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE shall perform re-selection to Cell 1 with higher priority during T2 for iteration of the tests.
	Neighbour cells		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	
Access Barring Information		-	1, 2, 3, 4, 5, 6, 7, 8	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6, 7, 8	0.64	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6, 7, 8	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3, 7, 8	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6	4	

Parameter	Unit	Test configuration	Value	Comment
T1	s	1, 2, 3, 4, 5, 6, 7, 8	35	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2	s	1, 2, 3, 4, 5, 6, 7, 8	35	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.16.1.2.5.2-3: Cell specific test parameters for NR Cell 1 for 1 Rx UE

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 4,7, 8	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4, 8	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4, 8	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4, 8	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4, 8	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.1 RedCap FR1	
SMTC configuration		1, 4, 8	SMTC.2	
		2, 5	SMTC.1	
		3, 6	SMTC.1	
OCNG Pattern		1, 2, 3, 4, 5, 6, 7, 8	OP.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6, 7, 8	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4, 8	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98	
SS-RSRP	dBm/SCS	1, 4, 8	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s / I_{ot}$	dB	1, 4, 8	-4	12
		2, 5		
		3, 6		
$\hat{E}_s / N_{oc}$	dB	1, 4, 8	-4	12
		2, 5		
		3, 6		
Io	dBm/9.36 MHz	1, 4, 8	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/18.36 MHz	3, 6	-65.67	-54.85
Tre-selectionP	s	1, 2, 3, 4, 5, 6, 7, 8	0	
Snonintrasearch	dB	1, 2, 3, 4, 5, 6, 7, 8	50	
$Thresh_{x, highP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	48	
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	44	
$Thresh_{x, lowP (Note 2)}$	dB	1, 2, 3, 4, 5, 6, 7, 8	50	
$S_{SearchDeltaP-Stationary}$	dB	1, 2, 3, 4, 5, 6, 7, 8	3	
$T_{SearchDeltaP-Stationary}$	s	1, 2, 3, 4, 5, 6, 7, 8	5	
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration			1x1	

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of $Thresh_{x, low}$ which is included in NR system information, and is a threshold for the E-UTRA target cell				

Table A.16.1.2.5.2-4: Cell specific test parameters for E-UTRA Cell 2 for 1 Rx UE

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 KHz	-84	-84
$\hat{E}_s / I_{ot}$	dB	14	14
$\hat{E}_s / N_{oc}$	dB	14	14
$Tre\text{-}selection_{EUTRAN}$	s	0	
Snonintrasearch	dB	Not sent	
$Thresh_{x, high (Note 2)}$	dB	48	
$Thresh_{serving, low}$	dB	44	
$Thresh_{x, low}$	dB	50	
Propagation Condition		AWGN	
Antenna Configuration		1x1	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell			

A.16.1.2.5.3 Test Requirements

The cell re-selection delay to a lower priority E-UTRAN cell with UE fulfilling stationary relaxed measurement criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCConnectionRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a lower priority cell shall be less than 32 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate,EUTRAN_Relax} + T_{SI\text{-}E\text{-}UTRA}$,

Where:

$T_{evaluate,EUTRAN_Relax}$ See table 4.2B.2.11.2-1 in clause 4.2B.2.11.2

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 30.72 ($T_{evaluate,EUTRAN_Relax}$) + 1.28 ($T_{SI-E-UTRA}$) = 32 s for the cell re-selection delay to a lower priority E-UTRAN cell for stationary relaxed measurement criterion.

A.16.1.2.6 Cell re-selection to lower priority E-UTRAN for UE fulfilling stationary relaxed measurement criterion for 2 Rx UE

A.16.1.2.6.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell re-selection when UE fulfills the stationary relaxed measurement criterion specified in clause 4.2B.2.11.2 and the E-UTRAN cell is of lower priority.

A.16.1.2.6.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.16.1.2.6.2-1, A.16.1.2.6.2-2, A.16.1.2.6.2-3 and A.16.1.2.6.2-4. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both NR Cell 1 and E-UTRAN Cell 2 are already identified by the UE prior to the start of the test. E-UTRAN Cell 2 is of lower priority than Cell 1.

As specified in the Test Purpose, the UE is configured with the stationary relaxed measurement criterion defined in clause 5.2.4.9.1 in [1]. So, Cell 1 configures the UE as follows:

- *stationaryMobilityEvaluation* [2] criterion is configured according to the parameters listed in table A.16.1.1.8.2-3;
- *cellEdgeEvaluationWhileStationary* [2] criterion is not configured;
- *combineRelaxedMeasCondition2* [2] is not configured;

Table A.16.1.2.6.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.16.1.2.6.2-2: General test parameters for NR to E-UTRAN cell re-selection test case for UE fulfilling stationary criterion for 2 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE camps on Cell 1 in the initial phase, it fulfills stationary criterion, and during T1 period the UE reselects to Cell 2
	Neighbour cells		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	
T1 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	The UE shall perform re-selection to Cell 2 during T1

Parameter		Unit	Test configuration	Value	Comment
	Neighbour cells		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	The UE shall perform re-selection to Cell 1 with higher priority during T2 for iteration of the tests.
	Neighbour cells		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	
Access Barring Information		-	1, 2, 3, 4, 5, 6, 7, 8	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6, 7, 8	0.64	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6, 7, 8	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3, 7	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6, 8	4	
T1		s	1, 2, 3, 4, 5, 6, 7, 8	35	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6, 7, 8	35	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.16.1.2.6.2-3: Cell specific test parameters for NR Cell 1 for 2 Rx UE

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 4, 7, 8	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4, 7, 8	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4, 7, 8	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4, 7, 8	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4, 7, 8	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4, 7, 8	SMTC.2	
		2, 5	SMTC.1	
		3, 6	SSB.1 RedCap FR1	
OCNG Pattern		1, 2, 3, 4, 5, 6, 7, 8	OP.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6, 7, 8	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4, 7, 8	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98	
SS-RSRP	dBm/SCS	1, 4, 7, 8	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s / I_{ot}$	dB	1, 4, 7, 8	-4	12
		2, 5		
		3, 6		
$\hat{E}_s / N_{oc}$	dB	1, 4, 7, 8	-4	12

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
		2, 5		
		3, 6		
Io	dBm/9.36 MHz	1, 4, 7, 8	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/18.36 MHz	3, 6	-65.67	-54.85
Tre-selectionP	s	1, 2, 3, 4, 5, 6, 7, 8	0	
Snonintrasearch	dB	1, 2, 3, 4, 5, 6, 7, 8	50	
$Thresh_{x, highP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	48	
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	44	
$Thresh_{x, lowP (Note 2)}$	dB	1, 2, 3, 4, 5, 6, 7, 8	50	
$S_{SearchDeltaP-Stationary}$	dB	1, 2, 3, 4, 5, 6, 7, 8	3	
$T_{SearchDeltaP-Stationary}$	s	1, 2, 3, 4, 5, 6, 7, 8	5	
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration			1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of $Thresh_{x, low}$ which is included in NR system information, and is a threshold for the E-UTRA target cell				

Table A.16.1.2.6.2-4: Cell specific test parameters for E-UTRA Cell 2 for 2 Rx UE

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA[Note 1]	dB		
OCNG_RB[Note 1]	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 KHz	-84	-84
$\hat{E}_s / I_{ot}$	dB	14	14
$\hat{E}_s / N_{oc}$	dB	14	14
$Tre\text{-}selection_{EUTRAN}$	s	0	
Snonintrasearch	dB	Not sent	
$Thresh_{x, high (Note 2)}$	dB	48	
$Thresh_{serving, low}$	dB	44	
$Thresh_{x, low}$	dB	50	
Propagation Condition		AWGN	
Antenna Configuration		1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell			

A.16.1.2.6.3 Test Requirements

The cell re-selection delay to a lower priority E-UTRAN cell with UE fulfilling stationary relaxed measurement criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCConnectionRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a lower priority cell shall be less than 32 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate,EUTRAN_Relax} + T_{SI\text{-}E\text{-}UTRA}$,

Where:

$T_{evaluate,EUTRAN_Relax}$ See table 4.2B.2.11.2-1 in clause 4.2B.2.11.2

$T_{SI\text{-}E\text{-}UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 30.72 ($T_{evaluate,EUTRAN_Relax}$) + 1.28 ($T_{SI\text{-}E\text{-}UTRA}$) = 32 s for the cell re-selection delay to a lower priority E-UTRAN cell for stationary relaxed measurement criterion.

A.16.2 SA: RRC_INACTIVE state mobility for RedCap

A.16.2.1 Configured Grant based Small Data Transmissions (CG-SDT) for RedCap

A.16.2.1.1 NR UE CG-SDT Test in FR1 for 1 Rx RedCap UE

A.16.2.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE properly perform TA validation for CG-SDT transmission in clause 5.2B.3. The test includes two sub-tests, Sub-test#1 for testing valid TA where UE can initiate CG-SDT transmission, and Sub-test#2 for testing invalid TA where UE does not initiate CG-SDT transmission. Subtest#2 is only tested if Sub-test#1 is passed. For each sub-test, UE is configured with CG-SDT configurations when entering RRC Inactive state. Sub-test#1 consists of four successive time periods, with time duration of T1, T2, T3 and T4 respectively. Sub-test#2 consists of two successive time periods, with time duration of T5 and T6 respectively. There is one cell, which is the active NR cell in FR1. Figure A.16.2.1.1.1-1 shows the variation of the RSRP over the duration of Sub-test#1 and Figure A.16.2.1.1.1-2 shows the variation of the RSRP over the duration of Sub-test#2.

In Sub-test#1:

- Prior to the time point TA, the UE shall be fully synchronized to PCell (Cell 1), be registered to the cell and have entered RRC connected mode.
- Before starting the test at time point TA, test equipment configures RSRP to P0.
- At time point TB, RSRP is changed from P0 to P1.
- At time point TC, which is W1 after time point TB, UE expect to receive RRC release with CG-SDT configuration and RRC status is changed to INACTIVE status.
- At time point TD, RSRP is changed from P1 to P0.
- At time point TE, RSRP is changed from P0 to P2. TE must be W2 before TF.
- Test equipment triggers UL data arrival at UE lower layer at time point TF. After time point TF, test equipment observes whether UE transmits with CG-SDT no later than TG which is W3 after TF.
- After time point TG, RRC status is changed from RRC INACTIVE to RRC CONNECTED.

In Sub-test#2:

- Prior to the time point TA, the UE shall pass Sub-test#1 and have entered RRC connected mode. Otherwise, Sub-test#2 shall not be executed.
- From time point TA to time point TD, RSRP is set to P2.
- At time point TC, which is W1 after time point TB, UE expect to receive RRC release with CG SDT configuration and RRC status is changed to INACTIVE status.
- At time point TD, RSRP is changed from P2 to P0.
- Test equipment triggers UL data arrival at UE lower layer at time point TF. TF is 3360 ms after TD. After time point TF, test equipment observes whether UE transmits with CG-SDT no later than TG which is W3 after TF.

W1 equals to 640 ms and W2 equals to 640 ms based on requirements in clause 5.2B.2.1. W3 is 860 ms.

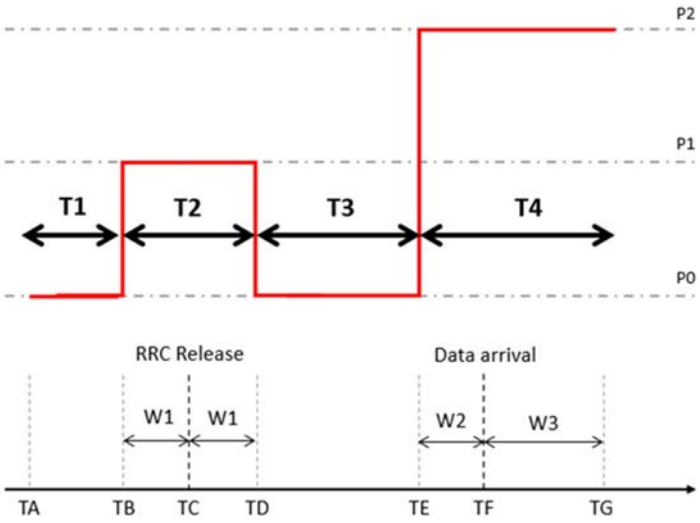


Figure A.16.2.1.1.1-1: RSRP variation model for CG-SDT Sub-test#1

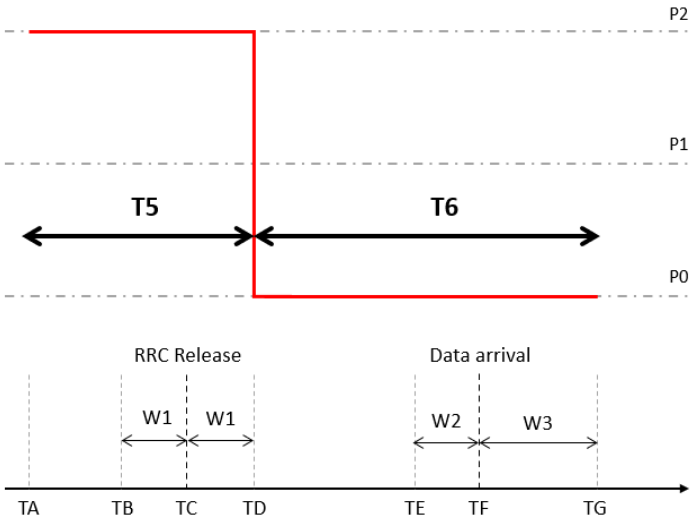


Figure A.16.2.1.1.1-2: RSRP variation model for CG-SDT Sub-test#2

A.16.2.1.1.2 Test Parameters

Supported test configurations are shown in table A.16.2.1.1.2-1. The test parameters for the PCell are given in table A.16.2.1.1.2-2 and table A.16.2.1.1.2-3.

Table A.16.2.1.1.2-1: NR configuration for FR1 SSB

Config	Description
1	NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	NR HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.2.1.1.2-2: General test parameters

Parameter		Unit	Value	Comment
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
	Config 4		HD-FDD	
TDD Configuration	Config 1		N/A	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
	Config 4		N/A	
$BW_{channel}$	Config 1, 2, 4	MHz	10: $N_{PRB,c}$ = 52	
	Config 3		20: $N_{PRB,c}$ = 51	
PDSCH Reference measurement channel	Config 1, 4		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.3 FDD	
	Config 2		CCR.1.3 TDD	
	Config 3		CCR.2.2 TDD	
SSB configuration	Config 1		SSB.1 FR1	
	Config 2, 4		SSB.1 FR1	
	Config 3		SSB. 1 RedCap FR1	
OCNG Patterns			OP.1	
Initial BWP Configuration	Config 1, 2, 3, 4		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1 ULBWP.1.1	
SMTC configuration	Config 1, 2, 4		SMTC.1	
	Config 3		SMTC.1	
DRX configuration	Config 1, 2, 3, 4	ms	640	
T_delay_modeB	Config 1, 2, 3, 4	s	[4]	
T1	Config 1, 2, 3, 4	s	0.4	
T2	Config 1, 2, 3, 4	s	1.28	2 x W1
T3	Config 1, 2, 3, 4	s	2.72	T_timer_modeB - W1 - W2
T4	Config 1, 2, 3, 4	s	[1.5]	W2+W3
T5	Config 1, 2, 3, 4	s	[1.68]	T1+T2
T6	Config 1, 2, 3, 4	s	4.22	T3+W2+W3
cg-SDT-RSRP-ChangeThreshold	Config 1, 2, 3, 4	dB	8	
cg-SDT-RSRP-ThresholdSSB	Config 1, 2, 3, 4	dBm	-110	
cg-SDT-TimeAlignmentTime	Config 1, 2, 3, 4		infinity	
CG-SDT resource period	Config 1, 2, 3, 4	ms	320 ms	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				

Parameter		Unit	Value	Comment
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS				
EPRE ratio of OCNG to OCNG DMRS				
Propagation condition	Config 1, 2, 3, 4		AWGN	
Antenna Configuration			1x1	

Table A.16.2.1.1.2-3: SSB specific test parameters

Parameter	Config	Unit	SSB#0					
			T1	T2	T3	T4	T5	T6
N_{oc} Note1	1, 2, 3, 4	dBm/15 kHz	-100					
N_{oc} Note1	1, 2, 4	dBm/SSB SCS	-100					
	3	dBm/SSB SCS	-97					
$\hat{E}_s/I_{ot}$	1, 2, 3, 4	dB	0	12	0	14	14	0
SS RSRP Note2	1, 2, 4	dBm/SSB SCS	-100	-88	-100	-86	-86	-100
	3	dBm/SSB SCS	-97	-85	-97	-83	-83	-97
Io Note2	1, 2, 4	dBm/ 9.36 MHz	-69.04	-59.78	-69.04	-57.88	-57.88	-69.04
	3	dBm/ 18.36 MHz	-66.11	-56.86	-66.11	-54.95	-54.95	-66.11
$\hat{E}_s/N_{oc}$	1, 2, 3, 4	dB	0	12	0	14	14	0
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

A.16.2.1.1.3 Test requirements

The UE behaviour in each test during time durations shall be as follows:

During Sub-test#1, UE shall transmit PUSCH at CG-SDT resource within 860 ms after time point TF.

During Sub-test#2, after passing Sub-test#1, UE shall not transmit PUSCH at CG-SDT resources after TF until the end of the test at time point TG.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.2.1.2 NR UE CG-SDT Test in FR1 for 2 Rx RedCap UE

A.16.2.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE properly perform TA validation for CG-SDT transmission in clause 5.2B.3. The test includes two sub-tests, Sub-test#1 for testing valid TA where UE can initiat CG-SDT transmission, and Sub-test#2 for testing invalid TA where UE does not initiate CG-SDT transmission. Subtest#2 is only tested if Sub-test#1 is passed. For each sub-test, UE is configured with CG-SDT configurations when entering RRC Inactive state. Sub-test#1 consists of four successive time periods, with time duration of T1, T2, T3 and T4 respectively. Sub-test#2 consists of two successive time periods, with time duration of T5 and T6 respectively. There is one cell, which is the active NR cell in FR1. Figure A.16.2.1.2.1-1 shows the variation of the RSRP over the duration of Sub-test#1 and Figure A.16.2.1.2.1-2 shows the variation of the RSRP over the duration of Sub-test#2.

In Sub-test#1:

- Prior to the time point TA, the UE shall be fully synchronized to PCell (Cell 1), be registered to the cell and have entered RRC connected mode.
- Before starting the test at time point TA, test equipment configures RSRP to P0.
- At time point TB, RSRP is changed from P0 to P1.
- At time point TC which is W1 after time point TB, UE expect to receive RRC release with CG-SDT configuration and RRC status is changed to INACTIVE status.
- At time point TD, RSRP is changed from P1 to P0.
- At time point TE, RSRP is changed from P0 to P2. TE must be W2 before TF.

  Test equipment triggers UL data arrival at UE lower layer at time point TF. After time point TF, test equipment observes whether UE transmits with CG-SDT no later than TG which is W3 after TF.
- After time point TG, RRC status is changed from RRC INACTIVE to RRC CONNECTED.

In Sub-test#2:

- Prior to the time point TA, the UE shall pass Sub-test#1 and have entered RRC connected mode. Otherwise, Sub-test#2 shall not be executed.
- From time point TA to time point TD, RSRP is set to P2.
- At time point TC, which is W1 after time point TB, UE expect to receive RRC release with CG SDT configuration and RRC status is changed to INACTIVE status.
- At time point TD, RSRP is changed from P2 to P0.
- Test equipment triggers UL data arrival at UE lower layer at time point TF. TF is 3360 ms after TD. After time point TF, test equipment observes whether UE transmits with CG-SDT no later than TG which is W3 after TF.

W1 equals to 640 ms and W2 equals to 640 ms based on requirements in clause 5.2B.2.1. W3 is 860 ms.

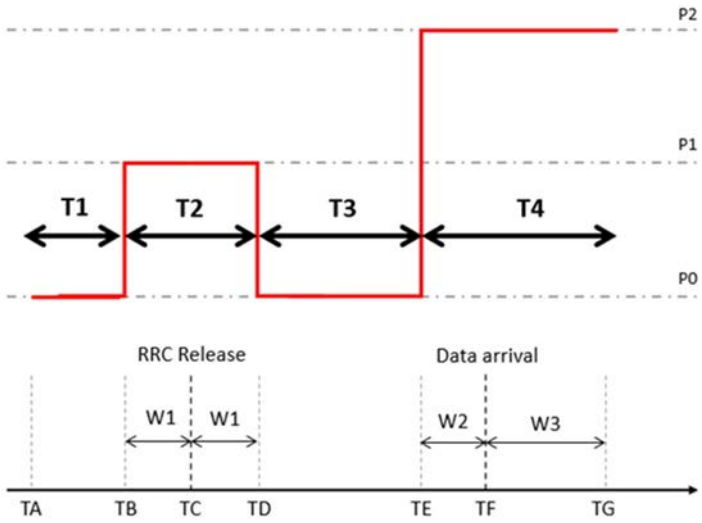


Figure A.16.2.1.2.1-1: RSRP variation model for CG-SDT Sub-test#1

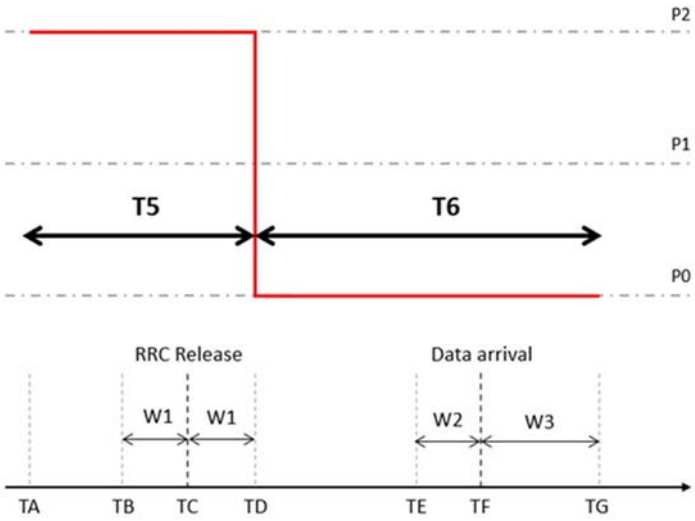


Figure A.16.2.1.2.1-2: RSRP variation model for CG-SDT Sub-test#2

A.16.2.1.2.2 Test Parameters

Supported test configurations are shown in table A.16.2.1.2.2-1. The test parameters for the PCell are given in table A.16.2.1.2.2-2 and table A.16.2.1.2.2-3.

Table A.16.2.1.2.2-1: NR configuration for FR1 SSB

Config	Description
1	NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	NR HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.2.1.2.2-2: General test parameters

Parameter		Unit	Value	Comment
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
	Config 4		HD-FDD	
TDD Configuration	Config 1		N/A	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
	Config 4		N/A	
$BW_{channel}$	Config 1, 2, 4	MHz	10: $N_{PRB,c}$ = 52	
	Config 3		20: $N_{PRB,c}$ = 51	
PDSCH Reference measurement channel	Config 1, 4		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.3 FDD	
	Config 2		CCR.1.3 TDD	
	Config 3		CCR.2.2 TDD	
SSB configuration	Config 1		SSB.1 FR1	
	Config 2, 4		SSB.1 FR1	
	Config 3		SSB. 1 RedCap FR1	
OCNG Patterns			OP.1	
Initial BWP Configuration	Config 1, 2, 3, 4		DLBWP.0.1 ULBWP.0.1	

Parameter		Unit	Value	Comment
Dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1 ULBWP.1.1	
SMTC configuration	Config 1, 2, 4		SMTC.1	
	Config 3		SMTC.1	
DRX configuration	Config 1, 2, 3, 4	ms	640	
T_delay_modeB	Config 1, 2, 3, 4	s	4	
T1	Config 1, 2, 3, 4	s	[0.4]	
T2	Config 1, 2, 3, 4	s	[1.28]	2 x W1
T3	Config 1, 2, 3, 4	s	[2.72]	T_timer_modeB - W1 - W2
T4	Config 1, 2, 3, 4	s	[1.5]	W2+W3
T5	Config 1, 2, 3, 4	s	[1.68]	T1+T2
T6	Config 1, 2, 3, 4	s	[4.22]	T3+W2+W3
cg-SDT-RSRP-ChangeThreshold	Config 1, 2, 3, 4	dB	[8]	
cg-SDT-RSRP-ThresholdSSB	Config 1, 2, 3, 4	dBm	[-110]	
cg-SDT-TimeAlignmentTime			infinity	
CG-SDT resource period		ms	[320 ms]	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS				
EPRE ratio of OCNG to OCNG DMRS				
Propagation condition	Config 1, 2, 3, 4		AWGN	
Antenna Configuration			1x2	

Table A.16.2.1.2.2-3: SSB specific test parameters

Parameter	Config	Unit	SSB#0					
			T1	T2	T3	T4	T5	T6
N_{oc} Note1	1, 2, 3, 4	dBm/15 kHz	-100					
N_{oc} Note1	1, 2, 4	dBm/SSB SCS	-100					
	3	dBm/SSB SCS	-97					
$\hat{E}_s/I_{ot}$	1, 2, 3, 4	dB	0	12	0	14	14	0
SS RSRP Note2	1, 2, 4	dBm/SSB SCS	-100	-88	-100	-86	-86	-100
	3	dBm/SSB SCS	-97	-85	-97	-83	-83	-97
Io Note2	1, 2, 4	dBm/ 9.36 MHz	-69.04	-59.78	-69.04	-57.88	-57.88	-69.04
	3	dBm/ 18.36 MHz	-66.11	-56.86	-66.11	-54.95	-54.95	-66.11
$\hat{E}_s/N_{oc}$	1, 2, 3, 4	dB	0	12	0	14	14	0

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.2.1.2.3 Test requirements

The UE behaviour in each test during time durations shall be as follows:

During Sub-test#1, UE shall transmit PUSCH at CG-SDT resource within 860 ms after time point TF.

During Sub-test#2, after passing Sub-test#1, UE shall not transmit PUSCH at CG-SDT resources after TF until the end of the test at time point TG.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.2.2 Cell Reselection for Positioning

A.16.2.2.1 Cell re-selection to FR1 intra-frequency NR case with RRC_INACTIVE eDRX and positioning SRS

A.16.2.2.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell re-selection requirements specified in clause 5.6A.2.2, when a RedCap UE is in RRC_INACTIVE and configured with eDRX and to transmit SRS for positioning.

A.16.2.2.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.16.2.2.1.2-1, A.16.2.2.1.2-2 and A.16.2.2.1.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. UE is configured with transmit SRS for positioning in Cell 1.

Table A.16.2.2.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.2.2.1.2-2: General test parameters for intra-frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell1	
T2 end condition	Active cell		1, 2, 3, 4	Cell2	
	Neighbour cells		1, 2, 3, 4	Cell1	
RF Channel Number			1, 2, 3, 4	1	
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1, 4	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1, 4	SMTC.2	Configured in SIB2 of Cell 1
			2	SMTC.1	
			3	SMTC.1	

DRX cycle length	s	1, 2, 3, 4	1.28	The value shall be used for all cells in the test.
CN and RAN eDRX configuration		1, 2, 3, 4	eDRX cycle = 40.96s PTW length = 1.28s	
PRACH configuration index		1, 2, 3, 4	102	The detailed configuration is specified in TS 38.211 [6] clause 6.3.3.2
rangeToBestCell		1, 2, 3, 4	Not configured	
T1	s	1, 2, 3, 4	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2	s	1, 2, 3, 4	120	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.16.2.2.1.2-3: Cell specific test parameters for intra-frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		SR.1.1 FDD	
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3, 4	OP.1		OP.1 defined in clause A.3.2.1	
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1		ULBWP.0.1	
Periodicity of SRS for positioning	s	1, 2, 3, 4	5.12		N/A	
Qrxlevmin	dBm/SCS	1, 2, 4	-130		-130	
		3	-127		-127	
Pcompensation	dB	1, 2, 3, 4	0		0	
$Qhyst_s$	dB	1, 2, 3, 4	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3, 4	0		0	
Cell_selection_and_ re-selection_quality_measurement		1, 2, 3, 4	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1, 4	16	-3.11	-infinity	2.79
		2				
		3				
N_{oc} Note2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s / N_{oc}$	dB	1, 4	16	13	-infinity	16
		2				
		3				
SS-RSRP Note3	dBm/SCS	1, 4	-82	-85	-infinity	-82
		2	-82	-85	-infinity	-82

		3	-79	-82	-infinity	-79
Io	dBm/9.36 MHz	1, 4	-53.94	-52.21	Same as parameters specified in Cell 1 columns-	
	dBm/9.36 MHz	2	-53.94	-52.21		
	dBm/18.36 MHz	3	-51.02	-53.92		
Tre-selection	s	1, 2, 3, 4	0	0	0	0
SintrasearchP	dB	1, 2, 3, 4	60		60	
Propagation Condition		1, 2, 3, 4	AWGN			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.16.2.2.1.3 Test Requirements

The cell re-selection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2 and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 119 s.

The rate of correct cell re-selections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI-NR}$,

where:

T_{detect, NR_Intra} See table 5.6.1A.2-1 in clause 5.6.1A.2,

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280ms is assumed in this test case.

This gives a total of 119.04 s, allow 120 s for the cell re-selection delay to a newly detectable cell.

A.16.3 RRC_CONNECTED state mobility for RedCap

A.16.3.1 Handover

A.16.3.1.1 Intra-frequency handover from FR1 to FR1; known target cell for 1 Rx UE

A.16.3.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency handover requirements for 1 Rx RedCap UE as specified in clause 6.1D.1.2.

A.16.3.1.1.2 Test Parameters

Supported test configurations are shown in table A.16.3.1.1.2-1. Both handover delay and interruption length are tested by using the parameters in table A.16.3.1.1.2-2, and A.16.3.1.1.2-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2.

NR shall send an RRC message implying handover to Cell 2, then UE handover to Cell 2's initial BWP associated with CD-SSB. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3. T3 is defined as the end of the last TTI containing the RRC message implying handover.

Table A.16.3.1.1.2-1: Intra-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.1.1.2-2: General test parameters Intra-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
TimeToTrigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.16.3.1.1.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency handover test case

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			1		
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
	Config 4		HD-FDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		20: $N_{PRB,c}$ = 51					
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		20: $N_{PRB,c}$ = 51					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD					
	Config 2		SR.1.1 TDD					
	Config 3		SR.2.1 TDD					
CORESET Reference Channel	Config 1,4		CR.1.1 FDD					
	Config 2		CR.1.1 TDD					
	Config 3		CR.2.1 TDD					
TRS configuration	Config 1,4		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
OCNG Patterns			OP.1					

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
SMTC Configuration			SMTC.1					
SSB Configuration	Config 1,2,4		SSB.1 FR1			SSB.1 FR1		
	Config 3		SSB.1 RedCap FR1			SSB.1 RedCap FR1		
PDSCH/PDCCH subcarrier spacing	Config 1,2,4	kHz	15 kHz					
	Config 3		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2,4	kHz	15 kHz					
	Config 3		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15 kHz	-98					
N_{oc} Note2	Config 1,2,4	dBm/SCS	-98					
	Config 3		-95					
$\hat{E}_s / I_{ot}$		dB	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s / N_{oc}$		dB	8	8	8	-Infinity	11	11
SSB_RP	Config 1,2,4	dBm/SCS	-90	-90	-90	-Infinity	-87	-87
	Config 3	dBm/SCS	-87	-87	-87	-Infinity	-84	-84
Io Note3	Config 1,2,4	dBm/ 9.36 MHz	-57.06	-57.06	-61.41	-57.06	-57.06	-57.06
	Config 3	dBm/ 18.36 MHz	-54.14	-54.14	-58.49	-54.14	-54.14	-54.14
Propagation condition		-	AWGN			AWGN		
Antenna Configuration			1x1					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.3.1.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 62 ms in the test. $T_{interrupt}$ is defined in clause 6.1D.1.2.

This gives a total of 72 ms.

A.16.3.1.2 Intra-frequency handover from FR1 to FR1; known target cell for 2 Rx UE

A.16.3.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency handover requirements for 2 Rx RedCap UE as specified in clause 6.1D.1.2.

A.16.3.1.2.2 Test Parameters

Supported test configurations are shown in table A.16.3.1.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.16.3.1.2.2-2, and A.16.3.1.2.2-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2.

NR shall send an RRC message implying handover to Cell 2, then UE handover to Cell 2's initial BWP associated with CD-SSB. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3. T3 is defined as the end of the last TTI containing the RRC message implying handover.

Table A.16.3.1.2.2-1: Intra-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.1.2.2-2: General test parameters Intra-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
TimeToTrigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.16.3.1.2.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency handover test case

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			1		
Duplex mode	Config 2,3		TDD					
	Config 4		HD-FDD					
Duplex mode	Config 1		FDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		20: $N_{PRB,c}$ = 51					
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
	Config 3		20: $N_{PRB,c}$ = 51					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD					
	Config 2		SR.1.1 TDD					
	Config 3		SR2.1 TDD					
CORESET Reference Channel	Config 1,4		CR.1.1 FDD					
	Config 2		CR.1.1 TDD					
	Config 3		CR2.1 TDD					
TRS configuration	Config 1,4		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
SSB Configuration	Config 1,2,4		SSB.1 FR1			SSB.1 FR1		
	Config 3		SSB.1 RedCap FR1			SSB.1 RedCap FR1		
PDSCH/PDCCH subcarrier spacing	Config 1,2,4	kHz	15 kHz					
	Config 3		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2,4	kHz	15 kHz					
	Config 3		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15 kHz	-98					
N_{oc} Note2	Config 1,2,4	dBm/SCS	-98					
	Config 3		-95					
$\hat{E}_s / I_{ot}$		dB	8	-3.3	-3.3	-Infinity	2.36	2.36
$\hat{E}_s / N_{oc}$		dB	8	8	8	-Infinity	11	11
SSB_RP	Config 1,2,4	dBm/SCS	-90	-90	-90	-Infinity	-87	-87
	Config 3	dBm/SCS	-87	-87	-87	-Infinity	-84	-84
Io Note3	Config 1,2,4	dBm/ 9.36 MHz	-61.41	-57.06	-57.06	-61.41	-57.06	-57.06
	Config 3	dBm/ 18.36 MHz	-58.49	-54.14	-54.14	-58.49	-54.14	-54.14
Propagation condition		-	AWGN			AWGN		
Antenna Configuration			1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.3.1.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 62 ms in the test. $T_{interrupt}$ is defined in clause 6.1D.1.2.

This gives a total of 72 ms.

A.16.3.1.3 Intra-frequency handover from FR1 to FR1; unknown target cell for 1 Rx UE

A.16.3.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency handover requirements for 1 Rx RedCap UE as specified in clause 6.1D.1.2.

A.16.3.1.3.2 Test Parameters

Supported test configurations are shown in table A.16.3.1.3.2-1. Both handover delay and interruption length are tested by using the parameters in table A.16.3.1.3.2-2, and A.16.3.1.3.2-3.

Before the test starts,

- UE is connected to Cell 1 with active DL BWP and active UL BWP;
- UE is configured with *nonCellDefiningSSB-r17* under *BWP-DownlinkDedicated* which serves as the reference SSB for the serving cell. The *nonCellDefiningSSB-r17* corresponds to the NCD-SSB within the active DL BWP.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network indicating the UE to handover to Cell 2 with *firstActiveDownlinkBWP-Id* configured to DL BWP and *firstActiveUplinkBWP-Id* configured to UL BWP. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.16.3.1.3.2-1: Intra-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.1.3.2-2: General test parameters Intra-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	

Table A.16.3.1.3.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
	Config 4		HD-FDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf. 2.1			
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		20: $N_{PRB,c}$ = 51			
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 25			
	Config 2		10: $N_{PRB,c}$ = 25			
	Config 3		20: $N_{PRB,c}$ = 25			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1, 4		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR.2.1 TDD			
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR.2.1 TDD			
TRS configuration	Config 1, 4		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC configuration for CD-SSB			SMTC.1			
SMTC configuration for NCD-SSB			SMTC.2 RedCap			
CD-SSB Configuration	Config 1,2,4		SSB.1 FR1			
	Config 3		SSB.1 RedCap FR1			
NCD-SSB Configuration	Config 1,2,4		SSB.6 RedCap FR1 (Note 1)			
	Config 3		SSB.7 RedCap FR1 (Note 1)			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4	kHz	15			
	Config 3		30			
PUCCH/PUSCH subcarrier spacing	Config 1,2,4	kHz	15			
	Config 3		30			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1 RedCap (Note 2)		DLBWP.1.1 RedCap (Note 2)	
	Initial UL BWP		ULBWP.0.1		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1 RedCap (Note 3)		ULBWP.1.1 RedCap (Note 3)	
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 4)						
EPRE ratio of OCNG to OCNG DMRS (Note 4)						
N_{oc} Note5		dBm/15 kHz	-98			
N_{oc} Note5	Config 1,2,4	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	8	-0.64	-Infinity	-0.64
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	8

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
SSB_RP	Config 1,4	dBm/SCS	-90	-90	-Infinity	-90
	Config 2	dBm/SCS	-90	-90	-Infinity	-90
	Config 3	dBm/SCS	-87	-87	-Infinity	-87
Io[Note6]	Config 1,2,4	dBm/ 9.36 MHz	-61.41	-58.71	-61.41	-58.71
	Config 3	dBm/ 18.36 MHz	-58.48	-55.78	-58.48	-55.78
Propagation condition		-	AWGN		AWGN	
Antenna Configuration			1x1		1x1	

NOTE 1: NCD-SSB is configured within dedicated RedCap DL BWP and CD-SSB is configured completely outside the dedicated RedCap DL BWP.
NOTE 2: The starting PRB index for dedicated DL BWP corresponding to NCD-SSB PRB index.
NOTE 3: The starting PRB index for dedicated UL BWP is the same as the dedicated DL BWP corresponding to NCD-SSB PRB index.
NOTE 4: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.3.1.3.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 292 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 282 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2 and T_{search} defined in caluse 6.1D.1.2.

This gives a total of 292 ms.

A.16.3.1.4 Intra-frequency handover from FR1 to FR1; unknown target cell for 2 Rx UE

A.16.3.1.4.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-frequency handover requirements for 2 Rx RedCap UE as specified in clause 6.1D.1.2.

A.16.3.1.4.2 Test Parameters

Supported test configurations are shown in table A.16.3.1.4.2-1. Both handover delay and interruption length are tested by using the parameters in table A.16.3.1.4.2-2, and A.16.3.1.4.2-3.

Before the test starts,

- UE is connected to Cell 1 with active DL BWP and active UL BWP
- UE is configured with *nonCellDefiningSSB-r17* under *BWP-DownlinkDedicated* which serves as the reference SSB for the serving cell. The *nonCellDefiningSSB-r17* corresponds to the NCD-SSB within the active DL BWP.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network indicating the UE to handover to Cell 2 with *firstActiveDownlinkBWP-Id* configured to DL BWP and *firstActiveUplinkBWP-Id* configured to UL BWP. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.16.3.1.4.2-1: Intra-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.1.4.2-2: General test parameters Intra-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	

Table A.16.3.1.4.2-3: Cell specific test parameters for NR FR1-FR1 Intra-frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
	Config 4		HD-FDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf. 2.1			
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		20: $N_{PRB,c}$ = 51			
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 25			
	Config 2		10: $N_{PRB,c}$ = 25			
	Config 3		20: $N_{PRB,c}$ = 25			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1, 4		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR.2.1 TDD			
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR.2.1 TDD			
TRS configuration	Config 1, 4		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC configuration for CD-SSB			SMTC.1			
SMTC configuration for NCD-SSB			SMTC.2 RedCap			
CD-SSB Configuration	Config 1,2,4		SSB.1 FR1			
	Config 3		SSB.1 RedCap FR1			
NCD-SSB Configuration	Config 1,2,4		SSB.6 RedCap FR1 (Note 1)			
	Config 3		SSB.7 RedCap FR1 (Note 1)			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4	kHz	15			
	Config 3		30			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
PUCCH/PUSCH subcarrier spacing	Config 1,2,4	kHz	15			
	Config 3		30			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1 RedCap (Note 2)		DLBWP.1.1 RedCap (Note 2)	
	Initial UL BWP		ULBWP.0.1		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1 RedCap (Note 3)		ULBWP.1.1 RedCap (Note 3)	
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 4)						
EPRE ratio of OCNG to OCNG DMRS (Note 4)						
N_{oc} Note5		dBm/15 kHz	-98			
N_{oc} Note5	Config 1,2,4	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	8	-0.64	-Infinity	-0.64
$\hat{E}_s / N_{oc}$		dB	8	8	-Infinity	8
SSB_RP	Config 1,4	dBm/SCS	-90	-90	-Infinity	-90
	Config 2	dBm/SCS	-90	-90	-Infinity	-90
	Config 3	dBm/SCS	-87	-87	-Infinity	-87
Io Note6	Config 1,2,4	dBm/ 9.36 MHz	-61.41	-58.71	-61.41	-58.71
	Config 3	dBm/ 18.36 MHz	-58.48	-55.78	-58.48	-55.78
Propagation condition		-	AWGN		AWGN	
Antenna Configuration			1x2		1x2	

NOTE 1: NCD-SSB is configured within dedicated RedCap DL BWP and CD-SSB is configured completely outside the dedicated RedCap DL BWP.
NOTE 2: The starting PRB index for dedicated DL BWP corresponding to NCD-SSB PRB index.
NOTE 3: The starting PRB index for dedicated UL BWP is the same as the dedicated DL BWP corresponding to NCD-SSB PRB index..
NOTE 4: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

The UE shall start to transmit the PRACH to Cell 2 less than 212 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 202 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2 and T_{search} defined in caluse 6.1D.1.2.

This gives a total of 212 ms.

A.16.3.1.5 Inter-frequency handover from FR1 to FR1; unknown target cell for 1 Rx UE

A.16.3.1.5.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 inter-frequency handover requirements for 1 Rx RedCap UE as specified in clause 6.1D.1.2.

A.16.3.1.5.2 Test Parameters

Supported test configurations are shown in table A.16.3.1.5.2-1. Both handover delay and interruption length are tested by using the parameters in table A.16.3.1.5.2-2, and A.16.3.1.5.2-3.

Before the test starts,

- UE is connected to Cell 1 with active DL BWP and active UL BWP;
- UE is not configured with *nonCellDefiningSSB-r17* under *BWP-DownlinkDedicated*, and CD-SSB serves as the reference SSB for the serving cell.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network indicating the UE to handover to Cell 2 with *firstActiveDownlinkBWP-Id* configured to DL BWP and *firstActiveUplinkBWP-Id* configured to UL BWP, where Cell 2's DL BWP is the Redcap specific BWP associated with NCD-SSB. The UE then performs handover from Cell 1's active DL BWP associated with the CD-SSB to Cell 2's Redcap specific BWP associated with NCD-SSB. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.16.3.1.5.2-1: Inter-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.1.5.2-2: General test parameters Inter-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤5	

Table A.16.3.1.5.2-3: Cell specific test parameters for NR FR1-FR1 inter-frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
	Config 4		HD-FDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Config 3		20: $N_{PRB,c}$ = 51			
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		20: $N_{PRB,c}$ = 51			
TRS configuration	Config 1,4		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR.2.1 TDD			
CORESET Reference Channel	Config 1,4		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR.2.1 TDD			
OCNG Patterns			OP.1			
SMTC configuration for CD-SSB			SMTC.1			
SMTC configuration for NCD-SSB			SMTC.2 RedCap			
CD-SSB Configuration	Config 1,2,4		SSB.1 FR1			
	Config 3		SSB.1 RedCap FR1			
NCD-SSB Configuration	Config 1,2,4		SSB.6 RedCap FR1 (Note 4)			
	Config 3		SSB.7 RedCap FR1 (Note 4)			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2,4	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1 RedCap (Note 5)		DLBWP.1.1 RedCap (Note 6)	
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		DLBWP.1.1 RedCap (Note 7)		ULBWP.1.1 RedCap (Note 8)	
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98		-98	
N_{oc} Note2	Config 1,2,4	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2,4	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2,4	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 18.36 MHz	-61.67	-61.67	-67.13	-60.93
Propagation condition		-	AWGN		AWGN	
Antenna Configuration			1x1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 4: NCD-SSB is configured within dedicated RedCap DL BWP.					
NOTE 5: The starting PRB index for dedicated DL BWP corresponding to CD-SSB PRB index;					
NOTE 6: The starting PRB index for dedicated DL BWP corresponding to NCD-SSB PRB index;					
NOTE 7: The starting PRB index for dedicated UL BWP is the same as the dedicated DL BWP corresponding to CD-SSB PRB index;					
NOTE 8: The starting PRB index for dedicated UL BWP is the same as the dedicated DL BWP corresponding to NCD-SSB PRB index;					

A.16.3.1.5.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 532 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 522 ms in the test. $T_{interrupt}$ is defined in clause 6.1D.1.2.

This gives a total of 532 ms.

A.16.3.1.6 Inter-frequency handover from FR1 to FR1; unknown target cell for 2 Rx UE

A.16.3.1.6.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 inter-frequency handover requirements for 2 Rx RedCap UE as specified in clause 6.1D.1.2.

A.16.3.1.6.2 Test Parameters

Supported test configurations are shown in table A.16.3.1.6.2-1. Both handover delay and interruption length are tested by using the parameters in table A.16.3.1.6.2-2, and A.16.3.1.6.2-3.

Before the test starts,

- UE is connected to Cell 1 with active DL BWP and active UL BWP;
- UE is not configured with *nonCellDefiningSSB-r17* under *BWP-DownlinkDedicated*, and CD-SSB serves as the reference SSB for the serving cell.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network indicating the UE to handover to Cell 2 with *firstActiveDownlinkBWP-Id* configured to DL BWP and *firstActiveUplinkBWP-Id* configured to UL BWP, where Cell 2's DL BWP is the Redcap specific BWP associated with NCD-SSB. The UE then performs handover from Cell 1's active DL-BWP associated with the CD-SSB to Cell 2's Redcap specific BWP associated with NCD-SSB. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.16.3.1.6.2-1: Inter-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode

3	Source cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.1.6.2-2: General test parameters Inter-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤5	

Table A.16.3.1.6.2-3: Cell specific test parameters for NR FR1-FR1 Inter frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
	Config 4		HD-FDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		20: $N_{PRB,c}$ = 51			
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		20: $N_{PRB,c}$ = 51			
TRS configuration	Config 1,4		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1,4		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OP.1			
SMTC configuration for CD-SSB			SMTC.1			
SMTC configuration for NCD-SSB			SMTC.2 RedCap			
CD-SSB Configuration	Config 1,2,4		SSB.1 FR1			
	Config 3		SSB.1 RedCap FR1			
NCD-SSB Configuration	Config 1,2,4		SSB.6 RedCap FR1 (Note 4)			
	Config 3		SSB.7 RedCap FR1 (Note 4)			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2,4	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
	Dedicated DL BWP		DLBWP.1.1 RedCap (Note 5)		DLBWP.1.1 RedCap (Note 6)	
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		DLBWP.1.1 RedCap (Note 7)		ULBWP.1.1 RedCap (Note 8)	
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98		-98	
N_{oc} Note2	Config 1,2,4	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s / I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2,4	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2,4	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 18.36 MHz	-61.67	-61.67	-67.13	-60.93
Propagation condition		-	AWGN		AWGN	
Antenna configuration			1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: NCD-SSB is configured within dedicated RedCap DL BWP.
NOTE 5: The starting PRB index for dedicated DL BWP corresponding to CD-SSB PRB index;
NOTE 6: The starting PRB index for dedicated DL BWP corresponding to NCD-SSB PRB index;
NOTE 7: The starting PRB index for dedicated UL BWP is the same as the dedicated DL BWP corresponding to CD-SSB PRB index;
NOTE 8: The starting PRB index for dedicated UL BWP is the same as the dedicated DL BWP corresponding to NCD-SSB PRB index;

A.16.3.1.6.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 372 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 362 ms in the test. $T_{interrupt}$ is defined in clause 6.1D.1.2.

This gives a total of 372 ms.

A.16.3.1.7 SA NR - E-UTRAN handover for 1 Rx UE

A.16.3.1.7.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to E-UTRAN handover requirements as specified in clause 6.1D.2.1.

The test comprises of one NR carrier and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in table 9.1.2-1 is configured before T2 begins to enable inter-RAT frequency monitoring.

A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the next instant after the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.16.3.1.7.1-1. General test parameters are provided in table A.16.3.1.7.1-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.16.3.1.7.1-3 and A.16.3.1.7.1-4 respectively.

Table A.16.3.1.7.1-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.1.7.1-2: General test parameters for SA inter-RAT E-UTRAN handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2	E-UTRAN cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
b2-Threshold1		dBm	As specified in table A.16.3.1.7.1-3	Absolute NR SS-RSRP threshold for event B2
b2-Threshold2EUTRAN		dBm	-98	Absolute E-UTRAN RSRP threshold for event B2
Hysteresis		dB	0	
TimeToTrigger		s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
Gap pattern configuration Id			0	As specified in table 9.1.2-1 started before T2 starts
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.16.3.1.7.1-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3, 4, 5, 6, 7, 8	1		
Duplex mode			1, 4	FDD		
			2, 3, 5, 6	TDD		
			7, 8	HD-FDD		
TDD Configuration			2, 5	TDDConf.1.1		
			3, 6	TDDConf.2.1		
$BW_{channel}$		MHz	1, 4, 7, 8	10: $N_{PRB,c}$ = 52 (FDD)		
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)		
			3, 6	20: $N_{PRB,c}$ = 51 (TDD)		
PDSCH reference measurement channel			1, 4, 7, 8	SR.1.1 FDD		
			2, 5	SR.1.1 TDD		
			3, 6	SR.2.1 TDD		
CORSET reference channel			1, 4, 7, 8	CR.1.1 FDD		
			2, 5	CR.1.1 TDD		
			3, 6	CR.2.1 TDD		
TRS configuration			1, 4, 7, 8	TRS.1.1 FDD		
			2, 5	TRS.1.1 TDD		
			3, 6	TRS.1.2 TDD		
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6, 7, 8	OP.1		
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2, 3, 4, 5, 6, 7, 8	SMTC.1 RedCap		
SSB configuration			1, 2, 4, 5, 7, 8	SSB.1 FR1		
			3, 6	SSB.1 RedCap FR1		
b2-Threshold1		dBm	1, 2, 4, 5, 7, 8	-96		
			3, 6	-93		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6, 7, 8	0		
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6, 7, 8	-100	-104	-100
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5, 7, 8	-100	-104	-100
			3, 6	-97	-101	-97
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6, 7, 8	12	0	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6, 7, 8	12	0	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5, 7, 8	-88	-104	-100
			3, 6	-85	-101	-97
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5, 7, 8	-59.78	-73.04	-69.04
		dBm/18.36 MHz	3, 6	-56.86	-70.11	-66.11
Propagation condition			1, 2, 3, 4, 5, 6, 7,8	AWGN		
Antenna Configuration				1x1		

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					

Table A.16.3.1.7.1-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	2		
Duplex mode		1, 2, 3, 7	FDD		
		4, 5, 6, 8	TDD		
TDD special subframe configuration[Note1]		4, 5, 6, 8	6		
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PRACH Configuration[Note2]		1, 2, 3, 7	4		
		4, 5, 6, 8	53		
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD		
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note3]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD		
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note4]					
OCNG_RB[Note4]					
N_{oc}[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	8	8

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
$\hat{E}_s/I_{ot}$ Note6	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	8	8
RSRP Note6	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-90	-90
SCH_RP Note6	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-90	-90
Io Note6	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-67.21 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN		
Antenna Configuration			1x1		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.16.3.1.7.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 85 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and $T_{interrupt}$ = 35 ms in the test based on requirements specified in clause 6.1D.2.1.

This gives a total of 85 ms.

A.16.3.1.8 SA NR - E-UTRAN handover for 2 Rx UE

A.16.3.1.8.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to E-UTRAN handover requirements as specified in clause 6.1D.2.1.

The test comprises of one NR carrier and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in table 9.1.2-1 is configured before T2 begins to enable inter-RAT frequency monitoring.

A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the next instant after the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.16.3.1.8.1-1. General test parameters are provided in table A.16.3.1.8.1-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.16.3.1.8.1-3 and A.16.3.1.8.1-4 respectively.

Table A.16.3.1.8.1-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests

Configuration	Description

1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.1.8.1-2: General test parameters for SA inter-RAT E-UTRAN handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2	E-UTRAN cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
b2-Threshold1		dBm	As specified in table A.16.3.1.8.1-3	Absolute NR SS-RSRP threshold for event B2
b2-Threshold2EUTRAN		dBm	-98	Absolute E-UTRAN RSRP threshold for event B2
Hysteresis		dB	0	
TimeToTrigger		s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
Gap pattern configuration Id			0	As specified in table 9.1.2-1 started before T2 starts
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.16.3.1.8.1-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3, 4, 5, 6,7, 8	1		
Duplex mode			1, 4	FDD		
			2, 3, 5, 6	TDD		
			7, 8	HD-FDD		
TDD Configuration			2, 5	TDDConf.1.1		
			3, 6	TDDConf.2.1		
$BW_{channel}$		MHz	1, 4, 7, 8	10: $N_{PRB,c}$ = 52 (FDD)		
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)		
			3, 6	20: $N_{PRB,c}$ = 51 (TDD)		
PDSCH reference measurement channel			1, 4,7, 8	SR.1.1 FDD		
			2, 5	SR.1.1 TDD		
			3, 6	SR.2.1 TDD		
CORSET reference channel			1, 4,7, 8	CR.1.1 FDD		
			2, 5	CR.1.1 TDD		
			3, 6	CR.2.1 TDD		
TRS configuration			1, 4,7, 8	TRS.1.1 FDD		
			2, 5	TRS.1.1 TDD		
			3, 6	TRS.1.2 TDD		
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6,7, 8	OP.1		
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6, 7,8	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2, 3, 4, 5, 6,7, 8	SMTC.1 RedCap		
SSB configuration			1, 2, 4, 5,7, 8	SSB.1 FR1		
			3, 6	SSB.1 RedCap FR1		
b2-Threshold1		dBm	1, 2, 4, 5,7, 8	-96		
			3, 6	-93		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6,7, 8	0		
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6,7, 8	-100	-104	-100
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5,7, 8	-100	-104	-100
			3, 6	-97	-101	-97
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6,7, 8	12	0	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6,7, 8	12	0	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5,7, 8	-88	-104	-100
			3, 6	-85	-101	-97
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5,7, 8	-59.78	-73.04	-69.04
		dBm/18.36 MHz	3, 6	-56.86	-70.11	-66.11
Propagation condition			1, 2, 3, 4, 5, 6,7, 8	AWGN		
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6,7, 8	1x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.16.3.1.8.1-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	2		
Duplex mode		1, 2, 3, 7	FDD		
		4, 5, 6, 8	TDD		
TDD special subframe configuration[Note1]		4, 5, 6, 8	6		
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PRACH Configuration[Note2]		1, 2, 3, 7	4		
		4, 5, 6, 8	53		
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD		
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note3]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD		
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note4]					
OCNG_RB[Note4]					
N_{oc}[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	8	8
$\hat{E}_s/I_{ot}$[Note6]	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	8	8
RSRP[Note6]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-90	-90
SCH_RP[Note6]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-90	-90
Io[Note6]	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-67.21 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)	-58.57 +10log($N_{PRB,c}$/100)
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN		
Antenna Configuration and Correlation Matrix [Note7]		1, 2, 3, 4, 5, 6, 7, 8	1x2 Low		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.16.3.1.8.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 85 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in clause 6.1.2.1.

$T_{interrupt}$ = 35 ms in the test; $T_{interrupt}$ is defined in clause 6.1.2.1.

This gives a total of 85 ms.

A.16.3.1.9 SA NR - E-UTRAN handover with unknown target cell for 1 Rx UE

A.16.3.1.9.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to E-UTRAN handover requirements for the case when the target E-UTRAN cell is unknown as specified in clause 6.1D.2.1.

The test comprises of one NR carrier and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable. No Gap pattern shall be configured.

A RRC message implying handover shall be sent to the UE during period T1. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.16.3.1.9-1. General test parameters are provided in table A.16.3.1.9.1-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.16.3.1.9.1-3 and A.16.3.1.9.1-4 respectively.

Table A.16.3.1.9.1-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.1.9.1-2: General test parameters for SA inter-RAT E-UTRAN handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2	E-UTRAN cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
T1		s	≤5	
T2		s	1	

Table A.16.3.1.9.1-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6,7, 8	1	
Duplex mode			1, 4	FDD	
			2, 3, 5, 6	TDD	
			7, 8	HD-FDD	
TDD Configuration			2, 5	TDDConf.1.1	
			3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4,7, 8	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)	
			3, 6	20: $N_{PRB,c}$ = 51 (TDD)	
PDSCH reference measurement channel			1, 4,7, 8	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
CORSET reference channel			1, 4,7, 8	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
TRS configuration			1, 4,7, 8	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6,7, 8	OP.1	
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1	
	Dedicated DL BWP			DLBWP.1.1	
	Initial UL BWP			ULBWP.0.1	
	Dedicated UL BWP			ULBWP.1.1	
SMTC configuration			1, 2, 3, 4, 5, 6,7, 8	SMTC.1 RedCap	
SSB configuration			1, 2, 4, 5,7, 8	SSB.1 FR1	
			3, 6	SSB.1 RedCap FR1	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6,7, 8	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6,7, 8	-98	
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5,7, 8	-98	
			3, 6	-95	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6,7, 8	0	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6,7, 8	0	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5,7, 8	-98	-98
			3, 6	-95	-95
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5,7, 8	-67.04	-67.04
		dBm/18.36 MHz	3, 6	-64.11	-64.11
Propagation condition			1, 2, 3, 4, 5, 6,7, 8	AWGN	
Antenna Configuration				1x1	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.16.3.1.9.1-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	2	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	
TDD special subframe configuration[Note1]		4, 5, 6, 7	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6, 7	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PRACH Configuration[Note2]		1, 2, 3, 7	4	
		4, 5, 6, 8	53	
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note3]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note4]				
OCNG_RB[Note4]				
N_{oc}[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
$\hat{E}_s/I_{ot}$[Note6]	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
RSRP[Note6]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-91
SCH_RP[Note6]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-91
Io[Note6]	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-70.22	-62.43
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration			1x1	
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23]. NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].				

Parameter	Unit	Configuration	Cell 2	
			T1	T2
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.				
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].				

A.16.3.1.9.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 165 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and $T_{interrupt}$ = 115 ms in the test based on requirements specified in clause 6.1D.2.1.

This gives a total of 165 ms.

A.16.3.1.10 SA NR - E-UTRAN handover with unknown target cell for 2 Rx UE

A.16.3.1.10.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to E-UTRAN handover requirements for the case when the target E-UTRAN cell is unknown as specified in clause 6.1D.2.1.

The test comprises of one NR carrier and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable. No Gap pattern shall be configured.

A RRC message implying handover shall be sent to the UE during period T1. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.16.3.1.10.1-1. General test parameters are provided in table A.16.3.1.10.12. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.16.3.1.10.1-3 and A.16.3.1.10.1-4 respectively.

Table A.16.3.1.10.1-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.1.10.1-2: General test parameters for SA inter-RAT E-UTRAN handover

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test

LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2	E-UTRAN cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
T1		s	≤5	
T2		s	1	

Table A.16.3.1.10.1-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6,7, 8	1	
Duplex mode			1, 4	FDD	
			2, 3, 5, 6	TDD	
			7, 8	HD-FDD	
TDD Configuration			2, 5	TDDConf.1.1	
			3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4,7, 8	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)	
			3, 6	20: $N_{PRB,c}$ = 51 (TDD)	
PDSCH reference measurement channel			1, 4,7, 8	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
CORSET reference channel			1, 4,7, 8	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
TRS configuration			1, 4,7, 8	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6,7, 8	OP.1	
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1	
	Dedicated DL BWP			DLBWP.1.1	
	Initial UL BWP			ULBWP.0.1	
	Dedicated UL BWP			ULBWP.1.1	
SMTC configuration			1, 2, 3, 4, 5, 6,7, 8	SMTC.1 RedCap	
SSB configuration			1, 2, 4, 5,7, 8	SSB.1 FR1	
			3, 6	SSB.1 RedCap FR1	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6,7, 8	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6,7, 8	-98	
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5,7, 8	-98	
			3, 6	-95	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6,7, 8	0	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6,7, 8	0	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5, 7, 8	-98	-98
			3, 6	-95	-95

Parameter	Unit	Configuration	Cell 1	
			T1	T2
Io[Note3]	dBm/9.36 MHz	1, 2, 4, 5,7, 8	-67.04	-67.04
	dBm/18.36 MHz	3, 6	-64.12	-64.12
Propagation condition		1, 2, 3, 4, 5, 6,7, 8	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6,7, 8	1x2 Low	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

Table A.16.3.1.10.1-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	2	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	
TDD special subframe configuration[Note1]		4, 5, 6, 8	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PRACH Configuration[Note2]		1, 2, 3, 7	4	
		4, 5, 6, 8	53	
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note3]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note4]				
OCNG_RB[Note4]				

Parameter	Unit	Configuration	Cell 2	
			T1	T2
N_{oc} Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
$\hat{E}_s/I_{ot}$ Note6	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
RSRP Note6	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-91
SCH_RP Note6	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-91
Io Note6	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-70.22	-62.43
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix Note7		1, 2, 3, 4, 5, 6, 7, 8	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.16.3.1.10.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 165 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in clause 6.1.2.1.

$T_{interrupt}$ = 115 ms in the test; $T_{interrupt}$ is defined in clause 6.1.2.1.

This gives a total of 165 ms.

A.16.3.2 RRC Connection Mobility Control

A.16.3.2.1 SA: RRC Re-establishment

A.16.3.2.1.1 Intra-frequency RRC Re-establishment in FR1 for 1 Rx UE

A.16.3.2.1.1.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR1 with known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1B.

The test parameters are given in table A.16.3.2.1.1.1-1, table A.16.3.2.1.1.1-2 and table A.16.3.2.1.1.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.16.3.2.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode

3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.3.2.1.1.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR1 for 1 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 1	
	Neighbour cells		1, 2, 3, 4	Cell 2	
Final condition	Active cell		1, 2, 3, 4	Cell 2	
RF Channel Number			1, 2, 3, 4	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
			4	3 ms	Asynchronous cells
N310		-	1, 2, 3, 4	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3, 4	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3, 4	0	Radio link failure timer;
T311		ms	1, 2, 3, 4	3000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
			4	SSB.1 FR1	
SMTC configuration			1	SMTC.2	
			2	SMTC.1	
			3	SMTC.1	
			4	SMTC.2	
DRX cycle length		s	1, 2, 3, 4	OFF	
PRACH configuration			1, 2, 3, 4	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2, 3, 4	5	
T2		ms	1, 2, 3, 4	440	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1B in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1B.5 in TS 38.133)
T3		s	1, 2, 3, 4	2	

Table A.16.3.2.1.1.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR1 for 1 Rx UE

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
		4	N/A			N/A		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
		4	SR.1.1 FDD			SR.1.1 FDD		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
		4	CR.1.1 FDD			CR.1.1 FDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
		4	CCR.1.1 FDD			CCR.1.1 FDD		
OCNG Pattern		1, 2, 3, 4	OP.1			OP.1		
TRS configuration		1	TRS.1.1 FDD			TRS.1.1 FDD		
		2	TRS.1.1 TDD			TRS.1.1 TDD		
		3	TRS.1.2 TDD			TRS.1.2 TDD		
		4	TRS.1.1 FDD			TRS.1.1 FDD		
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1			ULBWP.0.1		
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
RLM-RS		1, 2, 3, 4	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	1.54	-infinity	-infinity	-3.79	4	4
		2						
		3						
		4						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
		4	-98					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
		4						
$\hat{E}_s/N_{oc}$	dB	1	7	-infinity	-infinity	4	4	4
		2						
		3						
		4						
SS-RSRP Note3	dBm/SCS	1	-91	-infinity	-infinity	-94	-94	-94
		2	-91	-infinity	-infinity	-94	-94	-94
		3	-88	-infinity	-infinity	-91	-91	-91
		4	-91	-infinity	-infinity	-94	-94	-94
Io	dBm/9.36 MHz	1	-60.74	-64.59	-64.59	-60.74	-70.05	-64.59
	dBm/9.36 MHz	2	-60.74	-64.59	-64.59	-60.74	-70.05	-64.59
	dBm/18.36 MHz	3	-57.81	-61.66	-61.66	-57.81	-67.12	-61.66
	dBm/9.36 MHz	4	-60.74	-64.59	-64.59	-60.74	-70.05	-64.59
Propagation Condition		1, 2, 3, 4	AWGN					
Antenna Configuration			1x1					

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.								
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

A.16.3.2.1.1.2 Test Requirements

The RRC re-establishment delay is defined as the time from the moment UE declares RLF, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to a known NR intra-frequency cell shall be less than 1.6 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 1$

$T_{identify_intra_NR} = 200$ ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 1545 ms for RRC re-establishment delay, allow 440 ms + 1.6 s from the beginning of T2 in the test case.

A.16.3.2.1.2 Intra-frequency RRC Re-establishment in FR1 for 2 Rx UE

A.16.3.2.1.2.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR1 with known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1B.

The test parameters are given in table A.16.3.2.1.2.1-1, table A.16.3.2.1.2.1-2 and table A.16.3.2.1.2.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.16.3.2.1.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.3.2.1.2.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 1	
	Neighbour cells		1, 2, 3, 4	Cell 2	
Final condition	Active cell		1, 2, 3, 4	Cell 2	
RF Channel Number			1, 2, 3, 4	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
			4	3 ms	Asynchronous cells
N310		-	1, 2, 3, 4	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3, 4	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3, 4	0	Radio link failure timer;
T311		ms	1, 2, 3, 4	3000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
			4	SSB.1 FR1	
SMTC configuration			1	SMTC.2	
			2	SMTC.1	
			3	SMTC.1	
			4	SMTC.2	
DRX cycle length		s	1, 2, 3, 4	OFF	
PRACH configuration			1, 2, 3, 4	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2, 3, 4	5	
T2		ms	1, 2, 3, 4	240	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1B in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1B.5 in TS 38.133)
T3		s	1, 2, 3, 4	2	

Table A.16.3.2.1.2.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
		4	N/A			N/A		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
		4	SR.1.1 FDD			SR.1.1 FDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
		4	CR.1.1 FDD			CR.1.1 FDD		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
		4	CCR.1.1 FDD			CCR.1.1 FDD		
OCNG Pattern		1, 2, 3, 4	OP.1			OP.1		
TRS configuration		1	TRS.1.1 FDD			TRS.1.1 FDD		
		2	TRS.1.1 TDD			TRS.1.1 TDD		
		3	TRS.1.2 TDD			TRS.1.2 TDD		
		4	TRS.1.1 FDD			TRS.1.1 FDD		
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1			ULBWP.0.1		
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
RLM-RS		1, 2, 3, 4	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	1.54	-infinity	-infinity	-3.79	4	4
		2						
		3						
		4						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
		4	-98					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
		4						
$\hat{E}_s/N_{oc}$	dB	1	7	-infinity	-infinity	4	4	4
		2						
		3						
		4						
SS-RSRP Note3	dBm/SCS	1	-91	-infinity	-infinity	-94	-94	-94
		2	-91	-infinity	-infinity	-94	-94	-94
		3	-88	-infinity	-infinity	-91	-91	-91
		4	-91	-infinity	-infinity	-94	-94	-94
Io	dBm/9.36 MHz	1	-60.74	-64.59	-64.59	-60.74	-70.05	-64.59
	dBm/9.36 MHz	2	-60.74	-64.59	-64.59	-60.74	-70.05	-64.59
	dBm/18.36 MHz	3	-57.81	-61.66	-61.66	-57.81	-67.12	-61.66
	dBm/9.36 MHz	4	-60.74	-64.59	-64.59	-60.74	-70.05	-64.59
Propagation Condition		1, 2, 3, 4	AWGN					
Antenna Configuration			1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.3.2.1.2.2 Test Requirements

The RRC re-establishment delay is defined as the time from the moment UE declares RLF, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to a known NR intra-frequency cell shall be less than 1.6 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 1$

$T_{identify_intra_NR}$ = 200 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 1545 ms for RRC re-establishment delay, allow 240 ms + 1.6 s from the beginning of T2 in the test case.

A.16.3.2.1.3 Inter-frequency RRC Re-establishment in FR1 for 1 Rx UE

A.16.3.2.1.3.1 Test Purpose and Environment

The purpose is to verify that the NR inter-frequency RRC re-establishment delay in FR1 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1B.

The test parameters are given in table A.16.3.2.1.3.1-1, table A.16.3.2.1.3.1-2 and table A.16.3.2.1.3.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of Cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of Cell 2 by the end of T1.

Table A.16.3.2.1.3.1-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.16.3.2.1.3.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case in FR1 for 1 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 1	
	Neighbour cells		1, 2, 3, 4	Cell 2	
Final condition	Active cell		1, 2, 3, 4	Cell 2	
RF Channel Number			1, 2, 3, 4	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
			4	3 ms	Asynchronous cells
N310		-	1, 2, 3, 4	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3, 4	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3, 4	0	Radio link failure timer;
T311		ms	1, 2, 3, 4	5000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
			4	SSB.1 FR1	
SMTC configuration			1	SMTC.2	
			2	SMTC.1	
			3	SMTC.1	
			4	SMTC.2	
DRX cycle length		s	1, 2, 3, 4	OFF	
PRACH configuration			1, 2, 3, 4	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2, 3, 4	5	
T2		ms	1, 2, 3, 4	440	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1B in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1B.5 in TS 38.133)
T3		s	1, 2, 3, 4	5	

Table A.16.3.2.1.3.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
RF Channel Number		1, 2, 3, 4	1			2		
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
		4	N/A			N/A		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
		4	SR.1.1 FDD			SR.1.1 FDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
		4	CR.1.1 FDD			CR.1.1 FDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
		4	CCR.1.1 FDD			CCR.1.1 FDD		
OCNG Pattern		1, 2, 3, 4	OP.1			OP.1		
TRS configuration		1	TRS.1.1 FDD			TRS.1.1 FDD		
		2	TRS.1.1 TDD			TRS.1.1 TDD		
		3	TRS.1.2 TDD			TRS.1.2 TDD		
		4	TRS.1.1 FDD			TRS.1.1 FDD		
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1			ULBWP.0.1		
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
RLM-RS		1, 2, 3, 4	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	7
		2						
		3						
		4						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
		4	-98					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
		4						
$\hat{E}_s/N_{oc}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	7
		2						
		3						
		4						
SS-RSRP Note3	dBm/SCS	1	-94	-infinity	-infinity	-infinity	-infinity	-91
		2	-94	-infinity	-infinity	-infinity	-infinity	-91
		3	-91	-infinity	-infinity	-infinity	-infinity	-88
		4	-94	-infinity	-infinity	-infinity	-infinity	-91
Io	dBm/9.36 MHz	1	-64.59	-70.05	-70.05	-70.05	-70.05	-62.26
	dBm/9.36 MHz	2	-64.59	-70.05	-70.05	-70.05	-70.05	-62.26
	dBm/18.36 MHz	3	-61.66	-67.12	-67.12	-67.12	-67.12	-59.33
	dBm/9.36 MHz	4	-64.59	-70.05	-70.05	-70.05	-70.05	-62.26
Propagation Condition		1, 2, 3, 4	AWGN					
Antenna Configuration			1x1					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.3.2.1.3.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR inter-frequency cell shall be less than 3 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50\ ms + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

N_{freq} = 2

$T_{identify_intra_NR}$ = 800 ms

$T_{identify_inter_NR}$ = 800 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target inter-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 2945 ms, allow 3 s in the test case.

A.16.3.2.1.4 Inter-frequency RRC Re-establishment in FR1 for 2 Rx UE

A.16.3.2.1.4.1 Test Purpose and Environment

The purpose is to verify that the NR inter-frequency RRC re-establishment delay in FR1 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1B.

The test parameters are given in table A.16.3.2.1.4.1-1, table A.16.3.2.1.4.1-2 and table A.16.3.2.1.4.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of Cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of Cell 2 by the end of T1.

Table A.16.3.2.1.4.1-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.16.3.2.1.4.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case in FR1 for 2 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 1	
	Neighbour cells		1, 2, 3, 4	Cell 2	
Final condition	Active cell		1, 2, 3, 4	Cell 2	
RF Channel Number			1, 2, 3, 4	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
			4	3 ms	Asynchronous cells
N310		-	1, 2, 3, 4	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3, 4	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3, 4	0	Radio link failure timer;
T311		ms	1, 2, 3, 4	5000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
			4	SSB.1 FR1	
SMTC configuration			1	SMTC.2	
			2	SMTC.1	
			3	SMTC.1	
			4	SMTC.2	
DRX cycle length		s	1, 2, 3, 4	OFF	
PRACH configuration			1, 2, 3, 4	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2, 3, 4	5	
T2		ms	1, 2, 3, 4	240	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1B in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1B.5 in TS 38.133)
T3		s	1, 2, 3, 4	5	

Table A.16.3.2.1.4.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case in FR1 for 2 Rx UE

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
RF Channel Number		1, 2, 3, 4	1			2		
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
		4	N/A			N/A		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
		4	SR.1.1 FDD			SR.1.1 FDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
		4	CR.1.1 FDD			CR.1.1 FDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
		4	CCR.1.1 FDD			CCR.1.1 FDD		
OCNG Pattern		1, 2, 3, 4	OP.1			OP.1		
TRS configuration		1	TRS.1.1 FDD			TRS.1.1 FDD		
		2	TRS.1.1 TDD			TRS.1.1 TDD		
		3	TRS.1.2 TDD			TRS.1.2 TDD		
		4	TRS.1.1 FDD			TRS.1.1 FDD		
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1			ULBWP.0.1		
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
RLM-RS		1, 2, 3, 4	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	7
		2						
		3						
		4						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
		4	-98					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
		4						
$\hat{E}_s/N_{oc}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	7
		2						
		3						
		4						
SS-RSRP Note3	dBm/SCS	1	-94	-infinity	-infinity	-infinity	-infinity	-91
		2	-94	-infinity	-infinity	-infinity	-infinity	-91
		3	-91	-infinity	-infinity	-infinity	-infinity	-88
		4	-94	-infinity	-infinity	-infinity	-infinity	-91
Io	dBm/9.36 MHz	1	-64.59	-70.05	-70.05	-70.05	-70.05	-62.26
	dBm/9.36 MHz	2	-64.59	-70.05	-70.05	-70.05	-70.05	-62.26
	dBm/18.36 MHz	3	-61.66	-67.12	-67.12	-67.12	-67.12	-59.33
	dBm/9.36 MHz	4	-64.59	-70.05	-70.05	-70.05	-70.05	-62.26
Propagation Condition		1, 2, 3, 4	AWGN					
Antenna Configuration			1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.3.2.1.4.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR inter-frequency cell shall be less than 3 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50\ ms + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 2$

$T_{identify_intra_NR}$ = 800 ms

$T_{identify_inter_NR}$ = 800 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target inter-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 2945 ms, allow 3 s in the test case.

A.16.3.2.1.5 Intra-frequency RRC Re-establishment in FR1 for 1 Rx UE without serving cell timing

A.16.3.2.1.5.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR1 without serving cell timing is within the specified limits. These tests will verify the requirements in clause 6.2.1B.

The test parameters are given in table A.16.3.2.1.5.1-1, table A.16.3.2.1.5.1-2 and table A.16.3.2.1.5.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.16.3.2.1.5.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.3.2.1.5.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 1	
	Neighbour cells		1, 2, 3, 4	Cell 2	

Parameter		Unit	Test configuration	Value	Comment
Final condition	Active cell		1, 2, 3, 4	Cell 2	
RF Channel Number			1, 2, 3, 4	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
			4	3 ms	Asynchronous cells
N310		-	1, 2, 3, 4	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3, 4	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3, 4	6000	Radio link failure timer configured by *RLF-TimersAndConstants*
T311		ms	1, 2, 3, 4	3000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.1 RedCap FR1	
			4	SSB.1 FR1	
SMTC configuration			1	SMTC.2	
			2	SMTC.1	
			3	SMTC.1	
			4	SMTC.2	
DRX cycle length		s	1, 2, 3, 4	OFF	
PRACH configuration			1, 2, 3, 4	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2, 3, 4	5	
T2		s	1, 2, 3, 4	6.24	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1B in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1B.5 in TS 38.133)
T3		s	1, 2, 3, 4	3	

Table A.16.3.2.1.5.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
		4	N/A			N/A		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
		4	SR.1.1 FDD			SR.1.1 FDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
		4	CR.1.1 FDD			CR.1.1 FDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
		4	CCR.1.1 FDD			CCR.1.1 FDD		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
OCNG Pattern		1, 2, 3, 4	OP.1			OP.1		
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1			DLBWP.0.1		
TRS Configuration		1	TRS.1.1.FDD			TRS.1.1.FDD		
		2	TRS.1.1.TDD			TRS.1.1.TDD		
		3	TRS.1.2.TDD			TRS.1.2.TDD		
		4	TRS.1.1.FDD			TRS.1.1.FDD		
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3, 4	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	4
		2						
		3						
		4						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
		4	-98					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
		4						
$\hat{E}_s/N_{oc}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	4
		2						
		3						
		4						
SS-RSRP Note3	dBm/SCS	1	-94	-infinity	-infinity	-infinity	-infinity	-94
		2	-94	-infinity	-infinity	-infinity	-infinity	-94
		3	-91	-infinity	-infinity	-infinity	-infinity	-91
		4	-94	-infinity	-infinity	-infinity	-infinity	-94
Io	dBm/9.36 MHz	1	-64.59	-70.05	-70.05	-70.05	-70.05	-64.59
	dBm/9.36 MHz	2	-64.59	-70.05	-70.05	-70.05	-70.05	-64.59
	dBm/18.36 MHz	3	-61.66	-67.12	-67.12	-67.12	-67.12	-61.66
	dBm/9.36 MHz	4	-64.59	-70.05	-70.05	-70.05	-70.05	-64.59
Propagation Condition		1, 2, 3, 4	AWGN					
Antenna Configuration			1x1					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.3.2.1.5.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR intra-frequency cell without serving cell timing shall be less than 2.2 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

N_{freq} = 1

$T_{identify_intra_NR}$ = 800 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 [2] for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 2145 ms, allow 2.2 s in the test case.

A.16.3.2.1.6 Intra-frequency RRC Re-establishment in FR1 for 2 Rx UE without serving cell timing

A.16.3.2.1.6.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR1 without serving cell timing is within the specified limits. These tests will verify the requirements in clause 6.2.1B.

The test parameters are given in table A.16.3.2.1.6.1-1, table A.16.3.2.1.6.1-2 and table A.16.3.2.1.6.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.16.3.2.1.6.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.3.2.1.6.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4	Cell 1	
	Neighbour cells		1, 2, 3, 4	Cell 2	
Final condition	Active cell		1, 2, 3, 4	Cell 2	
RF Channel Number			1, 2, 3, 4	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
			4	3 ms	Asynchronous cells
N310		-	1, 2, 3, 4	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3, 4	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3, 4	6000	Radio link failure timer configured by *RLF-TimersAndConstants*
T311		ms	1, 2, 3, 4	3000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3, 4	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	

Parameter	Unit	Test configuration	Value	Comment
		2	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
		4	SSB.1 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
		4	SMTC.2	
DRX cycle length	s	1, 2, 3, 4	OFF	
PRACH configuration		1, 2, 3, 4	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	6.24	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1B in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1B.5 in TS 38.133)
T3	s	1, 2, 3, 4	3	

Table A.16.3.2.1.6.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
		4	N/A			N/A		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
		4	SR.1.1 FDD			SR.1.1 FDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
		4	CR.1.1 FDD			CR.1.1 FDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
		4	CCR.1.1 FDD			CCR.1.1 FDD		
OCNG Pattern		1, 2, 3, 4	OP.1			OP.1		
Initial DL BWP configuration		1, 2, 3, 4	DLBWP.0.1			DLBWP.0.1		
TRS Configuration		1	TRS.1.1.FDD			TRS.1.1.FDD		
		2	TRS.1.1.TDD			TRS.1.1.TDD		
		3	TRS.1.2.TDD			TRS.1.2.TDD		
		4	TRS.1.1.FDD			TRS.1.1.FDD		
Initial UL BWP configuration		1, 2, 3, 4	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3, 4	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	4
		2						
		3						
		4						
N_{oc} Note2	dBm/SCS	1	-98					

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
		2	-98					
		3	-95					
		4						
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
		4						
$\hat{E}_s / N_{oc}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	4
		2						
		3						
		4						
SS-RSRP Note3	dBm/SCS	1	-94	-infinity	-infinity	-infinity	-infinity	-94
		2	-94	-infinity	-infinity	-infinity	-infinity	-94
		3	-91	-infinity	-infinity	-infinity	-infinity	-91
		4	-94	-infinity	-infinity	-infinity	-infinity	-94
Io	dBm/9.36 MHz	1	-64.59	-70.05	-70.05	-70.05	-70.05	-64.59
	dBm/9.36 MHz	2	-64.59	-70.05	-70.05	-70.05	-70.05	-64.59
	dBm/18.36 MHz	3	-61.66	-67.12	-67.12	-67.12	-67.12	-61.66
	dBm/9.36 MHz	4	-64.59	-70.05	-70.05	-70.05	-70.05	-64.59
Propagation Condition		1, 2, 3, 4	AWGN					
Antenna Configuration			1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.3.2.1.6.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR intra-frequency cell without serving cell timing shall be less than 2.2 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 1$

$T_{identify_intra_NR} = 800$ ms

$T_{SI} = 1280$ ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 [2] for the target intra-frequency NR cell.

$T_{PRACH} = 15$ ms; it is the additional delay caused by the random access procedure.

This gives a total of 2145 ms, allow 2.2 s in the test case.

A.16.3.2.2 Random Access

A.16.3.2.2.1 4-step RA type contention based random access test in FR1 for NR standalone for 1 Rx UE

A.16.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2B.2 and clause 7.1A.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.16.3.2.2.1.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.16.3.2.2.1.1-2.

Table A.16.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.16.3.2.2.1.1-2: General test parameters for contention based random access test in FR1 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1,4		SSB pattern 1 in FR1	As defined in A.3.10 and A.3.10B, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 2		SSB pattern 1 in FR1	
	Config 3		SSB pattern 1 for RedCap in FR1	
Number of SSBs per SS-burst			2	Different from the definition in A.3.10 and A.3.10B
SS/PBCH block index			0,1	Different from the definition in A.3.10 and A.3.10B
Duplex Mode for Cell 1	Config 1		FDD	
	Config 2,3		TDD	
	Config 4		HD-FDD	
TDD Configuration	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
CSI-RS for tracking	Config 1,4		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
OCNG Pattern Note 1			OP.1	
PDSCH parameters Note 4	Config 1,4		SR.1.1 FDD	As defined in A.3.1.1.
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	

Parameter			Unit	Test-1	Comments
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH DMRS			dB		
EPRE ratio of PDCCH DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH DMRS			dB		
EPRE ratio of PDSCH DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*+[1]
	N_{oc}	Config 1,4	dBm/15 kHz	-98	
		Config 2		-98	
		Config 3		-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP Note 3		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*+1 dB
	N_{oc}	Config 1,4	dBm/15 kHz	-98	
		Config 2		-98	
		Config 3		-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	
Io Note 2		Config 1,4	dBm	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 2		-65.3/9.36 MHz	
		Config 3		-65.38/18.36 MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\mathrm{CMAX},\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 1	As defined in A.3.8.
Propagation Condition			-	AWGN	
Antenna Configuration				1x1	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: Void
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.16.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.16.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in clause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*+1 dB.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test

configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2.2.1.4 the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.16.3.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the

received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

A.16.3.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

A.16.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in clause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.16.3.2.2.2 4-step RA type contention based random access test in FR1 for NR standalone for 2 Rx UE

A.16.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2B.2 and clause 7.1A.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.16.3.2.2.2.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.16.3.2.2.2.1-2.

Table A.16.3.2.2.2.1-1: Supported test configurations for contention based random access test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.16.3.2.2.2.1-2: General test parameters for contention based random access test in FR1 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1,4		SSB pattern 1 in FR1	As defined in A.3.10 and A.3.10B, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 2		SSB pattern 1 in FR1	
	Config 3		SSB pattern 1 for RedCap in FR1	
Number of SSBs per SS-burst			2	Different from the definition in A.3.10 and A.3.10B
SS/PBCH block index			0,1	Different from the definition in A.3.10 and A.3.10B
Duplex Mode for Cell 1	Config 1,4		FDD	
	Config 2,3		TDD	
TDD Configuration	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	

Parameter			Unit	Test-1	Comments
CSI-RS for tracking		Config 1,4		TRS.1.1 FDD	
		Config 2		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD	
OCNG Pattern Note 1				OP.1	As defined in A.3.2.1.
PDSCH parameters Note 4		Config 1,4		SR.1.1 FDD	As defined in A.3.1.1.
		Config 2		SR.1.1 TDD	
		Config 3		SR.2.1 TDD	
RMSI CORESET Reference Channel		Config 1,4		CR.1.1 FDD	
		Config 2		CR.1.1 TDD	
		Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel		Config 1,4		CCR.1.1 FDD	
		Config 2		CCR.1.1 TDD	
		Config 3		CCR.2.1 TDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH DMRS			dB		
EPRE ratio of PDCCH DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH DMRS			dB		
EPRE ratio of PDSCH DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,4	dBm/15 kHz	-98	
		Config 2		-98	
		Config 3		-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP Note 3		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,4	dBm/15 kHz	-98	
		Config 2		-98	
		Config 3		-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	
Io Note 2		Config 1,4	dBm	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 2		-65.3/9.36 MHz	
		Config 3		-65.38/18.36 MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\mathrm{CMAX},\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1 [18].
PRACH Configuration				FR1 PRACH configuration 1	As defined in A.3.8.
Propagation Condition			-	AWGN	
Antenna Configuration				1x2	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: Void
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.16.3.2.2.2.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.16.3.2.2.2.2.1 Random Access Preamble Transmission

To test the UE behavior specified in clause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.2.2.2 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.2.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.2.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2.2.1.4 the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.16.3.2.2.2.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

A.16.3.2.2.2.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

A.16.3.2.2.2.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in clause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.16.3.2.2.3 4-step RA type non-contention based random access test in FR1 for NR standalone for 1 Rx UE

A.16.3.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2B and clause 7.1A.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.16.3.2.2.3.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.16.3.2.2.3.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports csi-RSRP-AndRSRQ-MeasWithSSB or csi-RSRP-AndRSRQ-MeasWithoutSSB.

Table A.16.3.2.2.3.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.16.3.2.2.3.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone

Parameter		Unit	Test-1	Test-2	Comments
SSB Configuration	Config 1, 2,4		SSB pattern 1 in FR1	SSB pattern 1 in FR1	As defined in A.3.10B, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 3		SSB pattern 1 for RedCap in FR1	SSB pattern 1 for RedCap in FR1	
Number of SSBs per SS-burst			2	2	Different from the definition in A.3.10B
SS/PBCH block index			0,1	0,1	Different from the definition in A.3.10B
CSI-RS Configuration	Config 1, 2, 4		N/A	CSI-RS.1.1 FDD	As defined in A.3.14
	Config 3			CSI-RS.2.1 TDD	
Duplex Mode for Cell 1	Config 1		FDD	FDD	
	Config 2, 3		TDD	TDD	
	Config 4		HD-FDD	HD-FDD	
TDD Configuration	Config 2		TDDConf.1.1	TDDConf.1.1	
	Config 3		TDDConf.2.1	TDDConf.2.1	
CSI-RS for tracking	Config 1,4		TRS.1.1 FDD	TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	TRS.1.2 TDD	
OCNG Pattern Note 1			OP.1	OP.1	
PDSCH parameters Note 4	Config 1,4		SR.1.1 FDD	SR.1.1 FDD	As defined in A.3.1B.1.
	Config 2		SR.1.1 TDD	SR.1.1 TDD	
	Config 3		CR.2.1 TDD	CR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 TDD	CR.1.1 TDD	
	Config 2		CR.1.1 TDD	CR.1.1 TDD	
	Config 3		CR.2.1 TDD	CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.1 TDD	CCR.1.1 TDD	
	Config 2		CCR.1.1 TDD	CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	CCR.2.1 TDD	
NR RF Channel Number			1	1	
EPRE ratio of PSS to SSS		dB	0	0	
EPRE ratio of PBCH DMRS to SSS		dB			
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PDCCH DMRS to SSS		dB			
EPRE ratio of PDCCH to PDCCH DMRS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
SSB with index 0	$\hat{E}_s / I_{ot}$	dB	3	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*+1 dB
	N_{oc} Config 1	dBm/15 kHz	-98	-98	
	N_{oc} Config 2		-98	-98	
	N_{oc} Config 3		-101	-101	
	$\hat{E}_s / N_{oc}$	dB	3	3	
	SS-RSRP Note 3	dBm/ SCS	-95	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$	dB	-17	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*+1 dB

Parameter			Unit	Test-1	Test-2	Comments
	N_{oc}	Config 1	dBm/15 kHz	-98	-98	
		Config 2		-98	-98	
		Config 3		-101	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	-115	
Io Note 2		Config 1	dBm	-65.3/9.36 MHz	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 2		-65.3/9.36 MHz	-65.3/9.36 MHz	
		Config 3		-65.38/18.36 MHz	-65.38/18.36 MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\text{CMAX, f,c}}$)			dBm	23	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 2	FR1 PRACH configuration 3	As defined in A.3.8B.2.
Propagation Condition			-	AWGN	AWGN	
Antenna Configuration				1x1	1x1	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: Void
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.16.3.2.2.3.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.16.3.2.2.3.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in clause 6.2.2.2.2.1 for SSB-based Random Access Preamble transmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.3.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in clause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble transmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be 25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2.

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.3.2.3 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.3.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.4 4-step RA type non-contention based random access test in FR1 for NR standalone for 2 Rx UE

A.16.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2B and clause 7.1A.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.16.3.2.2.4.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.16.3.2.2.4.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports csi-RSRP-AndRSRQ-MeasWithSSB or csi-RSRP-AndRSRQ-MeasWithoutSSB.

Table A.16.3.2.2.4.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.16.3.2.2.4.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone

Parameter		Unit	Test-1	Test-2	Comments
SSB Configuration	Config 1, 2,4		SSB pattern 1 in FR1	SSB pattern 1 in FR1	As defined in A.3.10B, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 3		SSB pattern 1 for RedCap in FR1	SSB pattern 1 for RedCap in FR1	
Number of SSBs per SS-burst			2	2	Different from the definition in A.3.10B
SS/PBCH block index			0,1	0,1	Different from the definition in A.3.10B
CSI-RS Configuration	Config 1, 2, 4		N/A	CSI-RS.1.1 FDD	As defined in A.3.14
	Config 3			CSI-RS.2.1 TDD	
Duplex Mode for Cell 1	Config 1		FDD	FDD	
	Config 2, 3		TDD	TDD	
	Config 4		HD-FDD	HD-FDD	
TDD Configuration	Config 2		TDDConf.1.1	TDDConf.1.1	
	Config 3		TDDConf.2.1	TDDConf.2.1	
CSI-RS for tracking	Config 1,4		TRS.1.1 FDD	TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	TRS.1.2 TDD	
OCNG Pattern Note 1			OP.1	OP.1	
PDSCH parameters Note 4	Config 1,4		SR.1.1 FDD	SR.1.1 FDD	As defined in A.3.1B.1.
	Config 2		SR.1.1 TDD	SR.1.1 TDD	
	Config 3		CR.2.1 TDD	CR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 TDD	CR.1.1 TDD	
	Config 2		CR.1.1 TDD	CR.1.1 TDD	
	Config 3		CR.2.1 TDD	CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.1 TDD	CCR.1.1 TDD	
	Config 2		CCR.1.1 TDD	CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	CCR.2.1 TDD	
NR RF Channel Number			1	1	
EPRE ratio of PSS to SSS		dB	0	0	
EPRE ratio of PBCH DMRS to SSS		dB			
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PDCCH DMRS to SSS		dB			
EPRE ratio of PDCCH to PDCCH DMRS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			

Parameter			Unit	Test-1	Test-2	Comments
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1.4	dBm/15 kHz	-98	-98	
		Config 2		-98	-98	
		Config 3		-101	-101	
	$\hat{E}_s / N_{oc}$		dB	3	3	
	SS-RSRP Note 3		dBm/ SCS	-95	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1.4	dBm/15 kHz	-98	-98	
		Config 2		-98	-98	
		Config 3		-101	-101	
	$\hat{E}_s / N_{oc}$		dB	-17	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	-115	
Io Note 2		Config 1.4	dBm	-65.3/9.36 MHz	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 2		-65.3/9.36 MHz	-65.3/9.36 MHz	
		Config 3		-65.38/18.36 MHz	-65.38/18.36 MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\text{CMAX, f,c}}$)			dBm	23	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 2	FR1 PRACH configuration 3	As defined in A.3.8B.2.
Propagation Condition			-	AWGN	AWGN	
Antenna Configuration				1x2	1x2	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: Void
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.16.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.16.3.2.2.4.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in clause 6.2.2.2.2.1 for SSB-based Random Access Preamble transmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.4.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in clause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble transmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.4.2.3 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.4.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.5 2-step RA type contention based random access test in FR1 for NR standalone for 1 Rx UE

A.16.3.2.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the 2-step RA type random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2B.2 and clause 7.1A.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.16.3.2.2.5.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.16.3.2.2.5.1-2.

Table A.16.3.2.2.5.1-1: Supported test configurations for 2-step RA type contention based random access with successRAR test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.16.3.2.2.5.1-2: General test parameters for 2-step RA type contention based random access with successRAR test in FR1 for NR standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1,2,4		SSB pattern 1 in FR1	As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 3		SSB.1 RedCap FR1	
Number of SSBs per SS-burst			2	Different from the definition in A.3.10
SS/PBCH block index			0,1	Different from the definition in A.3.10
Duplex Mode for Cell 2	Config 1		FDD	
	Config 2,3		TDD	
	Config 4		HD-FDD	
TDD Configuration	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
CSI-RS for tracking	Config 1,4		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
OCNG Pattern Note 1			OP.1	
PDSCH parameters Note 3	Config 1,4		SR.1.1 FDD	As defined in A.3.1.1.
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	

Parameter			Unit	Test-1	Comments
		Config 2		CCR.1.1 TDD	
		Config 3		CCR.2.1 TDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH DMRS			dB		
EPRE ratio of PDCCH DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH DMRS			dB		
EPRE ratio of PDSCH DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH DMRS			dB		
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*+1 dB
	N_{oc}	Config 1,2,4	dBm/15 kHz	-98	
		Config 3		-101	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*+1 dB
	N_{oc}	Config 1,2,4	dBm/15 kHz	-98	
		Config 3		-101	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP		dBm/ SCS	-115	
Io Note 2		Config 1,2,4	dBm	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 3		-65.38/18.36 MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
MsgA Configuration				FR1 MsgA configuration 1	As defined in A.3.20.2.1.
msgA-RSRP-ThresholdSSB			dBm	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
Propagation Condition			-	AWGN	
Antenna Configuration				1x1	1x1

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.16.3.2.2.5.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.16.3.2.2.5.2.1 MsgA Transmission

To test the UE behavior specified in clause 6.2.2.3.1.1 the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB*+1 dB.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first MsgA preamble transmission shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The power of the first MsgA PUSCH transmission shall be 3dB lower than the first MsgA preamble for test configuration 1 & 4 and same as the first MsgA preamble for test configuration 2 & 3 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.5.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.2 the System Simulator shall transmit a MsgB containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit an ACK if the MsgB with a successRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble and if the Contention Resolution is successful.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB(s) contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The power of the first MsgA PUSCH transmission shall be 3dB lower than the first MsgA preamble for test configuration 1 & 4 and same as the first MsgA preamble for test configuration 2 & 3 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.5.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The power of the first MsgA PUSCH transmission shall be 3dB lower than the first MsgA preamble for test configuration 1 & 4 and same as the first MsgA preamble for test configuration 2 & 3 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.6 2-step RA type contention based random access test in FR1 for NR standalone for 2 Rx UE

A.16.3.2.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the 2-step RA type random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2B.2 and clause 7.1A.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.16.3.2.2.6.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.16.3.2.2.6.1-2.

Table A.16.3.2.2.6.1-1: Supported test configurations for 2-step RA type contention based random access with successRAR test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.16.3.2.2.6.1-2: General test parameters for 2-step RA type contention based random access with successRAR test in FR1 for NR standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1,2,4		SSB.1 FR1	As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 3		SSB.1 RedCap FR1	
Number of SSBs per SS-burst			2	Different from the definition in A.3.10
SS/PBCH block index			0,1	Different from the definition in A.3.10
Duplex Mode for Cell 2	Config 1		FDD	
	Config 2,3		TDD	
	Config 4		HD-FDD	
TDD Configuration	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
CSI-RS for tracking	Config 1,4		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
OCNG Pattern Note 1			OP.1	
PDSCH parameters Note 3	Config 1,4		SR.1.1 FDD	As defined in A.3.1.1.
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH DMRS		dB		
EPRE ratio of PDCCH DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH DMRS		dB		
EPRE ratio of PDSCH DMRS to SSS		dB		

Parameter			Unit	Test-1	Comments
EPRE ratio of PDSCH to PDSCH DMRS			dB		
SSB with index 0	$\hat{E}_s/I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2,4	dBm/15 kHz	-98	
		Config 3		-101	
	$\hat{E}_s/N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s/I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2,4	dBm/15 kHz	-98	
		Config 3		-101	
	$\hat{E}_s/N_{oc}$		dB	-17	
	SS-RSRP		dBm/ SCS	-115	
Io Note 2		Config 1,2,4	dBm	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 3		-65.38/18.36 MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
MsgA Configuration				FR1 MsgA configuration 1	As defined in A.3.20.2.1.
msgA-RSRP-ThresholdSSB			dBm	RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
Propagation Condition			-	AWGN	
Antenna Configuration				1x2	1x2

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.16.3.2.2.6.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.16.3.2.2.6.2.1 MsgA Transmission

To test the UE behavior specified in clause 6.2.2.3.1.1 the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB.*

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first MsgA preamble transmission shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The power of the first MsgA PUSCH transmission shall be 3dB lower than the first MsgA preamble for test configuration 1 & 4 and same as the first MsgA preamble for test configuration 2 & 3 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.6.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.2 the System Simulator shall transmit a MsgB containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have

been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit an ACK if the MsgB with a successRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble and if the Contention Resolution is successful.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB(s) contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The power of the first MsgA PUSCH transmission shall be 3dB lower than the first MsgA preamble for test configuration 1 & 4 and same as the first MsgA preamble for test configuration 2 & 3 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.6.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 1,3 and 4, and be -25 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] for test configuration 2. The power of the first MsgA PUSCH transmission shall be 3dB lower than the first MsgA preamble for test configuration 1 & 4 and same as the first MsgA preamble for test configuration 2 & 3 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.7 2-step RA type non-contention based test in FR1 for NR standalone for 1 RX UE

A.16.3.2.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2B.2 and clause 7.1A.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.16.3.2.2.7.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.16.3.2.2.7.1-2.

Table A.16.3.2.2.7.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone

Config	Description
1	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode

2	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.16.3.2.2.7.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone

Parameter			Unit	Test-1	Comments
SSB Configuration		Config 1		SSB.1 RedCap FR1	As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
		Config 2		SSB.1 FR1	
Number of SSBs per SS-burst				2	Different from the definition in A.3.10
SS/PBCH block index				0,1	Different from the definition in A.3.10
Duplex Mode for Cell 1		Config 1		TDD	
		Config 2		HD-FDD	
TDD Configuration		Config 1		TDDConf.2.1	
CSI-RS for tracking		Config 1		TRS.1.2 TDD	
		Config 2		TRS.1.1 FDD	
OCNG Pattern Note 1				OP.1	
PDSCH parameters Note 4		Config 1		SR.2.1 TDD	As defined in A.3.1.1.
		Config 2		SR.1.1 FDD	
RMSI CORESET Reference Channel		Config 1		CR.2.1 TDD	
		Config 2		CR.1.1 FDD	
Dedicated CORESET Reference Channel		Config 1		CCR.2.1 TDD	
		Config 2		CCR.1.1 FDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH DMRS			dB		
EPRE ratio of PDCCH DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH DMRS			dB		
EPRE ratio of PDSCH DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH DMRS			dB		
msgA-*RSRP-ThresholdSSB*				RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured msgA-*RSRP-ThresholdSSB*+1 dB
	N_{oc}	Config 1	dBm/15 kHz	-101	
		Config 2		-98	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP Note 3		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured msgA-*RSRP-ThresholdSSB*+1 dB
	N_{oc}	Config 1	dBm/15 kHz	-101	
		Config 2		-98	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	
Io Note 2		Config 1	dBm	-65.38/18.36 MHz	For symbols without SSB index 1
		Config 2		-65.3/9.36 MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,\ c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
MsgA Configuration				FR1 MsgA configuration 2	As defined in A.3.20.2.2.

Parameter	Unit	Test-1	Comments
Propagation Condition	-	AWGN	
Antenna Configuration		1x1	1x1
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.			
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.			
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.			

A.16.3.2.2.7.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.16.3.2.2.7.2.1 MsgA Transmission

To test the UE behavior specified in clause 6.2.2.3.2.1, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA PRACH on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble for test configuration 1 and 3dB lower than the first MsgA preamble for test configuration 2 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.7.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a fallbackRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 containing the payload of MsgA PUSCH if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble. The UE shall monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB's contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble for test configuration 1 and 3dB lower than the first MsgA preamble for test configuration 2 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA and msg3 transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.7.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble for test configuration 1 and 3dB lower than the first MsgA preamble for test configuration 2 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.8 2-step RA type non-contention based test in FR1 for NR standalone for 2 RX UE

A.16.3.2.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2B.2 and clause 7.1A.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in table A.16.3.2.2.8.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.16.3.2.2.8.1-2.

Table A.16.3.2.2.8.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone

Config	Description
1	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.16.3.2.2.8.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.1 RedCap FR1	As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 2		SSB.1 FR1	
Number of SSBs per SS-burst			2	Different from the definition in A.3.10
SS/PBCH block index			0,1	Different from the definition in A.3.10
Duplex Mode for Cell 1	Config 1		TDD	
	Config 2		HD-FDD	
TDD Configuration	Config 1		TDDConf.2.1	
CSI-RS for tracking	Config 1		TRS.1.2 TDD	
	Config 2		TRS.1.1 FDD	
OCNG Pattern Note 1			OP.1	
PDSCH parameters Note 4	Config 1		SR.2.1 TDD	As defined in A.3.1.1.
	Config 2		SR.1.1 FDD	

Parameter			Unit	Test-1	Comments
RMSI CORESET Reference Channel		Config 1		CR.2.1 TDD	
		Config 2		CR.1.1 FDD	
Dedicated CORESET Reference Channel		Config 1		CCR.2.1 TDD	
		Config 2		CCR.1.1 FDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH DMRS			dB		
EPRE ratio of PDCCH DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH DMRS			dB		
EPRE ratio of PDSCH DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH DMRS			dB		
msgA-*RSRP-ThresholdSSB*				RSRP_51	The actual value of the threshold is -105 dBm, as defined in TS 38.331 [2].
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured msgA-*RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15 kHz	-101	
		Config 2		-98	
	$\hat{E}_s / N_{oc}$		dB	3	
	SS-RSRP Note 3		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured msgA-*RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15 kHz	-101	
		Config 2		-98	
	$\hat{E}_s / N_{oc}$		dB	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	
Io Note 2		Config 1	dBm	-65.3/9.36 MHz	For symbols without SSB index 1
		Config 2		-65.38/18.36 MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,\ c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1 [18].
MsgA Configuration				FR1 MsgA configuration 2	As defined in A.3.20.2.2.
Propagation Condition			-	AWGN	
Antenna Configuration				1x2	1x2

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
NOTE 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.16.3.2.2.8.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.16.3.2.2.8.2.1 MsgA Transmission

To test the UE behavior specified in clause 6.2.2.3.2.1, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA PRACH on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble for test configuration 1 and 3dB lower than the first MsgA preamble for test configuration 2 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.8.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a fallbackRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 containing the payload of MsgA PUSCH if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble. The UE shall monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB's contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble for test configuration 1 and 3dB lower than the first MsgA preamble for test configuration 2 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA and msg3 transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.2.8.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be -22 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble for test configuration 1 and 3dB lower than the first MsgA preamble for test configuration 2 with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.16.3.2.3 SA: RRC Connection Release with Redirection

A.16.3.2.3.1 Redirection from NR in FR1 to NR in FR1 for 1 Rx UE

A.16.3.2.3.1.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to NR requirements specified in clause 6.2.3A.2.1.

A.16.3.2.3.1.2 Test Parameters

Supported test configurations are shown in table A.16.3.2.3.1.2-1. The time delay is tested by using the parameters in table A.16.3.2.3.1.2-2, and A.16.3.2.3.1.2-3.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2. Cell 1 and Cell 2 belong to different tracking areas.

Table A.16.3.2.3.1.2-1: Redirection from NR to NR test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.2.3.1.2-2: General test parameters for Redirection from NR to NR test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	2.3	

Table A.16.3.2.3.1.2-3: Cell specific test parameters for Redirection from NR to NR test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2, 3		TDD			
	Config 4		HD-FDD			
SSB Configuration	Config 1		SSB.1 FR1			
	Config 2		SSB.1 FR1			
	Config 3		SSB.1 RedCap FR1			
	Config 4		SSB.1 FR1			
CSI-RS for tracking	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
	Config 4		TRS.1.1 FDD			
TDD configuration	Config 1		Not Applicable			

Parameter		Unit	Cell 1		Cell 2	
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
	Config 4		Not Applicable			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		20: $N_{PRB,c}$ = 51			
	Config 4		10: $N_{PRB,c}$ = 52			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		20: $N_{PRB,c}$ = 51			
	Config 4		10: $N_{PRB,c}$ = 52			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
	Config 4		SR.1.1 FDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR.2.1 TDD			
	Config 4		CR.1.1 FDD			
OCNG Patterns			OP.1			
SMTC configuration	Config 1, 2, 4		SMTC.1 FR1			
	Config 3		SMTC.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2,4	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98			
N_{oc} Note2	Config 1, 2, 4	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s / I_{ot}$		dB	4	4	-infinity	4
$\hat{E}_s / N_{oc}$		dB	4	4	-infinity	4
Io Note3	Config 1,2, 4	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-64.59
	Config 3	dBm/ 18.36 MHz	-61.66	-61.66	-67.12	-61.66
Propagation condition		-	AWGN			
Antenna Configuration			1x1			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Unit	Cell 1	Cell 2
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

A.16.3.2.3.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 2240 ms from the beginning of time period T2.
The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_NR} = T_{RRC_procedure_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH},$$

where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}NR}$ = 680 ms in the test.

$T_{SI\text{-}NR}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target NR cell.

T_{RACH} = 170 ms in the test.

This gives a total of 2240 ms.

A.16.3.2.3.2 Redirection from NR in FR1 to NR in FR1 for 2 Rx UE

A.16.3.2.3.2.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to NR requirements specified in clause 6.2.3A.2.1.

A.16.3.2.3.2.2 Test Parameters

Supported test configurations are shown in table A.16.3.2.3.2.2-1. The time delay is tested by using the parameters in table A.16.3.2.3.2.2-2, and A.16.3.2.3.2.2-3.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2. Cell 1 and Cell 2 belong to different tracking areas.

Table A.16.3.2.3.2.2-1: Redirection from NR to NR test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
	Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.2.3.2.2-2: General test parameters for Redirection from NR to NR test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	

Filter coefficient		0	L3 filtering is not used
Access Barring Information	-	Not Sent	No additional delays in random access procedure.
Time offset between cells		3 μs	Synchronous cells
T1	s	5	
T2	s	2.3	

Table A.16.3.2.3.2.2-3: Cell specific test parameters for Redirection from NR to NR test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2, 3		TDD			
	Config 4		HD-FDD			
SSB Configuration	Config 1		SSB.1 FR1			
	Config 2		SSB.1 FR1			
	Config 3		SSB.1 RedCap FR1			
	Config 4		SSB.1 FR1			
CSI-RS for tracking	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
	Config 4		TRS.1.1 FDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
	Config 4		Not Applicable			
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		20: $N_{PRB,c}$ = 51			
	Config 4		10: $N_{PRB,c}$ = 52			
BWP BW	Config 1	MHz	10: $N_{PRB,c}$ = 52			
	Config 2		10: $N_{PRB,c}$ = 52			
	Config 3		20: $N_{PRB,c}$ = 51			
	Config 4		10: $N_{PRB,c}$ = 52			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
	Config 4		SR.1.1 FDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
	Config 4		CR.1.1 FDD			
OCNG Patterns			OP.1			
SMTC configuration	Config 1, 2, 4		SMTC.1 FR1			
	Config 3		SMTC.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2,4	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-98			
N_{oc} Note2	Config 1, 2, 4	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s/I_{ot}$		dB	4	4	-infinity	4
$\hat{E}_s/N_{oc}$		dB	4	4	-infinity	4
Io Note3	Config 1,2, 4	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-64.59
	Config 3	dBm/ 18.36 MHz	-61.66	-61.66	-67.12	-61.66
Propagation condition		-	AWGN			
Antenna Configuration			1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.3.2.3.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 2240 ms from the beginning of time period T2.
The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_NR} = T_{RRC_procedure_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH},$$

where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}NR}$ = 680 ms in the test.

$T_{SI\text{-}NR}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target NR cell.

T_{RACH} = 170 ms in the test.

This gives a total of 2240 ms.

A.16.3.2.3.3 Redirection from NR in FR1 to E-UTRAN for 1 Rx UE

A.16.3.2.3.3.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to E-UTRAN requirements specified in clause 6.2.3A.2.2.

A.16.3.2.3.3.2 Test Parameters

Supported test configurations are shown in table A.16.3.2.3.3.2-1. The time delay is tested by using the parameters in table A.16.3.2.3.3.2-2, A.16.3.2.3.3.2-3 and A.16.3.2.3.3.2-4.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2.

Table A.16.3.2.3.3.2-1: Redirection from NR to E-UTRAN test configurations

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.2.3.3.2-2: General test parameters for Redirection from NR to E-UTRAN test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	2.3	

Table A.16.3.2.3.3.2-3: Cell specific test parameters for Redirection from NR to E-UTRAN (Cell 1)

Parameter		Unit	Cell 1	
			T1	T2
RF Channel Number			1	
Duplex mode	Config 1,4		FDD	
	Config 2,3,5,6		TDD	
	Config 7, 8		HD-FDD	
SSB Configuration	Config 1,2,4,5,7,8		SSB.1 FR1	
	Config 3,6		SSB.1 RedCap FR1	
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
	Config 7,8		TRS.1.1 FDD	
TDD configuration	Config 1,4, 7, 8		Not Applicable	
	Config 2,5		TDDConf.1.1	
	Config 3,6		TDDConf.2.1	
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5		10: $N_{PRB,c}$ = 52	
	Config 3,6		20: $N_{PRB,c}$ = 51	
	Config 7,8		10: $N_{PRB,c}$ = 52	
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5		10: $N_{PRB,c}$ = 52	
	Config 3,6		20: $N_{PRB,c}$ = 51	
	Config 7,8		10: $N_{PRB,c}$ = 52	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD	
	Config 3,6		SR2.1 TDD	
	Config 7,8		SR.1.1 FDD	

Parameter		Unit	Cell 1	
			T1	T2
CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD	
	Config 3,6		CR2.1 TDD	
	Config 7,8		CR.1.1 FDD	
OCNG Patterns			OP.1	
SMTC configuration	Config 1,2,4,5,7,8		SMTC.1 FR1	
	Config 3,6		SMTC.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz	
	Config 3,6		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz	
	Config 3,6		30 kHz	
PRACH configuration			FR1 PRACH configuration 1	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-98	
N_{oc} Note2	Config 1,2,4,5,7,8	dBm/SCS	-98	
	Config 3,6		-95	
$\hat{E}_s/I_{ot}$		dB	4	4
$\hat{E}_s/N_{oc}$		dB	4	4
Io Note3	Config 1,2,4,5,7,8	dBm/ 9.36 MHz	-64.59	-64.59
	Config 3,6	dBm/ 18.36 MHz	-61.66	-61.66
Propagation condition		-	AWGN	
Antenna Configuration			1x1	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.16.3.2.3.3.2-4: Cell specific test parameters for Redirection from NR to E-UTRAN (Cell 2)

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	2	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	
TDD special subframe configuration Note1		4, 5, 6, 8	6	
TDD uplink-downlink configuration Note1		4, 5, 6, 8	1	

Parameter	Unit	Configuration	Cell 2	
			T1	T2
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PRACH Configuration[Note2]		1, 2, 3, 7	4	
		4, 5, 6, 8	53	
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note3]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note4]				
OCNG_RB[Note4]				
N_{oc}[Note5]	dBm/15 kHz	1,2,3,4,5,6,7,8	-98	
$\hat{E}_s/N_{oc}$	dB	1,2,3,4,5,6,7,8	-Infinity	4
$\hat{E}_s/I_{ot}$[Note6]	dB	1,2,3,4,5,6,7,8	-Infinity	4
RSRP[Note6]	dBm/15 kHz	1,2,3,4,5,6,7,8	-Infinity	-94
SCH_RP[Note6]	dBm/15 kHz	1,2,3,4,5,6,7,8	-Infinity	-94
Io[Note6]	dBm/9 MHz	1,2,3,4,5,6,7,8	-70.22	-64.76
Propagation Condition		1,2,3,4,5,6,7,8	AWGN	
Antenna Configuration			1x1	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.16.3.2.3.3.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 2205 ms from the beginning of time period T2.
The rate of correct RRC connection release redirection to E-UTRAN observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_E\text{-}UTRA} = T_{RRC_procedure_delay} + T_{identify\text{-}E\text{-}UTRA} + T_{SI\text{-}E\text{-}UTRA} + T_{RACH},$$

where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}E\text{-}UTRA}$ = 800 ms in the test.

$T_{SI\text{-}E\text{-}UTRA}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 36.331 for the target E-UTRA cell.

T_{RACH} = 15 ms in the test.

This gives a total of 2205 ms.

A.16.3.2.3.4 Redirection from NR in FR1 to E-UTRAN for 2 Rx UE

A.16.3.2.3.4.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to E-UTRAN requirements specified in clause 6.2.3A.2.2.

A.16.3.2.3.4.2 Test Parameters

Supported test configurations are shown in table A.16.3.2.3.4.2-1. The time delay is tested by using the parameters in table A.16.3.2.3.4.2-2, A.16.3.2.3.4.2-3 and A.16.3.2.3.4.2-4.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2.

Table A.16.3.2.3.4.2-1: Redirection from NR to E-UTRAN test configurations

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.3.2.3.4.2-2: General test parameters for Redirection from NR to E-UTRAN test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	2.3	

Table A.16.3.2.3.4.2-3: Cell specific test parameters for Redirection from NR to E-UTRAN (Cell 1)

Parameter		Unit	Cell 1	
			T1	T2
RF Channel Number			1	
Duplex mode	Config 1,4		FDD	
	Config 2,3,5,6		TDD	
	Config 7, 8		HD-FDD	
SSB Configuration	Config 1,2,4,5,7,8		SSB.1 FR1	
	Config 3,6		SSB.1 RedCap FR1	
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
	Config 7,8		TRS.1.1 FDD	
TDD configuration	Config 1,4, 7, 8		Not Applicable	
	Config 2,5		TDDConf.1.1	
	Config 3,6		TDDConf.2.1	
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5		10: $N_{PRB,c}$ = 52	
	Config 3,6		20: $N_{PRB,c}$ = 51	
	Config 7,8		10: $N_{PRB,c}$ = 52	
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5		10: $N_{PRB,c}$ = 52	
	Config 3,6		20: $N_{PRB,c}$ = 51	
	Config 7,8		10: $N_{PRB,c}$ = 52	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD	
	Config 7,8		SR.1.1 FDD	
CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD	
	Config 7,8		CR.1.1 FDD	
OCNG Patterns			OP.1	
SMTC configuration	Config 1,2,4,5,7,8		SMTC.1 FR1	
	Config 3,6		SMTC.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz	
	Config 3,6		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz	
	Config 3,6		30 kHz	
PRACH configuration			FR1 PRACH configuration 1	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-98	
N_{oc} Note2	Config 1,2,4,5,7,8	dBm/SCS	-98	
	Config 3,6		-95	
$\hat{E}_s / I_{ot}$		dB	4	4

Parameter		Unit	Cell 1	
			T1	T2
$\hat{E}_s / N_{oc}$		dB	4	4
Io[Note3]	Config 1,2,4,5,7,8	dBm/ 9.36 MHz	-64.59	-64.59
	Config 3,6	dBm/ 18.36 MHz	-61.66	-61.66
Propagation condition		-	AWGN	
Antenna Configuration			1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

Table A.16.3.2.3.4.2-4: Cell specific test parameters for Redirection from NR to E-UTRAN (Cell 2)

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	2	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	
TDD special subframe configuration[Note1]		4, 5, 6, 8	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PRACH Configuration[Note2]		1, 2, 3, 7	4	
		4, 5, 6, 8	53	
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note3]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				

Parameter	Unit	Configuration	Cell 2	
			T1	T2
OCNG_RA[Note4]				
OCNG_RB[Note4]				
N_{oc}[Note5]	dBm/15 kHz	1,2,3,4,5,6,7,8	-98	
$\hat{E}_s/N_{oc}$	dB	1,2,3,4,5,6,7,8	-Infinity	4
$\hat{E}_s/I_{ot}$[Note6]	dB	1,2,3,4,5,6,7,8	-Infinity	4
RSRP[Note6]	dBm/15 kHz	1,2,3,4,5,6,7,8	-Infinity	-94
SCH_RP[Note6]	dBm/15 kHz	1,2,3,4,5,6,7,8	-Infinity	-94
Io[Note6]	dBm/9 MHz	1,2,3,4,5,6,7,8	-70.22	-64.76
Propagation Condition		1,2,3,4,5,6,7,8	AWGN	
Antenna Configuration			1x2	
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].				
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].				
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.				
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].				

A.16.3.2.3.4.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 2205 ms from the beginning of time period T2.
The rate of correct RRC connection release redirection to E-UTRAN observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_E\text{-}UTRA} = T_{RRC_procedure_delay} + T_{identify\text{-}E\text{-}UTRA} + T_{SI\text{-}E\text{-}UTRA} + T_{RACH},$$

where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}E\text{-}UTRA}$ = 800 ms in the test.

$T_{SI\text{-}E\text{-}UTRA}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 36.331 for the target E-UTRA cell.

T_{RACH} = 15 ms in the test.

This gives a total of 2205 ms.

A.16.4 Timing for RedCap

A.16.4.1 UE transmit timing

A.16.4.1.1 NR UE Transmit Timing Test for FR1 for 1 Rx RedCap UE

A.16.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNB and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1A.2.

Supported test configurations are shown in table A.16.4.1.1.1-1.

Table A.16.4.1.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	NR HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

For this test a single NR cell is used. Table A.16.4.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.16.4.1.1.1-3.

Table A.16.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2
SSB ARFCN		1,2,3	Freq1	Freq1
TDD configuration		1	Not Applicable	
		2	TDDConf.1.1	
		3	TDDConf.2.1	
		4	Not Applicable	
$BW_{channel}$	MHz	1	10: $N_{PRB,c}$ = 52	
		2	10: $N_{PRB,c}$ = 52	
		3	20: $N_{PRB,c}$ = 51	
		4	10: $N_{PRB,c}$ = 52	
Initial BWP Configuration		1,2,3,4	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1,2,3,4	DLBWP.1.1 ULBWP.1.1	
DRX Cycle	ms	1,2,3,4	N/A	DRX.8[Note5]
PDSCH Reference measurement channel		1	SR.1.1 FDD	
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
		4	SR.1.1 FDD	
RMSI CORESET Reference Channel		1	CR.1.1 FDD	
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
		4	CR.1.1 FDD	
Dedicated CORESET Reference Channel		1	CCR.1.1 FDD	
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
		4	CCR.1.1 FDD	
OCNG Patterns		1,2,3,4	OP.1	
SSB configuration		1,2,4	SSB.1 FR1	
		3	SSB. 1 RedCap FR1	
SMTC Configuration		1,2,4	SMTC.1	
		3	SMTC.2	
TRS configuration		1	TRS.1.1 FDD	
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
		4	TRS.1.1 FDD	
EPRE ratio of PSS to SSS	dB	1,2,3,4	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				

Parameter	Unit	Config	Test1	Test2
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1,2,3,4	-98	-98
N_{oc} Note2	dBm/SCS	1,2,4	-98	-98
		3	-95	-95
$\hat{E}_s / I_{ot}$		1,2,3,4	3	3
$\hat{E}_s / N_{oc}$		1,2,3,4	3	3
SS-RSRP Note3	dBm/SCS	1,2,4	-95	-95
		3	-92	-92
Io Note3	dBm/9.36 MHz	1,2,4	-65.2	-65.2
	dBm/18. 36 MHz	3	-62.36	-62.36
Propagation condition		1,2,3,4	AWGN	
Antenna Configuration			1x1	
SRS Config		1,2,4	SRSConf.1 Note6	SRSConf.3 Note6
		3	SRSConf.1 Note6	SRSConf.2 Note6

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.16.4.1.1.1-3

Table A.16.4.1.1.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	SRSConf.3	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	0	
	srs-ResourceIdList	0	0	0	
	resourceType	Periodic	Periodic	Periodic	
	Usage	Codebook	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	0	
	nrofSRS-Ports	Port1	Port1	Port1	
	transmissionComb	n2	n2	n2	
	combOffset-n2	0	0	0	
	cyclicShift-n2	0	0	0	
	resourceMapping startPosition	0	0	0	
	resourceMapping nrofSymbols	n1	n1	n1	
	resourceMapping repetitionFactor	n1	n1	n1	
	freqDomainPosition	0	0	0	
	freqDomainShift	0	0	0	
	freqHopping c-SRS	12 for test configuration 1,2, 3	12	12	
	freqHopping b-SRS	0	0	0	

	Field	SRSConf.1	SRSConf.2	SRSConf.3	Comments
	freqHopping b-hop	0	0	0	
	groupOrSequenceHopping	Neither	Neither	Neither	
	resourceType	Periodic	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl640, 0	sl320, 0	Offset to align with DRX periodicity
	sequenceId	0	0	0	Any 10 bit number

A.16.4.1.1.2 Test requirements

The test requirements are the same as in clause A.6.4.1.1.2.

A.16.4.1.2 NR UE Transmit Timing Test for FR1 for 2 Rx RedCap UE

A.16.4.1.2.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNB and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1A.2.

Supported test configurations are shown in table A.16.4.1.2.1-1.

Table A.16.4.1.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	NR HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to be tested in one of the supported test configurations	

For this test a single NR cell is used. Table A.16.4.1.2.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.16.4.1.1.1-3.

Table A.16.4.1.2.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2
SSB ARFCN		1,2,3,4	Freq1	Freq1
TDD configuration		1	Not Applicable	
		2	TDDConf.1.1	
		3	TDDConf.2.1	
		4	Not Applicable	
$BW_{channel}$	MHz	1	10: $N_{PRB,c}$ = 52	
		2	10: $N_{PRB,c}$ = 52	
		3	20: $N_{PRB,c}$ = 51	
		4	10: $N_{PRB,c}$ = 52	
Initial BWP Configuration		1,2,3,4	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1,2,3,4	DLBWP.1.1 ULBWP.1.1	
DRX Cycle	ms	1,2,3,4	N/A	DRX.8[Note5]
PDSCH Reference measurement channel		1	SR.1.1 FDD	
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
		4	SR.1.1 FDD	
		1	CR.1.1 FDD	

Parameter	Unit	Config	Test1	Test2
RMSI CORESET Reference Channel		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
		4	CR.1.1 FDD	
Dedicated CORESET Reference Channel		1	CCR.1.1 FDD	
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
		4	CCR.1.1 FDD	
OCNG Patterns		1,2,3,4	OP.1	
SSB configuration		1,2,4	SSB.1 FR1	
		3	SSB. 1 RedCap FR1	
SMTC Configuration		1,2,4	SMTC.1	
		3	SMTC.2	
TRS configuration		1	TRS.1.1 FDD	
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
		4	TRS.1.1 FDD	
EPRE ratio of PSS to SSS	dB	1,2,3,4	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1,2,3,4	-98	-98
N_{oc} Note2	dBm/SCS	1,2,4	-98	-98
		3	-95	-95
$\hat{E}_s / I_{ot}$		1,2,3,4	3	3
$\hat{E}_s / N_{oc}$		1,2,3,4	3	3
SS-RSRP Note3	dBm/SCS	1,2,4	-95	-95
		3	-92	-92
Io Note3	dBm/9.36 MHz	1,2,4	-65.2	-65.2
	dBm/18. 36 MHz	3	-62. 36	-62. 36
Propagation condition		1,2,3,4	AWGN	
Antenna Configuration			1x2	
SRS Config		1,2,4	SRSConf.1 Note6	SRSConf.3 Note6
		3	SRSConf.1 Note6	SRSConf.2 Note6

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.16.4.1.1.1-3

A.16.4.1.2.2 Test requirements

The test requirements are the same as in clause A.6.4.1.1.2.

A.16.4.2 Void

A.16.4.3 Timing advance

A.16.4.3.1 SA FR1 timing advance adjustment accuracy for 1 Rx UE

A.16.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3A.

A.16.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.16.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.16.4.3.1.2-2, A.16.4.3.1.2-3 and A.16.4.3.1.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.16.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.16.4.3.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.16.4.3.1.2-1: Timing advance supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.4.3.1.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		1	
Initial DL BWP		DLBWP.0.1	As specified in table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2

Timing Advance Command (T_A) value during T2		39	For 15 kHz SCS $N_{TA_new} = N_{TA_old} + 8192*T_c$ For 30 kHz SCS $N_{TA_new} = N_{TA_old} + 4096*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.16.4.3.1.2-3: Cell specific test parameters for timing advance

Parameter		Unit	Test1	
			T1	T2
Duplex mode	Config 1,4		FDD	
	Config 2,3		TDD	
	Config 4		HD-FDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		20: $N_{PRB,c}$ = 51	
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		20: $N_{PRB,c}$ = 51	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
OCNG Patterns			OP.1	
SMTC configuration	Config 1,2,4		SMTC.1 FR1	
	Config 3		SMTC.2 FR1	
SSB configuration	Config 1,2,4		SSB.1 FR1	
	Config 3		SSB.1 RedCap FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4	kHz	15 kHz	
	Config 3		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,4	kHz	15 kHz	
	Config 3		30 kHz	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-98	
N_{oc} Note2	Config 1,2,4	dBm/SCS	-98	

Parameter		Unit	Test1	
			T1	T2
	Config 3		-95	
$\hat{E}_s / I_{ot}$		dB	3	
$\hat{E}_s / N_{oc}$		dB	3	
Io[Note3]	Config 1,2,4	dBm/ 9.36 MHz	-67.57	
	Config 3	dBm/ 18.36 MHz	-65.76	
Propagation condition		-	AWGN	
Antenna Configuration			1x1	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

Table A.16.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance

Field		Value	Comment
c-SRS	Config 1,2,4	12	Frequency hopping is disabled
	Config 3	12	
b-SRS		0	
b-hop		0	
freqDomainPosition		0	Frequency domain position of SRS
freqDomainShift		0	
groupOrSequenceHopping		neither	No group or sequence hopping
SRS-PeriodicityAndOffset		sl5=2 for SCS 15 kHz sl5=4 for SCS 30 kHz	Once every 5 slots
pathlossReferenceRS		ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage		Codebook	Codebook based UL transmission
startPosition		0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols		n1	
repetitionFactor		n1	
combOffset-n2		0	transmissionComb setting
cyclicShift-n2		0	
nrofSRS-Ports		port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].			

A.16.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.16.4.3.2 SA FR1 timing advance adjustment accuracy for 2 Rx UE

A.16.4.3.2.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3A.

A.16.4.3.2.2 Test Parameters

Supported test configurations are shown in table A.16.4.3.2.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.16.4.3.2.2-2, A.16.4.3.2.2-3 and A.16.4.3.2.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.16.4.3.2.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.16.4.3.2.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.16.4.3.2.2-1: Timing advance supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.4.3.2.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		1	
Initial DL BWP		DLBWP.0.1	As specified in table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	For 15 kHz SCS $N_{TA_new} = N_{TA_old} + 8192*T_c$ For 30 kHz SCS $N_{TA_new} = N_{TA_old} + 4096*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.16.4.3.2.2-3: Cell specific test parameters for timing advance

Parameter		Unit	Test1	
			T1	T2
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	

Parameter		Unit	Test1	
			T1	T2
	Config 4		HD-FDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		20: $N_{PRB,c}$ = 51	
BWP BW	Config 1,4	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		20: $N_{PRB,c}$ = 51	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
OCNG Patterns			OP.1	
SMTC configuration	Config 1,2,4		SMTC.1 FR1	
	Config 3		SMTC.2 FR1	
SSB configuration	Config 1,2,4		SSB.1 FR1	
	Config 3		SSB.1 RedCap FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4	kHz	15 kHz	
	Config 3		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,4	kHz	15 kHz	
	Config 3		30 kHz	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-98	
N_{oc} Note2	Config 1,2,4	dBm/SCS	-98	
	Config 3		-95	
$\hat{E}_s / I_{ot}$		dB	3	
$\hat{E}_s / N_{oc}$		dB	3	
Io Note3	Config 1,2,4	dBm/ 9.36 MHz	-67.57	
	Config 3	dBm/ 18.36 MHz	-65.76	
Propagation condition		-	AWGN	
Antenna Configuration			1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Parameter	Unit	Test1	
		T1	T2
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

Table A.16.4.3.2.2-4: Sounding Reference Symbol Configuration for timing advance

Field		Value	Comment
c-SRS	Config 1,2,4	12	Frequency hopping is disabled
	Config 3	12	
b-SRS		0	
b-hop		0	
freqDomainPosition		0	Frequency domain position of SRS
freqDomainShift		0	
groupOrSequenceHopping		neither	No group or sequence hopping
SRS-PeriodicityAndOffset		sl5=2 for SCS 15 kHz sl5=4 for SCS 30 kHz	Once every 5 slots
pathlossReferenceRS		ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage		Codebook	Codebook based UL transmission
startPosition		0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols		n1	
repetitionFactor		n1	
combOffset-n2		0	transmissionComb setting
cyclicShift-n2		0	
nrofSRS-Ports		port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].			

A.16.4.3.2.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.16.5 Signalling characteristics for RedCap

A.16.5.1 Radio link Monitoring

A.16.5.1.1 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode for 1 Rx UE

A.16.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the 1 Rx RedCap UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell for 1 Rx RedCap UE. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1B.2.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.16.5.1.1.1-1. The test parameters are given in tables A.16.5.1.1.1-2, A.16.5.1.1.1-3, and A.16.5.1.1.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3

respectively. Figure A.16.5.1.1 .1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

Table A.16.5.1.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.1.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode for 1 Rx UE

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		FDD
		Config 2, 3		TDD
		Config 4		HD-FDD
$BW_{channel}$		Config 1, 4	MHz	10: $N_{PRB,c}$ = 52
		Config 2		10: $N_{PRB,c}$ = 52
		Config 3		20: $N_{PRB,c}$ = 51
DL initial BWP configuration		Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration		Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2, 3, 4		ULBWP.1.1
TDD Configuration		Config 1,4		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
RMSI CORESET Reference Channel		Config 1, 4		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel		Config 1, 4		CCR.3.2 FDD
		Config 2		CCR.4.2 TDD
		Config 3		CCR.5.2 TDD
SSB Configuration		Config 1, 4		SSB.1 FR1
		Config 2		SSB.1 FR1
		Config 3		SSB.1 RedCap FR1
SMTC Configuration		Config 1, 2, 4		SMTC.1
		Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1, 2, 4		15 kHz
		Config 3		30 kHz
PRACH Configuration		Config 1, 2, 4		Table A.3.8.2.1-1
		Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS				0
OCNG parameters				OP.1
CP length				Normal
Correlation Matrix and Antenna Configuration				2x1 low
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	16
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4

Parameter			Unit	Value
				Test 1
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				*gp0*
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS configuration for CSI reporting		Config 1, 4		CSI-RS.1.1 FDD
		Config 2		CSI-RS.1.1 TDD
		Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking		Config 1, 4		TRS.1.1 FDD
		Config 2		TRS.1.1 TDD
		Config 3		TRS.1.2 TDD
T1			s	0.2
T2			s	0.88
T3			s	0.88
D1			s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.16.5.1.1.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode for 1 Rx UE

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1, 4	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	Config 1, 4	dBm/SCS	-98		
	Config 2		-98		
	Config 3		-95		
Propagation condition			TDL-C 300 ns 100 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.1.1 .1-1. NOTE 5: Void					

Table A.16.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode for 1 Rx UE

Field	Test 1
	Value
gapOffset	0
NOTE: Ensure that RLM RS is partially overlapped with measurement gap	

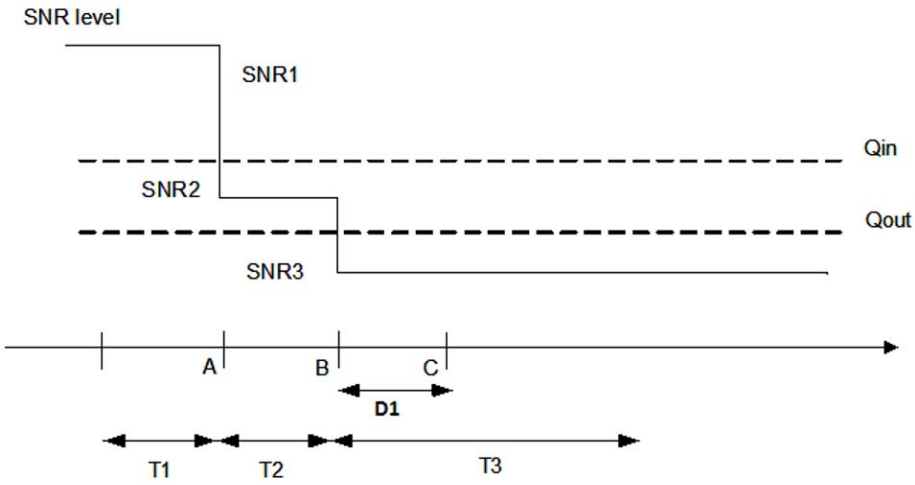


Figure A.16.5.1.1.1-1: SNR variation for out-of-sync testing

A.16.5.1.1.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.2 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode for 2 Rx UE

A.16.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell for 2 Rx RedCap UE. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1B.2.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.16.5.1.2.1-1. The test parameters are given in tables A.16.5.1.2.1-2, A.16.5.1.2.1-3, and A.16.5.1.2.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.16.5.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

Table A.16.5.1.2.1-1: Supported test configurations for FR1 PCell for 2 Rx Redcap UE

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.2.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode for 2 Rx Redcap UE

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
$BW_{channel}$	Config 1, 4	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		20: $N_{PRB,c}$ = 51
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
TDD Configuration	Config 1, 4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.3 FDD
	Config 2		CCR.1.3 TDD
	Config 3		CCR.2.2 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2, 4		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2,4		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*

Parameter		Unit	Value
			Test 1
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.2.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode for 2 Rx Redcap UE

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1, 4	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	Config 1, 4	dBm/SCS	-98		
	Config 2		-98		
	Config 3		-95		
Propagation condition			TDL-C 300 ns 100 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.1.2.1-1. NOTE 5: The SNR values are specified for testing a UE which supports 2 RX on at least one band.					

Table A.16.5.1.2.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE: Ensure that RLM RS is partially overlapped with measurement gap	

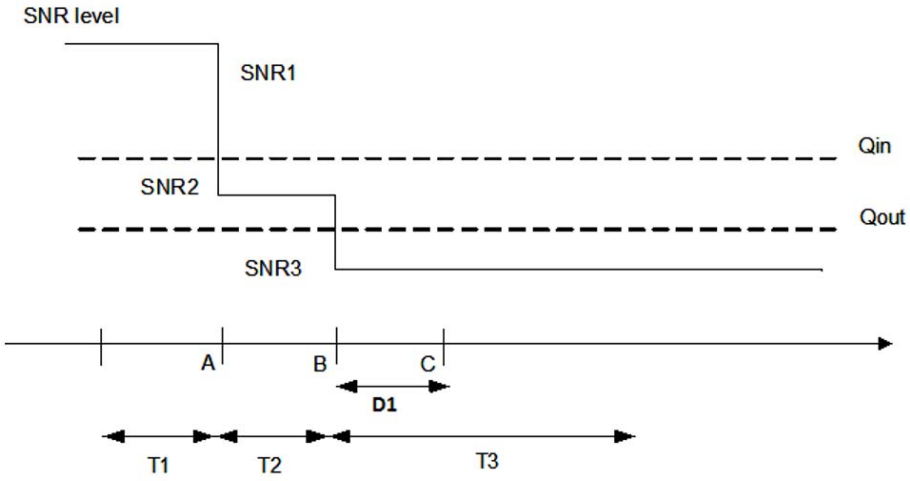


Figure A.16.5.1.2.1-1: SNR variation for out-of-sync testing

A.16.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.3 Radio Link Monitoring In-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode for 1 Rx UE

A.16.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1B.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.16.5.1.3.1-1. The test parameters are given in tables A.16.5.1.3.1-2, and A.16.5.1.3.1-3 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Table A.16.5.1.3.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.3.1-2: General test parameters for FR1 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
	Config 4		HD-FDD
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		20: $N_{PRB,c}$ = 51
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
TDD Configuration	Config 1,4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1,4		CCR.3.1 FDD
	Config 2		CCR.3.1 TDD
	Config 3		CCR.4.1 TDD
SSB Configuration	Config 1,4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2, 3, 4		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2, 3, 4		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x1 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	16
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*

Parameter		Unit	Value
			Test 1
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.44
T4		s	0.2
T5		s	0.88
D1		s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.3.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1,4	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1, 4	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
N_{oc}	Config 1, 4	dBm/SCS	-98				
	Config 2		-98				
	Config 3		-95				
Propagation condition			TDL-C 300 ns 100 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.16.5.1.3.1-1. NOTE 5: Void.								

Table A.16.5.1.3.1-4: Void

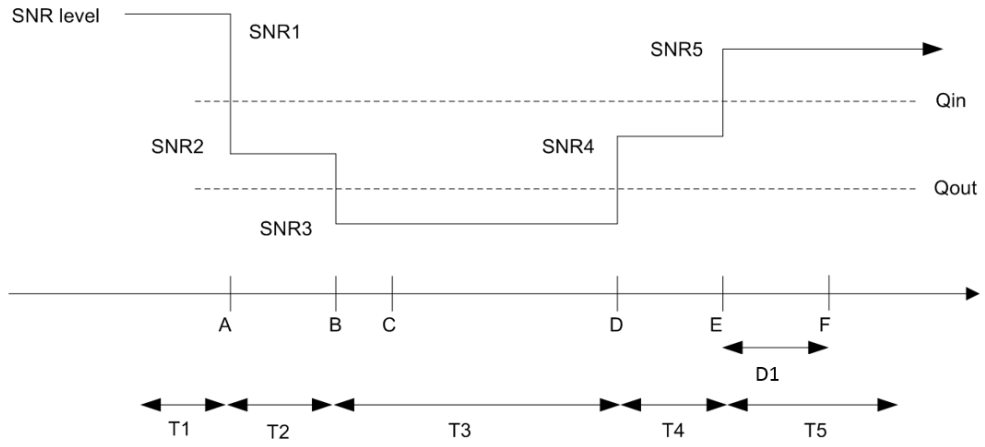


Figure A.16.5.1.3.1-1: SNR variation for in-sync testing

A.16.5.1.3.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.4 Radio Link Monitoring In-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode for 2 Rx UE

A.16.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1B.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.16.5.1.4.1-1. The test parameters are given in tables A.16.5.1.4.1-2, and A.16.5.1.4.1-3 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Table A.16.5.1.4.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.4.1-2: General test parameters for FR1 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
$BW_{channel}$	Config 1, 4	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		20: $N_{PRB,c}$ = 51
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
TDD Configuration	Config 1, 4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2, 3, 4		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2, 3 ,4		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1

Parameter		Unit	Value
			Test 1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.4.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1, 4	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
N_{oc}	Config 1, 4	dBm/SCS	-98				
	Config 2		-98				
	Config 3		-95				
Propagation condition			TDL-C 300 ns 100 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.16.5.1.4.1-1. NOTE 5: The SNR values are specified for testing a UE which supports 2 RX on at least one band.								

Table A.16.5.1.4.1-4: Void

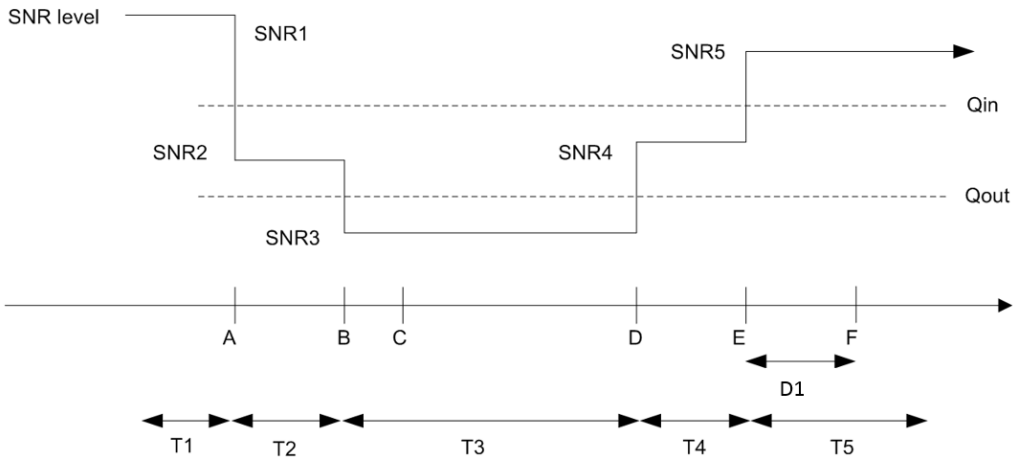


Figure A.16.5.1.4.1-1: SNR variation for in-sync testing

A.16.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.5 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in DRX mode for 1 Rx UE

A.16.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1B.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.16.5.1.5.1-1. The test parameters are given in tables A.16.5.1.5.1-2, and A.16.5.1.5.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.16.5.1.5.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.16.5.1.5.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.5.1-2: General test parameters for FR1 out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		20: $N_{PRB,c}$ = 51
	Config 4		10: $N_{PRB,c}$ = 52
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
	Config 4		Not Applicable
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.3.2 FDD
	Config 2		CCR.4.2 TDD
	Config 3		CCR.5.2 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2, 4		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2, 4		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x1 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	16
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000

Parameter		Unit	Value
			Test 1
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.5.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1, 4	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	Config 1, 4	dBm/SCS	-98		
	Config 2		-98		
	Config 3		-95		
Propagation condition			TDL-C 300 ns 100 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.1.5.1-1.					

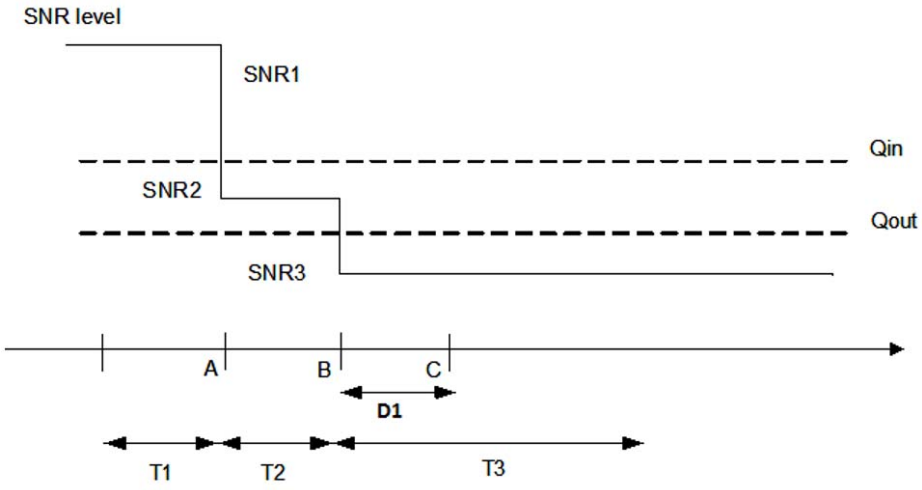


Figure A.16.5.1.5.1-1: SNR variation for out-of-sync testing

A.16.5.1.5.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.6 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in DRX mode for 2 Rx UE

A.16.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1B.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.16.5.1.6.1-1. The test parameters are given in tables A.16.5.1.6.1-2, and A.16.5.1.6.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.16.5.1.6.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.16.5.1.6.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.6.1-2: General test parameters for FR1 out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		20: $N_{PRB,c}$ = 51
	Config 4		10: $N_{PRB,c}$ = 52
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
	Config 4		Not Applicable
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.3 FDD
	Config 2		CCR.1.3 TDD
	Config 3		CCR.2.2 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2, 4		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2, 4		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*

Parameter		Unit	Value
			Test 1
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	0.68
T3		s	0.68
D1		s	0.64
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.6.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1, 4	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	Config 1, 4	dBm/SCS	-98		
	Config 2		-98		
	Config 3		-95		
Propagation condition			TDL-C 300 ns 100 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.1.6.1-1. NOTE 5: The SNR values are specified for testing a UE which supports 2 RX on at least one band.					

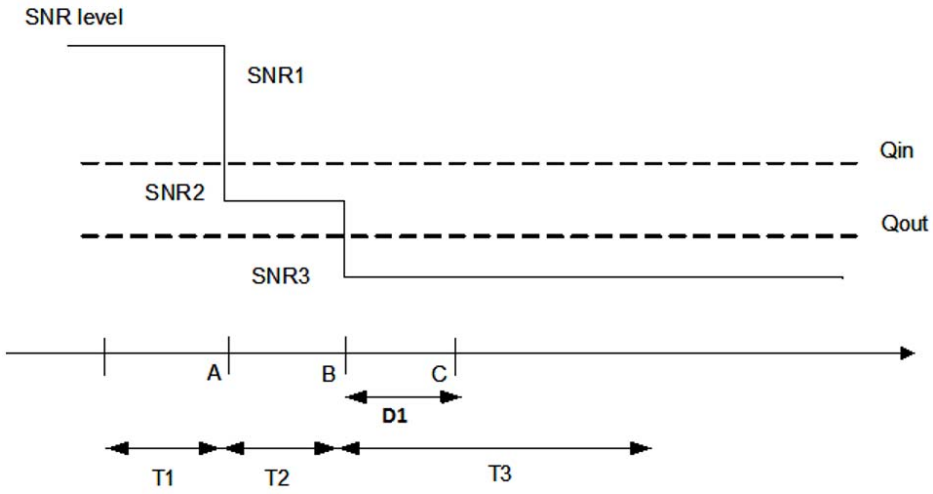


Figure A.16.5.1.6.1-1: SNR variation for out-of-sync testing

A.16.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.7 Radio Link Monitoring In-sync Test for FR1 PCell configured with SSB-based RLM RS in DRX mode for 1 Rx UE

A.16.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1B.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.16.5.1.7.1-1. The test parameters are given in tables A.16.5.1.7.1-2, and A.16.5.1.7.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.1.7.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.16.5.1.7.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.7.1-2: General test parameters for FR1 in-sync testing in DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		FDD
		Config 2, 3		TDD
		Config 4		HD-FDD
$BW_{channel}$		Config 1, 4	MHz	10: $N_{PRB,c}$ = 52
		Config 2		10: $N_{PRB,c}$ = 52
		Config 3		20: NRB,c = 51
DL initial BWP configuration		Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration		Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2, 3, 4		ULBWP.1.1
TDD Configuration		Config 1, 4		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
RMSI CORESET Reference Channel		Config 1, 4		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel		Config 1, 4		CCR.3.1 FDD
		Config 2		CCR.4.1 TDD
		Config 3		CCR.5.1 TDD
SSB Configuration		Config 1, 4		SSB.1 FR1
		Config 2		SSB.1 FR1
		Config 3		SSB.1 RedCap FR1
SMTC Configuration		Config 1, 2, 3, 4		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1, 2, 4		15 kHz
		Config 3		30 kHz
PRACH Configuration		Config 1, 2, 3, 4		Table A.3.8.2.1-1
SSB index assigned as RLM RS				0
OCNG parameters				OP.1
CP length				Normal
Correlation Matrix and Antenna Configuration				2x1 Low
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	0
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	16
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size

Parameter		Unit	Value
			Test 1
REG bundle size			6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1,4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	1.24
T4		s	0.2
T5		s	1.88
D1		s	1.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.7.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1, 4	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
N_{oc}	Config 1, 4	dBm/SCS	-98				
	Config 2		-98				
	Config 3		-95				
Propagation condition			TDL-C 300 ns 100 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.16.5.1.7.1-1. NOTE 5: Void.								

Table A.16.5.1.7.1-4: Void

Table A.16.5.1.7.1-5: Void

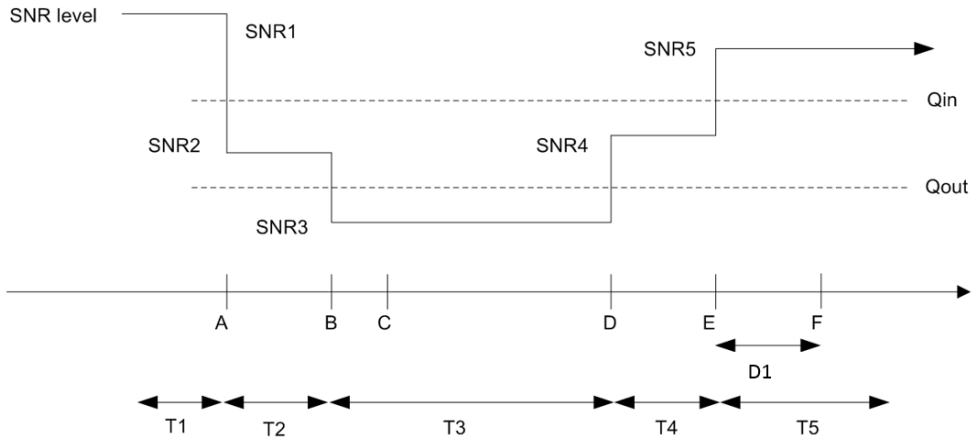


Figure A.16.5.1.7.1-1: SNR variation for in-sync testing.

A.16.5.1.7.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.8 Radio Link Monitoring In-sync Test for FR1 PCell configured with SSB-based RLM RS in DRX mode for 2 Rx UE

A.16.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1B.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.16.5.1.8.1-1. The test parameters are given in tables A.16.5.1.8.1-2, and A.16.5.1.8.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.1.8.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.16.5.1.8.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 20 MHz
4	HD-FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.8.1-2: General test parameters for FR1 in-sync testing in DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		FDD
		Config 2, 3		TDD
		Config 4		HD-FDD
$BW_{channel}$		Config 1, 4	MHz	10: $N_{PRB,c}$ = 52
		Config 2		10: $N_{PRB,c}$ = 52
		Config 3		20: $N_{PRB,c}$ = 51
DL initial BWP configuration		Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration		Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2, 3, 4		ULBWP.1.1
TDD Configuration		Config 1, 4		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
RMSI CORESET Reference Channel		Config 1, 4		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel		Config 1, 4		CCR.1.1 FDD
		Config 2		CCR.1.1 TDD
		Config 3		CCR.2.1 TDD
SSB Configuration		Config 1, 4		SSB.1 FR1
		Config 2		SSB.1 FR1
		Config 3		SSB.1 RedCap FR1
SMTC Configuration		Config 1, 2, 3, 4		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1, 2, 4		15 kHz
		Config 3		30 kHz
PRACH Configuration		Config 1, 2, 3, 4		Table A.3.8.2.1-1
SSB index assigned as RLM RS				0
OCNG parameters				OP.1
CP length				Normal
Correlation Matrix and Antenna Configuration				2x2 Low
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	0
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX Configuration				DRX.3

Parameter		Unit	Value
			Test 1
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.64
T4		s	0.2
T5		s	0.88
D1		s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.8.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1, 4	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
N_{oc}	Config 1, 4	dBm/SCS	-98				
	Config 2		-98				
	Config 3		-95				
Propagation condition			TDL-C 300 ns 100 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.16.5.1.8.1-1. NOTE 5: The SNR values are specified for testing a UE which supports 2 RX on at least one band..								

Table A.16.5.1.8.1-4: Void

Table A.16.5.1.8.1-5: Void

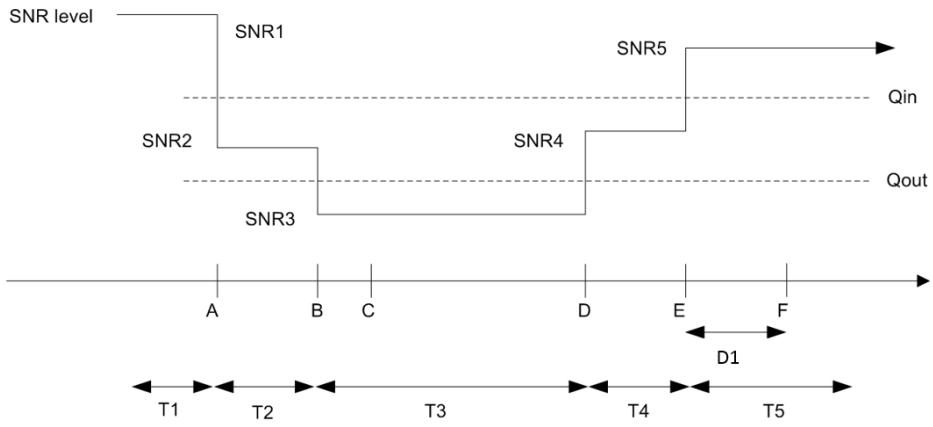


Figure A.16.5.1.8.1-1: SNR variation for in-sync testing.

A.16.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.9 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode for 1 Rx UE

A.16.5.1.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used for 1 Rx RedCap UE. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1B.3.

The test parameters are given in tables A.16.5.1.9.1-1, A.16.5.1.9.1-2, A.16.5.1.9.1-3, and A.16.5.1.9.1-3A below. There is one cell, Cell 1 which is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.16.5.1.9.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test. In the test, SSB0 is configured as the BFD-RS.

Table A.16.5.1.9.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.9.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter	Unit	Value
		Test 1
Active PCell		Cell 1

Parameter		Unit	Value
			Test 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
TDD Configuration	Config 1,4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.3.2 FDD
	Config 2		CCR.4.2 TDD
	Config 3		CCR.5.2 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2, 4		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x1 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	16
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2

Parameter	Unit	Value
		Test 1
T2	s	0.88
T3	s	0.88
D1	s	0.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.		

Table A.16.5.1.9.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4		
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta		dB	0		
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB			
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB			
EPRE ratio of PSS to SSSSSS_beta		dB			
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1,4	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1,4	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
Propagation condition			TDL-C 300 ns 100 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.					
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.					
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.					
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.					
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.					
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.					
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.1.9.1-1.					

Table A.16.5.1.9.1-3A: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: Void	

Table A.16.5.1.9.1-4: Void

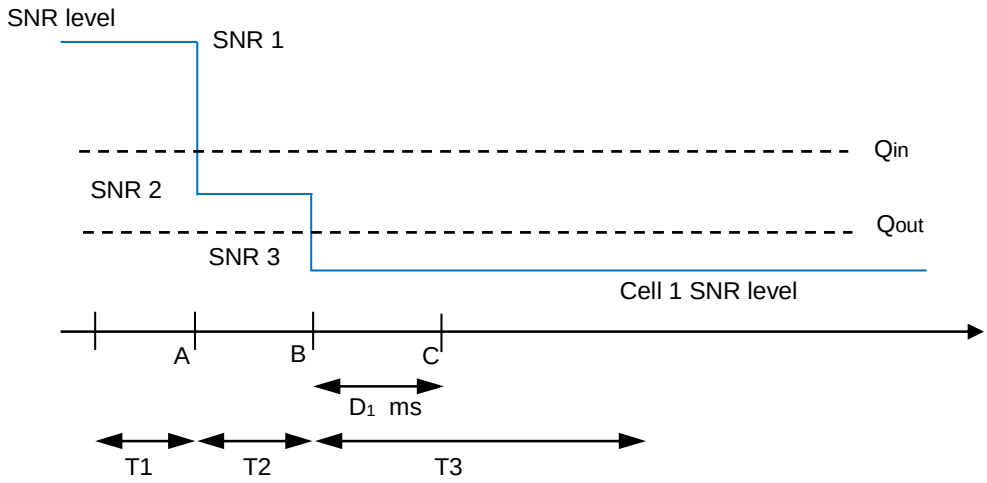


Figure A.16.5.1.9.1-1: SNR variation for CSI-RS out-of-sync testing

A.16.5.1.9.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.10 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode for 2 Rx UE

A.16.5.1.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used for 2 Rx RedCap UE. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1B.3.

The test parameters are given in tables A.16.5.1.10.1-1, A.16.5.1.10.1-2, A.16.5.1.10.1-3, and A.16.5.1.10.1-3A below. There is one cell, Cell 1 which is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.16.5.1.10.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test. In the test, SSB0 is configured as the BFD-RS and is not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.16.5.1.10.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.10.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
TDD Configuration	Config 1,4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.3 FDD
	Config 2		CCR.1.3 TDD
	Config 3		CCR.2.2 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2, 4		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
SSB index assigned as BFD-RS			0
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1

Parameter		Unit	Value
			Test 1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.10.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4		
EPRE ratio of PDCCH to PDCCH DMRSPDCCH DMRS_beta		dB	0		
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB			
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB			
EPRE ratio of PSS to SSSSSS_beta		dB			
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1,4	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1,4	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
Propagation condition			TDL-C 300 ns 100 Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.1.10.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2 RX on at least one band.

Table A.16.5.1.10.1-3A: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: Void	

Table A.16.5.1.10.1-4: Void

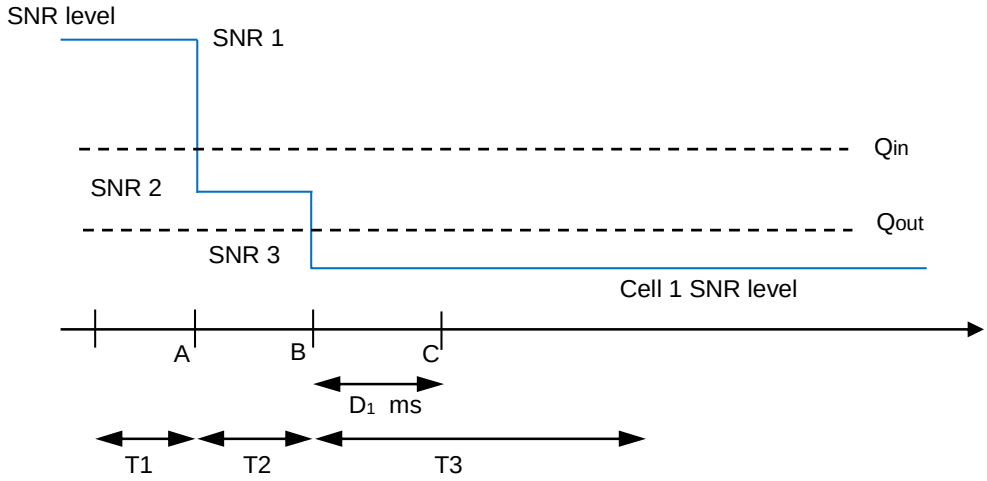


Figure A.16.5.1.10.1-1: SNR variation for CSI-RS out-of-sync testing

A.16.5.1.10.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.11 Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode for 1 Rx UE

A.16.5.1.11.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1B.3.

The test parameters are given in tables A.16.5.1.11.1-1, A.16.5.1.11.1-2, and A.16.5.1.11.1-3 below. There is one cells, Cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.1.11.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. In the test, SSB0 is configured as the BFD-RS.

Table A.16.5.1.11.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.11.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.3.1 FDD
	Config 2		CCR.4.1 TDD
	Config 3		CCR.5.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2, 4		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x1 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	16
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0

Parameter		Unit	Value
			Test 1
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.488
T4		s	0.2
T5		s	1.88
T6		s	1.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.11.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	0				
EPRE ratio of PDCCH to PDCCH DMRSPDCCH DMRS_beta		dB					
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB					
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB					
EPRE ratio of PSS to SSSSSS_beta		dB					
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1,4	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1,4	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1. NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1. NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1. NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.16.5.1.11.1-1.								

Table A.16.5.1.11.1-4: Void

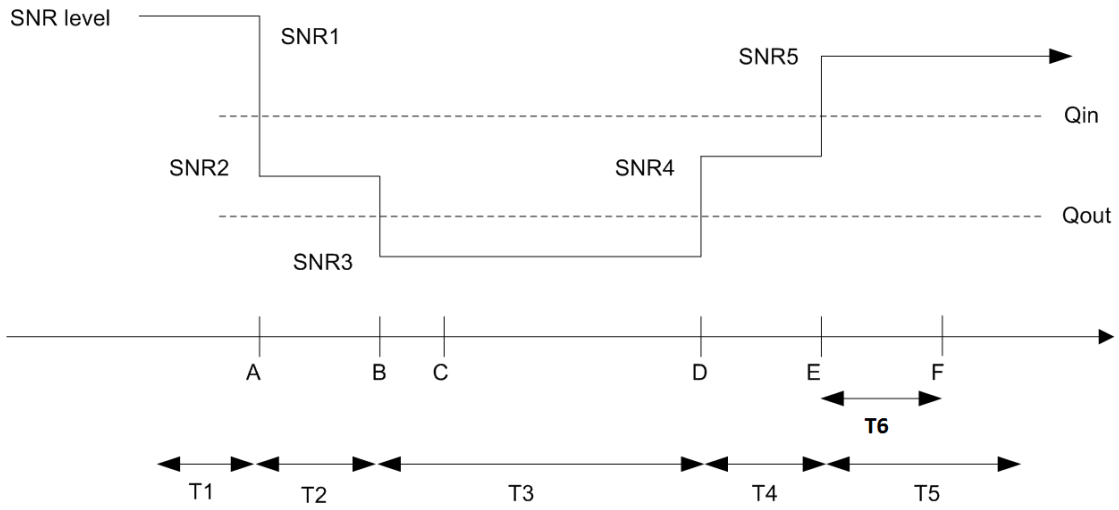


Figure A.16.5.1.11.1-1: SNR variation for CSI-RS in-sync testing

A.16.5.1.11.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.12 Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode for 2 Rx UE

A.16.5.1.12.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1B.3.

The test parameters are given in tables A.16.5.1.12.1-1, A.16.5.1.12.1-2, and A.16.5.1.12.1-3 below. There is one cells, Cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.1.12.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. In the test, SSB0 is configured as the BFD-RS and is not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.16.5.1.12.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.12.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2, 4		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
SSB index assigned as BFD-RS			0
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0

Parameter		Unit	Value
			Test 1
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.44
T4		s	0.2
T5		s	0.88
T6		s	0.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.12.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	0				
EPRE ratio of PDCCH to PDCCH DMRSPDCCH DMRS_beta		dB					
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB					
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB					
EPRE ratio of PSS to SSSSSS_beta		dB					
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1,4	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1,4	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.16.5.1.12.1-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2 RX on at least one band.						

Table A.16.5.1.12.1-4: Void

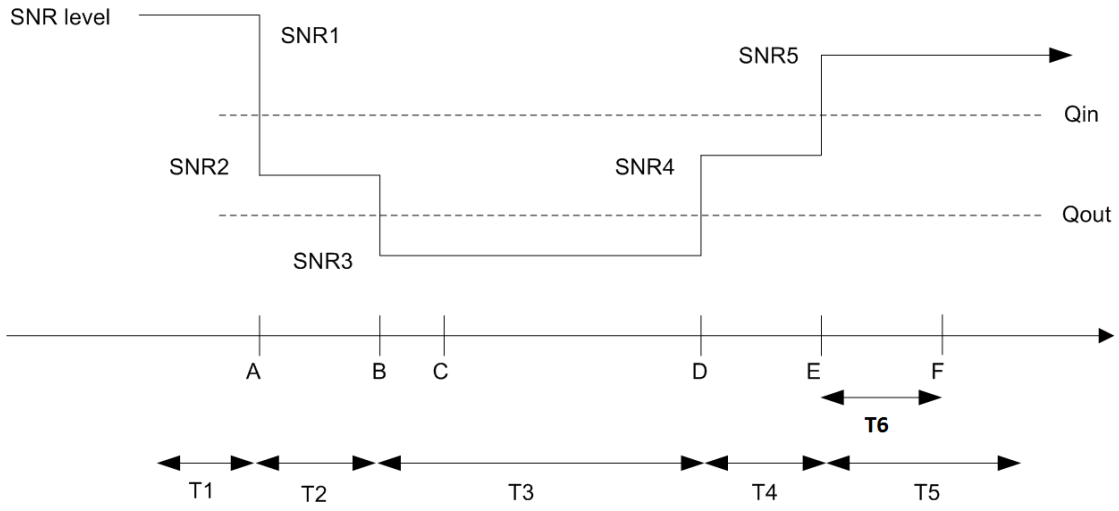


Figure A.16.5.1.12.1-1: SNR variation for CSI-RS in-sync testing

A.16.5.1.12.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.13 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode for 1 Rx UE

A.16.5.1.13.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1B.3.

The test parameters are given in tables A.16.5.1.13.1-1, A.16.5.1.13.1-2, and A.16.5.1.13.1-3 below. There is one cell, Cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.16.5.1.13.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be

configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. In the test, SSB0 is configured as the BFD-RS.

Table A.16.5.1.13.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.13.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.3.2 FDD
	Config 2		CCR.4.2 TDD
	Config 3		CCR.5.2 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2, 4		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x1 Low
Out of sync transmission parameters	DCI format		1-0

Parameter		Unit	Value
			Test 1
	Number of Control OFDM symbols		2
	Aggregation level	CCE	16
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	2.48
T3		s	2.48
D1		s	2.44
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.13.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4		
EPRE ratio of PDCCH to PDCCH DMRSPDCCH DMRS_beta		dB	0		
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB			
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB			
EPRE ratio of PSS to SSSSSS_beta		dB			
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1,4	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1,4	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
Propagation condition			TDL-C 300 ns 100 Hz		

Parameter	Unit	Test 1		
		T1	T2	T3
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.				
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.				
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.				
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.				
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.				
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.				
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.1.13.1-1.				

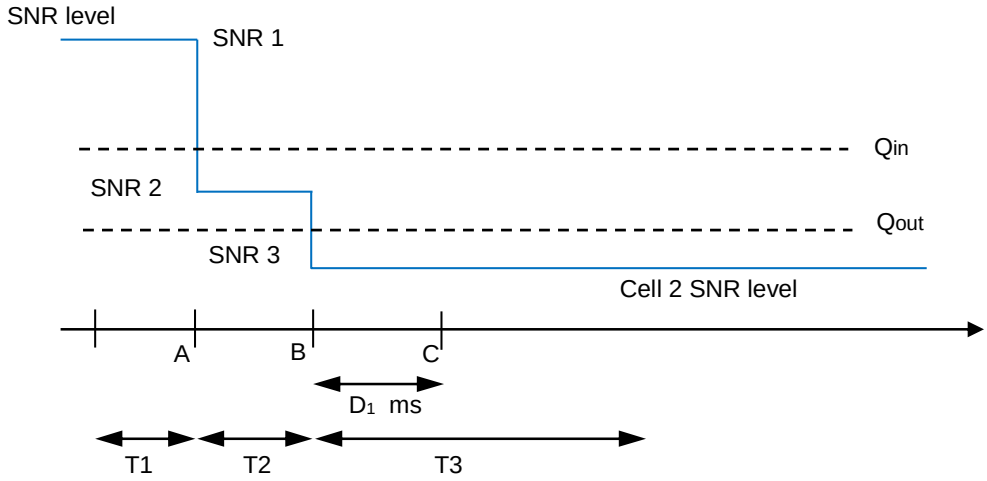


Figure A.16.5.1.13.1-1: SNR variation for CSI-RS out-of-sync testing

A.16.5.1.13.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on PCell.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.14 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode for 2 Rx UE

A.16.5.1.14.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in tables A.16.5.1.14.1-1, A.16.5.1.14.1-2, and A.16.5.1.14.1-3 below. There is one cell, Cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.16.5.1.14.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be

configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. In the test, SSB0 is configured as the BFD-RS and is not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.16.5.1.14.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.14.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.3 FDD
	Config 2		CCR.1.3 TDD
	Config 3		CCR.2.2 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2, 4		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
SSB index assigned as BFD-RS			0
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low

Parameter		Unit	Value
			Test 1
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.14.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4		
EPRE ratio of PDCCH to PDCCH DMRSPDCCH DMRS_beta		dB	0		
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB			
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB			
EPRE ratio of PSS to SSSSSS_beta		dB			
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1,4	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1,4	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
Propagation condition			TDL-C 300 ns 100 Hz		

Parameter	Unit	Test 1		
		T1	T2	T3
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.				
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.				
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.				
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.				
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.				
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.				
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.1.14.1-1.				
NOTE 9: The SNR values are specified for testing a UE which supports 2 RX on at least one band.				

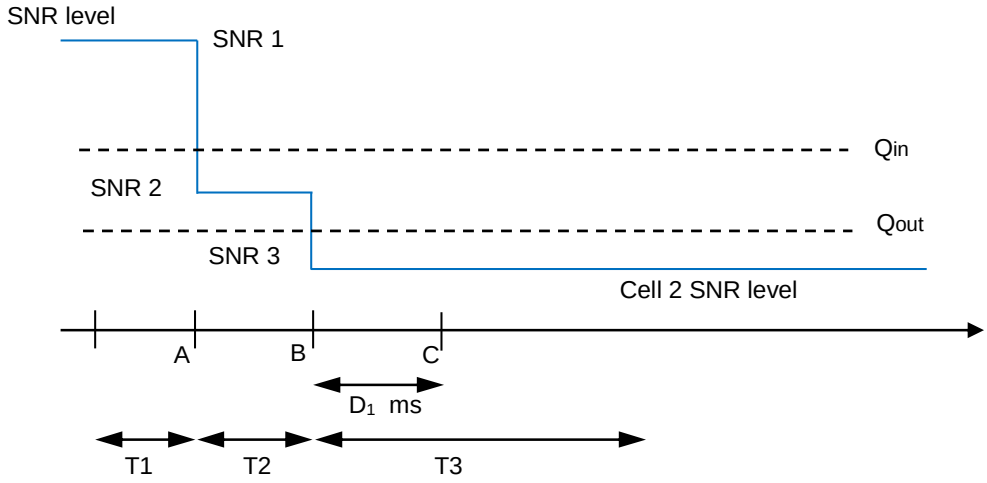


Figure A.16.5.1.14.1-1: SNR variation for CSI-RS out-of-sync testing

A.16.5.1.14.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on PCell.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.15 Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode for 1 Rx UE

A.16.5.1.15.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1B.3.

The test parameters are given in tables A.16.5.1.15.1-1, A.16.5.1.151-2, A.16.5.1.15.1-3 and A.16.5.1.15.1-3A below. There is one cells, Cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.1.15.1-1 shows the variation of the downlink SNR in the

PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test. In the test, SSB0 is configured as the BFD-RS.

Table A.16.5.1.15.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.15.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.3.1 FDD
	Config 2		CCR.4.1 TDD
	Config 3		CCR.5.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x1 Low
Out of sync transmission parameters	DCI format		1-0

Parameter		Unit	Value
			Test 1
	Number of Control OFDM symbols		2
	Aggregation level	CCE	16
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	4000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	2.44
T4		s	0.2
T5		s	1.88
T6		s	1.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.15.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	0				
EPRE ratio of PDCCH to PDCCH DMRSPDCCH DMRS_beta		dB					
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB					
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB					
EPRE ratio of PSS to SSSSSS_beta		dB					
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1,4	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
N_{oc}	Config 1,4	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.							
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.							
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.							
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.16.5.1.15.1-1.							

Table A.16.5.1.15.1-3A: Measurement gap configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: Void	

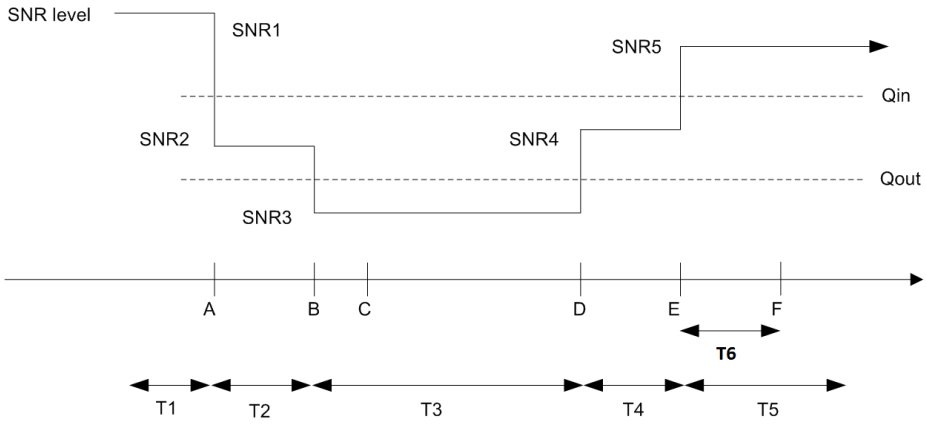


Figure A.16.5.1.15.1-1: SNR variation for CSI-RS in-sync testing

A.16.5.1.15.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.1.16 Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode for 2 Rx UE

A.16.5.1.16.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1B.3.

The test parameters are given in tables A.16.5.1.15.1-1, A.16.5.1.151-2, A.16.5.1.15.1-3 and A.16.5.1.15.1-3A below. There is one cells, Cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.1.15.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test. In the test, SSB0 is configured as the BFD-RS and is not same as RLM-RS to avoid triggering the beam failure during the RLM test.

Table A.16.5.1.16.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.1.16.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
	Config 4		HD-FDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD

Parameter		Unit	Value
			Test 1
SSB index assigned as BFD-RS			0
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	1.24
T4		s	0.2
T5		s	1.88
T6		s	1.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.1.16.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta	dB	0				
EPRE ratio of PDCCH to PDCCH DMRSPDCCH DMRS_beta	dB					
EPRE ratio of PBCH DMRS to SSSPBCH_beta	dB					
EPRE ratio of PBCH to PBCH DMRSPSS_beta	dB					
EPRE ratio of PSS to SSSSSS_beta	dB					
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1,4	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1,4	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.16.5.1.15.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2 RX on at least one band.

Table A.16.5.1.16.1-3A: Measurement gap configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: Void	

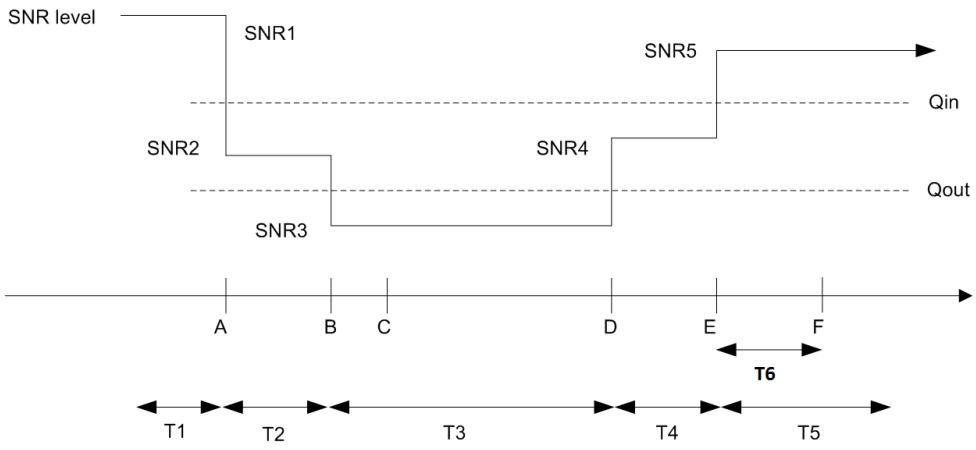


Figure A.16.5.1.15.1-1: SNR variation for CSI-RS in-sync testing

A.16.5.1.16.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.2 Beam Failure Detection and Link recovery procedures

A.16.5.2.1 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in non-DRX mode for 1 Rx UE

A.16.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5B.

The test parameters are given in tables A.16.5.2.1.1-1, A.16.5.2.1.1-2, A.16.5.2.1.1-3 and A.16.5.2.1.1-4 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.2.1.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.16.5.2.1.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test 1.

Table A.16.5.2.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.2.1.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
	Config 4		HD-FDD	
BWchannel	Config 1,4	MHz	10: NRB,c = 52	
	Config 2		10: NRB,c = 52	
	Config 3		20: NRB,c = 51	
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3,4		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3,4		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3,4		ULBWP.1.1	
TDD Configuration	Config 1,4		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
SSB Configuration	Config 1,4		SSB.3 FR1	
	Config 2		SSB.3 FR1	
	Config 3		SSB.2 RedCap FR1	
SMTC Configuration	Config 1, 2.4		SMTC.1 RedCap	
	Config 3		SMTC.1 RedCap	

Parameter		Unit	Value	Comment
			Test 1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
PRACH Configuration	Config 1, 2		Table A.3.8.2.2-1	
	Config 3		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x1 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	16	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			gp0	
gapOffset			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2,4	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3		-95	
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1,4		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1,4		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
SSB Index assigned as RLM RS			0, 1	
T310 Timer	ms		1000	
N310			2	
T1		s	0.2	During this time the the UE shall be fully synchronized to Cell 1
T2		s	0.37	
T3		s	0.44	
T4		s	0	
T5		s	0.17	
D1		s	0.14	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.16.5.2.1.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1,4	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1,4	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
SSB_RP of set q_1	Config 1,4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
N_{oc}	Config 1,4	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9: Void.

Table A.16.5.2.1.1-4: Void

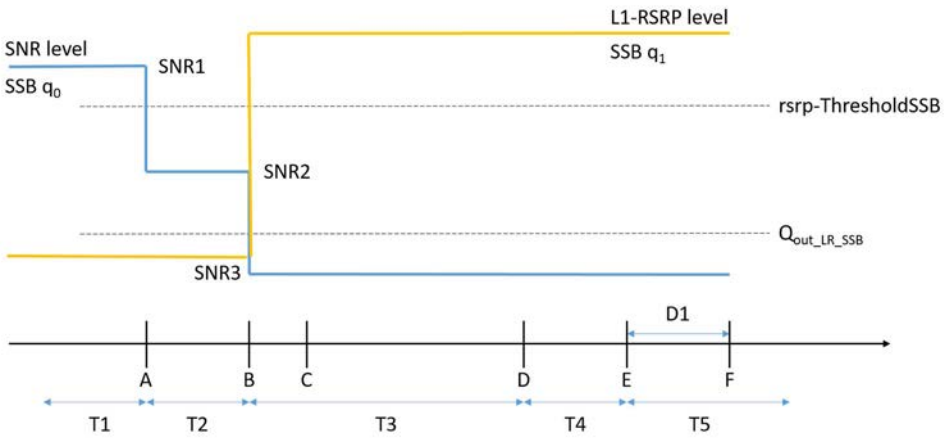


Figure A.16.5.2.1.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.16.5.2.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.2.2 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in non-DRX mode for 2 Rx UE

A.16.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5B.

The test parameters are given in tables A.16.5.2.2.1-1, A.16.5.2.2.1-2, A.16.5.2.2.1-3 and A.16.5.2.2.1-4 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.2.2.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.16.5.2.2.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test 1.

Table A.16.5.2.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.2.2.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PSCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
	Config 4		HD-FDD	
BWchannel	Config 1,4	MHz	10: NRB,c = 52	
	Config 2		10: NRB,c = 52	
	Config 3		20: NRB,c = 51	

Parameter			Unit	Value	Comment
				Test 1	
DL initial BWP configuration		Config 1, 2, 3,4		DLBWP.0.1	
DL dedicated BWP configuration		Config 1, 2, 3,4		DLBWP.1.1	
UL initial BWP configuration		Config 1, 2, 3,4		ULBWP.0.1	
UL dedicated BWP configuration		Config 1, 2, 3,4		ULBWP.1.1	
TDD Configuration		Config 1,4		Not Applicable	
		Config 2		TDDConf.1.1	
		Config 3		TDDConf.2.1	
CORESET Reference Channel		Config 1,4		CR.1.1 FDD	
		Config 2		CR.1.1 TDD	
		Config 3		CR.2.1 TDD	
SSB Configuration		Config 1,4		SSB.3 FR1	
		Config 2		SSB.3 FR1	
		Config 3		SSB.1 RedCap FR1	
SMTC Configuration		Config 1, 2,4		SMTC.1 RedCap	
		Config 3		SMTC.1 RedCap	
PDSCH/PDCCH subcarrier spacing		Config 1, 2,4		15 KHz	
		Config 3		30 KHz	
PRACH Configuration		Config 1, 2,4		Table A.3.8.2.2-1	
		Config 3		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)				0	
SSB Index assigned as CBD RS (q_1)				1	
OCNG parameters				OP.1	
CP length				Normal	
Correlation Matrix and Antenna Configuration				2x2 Low	
Beam failure detection transmission parameters	DCI format			1-0	
	Number of Control OFDM symbols			2	
	Aggregation level		CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy		dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy		dB	0	
	DMRS precoder granularity			REG bundle size	
	REG bundle size			6	
DRX				OFF	
Gap pattern ID				gp0	
gapOffset				0	
rlmInSyncOutOfSyncThreshold				absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2,4		dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3			-95	
powerControlOffsetSS				db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount				n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer				pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1,4			CSI-RS.1.1 FDD	
	Config 2			CSI-RS.1.1 TDD	
	Config 3			CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1,4			TRS.1.1 FDD	
	Config 2			TRS.1.1 TDD	
	Config 3			TRS.1.2 TDD	

Parameter		Unit	Value	Comment
			Test 1	
SSB Index assigned as RLM RS		0, 1		
T310 Timer	ms	1000		
N310		2		
T1		s	0.2	During this time the the UE shall be fully synchronized to Cell 1
T2		s	0.37	
T3		s	0.24	
T4		s	0	
T5		s	0.17	
D1		s	0.14	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.16.5.2.2.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1,4	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1,4	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
SSB_RP of set q_1	Config 1,4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
N_{oc}	Config 1,4	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300 ns 100 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1. NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1. NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1. NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.2.2.1-1. NOTE 9: The SNR values are specified for testing a UE which supports 2 RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.							

Table A.16.5.2.2.1-4: Void

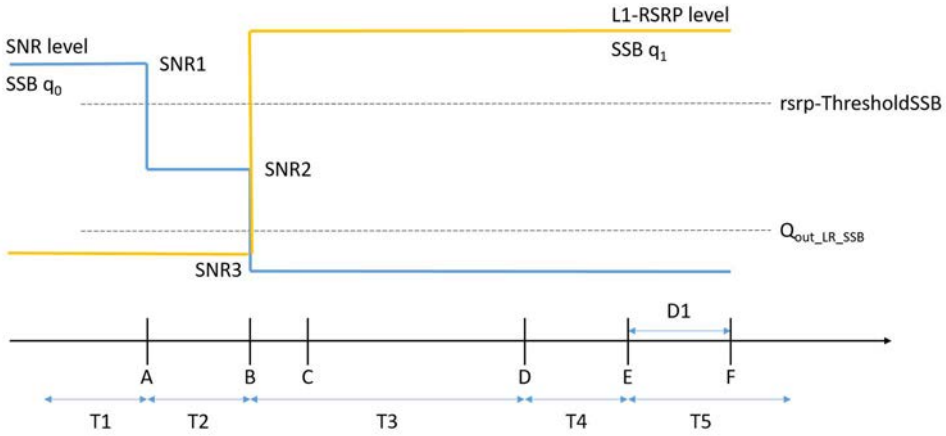


Figure A.16.5.2.2.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.16.5.2.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.2.3 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in DRX mode for 1 Rx UE

A.16.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery requirements for an FR1 serving cell in clause 8.5B.2.

The test parameters are given in tables A.16.5.2.3.1-1, A.16.5.2.3.1-2, and A.16.5.2.3.1-3 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.2.3.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.16.5.2.3.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.16.5.2.3.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.2.3.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PSCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
	Config 4		HD-FDD	
BWchannel	Config 1	MHz	10: NRB,c = 52	
	Config 2		10: NRB,c = 52	
	Config 3		20: NRB,c = 51	
	Config 4		10: NRB,c = 52	
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
	Config 4		Not Applicable	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
	Config 4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
	Config 4		CCR.1.1 FDD	
SSB Configuration	Config 1		SSB.3 FR1	
	Config 2		SSB.3 FR1	
	Config 3		SSB.2 RedCap FR1	
	Config 4		SSB.3 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	
	Config 3		SMTC.1	
	Config 4		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
	Config 4		15 KHz	
PRACH Configuration	Config 1, 2		Table A.3.8.2.2-1	
	Config 3		Table A.3.8.2.2-1	
	Config 4		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x1 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	16	
	Ratio of hypothetical PDCCH RE energy to	dB	0	

Parameter		Unit	Value	Comment
			Test 1	
	average SSS RE energy			
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
rlmInSyncOutOfSyncThreshold			Absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3		-95	
	Config 4		-98	
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
	Config 4		CSI-RS.1.1 FDD	
CSI-RS for tracking	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
	Config 4		TRS.1.1 FDD	
SSB Index assigned as RLM RS			0, 1	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to Cell 1
T2		s	5.17	
T3		s	6.44	
T4		s	0	
T5		s	1.97	
D1		s	1.94	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.16.5.2.3.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
	Config 3		5	-3	-12	-12	-12
	Config 4		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
	Config 4		-10	-10	10	10	10
SSB_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
	Config 4		-108	-108	-88	-88	-88
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
	Config 4		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.2.3.1-1.

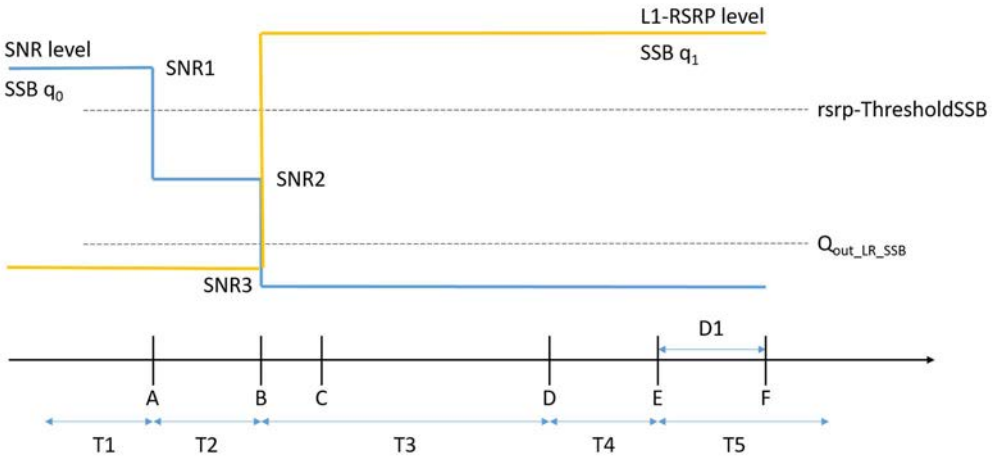


Figure A.16.5.2.2.1-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.16.5.2.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.2.4 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in DRX mode for 2 Rx UE

A.16.5.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery requirements for an FR1 serving cell in clause 8.5B.2.

The test parameters are given in tables A.16.5.2.4.1-1, A.16.5.2.4.1-2, and A.16.5.2.4.1-3 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.2.4.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.16.5.2.4.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.16.5.2.4.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.2.4.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PSCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
	Config 4		HD-FDD	
BWchannel	Config 1	MHz	10: NRB,c = 52	
	Config 2		10: NRB,c = 52	
	Config 3		20: NRB,c = 51	
	Config 4		10: NRB,c = 52	
DL initial BWP configuration	Config 1, 2, 3, 4		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4		ULBWP.1.1	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
	Config 4		Not Applicable	

Parameter		Unit	Value	Comment
			Test 1	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
	Config 4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
	Config 4		CCR.1.1 FDD	
SSB Configuration	Config 1		SSB.3 FR1	
	Config 2		SSB.3 FR1	
	Config 3		SSB.2 RedCap FR1	
	Config 4		SSB.3 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	
	Config 3		SMTC.1	
	Config 4		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
	Config 4		15 KHz	
PRACH Configuration	Config 1, 2		Table A.3.8.2.2-1	
	Config 3		Table A.3.8.2.2-1	
	Config 4		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
rlmInSyncOutOfSyncThreshold			Absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3		-95	
	Config 4		-98	
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
	Config 4		CSI-RS.1.1 FDD	
CSI-RS for tracking	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
	Config 4		TRS.1.1 FDD	
SSB Index assigned as RLM RS			0, 1	
T310 Timer		ms	1000	

Parameter	Unit	Value	Comment
		Test 1	
N310		2	
T1	s	1	During this time the the UE shall be fully synchronized to Cell 1
T2	s	5.17	
T3	s	3.24	
T4	s	0	
T5	s	1.97	
D1	s	1.94	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.2.4.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
	Config 4		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
	Config 4		-10	-10	10	10	10
SSB_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
	Config 4		-108	-108	-88	-88	-88
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
	Config 4		-98				
Propagation condition			TDL-C 300 ns 100 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1. NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1. NOTE 4: Void NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.2.4.1-1. NOTE 9: The SNR values are specified for testing a UE which supports 2 RX on at least one band.							

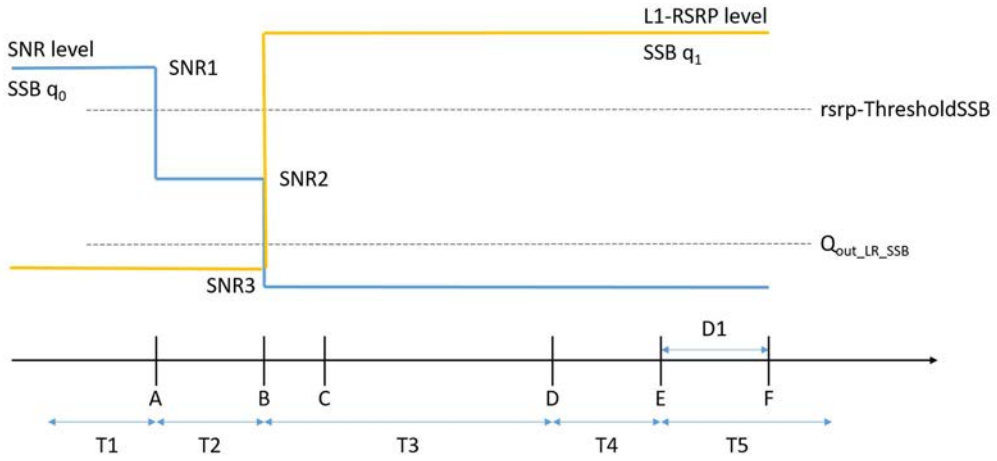


Figure A.16.5.2.4.1-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.16.5.2.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.2.5 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in non-DRX mode for 1 Rx UE

A.16.5.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery requirements for an FR1 serving cell in clause 8.5B.3.

The test parameters are given in tables A.16.5.2.5.1-1, A.16.5.2.5.1-2, and below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.2.5.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.16.5.2.5.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.16.5.2.5.1-1: Supported test configurations for FR1 PCell

Configuration	Description

1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.2.5.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
	Config 4		HD-FDD	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
	Config 4		Not Applicable	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
	Config 4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	A.3.1.3
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
	Config 4		CCR.1.1 FDD	
SSB Configuration	Config 1		SSB. 3 FR1	A.3.10
	Config 2		SSB. 3 FR1	
	Config 3		SSB.2 RedCap FR1	
	Config 4		SSB.3 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	A.3.11
	Config 3		SMTC.1	
	Config 4		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
PRACH Configuration	Config 1, 2, 4		FR1 PRACH configuration 4	A.3.8.2
	Config 3		FR1 PRACH configuration 4	A.3.8.2
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x1 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	16	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	

Parameter			Unit	Value	Comment
				Test 1	
	REG bundle size			6	
DRX				OFF	
Gap pattern ID				N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1				1	N
rlmInSyncOutOfSyncThreshold				absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2		dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3			-95	
	Config 4			-98	
powerControlOffsetSS				db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount				n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer				pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1		Config 1		CSI-RS.1.2 FDD	A.3.14
		Config 2		CSI-RS.1.2 TDD	
		Config 3		CSI-RS.2.2 TDD	
		Config 4		CSI-RS.1.2 FDD	
CSI-RS configuration for CSI reporting		Config 1		CSI-RS.1.1 FDD	A.3.14
		Config 2		CSI-RS.1.1 TDD	
		Config 3		CSI-RS.2.1 TDD	
		Config 4		CSI-RS.1.1 FDD	
TRS configuration		Config 1		TRS.1.1 FDD	
		Config 2		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD	
		Config 4		TRS.1.1 FDD	
CSI-RS-Index assigned as RLM RS		Config 1		CSI-RS.1.2 FDD	A.3.14
		Config 2		CSI-RS.1.2 TDD	
		Config 3		CSI-RS.2.2 TDD	
		Config 4		CSI-RS.1.2 FDD	
T310 Timer			ms	1000	
N310				2	
T1			s	0.2	During this time the the UE shall be fully synchronized to Cell 1
T2			s	0.18	
T3			s	0.27	
T4			s	0	
T5			s	0.08	
D1			s	0.05	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.16.5.2.5.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
	Config 4		5	-3	-12	-12	-12

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
SNR_CSI-RS of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
	Config 4		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
	Config 4		-108	-108	-88	-88	-88
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
	Config 4		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.2.5.1-1.

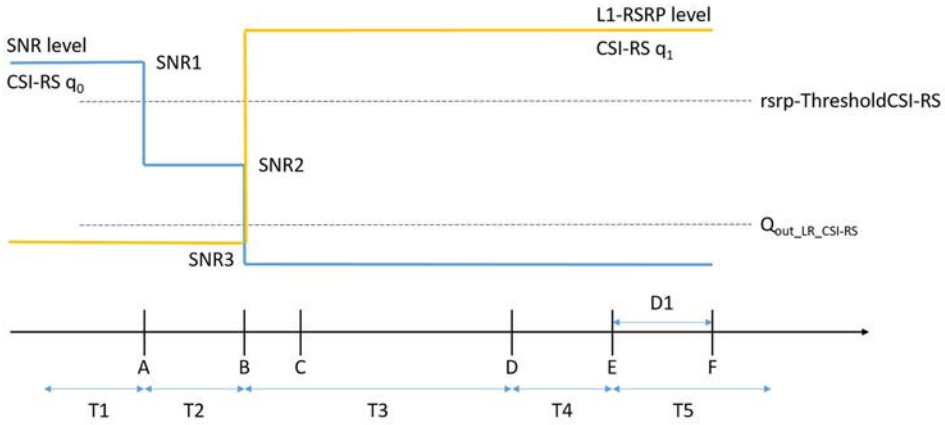


Figure A.16.5.2.5.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

A.16.5.2.5.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 30+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.2.6 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in non-DRX mode for 2 Rx UE

A.16.5.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5B.3.

The test parameters are given in tables A.16.5.2.6.1-1, A.16.5.2.6.1-2, and below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.2.6.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.16.5.2.6.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.16.5.2.6.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.2.6.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
	Config 4		HD-FDD	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
	Config 4		Not Applicable	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
	Config 4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	A.3.1.3
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
	Config 4		CCR.1.1 FDD	
SSB Configuration	Config 1		SSB. 3 FR1	A.3.10
	Config 2		SSB. 3 FR1	
	Config 3		SSB.2 RedCap FR1	
	Config 4		SSB.3 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	A.3.11
	Config 3		SMTC.1	
	Config 4		SMTC.1	

Parameter			Unit	Value	Comment
				Test 1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2			15 KHz	
	Config 3			30 KHz	
PRACH Configuration	Config 1, 2, 4			FR1 PRACH configuration 4	A.3.8.2
	Config 3			FR1 PRACH configuration 4	A.3.8.2
csi-RS-Index assigned as beam failure detection RS in set q_0				0	
OCNG parameters				OP.1	A.3.2.1
CP length				Normal	
Correlation Matrix and Antenna Configuration				2x2 Low	
Beam failure detection transmission parameters	DCI format			1-0	
	Number of Control OFDM symbols			2	
	Aggregation level		CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy		dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy		dB	0	
	DMRS precoder granularity			REG bundle size	
	REG bundle size			6	
DRX				OFF	
Gap pattern ID				N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1				1	N
rlmInSyncOutOfSyncThreshold				absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2		dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3			-95	
	Config 4			-98	
powerControlOffsetSS				db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount				n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer				pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1		Config 1		CSI-RS.1.2 FDD	A.3.14
		Config 2		CSI-RS.1.2 TDD	
		Config 3		CSI-RS.2.2 TDD	
		Config 4		CSI-RS.1.2 FDD	
CSI-RS configuration for CSI reporting		Config 1		CSI-RS.1.1 FDD	A.3.14
		Config 2		CSI-RS.1.1 TDD	
		Config 3		CSI-RS.2.1 TDD	
		Config 4		CSI-RS.1.1 FDD	
TRS configuration		Config 1		TRS.1.1 FDD	
		Config 2		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD	
		Config 4		TRS.1.1 FDD	
CSI-RS-Index assigned as RLM RS		Config 1		CSI-RS.1.2 FDD	A.3.14
		Config 2		CSI-RS.1.2 TDD	
		Config 3		CSI-RS.2.2 TDD	
		Config 4		CSI-RS.1.2 FDD	
T310 Timer			ms	1000	
N310				2	

Parameter	Unit	Value	Comment
		Test 1	
T1	s	0.2	During this time the the UE shall be fully synchronized to Cell 1
T2	s	0.18	
T3	s	0.14	
T4	s	0	
T5	s	0.08	
D1	s	0.05	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.16.5.2.6.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
	Config 4		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
	Config 4		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
	Config 4		-108	-108	-88	-88	-88
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
	Config 4		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.2.6.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2 RX on at least one band.

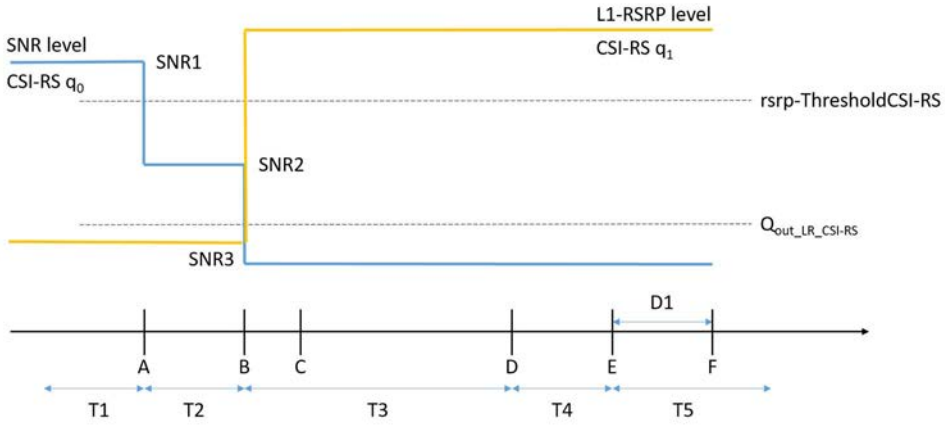


Figure A.16.5.2.6.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

A.16.5.2.6.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 30+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.2.7 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in DRX mode for 1 Rx UE

A.16.5.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery requirements for an FR1 serving cell in clause 8.5B.3.

The test parameters are given in tables A.16.5.2.7.1-1, A.16.5.2.7.1-2, and A.16.5.2.7.1-3 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.2.7.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.16.5.2.7.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.16.5.2.7.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.2.7.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
	Config 4		HD-FDD	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf..21	
	Config 4		Not Applicable	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
	Config 4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	A.3.1.3
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
	Config 4		CCR.1.1 FDD	
SSB Configuration	Config 1		SSB.3 FR1	A.3.10
	Config 2		SSB.3 FR1	
	Config 3		SSB.2 RedCap FR1	
	Config 4		SSB.3 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	A.3.11
	Config 3		SMTC.1	
	Config 4		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
PRACH Configuration	Config 1, 2, 4		FR1 PRACH configuration 4	A.3.8.2
	Config 3		FR1 PRACH configuration 4	A.3.8.2
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x1 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	16	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to	dB	0	

Parameter		Unit	Value	Comment
			Test 1	
	average CSI-RS RE energy			
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3		-95	
	Config 4		-98	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1	Config 1		CSI-RS.1.2 FDD	A.3.14 .1
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
	Config 4		CSI-RS.1.2 FDD	
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	A.3.14.1
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
	Config 4		CSI-RS.1.1 FDD	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
	Config 4		TRS.1.1 FDD	
CSI-RS-Index assigned as RLM RS	Config 1		CSI-RS.1.2 FDD	
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
	Config 4		CSI-RS.1.2 FDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to Cell 1
T2		s	8.37	
T3		s	12.24	
T4		s	0	
T5		s	1.97	
D1		s	1.94	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.16.5.2.7.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					
EPRE ratio of PSS to SSS	dB					
EPRE ratio of PDSCH DMRS to SSS	dB					
EPRE ratio of PDSCH to PDSCH DMRS	dB					
EPRE ratio of OCNG DMRS to SSS	dB					
EPRE ratio of OCNG to OCNG DMRS	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
	Config 4		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
	Config 4		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1	dB/SCS kHz	-110	-110	-88	-88	-88
	Config 2		-110	-110	-88	-88	-88
	Config 3		-107	-107	-85	-85	-85
	Config 4		-110	-110	-88	-88	-88
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
	Config 4		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.2.7.1-1.

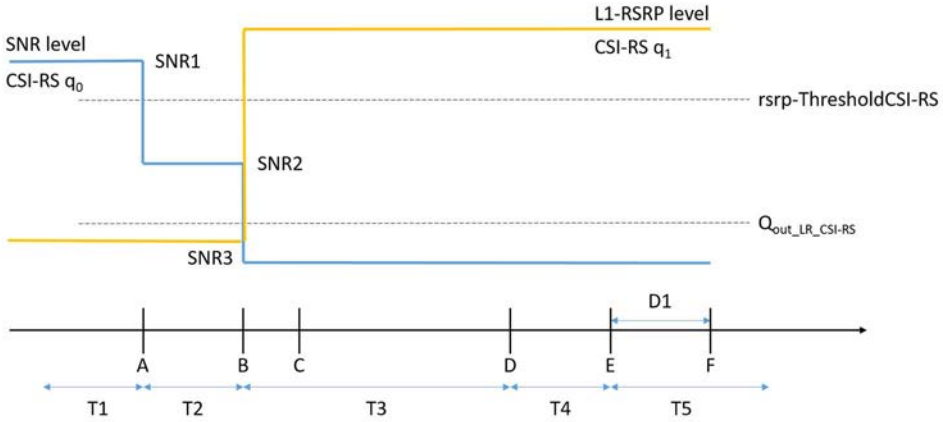


Figure A.16.5.2.7.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

A.16.5.2.7.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.2.8 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in DRX mode for 2 Rx UE

A.16.5.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery requirements for an FR1 serving cell in clause 8.5B.3.

The test parameters are given in Tables A.16.5.2.8.1-1, A.16.5.2.8.1-2, and A.16.5.2.8.1-3 below.There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.16.5.2.8.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.16.5.2.8.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.16.5.2.8.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 20 MHz bandwidth
4	HD-FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.16.5.2.8.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
	Config 4		HD-FDD	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf..21	
	Config 4		Not Applicable	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
	Config 4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	A.3.1.3
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
	Config 4		CCR.1.1 FDD	
SSB Configuration	Config 1		SSB.3 FR1	A.3.10
	Config 2		SSB.3 FR1	

Parameter		Unit	Value	Comment
			Test 1	
	Config 3		SSB.2 RedCap FR1	
	Config 4		SSB.3 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	A.3.11
	Config 3		SMTC.1	
	Config 4		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
	Config 4		15 KHz	
PRACH Configuration	Config 1, 2, 4		FR1 PRACH configuration 4	A.3.8.2
	Config 3		FR1 PRACH configuration 4	A.3.8.2
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	16	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3		-95	
	Config 4		-98	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1	Config 1		CSI-RS.1.2 FDD	A.3.14 .1
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
	Config 4		CSI-RS.1.2 FDD	
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	A.3.14.1
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
	Config 4		CSI-RS.1.1 FDD	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
	Config 4		TRS.1.1 FDD	
CSI-RS-Index assigned as RLM RS	Config 1		CSI-RS.1.2 FDD	
	Config 2		CSI-RS.1.2 TDD	

Parameter		Unit	Value	Comment
			Test 1	
	Config 3		CSI-RS.2.2 TDD	
	Config 4		CSI-RS.1.2 FDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to Cell 1
T2		s	8.37	
T3		s	6.44	
T4		s	0	
T5		s	1.97	
D1		s	1.94	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.16.5.2.8.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
	Config 4		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
	Config 4		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1	dB/SCS kHz	-110	-110	-88	-88	-88
	Config 2		-110	-110	-88	-88	-88
	Config 3		-107	-107	-85	-85	-85
	Config 4		-110	-110	-88	-88	-88
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
	Config 4		-98				
Propagation condition			TDL-C 300 ns 100 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.16.5.2.8.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2 RX on at least one band.

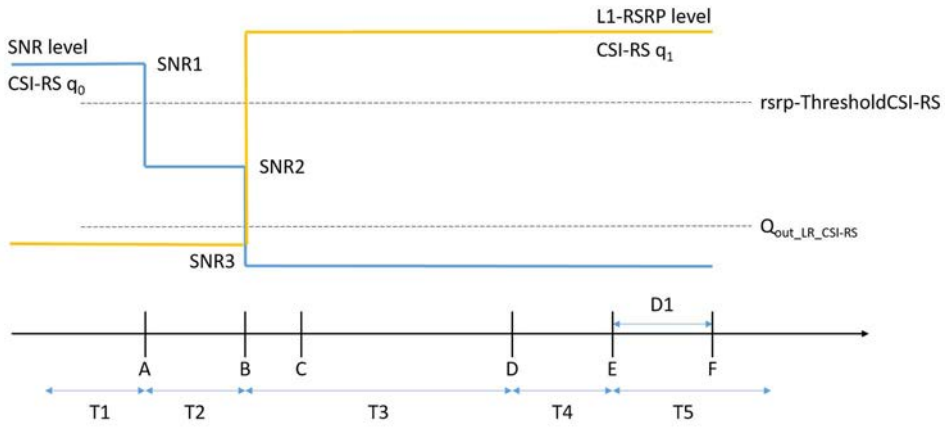


Figure A.16.5.2.8.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

A.16.5.2.8.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+20 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.3 Active BWP switch

A.16.5.3.1 DCI-based and Timer-based Active BWP Switch

A.16.5.3.1.1 NR FR1 DL active BWP switch with non-DRX in SA for 1 Rx UE

A.16.5.3.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for 1 Rx RedCap defined in clause 8.6A.

The supported test configurations are shown in table A.16.5.3.1.1.1-1. The test scenario comprises of one cell (Cell 1) as given in table A.16.5.3.1.1.1-2. Cell-specific parameters of the cell are specified in table A.16.5.3.1.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with 2 different UE-specific downlink bandwidth parts, BWP-1 and BWP-2 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1.

- UE is configured with a *bwp-InactivityTimer* timer value for Cell 1.

The cell has constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for DL BWP switch, sent from the test equipment to the UE, is received at the UE side in Cell 1's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6A and starts to report valid ACK/NACK for the Cell 1 no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-2 starting from the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

During T2, the test equipment won't transmit DCI format for PDSCH reception on Cell 1.

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6A and starts to report valid ACK/NACK for the Cell 1 at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-1 starting from the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The test equipment verifies the DL BWP switch time by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

Table A.16.5.3.1.1.1-1: DL BWP switch supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode,
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.5.3.1.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell 1 on RF channel number 1.
CP length		Normal	
DRX		OFF	
bwp-InactivityTimer	ms	200	
PDCCH and PDSCH maximum number of HARQ transmission		1	
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.16.5.3.1.1.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3		TDD
TDD configuration	Config 1,4		Not Applicable

Parameter		Unit	Cell 1
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
$BW_{channel}$	Config 1		10 MHz: $N_{PRB,c}$ = 52
	Config 2		10 MHz: $N_{PRB,c}$ = 52
	Config 3		20 MHz: $N_{PRB,c}$ = 51
	Config 4		10 MHz: $N_{PRB,c}$ = 52
Active BWP ID			1, 2
Initial DL BWP Configuration	Config 1,2,3,4		DLBWP.0.2 Note 4
Active DL BWP-1 Configuration	Config 1,2,3,4		DLBWP.1.1 Note 4
Active DL BWP-2 Configuration	Config 1,2,3,4		DLBWP.1.1 RedCap Note 4
Initial UL BWP Configuration	Config 1,2,3,4		ULBWP.0.2 Note 4
Active UL BWP-1 Configuration	Config 1,2,3,4		ULBWP.1.1 Note 4
Active UL BWP-2 Configuration	Config 1,4		N/A
	Config 2,3		ULBWP.1.1 RedCap Note 4
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET parameters	Config 1,4		CCR.1.2 FDD
	Config 2		CCR.1.2 TDD
	Config 3		CCR.2.4 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2,4		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration			SMTC.1
Antenna Configuration			1x1
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1,2,4	dBm/SCS	-104
	Config 3		-101
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3	Config 1,2,4	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.1 RedCap is linked with ULBWP.1.1 RedCap defined in clause 12 of TS 38.213 [3].

A.16.5.3.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for Cell 1 from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for Cell 1 from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6A.2-1.

All of the above test requirements shall be fulfilled in order for the observed Cell 1 active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after beginning of DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.16.5.3.1.2 NR FR1 DL active BWP switch with non-DRX in SA for 2 Rx UE

A.16.5.3.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for 2 Rx RedCap defined in clause 8.6A.

The supported test configurations are shown in table A.16.5.3.1.2.1-1. The test scenario comprises of one cell (Cell 1) as given in table A.16.5.3.1.2.1-2. Cell-specific parameters of the cell are specified in table A.16.5.3.1.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with 2 different UE-specific downlink bandwidth parts, BWP-1 and BWP-2 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1.
- UE is configured with a *bwp-InactivityTimer* timer value for Cell 1.

The cell has constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for DL BWP switch, sent from the test equipment to the UE, is received at the UE side in Cell 1's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6A and starts to report valid ACK/NACK for the Cell 1 no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-2 starting from the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

During T2, the test equipment won't transmit DCI format for PDSCH reception on Cell 1.

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6A and starts to report valid ACK/NACK for the Cell 1 at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-1 starting from the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The test equipment verifies the DL BWP switch time by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

Table A.16.5.3.1.2.1-1: DL BWP switch supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode,
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.5.3.1.2.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell 1 on RF channel number 1.
CP length		Normal	
DRX		OFF	
bwp-InactivityTimer	ms	200	
PDCCH and PDSCH maximum number of HARQ transmission		1	
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.16.5.3.1.2.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
$BW_{channel}$	Config 1		10 MHz: $N_{PRB,c}$ = 52
	Config 2		10 MHz: $N_{PRB,c}$ = 52
	Config 3		20 MHz: $N_{PRB,c}$ = 51
	Config 4		10 MHz: $N_{PRB,c}$ = 52
Active BWP ID			1, 2
Initial DL BWP Configuration	Config 1,2,3,4		DLBWP.0.2 Note 4
Active DL BWP-1 Configuration	Config 1,2,3,4		DLBWP.1.1 Note 4
Active DL BWP-2 Configuration	Config 1,2,3,4		DLBWP.1.1 RedCap Note 4
Initial UL BWP Configuration	Config 1,2,3,4		ULBWP.0.2 Note 4
Active UL BWP-1 Configuration	Config 1,2,3,4		ULBWP.1.1 Note 4
Active UL BWP-2 Configuration	Config 1,4		N/A
	Config 2,3		ULBWP.1.1 RedCap Note 4
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2		CR.1.1 TDD

Parameter		Unit	Cell 1
	Config 3		CR.2.1 TDD
Dedicated CORESET parameters	Config 1,4		CCR.1.2 FDD
	Config 2		CCR.1.2 TDD
	Config 3		CCR.2.4 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2,4		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1,2,4	dBm/SCS	-104
	Config 3		-101
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3	Config 1,2,4	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86
Propagation Condition			AWGN

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.1 RedCap is linked with ULBWP.1.1 RedCap defined in clause 12 of TS 38.213 [3].

A.16.5.3.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for Cell 1 from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for Cell 1 from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6A.2-1.

All of the above test requirements shall be fulfilled in order for the observed Cell 1 active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after beginning of DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.16.5.3.2 RRC-based Active BWP Switch

A.16.5.3.2.1 NR FR1 DL active BWP switch of Cell with non-DRX in SA for 1 Rx UE

A.16.5.3.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6A.

The supported test configurations are shown in table A.16.5.3.2.1.1-1. The test scenario comprises of one Cell (Cell 1) as given in table A.16.5.3.2.1.1-2. Cell-specific parameters of Cell are specified in table A.16.5.3.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE has bandwidth part BWP-1 in its *RRCReconfiguration* for Cell 1.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in Cell 1.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}}{\text{NR Slot length}}$ as defined in clause 8.6A.3 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}}{\text{NR Slot length}} + k1$ on BWP-1 of final condition. The UE shall be continuously scheduled on PCell's BWP-1 of final condition starting from the first DL slot right after slot $i + \frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}}{\text{NR Slot length}}$.

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6A.3.

The test equipment verifies the DL BWP switch time in Cell by counting the time from the time when the *RRCReconfiguration* message including updated BWP configuration is sent till the time when a valid ACK/NACK is received is received.

Table A.16.5.3.2.1.1-1: DL BWP switch supported test configurations in SA scenario

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode,
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.5.3.2.1.1-2: General test parameters for DL BWP switch in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
PDCCH and PDSCH maximum number of HARQ transmission		1	
T1	s	0.2	

Table A.16.5.3.2.1.1-3: NR Cell specific test parameters for DL BWP switch in SA scenario

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1,4		FDD
		Config 2,3		TDD
TDD configuration		Config 1,4		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
$BW_{channel}$		Config 1,4		10 MHz: $N_{PRB,c}$ = 52
		Config 2		10 MHz: $N_{PRB,c}$ = 52
		Config 3		20 MHz: $N_{PRB,c}$ = 51
Active BWP ID				1
Initial DL BWP Configuration		Config 1,2, 3,4		DLBWP.0.2
Initial UL BWP Configuration		Config 1,2, 3,4		ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration	Config 1, 2, 3,4		DLBWP.1.1 RedCap
	Active UL BWP-1 Configuration	Config 1, 2, 3,4		ULBWP.1.1 RedCap
Final Condition	Active DL BWP-1 Configuration	Config 1, 2, 3,4		DLBWP.1.1
	Active UL BWP-1 Configuration	Config 1, 2, 3,4		ULBWP.1.1
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD
		Config 2		SR.1.1 TDD
		Config 3		SR2.1 TDD
RMSI CORESET parameters		Config 1,4		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR2.1 TDD
Dedicated CORESET parameters		Config 1,4		CCR.1.2 FDD
		Config 2		CCR.1.2 TDD
		Config 3		CCR.2.4 TDD
OCNG Patterns				OP.1
SSB Configuration		Config 1,2,4		SSB.1 FR1
		Config 3		SSB.1 RedCap FR1
SMTC Configuration				SMTC.1
TRS Configuration		Config 1,4		TRS.1.1 FDD
		Config 2		TRS.1.1 TDD
		Config 3		TRS.1.2 TDD
Antenna Configuration				1x1
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS(Note 1)				
N_{oc} Note 2		Config 1,2	dBm/SCS	-104
		Config 3		-101

Parameter		Unit	Cell 1
SS-RSRP Note 3	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.1 RedCap is linked with ULBWP.1.1 RedCap defined in clause 12 of TS 38.213 [3].			

A.16.5.3.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the Cell from the first DL slot that occurs right after the beginning of slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed Cell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.3.2.2 NR FR1 DL active BWP switch of Cell with non-DRX in SA for 2 Rx UE

A.16.5.3.2.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6A.

The supported test configurations are shown in table A.16.5.3.2.2.1-1. The test scenario comprises of one Cell (Cell 1) as given in table A.16.5.3.2.2.1-2. Cell-specific parameters of Cell are specified in table A.16.5.3.2.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE has bandwidth part BWP-1 in its *RRCReconfiguration* for Cell 1.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in Cell 1.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ as defined in clause 8.6A.3 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1 on BWP-1 of final condition. The UE shall be continuously scheduled on PCell's BWP-1 of final condition starting from the first DL slot right after slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$.

$T_{\text{RRCprocessingDelay}}$ and $T_{\text{BWPswitchDelayRRC}}$ are defined in clause 8.6A.3.

The test equipment verifies the DL BWP switch time in Cell by counting the time from the time when the *RRCReconfiguration* message including updated BWP configuration is sent till the time when a valid ACK/NACK is received is received.

Table A.16.5.3.2.2.1-1: DL BWP switch supported test configurations in SA scenario

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode,
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.5.3.2.2.1-2: General test parameters for DL BWP switch in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
PDCCH and PDSCH maximum number of HARQ transmission		1	
T1	s	0.2	

Table A.16.5.3.2.2.1-3: NR Cell specific test parameters for DL BWP switch in SA scenario

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1,4		FDD
		Config 2,3		TDD
TDD configuration		Config 1,4		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
$BW_{channel}$		Config 1,4		10 MHz: $N_{PRB,c}$ = 52
		Config 2		10 MHz: $N_{PRB,c}$ = 52
		Config 3		20 MHz: $N_{PRB,c}$ = 51
Active BWP ID				1
Initial DL BWP Configuration		Config 1,2, 3,4		DLBWP.0.2
Initial UL BWP Configuration		Config 1,2, 3,4		ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration	Config 1, 2, 3,4		DLBWP.1.1 RedCap
	Active UL BWP-1 Configuration	Config 1, 2, 3,4		ULBWP.1.1 RedCap
Final Condition	Active DL BWP-1 Configuration	Config 1, 2, 3,4		DLBWP.1.1
	Active UL BWP-1 Configuration	Config 1, 2, 3,4		ULBWP.1.1
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD
		Config 2		SR.1.1 TDD
		Config 3		SR2.1 TDD

Parameter		Unit	Cell 1
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR2.1 TDD
Dedicated CORESET parameters	Config 1,4		CCR.1.2 FDD
	Config 2		CCR.1.2 TDD
	Config 3		CCR.2.4 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2,4		SSB.1 FR1
	Config 3		SSB.1 RedCap FR1
SMTC Configuration			SMTC.1
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
Antenna Configuration			1x2 Low
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS(Note 1)			
N_{oc} Note 2	Config 1,2,4	dBm/SCS	-104
	Config 3		-101
SS-RSRP Note 3	Config 1,2,4	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.2 RedCap is linked with ULBWP.1.1 RedCap defined in clause 12 of TS 38.213 [3].

A.16.5.3.2.2.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the Cell from the first DL slot that occurs right after the beginning of slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed Cell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.4 UE specific CBW change

A.16.5.4.1 UE specific CBW change on PCell in FR1 in non-DRX for 1 Rx UE

A.16.5.4.1.1 Test Purpose and Environment

The purpose of this test is to verify the UE specific CBW change delay requirement defined in clause 8.13A.

The supported test configurations are shown in table A.16.5.4.1.1-1. The test scenario comprises of one Cell (Cell 1) as given in table A.16.5.4.1.1-2. Cell-specific parameters are specified in table A.16.5.4.1.1-3.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE sends ACK/NACK during the test.

Before the test starts:

- UE is connected to Cell 1 on radio channel 1.
- UE has bandwidth part BWP-1 in its *RRCReconfiguration* for Cell 1.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in Cell 1.
- UE has been configured with UE specific CBW (CBW-1).
- UE is indicated in *SCS-SpecificCarrier* [2] that the UE specific CBW is CBW-1 as the initial condition in Cell 1.

Cell 1 has constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* containing *SCS-SpecificCarrier* with updated UE specific CBW, sent from the test equipment to the UE, is completely received at the UE side in Cell 1's slot # denoted *i*. The UE shall reconfigure its UE specific CBW with the updated CBW-2 for the final condition.

The UE shall be able to receive PDSCH on Cell 1 from the first DL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\,Slot\ length}$ as defined in clause 8.13A and starts to report valid ACK/NACK for Cell 1from the first UL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\,Slot\ length} + k1$ on the Cell 1's BWP-1 on CBW-2 for the final condition. The UE shall be continuously scheduled on the Cell 1's BWP-1 on CBW-2 for the final condition starting from the first DL slot right after slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\,Slot\ length}$.

$T_{RRCprocessingDelay}$ and $T_{CBWchangeDelayRRC}$ are defined in clause 8.13A.

The test equipment verifies the UE specific CBW switching delay in Cell 1 by estimating the time from the moment the *RRCReconfiguration* message including updated UE specific CBW configuration is sent until the moment a valid ACK/NACK is received.

Table A.16.5.4.1.1-1: Supported test configurations for UE specific CBW change in SA scenario

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode,
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.5.4.1.1-2: General test parameters for UE specific CBW change in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	

Table A.16.5.4.1.1-3: NR Cell specific test parameters for UE specific CBW change in SA scenario

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1		FDD
		Config 2,3		TDD
		Config 4		HD-FDD
TDD configuration		Config 1,4		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
$BW_{channel}$		Config 1		10 MHz: $N_{PRB,c}$ = 52
		Config 2		10 MHz: $N_{PRB,c}$ = 52
		Config 3		20 MHz: $N_{PRB,c}$ = 51
		Config 4		10 MHz: $N_{PRB,c}$ = 52
Active DL BWP ID		Config 1,2, 3,4		0
Initial DL BWP Configuration (BWP-1)		Config 1,2, 3,4		DLBWP.0.2
Initial UL BWP Configuration		Config 1,2, 3,4		ULBWP.0.2
Initial Condition	Active DL CBW Configureation (CBW-1)	Config 1, 2, 3,4		DLCBW.1.1
	Active UL CBW Configuration (CBW-1)	Config 1, 2, 3,4		ULCBW.1.1
Final Condition	Active DL CBW Configureation (CBW-2)	Config 1, 2, 3,4		DLCBW.1.2
	Active UL CBW Configuration (CBW-2)	Config 1, 2, 3,4		ULCBW.1.2
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD
		Config 2		SR.1.1 TDD
		Config 3		SR.2.1 TDD
RMSI CORESET parameters		Config 1,4		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR.2.1 TDD
Dedicated CORESET parameters		Config 1,4		CCR.1.1 FDD
		Config 2		CCR.1.1 TDD
		Config 3		CCR.2.1 TDD
OCNG Patterns				OP.1
SSB Configuration		Config 1,2,4		SSB.1 FR1
		Config 3		SSB.1 RedCap FR1
SMTC Configuration				SMTC.1 RedCap FR1
TRS Configuration		Config 1,4		TRS.1.1 FDD
		Config 2		TRS.1.1 TDD
		Config 3		TRS.1.2 TDD
Antenna Configuration				1x1
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		Config 1,2,4	dBm/SCS	-104
		Config 3		-101
SS-RSRP Note 3		Config 1,2,4	dBm/SCS	-87
		Config 3		-84
$\hat{E}_s/I_{ot}$			dB	17

Parameter		Unit	Cell 1
$\hat{E}_s/N_{oc}$		dB	17
Io^{Note3}	Config 1,2,4	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 18.36 MHz	-56.04
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.1 is linked with ULBWP.0.1; DLBWP.1.1 is linked with ULBWP.1.1; as defined in clause 12 of TS 38.213 [3].			

A.16.5.4.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the Cell 1 from the first DL slot that occurs right after the beginning of slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ and starts to report valid ACK/NACK for Cell 1 from the first UL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length} + k1$.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed UE specific CBW change delay on the Cell 1 to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.5.4.2 UE specific CBW change on PCell in FR1 in non-DRX for 2 Rx UE

A.16.5.4.2.1 Test Purpose and Environment

The purpose of this test is to verify the UE specific CBW change delay requirement defined in clause 8.13A.

The supported test configurations are shown in table A.16.5.4.2.1-1. The test scenario comprises of one Cell (Cell 1) as given in table A.16.5.4.2.1-2. Cell-specific parameters are specified in table A.16.5.4.2.1-3.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE sends ACK/NACK during the test.

Before the test starts:

- UE is connected to Cell 1 on radio channel 1.
- UE has bandwidth part BWP-1 in its *RRCReconfiguration* for Cell 1.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in Cell 1.
- UE has been configured with UE specific CBW (CBW-1).
- UE is indicated in *SCS-SpecificCarrier* [2] that the UE specific CBW is CBW-1 as the initial condition in Cell 1.

Cell 1 has constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

> Time period T1 starts when a *RRCReconfiguration* containing *SCS-SpecificCarrier* with updated UE specific CBW, sent from the test equipment to the UE, is completely received at the UE side in Cell 1's slot # denoted *i*. The UE shall reconfigure its UE specific CBW with the updated CBW-2 for the final condition.

The UE shall be able to receive PDSCH on Cell 1 from the first DL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\,Slot\,length}$ as defined in clause 8.13A and starts to report valid ACK/NACK for Cell 1from the first UL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\,Slot\,length} + k1$ on the Cell 1's BWP-1 on CBW-2 for the final condition. The UE shall be continuously scheduled on the Cell 1's BWP-1 on CBW-2 for the final condition starting from the first DL slot right after slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\,Slot\,length}$.

$T_{RRCprocessingDelay}$ and $T_{CBWchangeDelayRRC}$ are defined in clause 8.13A.

The test equipment verifies the UE specific CBW switching delay in Cell 1 by estimating the time from the moment the *RRCReconfiguration* message including updated UE specific CBW configuration is sent until the moment a valid ACK/NACK is received.

Table A.16.5.4.2.1-1: Supported test configurations for UE specific CBW change in SA scenario

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode,
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.5.4.2.1-2: General test parameters for UE specific CBW change in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	

Table A.16.5.4.2.1-3: NR Cell specific test parameters for UE specific CBW change in SA scenario

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1		FDD
		Config 2,3		TDD
		Config 4		HD-FDD
TDD configuration		Config 1,4		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
$BW_{channel}$		Config 1		10 MHz: $N_{PRB,c}$ = 52
		Config 2		10 MHz: $N_{PRB,c}$ = 52
		Config 3		20 MHz: $N_{PRB,c}$ = 51
		Config 4		10 MHz: $N_{PRB,c}$ = 52
Active DL BWP ID		Config 1,2, 3,4		0
Initial DL BWP Configuration (BWP-1)		Config 1,2, 3,4		DLBWP.0.1
Initial UL BWP Configuration		Config 1,2, 3,4		ULBWP.0.1
Initial Condition	Active DL CBW Configureation (CBW-1)	Config 1, 2, 3,4		DLCBW.1.1
	Active UL CBW Configuration (CBW-1)	Config 1, 2, 3,4		ULCBW.1.1
Final Condition	Active DL CBW Configureation (CBW-2)	Config 1, 2, 3,4		DLCBW.1.2

Parameter			Unit	Cell 1
	Active UL CBW Configuration (CBW-2)	Config 1, 2, 3,4		ULCBW.1.2
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD
		Config 2		SR.1.1 TDD
		Config 3		SR2.1 TDD
RMSI CORESET parameters		Config 1,4		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR2.1 TDD
Dedicated CORESET parameters		Config 1,4		CCR.1.1 FDD
		Config 2		CCR.1.1 TDD
		Config 3		CCR.2.1 TDD
OCNG Patterns				OP.1
SSB Configuration		Config 1,2,4		SSB.1 FR1
		Config 3		SSB.1 RedCap FR1
SMTC Configuration				SMTC.1 RedCap FR1
TRS Configuration		Config 1,4		TRS.1.1 FDD
		Config 2		TRS.1.1 TDD
		Config 3		TRS.1.2 TDD
Antenna Configuration				1x2 Low
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS(Note 1)				
N_{oc} Note 2		Config 1,2,4	dBm/SCS	-104
		Config 3		-101
SS-RSRP Note 3		Config 1,2,4	dBm/SCS	-87
		Config 3		-84
$\hat{E}_s/I_{ot}$			dB	17
$\hat{E}_s/N_{oc}$			dB	17
Io Note3		Config 1,2,4	dBm/ 9.36 MHz	-58.96
		Config 3	dBm/ 18.36 MHz	-56.04

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.1 is linked with ULBWP.0.1; DLBWP.1.1 is linked with ULBWP.1.1; as defined in clause 12 of TS 38.213 [3].

A.16.5.4.2.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the Cell 1 from the first DL slot that occurs right after the beginning of slot $i + \frac{T_{RRCprocessingDelay} + T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ and starts to report valid ACK/NACK for Cell 1 from the first UL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay} + T_{CBWchangeDelayRRC}}{NR\ Slot\ length} + k1$.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed UE specific CBW change delay on the Cell 1 to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.6 Measurement procedure for RedCap

A.16.6.1 Intra-frequency Measurements

A.16.6.1.1 SA event triggered reporting tests without gap under non-DRX for 1 Rx UE

A.16.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2B.5.1 and 9.2B.5.2.

A.16.6.1.1.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.16.6.1.1.1-1 and A.16.6.1.1.1-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.16.6.1.1.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.6.1.1.1.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4	Cell 1	
Neighbour cell		1, 2, 3, 4	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
CD-SSB configuration		1,2,4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
NCD-SSB configuration		1, 4	SSB.6 RedCap FR1 (Note 1)	
		2	SSB.6 RedCap FR1 (Note 1)	
		3	SSB.7 RedCap FR1 (Note 1)	
SMTC configuration for NCD-SSB		1, 4	SMTC.4 RedCap	
		2	SMTC.2 RedCap	
		3	SMTC.2 RedCap	
A3-Offset	dB	1, 2, 3, 4	-4.5	
CP length		1, 2, 3, 4	Normal	
Hysteresis	dB	1, 2, 3, 4	0	
Time To Trigger	s	1, 2, 3, 4	0	
Filter coefficient		1, 2, 3, 4	0	L3 filtering is not used
DRX		1, 2, 3, 4		OFF
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 μs	Synchronous cells
		3	3 μs	Synchronous cells
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	5	
NOTE 1: NCD-SSB is configured within dedicated RedCap DL BWP.				

Table A.16.6.1.1.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3,4	OP.1		OP.1	
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.2 RedCap		DLBWP.1.3 RedCap	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.2 RedCap		ULBWP.1.3 RedCap	
RLM-RS		1, 2, 3, 4	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/18.36 MHz	3	-61.68	-59.34	-61.68	-59.34
Propagation Condition		1, 2, 3, 4	AWGN			
Antenna Configuration			1x1		1x1	

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1000 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.1.2 SA event triggered reporting tests without gap under non-DRX for 2 Rx UE

A.16.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2B.5.1 and 9.2B.5.2.

A.16.6.1.2.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.16.6.1.2.1-1 and A.16.6.1.2.1-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.16.6.1.2.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.6.1.2.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4	Cell 1	
Neighbour cell		1, 2, 3, 4	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
CD-SSB configuration		1,2,4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
NCD-SSB configuration		1, 4	SSB.6 RedCap FR1 (Note 1)	
		2	SSB.6 RedCap FR1 (Note 1)	
		3	SSB.7 RedCap FR1 (Note 1)	
SMTC configuration for NCD-SSB		1, 4	SMTC.4 RedCap	
		2	SMTC.2 RedCap	
		3	SMTC.2 RedCap	
A3-Offset	dB	1, 2, 3, 4	-4.5	
CP length		1, 2, 3, 4	Normal	
Hysteresis	dB	1, 2, 3, 4	0	
Time To Trigger	s	1, 2, 3, 4	0	
Filter coefficient		1, 2, 3, 4	0	L3 filtering is not used
DRX		1, 2, 3, 4		OFF
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.

Parameter	Unit	Test configuration	Value	Comment
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	5	
NOTE 1: NCD-SSB is configured within dedicated RedCap DL BWP.				

Table A.16.6.1.2.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3,4	OP.1		OP.1	
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.3 RedCap		DLBWP.1.3 RedCap	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.3 RedCap		ULBWP.1.3 RedCap	
RLM-RS		1, 2, 3, 4	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/18.36 MHz	3	-61.68	-59.34	-61.68	-59.34
Propagation Condition		1, 2, 3, 4	AWGN			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.16.6.1.2.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 100 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.1.3 SA event triggered reporting tests without gap under DRX for 1 Rx UE

A.16.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell identification and measurement period requirements in clauses 9.2B.5.1 and 9.2B.5.2.

A.16.6.1.3.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.16.6.1.3.2-1, A.16.6.1.3.2-2 and A.16.6.1.3.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.16.6.1.3.2-1: Supported test configurations for NR Redcap UE

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode,
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.6.1.3.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2, 3, 4	Cell 1		
Neighbour cell		1, 2, 3, 4	Cell 2		Cell to be identified.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2		
SSB configuration		1, 4	SSB.1 FR1		
		2	SSB.1 FR1		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
		3	SSB.1 RedCap FR1		
SMTC configuration		1, 4	SMTC.2		
		2	SMTC.1		
		3	SMTC.1		
A3-Offset	dB	1, 2, 3, 4	-4.5		
CP length		1, 2, 3, 4	Normal		
Hysteresis	dB	1, 2, 3, 4	0		
Time To Trigger	s	1, 2, 3, 4	0		
Filter coefficient		1, 2, 3, 4	0		L3 filtering is not used
DRX		1, 2, 3, 4	DRX.1	DRX. 7	
Time offset between serving and neighbour cells		1, 4	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 μs		Synchronous cells
		3	3 μs		Synchronous cells
T1	s	1, 2, 3, 4	5		
T2	s	1, 2, 3, 4	5	10	

Table A.16.6.1.3.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3, 4	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2				
		3				

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/18.36 MHz	3	-61.68	-59.34	-61.68	-59.34
Propagation Condition		1, 2, 3, 4	AWGN			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.16.6.1.3.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 7680 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.1.4 SA event triggered reporting tests without gap under DRX for 2 Rx UE

A.16.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell identification and measurement period requirements in clauses 9.2B.5.1 and 9.2B.5.2.

A.16.6.1.4.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.16.6.1.4.2-1, A.16.6.1.4.2-2 and A.16.6.1.4.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.16.6.1.4.2-1: Supported test configurations for NR Redcap UE

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode,

NOTE: The UE is only required to be tested in one of the supported test configurations.

Table A.16.6.1.3.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2, 3, 4	Cell 1		
Neighbour cell		1, 2, 3, 4	Cell 2		Cell to be identified.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2		
SSB configuration		1, 4	SSB.1 FR1		
		2	SSB.1 FR1		
		3	SSB.1 RedCap FR1		
SMTC configuration		1, 4	SMTC.2		
		2	SMTC.1		
		3	SMTC.1		
A3-Offset	dB	1, 2, 3, 4	-4.5		
CP length		1, 2, 3, 4	Normal		
Hysteresis	dB	1, 2, 3, 4	0		
Time To Trigger	s	1, 2, 3, 4	0		
Filter coefficient		1, 2, 3, 4	0		L3 filtering is not used
DRX		1, 2, 3, 4	DRX.1	DRX. 7	
Time offset between serving and neighbour cells		1, 4	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 μs		Synchronous cells
		3	3 μs		Synchronous cells
T1	s	1, 2, 3, 4	5		
T2	s	1, 2, 3, 4	5	10	

Table A.16.6.1.4.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD		N/A	
		3	CCR.2.1 TDD		N/A	
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3, 4	SSB		SSB	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/18.36 MHz	3	-61.68	-59.34	-61.68	-59.34
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.1.4.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 6400 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.1.5 SA event triggered reporting tests with per-UE gaps under non-DRX for 1 Rx UE

A.16.6.1.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2B.6.1 and 9.2B.6.2.

A.16.6.1.5.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.16.6.1.5.2-1 and A.16.6.1.5.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with

time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.16.6.1.5.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.6.1.5.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4	Cell 1	
Neighbour cell		1, 2, 3, 4	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
Measurement gap type		1, 2, 3, 4	Per-UE gaps	
Measurement gap repetition periodicity	ms	1, 2, 3, 4	40	
Measurement gap length	ms	1, 2, 3, 4	6	
Measurement gap offset	ms	1, 2, 3, 4	39	
SSB configuration		1, 2, 4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 4	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CSI-RS parameters		1, 4	CSI-RS.1.2 FDD resource #0	
		2	CSI-RS.1.2 TDD resource #0	
		3	CSI-RS.2.2 TDD resource #0	
A3-Offset	dB	1, 2, 3, 4	-4.5	
CP length		1, 2, 3, 4	Normal	
Hysteresis	dB	1, 2, 3, 4	0	
Time To Trigger	s	1, 2, 3, 4	0	
Filter coefficient		1, 2, 3, 4	0	L3 filtering is not used
DRX	ms	1, 2, 3, 4	N/A	OFF
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	5	

Table A.16.6.1.5.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.2 FDD		N/A	
		2	CCR.1.2 TDD		N/A	
		3	CCR.2.3 TDD		N/A	
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.2 RedCap		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4	DLBWP.1.2 RedCap		ULBWP.1.1	
RLM-RS		1, 2, 3, 4	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/18.36 MHz	3	-61.68	-59.34	-61.68	-59.34
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.1.5.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.1.6 SA event triggered reporting tests with per-UE gaps under non-DRX for 2 Rx UE

A.16.6.1.6.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2B.6.1 and 9.2B.6.2.

A.16.6.1.6.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.16.6.1.6.2-1 and A.16.6.1.6.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.16.6.1.6.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.6.1.6.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4	Cell 1	
Neighbour cell		1, 2, 3, 4	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
Measurement gap type		1, 2, 3, 4	Per-UE gaps	
Measurement gap repetition periodicity	ms	1, 2, 3, 4	40	
Measurement gap length	ms	1, 2, 3, 4	6	
Measurement gap offset	ms	1, 2, 3, 4	39	
SSB configuration		1, 2, 4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 4	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CSI-RS parameters		1, 4	CSI-RS.1.2 FDD resource #0	
		2	CSI-RS.1.2 TDD resource #0	
		3	CSI-RS.2.2 TDD resource #0	
A3-Offset	dB	1, 2, 3, 4	-4.5	
CP length		1, 2, 3, 4	Normal	
Hysteresis	dB	1, 2, 3, 4	0	
Time To Trigger	s	1, 2, 3, 4	0	
Filter coefficient		1, 2, 3, 4	0	L3 filtering is not used
DRX	ms	1, 2, 3, 4	N/A	OFF

Parameter	Unit	Test configuration	Value	Comment
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	5	

Table A.16.6.1.6.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.2 FDD		N/A	
		2	CCR.1.2 TDD		N/A	
		3	CCR.2.3 TDD		N/A	
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.2 RedCap		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4	DLBWP.1.2 RedCap		ULBWP.1.1	
RLM-RS		1, 2, 3, 4	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/18.36 MHz	3	-61.68	-59.34	-61.68	-59.34

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1, 2, 3, 4	AWGN			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.16.6.1.6.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.1.7 SA event triggered reporting tests with per-UE gaps under DRX for 1 Rx UE

A.16.6.1.7.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell identification and measurement period requirements in clauses 9.2B.6.1 and 9.2B.6.2.

A.16.6.1.7.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.16.6.1.7.2-1, A.16.6.1.7.2-2 and A.16.6.1.7.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.16.6.1.7.2-1: Supported test configurations for NR Redcap UE

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode,
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.6.1.7.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2, 3, 4	Cell 1		
Neighbour cell		1, 2, 3, 4	Cell 2		Cell to be identified.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2		
Measurement gap type		1, 2, 3, 4,	Per-UE gaps		
Measurement gap repetition periodicity	ms	1, 2, 3, 4	40		
Measurement gap length	ms	1, 2, 3, 4	6		
Measurement gap offset	ms	1, 2, 3, 4	39		
SSB configuration		1, 4	SSB.1 FR1		
		2	SSB.1 FR1		
		3	SSB.1 RedCap FR1		
SMTC configuration		1, 4	SMTC.2		
		2	SMTC.1		
		3	SMTC.1		
CSI-RS parameters		1, 4	CSI-RS.1.2 FDD resource #0		
		2	CSI-RS.1.2 TDD resource #0		
		3	CSI-RS.2.2 TDD resource #0		
A3-Offset	dB	1, 2, 3, 4	-4.5		
CP length		1, 2, 3, 4	Normal		
Hysteresis	dB	1, 2, 3, 4	0		
Time To Trigger	s	1, 2, 3, 4	0		
Filter coefficient		1, 2, 3, 4	0		L3 filtering is not used
DRX		1, 2, 3, 4	DRX.1	DRX. 7	
Time offset between serving and neighbour cells		1, 4	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 μs		Synchronous cells
		3	3 μs		Synchronous cells
T1	s	1, 2, 3, 4	5		
T2	s	1, 2, 3, 4	5	10	

Table A.16.6.1.7.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.2 FDD		N/A	
		2	CCR.1.2 TDD		N/A	
		3	CCR.2.3 TDD		N/A	
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.2 RedCap		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.2 RedCap		ULBWP.1.1	
RLM-RS		1, 2, 3, 4	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/16.36 MHz	3	-61.68	-59.34	-61.68	-59.34
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.1.7.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 7680 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.1.8 SA event triggered reporting tests with per-UE gaps under DRX for 2 Rx UE

A.16.6.1.8.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell identification and measurement period requirements in clauses 9.2B.6.1 and 9.2B.6.2.

A.16.6.1.8.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.16.6.1.8.2-1, A.16.6.1.8.2-2 and A.16.6.1.8.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.16.6.1.8.2-1: Supported test configurations for NR Redcap UE

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode,
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.6.1.8.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2, 3, 4	Cell 1		
Neighbour cell		1, 2, 3, 4	Cell 2		Cell to be identified.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2		
Measurement gap type		1, 2, 3, 4,	Per-UE gaps		
Measurement gap repetition periodicity	ms	1, 2, 3, 4	40		
Measurement gap length	ms	1, 2, 3, 4	6		
Measurement gap offset	ms	1, 2, 3, 4	39		
SSB configuration		1, 4	SSB.1 FR1		
		2	SSB.1 FR1		
		3	SSB.1 RedCap FR1		
SMTC configuration		1, 4	SMTC.2		
		2	SMTC.1		
		3	SMTC.1		
CSI-RS parameters		1, 4	CSI-RS.1.2 FDD resource #0		
		2	CSI-RS.1.2 TDD resource #0		
		3	CSI-RS.2.2 TDD resource #0		
A3-Offset	dB	1, 2, 3, 4	-4.5		
CP length		1, 2, 3, 4	Normal		
Hysteresis	dB	1, 2, 3, 4	0		
Time To Trigger	s	1, 2, 3, 4	0		
Filter coefficient		1, 2, 3, 4	0		L3 filtering is not used
DRX		1, 2, 3, 4	DRX.1	DRX. 7	
Time offset between serving and neighbour cells		1, 4	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 μs		Synchronous cells
		3	3 μs		Synchronous cells
T1	s	1, 2, 3, 4	5		
T2	s	1, 2, 3, 4	5	10	

Table A.16.6.1.8.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD		N/A	
		3	CR.2.1 TDD		N/A	
Dedicated CORESET RMC configuration		1, 4	CCR.1.2 FDD		N/A	
		2	CCR.1.2 TDD		N/A	
		3	CCR.2.3 TDD		N/A	
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.2 RedCap		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.2 RedCap		ULBWP.1.1	
RLM-RS		1, 2, 3, 4	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/18.36 MHz	3	-61.68	-59.34	-61.68	-59.34
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.1.8.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 6400 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.1.9 SA event triggered reporting tests without gap under non-DRX with SSB index reading for 1 Rx UE

A.16.6.1.9.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2B.5.1 and 9.2B.5.2.

A.16.6.1.9.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cell are given in table A.16.6.1.9.2-1 and A.16.6.1.9.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.16.6.1.9.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode

Table A.16.6.1.9.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	Cell 1	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	
CD-SSB configuration		1, 2	SSB.1 FR1	
NCD-SSB configuration		1,2	SSB.6 RedCap FR1 Note 1	
SMTC configuration for CD-SSB		1, 2	SMTC.2	
SMTC configuration for NCD-SSB		1, 2	SMTC.4 RedCap	
A3-Offset	dB	1, 2	-4.5	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX	ms	1, 2	N/A	OFF
Time offset between serving and neighbour cells		1, 2	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	1, 2	5	
T2	s	1, 2	5	
NOTE 1: NCD-SSB is configured within dedicated RedCap DL BWP.				

Table A.16.6.1.9.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	N/A		N/A	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
Active UL BWP1 configuration			ULBWP.1.1		ULBWP.1.1	
Active DL BWP configuration		1, 2	DLBWP.1.3 RedCap Note 4		DLBWP.1.3 RedCap Note 4	
Active UL BWP configuration		1, 2	ULBWP.1.3 RedCap Note 5		ULBWP.1.3 RedCap Note 5	
RLM-RS		1, 2,	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	--64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The starting PRB index for dedicated DL BWP1 corresponding to CD-SSB PRB index; the starting PRB index for dediacted DL BWP2 corresponding to NCD-SSB PRB index;
NOTE 5: The starting PRB index for dedicated UL BWP1 is the same as the starting PRB index for dedicated DL BWP1; the starting PRB index for dedicated UL BWP2 is the same as the starting PRB index for dedicated DL BWP2.

A.16.6.1.9.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1480 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.1.10 SA event triggered reporting tests without gap under non-DRX with SSB index reading for 2 Rx UE

A.16.6.1.10.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.16.6.1.10.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cell are given in table A.16.6.1.10.2-1 and A.16.6.1.10.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.16.6.1.10.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode

Table A.16.6.1.10.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	Cell 1	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	
CD-SSB configuration		1, 2	SSB.1 FR1	
NCD-SSB configuration		1,2	SSB.6 RedCap FR1 Note 1	
SMTC configuration for CD-SSB		1, 2	SMTC.2	
SMTC configuration for NCD-SSB		1, 2	SMTC.4 RedCap	
A3-Offset	dB	1, 2, 3, 4	-4.5	
CP length		1, 2, 3, 4	Normal	
Hysteresis	dB	1, 2, 3, 4	0	
Time To Trigger	s	1, 2, 3, 4	0	
Filter coefficient		1, 2, 3, 4	0	L3 filtering is not used
DRX	ms	1, 2, 3, 4	N/A	OFF
Time offset between serving and neighbour cells		1, 2, 3, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	5	
NOTE 1: NCD-SSB is configured within dedicated RedCap DL BWP.				

Table A.16.6.1.10.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	N/A		N/A	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD		N/A	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
Initial BWP configuration		1, 2	DLBWP.0,1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Active DL BWP2 configuration		1, 2	DLBWP.1.3 RedCap Note 4		DLBWP.1.3 RedCap Note 4	
Active UL BWP2 configuration		1, 2	ULBWP.1.3 RedCap Note 5		ULBWP.1.3 RedCap Note 5	
RLM-RS		1, 2	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2, 4	-64.60	-62.25	--64.60	-62.25
Propagation Condition		1, 2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The starting PRB index for dedicated DL BWP1 corresponding to CD-SSB PRB index; the starting PRB index for dediacted DL BWP2 corresponding to NCD-SSB PRB index;
NOTE 5: The starting PRB index for dedicated UL BWP1 is the same as the starting PRB index for dedicated DL BWP1; the starting PRB index for dedicated UL BWP2 is the same as the starting PRB index for dedicated DL BWP2.

A.16.6.1.10.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1240 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.1.11 SA event triggered reporting tests with per-UE gaps under non-DRX with SSB index reading for 1 Rx UE

A.16.6.1.11.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell identification and measurement period requirements in clauses 9.2B.6.1 and 9.2B.6.2.

A.16.6.1.11.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.16.6.1.11.2-1, A.16.6.1.11.2-2 and A.16.6.1.11.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.16.6.1.11.2-1: Supported test configurations for NR Redcap UE

Configuration	Description
1	15 kHz SSB SCS, 10 MHz UE bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz UE bandwidth, HD-FDD duplex mode

Table A.16.6.1.11.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1,2	Cell 1	
Neighbour cell		1,2	Cell 2	Cell to be identified.
RF Channel Number		1,2	1: Cell 1 and Cell 2	
Measurement gap type		1,2	Per-UE gaps	
Measurement gap repetition periodicity	ms	1,2	40	
Measurement gap length	ms	1,2	6	
Measurement gap offset	ms	1,2	39	
CD-SSB configuration		1,2	SSB.1 FR1	
SMTC configuration for CD-SSB		1,2	SMTC.2	
A3-Offset	dB	1,2	-4.5	
CP length		1,2	Normal	
Hysteresis	dB	1,2	0	
Time To Trigger	s	1,2	0	
Filter coefficient		1,2	0	L3 filtering is not used
DRX		1,2	N/A	OFF
Time offset between serving and neighbour cells		1,2	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	1,2	5	
T2	s	1,2	5	

Table A.16.6.1.11.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gap for PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1,2	N/A		N/A	
PDSCH RMC configuration		1,2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1,2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1,2	CCR.1.2 FDD		N/A	
OCNG Patterns		1,2	OP.1		OP.1	
TRS configuration		1,2	TRS.1.1 FDD		N/A	
Initial BWP configuration		1,2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP2 configuration		1,2	DLBWP.1.3 RedCap		DLBWP.1.1	
Active UL BWP2 configuration		1,2	ULBWP.1.3 RedCap		ULBWP.1.1	
RLM-RS		1,2	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1,2	-98			
N_{oc} Note 2	dBm/15 kHz	1,2	-98			
$\hat{E}_s/I_{ot}$	dB	1,2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1,2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1,2	-94	-94	-Infinity	-94

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Io	dBm/9.36 MHz	1,2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1,2	AWGN			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.16.6.1.11.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1040 ms from the beginning of time period T2. The UE isrequired to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.1.12 SA event triggered reporting tests with per-UE gaps under non-DRX with SSB index reading for 2 Rx UE

A.16.6.1.12.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell identification and measurement period requirements in clauses 9.2B.6.1 and 9.2B.6.2.

A.16.6.1.12.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in table A.16.6.1.12.2-1, A.16.6.1.12.2-2 and A.16.6.1.12.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.16.6.1.12.2-1: Supported test configurations for NR Redcap UE

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode

Table A.16.6.1.12.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1,2	Cell 1	
Neighbour cell		1,2	Cell 2	Cell to be identified.
RF Channel Number		1,2	1: Cell 1 and Cell 2	
Measurement gap type		1,2	Per-UE gaps	
Measurement gap repetition periodicity	ms	1,2	40	
Measurement gap length	ms	1,2	6	
Measurement gap offset	ms	1,2	39	
CD-SSB configuration		1,2	SSB.1 FR1	

Parameter	Unit	Test configuration	Value	Comment
SMTC configuration for CD-SSB		1,2	SMTC.2	
A3-Offset	dB	1,2	-4.5	
CP length		1,2	Normal	
Hysteresis	dB	1,2	0	
Time To Trigger	s	1,2	0	
Filter coefficient		1,2	0	L3 filtering is not used
DRX		1,2	N/A	OFF
Time offset between serving and neighbour cells		1,2	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
T1	s	1,2	5	
T2	s	1,2	5	

Table A.16.6.1.11.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gap for PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1,2	N/A		N/A	
PDSCH RMC configuration		1,2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1,2	CR.1.1 FDD		N/A	
Dedicated CORESET RMC configuration		1,2	CCR.1.2 FDD		N/A	
OCNG Patterns		1,2	OP.1		OP.1	
TRS configuration		1,2	TRS.1.1 FDD		N/A	
IInitial BWP configuration		1,2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP2 configuration		1,2	DLBWP.1.2 RedCap		DLBWP.1.1	
Active UL BWP 2 configuration		1,2	ULBWP.1.2 RedCap		ULBWP.1.1	
RLM-RS		1,2	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1,2	-98			
N_{oc} Note 2	dBm/15 kHz	1,2	-98			
$\hat{E}_s/I_{ot}$	dB	1,2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1,2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1,2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1,2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1,2	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.1.12.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2 Inter-frequency Measurements

A.16.6.2.1 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is used for 1 Rx UE

A.16.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3B.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.16.6.2.1.1-1, A.16.6.2.1.1-2 and A.16.6.2.1.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.16.6.2.1.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.16.6.2.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3,4	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4	NR Cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4	9		
A3-Offset	dB	Config 1,2,3,4	-6		
Hysteresis	dB	Config 1,2,3,4	0		
CP length		Config 1,2,3,4	Normal		
TimeToTrigger	s	Config 1,2,3,4	0		
Filter coefficient		Config 1,2,3,4	0		L3 filtering is not used
DRX		Config 1,2,3,4	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,4	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3,4	5		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
T2	s	Config 1,2,3,4	1.1	12	

Table A.16.6.2.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3,4	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
			Config 4	HD-FDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3,4	DLBWP.0.1		NA	
	Initial UL BWP		Config 1, 2, 3,4	ULBWP.0.1		NA	
	Dedicated DL BWP		Config 1, 2, 3,4	DLBWP.1.1		NA	
	Dedicated UL BWP		Config 1, 2, 3,4	ULBWP.1.1		NA	
TRS configuration			Config 1,4	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3,4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD		NA	
			Config 3	SR2.1 TDD		NA	
RMSI CORESET Reference Channel			Config 1,4	CR.1.1 FDD		NA	
			Config 2	CR.1.1 TDD		NA	
			Config 3	CR.2.1 TDD		NA	
Dedicated CORESET Reference Channel			Config 1,4	CCR.1.1 FDD		NA	
			Config 2	CCR.1.1 TDD		NA	
			Config 3	CCR.2.1 TDD		NA	
SSB parameters			Config 1,4	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.1 RedCap FR1		SSB.3 RedCap FR1	
SMTC configuration			Config 1,4	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,4	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3,4	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	Config 1,2,3,4	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4	-64.59	-64.59	-70.05	-62.2
	dBm/18.36 MHz	Config 3	-61.66	-61.66	-67.11	-59.32
Propagation Condition		Config 1,2,3,4	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.16.6.2.1.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test1&3	Test2&4	Comment
	Value	Value	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.16.6.2.1.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.16.6.2.1.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 11520 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2.2 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is used for 2 Rx UE

A.16.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3B.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.16.6.2.22.2.1-1, A.16.6.2.2.1-2 and A.16.6.2.2.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.16.6.2.2.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.16.6.2.2.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3,4	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4	NR Cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4	9		
A3-Offset	dB	Config 1,2,3,4	-6		
Hysteresis	dB	Config 1,2,3,4	0		
CP length		Config 1,2,3,4	Normal		
TimeToTrigger	s	Config 1,2,3,4	0		
Filter coefficient		Config 1,2,3,4	0		L3 filtering is not used
DRX		Config 1,2,3,4	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,4	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3,4	5		
T2	s	Config 1,2,3,4	1.1	11	

Table A.16.6.2.2.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3,4	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
			Config 4	HD-FDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3,4	DLBWP.0.1		NA	
	Initial UL BWP		Config 1, 2, 3,4	ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,4	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3,4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD		NA	
			Config 3	SR2.1 TDD		NA	
RMSI CORESET Reference Channel			Config 1,4	CR.1.1 FDD		NA	
			Config 2	CR.1.1 TDD		NA	
			Config 3	CR.2.1 TDD		NA	
Dedicated CORESET Reference Channel			Config 1,4	CCR.1.1 FDD		NA	
			Config 2	CCR.1.1 TDD		NA	
			Config 3	CCR.2.1 TDD		NA	
SSB parameters			Config 1,4	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.1 RedCap FR1		SSB.3 RedCap FR1	
SMTC configuration			Config 1,4	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2, 4	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3, 4	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note2	dBm/15 kHz	Config 1,2,3	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SSB_RRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2	-64.59	-64.59	-70.05	-62.2
	dBm/38.16 MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.16.6.2.2.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test 1	Test 2	Comment
	Value	Value	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.16.6.2.2.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.16.6.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2.3 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is not used for 1 Rx UE

A.16.6.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3B.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.16.6.2.3.1-1, A.16.6.2.3.1-2 and A.16.6.2.3.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.16.6.2.3.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.16.6.2.3.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3,4	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4	9	
A3-Offset	dB	Config 1,2,3,4	-6	
Hysteresis	dB	Config 1,2,3,4	0	
CP length		Config 1,2,3,4	Normal	
TimeToTrigger	s	Config 1,2,3,4	0	
Filter coefficient		Config 1,2,3,4	0	L3 filtering is not used
DRX		Config 1,2,3,4	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3,4	5	
T2	s	Config 1,2,3,4	1.1	

Table A.16.6.2.3.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3,4	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
			Config 4	HD-FDD			
TDD configuration			Config 1,4	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3, 4	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,4	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3,4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
RMSI CORESET Reference Channel			Config 1,4	CR.1.1 FDD			
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
Dedicated CORESET Reference Channel			Config 1,4	CCR.1.1 FDD			
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SSB parameters			Config 1,2,4	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.1 RedCap FR1		SSB.1 RedCap FR1	
SMTC configuration			Config 1,4	SMTC.2		SMTC.2	
			Config 2, 3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,4	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3,4	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2,4	-98		-98	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4	-64.59	-64.59	-70.05	-62.26
	dBm/18.72 MHz	Config 3	-61.68	-61.68	-67.13	-59.34
Propagation Condition		Config 1,2,3,4	AWGN		AWGN	
Antenna Configuration			1x1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.16.6.2.3.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1000 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2.4 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is not used for 2 Rx UE

A.16.6.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3B.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.16.6.2.4.1-1, A.16.6.2.4.1-2 and A.16.6.2.4.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.16.6.2.4.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.16.6.2.4.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3,4	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4	9	
A3-Offset	dB	Config 1,2,3,4	-6	
Hysteresis	dB	Config 1,2,3,4	0	
CP length		Config 1,2,3,4	Normal	
TimeToTrigger	s	Config 1,2,3,4	0	
Filter coefficient		Config 1,2,3,4	0	L3 filtering is not used
DRX		Config 1,2,3,4	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3,4	5	
T2	s	Config 1,2,3,4	1	

Table A.16.6.2.4.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3,4	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
			Config 4	HD-FDD			
TDD configuration			Config 1,4	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3, 4	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,4	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.2			Config 1,2,3,4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD		NA	
			Config 3	SR2.1 TDD		NA	
RMSI CORESET Reference Channel			Config 1,4	CR.1.1 FDD		NA	
			Config 2	CR.1.1 TDD		NA	
			Config 3	CR2.1 TDD		NA	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD		NA	
		Config 2	CCR.1.1 TDD		NA	
		Config 3	CCR.2.1 TDD		NA	
SSB parameters		Config 1,2,4	SSB.1 FR1		SSB.5 FR1	
		Config 3	SSB.1 RedCap FR1		SSB.3 RedCap FR1	
SMTC configuration		Config 1,4	SMTC.2		SMTC.5	
		Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4	15			
		Config 3	30			
EPRE ratio of PSS to SSS		Config 1,2,3,4	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4	-98		-98	
		Config 3	-95		-95	
SSB_RP Note 3	dBm/SCS	Config 1,2,4	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4	-64.59	-64.59	-70.05	-62.26
	dBm/18.72 MHz	Config 3	-61.68	-61.68	-67.13	-59.34
Propagation Condition		Config 1,2,3,4	AWGN		AWGN	
Antenna Configuration			1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.6.2.4.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2.5 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is not used for 1 Rx UE

A.16.6.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3B.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.16.6.2.5.1-1, A.16.6.2.5.1-2 and A.16.6.2.5.1-3.7

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.16.6.2.5.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.16.6.2.5.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3,4	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4	9	
A3-Offset	dB	Config 1,2,3,4	-6	
Hysteresis	dB	Config 1,2,3,4	0	
CP length		Config 1,2,3,4	Normal	
TimeToTrigger	s	Config 1,2,3,4	0	
Filter coefficient		Config 1,2,3,4	0	L3 filtering is not used
DRX		Config 1,2,3,4	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3,4	5	
T2	s	Config 1,2,3,4	1.3	

Table A.16.6.2.5.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3,4	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
			Config 4	HD-FDD			
TDD configuration			Config 1,4	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3, 4	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,4	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3,4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
RMSI CORESET Reference Channel			Config 1,4	CR.1.1 FDD			
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
Dedicated CORESET Reference Channel			Config 1,4	CCR.1.1 FDD			
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SSB parameters			Config 1,2,4	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.1 RedCap FR1		SSB.3 RedCap FR1	
SMTC configuration			Config 1,4	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,4	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3,4	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz		-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2,4	-98		-98	

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		Config 3	-95		-95	
SSB_RP Note 3	dBm/SCS	Config 1,2,4	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4	-64.59	-64.59	-70.05	-62.26
	dBm/18.72 MHz	Config 3	-61.68	-61.68	-67.13	-59.34
Propagation Condition		Config 1,2,3,4	AWGN		AWGN	
Antenna Configuration		Config 1,2,3,4	1x1		1x1	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.6.2.5.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2.6 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is not used for 2 Rx UE

A.16.6.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3B.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.16.6.2.6.1-1, A.16.6.2.6.1-2 and A.16.6.2.6.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.16.6.2.6.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode

NOTE 1: The UE is only required to be tested in one of the supported test configurations
NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell

Table A.16.6.2.5.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3,4	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4	0	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4	9	
A3-Offset	dB	Config 1,2,3,4	-6	
Hysteresis	dB	Config 1,2,3,4	0	
CP length		Config 1,2,3,4	Normal	
TimeToTrigger	s	Config 1,2,3,4	0	
Filter coefficient		Config 1,2,3,4	0	L3 filtering is not used
DRX		Config 1,2,3,4	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1,4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3,4	5	
T2	s	Config 1,2,3,4	1.1	

Table A.16.6.2.6.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3,4	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
			Config 4	HD-FDD			
TDD configuration			Config 1,4	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3, 4	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,4	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3,4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
RMSI CORESET Reference Channel			Config 1,4	CR.1.1 FDD			
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD			
		Config 2	CCR.1.1 TDD			
		Config 3	CCR.2.1 TDD			
SSB parameters		Config 1,2,4	SSB.1 FR1		SSB.5 FR1	
		Config 3	SSB.1 RedCap FR1		SSB.3 RedCap FR1	
SMTC configuration		Config 1,4	SMTC.2		SMTC.5	
		Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4	15			
		Config 3	30			
EPRE ratio of PSS to SSS		Config 1,2,3,4	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	Config 1,2,3,4	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4	-98		-98	
		Config 3	-95		-95	
SSB_RP Note 3	dBm/SCS	Config 1,2,4	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4	-64.59	-64.59	-70.05	-62.26
	dBm/18.36 MHz	Config 3	-61.68	-61.68	-67.13	-59.34
Propagation Condition		Config 1,2,3,4	AWGN		AWGN	
Antenna Configuration		Config 1,2,3,4	1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.6.2.6.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1040 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2.7 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is used for 1 Rx UE

A.16.6.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that 1 Rx RedCap UE makes correct reporting of an event in FR1. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3B.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.16.6.2.7.1-1, A.16.6.2.7.1-2 and A.16.6.2.7.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.16.6.2.7.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.16.6.2.7.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3,4	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4	NR Cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4	0		As specified in clause 9.1A.2-1.
Measurement gap offset		Config 1,2,3,4	9		
A3-Offset	dB	Config 1,2,3,4	-6		
Hysteresis	dB	Config 1,2,3,4	0		
CP length		Config 1,2,3,4	Normal		
TimeToTrigger	s	Config 1,2,3,4	0		
Filter coefficient		Config 1,2,3,4	0		L3 filtering is not used
DRX		Config 1,2,3,4	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,4	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3 μs		Synchronous cells.
T1	s	Config 1,2,3,4	5		
T2	s	Config 1,2,3,4	1.5	16	

Table A.16.6.2.7.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3,4	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
			Config 4	HD-FDD			
TDD configuration			Config 1,4	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3,4	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,4	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3,4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
RMSI CORESET Reference Channel			Config 1,4	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
Dedicated CORESET Reference Channel			Config 1,4	CCR.1.1 FDD		-	
			Config 2	CCR.1.1 TDD			
			Config 3	CCR.2.1 TDD			
SSB parameters			Config 1,4	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.1 RedCap FR1		SSB.3 RedCap FR1	
SMTC configuration			Config 1,4	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2,4	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2,3,4	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2,4	-98		-98	
			Config 3	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2,4	-94	-94	-Infinity	-91

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4	4	4	-Infinity	7
Io^{Note3}	dBm/9.36 MHz	Config 1,2,4	-64.59	-64.59	-70.05	-62.26
	dBm/18.36 MHz	Config 3	-61.68	-61.68	-67.13	-59.34
Propagation Condition		Config 1,2,3,4	AWGN		AWGN	
Antenna Configuration		Config 1,2,3,4	1x1		1x1	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.6.2.7.2 Test Requirements

In test 1 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1440 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 15360 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2.8 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is used for 2 Rx UE

A.16.6.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that 2 Rx RedCap UE makes correct reporting of an event in FR1. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.16.6.2.8.1-1, A.16.6.2.8.1-2 and A.16.6.2.8.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.16.6.2.8.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode

NOTE 1: The UE is only required to be tested in one of the supported test configurations
NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell

Table A.16.6.2.8.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3,4	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4	NR Cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4	0		As specified in clause 9.1A.2-1.
Measurement gap offset		Config 1,2,3,4	9		
A3-Offset	dB	Config 1,2,3,4	-6		
Hysteresis	dB	Config 1,2,3,4	0		
CP length		Config 1,2,3,4	Normal		
TimeToTrigger	s	Config 1,2,3,4	0		
Filter coefficient		Config 1,2,3,4	0		L3 filtering is not used
DRX		Config 1,2,3,4	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1,4	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3 μs		Synchronous cells.
T1	s	Config 1,2,3,4	5		
T2	s	Config 1,2,3,4	1.3	13.5	

Table A.16.6.2.8.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3,4	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
			Config 4	HD-FDD			
TDD configuration			Config 1,4	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3,4	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1,4	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3,4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		Config 3	SR2.1 TDD			
RMSI CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2	CR.1.1 TDD			
		Config 3	CR2.1 TDD			
Dedicated CORESET Reference Channel		Config 1,4	CCR.1.1 FDD		-	
		Config 2	CCR.1.1 TDD			
		Config 3	CCR.2.1 TDD			
SSB parameters		Config 1,4	SSB.1 FR1		SSB.5 FR1	
		Config 2	SSB.1 FR1		SSB.5 FR1	
		Config 3	SSB.1 RedCap FR1		SSB.3 RedCap FR1	
SMTC configuration		Config 1,4	SMTC.2		SMTC.5	
		Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4	15			
		Config 3	30			
EPRE ratio of PSS to SSS		Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	Config 1,2,3,4	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4	-64.59	-64.59	-70.05	-62.26
	dBm/18.36 MHz	Config 3	-61.68	-61.68	-67.13	-59.34
Propagation Condition		Config 1,2,3,4	AWGN		AWGN	
Antenna Configuration		Config 1,2,3,4	1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.6.2.8.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement

reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 12160 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2.9 SA event triggered reporting tests with additional mandatory gap pattern for 1 Rx UE

A.16.6.2.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event when mandatory gap pattern with 3 ms MGL is configured.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.16.6.2.9.1-1, A.16.6.2.9.1-2 and A.16.6.2.9.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.16.6.2.9.1-1: Supported test configurations

Config	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.16.6.2.9.1-2: General test parameters for SA inter-frequency event triggered reporting with additional mandatory gap pattern

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
NR RF Channel Number		Config 1,2,3, 4	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3, 4	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3, 4	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3, 4	3	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1, , 4	12	
		Config 2,3	9	
A3-Offset	dB	Config 1,2,3	-6	
Hysteresis	dB	Config 1,2,3	0	
CP length		Config 1,2,3	Normal	
TimeToTrigger	s	Config 1,2,3	0	
Filter coefficient		Config 1,2,3	0	L3 filtering is not used
DRX		Config 1,2,3	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
T1	s	Config 1,2,3	5	
T2	s	Config 1,2,3	1.5	

Table A.16.6.2.9.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting with additional mandatory gap pattern

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3, 4	1		2	
Duplex mode			Config 1, 4	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2, 4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2, 4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3, 4	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1, 4	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3, 4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1, 4	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1, 4	CR.1.1 FDD			
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
SSB parameters			Config 1, 4	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.1 RedCap FR1		SSB.3 RedCap FR1	
SMTC configuration			Config 1, 4	SMTC.1		SMTC.9	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2, 4	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3, 4	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS (Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2, 4	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2, 4	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3, 4	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2, 4	-64.59	-64.59	-70.05	-62.26
	dBm/18.36 MHz	Config 3	-61.66	-61.66	-67.11	-59.32
Propagation Condition		Config 1,2,3, 4	AWGN		AWGN	
Antenna Configuration			1x1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.16.6.2.9.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1440 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2.10 SA event triggered reporting tests with additional mandatory gap pattern for 2 Rx UE

A.16.6.2.10.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event when mandatory gap pattern with 3 ms MGL is configured.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in tables A.16.6.2.10.1-1, A.16.6.2.10.1-2 and A.16.6.2.10.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.16.6.2.10.1-1: Supported test configurations

Config	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode,
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell

Table A.16.6.2.10.1-2: General test parameters for SA inter-frequency event triggered reporting with additional mandatory gap pattern

Parameter	Unit	Test configuration	Value		Comment
			Test 1		
NR RF Channel Number		Config 1,2,3, 4	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3, 4	NR Cell 1 (PCell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3, 4	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3, 4	3		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1, 4	12		
		Config 2, 3	9		
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	OFF		DRX is not used
Time offset between serving and neighbour cells		Config 1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	1.5	1	

Table A.16.6.2.10.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting with additional mandatory gap pattern

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3, 4	1		2	
Duplex mode			Config 1, 4	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2, 4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2, 4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3, 4	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1, 4	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3, 4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1, 4	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
CORESET Reference Channel		Config 1, 4	CR.1.1 FDD			
		Config 2	CR.1.1 TDD			
		Config 3	CR2.1 TDD			
SSB parameters		Config 1, 4	SSB.1 FR1		SSB.5 FR1	
		Config 2	SSB.1 FR1		SSB.5 FR1	
		Config 3	SSB.1 RedCap FR1		SSB.3 RedCap FR1	
SMTC configuration		Config 1, 4	SMTC.1		SMTC.9	
		Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2, 4	15			
		Config 3	30			
EPRE ratio of PSS to SSS		Config 1,2,3, 4	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS (Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2, 4	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2, 4	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3, 4	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2, 4	-64.59	-64.59	-70.05	-62.26
	dBm/18.36 MHz	Config 3	-61.66	-61.66	-67.11	-59.32
Propagation Condition		Config 1,2,3, 4	AWGN		AWGN	
Antenna Configuration			1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.6.2.10.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1440 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2.11 SA event triggered reporting tests for FR1 when DRX is used for 1 Rx UE

A.16.6.2.11.1 Test Purpose and Environment

The purpose of this test is to verify that the UE which supports interFrequencyMeas-Nogap-r16 makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search without measurement gap requirements in clause 9.3B.7.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on RF channel 2. The SSB of Cell 2 is completely within UE's active BWP BW. The PRBs containing SSB from Cell 1 and Cell 2 should be different in frequency location within the cell bandwidth. The test parameters are given in tables A.16.6.2.11.1-1, A.16.6.2.11.1-2 and A.16.6.2.11.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.16.6.2.11.1-1: Supported test configurations

Config	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.16.6.2.11.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 when DRX is used

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3, 4	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3, 4	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3, 4	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
A3-Offset	dB	Config 1,2,3, 4	-6	
Hysteresis	dB	Config 1,2,3, 4	0	
CP length		Config 1,2,3, 4	Normal	
TimeToTrigger	s	Config 1,2,3, 4	0	
Filter coefficient		Config 1,2,3, 4	0	L3 filtering is not used
DRX		Config 1,2,3, 4	DRX.1	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.

Parameter	Unit	Test configuration	Value	Comment
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3, 4	5	
T2	s	Config 1,2,3, 4	1	

Table A.16.6.2.11.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 when DRX is used

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3,4	1		2	
Duplex mode			Config 1,4	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1,4	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3, 4	DLBWP.0.1		NA	
	Initial UL BWP		Config 1, 2, 3, 4	ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3,4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD		NA	
			Config 3	SR2.1 TDD		NA	
CORESET Reference Channel			Config 1,4	CR.1.1 FDD		NA	
			Config 2	CR.1.1 TDD		NA	
			Config 3	CR2.1 TDD		NA	
SSB parameters			Config 1,4	SSB.1 FR1		SSB.1 FR1	
			Config 2	SSB.1 FR1		SSB.1 FR1	
			Config 3	SSB.1 RedCap FR1		SSB.1 RedCap FR1	
SMTC configuration			Config 1,4	SMTC.2		SMTC.2	
			Config 2, 3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2, 4	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3,4	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS (Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	Config 1,2,3,4	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4	-64.59	-64.59	-70.05	-62.2
	dBm/18.36 MHz	Config 3	-61.66	-61.66	-67.11	-59.32
Propagation Condition		Config 1,2,3	AWGN		AWGN	
Antenna Configuration			1x1			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.16.6.2.11.1-4: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting when DRX is used

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.16.6.2.11.2 Test Requirements

In test config 1, UE is required to report SSB time index. The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test config 2 and 3, UE is not required to report SSB time index. The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.2.12 SA event triggered reporting tests for FR1 when DRX is used for 2 Rx UE

A.16.6.2.12.1 Test Purpose and Environment

The purpose of this test is to verify that the UE which supports interFrequencyMeas-Nogap-r16 makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search without measurement gap requirements in clause 9.3B.7.

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on RF channel 2. The SSB of Cell 2 is completely within UE's active BWP BW. The PRBs containing SSB from Cell 1 and Cell 2 should be different in frequency location within the cell bandwidth. The test parameters are given in tables A.16.6.2.12.1-1, A.16.6.2.12.1-2 and A.16.6.2.12.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.16.6.2.12.1-1: Supported test configurations

Config	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations NOTE 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.16.6.2.12.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 when DRX is used

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1,2,3, 4	1, 2	Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3, 4	NR Cell 1 (PCell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3, 4	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
A3-Offset	dB	Config 1,2,3, 4	-6	
Hysteresis	dB	Config 1,2,3, 4	0	
CP length		Config 1,2,3, 4	Normal	
TimeToTrigger	s	Config 1,2,3, 4	0	
Filter coefficient		Config 1,2,3, 4	0	L3 filtering is not used
DRX		Config 1,2,3, 4	DRX.1	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs	Synchronous cells.
T1	s	Config 1,2,3, 4	5	
T2	s	Config 1,2,3, 4	1.5	

Table A.16.6.2.12.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 when DRX is used

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3,4	1		2	
Duplex mode			Config 1,4	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1,4	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2,4	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP BW		MHz	Config 1,2	10: $N_{PRB,c}$ = 52			
			Config 3	20: $N_{PRB,c}$ = 51			
BWP configuration	Initial DL BWP		Config 1, 2, 3, 4	DLBWP.0.1		NA	
	Initial UL BWP		Config 1, 2, 3, 4	ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns			Config 1,2,3,4	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1,4	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD		NA	
			Config 3	SR2.1 TDD		NA	
CORESET Reference Channel			Config 1,4	CR.1.1 FDD		NA	
			Config 2	CR.1.1 TDD		NA	
			Config 3	CR2.1 TDD		NA	
SSB parameters			Config 1,4	SSB.1 FR1		SSB.1 FR1	
			Config 2	SSB.1 FR1		SSB.1 FR1	
			Config 3	SSB.1 RedCap FR1		SSB.1 RedCap FR1	
SMTC configuration			Config 1,4	SMTC.2		SMTC.2	
			Config 2, 3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2, 4	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3,4	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS (Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz	Config 1,2,3,4	-98		-98	
N_{oc} Note2		dBm/SCS	Config 1,2,4	-98		-98	
			Config 3	-95		-95	
SS-RSRP Note 3		dBm/SCS	Config 1,2,4	-94	-94	-Infinity	-91
			Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	Config 1,2,3,4,5,6	4	4	-Infinity	7

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4	4	4	-Infinity	7
Io[Note3]	dBm/9.36 MHz	Config 1,2,4	-64.59	-64.59	-70.05	-62.2
	dBm/18.36 MHz	Config 3	-61.66	-61.66	-67.11	-59.32
Propagation Condition		Config 1,2,3	AWGN		AWGN	
Antenna Configuration			1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.16.6.2.12.1-4: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting when DRX is used

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.16.6.2.12.2 Test Requirements

In test config 1 and 4, UE is required to report SSB time index. The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1120 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test config 2 and 3, UE is not required to report SSB time index. The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.3 Inter-RAT Measurements

A.16.6.3.1 SA NR - E-UTRAN event-triggered reporting in non-DRX in FR1 for 1 Rx UE

A.16.6.3.1.1 Test purpose and Environment

The purpose of this set of tests is to verify that the 1 Rx redcap UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in clauses 9.4A.2 and 9.4A.3.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. In the measurement control information from the PCell it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are shown in table A.16.6.3.1.1-1. General test parameters are provided in table A.16.6.3.1.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.16.6.3.1.1-3 and A.16.6.3.1.1-4, respectively.

Table A.16.6.3.1.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.6.3.1.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		1	1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.16.6.3.1.1-3 and A.16.6.3.1.1-4.	
Active cell		Cell 1	Cell 1 is on RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on RF channel number 1
Gap Pattern Id		0	As specified in clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP	Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP	Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1	SS-RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
b2-Threshold2EUTRA	dBm	-95	E-UTRAN RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	OFF
T1	s	5	
T2	s	3	
NOTE 1: Values are defined in table A.16.6.3.1.1-3			

Table A.16.6.3.1.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in non-DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode			1, 3, 7, 8	FDD	
			2, 4, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4, 7, 8	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52(TDD)	
			3, 6	20: $N_{PRB,c}$ = 51 (TDD)	
PDSCH reference measurement channel			1, 4, 7, 8	SR.1.1 FDD	

Parameter		Unit	Configuration	Cell 1	
				T1	T2
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
RMSI CORSET reference channel			1, 4, 7, 8	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
Dedicated CORSET reference channel			1, 4	CCR.1.1 FDD	
			2, 5	CCR.1.1 TDD	
			3, 6	CCR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.1.1	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6, 7, 8	OP.1	
SMTC configuration			1, 2, 3, 4, 5, 6, 7, 8	SMTC.1 FR1	
SSB configuration			1, 2, 4, 5, 7, 8	SSB.1 FR1	
			3, 6	SSB.1 RedCap FR1	
CSI-RS for tracking			1, 4, 7, 8	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
b2-Threshold1		dBm	1, 2, 4, 5, 7, 8	-96	
			3, 6	-93	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6, 7, 8	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6, 7, 8	-104	
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5, 7, 8	-104	
			3, 6	-101	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6, 7, 8	16	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	16	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5, 7, 8	-88	-104
			3, 6	-85	-101
SSB_RP[Note3]		dBm/SCS	1, 2, 4, 5, 7, 8	-88	-104
			3, 6	-85	-101
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5, 7, 8	-59.94	-73.04
		dBm/18.36 MHz	3, 6	-57.01	-70.11
Propagation condition			1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration			1, 2, 3, 4, 5, 6, 7, 8	1x1	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.16.6.3.1.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	

Parameter	Unit	Configuration	Cell 2	
			T1	T2
TDD special subframe configuration[Note1]		4, 5, 6, 8	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	17
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-87
Io[Note5]	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-76.22+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration		1, 2, 3, 4, 5, 6, 7, 8	1x1	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.3.1.2 Test Requirements

The UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.3.2 SA NR - E-UTRAN event-triggered reporting in non-DRX in FR1 for 2 Rx UE

A.16.6.3.2.1 Test purpose and Environment

The purpose of this set of tests is to verify that the 2 Rx redcap UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in clauses 9.4A.2 and 9.4A.3.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. In the measurement control information from the PCell it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are shown in table A.16.6.3.2.1-1. General test parameters are provided in table A.16.6.3.2.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.16.6.3.2.1-3 and A.16.6.3.2.1-4, respectively.

Table A.16.6.3.2.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1 for 1 Rx UE

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.6.3.2.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		1	1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.16.6.3.2.1-3 and A.16.6.3.2.1-4.	
Active cell		Cell 1	Cell 1 is on RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on RF channel number 1
Gap Pattern Id		0	As specified in clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP	Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP	Measurement quantity for Cell 2

Parameter	Unit	Value	Comment
b2-Threshold1	dBm	Note 1	SS-RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
b2-Threshold2EUTRA	dBm	-95	E-UTRAN RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	OFF
T1	s	5	
T2	s	5	
NOTE 1: Values are defined in table A.16.6.3.2.1-3			

Table A.16.6.3.1.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in non-DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode			1, 3, 7, 8	FDD	
			2, 4, 5, 6	TDD	
TDD Configuration	SCS=15 KHz	2, 5	2, 5	TDDConf.1.1	
	SCS=30 KHz	3, 6	3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4, 7, 8	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52(TDD)	
			3, 6	20: $N_{PRB,c}$ = 51 (TDD)	
PDSCH reference measurement channel			1, 4, 7, 8	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
RMSI CORSET reference channel			1, 4, 7, 8	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
Dedicated CORSET reference channel			1, 4, 7, 8	CCR.1.1 FDD	
			2, 5	CCR.1.1 TDD	
			3, 6	CCR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.1.1	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6, 7, 8	OP.1	
SMTC configuration			1, 2, 3, 4, 5, 6, 7, 8	SMTC.1 FR1	
SSB configuration			1, 2, 4, 5, 7, 8	SSB.1 FR1	
			3, 6	SSB.1 RedCap FR1	
CSI-RS for tracking			1, 4, 7, 8	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
b2-Threshold1		dBm	1, 2, 4, 5, 7, 8	-96	
			3, 6	-93	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6, 7, 8	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6, 7, 8	-104	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
N_{oc}[Note2]	dBm/SCS	1, 2, 4, 5, 7, 8	-104	
		3, 6	-101	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	116	70
$\hat{E}_s/I_{ot}$[Note3]	dB	1, 2, 3, 4, 5, 6, 7, 8	116	70
SS-RSRP[Note3]	dBm/SCS	1, 2, 4, 5, 7, 8	-88	-104
		3, 6	-85	-101
SSB_RP[Note3]	dBm/SCS	1, 2, 4, 5, 7, 8	-88	-104
		3, 6	-85	-101
Io[Note3]	dBm/9.36 MHz	1, 2, 4, 5, 7, 8	-59.94	-73.04
	dBm/18.36 MHz	3, 6	-57.01	-70.11
Propagation condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6, 7, 8	1x2 Low	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.16.6.3.2.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	
TDD special subframe configuration[Note1]		4, 5, 6, 8	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				

Parameter	Unit	Configuration	Cell 2	
			T1	T2
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	17
RSRP Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-87
SCH_RP Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-87
Io Note5	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-76.22+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6, 7, 8	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.3.2.2 Test Requirements

The UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.3.3 SA NR - E-UTRAN event-triggered reporting in DRX in FR1 for 1 Rx UE

A.16.6.3.3.1 Test purpose and Environment

The purpose of this set of tests is to verify that the 1 Rx redcap UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1 when DRX is used. This test shall partly verify the cell search and measurement requirements in clauses 9.4A.2 and 9.4A.3. There are two test cases. In test 1 the UE shall be configured with DRX cycle of 40 ms. In test 2 the UE shall be configured with DRX cycle of 640 ms.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. In the measurement control information from the PCell it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2..

In each test the UE shall be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore the UE shall be allocated with PUSCH resource at every DRX cycle.

Supported test configurations are shown in table A.16.6.3.3.1-1. General test parameters are provided in table A.16.6.3.3.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.16.6.3.3.1-3 and A.16.6.3.3.1-4, respectively.

Table A.16.6.3.3.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.6.3.3.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Value		Comment
		Test 1	Test 2	
NR RF Channel Number		1		1 NR carrier frequency is used in the test
LTE RF Channel Number		2		1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.16.6.3.3.1-3 and A.16.6.3.3.1-4.		
Active cell		Cell 1		Cell 1 is on RF channel number 1
Neighbour cell		Cell 2		Cell 2 is on RF channel number 2
Gap Pattern Id		0		As specified in clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP		Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP		Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1		SS-RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
b2-Threshold2EUTRA	dBm	-95		E-UTRAN RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
Hysteresis	dB	0		
TimeToTrigger	s	0		
Filter coefficient		0		L3 filtering is not used
DRX		DRX.1	DRX.7	DRX cycle configurations DRX.1 and DRX. 7 are defined in table A.3.3.1-1 and table A.3.3.7-1 respectively.
T1	s	5		
T2	s	5	15	
NOTE 1: Values are defined in table A.16.6.3.3.1-3				

Table A.16.6.3.3.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode		1, 3, 7, 8	FDD	

Parameter		Unit	Configuration	Cell 1	
				T1	T2
			2, 4, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4, 7, 8	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52(TDD)	
			3, 6	20: $N_{PRB,c}$ = 51 (TDD)	
PDSCH reference measurement channel			1, 4, 7, 8	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
RMSI CORSET reference channel			1, 4, 7, 8	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
Dedicated CORSET reference channel			1, 4, 7, 8	CCR.1.1 FDD	
			2, 5	CCR.1.1 TDD	
			3, 6	CCR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.1.1	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6, 7, 8	OP.1	
SMTC configuration			1, 2, 3, 4, 5, 6, 7, 8	SMTC.1 FR1	
SSB configuration			1, 2, 4, 5, 7, 8	SSB.1 FR1	
			3, 6	SSB.1 RedCap FR1	
CSI-RS for tracking			1, 4, 7, 8	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
b2-Threshold1		dBm	1, 2, 4, 5, 7, 8	-96	
			3, 6	-93	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6, 7, 8	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6, 7, 8	-104	
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5, 7, 8	-104	
			3, 6	-101	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6, 7, 8	116	70
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6, 7, 8	116	70
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5, 7, 8	-88	-104
			3, 6	-85	-101
SSB_RP[Note3]		dBm/SCS	1, 2, 4, 5, 7, 8	-88	-104
			3, 6	-85	-101
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5, 7, 8	-59.94	-73.04
		dBm/18.36 MHz	3, 6	-57.01	-70.11
Propagation condition			1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration			1, 2, 3, 4, 5, 6, 7, 8	1x1	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.16.6.3.3.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	2	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	
TDD special subframe configuration[Note1]		4, 5, 6, 8	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	17
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-87
Io[Note5]	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-76.22+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration		1, 2, 3, 4, 5, 6, 7, 8	1x1	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Parameter	Unit	Configuration	Cell 2	
			T1	T2
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.16.6.3.3.2 Test Requirements

In test 1, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

In test 2, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 12.8 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.3.4 SA NR - E-UTRAN event-triggered reporting in DRX in FR1 for 2 Rx UE

A.16.6.3.4.1 Test purpose and Environment

The purpose of this set of tests is to verify that the 2 Rx redcap UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1 when DRX is used. This test shall partly verify the cell search and measurement requirements in clauses 9.4A.2 and 9.4A.3. There are two test cases. In test 1 the UE shall be configured with DRX cycle of 40 ms. In test 2 the UE shall be configured with DRX cycle of 640 ms.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. In the measurement control information from the PCell it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

In each test the UE shall be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore the UE shall be allocated with PUSCH resource at every DRX cycle.

Supported test configurations are shown in table A.16.6.3.4.1-1. General test parameters are provided in table A.16.6.3.4.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in tables A.16.6.3.4.1-3 and A.16.6.3.4.1-4, respectively.

Table A.16.6.3.4.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE TDD

NOTE: The UE is only required to be tested in one of the supported test configurations

Table A.16.6.3.4.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Value		Comment
		Test 1	Test 2	
NR RF Channel Number		1		1 NR carrier frequency is used in the test
LTE RF Channel Number		1		1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in tables A.16.6.3.4.1-3 and A.16.6.3.4.1-4.		
Active cell		Cell 1		Cell 1 is on RF channel number 1
Neighbour cell		Cell 2		Cell 2 is on RF channel number 2
Gap Pattern Id		0		As specified in clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP		Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP		Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1		SS-RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
b2-Threshold2EUTRA	dBm	-95		E-UTRAN RSRP threshold for SS-RSRP measurement on Cell 1 for event B2
Hysteresis	dB	0		
TimeToTrigger	s	0		
Filter coefficient		0		L3 filtering is not used
DRX		DRX.1	DRX.7	DRX cycle configurations DRX.1 and DRX. 7 are defined in table A.3.3.1-1 and table A.3.3.7-1 respectively.
T1	s	5		
T2	s	5	15	
NOTE 1: Values are defined in table A.16.6.3.4.1-3				

Table A.16.6.3.4.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode			1, 3, 7, 8	FDD	
			2, 4, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4, 7, 8	10: $N_{PRB,c}$ = 52 (FDD)	
			2, 5	10: $N_{PRB,c}$ = 52(TDD)	
			3, 6	20: $N_{PRB,c}$ = 51 (TDD)	
PDSCH reference measurement channel			1, 4, 7, 8	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
RMSI CORSET reference channel			1, 4, 7, 8	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
Dedicated CORSET reference channel			1, 4, 7, 8	CCR.1.1 FDD	
			2, 5	CCR.1.1 TDD	
			3, 6	CCR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.1.1	
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6, 7, 8	OP.1	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
SMTC configuration		1, 2, 3, 4, 5, 6, 7, 8	SMTC.1 FR1	
SSB configuration		1, 2, 4, 5, 7, 8	SSB.1 FR1	
		3, 6	SSB.1 RedCap FR1	
CSI-RS for tracking		1, 4, 7, 8	TRS.1.1 FDD	
		2, 5	TRS.1.1 TDD	
		3, 6	TRS.1.2 TDD	
b2-Threshold1	dBm	1, 2, 4, 5, 7, 8	-96	
		3, 6	-93	
EPRE ratio of PSS to SSS	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS				
EPRE ratio of OCNG to OCNG DMRS				
N_{oc}[Note2]	dBm/15 KHz	1, 2, 3, 4, 5, 6, 7, 8	-104	
N_{oc}[Note2]	dBm/SCS	1, 2, 4, 5, 7, 8	-104	
		3, 6	-101	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	16	0
$\hat{E}_s/I_{ot}$[Note3]	dB	1, 2, 3, 4, 5, 6, 7, 8	16	0
SS-RSRP[Note3]	dBm/SCS	1, 2, 4, 5, 7, 8	-88	-104
		3, 6	-85	-101
SSB_RP[Note3]	dBm/SCS	1, 2, 4, 5, 7, 8	-88	-104
		3, 6	-85	-101
Io[Note3]	dBm/9.36 MHz	1, 2, 4, 5, 7, 8	-59.94	-73.04
	dBm/18.36 MHz	3, 6	-57.01	-70.11
Propagation condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6, 7, 8	1x2 Low	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.16.6.3.4.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	2	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	
TDD special subframe configuration[Note1]		4, 5, 6, 8	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	

Parameter	Unit	Configuration	Cell 2	
			T1	T2
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	17
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	-87
Io[Note5]	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-76.22+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6, 7, 8	1x2 Low	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.3.4.2 Test Requirements

In test 1, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

In test 2, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 12.8 s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.4 L1-RSRP measurement for beam reporting

A.16.6.4.1 SSB based L1-RSRP measurement when DRX is not used for 1 Rx UE

A.16.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.1, with the testing configurations for NR cells in table A.16.6.4.1.1-1.

Table A.16.6.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.16.6.4.1.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.16.6.4.1.2-1 and table A.16.6.4.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.16.6.4.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
	4		HD-FDD
TDD Configuration	1,4		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		20: $N_{PRB,c}$ = 51
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.2 RedCap FR1
OCNG Patterns	1~4		OP.1

Parameter	Config	Unit	Value
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~4		SMTC.1 RedCap
TRS Configuration	1,4		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~4		Off
reportConfigType	1~4		periodic
reportQuantity	1~4		ssb-Index-RSRP
Number of reported RS	1~4		2
L1-RSRP reporting period	1~4	slot	80
T1	1~4	s	5
T2	1~4	s	1
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
Antenna Configuration			1x1
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.16.6.4.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~4	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2,4	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~4	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2.4	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2.4	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/18.36 MHz	-60.77	-60.77	-63.79	-59.02
$\hat{E}_s/N_{oc}$	1~4	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.16.6.4.1.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.4.2 SSB based L1-RSRP measurement when DRX is not used for 2 Rx UE

A.16.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.1, with the testing configurations for NR cells in table A.16.6.4.2.1-1.

Table A.16.6.4.2.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.16.6.4.2.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.16.6.4.2.2-1 and table A.16.6.4.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.16.6.4.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
	4		HD-FDD
TDD Configuration	1,4		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		20: $N_{PRB,c}$ = 51
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.2 RedCap FR1
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~4		SMTC.1 RedCap
TRS Configuration	1,4		TRS.1.1 FDD
	2		TRS.1.1 TDD

Parameter	Config	Unit	Value
	3		TRS.1.2 TDD
DRX configuration	1~4		Off
reportConfigType	1~4		periodic
reportQuantity	1~4		ssb-Index-RSRP
Number of reported RS	1~4		2
L1-RSRP reporting period	1~4	slot	80
T1	1~4	s	5
T2	1~4	s	1
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
Antenna Configuration			1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.16.6.4.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~4	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2,4	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s / I_{ot}$	1~4	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,4	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/18.36 MHz	-60.77	-60.77	-63.79	-59.02
$\hat{E}_s / N_{oc}$	1~4	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.16.6.4.2.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.4.3 SSB based L1-RSRP measurement when DRX is used for 1 Rx UE

A.16.6.4.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.1, with the testing configurations for NR cells in table A.16.6.4.3.1-1.

Table A.16.6.4.3.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.16.6.4.3.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.16.6.4.3.2-1 and table A.16.6.4.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.16.6.4.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1,4		FDD
	2		TDD
	3		TDD
	4		HD-FDD
TDD Configuration	1,4		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		20: $N_{PRB,c}$ = 51
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.2 RedCap FR1
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~4		SMTC.1 RedCap
TRS Configuration	1,4		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~4		DRX.3
reportConfigType	1~4		periodic
reportQuantity	1~4		ssb-Index-RSRP

Parameter	Config	Unit	Value
Number of reported RS	1~4		2
L1-RSRP reporting period	1~4	slot	80
T1	1~4	s	5
T2	1~4	s	1
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
Antenna Configuration			1x1
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.16.6.4.3.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~4	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2,4	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~4	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2,4	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,4	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/18.36 MHz	-60.77	-60.77	-63.79	-59.02
$\hat{E}_s/N_{oc}$	1~4	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.16.6.4.3.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.4.4 SSB based L1-RSRP measurement when DRX is used for 2 Rx UE

A.16.6.4.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.1, with the testing configurations for NR cells in table A.16.6.4.4.1-1.

Table A.16.6.4.4.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.16.6.4.4.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.16.6.4.4.2-1 and table A.16.6.4.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.16.6.4.34.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
	4		HD-FDD
TDD Configuration	1,4		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		20: $N_{PRB,c}$ = 51
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.2 RedCap FR1
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~4		SMTC.1 RedCap
TRS Configuration	1,4		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~4		DRX.3
reportConfigType	1~4		periodic
reportQuantity	1~4		ssb-Index-RSRP
Number of reported RS	1~4		2
L1-RSRP reporting period	1~4	slot	80
T1	1~4	s	5
T2	1~4	s	1
EPRE ratio of PSS to SSS	1~4	dB	0

Parameter	Config	Unit	Value
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
Antenna Configuration			1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.16.6.4.34.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~4	dBm/15 kHz	-94.65			
N_{oc} Note2	1,2,4	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~4	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2,4	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,4	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/18.36 MHz	-60.77	-60.77	-63.79	-59.02
$\hat{E}_s/N_{oc}$	1~4	dB	0	0	-Infinity	3
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.16.6.4.4.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640 ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.4.5 CSI-RS based L1-RSRP measurement when DRX is not used for 1 Rx UE

A.16.6.4.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.2, with the testing configurations for NR cells in table A.16.6.4.5.1-1.

Table A.16.6.4.5.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

A.16.6.4.5.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.16.6.4.5.2-1 and table A.16.6.4.5.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (0 for Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.16.6.4.5.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.16.6.4.5.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
	4		HD-FDD
TDD Configuration	1,4		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		20: $N_{PRB,c}$ = 51
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.2 Redcap FR1
CSI-RS configuration	1,4		CSI-RS 1.3 FDD
	2		CSI-RS 1.3 TDD
	3		CSI-RS 2.3 TDD
OCNG Patterns	1~4		OP.1
TRS Configuration	1,4		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1,2,4		SMTC.1 Redcap
	3		SMTC.1 Redcap
DRX configuration	1~4		Off
reportConfigType	1~4		aperiodic
reportQuantity	1~4		cri-RSRP
Number of reported RS	1~4		2
qcl-Info	1~4		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~4	slots	8
T1	1~4	s	5
EPRE ratio of PSS to SSS	1~4	dB	0

Parameter	Config	Unit	Value
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
Antenna Configuration			1x1
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.16.6.4.5.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~4	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2,4	dBm/SSB SCS	-94.65	
	3		-91.65	
$\hat{E}_s/I_{ot}$	1~4	dB	0	3
CSI-RS RSRP Note2	1,2,4	dBm/SSB SCS	-94.65	-91.65
	3		-91.65	-88.65
Io Note2	1,2,4	dBm/9.36 MHz	-63.69	-61.93
	3	dBm/18.36 MHz	-60.77	-59.02
$\hat{E}_s/N_{oc}$	1~4	dB	0	3
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.16.6.4.5.3 Test Requirements

After 80 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.19.2.1 and relative accuracy requirement in clause 10.1.19.2.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.4.6 CSI-RS based L1-RSRP measurement when DRX is not used for 2 Rx UE

A.16.6.4.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.2, with the testing configurations for NR cells in table A.16.6.4.6.1-1.

Table A.16.6.4.6.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

A.16.6.4.6.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.16.6.4.6.2-1 and table A.16.6.4.6.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (0 for Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.16.6.4.6.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.16.6.4.6.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
	4		HD-FDD
TDD Configuration	1,4		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		20: $N_{PRB,c}$ = 51
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.2 Redcap FR1
CSI-RS configuration	1,4		CSI-RS 1.3 FDD
	2		CSI-RS 1.3 TDD
	3		CSI-RS 2.3 TDD
OCNG Patterns	1~4		OP.1
TRS Configuration	1,4		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1,2,4		SMTC.1 Redcap
	3		SMTC.1 Redcap
DRX configuration	1~4		Off
reportConfigType	1~4		aperiodic
reportQuantity	1~4		cri-RSRP
Number of reported RS	1~4		2
qcl-Info	1~4		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~4	slots	8
T1	1~4	s	5
EPRE ratio of PSS to SSS	1~4	dB	0

Parameter	Config	Unit	Value
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
Antenna Configuration			1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.16.6.4.6.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~4	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2,4	dBm/SSB SCS	-94.65	
	3		-91.65	
$\hat{E}_s/I_{ot}$	1~4	dB	0	3
CSI-RS RSRP Note2	1,2,4	dBm/SSB SCS	-94.65	-91.65
	3		-91.65	-88.65
Io Note2	1,2,4	dBm/9.36 MHz	-63.69	-61.93
	3	dBm/18.36 MHz	-60.77	-59.02
$\hat{E}_s/N_{oc}$	1~4	dB	0	3
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.16.6.4.6.3 Test Requirements

After 80 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.19.2.1 and relative accuracy requirement in clause 10.1.19.2.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.4.7 CSI-RS based L1-RSRP measurement when DRX is used for 1 Rx UE

A.16.6.4.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.2, with the testing configurations for NR cells in table A.16.6.4.7.1-1.

Table A.16.6.4.7.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

A.16.6.4.7.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.16.6.4.7.2-1 and table A.16.6.4.7.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (0 for Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.16.6.4.7.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.16.6.4.7.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
	4		HD-FDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		20: $N_{PRB,c}$ = 51
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.2 Redcap FR1
CSI-RS configuration	1,4		CSI-RS 1.3 FDD
	2		CSI-RS 1.3 TDD
	3		CSI-RS 2.3 TDD
OCNG Patterns	1~4		OP.1
TRS Configuration	1,4		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1,2,4		SMTC.1 Redcap
	3		SMTC.1 Redcap
DRX configuration	1~4		DRX.3
reportConfigType	1~4		aperiodic
reportQuantity	1~4		cri-RSRP
Number of reported RS	1~4		2
qcl-Info	1~4		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~4	slots	8
T1	1~4	s	5
EPRE ratio of PSS to SSS	1~4	dB	0

Parameter	Config	Unit	Value
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
Antenna Configuration			1x1
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.16.6.4.7.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~4	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2,4	dBm/SSB SCS	-94.65	
	3		-91.65	
$\hat{E}_s/I_{ot}$	1~4	dB	0	3
CSI-RS RSRP Note2	1,2,4	dBm/SSB SCS	-94.65	-91.65
	3		-91.65	-88.65
Io Note2	1,2,4	dBm/9.36 MHz	-63.69	-61.93
	3	dBm/18.36 MHz	-60.77	-59.02
$\hat{E}_s/N_{oc}$	1~4	dB	0	3
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.16.6.4.7.3 Test Requirements

After 80 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.19.2.1 and relative accuracy requirement in clause 10.1.19.2.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.4.8 CSI-RS based L1-RSRP measurement when DRX is used for 2 Rx UE

A.16.6.4.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.2, with the testing configurations for NR cells in table A.16.6.4.8.1-1.

Table A.16.6.4.8.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations

A.16.6.4.8.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.16.6.4.8.2-1 and table A.16.6.4.8.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (0 for Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.16.6.4.8.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.16.6.4.8.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~4		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
	4		HD-FDD
TDD Configuration	1,4		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52
	2		10: $N_{PRB,c}$ = 52
	3		20: $N_{PRB,c}$ = 51
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.1 Redcap FR1
CSI-RS configuration	1,4		CSI-RS 1.3 FDD
	2		CSI-RS 1.3 TDD
	3		CSI-RS 2.3 TDD
OCNG Patterns	1~4		OP.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1,2,4		SMTC.1 Redcap
	3		SMTC.1 Redcap
DRX configuration	1~4		DRX.3
reportConfigType	1~4		aperiodic
reportQuantity	1~4		cri-RSRP
Number of reported RS	1~4		2
qcl-Info	1~4		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~4	slots	8
T1	1~4	s	5
EPRE ratio of PSS to SSS	1~4	dB	0

Parameter	Config	Unit	Value
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
Antenna Configuration			1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.16.6.4.8.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~4	dBm/15 kHz	-94.65	
N_{oc} Note1	1,2,4	dBm/SSB SCS	-94.65	
	3		-91.65	
$\hat{E}_s/I_{ot}$	1~4	dB	0	3
CSI-RS RSRP Note2	1,2,4	dBm/SSB SCS	-94.65	-91.65
	3		-91.65	-88.65
Io Note2	1,2,4	dBm/9.36 MHz	-63.69	-61.93
	3	dBm/18.36 MHz	-60.77	-59.02
$\hat{E}_s/N_{oc}$	1~4	dB	0	3
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 2: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.16.6.4.8.3 Test Requirements

After 80 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.19.2.1 and relative accuracy requirement in clause 10.1.19.2.2.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.16.6.5 NR measurements with autonomous gaps

A.16.6.5.1 SA intra-frequency CGI identification of NR neighbor cell in FR1 for 1 Rx UE

A.16.6.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of intra-frequency CGI identification of an NR neighbour cell in FR1 with autonomous gaps. This test shall partly verify the measurement requirements in clause 9.11A.

A.16.6.5.1.2 Test Parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the FR1 PCell and Cell 2 is an FR1 neighbour cell on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.16.6.5.1.2-1,

A.16.6.5.1.2-2 and A.16.6.5.1.2-3 below. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable. A measurement object is configured for the frequency of the PCell and it is indicated to the UE that event-triggered reporting with Event A3 is used. The UE is expected to detect and send a measurement report with Event A3.

A new RRC message triggering CGI identification shall be sent to the UE during period T2, after the UE has reported Event A3. The RRC message shall create a measurement report configuration with purpose *reportCGI* and *useAutonomousGaps* set to *setup*. The start of T3 is the instant when the last TTI containing the RRC message implying CGI identification is sent to the UE.

The test equipment verifies that potential interruption is carried out correctly by monitoring ACK/NACK sent in PCell during T3 until a measurement report with CGI is sent.

Table A.16.6.5.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.6.5.1.2-2: General test parameters for SA intra-frequency CGI identification of NR neighbor cell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4	Cell 1	
Neighbour cell		1, 2, 3, 4	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
SSB configuration		1, 4	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 4	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A3-Offset	dB	1, 2, 3, 4	-4.5	
CP length		1, 2, 3, 4	Normal	
Hysteresis	dB	1, 2, 3, 4	0	
Time To Trigger	s	1, 2, 3, 4	0	
Filter coefficient		1, 2, 3, 4	0	L3 filtering is not used
DRX		1, 2, 3, 4		OFF
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	5	
T3	s	1, 2, 3, 4	5	

Table A.16.6.5.1.2-3: NR Cell specific test parameters for SA intra-frequency CGI identification of NR neighbor cell in FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3, 4	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/18.36 MHz	3	-61.67	-59.32	-61.67	-59.32
Propagation Condition		1, 2, 3, 4	AWGN			
Antenna Configuration			1x1			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.5.1.3 Test Requirements

The UE shall send a measurement report containing the CGI of Cell 2 within 375 ms from the start of time period T3.

Test requirement = RRC Procedure delay + $T_{identify_CGI_redcap}$ + reporting delay

- = 10 + 360 + 2 ms from the start of T3
- = 372 ms, allow 375 ms

The UE shall be scheduled continuously throughout the test. From the start of T3 until 372 ms, the interruption on PCell shall not be more than the values specified for SA in clause 9.11A.4.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.6.5.2 SA intra-frequency CGI identification of NR neighbor cell in FR1 for 2 Rx UE

A.16.6.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of intra-frequency CGI identification of an NR neighbour cell in FR1 with autonomous gaps. This test shall partly verify the measurement requirements in clause 9.11A.

A.16.6.5.2.2 Test Parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the FR1 PCell and Cell 2 is an FR1 neighbour cell on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in table A.16.6.5.2.2-1, A.16.6.5.2.2-2 and A.16.6.5.2.2-3 below. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable. A measurement object is configured for the frequency of the PCell and it is indicated to the UE that event-triggered reporting with Event A3 is used. The UE is expected to detect and send a measurement report with Event A3.

A new RRC message triggering CGI identification shall be sent to the UE during period T2, after the UE has reported Event A3. The RRC message shall create a measurement report configuration with purpose *reportCGI* and *useAutonomousGaps* set to *setup*. The start of T3 is the instant when the last TTI containing the RRC message implying CGI identification is sent to the UE.

The test equipment verifies that potential interruption is carried out correctly by monitoring ACK/NACK sent in PCell during T3 until a measurement report with CGI is sent.

Table A.16.6.5.2.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.6.5.2.2-2: General test parameters for SA intra-frequency CGI identification of NR neighbor cell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4	Cell 1	
Neighbour cell		1, 2, 3, 4	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
SSB configuration		1, 4	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 4	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A3-Offset	dB	1, 2, 3, 4	-4.5	
CP length		1, 2, 3, 4	Normal	
Hysteresis	dB	1, 2, 3, 4	0	
Time To Trigger	s	1, 2, 3, 4	0	
Filter coefficient		1, 2, 3, 4	0	L3 filtering is not used
DRX		1, 2, 3, 4		OFF
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	5	
T3	s	1, 2, 3, 4	5	

Table A.16.6.5.2.2-3: NR Cell specific test parameters for SA intra-frequency CGI identification of NR neighbor cell in FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3, 4	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/18.36 MHz	3	-61.67	-59.32	-61.67	-59.32
Propagation Condition		1, 2, 3, 4	AWGN			
Antenna Configuration			1x2			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.5.2.3 Test Requirements

The UE shall send a measurement report containing the CGI of Cell 2 within 255 ms from the start of time period T3.

Test requirement = RRC Procedure delay + $T_{identify_CGI}$ + reporting delay

- = 10 + 240 + 2 ms from the start of T3

- = 252 ms, allow 255 ms

The UE shall be scheduled continuously throughout the test. From the start of T3 until 252 ms, the interruption on PCell shall not be more than the values specified for SA in clause 9.11A.4.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.16.6.5.3 Identification of a new CGI of inter-RAT E-UTRA cell using autonomous gaps in NR SA for 1 Rx UE

A.16.6.5.3.1 Test Purpose and Environment

This test is to verify the requirement for identification of a new CGI of E-UTRA cell with autonomous gaps in NR SA in clause 9.4A.4.

The test scenario comprises of one NR carrier and an E-UTRA carrier and two cells as given in tables A.16.6.5.3.1-1, A.16.6.5.3.1-2, A.16.6.5.3.1-3 and A.16.6.5.3.1-4. PDCCHs indicating new transmissions shall be sent continuously to ensure that the UE would have ACK/NACK sending during identifying a new CGI of E-UTRAN cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report.

A RRC message implying SI reading shall be sent to the UE during period T2, after the UE has reported Event B2. The RRC message shall create a measurement report configuration with purpose *reportCGI* and *useAutonomousGaps* set to *setup*. The start of T3 is the instant when the last TTI containing the RRC message implying SI reading is sent to the UE.

Table A.16.6.5.3.1-1: Supported test configurations of inter-RAT E-UTRAN cell using autonomous gap in SA

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.6.5.3.1-2: General test parameters for identification of a new CGI of inter-RAT E-UTRA cell using autonomous gaps in NR SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		2	1 LTE carrier frequency is used in the test
Active cell		Cell 1	
Neighbour cell		Cell 2	Cell to be identified.
LTE Channel Bandwidth	MHz	10	
LTE PDSCH/PCFICH/PDCCH/PHICH parameters			As specified in clause A.3.7.2.1
CP length		Normal	
Hysteresis	dB	0	
Time To Trigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	
useAutonomousGaps		setup	As specified in clause 5.5.3.1 in TS 38.331.
Time offset between cells	ms	3	Asynchronous cells
T1	s	5	
T2	s	≤10	
T3	s	5	

Table A.16.6.5.3.1-3: PCell specific test parameters for identification of a new CGI of inter-RAT E-UTRA cell using autonomous gaps in NR

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3, 4, 5, 6	1		
Duplex mode			1, 4	FDD		
			2, 3,5, 6	TDD		
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1		
	SCS=30 KHz		3, 6	TDDConf.2.1		
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)		
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)		
			3, 6	20: $N_{PRB,c}$ = 51 (TDD)		
PDSCH reference measurement channel			1, 4	SR.1.1 FDD		
			2, 5	SR.1.1 TDD		
			3, 6	SR.2.1 TDD		
CORSET reference channel			1, 4	CR.1.1 FDD		
			2, 5	CR.1.1 TDD		
			3, 6	CR.2.1 TDD		
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1		
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1		
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1		
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1		
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1		
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration			1, 2, 4, 5	SSB.1 FR1		
			3, 6	SSB.1 RedCap FR1		
b2-Threshold1		dBm/SCS	1, 2, 4, 5	-98		
			3, 6	-95		
b2-Threshold2EUTRA		dBm/15 kHz	1, 2, 3, 4, 5, 6	-109		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0		
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6	-106		
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-106		
			3, 6	-103		
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	18	-2	
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	18	-2	
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-108	
			3, 6	-85	-105	
SSB_RP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-108	
			3, 6	-85	-105	
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-59.98	-75.92	
		dBm/18.36 MHz	3, 6	-57.05	-72.99	
Propagation condition			1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration			1, 2, 3, 4, 5, 6	1x1		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.16.6.5.3.1-4: Cell specific test parameters for inter-RAT E-UTRAN cell for identification of a new CGI of E-UTRA cell using autonomous gaps

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6	2		
Duplex mode		1, 2, 3	FDD		
		4, 5, 6	TDD		
TDD special subframe configuration[Note1]		4, 5, 6	6		
TDD uplink-downlink configuration[Note1]		4, 5, 6	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	10 MHz: $N_{PRB,c}$ = 50		
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	10 MHz: R.3 FDD		
		4, 5, 6	10 MHz: R.0 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	10 MHz: R.6 FDD		
		4, 5, 6	10 MHz: R.6 TDD		
OCNG Patterns[Note2]		1, 2, 3	10 MHz: OP.10 FDD		
		4, 5, 6	10 MHz: OP.1 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note3]					
OCNG_RB[Note3]					
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-106		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7	7
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	-Infinity	7	7
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-99	-99
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-99	-99
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x1		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.5.3.2 Test Requirements

The UE shall transmit a measurement report containing the cell global identifier of Cell 2 within 240 milliseconds from the start of T3.

Test requirement = RRC Procedure delay with additional margin + $T_{identify_CGI_LC\text{-}UE}$ + TTI insertion uncertainty

= 15 + 30 + 190 + 2 ms from the start of T3

= 237 ms, allow 240 ms.

- The UE shall be scheduled continuously throughout the test, and from the start of T3 until 240 ms at least the number of ACK/NACK specified in NOTE 2 shall be detected as being transmitted by the UE.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE 1: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

NOTE 2: The overall ACK/NACK number is caused by two parts. Firstly, at least X ACK/NACK shall be sent during identifying the cell global identifier of Cell 2, where X is defined in table 9.4A.4.3-1. Secondly, given that continuous DL data allocation, additional 43, 14 and 34 ACK/NACK shall be sent for FDD 15 kHz, TDD 15 kHz and TDD 30 kHz, respectively, from the start of T3 until 240 ms excludes 190 ms for identifying the cell global identifier of Cell 2.

A.16.6.5.4 Identification of a new CGI of inter-RAT E-UTRA cell using autonomous gaps in NR SA for 2 Rx UE

A.16.6.5.4.1 Test Purpose and Environment

This test is to verify the requirement for identification of a new CGI of E-UTRA cell with autonomous gaps in NR SA in clause 9.4A.4.

The test scenario comprises of one NR carrier and an E-UTRA carrier and two cells as given in tables A.16.6.5.4.1-1, A.16.6.5.4.1-2, A.16.6.5.4.1-3 and A.16.6.5.4.1-4. PDCCHs indicating new transmissions shall be sent continuously to ensure that the UE would have ACK/NACK sending during identifying a new CGI of E-UTRAN cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report.

A RRC message implying SI reading shall be sent to the UE during period T2, after the UE has reported Event B2. The RRC message shall create a measurement report configuration with purpose *reportCGI* and *useAutonomousGaps* set to *setup*. The start of T3 is the instant when the last TTI containing the RRC message implying SI reading is sent to the UE.

Table A.16.6.5.4.1-1: Supported test configurations of inter-RAT E-UTRAN cell using autonomous gap in SA

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.6.5.4.1-2: General test parameters for identification of a new CGI of inter-RAT E-UTRA cell using autonomous gaps in NR SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		2	1 LTE carrier frequency is used in the test
Active cell		Cell 1	
Neighbour cell		Cell 2	Cell to be identified.
LTE Channel Bandwidth	MHz	10	
LTE PDSCH/PCFICH/PDCCH/PHICH parameters			As specified in clause A.3.7.2.1
CP length		Normal	
Hysteresis	dB	0	
Time To Trigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	
useAutonomousGaps		setup	As specified in clause 5.5.3.1 in TS 38.331.

Parameter	Unit	Value	Comment
Time offset between cells	ms	3	Asynchronous cells
T1	s	5	
T2	s	≤10	
T3	s	5	

Table A.16.6.5.4.1-3: PCell specific test parameters for identification of a new CGI of inter-RAT E-UTRA cell using autonomous gaps in NR

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3, 4, 5, 6	1		
Duplex mode			1, 4	FDD		
			2,3, 5	TDD		
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1		
	SCS=30 KHz		3, 6	TDDConf.2.1		
$BW_{channel}$		MHz	1, 4	10: $N_{PRB,c}$ = 52 (FDD)		
			2, 5	10: $N_{PRB,c}$ = 52 (TDD)		
			3, 6	20: $N_{PRB,c}$ = 51 (TDD)		
PDSCH reference measurement channel			1, 4	SR.1.1 FDD		
			2, 5	SR.1.1 TDD		
			3, 6	SR.2.1 TDD		
CORSET reference channel			1, 4	CR.1.1 FDD		
			2, 5	CR.1.1 TDD		
			3, 6	CR.2.1 TDD		
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1		
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1		
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1		
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1		
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1		
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration			1, 2, 4, 5	SSB.1 FR1		
			3, 6	SSB.1 RedCap FR1		
b2-Threshold1		dBm/SCS	1, 2, 4, 5	-98		
			3, 6	-95		
b2-Threshold2EUTRA		dBm/15 kHz	1, 2, 3, 4, 5, 6	-109		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0		
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6	-106		
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-106		
			3, 6	-103		
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	18	-2	
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	18	-2	
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-108	
			3, 6	-85	-105	
SSB_RP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-108	
			3, 6	-85	-105	
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-59.98	-75.92	
		dBm/18.36 MHz	3, 6	-57.05	-72.99	
Propagation condition			1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6	1x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					

Table A.16.6.5.4.1-4: Cell specific test parameters for inter-RAT E-UTRAN cell for identification of a new CGI of E-UTRA cell using autonomous gaps

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6	2		
Duplex mode		1, 2, 3	FDD		
		4, 5, 6	TDD		
TDD special subframe configuration[Note1]		4, 5, 6	6		
TDD uplink-downlink configuration[Note1]		4, 5, 6	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	10 MHz: $N_{PRB,c}$ = 50		
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	10 MHz: R.3 FDD		
		4, 5, 6	10 MHz: R.0 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	10 MHz: R.6 FDD		
		4, 5, 6	10 MHz: R.6 TDD		
OCNG Patterns[Note2]		1, 2, 3	10 MHz: OP.10 FDD		
		4, 5, 6	10 MHz: OP.1 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note3]					
OCNG_RB[Note3]					
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-106		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7	7
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	-Infinity	7	7
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-99	-99
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6	-Infinity	-99	-99
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.5.4.2 Test Requirements

The UE shall transmit a measurement report containing the cell global identifier of Cell 2 within 200 milliseconds from the start of T3.

Test requirement = RRC Procedure delay with additional margin + $T_{identify_CGI,E\text{-}UTRAN}$ + TTI insertion uncertainty

= 15 + 30 + 150 + 2 ms from the start of T3

= 197 ms, allow 200 ms.

- The UE shall be scheduled continuously throughout the test, and from the start of T3 until 200 ms at least the number of ACK/NACK specified in NOTE 2 shall be detected as being transmitted by the UE.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE 1: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

NOTE 2: The overall ACK/NACK number is caused by two parts. Firstly, at least X ACK/NACK shall be sent during identifying the cell global identifier of Cell 2, where X is defined in table 9.4A.4.3-1. Secondly, given that continuous DL data allocation, additional 43, 14 and 34 ACK/NACK shall be sent for FDD 15 kHz, TDD 15 kHz and TDD 30 kHz, respectively, from the start of T3 until 200 ms excludes 150 ms for identifying the cell global identifier of Cell 2.

A.16.6.6 RSTD Measurements

A.16.6.6.1 NR RSTD measurement reporting delay test case for RedCap UE without FH in FR1 SA

A.16.6.6.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC CONNECTED state meets the requirements specified in clause 9.9A.2 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.16.6.6.1.1-1.

Table A.16.6.6.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *NR-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the RedCap UE during T1. The measurement reporting delay test in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request. The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #0 before T2.

The general test parameters are listed in table A.16.6.6.1.1-2, and cell specific test parameters are listed in table A.16.6.6.1.1-3.

Table A.16.6.6.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.1 RedCap FR1	
	Config 4		SSB.1 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
	Config 4		SMTC.2	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
	Config 4		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
	Config 4		CR.1.1 FDD	
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
	Config 4		CCR.1.1 FDD	
Initial BWP configuration	Config 1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration	Config 1,2,3,4		DLBWP.1.1	
Active UL BWP configuration	Config 1,2,3,4		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.1 FR1	
	Config 3		PRS.2.1 FR1	
	Config 4		PRS.1.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#0	GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells

Expected RSTD	µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells	µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		3	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.16.6.6.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
EPRE ratio of PSS to SSS		dB	0	N/A	N/A
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
	Config 4	dBm/SCS	-98		

PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 9.36MHz	-59.63	-59.63	-59.63
	Config 2	dBm/ 9.36MHz	-59.63	-59.63	-59.63
	Config 3	dBm/ 18.36MHz	-56.71	-56.71	-56.71
	Config 4	dBm/ 9.36MHz	-59.63	-59.63	-59.63
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
	Config 4	dBm/SCS	-88	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.16.6.6.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
NR RF Channel Number		1	1	1
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1		OP.1	OP.1	OP.1
PRACH configuration		FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
EPRE ratio of PSS to SSS	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				

EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
	Config 4	dBm/SCS	-98	-98	-98
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
	Config 4	dB	-5.45	-11.67	-11.67
SSB $\hat{E}_s/N_{oc}$	Config 1,2,3,4	dB	10	3	3
Io Note 4	Config 1	dBm/ 9.36MHz	-68.52	-68.52	-68.52
	Config 2	dBm/ 9.36MHz	-68.52	-68.52	-68.52
	Config 3	dBm/ 18.36MHz	-65.61	-65.61	-65.61
	Config 4	dBm/ 9.36MHz	-68.52	-68.52	-68.52
SSB RP Note4	Config 1	dBm/SCS	-88	-95	-95
	Config 2	dBm/SCS	-88	-95	-95
	Config 3	dBm/SCS	-85	-92	-92
	Config 4	dBm/SCS	-88	-95	-95
PRS $\hat{E}_s/I_{ot}$		dB	-6.00	-12.98	-12.98
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.

A.16.6.6.1.2 Test Requirements

The RSTD measurement time without FH for RedCap fulfils the requirements specified in clause 9.9A.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 9.9.2A.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3, i.e., between RSTD_0000000 and RSTD1970049.

A.16.6.6.2 NR RSTD measurement reporting delay test case with PRS frequency hopping

A.16.6.6.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 9.9A.2.6 in an environment with AWGN propagation conditions in FR1 in standalone scenario when frequency hopping is configured.

The supported test configurations are specified in table A.16.6.6.2.1-1.

Table A.16.6.6.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: UE with 1 Rx or 2 Rx is required to meet the same requirements specified in this clause. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 4: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The test requirements apply when *frequencyHopping* is configured to UE.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #0 before T2.

The general test parameters are listed in table A.16.6.6.2.1-2, and cell specific test parameters are listed in table A.16.6.6.2.1-3.

Table A.16.6.6.2.1-2: General test parameters for RSTD measurement reporting delay

Parameter	Unit	Value	Comment
Reference cell		Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.

Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
CD-SSB configuration	Config 1, 2, 4		SSB.1 FR1	
	Config 3		SSB.1 RedCap FR1	
NCD-SSB configuration	Config 1, 2, 4		SSB.6 RedCap FR1	
	Config 3		SSB.7 RedCap FR1	
SMTC configuration	Config 1, 4		SMTC.4 RedCap	
	Config 2		SMTC.2 RedCap	
	Config 3		SMTC.2 RedCap	
PRS Configuration	Config 1, 4		PRS.1.5 FR1	PRS configured with frequency hopping as specified in clause A.3.31
	Config 2		PRS.1.5 FR1	
	Config 3		PRS.2.6 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#0	GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			3	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		s	1.28	The length of the time interval that follows immediately after time interval T1

Table A.16.6.6.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
PDSCH RMC configuration	Config 1, 4		SR.1.1 FDD	N/A	N/A
	Config 2		SR.1.1 TDD		
	Config 3		SR.2.1 TDD		
RMSI CORESET RMC configuration	Config 1, 4		CR.1.1 FDD	N/A	N/A
	Config 2		CR.1.1 TDD		
	Config 3		CR.2.1 TDD		
Dedicated CORESET RMC configuration	Config 1, 4		CCR.1.1 FDD	N/A	N/A
	Config 2		CCR.1.1 TDD		
	Config 3		CCR.2.1 TDD		
OCNG Patterns	Config 1,2,3,4		OP.1	OP.1	OP.1
RMSI CORESET RMC configuration	Config 1, 4		CR.1.1 FDD	N/A	N/A
	Config 2		CR.1.1 TDD		
	Config 3		CR.2.1 TDD		
Initial BWP configuration	Config 1,2,3,4		DLBWP.0.1 ULBWP.0.1	N/A	N/A
Active DL BWP configuration	Config 1,2,3,4		DLBWP.1.3 RedCap	N/A	N/A
Active UL BWP configuration	Config 1,2,3,4		ULBWP.1.3 RedCap	N/A	N/A
N_{oc} Note 3	Config 1, 4	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1, 4	dBm/ 48.6MHz	-52.48	-52.48	-52.48
	Config 2	dBm/ 48.6MHz	-52.48	-52.48	-52.48
	Config 3	dBm/ 98.28MHz	-49.43	-49.43	-49.43
SSB RP Note4	Config 1, 4	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.16.6.6.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1, 4	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1, 4	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
SSB $\hat{E}_s/N_{oc}$	Config 1,2,3,4	dB	10	3	3
Io Note 4	Config 1, 4	dBm/ 48.6MHz	-61.37	-61.37	-61.37
	Config 2	dBm/ 48.6MHz	-61.37	-61.37	-61.37
	Config 3	dBm/ 98.28MHz	-61.32	-61.32	-61.32
SSB RP Note4	Config 1, 4	dBm/SCS	-88	-95	-95
	Config 2	dBm/SCS	-88	-95	-95
	Config 3	dBm/SCS	-85	-92	-92
PRS $\hat{E}_s/I_{ot}$		dB	-6.00	-12.98	-12.98
Propagation Condition			AWGN		

Note 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
Note 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.

A.16.6.6.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 9.9A.2.6.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 9.9A.2.6 starting from the beginning of time interval T2.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3, i.e., between RSTD_0000000 and RSTD1970049.

A.16.6.7 UE Rx-Tx Measurements

A.16.6.7.1 UE Rx-Tx measurement reporting delay test case for single positioning frequency layer in FR1 SA for RedCap UE without RX FH in RRC_CONNECTED mode

A.16.6.7.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement without RX FH reported by the RedCap UE meets the requirements specified in clause 9.9A.4.5 in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured. The measurement reporting delay test defined in this clause is valid for both 1 Rx and 2 Rx RedCap UEs.

The supported test configurations in listed in table A.16.6.7.1.1-1.

Table A.16.6.7.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *NR-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The measurement reporting delay test in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform UE Rx-Tx time difference measurement with RX FH via *NR-Multi-RTT-RequestLocationInformation* or the UE is configured by the LMF to perform UE Rx-Tx time difference measurement with RX FH via *NR-Multi-RTT-RequestLocationInformation* but reports the UE Rx-Tx time difference measurement based on the single hop in *NR-Multi-RTT-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The last TTI containing the two messages shall be provided to the RedCap UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request. The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The RedCap UE is configured with measurement gap pattern ID #0 or ID #24 before T2.

The RedCap UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.16.6.7.1.1-2 and table A.16.6.7.1.1-3, respectively.

Table A.16.6.7.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1,2,3,4	Cell 1	Cell 1 is the reference cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1,2,3,4	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* TS 37.355 [34].
RF Channel Number		1,2,3,4	1	For both Cell 1 and Cell 2

$BW_{channel}$	MHz	1,4	10: $N_{RB,c}$ = 52	
		2	10: $N_{RB,c}$ = 52	
		3	20: $N_{RB,c}$ = 52	
SSB configuration		1,4	SSB.4 RedCap FR1	
		2	SSB.4 RedCap FR1	
		3	SSB.5 RedCap FR1	
SMTC configuration		1,4	SMTC.1 RedCap	
		2	SMTC.1 RedCap	
		3	SMTC.1 RedCap	
Measurement gap		1,2,3,4	GP#24 or GP#0 Note 1	
CP length		1,2,3,4	Normal	
DRX		1,2,3,4	OFF	
Time offset between serving and neighbour cells	μs	1,2,3,4	3	Synchronous cells
T1	s	1,2,3,4	5	
T2	s	1,2,3,4	10	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.16.6.7.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1,4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1,4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1,4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1,4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1,2,3,4	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1,2,3,4	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1,4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1,2,3,4	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1,2,3,4	DLBWP.1.1 RedCap		N/A	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1 RedCap		N/A	
PRS configuration		1,4	PRS.1.1 FR1		PRS.1.1 FR1	
		2	PRS.1.1 FR1		PRS.1.1 FR1	
		3	PRS.2.1 FR1		PRS.2.1 FR1	
PRS muting info		1,2,3,4	‘10’		‘01’	
SRS configuration		1,4	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
	dBm/SCS	1,4	-98			

N_{oc} Note 2		2	-98			
		3	-95			
PRS $\hat{E}_s/I_{ot}$	dB	1,4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1,4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRP Note 3	dBm/SCS kHz	1,4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/9.36 MHz	1,4	N/A	-66.22	N/A	-66.22
	dBm/9.36 MHz	2		-66.22		-66.22
	dBm/18.72 MHz	3		-63.22		-63.22
Propagation Condition		1,2,3,4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

A.16.6.7.1.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9A.4.5.

The UE shall perform and report the UE Rx-Tx time difference measurements without RX FH for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1A.18.3.

A.16.6.7.2 UE Rx-Tx time difference measurement with Rx FH for single positioning frequency layer in FR1 SA in RRC_CONNECTED state

A.16.6.7.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement with Rx FH in RRC_CONNECTED state meets the requirements specified in clause 9.9A.4.8 in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.16.6.7.2.1-1.

Table A.16.6.7.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode

NOTE 1: The RedCap UE is only required to be tested in one of the supported test configurations.
NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz.
NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID #0 or ID #24 before T2.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.16.6.7.2.1-2 and table A.16.6.7.2.1-3, respectively.

Table A.16.6.7.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3, 4	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1, 2, 4	50: $N_{RB,c} = 270$	
		3	100: $N_{RB,c} = 273$	
SSB configuration		1, 2, 4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 2, 3, 4	SMTC.1	
Measurement gap		1, 2, 3, 4	GP#24 or GP#0 Note 1	
CP length		1, 2, 3, 4	Normal	
DRX		1, 2, 3, 4	OFF	
Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells
PRS RX hopping request		1, 2, 3, 4	Requested	
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	10	
NOTE 1: GP#24 is configured if RedCap UE supports MG#24, otherwise GP#0 is configured.				

Table A.16.6.7.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3, 4	0		0	

EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1 RedCap		N/A	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1 RedCap		N/A	
PRS configuration		1, 4	PRS.1.5 FR1		PRS.1.5 FR1	
		2	PRS.1.5 FR1		PRS.1.5 FR1	
		3	PRS.2.6 FR1		PRS.2.6 FR1	
PRS muting info		1, 2, 3, 4	‘10’		‘01’	
SRS configuration		1, 4	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRP Note 3	dBm/SCS	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/48.6MHz	1, 4	N/A	-60.51	N/A	-60.51
	dBm/48.6MHz	2		-60.51		-60.51
	dBm/ 98.28MHz	3		-57.46		-57.46
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the RedCap UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.7.2.2 Test requirements

The UE Rx-Tx time difference measurement time in RRC_CONNECTED state fulfils the requirements specified in clause 9.9A.4.8.

The RedCap UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1A.18.3.

A.16.6.8 PRS-RSRP measurements

A.16.6.8.1 PRS-RSRP measurement delay test case for single positioning frequency layer

A.16.6.8.1.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement meets the delay requirements specified in clause 9.9.3.5 in an environment with AWGN propagation conditions. The test is applicable to 1 Rx or 2 Rx RedCap UE.

The supported test configurations are specified in table A.16.6.8.1.1-1.

Table A.16.6.8.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. The measurement reporting delay test in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform PRS-RSRP measurement with RX FH via *NR-DL-AoD-RequestLocationInformation* or the UE is configured by the LMF to perform PRS-RSRP measurement with RX FH but reports the PRS-RSRP measurement based on the single hop in *NR-DL-AoD-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.6.8.1.1-2, and cell specific test parameters are listed in table A.16.6.8.1.1-3.

Table A.16.6.8.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 2, 4	10: $N_{RB,c}$ = 52	
		3	20: $N_{RB,c}$ = 51	
SSB configuration		1, 2, 4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 2, 3, 4	SMTC.1 RedCap	
Measurement gap		1, 2, 3, 4	GP#24 or GP#0 Note 1	
CP length		1, 2, 3, 4	Normal	
DRX		1, 2, 3, 4	N/A	OFF
Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells
Expected RSTD	µs	1, 2, 3, 4	3	
Expected RSTD uncertainty	µs	1, 2, 3, 4	5	
T1	s	1, 2, 3, 4	2	
T2	s	1, 2, 3, 4	5	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.16.6.8.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1.TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1.TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3, 4	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.2.1 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1 RedCap		N/A	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1 RedCap		N/A	
PRS configuration		1, 4	PRS.1.3 FR1		PRS.1.3 FR1	
		2	PRS.1.3 FR1		PRS.1.3 FR1	
		3	PRS.2.3 FR1		PRS.2.3 FR1	
PRS muting info		1, 2, 3, 4	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRP Note 3	dBm/SCS kHz	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/9.36 MHz	1, 4	N/A	-66.22	N/A	-66.22
	dBm/9.36 MHz	2		-66.22		-66.22
	dBm/18.72 MHz	3		-63.22		-63.22
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.8.1.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9.3.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time limit above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of correct events observed during repeated tests shall be at least 90%, where the reported PRS-RSRP measurement for each correct event shall be within the reporting range specified in clause 10.1A.17.3.

A.16.6.8.2 PRS-RSRP measurement delay with FH in RRC_CONNECTED state in FR1

A.16.6.8.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement with FH by a RedCap UE meets the delay requirements specified in clause 9.9A.3.6 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.16.6.8.2.1-1.

Table A.16.6.8.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.6.8.2.1-2, and cell specific test parameters are listed in table A.16.6.8.2.1-3.

Table A.16.6.8.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 2, 4	50: $N_{RB,c}$ = 270	
		3	100: $N_{RB,c}$ = 273	
SSB configuration		1, 2, 4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 2, 3, 4	SMTC.1 RedCap	
Measurement gap		1, 2, 3, 4	GP#24 or GP#0 Note 1	
CP length		1, 2, 3, 4	Normal	
DRX		1, 2, 3, 4	N/A	OFF
Time offset between serving and neighbour cells	μs	1, 2, 3, 4	3	Synchronous cells
Expected RSTD	μs	1, 2, 3, 4	3	
Expected RSTD uncertainty	μs	1, 2, 3, 4	5	
PRS RX hopping request		1, 2, 3, 4	Present	
T1	s	1, 2, 3, 4	2	
T2	s	1, 2, 3, 4	5	

NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.

Table A.16.6.8.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3, 4	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1 RedCap		N/A	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1 RedCap		N/A	
PRS configuration		1, 4	PRS.1.5 FR1		PRS.1.5 FR1	
		2	PRS.1.5 FR1		PRS.1.5 FR1	
		3	PRS.2.6 FR1		PRS.2.6 FR1	
PRS muting info		1, 2, 3, 4	‘10’		‘01’	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
	dBm/15 kHz	1, 4	-98			

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
N_{oc} Note 2		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRP Note 3	dBm/SCS	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS	1, 2, 4	-88	-88	-Infinity	-Infinity
		3	-85	-85	-Infinity	-Infinity
Io	dBm/48.6 MHz	1, 4	-52.48	-60.51	-70.05	-60.51
	dBm/48.6 MHz	2	-52.48	-60.51	-70.05	-60.51
	dBm/98.28 MHz	3	-49.43	-57.46	-67.13	-57.46
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP/SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

A.16.6.8.2.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9A.3.6, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time limit above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of correct events observed during repeated tests shall be at least 90%, where the reported PRS-RSRP measurement for each correct event shall be within the reporting range specified in clause 10.1A.17.3.

A.16.6.9 PRS-RSRPP Measurements

A.16.6.9.1 PRS-RSRPP measurement delay without FH in RRC_CONNECTED state in FR1

A.16.6.9.1.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement without FH by a RedCap UE meets the delay requirements specified in clause 9.9A.5.5 in an environment with a 2-tap channel propagation condition.

The supported test configurations are specified in table A.16.6.9.1.1-1.

Table A.16.6.9.1.11: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.6.9.1.1-2, and cell specific test parameters are listed in table A.16.6.9.1.1-3.

Table A.16.6.9.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 2, 4	10: $N_{RB,c}$ = 52	
		3	20: $N_{RB,c}$ = 51	
SSB configuration		1, 2, 4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 2, 3, 4	SMTC.1 RedCap	
Measurement gap		1, 2, 3, 4	GP#24 or GP#0 Note 1	
CP length		1, 2, 3, 4	Normal	
DRX		1, 2, 3, 4	N/A	OFF
Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells
Expected RSTD	µs	1, 2, 3, 4	3	
Expected RSTD uncertainty	µs	1, 2, 3, 4	5	
PRS RX hopping request		1, 2, 3, 4	NOT present	
T1	s	1, 2, 3, 4	2	
T2	s	1, 2, 3, 4	5	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.16.6.9.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			

Dedicated CORESET RMC configuration		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1 RedCap		N/A	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1 RedCap		N/A	
PRS configuration		1, 4	PRS.1.3 FR1		PRS.1.3 FR1	
		2	PRS.1.3 FR1		PRS.1.3 FR1	
		3	PRS.2.3 FR1		PRS.2.3 FR1	
PRS muting info		1, 2, 3, 4	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/9.36 MHz	1, 4	-70.05	-67.67	-70.05	-67.67
	dBm/9.36 MHz	2	-70.05	-67.67	-70.05	-67.67
	dBm/18.36 MHz	3	-67.13	-64.75	-67.13	-64.75
Propagation Condition		1, 2, 3, 4	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, τ_d = 0.45 μs and f_D = 5 Hz			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

A.16.6.9.1.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9A.5.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of correct events observed during repeated tests shall be at least 90%, where the reported PRS-RSRPP measurement for each correct event shall be within the reporting range specified in clause 10.1A.19.3.

A.16.6.9.2 PRS-RSRPP measurement with Rx FH reporting delay test case for single positioning frequency layer in FR1 SA in RRC_CONNECTED state

A.16.6.9.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement with Rx FH in RRC_CONNECTED state meets the delay requirements specified in clause 9.9A.5.8 in an environment with two-tap channel propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.16.6.9.2.1-1.

Table A.16.6.9.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The RedCap UE is only required to be tested in one of the supported test configurations. NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.6.9.2.1-2, and cell specific test parameters are listed in table A.16.6.9.2.1-3.

Table A.16.6.9.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 4	50: $N_{RB,c}$ = 270	
		2	50: $N_{RB,c}$ = 270	
		3	100: $N_{RB,c}$ = 273	
SSB configuration		1, 4	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 4	SMTC.1	
		2	SMTC.1	
		3	SMTC.1	
Measurement gap		1, 2, 3, 4	GP#24 or GP#0 Note 1	
CP length		1, 2, 3, 4	Normal	
DRX		1, 2, 3, 4	N/A	OFF
Time offset between serving and neighbour cells	μs	1, 2, 3, 4	3	Synchronous cells
PRS RX hopping request		1, 2, 3, 4	Requested	

Expected RSTD	µs	1, 2, 3, 4	3	
Expected RSTD uncertainty	µs	1, 2, 3, 4	5	
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	10	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

Table A.16.6.9.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1 RedCap		N/A	
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1 RedCap		N/A	
PRS configuration		1, 4	PRS.1.5 FR1		PRS.1.5 FR1	
		2	PRS.1.5 FR1		PRS.1.5 FR1	
		3	PRS.2.6 FR1		PRS.2.6 FR1	
PRS muting info		1, 2, 3, 3	‘10’		‘01’	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS	1, 4	-88	-88	-Infinity	-Infinity
		2	-88	-88	-Infinity	-Infinity
		3	-85	-85	-Infinity	-Infinity
Io	dBm/48.6 MHz	1, 4	-52.48	-60.51	N/A	-60.51
	dBm/48.6 MHz	2	-52.48	-60.51	N/A	-60.51
	dBm/98.28 MHz	3	-49.43	-57.46	N/A	-57.46
Propagation Condition		1, 2, 3, 4	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ µs and $f_D = 5$ Hz			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.6.9.2.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9A.5.8, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each cell observed during repeated tests shall be at least 90%, where the reported PRS-RSRPP measurement for each correct event shall be within the PRS-RSRPP reporting range specified in clause 10.1A.19.3, i.e., between PRS RSRPP_0 and PRS RSRPP_126.

A.16.7 Measurement Performance requirements for RedCap

A.16.7.1 SS-RSRP

A.16.7.1.1 SA: intra-frequency case measurement accuracy with FR1 serving cell and FR1 target cell for 1 Rx UE

A.16.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1A.2.1 and 10.1A.2.2 for intra-frequency measurements for 1 RX RedCap UE.

A.16.7.1.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.16.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in A.16.7.1.1.2-2. In all test cases, Cell 1 is the PCell, and Cell 2 is the target cell.

Table A.16.7.1.1.2-1: SS-RSRP Intra-frequency SS-RSRP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.16.7.1.1.2-2: SS-RSRP Intra-frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0	489	0
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
	Config 4		HD-FDD					
TDD configuration	Config 1, 4		Not Applicable					

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1, 4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		20: $N_{PRB,c}$ = 51					
BWP BW	Config 1, 4		10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		20: $N_{PRB,c}$ = 51					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
TRS configuration	Config 1, 4		TRS.1.1 FDD	NA	TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
	Config 2		TRS.1.1 TDD	NA	TRS.1.1 TDD	NA	TRS.1.1 TDD	NA
	Config 3		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1, 4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1, 4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
SSB configuration	Config 1, 4		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.1 RedCap FR1	SSB. 1 RedCap FR1	SSB. 1 RedCap FR1	SSB. 1 RedCap FR1	SSB.1 RedCap FR1	SSB.1 RedCap FR1
Time offset with Cell 1	Config 1, 4	ms	-	3	-	3	-	3
	Config 2,3	μs	-	3	-	3	-	3
SMTC configuration	Config 1, 4		SMTC.2					
	Config 2,3		SMTC.1					
OCNG Patterns			OP.1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4	kHz	15 kHz					
	Config 3		30 kHz					
EPRE ratio of PSS to SSS		dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15KhZ	-106		-88		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-94		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-106		-88		Same as Noc/15 kHz	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-91		-111	
		NR_FDD_FR1_B						-110.5	
		NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$			dB	2.46	-5.97	2.46	-5.97	-0.01	-4.76
$\hat{E}_s/N_{oc}$			dB	6	1	6	1	3	0
SS-RSRP Note 3	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-100	-105	-82	-87	-111.00	-114.00

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_B						-110.50	-113.50
		NR_TDD_FR1_C						-110.00	-113.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.50	-112.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109.00	-112.00
		NR_FDD_FR1_F						-108.50	-111.50
		NR_FDD_FR1_G						-108.00	-111.00
		NR_FDD_FR1_H						-107.50	-110.50
		NR_FDD_FR1_N						-104.50	-107.50
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5	Not applicable Note 5	-85	-90	-108.00	-111.00
		NR_FDD_FR1_B						-107.50	-110.50
		NR_TDD_FR1_C						-107.00	-110.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-106.50	-109.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-106.00	-109.00
		NR_FDD_FR1_F						-105.50	-108.50
		NR_FDD_FR1_G						-105.00	-108.00
		NR_FDD_FR1_H						-104.50	-107.50
		NR_FDD_FR1_N						-101.50	-104.50
I_{oNote3}	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-70.09		-52.09		-80.03	
		NR_FDD_FR1_B						-79.53	
		NR_TDD_FR1_C						-79.03	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-78.53	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-78.03	
		NR_FDD_FR1_F						-77.53	
		NR_FDD_FR1_G						-77.03	
		NR_FDD_FR1_H						-76.53	
		NR_FDD_FR1_N						-73.53	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	Not applicable Note 5 -		-55.18		-77.12	
		NR_FDD_FR1_B						-76.62	
		NR_TDD_FR1_C						-76.12	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-75.62	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-75.12	
		NR_FDD_FR1_F						-74.62	
		NR_FDD_FR1_G						-74.12	
		NR_FDD_FR1_H						-73.62	
		NR_FDD_FR1_N						-70.62	
Propagation condition			-	AWGN					

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Antenna configuration		1x1					
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 5: Subtest 1 is not used when testing with 30 kHz SSB SCS.							
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification							

A.16.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil absolute requirement in clause 10.1A.2.1 and relative requirement in clause 10.1A.2.2 for 1 RX RedCap UE.

A.16.7.1.2 SA: intra-frequency case measurement accuracy with FR1 serving cell and FR1 target cell for 2 RX UE

A.16.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1A.2.1 and 10.1A.2.2 for intra-frequency measurements for 2 RX RedCap UE.

A.16.7.1.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.16.7.1.2.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in A.16.7.1.2.2-2. In all test cases, Cell 1 is the PCell, and Cell 2 is the target cell.

Table A.16.7.1.2.2-1: SS-RSRP Intra-frequency SS-RSRP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.16.7.1.2.2-2: SS-RSRP Intra-frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0	489	0
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
	Config 4		HD-FDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		20: $N_{PRB,c}$ = 51					
BWP BW	Config 1,4		10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
	Config 3		20: $N_{PRB,c}$ = 51					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
TRS configuration	Config 1,4		TRS.1.1 FDD	NA	TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
	Config 2		TRS.1.1 TDD	NA	TRS.1.1 TDD	NA	TRS.1.1 TDD	NA
	Config 3		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
SSB configuration	Config 1,4		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.1 RedCap FR1	SSB. 1 RedCap FR1	SSB. 1 RedCap FR1	SSB. 1 RedCap FR1	SSB.1 RedCap FR1	SSB.1 RedCap FR1
Time offset with Cell 1	Config 1,4	ms	-	3	-	3	-	3
	Config 2,3	µs	-	3	-	3	-	3
SMTC configuration	Config 1,4		SMTC.2					
	Config 2,3		SMTC.1					
OCNG Patterns			OP.1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4	kHz	15 kHz					
	Config 3		30 kHz					
EPRE ratio of PSS to SSS		dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A,	dBm/15KhZ	-106		-88		-114

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_TDD_FR1_A NOTE 6							
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D , NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E , NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_ G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3	NR_FDD_FR1_A , NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-94		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D , NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E , NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_ G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-106		-88		Same as Noc/15 kHz	
	Config 3	NR_FDD_FR1_A , NR_TDD_FR1_A NOTE 6		Not applicable Note 5		-91		-111	
		NR_FDD_FR1_B						-110.5	
		NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D , NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E , NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_ G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$			dB	2.46	-5.97	2.46	-5.97	-0.01	-4.76
$\hat{E}_s/N_{oc}$			dB	6	1	6	1	3	0
SS-RSRP Note 3	Config 1,2,4	NR_FDD_FR1_A , NR_TDD_FR1_A NOTE 6	dBm/SCS	-100	-105	-82	-87	-111.00	-114.00
		NR_FDD_FR1_B						-110.50	-113.50
		NR_TDD_FR1_C						-110.00	-113.00
		NR_FDD_FR1_D , NR_TDD_FR1_D						-109.50	-112.50

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109.00	-112.00
		NR_FDD_FR1_F						-108.50	-111.50
		NR_FDD_FR1_G						-108.00	-111.00
		NR_FDD_FR1_H						-107.50	-110.50
		NR_FDD_FR1_N						-104.50	-107.50
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable Note 5	Not applicable Note 5	-85	-90	-108.00	-111.00
		NR_FDD_FR1_B						-107.50	-110.50
		NR_TDD_FR1_C						-107.00	-110.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-106.50	-109.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-106.00	-109.00
		NR_FDD_FR1_F						-105.50	-108.50
		NR_FDD_FR1_G						-105.00	-108.00
		NR_FDD_FR1_H						-104.50	-107.50
		NR_FDD_FR1_N						-101.50	-104.50
Io Note3	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-70.09		-52.09		-80.03	
		NR_FDD_FR1_B						-79.53	
		NR_TDD_FR1_C						-79.03	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-78.53	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-78.03	
		NR_FDD_FR1_F						-77.53	
		NR_FDD_FR1_G						-77.03	
		NR_FDD_FR1_H						-76.53	
		NR_FDD_FR1_N						-73.53	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16 MHz	Not applicable Note 5		-55.18		-77.12	
		NR_FDD_FR1_B						-76.62	
		NR_TDD_FR1_C						-76.12	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-75.62	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-75.12	
		NR_FDD_FR1_F						-74.62	
		NR_FDD_FR1_G						74.12	
		NR_FDD_FR1_H						73.62	
		NR_FDD_FR1_N						-70.62	
Propagation condition			-	AWGN					
Antenna configuration				1x2					
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.									

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 5: Subtest 1 is not used when testing with 30 kHz SSB SCS.							
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification							

A.16.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil absolute requirement in clause 10.1A.2.1 and relative requirement in clause 10.1A.2.2 for 2 RX RedCap UE.

A.16.7.1.3 SA inter-frequency case measurement accuracy with FR1 serving cell and FR1 target cell for 1 Rx UE

A.16.7.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1A.4.1.1 and 10.1A.4.1.2 for inter-frequency measurements with the testing configurations for NR cells in table A.16.7.1.3.1-1.

Table A.16.7.1.3.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.16.7.1.3.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.16.7.1.3.2-1 below. Both absolute and relative accuracy of RSRP inter-frequency measurements is tested by using the parameters in table A.16.7.1.3.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.16.7.1.3.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN	1~4		freq1	freq2	freq1	freq2
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	2		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	3		20: $N_{PRB,c}$ = 51		20: $N_{PRB,c}$ = 51	
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
	4		HD-FDD		HD-FDD	
TDD configuration	1		N/A		N/A	
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
		3		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel		1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
		2		CR.1.1 TDD	-	CR.1.1 TDD	-
		3		CR.2.1 TDD	-	CR.2.1 TDD	-
Dedicated CORESET Reference Channel		1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
		2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
		3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration		1,4		SSB.1 FR1		SSB.1 FR1	
		2		SSB.1 FR1		SSB.1 FR1	
		3		SSB.1 RedCap FR1		SSB.1 RedCap FR1	
OCNG Patterns		1~4		OP.1		OP.1	
TRS configuration		1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	
		2		TRS.1.1 TDD		TRS.1.1 TDD	
		3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration		1~4		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration		1~4		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1		1,4	ms	-	3	-	3
		2,3	µs	-	3	-	3
SMTC configuration		1,4		SMTC.2		SMTC.2	
		2,3		SMTC.1		SMTC.1	
EPRE ratio of PSS to SSS		1~4	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~4	dBm/15 kHz	-94.65		(N_{oc} for Channel 2 +8 dB)	-115
	NR_FDD_FR1_B						-114.5
	NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_N						-108.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2,4	dBm/SSB SCS	-94.65		(N_{oc} for Channel 2 +8 dB)	-115
	NR_FDD_FR1_B						-114.5
	NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
	NR_FDD_FR1_N						-108.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3		-91.65		(N_{oc} for Channel 2 +8 dB)	-112.00
	NR_FDD_FR1_B						-111.50
	NR_TDD_FR1_C						-111.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-110.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-110.00
	NR_FDD_FR1_F						-109.50
	NR_FDD_FR1_G						-109.00
	NR_FDD_FR1_H						-108.50
	NR_FDD_FR1_N						-105.50
$\hat{E}_s/I_{ot}$		1~4	dB	10	10	13	-3
SS-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2,4	dBm/SCS	-84.65		(RSRP for Cell 2 +24 dB)	-118.00
	NR_FDD_FR1_B						-117.50
	NR_TDD_FR1_C						-117.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-116.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-116.00
	NR_FDD_FR1_F						-115.50
	NR_FDD_FR1_G						-115.00
	NR_FDD_FR1_H						-114.50
	NR_FDD_FR1_N						-111.50
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3		-84.65		(RSRP for Cell 2 +24 dB)	-115.00
	NR_FDD_FR1_B						-114.50
	NR_TDD_FR1_C						-114.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113.00
	NR_FDD_FR1_F						-112.50
	NR_FDD_FR1_G						-112.00
	NR_FDD_FR1_H						-111.50
	NR_FDD_FR1_N						-108.50
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2,4	dBm/ 9.36 MHz	-56.28		(Io for Channel 2 +19.45 dB)	-85.28
	NR_FDD_FR1_B						-84.78
	NR_TDD_FR1_C						-84.28
	NR_FDD_FR1_D, NR_TDD_FR1_D						-83.78
	NR_FDD_FR1_E, NR_TDD_FR1_E						-83.28
	NR_FDD_FR1_F						-82.78
	NR_FDD_FR1_G						-82.28
	NR_FDD_FR1_H						-81.78
	NR_FDD_FR1_N						-78.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3	dBm/ 18.36 MHz	-53.33		(Io for Channel 2 +19.45 dB)	-82.35
	NR_FDD_FR1_B						-81.85
	NR_TDD_FR1_C						-81.35
	NR_FDD_FR1_D, NR_TDD_FR1_D						-80.85
	NR_FDD_FR1_E, NR_TDD_FR1_E						-80.35
	NR_FDD_FR1_F						-79.85
	NR_FDD_FR1_G						-79.35
	NR_FDD_FR1_H						-78.85
	NR_FDD_FR1_N						-75.85
$\hat{E}_s/N_{oc}$		1~4	dB	10	10	13	-3
Propagation condition		1~4	-	AWGN		AWGN	

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Antenna configuration	1~4		1x1		1x1	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.						

A.16.7.1.3.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirement in clause 10.1A.4.1.1 and relative requirement in clause 10.1A.4.1.2.

A.16.7.1.4 SA inter-frequency case measurement accuracy with FR1 serving cell and FR1 target cell for 2 Rx UE

A.16.7.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1A.4.1.1 and 10.1A.4.1.2 for inter-frequency measurements with the testing configurations for NR cells in table A.16.7.1.4.1-1.

Table A.16.7.1.4.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.16.7.1.4.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.16.7.1.4.2-1 below. Both absolute and relative accuracy of RSRP inter-frequency measurements is tested by using the parameters in table A.16.7.1.4.1-1. The inter-frequency measurements are supported by a measurement gap.

Table A.16.7.1.4.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN	1~4		freq1	freq2	freq1	freq2
$BW_{channel}$	1,4	MHz	10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	2		10: $N_{PRB,c}$ = 52		10: $N_{PRB,c}$ = 52	
	3		20: $N_{PRB,c}$ = 51		20: $N_{PRB,c}$ = 51	
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
	4		HD-FDD		HD-FDD	
TDD configuration	1		N/A		N/A	
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
PDSCH Reference measurement channel		1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
		2		SR.1.1 TDD		SR.1.1 TDD	
		3		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel		1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
		2		CR.1.1 TDD	-	CR.1.1 TDD	-
		3		CR.2.1 TDD	-	CR.2.1 TDD	-
Dedicated CORESET Reference Channel		1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
		2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
		3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration		1,4		SSB.1 FR1		SSB.1 FR1	
		2		SSB.1 FR1		SSB.1 FR1	
		3		SSB.1 RedCap FR1		SSB.1 RedCap FR1	
OCNG Patterns		1~4		OP.1		OP.1	
TRS configuration		1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	
		2		TRS.1.1 TDD		TRS.1.1 TDD	
		3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration		1~4		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration		1~4		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1		1,4	ms	-	3	-	3
		2,3	µs	-	3	-	3
SMTC configuration		1,4		SMTC.2		SMTC.2	
		2,3		SMTC.1		SMTC.1	
EPRE ratio of PSS to SSS		1~4	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~4	dBm/15 kHz	-94.65		(N_{oc} for Channel 2 +8 dB)	-115
	NR_FDD_FR1_B						-114.5
	NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_N						-108.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2,4	dBm/SSB SCS	-94.65		(N_{oc} for Channel 2 +8 dB)	-115
	NR_FDD_FR1_B						-114.5
	NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_N						-108.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3		-91.65		(N_{oc} for Channel 2 +8 dB)	-112.00
	NR_FDD_FR1_B						-111.50
	NR_TDD_FR1_C						-111.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-110.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-110.00
	NR_FDD_FR1_F						-109.50
	NR_FDD_FR1_G						-109.00
	NR_FDD_FR1_H						-108.50
	NR_FDD_FR1_N						-105.50
$\hat{E}_s/I_{ot}$		1~4	dB	10	10	13	-3
SS-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2,4	dBm/SCS	-84.65		(RSRP for Cell 2 +24 dB)	-118.00
	NR_FDD_FR1_B						-117.50
	NR_TDD_FR1_C						-117.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-116.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-116.00
	NR_FDD_FR1_F						-115.50
	NR_FDD_FR1_G						-115.00
	NR_FDD_FR1_H						-114.50
	NR_FDD_FR1_N						-111.50
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3		-84.65		(RSRP for Cell 2 +24 dB)	-115.00
	NR_FDD_FR1_B						-114.50
	NR_TDD_FR1_C						-114.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113.00
	NR_FDD_FR1_F						-112.50
	NR_FDD_FR1_G						-112.00
	NR_FDD_FR1_H						-111.50
	NR_FDD_FR1_N						-108.50
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2,4	dBm/ 9.36 MHz	-56.28		(Io for Channel 2 +19.45 dB)	-85.28
	NR_FDD_FR1_B						-84.78
	NR_TDD_FR1_C						-84.28
	NR_FDD_FR1_D, NR_TDD_FR1_D						-83.78
	NR_FDD_FR1_E, NR_TDD_FR1_E						-83.28
	NR_FDD_FR1_F						-82.78
	NR_FDD_FR1_G						-82.28
	NR_FDD_FR1_H						-81.78
	NR_FDD_FR1_N						-78.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3	dBm/ 18.36 MHz	-53.33		(Io for Channel 2 +19.45 dB)	-82.35
	NR_FDD_FR1_B						-81.85
	NR_TDD_FR1_C						-81.35
	NR_FDD_FR1_D, NR_TDD_FR1_D						-80.85
	NR_FDD_FR1_E, NR_TDD_FR1_E						-80.35
	NR_FDD_FR1_F						-79.85
	NR_FDD_FR1_G						-79.35
	NR_FDD_FR1_H						-78.85
	NR_FDD_FR1_N						-75.85

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
$\hat{E}_s / N_{oc}$	1~4	dB	10	10	13	-3
Propagation condition	1~4	-	AWGN		AWGN	
Antenna configuration	1~4		1x2		1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.						

A.16.7.1.4.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirement in clause 10.1A.4.1.1 and relative requirement in clause 10.1A.4.1.2.

A.16.7.2 SS-RSRQ

A.16.7.2.1 SA: Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell for 1 Rx UE

A.16.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1A.6.

A.16.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.16.7.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is tested by using the parameters in table A.16.7.2.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.16.7.2.1.2-1: SS-RSRQ Intra-frequency SS-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.7.2.1.2-2: SS-RSRQ Intra-frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
	Config 4		HD-FDD					
TDD configuration	Config 1, 4		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1, 4	MHz	10: $N_{PRB,c}$ = 52					

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		Config 2		10: $N_{PRB,c}$ = 52					
		Config 3		20: $N_{PRB,c}$ = 51					
BWP configuration		Initial DL BWP		DLBWP.0.1					
		Dedicated DL BWP		DLBWP.1.1					
		Initial UL BWP		ULBWP.0.1					
		Dedicated UL BWP		ULBWP.1.1					
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel		Config 1, 4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
		Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
		Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel		Config 1, 4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
		Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
		Config 3		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Control Channel RMC		Config 1, 4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
		Config 3		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
TRS Configuration		Config 1, 4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
		Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OP. 1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 1		Config 1,4	ms	-	3	-	3	-	3
		Config 2,3	µs	-	3	-	3	-	3
SMTC configuration		Config 1,4		SMTC.2					
		Config 2,3		SMTC.1					
SSB configuration		Config 1,2,4		SSB.1 FR1					
		Config 3		SSB.1 RedCap FR1					
CSI-RS for tracking		Config 1,4		TRS.1.1 FDD					
		Config 2		TRS.1.1 TDD					
		Config 3		TRS.1.2 TDD					
PDSCH/PDCCH subcarrier spacing		Config 1,2,4	kHz	15 kHz					
		Config 3		30 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-85		-101		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-91		-		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-85		-101		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-88		-		-111	
		NR_FDD_FR1_B						-110.5	
		NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$			dB	-1.76		-4.7		-5..46	-5.46
$\hat{E}_s/N_{oc}$			dB	3	3	-2.9	-2.9	-4	-4
SS-RSRP Note3	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-82	-82	-103.9	-103.9	-118	-118
		NR_FDD_FR1_B						-117.5	-117.5
		NR_TDD_FR1_C						-117	-117
		NR_FDD_FR1_D, NR_TDD_FR1_D						-116.5	-116.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-116	-116
		NR_FDD_FR1_F						-115.5	-115.5
		NR_FDD_FR1_G						-115	-115
		NR_FDD_FR1_H						-114.5	-114.5
		NR_FDD_FR1_N						-111.5	-111.5
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85	-85	-	-	-115	-115
		NR_FDD_FR1_B						-114.5	-114.5
		NR_TDD_FR1_C						-114	-114
		NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5	-113.5

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_E, NR_TDD_FR1_E						-113	-113
		NR_FDD_FR1_F						-112.5	-112.5
		NR_FDD_FR1_G						-112	-112
		NR_FDD_FR1_H						-111.5	-111.5
		NR_FDD_FR1_N						-108.5	-108.5
SS-RSRQ Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	-14.77	-14.77	-16.76	-16.76	-17.34	-17.34
		NR_FDD_FR1_B							
		NR_TDD_FR1_C							
		NR_FDD_FR1_D, NR_TDD_FR1_D							
		NR_FDD_FR1_E, NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io Note3	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-50		-70		-83.5	
		NR_FDD_FR1_B						-83	
		NR_TDD_FR1_C						-82.5	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-82	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-81.5	
		NR_FDD_FR1_F						-81	
		NR_FDD_FR1_G						-80.5	
		NR_FDD_FR1_H						-80	
		NR_FDD_FR1_N						-77	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 18.36 MHz	-50		-		-80.6	
		NR_FDD_FR1_B						-80.1	
		NR_TDD_FR1_C						-79.6	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-79.1	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-78.6	
		NR_FDD_FR1_F						-78.1	
		NR_FDD_FR1_G						-77.6	
		NR_FDD_FR1_H						-77.1	
		NR_FDD_FR1_N						-74.1	
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x1	1x1	1x1	1x1	1x1	1x1

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.16.7.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1A.6.

A.16.7.2.2 SA: Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell for 2 Rx UE

A.16.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1A.6.

A.16.7.2.2.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.16.7.2.2.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is tested by using the parameters in table A.16.7.2.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.16.7.2.2.2-1: SS-RSRQ Intra-frequency SS-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.7.2.2.2-2: SS-RSRQ Intra-frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
	Config 4		HD-FDD					
TDD configuration	Config 1, 4		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1, 4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		20: $N_{PRB,c}$ = 51					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1, 4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Control Channel RMC	Config 1, 4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
TRS Configuration	Config 1, 4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		Config 3		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OP. 1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 1		Config 1,4	ms	-	3	-	3	-	3
		Config 2,3	µs	-	3	-	3	-	3
SMTC configuration		Config 1,4		SMTC.2					
		Config 2,3		SMTC.1					
SSB configuration		Config 1,2,4		SSB.1 FR1					
		Config 3		SSB.1 RedCap FR1					
CSI-RS for tracking		Config 1,4		TRS.1.1 FDD					
		Config 2		TRS.1.1 TDD					
		Config 3		TRS.1.2 TDD					
PDSCH/PDCCH subcarrier spacing		Config 1,2,4	kHz	15 kHz					
		Config 3		30 kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-85		-101		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-91		-		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
		NR_FDD_FR1_N						-107.5	
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-85		-101		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_N						-107.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-88		-		-111	
		NR_FDD_FR1_B						-110.5	
		NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
		NR_FDD_FR1_N						-104.5	
$\hat{E}_s/I_{ot}$			dB	-1.76		-4.7		-5..46	-5.46
$\hat{E}_s/N_{oc}$			dB	3	3	-2.9	-2.9	-4	-4
SS-RSRP Note3	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-82	-82	-103.9	-103.9	-118	-118
		NR_FDD_FR1_B						-117.5	-117.5
		NR_TDD_FR1_C						-117	-117
		NR_FDD_FR1_D, NR_TDD_FR1_D						-116.5	-116.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-116	-116
		NR_FDD_FR1_F						-115.5	-115.5
		NR_FDD_FR1_G						-115	-115
		NR_FDD_FR1_H						-114.5	-114.5
		NR_FDD_FR1_N						-111.5	-111.5
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85	-85	-	-	-115	-115
		NR_FDD_FR1_B						-114.5	-114.5
		NR_TDD_FR1_C						-114	-114
		NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5	-113.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-113	-113
		NR_FDD_FR1_F						-112.5	-112.5
		NR_FDD_FR1_G						-112	-112
		NR_FDD_FR1_H						-111.5	-111.5
		NR_FDD_FR1_N						-108.5	-108.5
SS-RSRQ Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	-14.77	-14.77	-16.76	-16.76	-17.34	-17.34
		NR_FDD_FR1_B							
		NR_TDD_FR1_C							
		NR_FDD_FR1_D, NR_TDD_FR1_D							
		NR_FDD_FR1_E, NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io Note3	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-50		-70		-83.5	
		NR_FDD_FR1_B						-83	
		NR_TDD_FR1_C						-82.5	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-82	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_E, NR_TDD_FR1_E						-81.5	
		NR_FDD_FR1_F						-81	
		NR_FDD_FR1_G						-80.5	
		NR_FDD_FR1_H						-80	
		NR_FDD_FR1_N						-77	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 18.36 MHz	-50		-		-80.6	
		NR_FDD_FR1_B						-80.1	
		NR_TDD_FR1_C						-79.6	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-79.1	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-78.6	
		NR_FDD_FR1_F						-78.1	
		NR_FDD_FR1_G						-77.6	
		NR_FDD_FR1_H						-77.1	
		NR_FDD_FR1_N						-74.1	
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.16.7.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1A.6.

A.16.7.2.3 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell for 1 Rx UE

A.16.7.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1A.8.1.1 and 10.1A.8.1.2.

A.16.7.2.3.2 Test parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.16.7.2.3.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in table A.16.7.2.3.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.16.7.2.3.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.16.7.2.3.2-2: SS-RSRQ Inter frequency test parameters

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN				freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode		Config 1		FDD					
		Config 2,3		TDD					
		Config 4		HD-FDD					
TDD configuration		Config 1,4		Not Applicable					
		Config 2		TDDConf.1.1					
		Config 3		TDDConf.2.1					
$BW_{channel}$		Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
		Config 2		10: $N_{PRB,c}$ = 52					
		Config 3		20: $N_{PRB,c}$ = 51					
Gap pattern ID		Config 1,2,3,4		0					
BWP BW		Config 1,4		10: $N_{PRB,c}$ = 52					
		Config 2		10: $N_{PRB,c}$ = 52					
		Config 3		20: $N_{PRB,c}$ = 51					
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
		Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
		Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel		Config 1,4		CR.1.1 FDD	-	R.1.1 FDD	-	CR.1.1 FDD	
		Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
		Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Dedicated CORESET Reference Channel		Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
		Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
TRS Configuration		Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
		Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OCNG pattern 1					
Time offset with Cell 1		Config 1,4	ms	-	3	-	3	-	3
		Config 2,3	µs	-	3	-	3	-	3
SMTC configuration		Config 1,4		SMTC.2					
		Config 2,3		SMTC.1					
SSB configuration		Config 1,2,4		SSB.1 FR1					
		Config 3		SSB.1 RedCap FR1					
PDSCH/PDCCH subcarrier spacing		Config 1,2,4	kHz	15					
		Config 3		30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-80.18		-106		-116	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_B						-115.5	
		NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
N_{oc} Note2	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-86.27		-113		-116	
		NR_FDD_FR1_B						-115.5	
		NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-80.18		-106		-116	
		NR_FDD_FR1_B						-115.5	
		NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-83.27		-110		-113	
		NR_FDD_FR1_B						-112.5	
		NR_TDD_FR1_C						-112	
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	
		NR_FDD_FR1_F						-110.5	
		NR_FDD_FR1_G						-110	
		NR_FDD_FR1_H						-109.5	
		NR_FDD_FR1_N						-106.5	
$\hat{E}_s/I_{ot}$			dB	-1.75		-1.75		3	-1.75
$\hat{E}_s/N_{oc}$			dB	-1.75		-1.75		3	-1.75
SS-RSRP Note3	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-81.93	-81.93	-107.75	-107.75	-113	-117.75
		NR_FDD_FR1_B						-112.5	-117.25
		NR_TDD_FR1_C						-112	-116.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	-116.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	-115.75
		NR_FDD_FR1_F						-110.5	-115.2

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_G						-110	-114.75
		NR_FDD_FR1_H						-109.5	-114.25
		NR_FDD_FR1_N						-106.5	-111.25
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85.02	-85.02	-111.75	-111.75	-110	-114.75
		NR_FDD_FR1_B						-109.5	-114.25
		NR_TDD_FR1_C						-109	-113.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-108.5	-113.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-108	-112.75
		NR_FDD_FR1_F						-107.5	-112.2
		NR_FDD_FR1_G						-107	-111.75
		NR_FDD_FR1_H						-106.5	-111.25
		NR_FDD_FR1_N						-103.5	-108.25
SS-RSRQ[Note3]		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-14.77	-14.77	-14.77	-14.77	-12.56	-14.76
		NR_FDD_FR1_B							
		NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io[Note3]	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-50		-75.83		-83.28	-85.83
		NR_FDD_FR1_B						-82.78	-85.33
		NR_TDD_FR1_C						-82.28	-84.83
		NR_FDD_FR1_D NR_TDD_FR1_D						-81.78	-84.33
		NR_FDD_FR1_E NR_TDD_FR1_E						-81.28	-83.83
		NR_FDD_FR1_F						-80.78	-83.33
		NR_FDD_FR1_G						-80.28	-82.83
		NR_FDD_FR1_H						-79.78	-82.33
		NR_FDD_FR1_N						-76.78	-79.33
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-53.17		-79.90		-80.36	-82.90
		NR_FDD_FR1_B						-79.86	-82.40
		NR_TDD_FR1_C						-79.36	-81.90
		NR_FDD_FR1_D NR_TDD_FR1_D						-78.86	-81.40
		NR_FDD_FR1_E NR_TDD_FR1_E						-78.36	-80.90
		NR_FDD_FR1_F						-77.86	-80.40
		NR_FDD_FR1_G						-77.36	-79.90
		NR_FDD_FR1_H						-76.86	-79.40
		NR_FDD_FR1_N						-79.86	-82.40
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Antenna configuration		1x1	1x1	1x1	1x1	1x1	1x1
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 5: NR operating band groups are as defined in clause 3.5.2.							
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.							

A.16.7.2.3.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1A.8.1.1 and 10.1A.8.1.2.

A.16.7.2.4 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell for 2 Rx UE

A.16.7.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1A.8.1.1 and 10.1A.8.1.2.

A.16.7.2.4.2 Test parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.16.7.2.4.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in table A.16.7.2.4.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.16.7.2.4.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.16.7.2.4.2-2: SS-RSRQ Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
	Config 4		HD-FDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		20: $N_{PRB,c}$ = 51					
Gap pattern ID	Config 1,2,3,4		0					
BWP BW	Config 1,4		10: $N_{PRB,c}$ = 52					
	Config 2		10: $N_{PRB,c}$ = 52					
	Config 3		20: $N_{PRB,c}$ = 51					

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
		Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
		Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel		Config 1,4		CR.1.1 FDD	-	R.1.1 FDD	-	CR.1.1 FDD	
		Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
		Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Dedicated CORESET Reference Channel		Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
		Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
TRS Configuration		Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
		Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns				OP.1					
Time offset with Cell 1		Config 1,4	ms	-	3	-	3	-	3
		Config 2,3	μs	-	3	-	3	-	3
SMTC configuration		Config 1,4		SMTC.2					
		Config 2,3		SMTC.1					
SSB configuration		Config 1,2,4		SSB.1 in FR1					
		Config 3		SSB.1 RedCap FR1					
PDSCH/PDCCH subcarrier spacing		Config 1,2,4	kHz	15					
		Config 3		30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-80.18		-106		-116	
		NR_FDD_FR1_B						-115.5	
		NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
N_{oc} Note2	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-86.27		-113		-116	
		NR_FDD_FR1_B						-115.5	
		NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E						-114	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_TDD_FR1_E							
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-80.18		-106		-116	
		NR_FDD_FR1_B						-115.5	
		NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
		NR_FDD_FR1_N						-109.5	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-83.27		-110		-113	
		NR_FDD_FR1_B						-112.5	
		NR_TDD_FR1_C						-112	
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	
		NR_FDD_FR1_F						-110.5	
		NR_FDD_FR1_G						-110	
		NR_FDD_FR1_H						-109.5	
		NR_FDD_FR1_N						-106.5	
$\hat{E}_s/I_{ot}$			dB	-1.75		-1.75		3	-1.75
$\hat{E}_s/N_{oc}$			dB	-1.75		-1.75		3	-1.75
SS-RSRP Note3	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-81.93	-81.93	-107.75	-107.75	-113	-117.75
		NR_FDD_FR1_B						-112.5	-117.25
		NR_TDD_FR1_C						-112	-116.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	-116.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	-115.75
		NR_FDD_FR1_F						-110.5	-115.2
		NR_FDD_FR1_G						-110	-114.75
		NR_FDD_FR1_H						-109.5	-114.25
		NR_FDD_FR1_N						-106.5	-111.25
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85.02	-85.02	-111.75	-111.75	-110	-114.75
		NR_FDD_FR1_B						-109.5	-114.25
		NR_TDD_FR1_C						-109	-113.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-108.5	-113.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-108	-112.75
		NR_FDD_FR1_F						-107.5	-112.2

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_G						-107	-111.75
		NR_FDD_FR1_H						-106.5	-111.25
		NR_FDD_FR1_N						-103.5	-108.25
SS-RSRQ[Note3]		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-14.77	-14.77	-12.56	-14.76	-14.77	-14.77
		NR_FDD_FR1_B							
		NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io[Note3]	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-50		-75.83		-83.28	-85.83
		NR_FDD_FR1_B						-82.78	-85.33
		NR_TDD_FR1_C						-82.28	-84.83
		NR_FDD_FR1_D NR_TDD_FR1_D						-81.78	-84.33
		NR_FDD_FR1_E NR_TDD_FR1_E						-81.28	-83.83
		NR_FDD_FR1_F						-80.78	-83.33
		NR_FDD_FR1_G						-80.28	-82.83
		NR_FDD_FR1_H						-79.78	-82.33
		NR_FDD_FR1_N						-76.78	-79.33
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-53.17		-79.90		-80.36	-82.90
		NR_FDD_FR1_B						-79.86	-82.40
		NR_TDD_FR1_C						-79.36	-81.90
		NR_FDD_FR1_D NR_TDD_FR1_D						-78.86	-81.40
		NR_FDD_FR1_E NR_TDD_FR1_E						-78.36	-80.90
		NR_FDD_FR1_F						-77.86	-80.40
		NR_FDD_FR1_G						-77.36	-79.90
		NR_FDD_FR1_H						-76.86	-79.40
		NR_FDD_FR1_N						-79.86	-82.40
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.16.7.2.4.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1A.8.1.1 and 10.1A.8.1.2.

A.16.7.3 SS-SINR

A.16.7.3.1 SA intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell for 1 Rx UE

A.16.7.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1A.10.1.

A.16.7.3.1.2 Test parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.16.7.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in table A.16.7.3.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.16.7.3.1.2-1: SS-SINR Intra-frequency supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.16.7.3.1.2-2: SS-SINR Intra-frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
	Config 4		HD-FDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
DRX Cycle configuration		ms	Not Applicable			
TRS configuration	Config 1,4		TRS.1.1 FDD		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR.2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
	Config 3			CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns				OP.1			
SS-RSSI-Measurement				Not Applicable			
SMTC configuration	Config 1,4			SMTC.2			
	Config 2,3			SMTC.1			
Time offset with Cell 1	Config 1,4		ms	-	3	-	3
	Config 2,3		µs	-	3	-	3
SSB configuration	Config 1,2			SSB.1 FR1			
	Config 3			SSB.1 RedCap FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4		kHz	15			
	Config 3			30			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-93		-116	
		NR_FDD_FR1_B				-115.5	
		NR_TDD_FR1_C				-115	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-114.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-114	
		NR_FDD_FR1_F				-113.5	
		NR_FDD_FR1_G				-113	
		NR_FDD_FR1_H				-112.5	
		NR_FDD_FR1_N				-109.5	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-93		Same as Noc for 15 kHz	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-90		-113	
		NR_FDD_FR1_B				-112.5	
		NR_TDD_FR1_C				-112	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-111.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-111	
		NR_FDD_FR1_F				-110.5	
		NR_FDD_FR1_G				-110	
		NR_FDD_FR1_H				-109.5	
		NR_FDD_FR1_N				-106.5	
$\hat{E}_s / I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	4.54	2.66	-4	-4
SS-RSRP Note3	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-88.46	-90.34	-120	-120
		NR_FDD_FR1_B				-119.5	-119.5
		NR_TDD_FR1_C				-119	-119
		NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5	-118.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-118	-118
		NR_FDD_FR1_F				-117.5	-117.5
		NR_FDD_FR1_G				-117	-117

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_H				-116.5	-116.5
		NR_FDD_FR1_N				-113.5	-113.5
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85.46	-87.34	-117	-117
		NR_FDD_FR1_B				-116.5	-116.5
		NR_TDD_FR1_C				-116	-116
		NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5	-115.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-115	-115
		NR_FDD_FR1_F				-114.5	-114.5
		NR_FDD_FR1_G				-114	-114
		NR_FDD_FR1_H				-113.5	-113.5
		NR_FDD_FR1_N				-110.5	-110.5
SS-SINR Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	0	-3.19	-5.46	-5.46
		NR_FDD_FR1_B					
		NR_TDD_FR1_C					
		NR_FDD_FR1_D, NR_TDD_FR1_D					
		NR_FDD_FR1_E, NR_TDD_FR1_E					
		NR_FDD_FR1_F					
		NR_FDD_FR1_G					
		NR_FDD_FR1_H					
		NR_FDD_FR1_N					
Io Note3	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.5		-85.51	
		NR_FDD_FR1_B				-85.01	
		NR_TDD_FR1_C				-84.51	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-84.01	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-83.51	
		NR_FDD_FR1_F				-83.01	
		NR_FDD_FR1_G				-82.51	
		NR_FDD_FR1_H				-82.01	
		NR_FDD_FR1_N				-79.01	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 18.36 MHz	-54.57		-82.57	
		NR_FDD_FR1_B				-82.07	
		NR_TDD_FR1_C				-81.57	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-81.07	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-81.07	
		NR_FDD_FR1_F				-80.57	
		NR_FDD_FR1_G				-80.07	
		NR_FDD_FR1_H				-79.57	
		NR_FDD_FR1_N				-76.57	
Propagation condition			-	AWGN			
Antenna configuration			-	1x1			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
NOTE 5: NR operating band groups are as defined in clause 3.5.2. NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.					

A.16.7.3.1.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1A.10.1.1 and 10.1A.10.1.2

A.16.7.3.2 SA intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell for 2 Rx UE

A.16.7.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1A.10.1.

A.16.7.3.2.2 Test parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.16.7.3.2.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in table A.16.7.3.2.22. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.16.7.3.2.2-1: SS-SINR Intra-frequency supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.16.7.3.2.2-2: SS-SINR Intra-frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
	Config 4		HD-FDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
DRX Cycle configuration		ms	Not Applicable			
TRS configuration	Config 1,4		TRS.1.1 FDD		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR.2.1 TDD		SR2.1 TDD	

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
RMSI CORESET Reference Channel		Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	
		Config 2		CR.1.1 TDD		CR.1.1 TDD	
		Config 3		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel		Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
		Config 3		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns				OP.1			
SS-RSSI-Measurement				Not Applicable			
SMTC configuration		Config 1,4		SMTC.2			
		Config 2,3		SMTC.1			
Time offset with Cell 1		Config 1,4	ms	-	3	-	3
		Config 2,3	µs	-	3	-	3
SSB configuration		Config 1,2,4		SSB.1 FR1			
		Config 3		SSB.1 RedCap FR1			
PDSCH/PDCCH subcarrier spacing		Config 1,2,4	kHz	15			
		Config 3		30			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-93		-116	
		NR_FDD_FR1_B				-115.5	
		NR_TDD_FR1_C				-115	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-114.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-114	
		NR_FDD_FR1_F				-113.5	
		NR_FDD_FR1_G				-113	
		NR_FDD_FR1_H				-112.5	
		NR_FDD_FR1_N				-109.5	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-93		Same as Noc for 15 kHz	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-90		-113	
		NR_FDD_FR1_B				-112.5	
		NR_TDD_FR1_C				-112	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-111.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-111	
		NR_FDD_FR1_F				-110.5	
		NR_FDD_FR1_G				-110	
		NR_FDD_FR1_H				-109.5	
		NR_FDD_FR1_N				-106.5	
$\hat{E}_s / I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s / N_{oc}$			dB	4.54	2.66	-4	-4

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
SS-RSRP Note3	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-88.46	-90.34	-120	-120
		NR_FDD_FR1_B				-119.5	-119.5
		NR_TDD_FR1_C				-119	-119
		NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5	-118.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-118	-118
		NR_FDD_FR1_F				-117.5	-117.5
		NR_FDD_FR1_G				-117	-117
		NR_FDD_FR1_H				-116.5	-116.5
		NR_FDD_FR1_N				-113.5	-113.5
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85.46	-87.34	-117	-117
		NR_FDD_FR1_B				-116.5	-116.5
		NR_TDD_FR1_C				-116	-116
		NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5	-115.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-115	-115
		NR_FDD_FR1_F				-114.5	-114.5
		NR_FDD_FR1_G				-114	-114
		NR_FDD_FR1_H				-113.5	-113.5
		NR_FDD_FR1_N				-110.5	-110.5
SS-SINR Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	0	-3.19	-5.46	-5.46
		NR_FDD_FR1_B					
		NR_TDD_FR1_C					
		NR_FDD_FR1_D, NR_TDD_FR1_D					
		NR_FDD_FR1_E, NR_TDD_FR1_E					
		NR_FDD_FR1_F					
		NR_FDD_FR1_G					
		NR_FDD_FR1_H					
		NR_FDD_FR1_N					
Io Note3	Config 1,2,4	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.5		-85.51	
		NR_FDD_FR1_B				-85.01	
		NR_TDD_FR1_C				-84.51	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-84.01	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-83.51	
		NR_FDD_FR1_F				-83.01	
		NR_FDD_FR1_G				-82.51	
		NR_FDD_FR1_H				-82.01	
		NR_FDD_FR1_N				-79.01	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 18.36 MHz	-54.57		-82.57	
		NR_FDD_FR1_B				-82.07	
		NR_TDD_FR1_C				-81.57	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-81.07	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-81.07	
		NR_FDD_FR1_F				-80.57	
		NR_FDD_FR1_G				-80.07	
		NR_FDD_FR1_H				-79.57	

Parameter			Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_N				-76.57	
Propagation condition			-	AWGN			
Antenna configuration			-	1x2			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.							
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							
NOTE 5: NR operating band groups are as defined in clause 3.5.2.							
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.							

A.16.7.3.3 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell for 1 Rx UE

A.16.7.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1A.12.1.

A.16.7.3.3.2 Test parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.16.7.3.3.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in table A.16.7.3.3.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.16.7.3.3.2-1: SS-SINR Inter frequency supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.16.7.3.3.2-2: SS-SINR Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
	Config 4		HD-FDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
DRX Cycle configuration		ms	Not Applicable					
Gap pattern ID			0	-	0	-	0	-
TRS configuration	Config 1,4		TRS.1.1 FDD		TRS.1.1 FDD		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
	Config 3			TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1,4			SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2			SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3			SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4			CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2			CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3			CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4			CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2			CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3			CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 1	Config 1,4		ms	-	3	-	3	-	3
	Config 2,3		µs	-	3	-	3	-	3
SMTC configuration	Config 1,4			SMTC.2					
	Config 2,3			SMTC.1					
SSB configuration	Config 1,2,4			SSB.1 FR1					
	Config 3			SSB.1 RedCap FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4		kHz	15					
	Config 3			30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-88		-108.5		-119.5	
		NR_FDD_FR1_B						-119	
		NR_TDD_FR1_C						-118.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-118	
		NR_FDD_FR1_E NR_TDD_FR1_E						-117.5	
		NR_FDD_FR1_F						-117	
		NR_FDD_FR1_G						-116.5	
		NR_FDD_FR1_H						-116	
		NR_FDD_FR1_N						-113	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-88		-108.5		Same as Noc for 15 kHz	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85		-105.5		-116.5	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_B						-116	
		NR_TDD_FR1_C						-115.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-115	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114.5	
		NR_FDD_FR1_F						-114	
		NR_FDD_FR1_G						-114.5	
		NR_FDD_FR1_H						-113	
		NR_FDD_FR1_N						-110	
$\hat{E}_s/I_{ot}$			dB	-1.75	-1.75	20	20	-4.0	-4.0
$\hat{E}_s/N_{oc}$			dB	-1.75		20		-4.0	
SS-RSRP Note3	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-89.75		-88.5		-123.5	
		NR_FDD_FR1_B						-123	
		NR_TDD_FR1_C						-122.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-122	
		NR_FDD_FR1_E NR_TDD_FR1_E						-121.5	
		NR_FDD_FR1_F						-121	
		NR_FDD_FR1_G						-120.5	
		NR_FDD_FR1_H						-120	
		NR_FDD_FR1_N						-117	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-86.75		-85.5		-120.5	
		NR_FDD_FR1_B						-120	
		NR_TDD_FR1_C						-119.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-119	
		NR_FDD_FR1_E NR_TDD_FR1_E						-118.5	
		NR_FDD_FR1_F						-118	
		NR_FDD_FR1_G						-117.5	
		NR_FDD_FR1_H						-117	
		NR_FDD_FR1_N						-114	
SS-SINR Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-1.75		20		-4.0	
		NR_FDD_FR1_B							
		NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G							
		NR_FDD_FR1_H							
		NR_FDD_FR1_N							
Io Note3	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.83		-60.5		-90.09	
		NR_FDD_FR1_B						-89.59	
		NR_TDD_FR1_C						-89.09	
		NR_FDD_FR1_D NR_TDD_FR1_D						-88.59	
		NR_FDD_FR1_E NR_TDD_FR1_E						-88.09	
		NR_FDD_FR1_F						-87.59	
		NR_FDD_FR1_G						-87.09	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_H						-86.59	
		NR_FDD_FR1_N						-83.59	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 18.36 MHz	-54.87		-57.57		-87.97	
		NR_FDD_FR1_B						-87.47	
		NR_TDD_FR1_C						-86.97	
		NR_FDD_FR1_D NR_TDD_FR1_D						-86.47	
		NR_FDD_FR1_E NR_TDD_FR1_E						-85.97	
		NR_FDD_FR1_F						-85.47	
		NR_FDD_FR1_G						-84.97	
		NR_FDD_FR1_H						-84.47	
		NR_FDD_FR1_N						-81.47	
Propagation condition			-	AWGN					
Antenna configuration			-	1x1					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.16.7.3.3.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1A.12.1.1 and 10.1A.12.1.2.

A.16.7.3.4 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell for 2 Rx UE

A.16.7.3.4.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1A.12.1.

A.16.7.3.4.2 Test parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.16.7.3.4.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in table A.16.7.3.4.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.16.7.3.4.2-1: Inter frequency SS-SINR supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.16.7.3.4.2-2: SS-SINR Inter frequency test parameters

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN				freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode		Config 1		FDD					
		Config 2,3		TDD					
		Config 4		HD-FDD					
TDD configuration		Config 1,4		Not Applicable					
		Config 2		TDDConf.1.1					
		Config 3		TDDConf.2.1					
Downlink initial BWP configuration				DLBWP.0.1					
Downlink dedicated BWP configuration				DLBWP.1.1					
Uplink initial BWP configuration				ULBWP.0.1					
Uplink dedicated BWP configuration				ULBWP.1.1					
DRX Cycle configuration			ms	Not Applicable					
Gap pattern ID				0	-	0	-	0	-
TRS configuration		Config 1,4		TRS.1.1 FDD		TRS.1.1 FDD		TRS.1.1 FDD	
		Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
		Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
		Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel		Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
		Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
		Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Dedicated CORESET Reference Channel		Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
		Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 1		Config 1,4	ms	-	3	-	3	-	3
		Config 2,3	µs	-	3	-	3	-	3
SMTC configuration		Config 1,4		SMTC.2					
		Config 2,3		SMTC.1					
SSB configuration		Config 1,2,4		SSB.1 FR1					
		Config 3		SSB.1 RedCap FR1					
PDSCH/PDCCH subcarrier spacing		Config 1,2,4	kHz	15					
		Config 3		30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15 kHz	-88		-108.5		-119.5	
		NR_FDD_FR1_B						-119	
		NR_TDD_FR1_C						-118.5	
		NR_FDD_FR1_D						-118	

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E						-117.5	
		NR_FDD_FR1_F						-117	
		NR_FDD_FR1_G						-116.5	
		NR_FDD_FR1_H						-116	
		NR_FDD_FR1_N						-113	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-88		-108.5		Same as Noc for 15 kHz	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85		-105.5		-116.5	
		NR_FDD_FR1_B						-116	
		NR_TDD_FR1_C						-115.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-115	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114.5	
		NR_FDD_FR1_F						-114	
		NR_FDD_FR1_G						-114.5	
		NR_FDD_FR1_H						-113	
		NR_FDD_FR1_N						-110	
$\hat{E}_s / I_{ot}$			dB	-1.75	-1.75	20	20	-4.0	-4.0
$\hat{E}_s / N_{oc}$			dB	-1.75		20		-4.0	
SS-RSRP Note3	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-89.75		-88.5		-123.5	
		NR_FDD_FR1_B						-123	
		NR_TDD_FR1_C						-122.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-122	
		NR_FDD_FR1_E NR_TDD_FR1_E						-121.5	
		NR_FDD_FR1_F						-121	
		NR_FDD_FR1_G						-120.5	
		NR_FDD_FR1_H						-120	
		NR_FDD_FR1_N						-117	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-86.75		-85.5		-120.5	
		NR_FDD_FR1_B						-120	
		NR_TDD_FR1_C						-119.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-119	
		NR_FDD_FR1_E NR_TDD_FR1_E						-118.5	
		NR_FDD_FR1_F						-118	
		NR_FDD_FR1_G						-117.5	
		NR_FDD_FR1_H						-117	
		NR_FDD_FR1_N						-114	
SS-SINR Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-1.75		20		-4.0	
		NR_FDD_FR1_B							
		NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G							
		NR_FDD_FR1_H							

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
		NR_FDD_FR1_N							
Io^{Note3}	Config 1,2,4	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36 MHz	-57.83		-60.5		-90.09	
		NR_FDD_FR1_B						-89.59	
		NR_TDD_FR1_C						-89.09	
		NR_FDD_FR1_D NR_TDD_FR1_D						-88.59	
		NR_FDD_FR1_E NR_TDD_FR1_E						-88.09	
		NR_FDD_FR1_F						-87.59	
		NR_FDD_FR1_G						-87.09	
		NR_FDD_FR1_H						-86.59	
		NR_FDD_FR1_N						-83.59	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 18.36 MHz	-54.87		-57.57		-87.97	
		NR_FDD_FR1_B						-87.47	
		NR_TDD_FR1_C						-86.97	
		NR_FDD_FR1_D NR_TDD_FR1_D						-86.47	
		NR_FDD_FR1_E NR_TDD_FR1_E						-85.97	
		NR_FDD_FR1_F						-85.47	
		NR_FDD_FR1_G						-84.97	
		NR_FDD_FR1_H						-84.47	
		NR_FDD_FR1_N						-81.47	
Propagation condition			-	AWGN					
Antenna configuration			-	1x2					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: NR operating band groups are as defined in clause 3.5.2.
NOTE 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.16.7.3.4.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1A.12.1.1 and 10.1A.12.1.2.

A.16.7.4 L1-RSRP measurement for beam reporting

A.16.7.4.1 SSB based L1-RSRP measurement for 1 Rx UE

A.16.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.5B.3 and clause 10.1A.14.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.16.7.4.1.1-1.

Table A.16.7.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode

3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.16.7.4.1.2 Test parameters

In this set of test cases there is one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.16.7.4.1.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.16.7.4.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured with one SSB resource set containing two SSB resources (SSB#0) and 1 (SSB#1). UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0.

Table A.16.7.4.1.2-1: FR1 SSB based L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~4		freq1	freq1
Duplex mode	1		FDD	FDD
	2		TDD	TDD
	3		TDD	TDD
	4		HD-FDD	HD-FDD
TDD Configuration	1, 4		N/A	N/A
	2		TDDConf.1.1	TDDConf.1.1
	3		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1, 2, 4	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	3		20: $N_{PRB,c}$ = 51	20: $N_{PRB,c}$ = 51
PDSCH Reference measurement channel	1, 4		SR.1.1 FDD	SR.1.1 FDD
	2		SR.1.1 TDD	SR.1.1 TDD
	3		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1, 4		CR.1.1 FDD	CR.1.1 FDD
	2		CR.1.1 TDD	CR.1.1 TDD
	3		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1, 4		CCR.1.1 FDD	CCR.1.1 FDD
	2		CCR.1.1 TDD	CCR.1.1 TDD
	3		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1, 2, 4		SSB.3 FR1	SSB.3 FR1
	3		SSB.2 RedCap FR1	SSB.2 RedCap FR1
OCNG Patterns	1~4		OP.1	OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
TRS configuration	1, 4		TRS.1.1 FDD	TRS.1.1 FDD
	2		TRS.1.1 TDD	TRS.1.1 TDD
	3		TRS.1.2 TDD	TRS.1.2 TDD
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~4		SMTC.1	SMTC.1
reportConfigType	1~4		periodic	periodic
reportQuantity	1~4		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1~4		2	2
L1-RSRP reporting period	1~4		slot80	slot80
EPRE ratio of PSS to SSS	1~4	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS[Note 1]				

Parameter		Config	Unit	Test 1	Test 2
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~4	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2, 4	dBm/SSB SCS	-94.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-91.65	-114
	NR_FDD_FR1_B				-113.5
	NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
$\hat{E}_s/I_{ot}$		1~4	dB	10	-3
SSB RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2, 4	dBm/SSB SCS	-84.65	-120
	NR_FDD_FR1_B				-119.5
	NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-81.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2, 4	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B				-86.78
	NR_TDD_FR1_C				-86.28

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3	dBm/18.36 MHz	-53.36	-84.36
	NR_FDD_FR1_B				-83.86
	NR_TDD_FR1_C				-83.36
	NR_FDD_FR1_D, NR_TDD_FR1_D				-82.86
	NR_FDD_FR1_E, NR_TDD_FR1_E				-82.36
	NR_FDD_FR1_F				-81.86
	NR_FDD_FR1_G				-81.36
	NR_FDD_FR1_H				-80.86
$\hat{E}_s/N_{oc}$		1~4	dB	10	-3
Propagation condition		1~4		AWGN	AWGN
Antenna configuration		1~4		1x1	1x1

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.16.7.4.1.3 Test Requirements

The L1-RSRP measurement accuracy for SSB resource reported by UE in L1-RSRP report (SSB#0 or SSB#1) of Cell 2 shall fulfil the requirements in clauses 10.1A.14.1.

A.16.7.4.2 SSB based L1-RSRP measurement for 2 Rx UE

A.16.7.4.2.1 Test Purpose and Environment

Test purpose and environment defined in clause A.16.7.4.1.1 apply in this clause.

A.16.7.4.2.2 Test parameters

Test parameters defined in clause A.16.7.4.1.2 apply in this clause except the antenna configuration defined in table A.16.7.4.2.2-1.

Table A.16.7.4.2.2-1: FR1 SSB based L1-RSRP test parameters

Antenna configuration and Correlation matrix	1~4		1x2 Low	1x2 Low

A.16.7.4.2.3 Test Requirements

The L1-RSRP measurement accuracy for SSB resource reported by UE in L1-RSRP report (SSB#0 or SSB#1) of Cell 2 shall fulfil the requirements in clauses 10.1A.14.1.

A.16.7.4.3 CSI-RS based L1-RSRP measurement on resource set with repetition off for 1 Rx UE

A.16.7.4.3.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.5B.3 and clause 10.1A.14.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in table A.16.7.4.3.1-1.

Table A.16.7.4.3.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.16.7.4.3.2 Test parameters

In this set of test cases there is one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in table A.16.7.4.3.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.16.7.4.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set containing two CSI-RS resources (CSI-RS#0 or CSI-RS#1). UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.16.7.4.3.2-1: FR1 CSI-RS based L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB ARFCN	1~4		freq1	freq1
Duplex mode	1		FDD	FDD
	2, 3		TDD	TDD
	4		HD-FDD	HD-FDD
TDD Configuration	1,4		N/A	N/A
	2		TDDConf.1.1	TDDConf.1.1
	3		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1, 2, 4	MHz	10: $N_{PRB,c}$ = 52	10: $N_{PRB,c}$ = 52
	3		20: $N_{PRB,c}$ = 51	20: $N_{PRB,c}$ = 51
PDSCH Reference measurement channel	1, 4		SR.1.1 FDD	SR.1.1 FDD
	2		SR.1.1 TDD	SR.1.1 TDD
	3		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1, 4		CR.1.1 FDD	CR.1.1 FDD
	2		CR.1.1 TDD	CR.1.1 TDD
	3		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1, 4		CCR.1.1 FDD	CCR.1.1 FDD
	2		CCR.1.1 TDD	CCR.1.1 TDD
	3		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1, 2, 4		SSB.3 FR1	SSB.3 FR1
	3		SSB.2 RedCap FR1	SSB.2 RedCap FR1
OCNG Patterns	1~4		OP.1	OP.1
TRS configuration	1, 4		TRS.1.1 FDD	TRS.1.1 FDD
	2		TRS.1.1 TDD	TRS.1.1 TDD
	3		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~4		SMTC.1	SMTC.1

Parameter		Config	Unit	Test 1	Test 2
CSI-RS		1, 4		CSI-RS 1.2 FDD	CSI-RS 1.2 FDD
		2		CSI-RS 1.2 TDD	CSI-RS 1.2 TDD
		3		CSI-RS 2.2 TDD	CSI-RS 2.2 FDD
reportConfigType		1~4		periodic	periodic
reportQuantity		1~4		cri-RSRP	cri-RSRP
Number of reported RS		1~4		2	2
L1-RSRP reporting period		1~4		slot80	slot80
EPRE ratio of PSS to SSS		1~4	dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~4	dBm/15 kHz	-94.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2, 4	dBm/CSI-RS SCS	-94.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-91.65	-114
	NR_FDD_FR1_B				-113.5
	NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
$\hat{E}_s/I_{ot}$		1~4	dB	10	-3
CSI-RS RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2, 4	dBm/CSI-RS SCS	-84.65	-120
	NR_FDD_FR1_B				-119.5
	NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G				-117

Parameter		Config	Unit	Test 1	Test 2
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-81.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2, 4	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B				-86.78
	NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3	dBm/18.36 MHz	-53.36	-84.36
	NR_FDD_FR1_B				-83.86
	NR_TDD_FR1_C				-83.36
	NR_FDD_FR1_D, NR_TDD_FR1_D				-82.86
	NR_FDD_FR1_E, NR_TDD_FR1_E				-82.36
	NR_FDD_FR1_F				-81.86
	NR_FDD_FR1_G				-81.36
	NR_FDD_FR1_H				-80.86
$\hat{E}_s/N_{oc}$		1~4	dB	10	-3
Propagation condition		1~4		AWGN	AWGN
Antenna configuration		1~4		1x1	1x1

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.16.7.4.3.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS resource reported by UE in L1-RSRP report (CSI-RS#0 or CSI-RS#1) of Cell 1 shall fulfil the requirements in clause 10.1A.14.2.

A.16.7.4.4 CSI-RS based L1-RSRP measurement on resource set with repetition off for 2 Rx UE

A.16.7.4.4.1 Test Purpose and Environment

Test purpose and environment defined in clause A.16.7.4.3.1 apply in this clause.

A.16.7.4.4.2 Test parameters

Test parameters defined in clause A.16.7.4.3.2 apply in this clause except the antenna configuration defined in table A.16.7.4.2.2-1.

Table A.16.7.4.2.2-1: FR1 SSB based L1-RSRP test parameters

Antenna configuration and Correlation matrix	1~4		1x2 Low	1x2 Low

A.16.7.4.4.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS resource reported by UE in L1-RSRP report (CSI-RS#0 or CSI-RS#1) of Cell 1 shall fulfil the requirements in clause 10.1A.14.2.

A.16.7.5 E-UTRAN RSRP

A.16.7.5.1 SA: inter-RAT measurement accuracy with FR1 serving cell for 1 Rx UE

A.16.7.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the E-UTRAN RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.2A.2 for SA inter-RAT E-UTRAN RSRP measurements.

A.16.7.5.1.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an E-UTRAN inter-RAT neighbour cell. Supported test configurations are shown in table A.16.7.5.1.2-1. The measurement accuracy of SA inter-RAT E-UTRAN RSRP are tested by using the parameters in A.16.7.5.1.2-2 and A.16.7.5.1.2-3.

Table A.16.7.5.1.2-1: Inter-RAT E-UTRAN RSRP supported test configurations with FR1 serving cell

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode. E-UTRAN FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode. E-UTRAN TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.7.5.1.2-2: NR Cell specific test parameters for SA Inter-RAT E-UTRAN RSRP test parameters

Parameter		Unit	Cell 1
NR RF channel number			1
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
	Config 7,8		HD-FDD
TDD Configuration	Config 1, 4, 7, 8		N/A
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
$BW_{channel}$	Config 1, 4, 7, 8	MHz	10: $N_{PRB,c}$ = 52 (FDD)
	Config 2, 5		10: $N_{PRB,c}$ = 52 (TDD)
	Config 3, 6		20: $N_{PRB,c}$ = 51 (TDD)
Gap pattern Id			0
PDSCH reference measurement channel	Config 1, 4,7,8		SR.1.1 FDD
	Config 2, 5		SR.1.1 TDD

Parameter		Unit	Cell 1
	Config 3, 6		SR.2.1 TDD
RMSI CORSET reference channel	Config 1, 4,7,8		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
Dedicated CORSET reference channel	Config 1, 4,7,8		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
CSI-RS for tracking	Config 1, 4,7,8		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
BWP configurations	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
OCNG pattern[Note1]			OP.1
SMTC configuration			SMTC.1
SSB configuration	Config 1, 2, 4, 5,7,8		SSB.1 FR1
	Config 3, 6		SSB.1 RedCap FR1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS			
EPRE ratio of OCNG to OCNG DMRS			
N_{oc}[Note2]		dBm/15 kHz	-104
N_{oc}[Note2]	Config 1, 2, 4, 5,7,8	dBm/SCS	-104
	Config 3, 6		-101
$\hat{E}_s/N_{oc}$		dB	17
$\hat{E}_s/I_{ot}$[Note3]		dB	17
SS-RSRP[Note3]	Config 1, 2, 4, 5,7,8	dBm/SCS	-87
	Config 3, 6		-84
SSB_RP[Note3]	Config 1, 2, 4, 5,7,8	dBm/SCS	-87
	Config 3, 6		-84
Io[Note3]	Config 1, 2, 4, 5,7,8	dBm/9.36 MHz	-58.96
	Config 3, 6	dBm/18.36 MHz	-56.03
Propagation condition			AWGN
Antenna Configuration			1x1

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.16.7.5.1.2-3: E-UTRAN Cell specific test parameters for SA Inter-RAT E-UTRAN RSRP test parameters

Parameter		Unit	Cell 2	
			Test 1	Test 2
E-UTRA RF channel number			2	
Duplex mode	Config 1, 2, 3, 7		FDD	
	Config 4, 5, 6, 8		TDD	
TDD special subframe configuration[Note1]	Config 1, 2, 3, 7		N/A	
	Config 4, 5, 6, 8		6	
TDD uplink-downlink configuration[Note1]	Config 1, 2, 3, 7		N/A	
	Config 4, 5, 6, 8		1	
$BW_{channel}$		MHz	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50	

Parameter		Unit	Cell 2	
			Test 1	Test 2
			20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]			-	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]	Config 1, 2, 3, 7		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
	Config 4, 5, 6, 8		5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]	Config 1, 2, 3, 7		5 MHz: OP.19 FDD 10 MHz: OP.6 FDD 20 MHz: OP.14 FDD	
	Config 4, 5, 6 ,8		5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD	
PBCH_RA		dB	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-91.65	-117
	Bands FDD_B1, FDD_B2 [Note 10]			-116.5
	Bands FDD_C, TDD_C			-116
	Bands FDD_D			-115.5
	Bands FDD_E, FDD_F [Note 7], TDD_E			-115
	Bands FDD_G [Note 8]			-114
	Bands FDD_H			-113.5
$\hat{E}_s/N_{oc}$		dB	10	-4
$\hat{E}_s/I_{ot}$[Note5]		dB	10	-4
RSRP[Note5]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-81.65	-121
	Bands FDD_B1, FDD_B2 [Note 10]			-120.5
	Bands FDD_C, TDD_C			-120
	Bands FDD_D			-119.5
	Bands FDD_E, FDD_F [Note 7], TDD_E			-119
	Bands FDD_G [Note 8]			-118
	Bands FDD_H			-117.5
SCH_RP[Note5]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-81.65	-121
	Bands FDD_B1, FDD_B2 [Note 10]			-120.5
	Bands FDD_C, TDD_C			-120
	Bands FDD_D			-119.5
	Bands FDD_E, FDD_F [Note 7], TDD_E			-119
	Bands FDD_G [Note 8]			-118
	Bands FDD_H			-117.5
Io[Note5]	Bands FDD_A [Note 9], TDD_A	dBm/Ch BW	-53.45 + 10log($N_{PRB,c}$/50)	-87.76 + 10log($N_{PRB,c}$/50)

Parameter		Unit	Cell 2	
			Test 1	Test 2
	Bands FDD_B1, FDD_B2 Note 10			-87.26 + 10log($N_{PRB,c}$/50)
	Bands FDD_C, TDD_C			-86.76 + 10log($N_{PRB,c}$/50)
	Bands FDD_D			-86.26 + 10log($N_{PRB,c}$/50)
	Bands FDD_E, FDD_F Note 7, TDD_E			-85.76 + 10log($N_{PRB,c}$/50)
	Bands FDD_G Note 8			-84.76 + 10log($N_{PRB,c}$/50)
	Bands FDD_H			-84.26 + 10log($N_{PRB,c}$/50)
Propagation Condition			AWGN	
Antenna Configuration			1x1	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: E-UTRA operating band groups are as defined in clause 3.5 of TS 36.133 [15].
NOTE 7: For Band 26, the tests shall be performed with the carrier frequency of assigned E-UTRA channel bandwidth within 865-894 MHz.
NOTE 8: Except Band 29.
NOTE 9: Except Band 32, Band 75 and Band 76.
NOTE 10: For Band 74, the tests shall be performed with the carrier frequency of the assigned E-UTRA channel bandwidth within 1475.9-1510.9 MHz.

A.16.7.5.1.3 Test Requirements

The SA inter-RAT E-UTRAN RSRP measurement accuracy for Cell 2 shall fulfil absolute requirement in clause 9.4A.2 and 9.4A.3.

A.16.7.5.2 SA: inter-RAT measurement accuracy with FR1 serving cell for 2 Rx UE

A.16.7.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the E-UTRAN RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.2A.2 for SA inter-RAT E-UTRAN RSRP measurements.

A.16.7.5.2.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an E-UTRAN inter-RAT neighbour cell. Supported test configurations are shown in table A.16.7.5.2.2-1. The measurement accuracy of SA inter-RAT E-UTRAN RSRP are tested by using the parameters in A.16.7.5.2.2-2 and A.16.7.5.2.2-3.

Table A.16.7.5.2.2-1: Inter-RAT E-UTRAN RSRP supported test configurations with FR1 serving cell

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode. E-UTRAN FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode. E-UTRAN TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.7.5.2.2-2: NR Cell specific test parameters for SA Inter-RAT E-UTRAN RSRP test parameters

Parameter		Unit	Cell 1
NR RF channel number			1
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
	Config 7.8		HD-FDD
TDD Configuration	Config 1, 4, 7, 8		N/A
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
$BW_{channel}$	Config 1, 4, 7, 8	MHz	10: $N_{PRB,c}$ = 52 (FDD)
	Config 2, 5		10: $N_{PRB,c}$ = 52 (TDD)
	Config 3, 6		20: $N_{PRB,c}$ = 51 (TDD)
Gap pattern Id			0
PDSCH reference measurement channel	Config 1, 4, 7, 8		SR.1.1 FDD
	Config 2, 5		SR.1.1 TDD
	Config 3, 6		SR.2.1 TDD
RMSI CORSET reference channel	Config 1, 4, 7, 8		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
Dedicated CORSET reference channel	Config 1, 4, 7, 8		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
CSI-RS for tracking	Config 1, 4, 7, 8		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
BWP configurations	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
OCNG pattern[Note1]			OP.1
SMTC configuration			SMTC.1
SSB configuration	Config 1, 2, 4, 5,7,8		SSB.1 FR1
	Config 3, 6		SSB.1 RedCap FR1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS			
EPRE ratio of OCNG to OCNG DMRS			
N_{oc}[Note2]		dBm/15 kHz	-104
N_{oc}[Note2]	Config 1, 2, 4, 5,7,8	dBm/SCS	-104
	Config 3, 6		-101
$\hat{E}_s/N_{oc}$		dB	17
$\hat{E}_s/I_{ot}$[Note3]		dB	17
SS-RSRP[Note3]	Config 1, 2, 4, 5,7,8	dBm/SCS	-87
	Config 3, 6		-84
SSB_RP[Note3]	Config 1, 2, 4, 5,7,8	dBm/SCS	-87
	Config 3, 6		-84
Io[Note3]	Config 1, 2, 4, 5,7,8	dBm/9.36 MHz	-58.96
	Config 3, 6	dBm/18.36 MHz	-56.03
Propagation condition			AWGN
Antenna Configuration and Correlation Matrix			1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Parameter	Unit	Cell 1
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		

Table A.16.7.5.2.2-3: E-UTRAN Cell specific test parameters for SA Inter-RAT E-UTRAN RSRP test parameters

Parameter		Unit	Cell 2	
			Test 1	Test 2
E-UTRA RF channel number			2	
Duplex mode	Config 1, 2, 3, 7		FDD	
	Config 4, 5, 6, 8		TDD	
TDD special subframe configuration[Note1]	Config 1, 2, 3, 7		N/A	
	Config 4, 5, 6, 8		6	
TDD uplink-downlink configuration[Note1]	Config 1, 2, 3, 7		N/A	
	Config 4, 5, 6, 8		1	
$BW_{channel}$		MHz	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]			-	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]	Config 1, 2, 3, 7		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
	Config 4, 5, 6, 8		5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]	Config 1, 2, 3, 7		5 MHz: OP.19 FDD 10 MHz: OP.6 FDD 20 MHz: OP.14 FDD	
	Config 4, 5, 6 ,8		5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD	
PBCH_RA		dB	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-91.65	-117
	Bands FDD_B1, FDD_B2 [Note 10]			-116.5
	Bands FDD_C, TDD_C			-116
	Bands FDD_D			-115.5
	Bands FDD_E, FDD_F [Note 7], TDD_E			-115
	Bands FDD_G [Note 8]			-114
	Bands FDD_H			-113.5
$\hat{E}_s/N_{oc}$		dB	10	-4
$\hat{E}_s/I_{ot}$[Note5]		dB	10	-4
RSRP[Note5]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-81.65	-121
	Bands FDD_B1, FDD_B2 [Note 10]			-120.5

Parameter		Unit	Cell 2	
			Test 1	Test 2
	Bands FDD_C, TDD_C			-120
	Bands FDD_D			-119.5
	Bands FDD_E, FDD_F Note 7, TDD_E			-119
	Bands FDD_G Note 8			-118
	Bands FDD_H			-117.5
SCH_RP Note5	Bands FDD_A Note 9, TDD_A	dBm/15 kHz	-81.65	-121
	Bands FDD_B1, FDD_B2 Note 10			-120.5
	Bands FDD_C, TDD_C			-120
	Bands FDD_D			-119.5
	Bands FDD_E, FDD_F Note 7, TDD_E			-119
	Bands FDD_G Note 8			-118
	Bands FDD_H			-117.5
Io Note5	Bands FDD_A Note 9, TDD_A	dBm/Ch BW	-53.45 + 10log($N_{PRB,c}$/50)	-87.76 + 10log($N_{PRB,c}$/50)
	Bands FDD_B1, FDD_B2 Note 10			-87.26 + 10log($N_{PRB,c}$/50)
	Bands FDD_C, TDD_C			-86.76 + 10log($N_{PRB,c}$/50)
	Bands FDD_D			-86.26 + 10log($N_{PRB,c}$/50)
	Bands FDD_E, FDD_F Note 7, TDD_E			-85.76 + 10log($N_{PRB,c}$/50)
	Bands FDD_G Note 8			-84.76 + 10log($N_{PRB,c}$/50)
	Bands FDD_H			-84.26 + 10log($N_{PRB,c}$/50)
Propagation Condition			AWGN	
Antenna Configuration and Correlation Matrix			1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: E-UTRA operating band groups are as defined in clause 3.5 of TS 36.133 [15].
NOTE 7: For Band 26, the tests shall be performed with the carrier frequency of assigned E-UTRA channel bandwidth within 865-894 MHz.
NOTE 8: Except Band 29.
NOTE 9: Except Band 32, Band 75 and Band 76.
NOTE 10: For Band 74, the tests shall be performed with the carrier frequency of the assigned E-UTRA channel bandwidth within 1475.9-1510.9 MHz.

A.16.7.5.2.3 Test Requirements

The SA inter-RAT E-UTRAN RSRP measurement accuracy for Cell 2 shall fulfil absolute requirement in clause 9.4A.2 and 9.4A.3.

A.16.7.6 E-UTRAN RSRQ

A.16.7.6.1 SA: inter-RAT measurement accuracy with FR1 serving cell for 1 Rx UE

A.16.7.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the E-UTRAN RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.2A.3 for SA inter-RAT E-UTRAN RSRQ measurements.

A.16.7.6.1.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an E-UTRAN inter-RAT neighbour cell. Supported test configurations are shown in table A.16.7.6.1.2-1. The measurement accuracy of SA inter-RAT E-UTRAN RSRQ are tested by using the parameters in A.16.7.6.1.2-2 and A.16.7.6.1.2-3.

Table A.16.7.6.1.2-1: Inter-RAT E-UTRAN RSRQ supported test configurations with FR1 serving cell

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode. E-UTRAN FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode. E-UTRAN TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.7.6.1.2-2: NR Cell specific test parameters for SA Inter-RAT E-UTRAN RSRQ test parameters

Parameter		Unit	Cell 1
NR RF channel number			1
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
	Config 7, 8		HD-FDD
TDD Configuration	Config 1, 4, 7, 8		N/A
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
$BW_{channel}$	Config 1, 4, 7, 8	MHz	10: $N_{PRB,c}$ = 52 (FDD)
	Config 2, 5		10: $N_{PRB,c}$ = 52 (TDD)
	Config 3, 6		20: $N_{PRB,c}$ = 51 (TDD)
Gap pattern Id			0
PDSCH reference measurement channel	Config 1, 4, 7, 8		SR.1.1 FDD
	Config 2, 5		SR.1.1 TDD
	Config 3, 6		SR.2.1 TDD
RMSI CORSET reference channel	Config 1, 4, 7, 8		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
Dedicated CORSET reference channel	Config 1, 4, 7, 8		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
CSI-RS for tracking	Config 1, 4, 7, 8		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
BWP configurations	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
OCNG pattern[Note1]			OP.1
SMTC configuration			SMTC.1
SSB configuration	Config 1, 2, 4, 5, 7, 8		SSB.1 FR1
	Config 3, 6		SSB.1 RedCap FR1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			

Parameter		Unit	Cell 1
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS			
EPRE ratio of OCNG to OCNG DMRS			
N_{oc} Note2		dBm/15 kHz	-104
N_{oc} Note2	Config 1, 2, 4, 5, 7, 8	dBm/SCS	-104
	Config 3, 6		-101
$\hat{E}_s/N_{oc}$		dB	17
$\hat{E}_s/I_{ot}$ Note3		dB	17
SS-RSRP Note3	Config 1, 2, 4, 5, 7, 8	dBm/SCS	-87
	Config 3, 6		-84
SSB_RP Note3	Config 1, 2, 4, 5, 7, 8	dBm/SCS	-87
	Config 3, 6		-84
Io Note3	Config 1, 2, 4, 5, 7, 8	dBm/9.36 MHz	-58.96
	Config 3, 6	dBm/18.36 MHz	-56.03
Propagation condition			AWGN
Antenna Configuration			1x1

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRQ, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.16.7.6.1.2-3: E-UTRAN Cell specific test parameters for SA Inter-RAT E-UTRAN RSRQ test parameters

Parameter		Unit	Cell 2		
			Test 1	Test 2	Test 3
E-UTRA RF channel number			2		
Duplex mode	Config 1, 2, 3, 7		FDD		
	Config 4, 5, 6, 8		TDD		
TDD special subframe configuration Note1	Config 1, 2, 3, 7		N/A		
	Config 4, 5, 6, 8		6		
TDD uplink-downlink configuration Note1	Config 1, 2, 3, 7		N/A		
	Config 4, 5, 6, 8		1		
$BW_{channel}$		MHz	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PDSCH parameters: DL Reference Measurement Channel Note2			-		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel Note2	Config 1, 2, 3, 7		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
	Config 4, 5, 6, 8		5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns Note2	Config 1, 2, 3, 7		5 MHz: OP.19 FDD 10 MHz: OP.6 FDD 20 MHz: OP.14 FDD		
	Config 4, 5, 6, 8		5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD		
PBCH_RA		dB	0		
PBCH_RB					
PSS_RA					
SSS_RA					

Parameter		Unit	Cell 2		
			Test 1	Test 2	Test 3
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA Note3					
OCNG_RB Note3					
N_{oc} Note4	Bands FDD_A Note 9, TDD_A	dBm/15 kHz	-83	-104.70	-119.5
	Bands FDD_B1, FDD_B2 Note 10				-119
	Bands FDD_C, TDD_C				-118.5
	Bands FDD_D				-118
	Bands FDD_E, FDD_F Note 7, TDD_E				-117.5
	Bands FDD_G Note 8				-116.5
	Bands FDD_H				-116
$\hat{E}_s/N_{oc}$		dB	-1.75	-4.0	-4.0
$\hat{E}_s/I_{ot}$ Note5		dB	-1.75	-4.0	-4.0
RSRP Note5	Bands FDD_A Note 9, TDD_A	dBm/15 kHz	-84.75	-108.70	-123.5
	Bands FDD_B1, FDD_B2 Note 10				-123
	Bands FDD_C, TDD_C				-122.5
	Bands FDD_D				-122
	Bands FDD_E, FDD_F Note 7, TDD_E				-121.5
	Bands FDD_G Note 8				-120.5
	Bands FDD_H				-120
RSRQ Note5	Bands FDD_A Note 9, TDD_A	dB	-14.76	-16.25	-16.25
	Bands FDD_B1, FDD_B2 Note 10				
	Bands FDD_C, TDD_C				
	Bands FDD_D				
	Bands FDD_E, FDD_F Note 7, TDD_E				
	Bands FDD_G Note 8				
	Bands FDD_H				
Io Note5	Bands FDD_A Note 9, TDD_A	dBm/Ch BW	-53 + 10log($N_{PRB,c}$ /50)	-75.46 + 10log($N_{PRB,c}$ /50)	-90.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_B1, FDD_B2 Note 10				-89.76 + 10log($N_{PRB,c}$ /50)
	Bands FDD_C, TDD_C				-89.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_D				-88.76 + 10log($N_{PRB,c}$ /50)
	Bands FDD_E, FDD_F Note 7, TDD_E				-88.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_G Note 8				-87.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_H				-86.76 + 10log($N_{PRB,c}$ /50)
Propagation Condition			AWGN		
Antenna Configuration			1x1		

Parameter	Unit	Cell 2		
		Test 1	Test 2	Test 3
NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].				
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.				
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, RSRQ and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 6: E-UTRA operating band groups are as defined in clause 3.5 of TS 36.133 [15].				
NOTE 7: For Band 26, the tests shall be performed with the carrier frequency of assigned E-UTRA channel bandwidth within 865-894 MHz.				
NOTE 8: Except Band 29.				
NOTE 9: Except Band 32, Band 75 and Band 76.				
NOTE 10: For Band 74, the tests shall be performed with the carrier frequency of the assigned E-UTRA channel bandwidth within 1475.9-1510.9 MHz.				

A.16.7.6.1.3 Test Requirements

The SA inter-RAT E-UTRAN RSRQ measurement accuracy for Cell 2 shall fulfil absolute requirement in clause 10.2A.3.

A.16.7.6.2 SA: inter-RAT measurement accuracy with FR1 serving cell for 2 Rx UE

A.16.7.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the E-UTRAN RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.2A.3 for SA inter-RAT E-UTRAN RSRQ measurements.

A.16.7.6.2.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an E-UTRAN inter-RAT neighbour cell. Supported test configurations are shown in table A.16.7.6.2.2-1. The measurement accuracy of SA inter-RAT E-UTRAN RSRQ are tested by using the parameters in A.16.7.6.2.22-2 and A.16.7.6.2.2-3.

Table A.16.7.6.2.2-1: Inter-RAT E-UTRAN RSRQ supported test configurations with FR1 serving cell

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode. E-UTRAN FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode. E-UTRAN TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.16.7.6.2.2-2: NR Cell specific test parameters for SA Inter-RAT E-UTRAN RSRQ test parameters

Parameter		Unit	Cell 1
NR RF channel number			1
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
	Config 7, 8		HD-FDD
TDD Configuration	Config 1, 4, 7, 8		N/A
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
$BW_{channel}$	Config 1, 4, 7, 8	MHz	10: $N_{PRB,c}$ = 52 (FDD)

Parameter		Unit	Cell 1
	Config 2, 5		10: $N_{PRB,c}$ = 52 (TDD)
	Config 3, 6		20: $N_{PRB,c}$ = 51 (TDD)
Gap pattern Id			0
PDSCH reference measurement channel	Config 1, 4, 7, 8		SR.1.1 FDD
	Config 2, 5		SR.1.1 TDD
	Config 3, 6		SR.2.1 TDD
RMSI CORSET reference channel	Config 1, 4, 7, 8		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
Dedicated CORSET reference channel	Config 1, 4, 7, 8		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
CSI-RS for tracking	Config 1, 4, 7, 8		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
BWP configurations	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
OCNG pattern[Note1]			OP.1
SMTC configuration			SMTC.1
SSB configuration	Config 1, 2, 4, 5, 7, 8		SSB.1 FR1
	Config 3, 6		SSB.1 RedCap FR1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS			
EPRE ratio of OCNG to OCNG DMRS			
N_{oc}[Note2]		dBm/15 kHz	-104
N_{oc}[Note2]	Config 1, 2, 4, 5, 7, 8	dBm/SCS	-104
	Config 3, 6		-101
$\hat{E}_s/N_{oc}$		dB	17
$\hat{E}_s/I_{ot}$[Note3]		dB	17
SS-RSRP[Note3]	Config 1, 2, 4, 5, 7, 8	dBm/SCS	-87
	Config 3, 6		-84
SSB_RP[Note3]	Config 1, 2, 4, 5, 7, 8	dBm/SCS	-87
	Config 3, 6		-84
Io[Note3]	Config 1, 2, 4, 5, 7, 8	dBm/9.36 MHz	-58.96
	Config 3, 6	dBm/18.36 MHz	-56.03
Propagation condition			AWGN
Antenna Configuration and Correlation Matrix			1x2 Low

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRQ, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.16.7.6.2.2-3: E-UTRAN Cell specific test parameters for SA Inter-RAT E-UTRAN RSRQ test parameters

Parameter		Unit	Cell 2		
			Test 1	Test 2	Test 3
E-UTRA RF channel number			2		
Duplex mode	Config 1, 2, 3, 7		FDD		
	Config 4, 5, 6, 8		TDD		
TDD special subframe configuration[Note1]	Config 1, 2, 3, 7		N/A		
	Config 4, 5, 6, 8		6		
TDD uplink-downlink configuration[Note1]	Config 1, 2, 3, 7		N/A		
	Config 4, 5, 6, 8		1		
$BW_{channel}$		MHz	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PDSCH parameters: DL Reference Measurement Channel[Note2]			-		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]	Config 1, 2, 3, 7		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
	Config 4, 5, 6, 8		5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note2]	Config 1, 2, 3, 7		5 MHz: OP.19 FDD 10 MHz: OP.6 FDD 20 MHz: OP.14 FDD		
	Config 4, 5, 6, 8		5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD		
PBCH_RA		dB	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note3]					
OCNG_RB[Note3]					
N_{oc}[Note4]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-83	-104.70	-119.5
	Bands FDD_B1, FDD_B2 [Note 10]				-119
	Bands FDD_C, TDD_C				-118.5
	Bands FDD_D				-118
	Bands FDD_E, FDD_F [Note 7], TDD_E				-117.5
	Bands FDD_G [Note 8]				-116.5
	Bands FDD_H				-116
$\hat{E}_s/N_{oc}$		dB	-1.75	-4.0	-4.0
$\hat{E}_s/I_{ot}$[Note5]		dB	-1.75	-4.0	-4.0
RSRP[Note5]	Bands FDD_A [Note 9], TDD_A	dBm/15 kHz	-84.75	-108.70	-123.5
	Bands FDD_B1, FDD_B2 [Note 10]				-123
	Bands FDD_C, TDD_C				-122.5
	Bands FDD_D				-122
	Bands FDD_E, FDD_F [Note 7], TDD_E				-121.5
	Bands FDD_G [Note 8]				-120.5

Parameter		Unit	Cell 2		
			Test 1	Test 2	Test 3
	Bands FDD_H				-120
RSRQ Note5	Bands FDD_A Note 9, TDD_A	dB	-14.76	-16.25	-16.25
	Bands FDD_B1, FDD_B2 Note 10				
	Bands FDD_C, TDD_C				
	Bands FDD_D				
	Bands FDD_E, FDD_F Note 7, TDD_E				
	Bands FDD_G Note 8				
	Bands FDD_H				
Io Note5	Bands FDD_A Note 9, TDD_A	dBm/Ch BW	-53 + 10log($N_{PRB,c}$ /50)	-75.46 + 10log($N_{PRB,c}$ /50)	-90.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_B1, FDD_B2 Note 10				-89.76 + 10log($N_{PRB,c}$ /50)
	Bands FDD_C, TDD_C				-89.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_D				-88.76 + 10log($N_{PRB,c}$ /50)
	Bands FDD_E, FDD_F Note 7, TDD_E				-88.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_G Note 8				-87.26 + 10log($N_{PRB,c}$ /50)
	Bands FDD_H				-86.76 + 10log($N_{PRB,c}$ /50)
Propagation Condition			AWGN		
Antenna Configuration and Correlation Matrix			1x2 Low		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, RSRQ and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: E-UTRA operating band groups are as defined in clause 3.5 of TS 36.133 [15].
NOTE 7: For Band 26, the tests shall be performed with the carrier frequency of assigned E-UTRA channel bandwidth within 865-894 MHz.
NOTE 8: Except Band 29.
NOTE 9: Except Band 32, Band 75 and Band 76.
NOTE 10: For Band 74, the tests shall be performed with the carrier frequency of the assigned E-UTRA channel bandwidth within 1475.9-1510.9 MHz.

A.16.7.6.2.3 Test Requirements

The SA inter-RAT E-UTRAN RSRQ measurement accuracy for Cell 2 shall fulfil absolute requirement in clause 10.2A.3.

A.16.7.7 RSTD measurements

A.16.7.7.1 RSTD measurement accuracy test case for RedCap UE without FH

A.16.7.7.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC CONNECTED state meets the accuracy requirements specified in clause 10.1A.16.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.16.7.7.1.1-1.

Table A.16.7.7.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the RedCap UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9A.2.

The RSTD measurement accuracy in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

Table A.16.7.7.1.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1	
			Cell 1	Cell 2
PRS ARFCN	1,2,3,4		freq1	Freq1
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52	
	2		10: $N_{RB,c}$ = 52	
	3		20: $N_{RB,c}$ = 51	
	4		10: $N_{RB,c}$ = 52	
Duplex mode	1		FDD	
	2		TDD	
	3		TDD	
	4		HD-FDD	
TDD configuration	1		N/A	
	2		TDDConf.1.1	
	3		TDDConf.2.1	
	4		N/A	
Measurement gap	1, 2, 3, 4		GP#24 or GP#0	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-
	2		SR.1.1 TDD	
	3		SR.2.1 TDD	
	4		SR.1.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-
	2		CR.1.1 TDD	-
	3		CR.2.1 TDD	-
	4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-

	3		CCR.2.1 TDD	-
	4		CCR.1.1 FDD	
SSB configuration	1		SSB.1 FR1	
	2		SSB.1 FR1	
	3		SSB.1 RedCap FR1	
	4		SSB.1 FR1	
OCNG Patterns	1,2,3,4		OP.1	
TRS configuration	1		TRS.1.1 FDD	-
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
	4		TRS.1.1 FDD	
Initial BWP Configuration	1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1,2,3,4		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1,2,3,4	µs	-	3
SMTC configuration	1,4		SMTC.2	
	2,3		SMTC.1	
PRS configuration	1		PRS.1.1 FR1	
	2		PRS.1.1 FR1	
	3		PRS.2.1 FR1	
	4		PRS.1.1 FR1	
PRS Resource slot offset	1, 2, 3, 4	slot	0	4
Expected RSTD	1, 2, 3, 4	µs	N/A	3
Expected RSTD uncertainty	1, 2, 3, 4	µs	N/A	5
EPRE ratio of PSS to SSS	1,2,3,4	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS	1,2,3,4	dB	0	0
N_{oc} Note2	1,2,4	dBm/ SCS	-98	
	3		-95	
PRS $\hat{E}_s/I_{ot}$	1,2,3,4	dB	-6	-13
PRP Note3	1,2,4	dBm/SCS	-103.7	-109.9
	3		-100.7	-106.9
Io Note3	1,2,4	dBm/ 9.36MHz	-68.8	-68.8
	3	dBm/ 18.36MHz	-65.88	-65.88
PRS $\hat{E}_s/N_{oc}$	1,2,3,4	dB	-5.7	-11.9
Propagation condition	1,2,3,4	-	AWGN	
Antenna configuration	1,2,3,4		1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.				

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.16.7.7.1.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1A.16.2.

A.16.7.7.2 RSTD measurement accuracy test case for RedCap UE with FH in RRC_CONNECTED state

A.16.7.7.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE with FH in RRC CONNECTED state meets the accuracy requirements specified in clause 10.1A.16.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.16.7.7.2.1-1.

Table A.16.7.7.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, cell bandwidth 50 Hz, FDD duplex mode
2	15 kHz SSB SCS, cell bandwidth 50 Hz, TDD duplex mode
3	30 kHz SSB SCS, cell bandwidth 100 Hz, TDD duplex mode
4	15 kHz SSB SCS, cell bandwidth 50 Hz, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: UE with 1 Rx or 2 Rx is required to meet the same requirements specified in this clause. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 4: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the RedCap UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9A.2.

The RSTD measurement accuracy in this clause is valid for the cases where the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* as specified in TS 37.355 [34], clause 6.5.12. The frequency hopping configurations are specified in clause A.3.31.

Table A.16.7.7.2.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1	
			Cell 1	Cell 2
PRS ARFCN	1,2,3,4		freq1	Freq1
$BW_{channel}$	1	MHz	50: $N_{RB,c}$ = 270	
	2		50: $N_{RB,c}$ = 270	
	3		100: $N_{RB,c}$ = 273	
	4		50: $N_{RB,c}$ = 270	
Duplex mode	1		FDD	
	2		TDD	

	3		TDD	
	4		HD-FDD	
TDD configuration	1		N/A	
	2		TDDConf.1.1	
	3		TDDConf.2.1	
	4		N/A	
Measurement gap	1, 2, 3, 4		GP#24 or GP#0	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-
	2		SR.1.1 TDD	
	3		SR.2.1 TDD	
	4		SR.1.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-
	2		CR.1.1 TDD	-
	3		CR.2.1 TDD	-
	4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-
	4		CCR.1.1 FDD	
SSB configuration	1		SSB.1 FR1	
	2		SSB.1 FR1	
	3		SSB.1 RedCap FR1	
	4		SSB.1 FR1	
OCNG Patterns	1,2,3,4		OP.1	
TRS configuration	1		TRS.1.1 FDD	-
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
	4		TRS.1.1 FDD	
Initial BWP Configuration	1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1,2,3,4		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1,2,3,4	µs	-	3
SMTC configuration	1,4		SMTC.2	
	2,3		SMTC.1	
PRS configuration	1		PRS.1.5 FR1	
	2		PRS.1.5 FR1	
	3		PRS.2.6 FR1	
	4		PRS.1.5 FR1	
PRS Resource slot offset	1, 2, 3, 4	slot	0	4
Expected RSTD	1, 2, 3, 4	µs	N/A	3
Expected RSTD uncertainty	1, 2, 3, 4	µs	N/A	5
EPRE ratio of PSS to SSS	1,2,3,4	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS	1,2,3,4	dB	0	0
N_{oc} Note2	1,2,4	dBm/ SCS	-98	
	3		-95	
PRS $\hat{E}_s / I_{ot}$	1,2,3,4	dB	-6	-13
PRP Note3	1,2,4		-103.7	-109.9

	3	dBm/SCS	-100.7	-106.9
Io[Note3]	1,2,4	dBm/48.6MHz	-61.64	-61.64
	3	dBm/98.28MHz	-58.51	-58.51
PRS $\hat{E}_s/N_{oc}$	1,2,3,4	dB	-5.7	-11.9
Propagation condition	1,2,3,4	-	AWGN	
Antenna configuration	1,2,3,4		1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted. NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.				

A.16.7.7.2.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1A.16.2.

A.16.7.8 UE Rx-Tx measurements

A.16.7.8.1 UE Rx-Tx time difference measurement accuracy for single positioning frequency layer in FR1 SA for RedCap UE without RX FH in RRC_CONNECTED mode

A.16.7.8.1.1 Test purpose and environment

The purpose of the test is to verify that the accuracy of the UE Rx-Tx time difference measurement without RX FH reported by the RedCap UE is within the specified limits in clause 10.1A.18.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations is listed in table A.16.7.8.1.1-1.

Table A.16.7.8.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE before the start of the test. The UE Rx-Tx measurement accuracy test in

this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform UE Rx-Tx time difference measurement with RX FH via *NR-Multi-RTT-RequestLocationInformation* or the UE is configured by the LMF to perform UE Rx-Tx time difference measurement with RX FH via *NR-Multi-RTT-RequestLocationInformation* but reports the UE Rx-Tx time difference measurement based on the single hop in *NR-Multi-RTT-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The UE is configured with measurement gap pattern ID #0 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.16.7.8.1.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.16.7.8.1.2-1.

Table A.16.7.8.1.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Cell 1	Cell 2
RF Channel Number		1,2,3,4	1	1
Measurement gap		1,2,3,4	GP#24 or GP#0 Note 4	
DRX		1,2,3,4	OFF	
Time offset with Cell 1	µs	1,2,3,4	N/A	3
TDD configuration		1,4	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1,4	SR.1.1 FDD	N/A
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET RMC configuration		1,4	CR.1.1 FDD	N/A
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1,4	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns		1,2,3,4	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1,2,3,4	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				

EPRE ratio of OCNG to OCNG DMRS Note 1				
EPRE ratio of PRS to SSS				
TRS Configuration		1,4	TRS.1.1 FDD	N/A
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
Initial BWP configuration		1,2,3,4	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1,2,3,4	DLBWP.1.1 RedCap	N/A
Active UL BWP configuration		1,2,3,4	ULBWP.1.1 RedCap	N/A
PRS configuration		1,4	PRS.1.1 FR1	PRS.1.1 FR1
		2	PRS.1.1 FR1	PRS.1.1 FR1
		3	PRS.2.1 FR1	PRS.2.1 FR1
PRS Resource slot offset	slot	1,2,3,4	0	4
SRS configuration		1,4	POS-SRS.1	N/A
		2	POS-SRS.1	N/A
		3	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1,4	-98	
		2	-98	
		3	-95	
PRS $\hat{E}_s/I_{ot}$	dB	1,2,3,4	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1,2,3,4	-2	-10
PRP Note 3	dBm/SCS kHz	1,4	-100	-108
		2	-100	-108
		3	-97	-105
Io	dBm/9.36 MHz	1,4	-66.22	-66.22
	dBm/9.36 MHz	2	-66.22	-66.22
	dBm/18.72 MHz	3	-63.22	-63.22
Propagation Condition		1,2,3,4	AWGN	

A.16.7.8.1.3 Test requirements

The UE Rx-Tx time difference measurement without RX FH fulfils the UE Rx-Tx measurement accuracy requirements for AWGN propagation condition specified in the clause 10.1A.18.2.

A.16.7.8.2 SA: UE Rx-Tx time difference measurement accuracy with Rx FH in RRC_CONNECTED state in FR1

A.16.7.8.2.1 Test purpose and Environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy in RRC_CONNECTED with FH by a RedCap UE is within the specified limits. This test will verify the requirements in clause 10.1A.18.2.3 and 10.1A.18.2.4. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.16.7.8.2.1-1.

Table A.16.7.8.2.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	NR 30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations in each supported band.	

NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz.
NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE before the start of the test. The test requirements apply when *frequencyHopping* is configured to UE.

The UE is configured with measurement gap pattern ID #0 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.16.7.8.2.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.16.7.8.2.2-1.

Table A.16.7.8.2.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
RF Channel Number		1,2,3,4	1	1	1	1
Measurement gap		1,2,3,4	GP#24 or GP#0 Note 4		GP#24 or GP#0 Note 4	
DRX		1,2,3,4	OFF		OFF	
Time offset with Cell 1	μs	1, 2, 3, 4	N/A	3	N/A	3
TDD configuration		1, 4	N/A	N/A	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1, 4	SR.1.1 FDD	N/A	SR.1.1 FDD	N/A
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD	N/A	CR.1.1 FDD	N/A
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD	N/A	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3, 4	OP.1	OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1, 2, 3, 4	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						

EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1, 4	TRS.1.1 FDD	N/A	TRS.1.1 FDD	N/A
		2	TRS.1.1 TDD		TRS.1.1 TDD	
		3	TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1	N/A	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1, 2, 3, 4	DLBWP.1.1	N/A	DLBWP.1.1	N/A
Active UL BWP configuration		1, 2, 3, 4	ULBWP.1.1	N/A	ULBWP.1.1	N/A
PRS configuration		1, 4	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1
		2	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1
		3	PRS.2.6 FR1	PRS.2.6 FR1	PRS.2.6 FR1	PRS.2.6 FR1
PRS Resource slot offset	slot	1, 2, 3, 4	0	4	0	4
SRS configuration		1, 4	POS-SRS.1	N/A	POS-SRS.1	N/A
		2	POS-SRS.1	N/A	POS-SRS.1	N/A
		3	POS-SRS.2	N/A	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1	-98		-98	
		2	-98		-98	
		3	-95		-95	
		4	-98		-98	
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
		2				
		3				
		4				
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	-12.12	-2.41	-12.12
		2				
		3				
		4				
PRS $\hat{E}_s/N_{oc}$	dB	1	-2	-10	-2	-10
		2				
		3				
		4				
PRP Note 3	dBm/SCS	1	-100	-108	-100	-108
		2	-100	-108	-100	-108
		3	-97	-105	-97	-105
		4	-100	-108	-100	-108
Io	dBm/48.6MHz	1	-60.51	-60.51	-60.51	-60.51
	dBm/48.6MHz	2	-60.51	-60.51	-60.51	-60.51
	dBm/98.28MHz	3	-57.46	-57.46	-57.46	-57.46
	dBm/48.6MHz	4	-60.51	-60.51	-60.51	-60.51
Propagation Condition		1, 2, 3, 4	AWGN		AWGN	

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.

A.16.7.8.2.3 Test requirements

The UE Rx-Tx time difference measurement fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1A.18.2.3 and 10.1A.18.2.4 for both Cell 1 and Cell 2.

A.16.7.9 PRS-RSRP Measurements

A.16.7.9.1 PRS-RSRP measurement accuracy without FH in RRC_CONNECTED state in FR1

A.16.7.9.1.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRP measurement in RRC_CONNECTED without FH by a RedCap UE is within the specified limits. This test will verify the requirements in clauses 10.1A.17.2.

A.16.7.9.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.16.7.9.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in A.16.7.9.1.2-2. In all test cases, Cell 1 is the PCell. PRS RX hopping is not requested in *NR-DL-AoD-RequestLocationInformation*.

Table A.16.7.9.1.2-1: PRS-RSRP supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.7.9.1.2-2: PRS-RSRP test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1,4		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1,2,4	MHz	10: $N_{RB,c}$ = 52			
	Config 2		20: $N_{RB,c}$ = 51			
Downlink initial BWP configuration			DLBWP.0.1			

Downlink dedicated BWP configuration			DLBWP.1.1 RedCap			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1 RedCap			
TRS configuration	Config 1,4		TRS.1.1 FDD	N/A	TRS.1.1 FDD	N/A
	Config 2		TRS.1.1 TDD	N/A	TRS.1.1 TDD	N/A
	Config 3		TRS.1.2 TDD	N/A	TRS.1.2 TDD	N/A
DRX Cycle		ms	Not Applicable			
Measurement gap			GP#24 or GP#0 Note 6			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD	
PRS configuration	Config 1,4		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1
	Config 2		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1
	Config 3		PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.3 FR1
PRS Resource slot offset (slot)	Config 1,2,3,4	slot	0	4	0	4
SSB configuration	Config 1,4		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.1 RedCap FR1	SSB.1 RedCap FR1	SSB.1 RedCap FR1	SSB.1 RedCap FR1
Time offset with Cell 1	Config 1,4	µs	-	3	-	3
	Config 2,3		-	3	-	3
Expected RSTD	Config 1,2,3,4	µs	3			
Expected RSTD uncertainty	Config 1,2,3,4	µs	5			
SMTC configuration	Config 1,2,3,4		SMTC.1 RedCap			
OCNG Patterns			OCNG pattern 1			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
EPRE ratio of PRS to SSS		dB	0	0	0	0

N_{oc} Note2	Config 1,2,4		dBm/15kHz	-98		-98	
	Config 3			-98		-98	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-98		-98	
	Config 3			-95		-95	
PRS $\hat{E}_s/I_{ot}$			dB	-2.41	-12.12	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$			dB	-2	-10	-2	-10
PRP Note3	Config 1,2,4		dBm/SCS	-100	-108	-100	-108
	Config 3			-97	-105	-97	-105
Io Note3	Config 1,2,4		dBm/9.36MHz	-67.67		-67.67	
	Config 3		dBm/18.36MHz	-64.75		-64.75	
Propagation condition				AWGN			
Antenna configuration				1x2			

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.
NOTE 6: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.

A.16.7.9.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.17.2.1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1A.17.2.2.

A.16.7.9.2 PRS-RSRP measurement accuracy with FH in RRC_CONNECTED state in FR1

A.16.7.9.2.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRP measurement in RRC_CONNECTED with FH by a RedCap UE is within the specified limits. This test will verify the requirements in clauses 10.1A.17.2.

A.16.7.9.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.16.7.9.2.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in A.16.7.9.2.2-2. In all test cases, Cell 1 is the PCell. PRS RX hopping is present in *NR-DL-AoD-RequestLocationInformation*.

Table A.16.7.9.2.2-1: PRS-RSRP supported test configurations

Configuration	Description

1	15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

Table A.16.7.9.2.2-2: PRS-RSRP test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1,4		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1,2,4	MHz	50: $N_{RB,c}$ = 270			
	Config 3		100: $N_{RB,c}$ = 273			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1 RedCap			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1 RedCap			
TRS configuration	Config 1,4		TRS.1.1 FDD	N/A	TRS.1.1 FDD	N/A
	Config 2		TRS.1.1 TDD	N/A	TRS.1.1 TDD	N/A
	Config 3		TRS.1.2 TDD	N/A	TRS.1.2 TDD	N/A
DRX Cycle		ms	Not Applicable			
Measurement gap			GP#24 or GP#0 Note 6			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD	
PRS configuration	Config 1,4		PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1
	Config 2		PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1
	Config 3		PRS.2.6 FR1	PRS.2.6 FR1	PRS.2.6 FR1	PRS.2.6 FR1
PRS Resource slot offset (slot)	Config 1,2,3,4	slot	0	4	0	4
SSB configuration	Config 1,4		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1

	Config 3		SSB.1 RedCap FR1	SSB.1 RedCap FR1	SSB.1 RedCap FR1	SSB.1 RedCap FR1
Time offset with Cell 1	Config 1,4	µs	-	3	-	3
	Config 2,3		-	3	-	3
Expected RSTD	Config 1,2,3,4	µs	3			
Expected RSTD uncertainty	Config 1,2,3,4	µs	5			
SMTC configuration	Config 1,2,3,4		SMTC.1 RedCap			
OCNG Patterns			OCNG pattern 1			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
EPRE ratio of PRS to SSS		dB	0	0	0	0
N_{oc} Note2	Config 1,2,4	dBm/15kHz	-98		-98	
	Config 3		-98		-98	
N_{oc} Note2	Config 1,2,4	dBm/SCS	-98		-98	
	Config 3		-95		-95	
PRS $\hat{E}_s/I_{ot}$		dB	-2.41	-12.12	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$		dB	-2	-10	-2	-10
PRP Note3	Config 1,2,4	dBm/SCS	-100	-108	-100	-108
	Config 3		-97	-105	-97	-105
Io Note3	Config 1,2,4	dBm/48.6MHz	-60.51		-60.51	
	Config 3	dBm/98.28MHz	-57.46		-57.46	
Propagation condition			AWGN			
Antenna configuration			1x2			

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.
NOTE 6: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.

A.16.7.9.2.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.17.2.1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1A.17.2.2.

A.16.7.10 PRS-RSRPP measurements

A.16.7.10.1 PRS-RSRPP measurement accuracy without FH in RRC_CONNECTED state in FR1

A.16.7.10.1.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRPP measurement in RRC_CONNECTED without FH by a RedCap UE is within the specified limits. This test will verify the requirements in clauses 10.1A.19.2.

A.16.7.10.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.16.7.10.1.2-1. Both absolute accuracy of PRS-RSRPP measurements are tested by using the parameters in A.16.7.10.1.2-2. In all test cases, Cell 1 is the PCell. PRS RX hopping is not requested in *NR-DL-AoD-RequestLocationInformation*.

Table A.16.7.10.1.2-1: PRS-RSRPP supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.7.10.1.2-2: PRS-RSRPP test parameters

Parameter		Unit	Cell 1	Cell 2
Cell ID			489	0
SSB ARFCN			freq1	
Duplex mode	Config 1,4		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,2,4	MHz	10: $N_{RB,c}$ = 52	
	Config 2		20: $N_{RB,c}$ = 51	
Downlink initial BWP configuration			DLBWP.0.1	
Downlink dedicated BWP configuration			DLBWP.1.1 RedCap	
Uplink initial BWP configuration			ULBWP.0.1	
Uplink dedicated BWP configuration			ULBWP.1.1 RedCap	
TRS configuration	Config 1,4		TRS.1.1 FDD	N/A
	Config 2		TRS.1.1 TDD	N/A
	Config 3		TRS.1.2 TDD	N/A
DRX Cycle		ms	Not Applicable	
Measurement gap			GP#24 or GP#0 Note 6	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-

		Config 2		SR.1.1 TDD	
		Config 3		SR2.1 TDD	
RMSI CORESET Reference Channel		Config 1,4		CR.1.1 FDD	-
		Config 2		CR.1.1 TDD	
		Config 3		CR2.1 TDD	
Control channel RMC		Config 1,4		CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD	
		Config 3		CCR2.1 TDD	
PRS configuration		Config 1,4		PRS.1.3 FR1	PRS.1.3 FR1
		Config 2		PRS.1.3 FR1	PRS.1.3 FR1
		Config 3		PRS.2.3 FR1	PRS.2.3 FR1
PRS Resource slot offset (slot)		Config 1,2,3,4	slot	0	4
SSB configuration		Config 1,4		SSB.1 FR1	SSB.1 FR1
		Config 2		SSB.1 FR1	SSB.1 FR1
		Config 3		SSB.1 RedCap FR1	SSB.1 RedCap FR1
Time offset with Cell 1		Config 1,4	µs	-	3
		Config 2,3		-	3
Expected RSTD		Config 1,2,3,4	µs	3	
Expected RSTD uncertainty		Config 1,2,3,4	µs	5	
SMTC configuration		Config 1,2,3,4		SMTC.1 RedCap	
OCNG Patterns				OCNG pattern 1	
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
EPRE ratio of PRS to SSS			dB	0	0
N_{oc} Note2	Config 1,2,4		dBm/15kHz	-98	
	Config 3			-98	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-98	
	Config 3			-95	
PRS $\hat{E}_s/I_{ot}$			dB	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$			dB	-2	-10
PRP Note3	Config 1,2,4		dBm/SCS	-100	-108
	Config 3			-97	-105
Io Note3	Config 1,2,4		dBm/9.36MHz	-67.67	
	Config 3		dBm/18.36MHz	-64.75	
Propagation condition				AWGN	
Antenna configuration				1x2	

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.
NOTE 6: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.

A.16.7.10.1.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.19.2.

A.16.7.10.2 SA: PRS-RSRPP measurement accuracy with Rx FH in RRC_CONNECTED state in FR1

A.16.7.10.2.1 Test purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRPP measurement in RRC_CONNECTED with FH by a RedCap UE is within the specified limits. This test will verify the requirements in clauses 10.1A.19.2.

A.16.7.10.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.16.7.10.2.2-1. Both absolute and relative accuracy of PRS-RSRPP measurements are tested by using the parameters in A.16.7.10.2.2-2. In all test cases, Cell 1 is the PCell. PRS RX hopping is requested in *NR-DL-AoD-RequestLocationInformation*.

Table A.16.7.10.2.2-1: PRS-RSRPP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	NR 30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations in each supported band. NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

Table A.16.7.10.2.2-2: PRS-RSRPP test parameters

Parameter		Unit	Cell 1	Cell 2
Cell ID			489	0
SSB ARFCN			freq1	
Duplex mode	Config 1,4		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,2,4	MHz	50: $N_{RB,c}$ = 270	
	Config 3		100: $N_{RB,c}$ = 273	
Downlink initial BWP configuration			DLBWP.0.1	
Downlink dedicated BWP configuration			DLBWP.1.1 RedCap	
Uplink initial BWP configuration			ULBWP.0.1	
Uplink dedicated BWP configuration			ULBWP.1.1 RedCap	
TRS configuration	Config 1,4		TRS.1.1 FDD	N/A

	Config 2			TRS.1.1 TDD	N/A
	Config 3			TRS.1.2 TDD	N/A
DRX Cycle			ms	Not Applicable	
Measurement gap				GP#24 or GP#0 Note 5	
PDSCH Reference measurement channel	Config 1,4			SR.1.1 FDD	-
	Config 2			SR.1.1 TDD	
	Config 3			SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4			CR.1.1 FDD	-
	Config 2			CR.1.1 TDD	
	Config 3			CR2.1 TDD	
Control channel RMC	Config 1,4			CCR.1.1 FDD	-
	Config 2			CCR.1.1 TDD	
	Config 3			CCR2.1 TDD	
PRS configuration	Config 1,4			PRS.1.5 FR1	PRS.1.5 FR1
	Config 2			PRS.1.5 FR1	PRS.1.5 FR1
	Config 3			PRS.2.6 FR1	PRS.2.6 FR1
PRS Resource slot offset (slot)	Config 1,2,3,4		slot	0	4
SSB configuration	Config 1			SSB.1 FR1	SSB.1 FR1
	Config 2			SSB.1 FR1	SSB.1 FR1
	Config 3			SSB.1 RedCap FR1	SSB.1 RedCap FR1
Time offset with Cell 1	Config 1		ms	-	3
	Config 2,3		μs	-	3
Expected RSTD	Config 1,2,3,4		μs	3	
Expected RSTD uncertainty	Config 1,2,3,4			5	
SMTC configuration	Config 1,2,3,4			SMTC.1 RedCap	
OCNG Patterns				OCNG pattern 1	
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
EPRE ratio of PRS to SSS			dB	0	0
N_{oc} Note2	Config 1,2,4		dBm/15kHz	-98	
	Config 3			-98	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-98	
	Config 3			-95	
PRS $\hat{E}_s/I_{ot}$			dB	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$			dB	-2	-10
PRS-RSRPP Note3	Config 1, 2,4		dBm/SCS	-100	-108
	Config 3			-97	-105

Io[Note3]	Config 1,2,4		dBm/48.6MHz	-60.51
	Config 3		dBm/98.28MHz	-57.46
Propagation condition				Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ µs and $f_D = 5$ Hz
Antenna configuration				1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: PRS-RSRPP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. NOTE 5: GP#24 is configured if UE supports MG#24, otherwise GP#0 is configured.				

A.16.7.10.2.3 Test requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.19.2.

A.16.8 Measurement Procedure for RedCap in RRC_INACTIVE

A.16.8.1 RSTD Measurements

A.16.8.1.1 NR RSTD measurement reporting delay test case for for RedCap UE without FH in FR1 SA in RRC_INACTIVE state

A.16.8.1.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC INACTIVE state meets the requirements specified in clause 5.6A.4.5 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.16.8.1.1.1-1.

Table A.16.8.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell 3. During T2 UE shall be

in RRC_INACTIVE state and all three cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the RedCap UE during T1. The measurement reporting delay test in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The last TTI containing the two messages shall be provided to the RedCap UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request. The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s).

The UE is configured with DRX cycle of 1.28s.

The general test parameters are listed in table A.16.8.1.1.1-2, and cell specific test parameters are listed in table A.16.8.1.1.1-3 and table A.16.8.1.1.1-4.

Table A.16.8.1.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.1 RedCap FR1	
	Config 4		SSB.1 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
	Config 4		SMTC.2	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
	Config 4		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
	Config 4		CR.1.1 FDD	
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
	Config 4		CCR.1.1 FDD	
Initial BWP configuration	Config 1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Active UL BWP configuration	Config 1,2,3,4		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.1 FR1	
	Config 3		PRS.2.1 FR1	

Config 4		PRS.1.1 FR1	
Physical cell ID PCI		(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length		Normal	
DRX	s	1.28	
Radio frame receive time offset between the cells at the UE antenna connector	µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD	µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells	µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		3	Including the reference cell
PRS muting info		Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	5	The length of the time interval that follows immediately after time interval T1.

Table A.16.8.1.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
	Config 4	dBm/SCS	-98		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 9.36MHz	-59.63	-59.63	-59.63
	Config 2	dBm/ 9.36MHz	-59.63	-59.63	-59.63
	Config 3	dBm/ 18.36MHz	-56.71	-56.71	-56.71

	Config 4	dBm/ 9.36MHz	-59.63	-59.63	-59.63
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
	Config 4	dBm/SCS	-88	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.16.8.1.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
	Config 4	dBm/SCS	-98	-98	-98
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
	Config 4	dB	-5.45	-11.67	-11.67
Io Note 4	Config 1	dBm/ 9.36MHz	-68.52	-68.52	-68.52
	Config 2	dBm/ 9.36MHz	-68.52	-68.52	-68.52
	Config 3	dBm/ 18.36MHz	-65.61	-65.61	-65.61
	Config 4	dBm/ 9.36MHz	-68.52	-68.52	-68.52
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T2) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

A.16.8.1.1.2 Test Requirements

The RSTD measurement time without FH for RedCap fulfils the requirements specified in clause 5.6A.4.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6A.4.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3, i.e., between RSTD_0000000 and RSTD1970049.

A.16.8.1.2 NR RSTD measurement reporting delay test case with PRS frequency hopping

A.16.8.1.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 5.6A.4.6 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.16.8.1.2.1-1.

Table A.16.8.1.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: UE with 1 Rx or 2 Rx is required to meet the same requirements specified in this clause. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 4: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell 3. During T2 UE shall be in RRC_INACTIVE state and all three cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be

provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The test requirements apply when *frequencyHopping* is configured to UE.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s).

The UE is configured with DRX cycle of 1.28s.

The general test parameters are listed in table A.16.8.1.2.1-2, and cell specific test parameters are listed in table A.16.8.1.2.1-3 and table A.16.8.1.2.1-4.

Table A.16.8.1.2.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
CD-SSB configuration	Config 1, 4		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.1 RedCap FR1	
NCD-SSB configuration	Config 1, 4		SSB.6 RedCap FR1	NCD-SSB is configured within dedicated RedCap DL BWP.
	Config 2		SSB.6 RedCap FR1	
	Config 3		SSB.7 RedCap FR1	
SMTC configuration	Config 1, 4		SMTC.4 RedCap	
	Config 2		SMTC.2 RedCap	
	Config 3		SMTC.2 RedCap	
PDSCH RMC configuration	Config 1, 4		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1, 4		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1, 4		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
Initial BWP configuration	Config 1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Active UL BWP configuration	Config 1,2,3,4		ULBWP.1.1	
PRS Configuration	Config 1, 4		PRS.1.5 FR1	
	Config 2		PRS.1.5 FR1	

	Config 3		PRS.2.6 FR1	PRS configured with frequency hopping as specified in clause A.3.31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	1.28	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			3	Including the reference cell
PRS muting info			Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		s	5	The length of the time interval that follows immediately after time interval T1.

Table A.16.8.1.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1, 4	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1, 4	dBm/ 48.6MHz	-52.48	-62.89	-62.89
	Config 2	dBm/ 48.6MHz	-52.48	-62.89	-62.89
	Config 3	dBm/ 98.28MHz	-49.43	-59.85	-59.85
SSB RP Note4	Config 1, 4	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity

Propagation Condition		AWGN

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.16.8.1.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1, 4	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1, 4	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
Io Note 4	Config 1, 4	dBm/ 48.6MHz	-61.37	-61.37	-61.37
	Config 2	dBm/ 48.6MHz	-61.37	-61.37	-61.37
	Config 3	dBm/ 98.28MHz	-58.32	-58.32	-58.32
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T2) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

A.16.8.1.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 5.6A.4.6.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6A.4.6 starting from the beginning of time interval T2.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3, i.e., between RSTD_0000000 and RSTD1970049.

A.16.8.1.3 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR1 SA in RRC_INACTIVE state when eDRX cycle > 10.24s for RedCap UE

A.16.8.1.3.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement, reported by RedCap UE with 1 Rx or 2 Rx branches, meets the requirements specified in clause 5.6A.4.5 when the RedCap UE is configured with eDRX cycle longer than 10.24 s in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.16.8.1.3.1-1.

Table A.16.8.1.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell 3. During T2 UE shall be in RRC_INACTIVE state and all three cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

***Note**: The information on when PRS is muted is conveyed to the UE using PRS muting information.*

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.10, shall be provided to the UE during T1. The UE is configured to report positioning measurements every 20s via *reportingInterval* in *nr-DL-TDOA-RequestLocationInformation* such the value of *reportingInterval* is set to "*ri20*". The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the DL-TDOA assistance data and location information request.

The beginning of the time interval T2 is not limited to PTW.

The UE is configured with eDRX cycle of 40.96 s.

The general test parameters are listed in table A.16.8.1.3.1-2, and cell specific test parameters are listed in table A.16.8.1.3.1-3 and table A.16.8.1.3.1-4.

Table A.16.8.1.3.1-2: General test parameters for RSTD measurement reporting delay

Parameter	Unit	Value	Comment
Reference cell		Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.

Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1,4		SSB.4 RedCap FR1	
	Config 2		SSB.4 RedCap FR1	
	Config 3		SSB.5 RedCap FR1	
SMTC configuration	Config 1,4		SMTC.1 RedCap	
	Config 2		SMTC.1 RedCap	
	Config 3		SMTC.1 RedCap	
PDSCH RMC configuration	Config 1,4		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1,4		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1,4		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Initial BWP configuration	Config 1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Active UL BWP configuration	Config 1,2,3,4		ULBWP.1.1	
PRS Configuration	Config 1,4		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.1 FR1	
	Config 3		PRS.2.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2) mod 6 = 0 and (PCI of Cell 1 – PCI of Cell 3) mod 6 = 0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	1.28	
CN and RAN eDRX configuration		s	eDRX length = 40.96 PTW length = 1.28	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			3	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to *NR-MutingPattern* defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test

T2	s	5	The length of the time interval that follows immediately after time interval T1.

Table A.16.8.1.3.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 9.36 MHz	-56.54	-56.54	-56.54
	Config 2	dBm/ 9.36 MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 18.72 MHz	-56.54	-56.54	-56.54
SSB RP Note4	Config 1	dBm/SCS	-82	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.16.8.1.3.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
	Config 1	dB	-5	-11	-11

PRS $\hat{E}_s/N_{oc}$	Config 2	dB	-5	-11	-11
	Config 3	dB	-5	-11	-11
Io Note 4	Config 1	dBm/ 9.36MHz	-69.26	-69.26	-69.26
	Config 2	dBm/ 9.36MHz	-69.26	-69.26	-69.26
	Config 3	dBm/ 18.72MHz	-66.63	-66.63	-66.63
PRS $\hat{E}_s/I_{ot}$		dB	-5.33	-12.19	-12.19
Propagation Condition			AWGN		
NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T2) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS. NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting. NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					

A.16.8.1.3.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 5.6A.4.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6A.4.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during the repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in the clause 10.1A.16.3, i.e., between RSTD_000000000 and RSTD_126083073.

A.16.8.2 UE Rx-Tx Measurements

A.16.8.2.1 UE Rx-Tx measurement reporting delay test case for single positioning frequency layer in FR1 SA for RedCap UE without RX FH in RRC_INACTIVE mode

A.16.8.2.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement without RX FH reported by the RedCap UE meets the requirements specified in clause 5.6A.6.5 in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured. The measurement reporting delay test defined in this clause is valid for both 1 Rx and 2 Rx RedCap UEs.

The supported test configurations in listed in table A.16.8.2.1.1-1.

Table A.16.8.2.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode

NOTE: The UE is only required to be tested in one of the supported test configurations.

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE. The measurement reporting delay test in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform UE Rx-Tx time difference measurement with RX FH via *NR-Multi-RTT-RequestLocationInformation* or the UE is configured by the LMF to perform UE Rx-Tx time difference measurement with RX FH via *NR-Multi-RTT-RequestLocationInformation* but reports the UE Rx-Tx time difference measurement based on the single hop in *NR-Multi-RTT-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The RedCap UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.16.8.2.1.1-2 and table A.16.8.2.1.1-3, respectively.

Table A.16.8.2.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1,2,3,4	Cell 1	Cell 1 is the reference cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1,2,3,4	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1,2,3,4	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1,4	10: $N_{RB,c}$ = 52	
		2	10: $N_{RB,c}$ = 52	
		3	20: $N_{RB,c}$ = 52	
SSB configuration		1,4	SSB.4 RedCap FR1	
		2	SSB.4 RedCap FR1	
		3	SSB.5 RedCap FR1	
SMTC configuration		1,4	SMTC.1 RedCap	
		2	SMTC.1 RedCap	
		3	SMTC.1 RedCap	
CP length		1,2,3,4	Normal	
DRX cycle		1,2,3,4	1.28s	
Time offset between serving and neighbour cells	µs	1,2,3,4	3	Synchronous cells
T1	s	1,2,3,4	5	
T2	s	1,2,3,4	10	

Table A.16.8.2.1.1-3: Cell specific test parameters.

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1,4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1,4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1,4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			

		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1,4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1,2,3,4	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1,2,3,4	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1,4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1,2,3,4	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1,4	PRS.1.1 FR1		PRS.1.1 FR1	
		2	PRS.1.1 FR1		PRS.1.1 FR1	
		3	PRS.2.1 FR1		PRS.2.1 FR1	
PRS muting info		1,2,3,4	‘10’		‘01’	
SRS configuration		1,4	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1,4	-98			
		2	-98			
		3	-95			
PRS $\hat{E}_s/I_{ot}$	dB	1,4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1,4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRP Note 3	dBm/SCS kHz	1,4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/9.36 MHz	1,4	N/A	-66.22	N/A	-66.22
	dBm/9.36 MHz	2		-66.22		-66.22
	dBm/18.72 MHz	3		-63.22		-63.22
Propagation Condition		1,2,3,4	AWGN			

NOTE 1:	OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3:	PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4:	The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

A.16.8.2.1.2 Test requirements

The UE Rx-Tx time difference measurement time in RRC_INACTIVE state fulfils the requirements specified in clause 5.6A.6.5.

The UE shall perform and report the UE Rx-Tx time difference measurements without RX FH for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1A.18.3 for both Cell 1 and Cell 2.

A.16.8.2.2 UE Rx-Tx time difference measurement with Rx FH for single positioning frequency layer in FR1 SA in RRC_INACTIVE state

A.16.8.2.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement with Rx FH in RRC_INACTIVE state meets the requirements specified in clause 5.6A.6.6 in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.16.8.2.2.1-1.

Table A.16.8.2.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The RedCap UE is only required to be tested in one of the supported test configurations. NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE state.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.16.8.2.2.1-2 and table A.16.8.2.2.1-3 respectively.

Table A.16.8.2.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3, 4	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1, 2, 4	50: $N_{RB,c}$ = 270	
		3	100: $N_{RB,c}$ = 273	
SSB configuration		1, 2 ,4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 2, 3 ,4	SMTC.1	
CP length		1, 2, 3, 4	Normal	
DRX cycle		1, 2, 3, 4	1.28s	
Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells
PRS RX hopping request		1, 2, 3, 4	requested	
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	10	

Table A.16.8.2.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3, 4	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						

TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1, 4	PRS.1.5 FR1		PRS.1.5 FR1	
		2	PRS.1.5 FR1		PRS.1.5 FR1	
		3	PRS.2.6 FR1		PRS.2.6 FR1	
PRS muting info		1, 2, 3, 4	'10'		'01'	
SRS configuration		1, 4	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRP Note 3	dBm/SCS	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/48.6MHz	1, 4	N/A	-60.51	N/A	-60.51
	dBm/48.6MHz	2		-60.51		-60.51
	dBm/98.28MHz	3		-57.46		-57.46
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

A.16.8.2.2.2 Test requirements

The UE Rx-Tx time difference measurement time in RRC_INACTIVE state fulfils the requirements specified in clause 5.6A.6.6.

The RedCap UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10. 1A.18.3 for both Cell 1 and Cell 2.

A.16.8.2.3. UE Rx-Tx time difference measurement for single positioning frequency layer with eDRX > 10.24s in FR1 SA

A.16.8.2.3.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 5.6A.6.5 for UE Rx-Tx measurements in RRC_INACTIVE with eDRX. The tests are conducted under AWGN propagation condition with the UE operating in FR1 stand-alone mode and configured to perform UE Rx-Tx measurements on a single positioning frequency layer (PFL) in FR1.

The supported test configuration in listed in table A.16.8.2.3.1-1.

Table A.16.8.2.3.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. The UE shall be in RRC_CONNECTED state during T1 and in RRC_INACTIVE state during T2. Cell 1 and Cell 2 transmit PRS only during the second time interval of duration T2. Similarly, the UE is configured to transmit positioning SRS during only during the second time interval of duration T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI of the last message shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle in RRC_INACTIVE.

The general test parameters and cell specific test parameters are as given in table A.16.8.2.3.1-2 and table A.16.8.2.3.1-3, respectively.

Table A.16.8.2.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1, 2, 3, 4	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1, 2, 4	10: $N_{RB,c} = 52$	
		3	20: $N_{RB,c} = 51$	
SSB configuration		1, 2, 4	SSB.4 RedCap FR1	
		3	SSB.5 RedCap FR1	
SMTC configuration		1, 4	SMTC.1 RedCap	
		2, 3	SMTC.1 RedCap	
CP length		1, 2, 3, 4	Normal	
DRX cycle		1, 2, 3, 4	1.28s	
eDRX cycle length (for both RAN and CN)	s	1, 2, 3, 4	40.96	
PTW window length	s	1, 2, 3, 4	1.28	
Reporting periodicity	s	1, 2, 3, 4	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34]

Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells
Expected RSTD	µs	1, 2, 3, 4	3	
Expected RSTD uncertainty	µs	1, 2, 3, 4	5	
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	10	

Table A.16.8.2.3.1-2: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1, 2, 3, 4	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 RedCap ULBWP.0.1 RedCap		N/A	
Active DL BWP configuration		1	DLBWP.1.1 RedCap		N/A	
Active UL BWP configuration		1	ULBWP.1.1 RedCap		N/A	
PRS configuration		1, 4	PRS.1.2 FR1		PRS.1.2 FR1	
		2	PRS.1.2 FR1		PRS.1.2 FR1	
		3	PRS.2.1 FR1		PRS.2.1 FR1	
PRS muting info		1, 2, 3, 4	‘10’		‘01’	
SRS configuration		1, 4	POS-SRS.1		N/A	
		2	POS-SRS.1		N/A	
		3	POS-SRS.2		N/A	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			

N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRP Note 3	dBm/SCS kHz	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
Io	dBm/9.36 MHz	1, 4	N/A	-67.92	N/A	-69.63
	dBm/9.36 MHz	2		-67.92		-69.63
	dBm/18.36 MHz	3		-65.01		-.66.72
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

A.16.8.2.3.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 5.6A.6.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

A test is considered complete after the UE has reported first set of measurement based on the configured reporting periodicity. The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1A.18.3.

A.16.8.3 PRS-RSRP Measurements

A.16.8.3.1 PRS-RSRP reporting delay test case for single positioning frequency layer in RRC_INACTIVE

A.16.8.3.1.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement in RRC_INACTIVE meets the delay requirements specified in clause 9.9A.3.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.16.8.3.1.1-1.

Table A.16.8.3.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

During T1 UE is in RRC_CONNECTED, the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. The measurement reporting delay test in this clause is valid in the cases where the RedCap UE is either not configured by the LMF to perform PRS-RSRP measurement with RX FH via *NR-DL-AoD-RequestLocationInformation* or the UE is configured by the LMF to perform PRS-RSRP measurement with RX FH and reports the PRS-RSRP measurement based on the single hop in *NR-DL-AoD-SignalMeasurementInformation* as specified in TS 37.355 [34, clause 6.5.12]. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.8.3.1.1-2, and cell specific test parameters are listed in table A.16.8.3.1.1-3.

Table A.16.8.3.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 2, 4	10: $N_{RB,c}$ = 52	
		3	20: $N_{RB,c}$ = 51	
SSB configuration		1, 2, 4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 2, 3, 4	SMTC.1 RedCap	
CP length		1, 2, 3, 4	Normal	
DRX		1, 2, 3, 4	1.28s	
Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells
Expected RSTD	µs	1, 2, 3, 4	3	
Expected RSTD uncertainty	µs	1, 2, 3, 4	5	
T1	s	1, 2, 3, 4	2	
T2	s	1, 2, 3, 4	6	

Table A.16.8.3.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			

RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1, 4	PRS.1.4 FR1		PRS.1.4 FR1	
		2	PRS.1.4 FR1		PRS.1.4 FR1	
		3	PRS.2.4 FR1		PRS.2.4 FR1	
PRS muting info		1, 2, 3, 4	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/9.36 MHz	1, 4	N/A	-66.22	N/A	-66.22
	dBm/9.36 MHz	2		-66.22		-66.22
	dBm/18.72 MHz	3		-63.22		-63.22
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.8.3.1.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 9.9A.3.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of correct events observed during repeated tests shall be at least 90%, where the reported PRS-RSRP measurement for each correct event shall be within the reporting range specified in clause 10.1A.17.3.

A.16.8.3.3 PRS-RSRP reporting delay test case in RRC_INACTIVE state in FR1 when eDRX cycle > 10.24s

A.16.8.3.3.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement for RedCap UE in RRC_INACTIVE with eDRX meets the delay requirements specified in clause 5.6A.3.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.16.8.3.3.1-1.

Table A.16.8.3.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

During T1 UE is in RRC_CONNECTED, the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.8.3.3.1-2, and cell specific test parameters are listed in table A.16.8.3.3.1-3.

Table A.16.8.3.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 4	10: $N_{RB,c}$ = 52	
		2	10: $N_{RB,c}$ = 52	
		3	20: $N_{RB,c}$ = 51	
SSB configuration		1, 4	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 RedCap FR1	
SMTC configuration		1, 4	SMTC.1	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3, 4	Normal	
DRX	s	1, 2, 3, 4	1.28	
eDRX cycle length (for both RAN and CN)	s	1, 2, 3, 4	40.96	
PTW window length	s	1, 2, 3, 4	1.28	
Reporting periodicity	s	1, 2, 3, 4	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34]
Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells

Expected RSTD	µs	1, 2, 3, 4	3	
Expected RSTD uncertainty	µs	1, 2, 3, 4	5	
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	10	

Table A.16.8.3.3.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1	PRS.1.3 FR1		PRS.1.3 FR1	
		2	PRS.1.3 FR1		PRS.1.3 FR1	
		3	PRS.2.3 FR1		PRS.2.3 FR1	
PRS muting info		1, 2, 3, 4	‘10’		‘01’	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/9.36 MHz	1, 4	N/A	-67.92	N/A	-69.63
	dBm/9.36 MHz	2		-67.92		-69.63
	dBm/18.36 MHz	3		-65.01		-66.72
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.8.3.3.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 5.6A.5.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

A test is considered complete after the UE has reported first set of measurement based on the configured reporting periodicity. The rate of correct events observed during repeated tests shall be at least 90%, where the reported PRS-RSRP measurement for each correct event shall be within the reporting range specified in clause 10.1A.17.3.

A.16.8.4 PRS-RSRPP Measurements

A.16.8.4.1 PRS-RSRPP measurement delay without FH in RRC_INACTIVE state in FR1

A.16.8.4.1.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement without FH by a RedCap UE meets the delay requirements specified in clause 5.6A.7.5 in an environment with a 2-tap channel propagation condition.

The supported test configurations are specified in table A.16.8.4.1.1-1.

Table A.16.8.4.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2. During T2 UE shall be in RRC_INACTIVE state and all both cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.8.4.1.1-2, and cell specific test parameters are listed in table A.16.8.4.1.1-3.

Table A.16.8.4.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.

RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 2, 4	10: $N_{RB,c}$ = 52	
		3	20: $N_{RB,c}$ = 51	
SSB configuration		1, 2, 4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 2, 3, 4	SMTC.1 RedCap	
CP length		1, 2, 3, 4	Normal	
DRX	s	1, 2, 3, 4	1.28	ON
Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells
Expected RSTD	µs	1, 2, 3, 4	3	
Expected RSTD uncertainty	µs	1, 2, 3, 4	5	
PRS RX hopping request		1, 2, 3, 4	NOT present	
T1	s	1, 2, 3, 4	2	
T2	s	1, 2, 3, 4	5	

Table A.16.8.4.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1, 4	PRS.1.3 FR1		PRS.1.3 FR1	
		2	PRS.1.3 FR1		PRS.1.3 FR1	
		3	PRS.2.3 FR1		PRS.2.3 FR1	
PRS muting info		1, 2, 3, 4	‘10’		‘01’	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-3	-Infinity	-10
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/9.36 MHz	1, 4	-70.05	-67.67	-70.05	-67.67
	dBm/9.36 MHz	2	-70.05	-67.67	-70.05	-67.67
	dBm/18.36 MHz	3	-67.13	-64.75	-67.13	-64.75

Propagation Condition		1, 2, 3, 4	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, τ_d = 0.45 μs and f_D = 5 Hz
NOTE 1: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.			

A.16.8.4.1.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 5.6A.7.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of correct events observed during repeated tests shall be at least 90%, where the reported PRS-RSRPP measurement for each correct event shall be within the PRS-RSRPP reporting range specified in clause 10.1A.19.3.

A.16.8.4.2 PRS-RSRPP measurement with Rx FH reporting delay test case for single positioning frequency layer in FR1 SA in RRC_INACTIVE state

A.16.8.4.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement with Rx FH in RRC_INACTIVE state meets the delay requirements specified in clause 5.6A.7.6 in an environment with two-tap channel propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.16.8.4.2.1-1.

Table A.16.8.4.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The RedCap UE is only required to be tested in one of the supported test configurations. NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The test requirements apply when *frequencyHopping* is configured to UE.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource occasion occuring ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.8.4.2.1-2, and cell specific test parameters are listed in table A.16.8.4.2.1-3.

Table A.16.8.4.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 4	50: $N_{RB,c}$ = 270	
		2	50: $N_{RB,c}$ = 270	
		3	100: $N_{RB,c}$ = 273	
SSB configuration		1, 4	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 4	SMTC.1	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3, 4	Normal	
DRX	s	1, 2, 3, 4	1.28	
Time offset between serving and neighbour cells	μs	1, 2, 3, 4	3	Synchronous cells
PRS RX hopping request		1, 2, 3, 4	requested	
Expected RSTD	μs	1, 2, 3, 4	3	
Expected RSTD uncertainty	μs	1, 2, 3, 4	5	
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	10	

Table A.16.8.4.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1, 4	PRS.1.5 FR1		PRS.1.5 FR1	
		2	PRS.1.5 FR1		PRS.1.5 FR1	
		3	PRS.2.6 FR1		PRS.2.6 FR1	
PRS muting info		1, 2, 3, 3	‘10’		‘01’	
	dBm/SCS	1, 4	-98			

N_{oc} Note 2		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS	1, 4	-88	-88	-Infinity	-Infinity
		2	-88	-88	-Infinity	-Infinity
		3	-85	-85	-Infinity	-Infinity
Io	dBm/48.6MHz	1, 4	N/A	-60.51	N/A	-60.51
	dBm/48.6MHz	2		-60.51		-60.51
	dBm/98.28MHz	3		-57.46		-57.46
Propagation Condition		1, 2, 3, 4	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ µs and $f_D = 5$ Hz			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.8.4.2.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 5.6A.7.6, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each cell observed during repeated tests shall be at least 90%, where the reported PRS-RSRPP measurement for each correct event shall be within the PRS-RSRPP reporting range specified in clause 10.1A.19.3, i.e., between PRS RSRPP_0 and PRS RSRPP_126.

A.16.8.4.3 PRS-RSRPP reporting delay in RRC_INACTIVE with eDRX

A.16.8.4.3.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement by a RedCap UE meets the delay requirements specified in clause 5.6A.7.5 in an environment with a 2-tap channel propagation condition in RRC_INACTIVE, when configured with eDRX and without FH.

The supported test configurations are specified in table A.16.8.4.3.1-1.

Table A.16.8.4.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2. During T2 UE shall be in RRC_INACTIVE state and all both cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.8.4.3.1-2, and cell specific test parameters are listed in table A.16.8.4.3.1-3.

Table A.16.8.4.3.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 2, 4	10: $N_{RB,c}$ = 52	
		3	20: $N_{RB,c}$ = 51	
SSB configuration		1, 2, 4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 2, 3, 4	SMTC.1 RedCap	
CP length		1, 2, 3, 4	Normal	
DRX	s	1, 2, 3, 4	1.28	ON
CN and RAN eDRX configuration		1, 2, 3, 4	eDRX cycle = 40.96s PTW length = 1.28s	
reportingInterval	s	1, 2, 3	20	PRS measurement reporting periodicity
Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells
Expected RSTD	µs	1, 2, 3, 4	3	
Expected RSTD uncertainty	µs	1, 2, 3, 4	5	
PRS RX hopping request		1, 2, 3, 4	NOT present	
T1	s	1, 2, 3, 4	2	
T2	s	1, 2, 3, 4	5	

Table A.16.8.4.3.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			

OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1, 4	PRS.1.3 FR1		PRS.1.3 FR1	
		2	PRS.1.3 FR1		PRS.1.3 FR1	
		3	PRS.2.3 FR1		PRS.2.3 FR1	
PRS muting info		1, 2, 3, 4	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-3	-Infinity	-10
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/9.36 MHz	1, 4	-70.05	-67.67	-70.05	-67.67
	dBm/9.36 MHz	2	-70.05	-67.67	-70.05	-67.67
	dBm/18.36 MHz	3	-67.13	-64.75	-67.13	-64.75
Propagation Condition		1, 2, 3, 4	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ µs and $f_D = 5$ Hz			

NOTE 1: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

A.16.8.4.3.2 Test Requirements

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2, within the time limit specified in clause 5.6A.7.5 with $T_{available_PRS}$ = 1.28s, starting from the beginning of time interval T2.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The test is considered complete after the UE reports the first set of positioning measurements based on the configured reportingInterval.

A test is considered complete after the UE has reported first set of results based on the configured reporting periodicity. The rate of correct events observed during repeated tests shall be at least 90%, where the reported PRS-RSRPP measurement for each correct event shall be within the PRS-RSRPP reporting range specified in clause 10.1A.19.3.

A.16.9 Measurement Performance Requirements for RedCap in RRC_INACTIVE

A.16.9.1 RSTD Measurements

A.16.9.1.1 RSTD measurement accuracy test case for RedCap UE without FH in FR1 in RRC_INACTIVE state

A.16.9.1.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC_INACTIVE state meets the accuracy requirements specified in clause 10.1A.16.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.16.9.1.1.1-1.

Table A.16.9.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The UE is configured with DRX cycle of 1.28 s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the RedCap UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 5.6A.4.5.

The RSTD measurement accuracy in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

Table A.16.9.1.1.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1	
			Cell 1	Cell 2
PRS ARFCN	1,2,3,4		freq1	Freq1
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52	
	2		10: $N_{RB,c}$ = 52	
	3		20: $N_{RB,c}$ = 51	
	4		10: $N_{RB,c}$ = 52	
Duplex mode	1		FDD	
	2		TDD	
	3		TDD	
	4		HD-FDD	
TDD configuration	1		N/A	
	2		TDDConf.1.1	
	3		TDDConf.2.1	
	4		N/A	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-
	2		SR.1.1 TDD	
	3		SR.2.1 TDD	
	4		SR.1.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-
	2		CR.1.1 TDD	-

	3		CR.2.1 TDD	-
	4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-
	4		CCR.1.1 FDD	-
SSB configuration	1		SSB.1 FR1	
	2		SSB.1 FR1	
	3		SSB.1 RedCap FR1	
	4		SSB.1 FR1	
OCNG Patterns	1,2,3,4		OP.1	
TRS configuration	1		TRS.1.1 FDD	-
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
	4		TRS.1.1 FDD	
Initial BWP Configuration	1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Time offset with Cell 1	1,4	µs	-	3
	2,3		-	3
SMTC configuration	1,4		SMTC.2	
	2,3		SMTC.1	
PRS configuration	1		PRS.1.3 FR1	
	2		PRS.1.3 FR1	
	3		PRS.2.3 FR1	
	4		PRS.1.3 FR1	
PRS muting info	1,2,3,4		'10'	'01'
Expected RSTD	1, 2, 3, 4	µs	N/A	3
Expected RSTD uncertainty	1, 2, 3, 4	µs	N/A	5
EPRE ratio of PSS to SSS	1,2,3,4	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	1,2,4	dBm/ SCS	-98	
	3		-95	
$\hat{E}_s / I_{ot}$	1,2,3,4	dB	-6	-13
PRS-RSRP Note3	1,2,4	dBm/SCS	-103.7	-109.9
	3		-100.7	-106.9
Io Note3	1,2,4	dBm/ 9.36MHz	-68.8	-68.8
	3	dBm/ 18.36MHz	-65.88	-65.88
$\hat{E}_s / N_{oc}$	1,2,3,4	dB	-5.7	-11.9
Propagation condition	1,2,3,4	-	AWGN	
Antenna configuration	1,2,3,4		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.9.1.1.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1A.16.2.

A.16.9.1.2 RSTD measurement accuracy test case for RedCap UE with FH in FR1 in RRC_INACTIVE state

A.16.9.1.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE with FH in RRC_INACTIVE state meets the accuracy requirements specified in clause 10.1A.16.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.16.9.1.2.1-1.

Table A.16.9.1.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The UE is configured with DRX cycle of 1.28 s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the RedCap UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 5.6A.4.5.

The RSTD measurement accuracy in this clause is valid for the cases where the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* as specified in TS 37.355 [34], clause 6.5.12. The frequency hopping configurations are specified in clause A.3.31.

Table A.16.9.1.2.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1	
			Cell 1	Cell 2
PRS ARFCN	1,2,3,4		freq1	Freq1
$BW_{channel}$	1	MHz	50: $N_{RB,c}$ = 270	
	2		50: $N_{RB,c}$ = 270	
	3		100: $N_{RB,c}$ = 273	
	4		50: $N_{RB,c}$ = 270	
Duplex mode	1		FDD	
	2		TDD	
	3		TDD	
	4		HD-FDD	
TDD configuration	1		N/A	
	2		TDDConf.1.1	
	3		TDDConf.2.1	

	4		N/A	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-
	2		SR.1.1 TDD	
	3		SR.2.1 TDD	
	4		SR.1.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-
	2		CR.1.1 TDD	-
	3		CR.2.1 TDD	-
	4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-
	4		CCR.1.1 FDD	-
SSB configuration	1		SSB.1 FR1	
	2		SSB.1 FR1	
	3		SSB.1 RedCap FR1	
	4		SSB.1 FR1	
OCNG Patterns	1,2,3,4		OP.1	
TRS configuration	1		TRS.1.1 FDD	-
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
	4		TRS.1.1 FDD	
Initial BWP Configuration	1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Time offset with Cell 1	1,4	µs	-	3
	2,3		-	3
SMTC configuration	1,4		SMTC.2	
	2,3		SMTC.1	
PRS configuration	1		PRS.1.3 FR1	
	2		PRS.1.3 FR1	
	3		PRS.2.3 FR1	
	4		PRS.1.3 FR1	
PRS muting info	1,2,3,4		‘10’	‘01’
Expected RSTD	1, 2, 3, 4	µs	N/A	3
Expected RSTD uncertainty	1, 2, 3, 4	µs	N/A	5
EPRE ratio of PSS to SSS	1,2,3,4	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	1,2,4	dBm/ SCS	-98	
	3		-95	
$\hat{E}_s / I_{ot}$	1,2,3,4	dB	-6	-13
PRS-RSRP Note3	1,2,4	dBm/SCS	-103.7	-109.9
	3		-100.7	-106.9
Io Note3	1,2,4	dBm/ 48.6MHz	-61.44	-61.44
	3	dBm/ 98.28MHz	-58.6	-58.6

$\hat{E}_s / N_{oc}$	1,2,3,4	dB	-5.7	-11.9
Propagation condition	1,2,3,4	-	AWGN	
Antenna configuration	1,2,3,4		1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				

A.16.9.1.2.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1A.16.2.

A.16.9.2 UE Rx-Tx measurements

A.16.9.2.1 UE Rx-Tx time difference measurement accuracy for single positioning frequency layer in FR1 SA for RedCap UE without RX FH in RRC_INACTIVE mode

A.16.9.2.1.1 Test purpose and environment

The purpose of the test is to verify that the accuracy of the UE Rx-Tx time difference measurement without RX FH reported by the RedCap UE is within the specified limits in clause 10.1A.18.2. The test is conducted in AWGN propagation condition in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations in listed in table A.16.9.2.1.1-1.

Table A.16.9.2.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR1.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12, shall be provided to the UE before the start of the test. The UE Rx-Tx measurement accuracy test in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform UE Rx-Tx time difference measurement with RX FH via *NR-Multi-RTT-RequestLocationInformation* or the UE is configured by the LMF to perform UE Rx-Tx time difference measurement with RX FH via *NR-Multi-RTT-RequestLocationInformation* but reports the UE Rx-Tx time difference measurement based on the single hop in *NR-Multi-RTT-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The UE is configured to transmit SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.16.9.2.1.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.16.9.2.1.2-1.

Table A.16.9.2.1.2-1: UE Rx-Tx time difference measurement accuracy test parameters.

Parameter	Unit	Test configuration	Cell 1	Cell 2
RF Channel Number		1,2,3,4	1	1
DRX	s	1,2,3,4	1.28	
Time offset with Cell 1	μs	1,2,3,4	N/A	3
TDD configuration		1,4	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1,4	SR.1.1 FDD	N/A
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET RMC configuration		1,4	CR.1.1 FDD	N/A
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1,4	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns		1,2,3,4	OP.1	OP.1
Initial BWP configuration		1,2,3,4	DLBWP.0.1 ULBWP.0.1	N/A
PRS configuration		1,4	PRS.1.1 FR1	PRS.1.1 FR1
		2	PRS.1.1 FR1	PRS.1.1 FR1
		3	PRS.2.1 FR1	PRS.2.1 FR1
PRS Resource slot offset	slot	1,2,3,4	0	4
SRS configuration		1,4	POS-SRS.1	N/A
		2	POS-SRS.1	N/A
		3	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1,4	-98	
		2	-98	
		3	-95	
PRS $\hat{E}_s/I_{ot}$	dB	1,4	-2.41	-12.12
		2		
		3		
PRS $\hat{E}_s/N_{oc}$	dB	1,4	-2	-10
		2		
		3		
PRP Note 3	dBm/SCS kHz	1,4	-100	-108
		2	-100	-108
		3	-97	-105
Io	dBm/9.36 MHz	1,4	-66.22	-66.22
	dBm/9.36 MHz	2	-66.22	-66.22
	dBm/18.72 MHz	3	-63.22	-63.22
Propagation Condition		1,2,3,4	AWGN	

A.16.9.2.1.3 Test requirements

The UE Rx-Tx time difference measurement without RX FH fulfils the UE Rx-Tx measurement absolute accuracy requirements for AWGN propagation condition specified in clause 10.1A.18.2 for both Cell 1 and Cell 2.

A.16.9.2.2 SA: UE Rx-Tx time difference measurement accuracy with Rx FH in RRC_INACTIVE state in FR1

A.16.9.2.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE Rx-Tx measurement accuracy in FR1 with FH by a RedCap UE in RRC_INACTIVE state is within the specified limits. This test will verify the requirements in clauses 10.1A.18.2.3 and 10.1A.18.2.4.

The supported test configurations are listed in table A.16.9.2.2.1-1.

Table A.16.9.2.2.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	NR 30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations in each supported band. NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR1.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE before the start of the test. The test requirements apply when *frequencyHopping* is configured to UE.

The UE is configured to transmit SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.16.9.2.2.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.16.9.2.2.2-1.

Table A.16.9.2.2.2-1: UE Rx-Tx time difference test parameters

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
RF Channel Number		1,2,3,4	1	1	1	1
DRX	s	1,2,3	1.28		1.28	
Time offset with Cell 1	μs	1, 2, 3, 4	N/A	3	N/A	3
TDD configuration		1, 4	N/A	N/A	N/A	N/A
		2	TDDConf.1.1	TDDConf.1.1	TDDConf.1.1	TDDConf.1.1
		3	TDDConf.2.1	TDDConf.2.1	TDDConf.2.1	TDDConf.2.1
PDSCH RMC configuration		1, 4	SR.1.1 FDD	N/A	SR.1.1 FDD	N/A
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD	N/A	CR.1.1 FDD	N/A
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD	N/A	CCR.1.1 FDD	N/A
		2	CCR.1.1 TDD		CCR.1.1 TDD	

		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3, 4	OP.1	OP.1	OP.1	OP.1
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1	N/A	DLBWP.0.1 ULBWP.0.1	N/A
PRS configuration		1, 4	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1
		2	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1
		3	PRS.2.6 FR1	PRS.2.6 FR1	PRS.2.6 FR1	PRS.2.6 FR1
PRS Resource slot offset	slot	1, 2, 3, 4	0	4	0	4
SRS configuration		1, 4	POS-SRS.1	N/A	POS-SRS.1	N/A
		2	POS-SRS.1	N/A	POS-SRS.1	N/A
		3	POS-SRS.2	N/A	POS-SRS.2	N/A
N_{oc} Note 2	dBm/SCS	1	-98		-98	
		2	-98		-98	
		3	-95		-95	
		4	-98		-98	
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
		2				
		3				
		4				
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	-12.12	-2.41	-12.12
		2				
		3				
		4				
PRS $\hat{E}_s/N_{oc}$	dB	1	-2	-10	-2	-10
		2				
		3				
		4				
PRS-RSRP Note 3	dBm/SCS	1	-100	-108	-100	-108
		2	-100	-108	-100	-108
		3	-97	-105	-97	-105
		4	-100	-108	-100	-108
Io Note 3	dBm/48.6MHz	1	-60.51	-60.51	-60.51	-60.51
	dBm/48.6MHz	2	-60.51	-60.51	-60.51	-60.51
	dBm/48.6MHz	4	-60.51	-60.51	-60.51	-60.51
	dBm/98.28MHz	3	-57.46	-57.46	-57.46	-57.46
Propagation Condition		1, 2, 3, 4	AWGN		AWGN	

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.9.2.2.3 Test requirements

The UE Rx-Tx time difference measurement time fulfils the UE Rx-Tx measurement absolute and relative accuracy requirements specified in clause 10.1A.18.2 for both Cell 1 and Cell 2.

A.16.9.3 PRS-RSRP Measurements

A.16.9.3.1 PRS-RSRP measurement accuracy without FH in RRC_INACTIVE state in FR1

A.16.9.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRP measurement in RRC_INACTIVE without FH by a RedCap UE is within the specified limits. This test will verify the requirements in clauses 10.1A.17.2.1 for absolute accuracy and 10.1A.17.2.1 for relative accuracy.

A.16.9.3.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.16.9.3.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in A.16.9.3.1.2-2. In all test cases, Cell 1 is the PCell. PRS RX hopping is not requested in *NR-DL-AoD-RequestLocationInformation*.

Table A.16.9.3.1.2-1: PRS-RSRP supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.16.9.3.1.2-2: PRS-RSRP test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1,4		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1,2,4	MHz	10: $N_{RB,c}$ = 52			
	Config 3		20: $N_{RB,c}$ = 51			
Downlink initial BWP configuration			DLBWP.0.1			
Uplink initial BWP configuration			ULBWP.0.1			
DRX Cycle		ms	1280			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD	

PRS configuration		Config 1,4		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1
		Config 2		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1
		Config 3		PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.3 FR1
PRS Resource slot offset (slot)		Config 1,2,3,4	slot	0	4	0	4
SSB configuration		Config 1,2,4		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
		Config 3		SSB.1 RedCap FR1	SSB.1 RedCap FR1	SSB.1 RedCap FR1	SSB.1 RedCap FR1
Time offset with Cell 1		Config 1,4	ms	-	3	-	3
		Config 2,3	µs	-	3	-	3
SMTC configuration		Config 1,2,3,4		SMTC.1 RedCap			
OCNG Patterns				OCNG pattern 1			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config 1,2,4		dBm/15kHz	-98		-98	
	Config 3			-98		-98	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-98		-98	
	Config 3			-95		-95	
$\hat{E}_s/I_{ot}$			dB	-2.41	-12.12	-2.41	-12.12
$\hat{E}_s/N_{oc}$			dB	-2	-10	-2	-10
PRS-RSRP Note3	Config 1, 2,4		dBm/SCS	-100	-108	-100	-108
	Config 3			-97	-105	-97	-105
Io Note3	Config 1,2,4		dBm/9.36MHz	-67.67		-67.67	
	Config 3		dBm/18.36MHz	-64.75		-64.75	
Propagation condition				AWGN			
Antenna configuration				1x2			

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.9.3.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.17.2.1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1A.17.2.2.

A.16.9.3.2 PRS-RSRP measurement accuracy with FH in RRC_INACTIVE state in FR1

A.16.9.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRP measurement in RRC_INACTIVE with FH by a RedCap UE is within the specified limits. This test will verify the requirements in clauses 10.1A.17.2.1 for absolute accuracy and 10.1A.17.2.1 for relative accuracy.

A.16.9.3.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.16.9.3.2.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in A.16.9.3.2.2-2. In all test cases, Cell 1 is the PCell. PRS RX hopping is present in *NR-DL-AoD-RequestLocationInformation*.

Table A.16.9.3.2.2-1: PRS-RSRP supported test configurations

Configuration	Description
1	15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

Table A.16.9.3.2.2-2: PRS-RSRP test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1,4		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1,2,4	MHz	50: $N_{RB,c}$ = 270			
	Config 3		100: $N_{RB,c}$ = 273			
Downlink initial BWP configuration			DLBWP.0.1			
Uplink initial BWP configuration			ULBWP.0.1			
DRX Cycle		ms	1280			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD	

Control channel RMC	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD	
PRS configuration	Config 1,4		PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1
	Config 2		PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1	PRS.1.5 FR1
	Config 3		PRS.2.6 FR1	PRS.2.6 FR1	PRS.2.6 FR1	PRS.2.6 FR1
PRS Resource slot offset (slot)	Config 1,2,3,4	slot	0	4	0	4
SSB configuration	Config 1,2,4		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.1 RedCap FR1	SSB.1 RedCap FR1	SSB.1 RedCap FR1	SSB.1 RedCap FR1
Time offset with Cell 1	Config 1,4	ms	-	3	-	3
	Config 2,3	µs	-	3	-	3
SMTC configuration	Config 1,2,3,4		SMTC.1 RedCap			
OCNG Patterns			OCNG pattern 1			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	Config 1,2,4		dBm/15kHz	-98	-98	
	Config 3			-98	-98	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-98	-98	
	Config 3			-95	-95	
$\hat{E}_s/I_{ot}$			dB	-2.41	-12.12	-2.41	-12.12
$\hat{E}_s/N_{oc}$			dB	-2	-10	-2	-10
PRS-RSRP Note3	Config 1, 2,4		dBm/SCS	-100	-108	-100	-108
	Config 3			-97	-105	-97	-105
Io Note3	Config 1,2,4		dBm/48.6MHz	-60.51		-60.51	
	Config 3		dBm/98.28MHz	-57.46		-57.46	
Propagation condition				AWGN			
Antenna configuration				1x2			

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.9.3.2.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.17.2.1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1A.17.2.2.

A.16.9.4 PRS-RSRPP measurements

A.16.9.4.1 PRS-RSRPP measurement accuracy without Rx FH in RRC_INACTIVE state in FR1

A.16.9.4.1.1 Test purpose and Environment

The purpose of this test is to verify that the PRS-RSRPP measurement accuracy in FR1 without FH by a RedCap UE in RRC_INACTIVE state is within the specified limits. This test will verify the requirements in clauses 10.1A.19.2.

A.16.9.4.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.16.9.4.1.2-1. Absolute accuracy of PRS-RSRPP measurements are tested by using the parameters in A.16.9.4.1.2-2. In all test cases, Cell 1 is the PCell, and PRS RX hopping is not requested in *NR-DL-AoD-RequestLocationInformation*.

Table A.16.9.4.1.2-1: PRS-RSRPP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band.	

Table A.16.9.4.1.2-2: PRS-RSRPP test parameters

Parameter		Unit	Test 1	
			Cell 1	Cell 2
Cell ID			489	0
SSB ARFCN			freq1	
Duplex mode	Config 1,4		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,2,4	MHz	10: $N_{RB,c}$ = 52	
	Config 3		20: $N_{RB,c}$ = 51	
Downlink initial BWP configuration			DLBWP.0.1	
Uplink initial BWP configuration			ULBWP.0.1	
DRX Cycle		ms	1280	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-
	Config 2		SR.1.1 TDD	
	Config 3		SR2.1 TDD	

RMSI CORESET Reference Channel		Config 1,4		CR.1.1 FDD	-
		Config 2		CR.1.1 TDD	
		Config 3		CR2.1 TDD	
Control channel RMC		Config 1,4		CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD	
		Config 3		CCR2.1 TDD	
PRS configuration		Config 1,4		PRS.1.3 FR1	PRS.1.3 FR1
		Config 2		PRS.1.3 FR1	PRS.1.3 FR1
		Config 3		PRS.2.3 FR1	PRS.2.3 FR1
PRS Resource slot offset (slot)		Config 1,2,3,4	slot	0	4
SSB configuration		Config 1,2,4		SSB.1 FR1	SSB.1 FR1
		Config 3		SSB.1 RedCap FR1	SSB.1 RedCap FR1
Time offset with Cell 1		Config 1,4	ms	-	3
		Config 2,3	µs	-	3
SMTC configuration		Config 1,2,3,4		SMTC.1 RedCap	
OCNG Patterns				OCNG pattern 1	
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	Config 1,2,4		dBm/15kHz	-98	
	Config 3			-98	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-98	
	Config 3			-95	
$\hat{E}_s/I_{ot}$			dB	-2.41	-12.12
$\hat{E}_s/N_{oc}$			dB	-2	-10
PRS-RSRP Note3	Config 1, 2,4		dBm/SCS	-100	-108
	Config 3			-97	-105
Io Note3	Config 1,2,4		dBm/9.36MHz	-67.67	
	Config 3		dBm/18.36MHz	-64.75	
Propagation condition				AWGN	
Antenna configuration				1x2	

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.9.4.1.3 Test requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.19.2.

A.16.9.4.2 SA: PRS-RSRPP measurement accuracy with Rx FH in RRC_INACTIVE state in FR1

A.16.9.4.2.1 Test purpose and Environment

The purpose of this test is to verify that the PRS-RSRPP measurement accuracy in FR1 with FH by a RedCap UE in RRC_INACTIVE state is within the specified limits. This test will verify the requirements in clauses 10.1A.19.2.

A.16.9.4.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.16.9.4.2.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in A.16.9.4.2.2-2. In all test cases, Cell 1 is the PCell, and PRS RX hopping is requested in *NR-DL-AoD-RequestLocationInformation*.

Table A.16.9.4.2.2-1: PRS-RSRPP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, FDD duplex mode
2	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, TDD duplex mode
3	NR 30 kHz SSB SCS, cell bandwidth 100 MHz, TDD duplex mode
4	NR 15 kHz SSB SCS, cell bandwidth 50 MHz, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations in each supported band. NOTE 2: This test case is applicable to the UE supporting per hop bandwidth ≥ 10 MHz for SCS 15 kHz. NOTE 3: This test case is applicable to the UE supporting per hop bandwidth = 20 MHz for SCS 30 kHz.	

Table A.16.9.4.2.2-2: PRS-RSRPP test parameters

Parameter		Unit	Cell 1	Cell 2
Cell ID			489	0
SSB ARFCN			freq1	
Duplex mode	Config 1,4		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,2,4	MHz	50: $N_{RB,c}$ = 270	
	Config 3		100: $N_{RB,c}$ = 273	
Downlink initial BWP configuration			DLBWP.0.1	
Uplink initial BWP configuration			ULBWP.0.1	
TRS configuration	Config 1,4		TRS.1.1 FDD	N/A
	Config 2		TRS.1.1 TDD	N/A
	Config 3		TRS.1.2 TDD	N/A

DRX cycle length		Config 1,2,3	ms	1280	
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD	-
		Config 2		SR.1.1 TDD	
		Config 3		SR2.1 TDD	
RMSI CORESET Reference Channel		Config 1,4		CR.1.1 FDD	-
		Config 2		CR.1.1 TDD	
		Config 3		CR2.1 TDD	
Control channel RMC		Config 1,4		CCR.1.1 FDD	-
		Config 2		CCR.1.1 TDD	
		Config 3		CCR2.1 TDD	
PRS configuration		Config 1,4		PRS.1.5 FR1	PRS.1.5 FR1
		Config 2		PRS.1.5 FR1	PRS.1.5 FR1
		Config 3		PRS.2.6 FR1	PRS.2.6 FR1
PRS Resource slot offset (slot)		Config 1,2,3,4	slot	0	4
SSB configuration		Config 1,2,4		SSB.1 FR1	SSB.1 FR1
		Config 3		SSB.1 RedCap FR1	SSB.1 RedCap FR1
Time offset with Cell 1		Config 1,4	ms	-	3
		Config 2,3	µs	-	3
SMTC configuration		Config 1,2,3,4		SMTC.1 RedCap	
OCNG Patterns				OCNG pattern 1	
EPRE ratio of PSS to SSS			dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	Config 1,2,4		dBm/15kHz	-98	
	Config 3			-98	
N_{oc} Note2	Config 1,2,4		dBm/SCS	-98	
	Config 3			-98	
$\hat{E}_s/I_{ot}$			dB	-2.41	-12.12
$\hat{E}_s/N_{oc}$			dB	-2	-10
PRS-RSRP Note3	Config 1, 2,4		dBm/SCS	-100	-108
	Config 3			-97	-105
Io Note3	Config 1,2,4		dBm/48.6MHz	-60.51	
	Config 3		dBm/98.28MHz	-57.46	
Propagation condition				Two-tap channel Note 5	
Antenna configuration				1x2	
NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: The two-tap channel model is defined in 38.101-4 annex B.2.4 (a = 1, τ_d=0.45 μs and f_D=5 Hz).

A.16.9.4.2.3 Test requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.19.2.

A.16.10 Measurement procedure for RedCap in RRC_IDLE

A.16.10.1 RSTD measurements

A.16.10.1.1 NR RSTD measurement reporting delay test case for RedCap UE without FH in FR1 SA in RRC_IDLE state without eDRX

A.16.10.1.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC IDLE state and without eDRX meets the requirements specified in clause 4.6.2.5 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.16.10.1.1.1-1.

Table A.16.10.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell 3. During T2 UE shall be in RRC_IDLE state and all three cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the RedCap UE during T1. The measurement reporting delay test in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The last TTI containing the two messages shall be provided to the RedCap UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request. The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s).

The UE is configured with DRX cycle of 1.28 s.

The general test parameters are listed in table A.16.10.1.1.1-2, and cell specific test parameters are listed in table A.16.10.1.1.1-3 and table A.16.10.1.1.1-4.

Table A.16.10.1.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 FR1	
	Config 2		SSB.1 FR1	
	Config 3		SSB.1 RedCap FR1	
	Config 4		SSB.1 FR1	
SMTC configuration	Config 1		SMTC.2	
	Config 2		SMTC.1	
	Config 3		SMTC.1	
	Config 4		SMTC.2	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
	Config 4		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.1.1 FDD	As specified in clause A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
	Config 4		CR.1.1 FDD	
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
	Config 4		CCR.1.1 FDD	
Initial BWP configuration	Config 1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Active UL BWP configuration	Config 1,2,3,4		ULBWP.1.1	
PRS Configuration	Config 1		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.1 FR1	
	Config 3		PRS.2.1 FR1	
	Config 4		PRS.1.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	1.28	
Radio frame receive time offset between the cells at the UE antenna connector		μs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		μs	Cell 2: 3 Cell 3: 3	The expected RSTD is what is expected at the receiver. The corresponding

		Other neighbour cells: randomly between -3 and 3	parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells	μs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		3	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	5	The length of the time interval that follows immediately after time interval T1.

Table A.16.10.1.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
	Config 4	dBm/SCS	-98		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 9.36MHz	-59.63	-59.63	-59.63
	Config 2	dBm/ 9.36MHz	-59.63	-59.63	-59.63
	Config 3	dBm/ 18.36MHz	-56.71	-56.71	-56.71
	Config 4	dBm/ 9.36MHz	-59.63	-59.63	-59.63
SSB RP Note4	Config 1	dBm/SCS	-88	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
	Config 4	dBm/SCS	-88	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.16.10.1.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
NR RF Channel Number			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
	Config 4	dBm/SCS	-98	-98	-98
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
	Config 2	dB	-5.45	-11.67	-11.67
	Config 3	dB	-5.45	-11.67	-11.67
	Config 4	dB	-5.45	-11.67	-11.67
Io Note 4	Config 1	dBm/ 9.36MHz	-68.52	-68.52	-68.52
	Config 2	dBm/ 9.36MHz	-68.52	-68.52	-68.52
	Config 3	dBm/ 18.36MHz	-65.61	-65.61	-65.61
	Config 4	dBm/ 9.36MHz	-68.52	-68.52	-68.52
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T2) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

A.16.10.1.1.2 Test Requirements

The RSTD measurement time without FH for RedCap fulfils the requirements specified in clause 4.6.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 4.6.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3, i.e., between RSTD_0000000 and RSTD1970049.

A.16.10.1.2 NR RSTD measurement reporting delay test case for RedCap UE without RX FH in FR1 SA in RRC_IDLE state when eDRX > 10.24s

A.16.10.1.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement, reported by RedCap UE with 1 Rx or 2 Rx branches, meets the requirements specified in clause 4.6.2.5 when the RedCap UE is configured with eDRX cycle longer than 10.24 s in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.16.10.1.2.1-1.

Table A.16.10.1.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All 3 cells are on the same RF channel in FR1.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell 3. During T2 UE shall be in RRC_IDLE state and all three cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

NOTE: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.10, shall be provided to the UE during T1. The UE is configured to report positioning measurements every 20s by setting the value of *reportingInterval* to "*ri20*" in *nr-DL-TDOA-RequestLocationInformation*. The UE is not configured by the LMF to perform RSTD measurement with RX FH in *NR-DL-TDOA-RequestLocationInformation*. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the DL-TDOA assistance data and location information request.

The beginning of the time interval T2 is not limited to PTW.

The UE is configured with eDRX cycle of 40.96 s.

The general test parameters are listed in table A.16.10.1.2.1-2, and cell specific test parameters are listed in table A.16.10.1.2.1-3 and table A.16.10.1.2.1-4.

Table A.16.10.1.2.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1,4		SSB.4 RedCap FR1	
	Config 2		SSB.4 RedCap FR1	
	Config 3		SSB.5 RedCap FR1	
SMTC configuration	Config 1,4		SMTC.1 RedCap	
	Config 2		SMTC.1 RedCap	
	Config 3		SMTC.1 RedCap	
PDSCH RMC configuration	Config 1,4		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET RMC configuration	Config 1,4		CR.1.1 FDD	As specified in clause A.3.1.2.1
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET RMC configuration	Config 1,4		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Initial BWP configuration	Config 1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Active UL BWP configuration	Config 1,2,3,4		ULBWP.1.1	
PRS Configuration	Config 1,4		PRS.1.1 FR1	As specified in clause A.3.31
	Config 2		PRS.1.1 FR1	
	Config 3		PRS.2.1 FR1	
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2) mod 6 = 0 and (PCI of Cell 1 – PCI of Cell 3) mod 6 = 0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
CN and RAN eDRX configuration		s	eDRX length = 40.96 PTW length = 1.28	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance ta specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index

Number of cells provided in DL-TDOA assistance data		3	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to *NR-MutingPattern* defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	5	The length of the time interval that follows immediately after time interval T1.

Table A.16.10.1.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-98		
	Config 2	dBm/SCS	-98		
	Config 3	dBm/SCS	-95		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	10	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 9.36 MHz	-56.54	-56.54	-56.54
	Config 2	dBm/ 9.36 MHz	-56.54	-56.54	-56.54
	Config 3	dBm/ 18.72 MHz	-56.54	-56.54	-56.54
SSB RP Note4	Config 1	dBm/SCS	-82	-Infinity	-Infinity
	Config 2	dBm/SCS	-88	-Infinity	-Infinity
	Config 3	dBm/SCS	-85	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over sub-carriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.16.10.1.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
NR RF Channel Number		1	1	1
Correlation Matrix and Antenna Configuration		1×2 Low	1×2 Low	1×2 Low
OCNG patterns defined in A.3.2.1		OP.1	OP.1	OP.1

PRACH configuration			FR1 PRACH configuration 1	FR1 PRACH configuration 1	FR1 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-98	-98	-98
	Config 2	dBm/SCS	-98	-98	-98
	Config 3	dBm/SCS	-95	-95	-95
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5	-11	-11
	Config 2	dB	-5	-11	-11
	Config 3	dB	-5	-11	-11
Io Note 4	Config 1	dBm/ 9.36MHz	-69.26	-69.26	-69.26
	Config 2	dBm/ 9.36MHz	-69.26	-69.26	-69.26
	Config 3	dBm/ 18.72MHz	-66.63	-66.63	-66.63
PRS $\hat{E}_s/I_{ot}$		dB	-5.33	-12.19	-12.19
Propagation Condition			AWGN		
NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T2) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the sub-frames with transmitted PRS. NOTE 2: The resources for uplink transmission are assigned after the end of time period T2. NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over sub-carriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					

A.16.10.1.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 4.6.2.5. The test is considered complete after the UE reports the first set of positioning measurements based on the configured *reportingInterval.*

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 4.6.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during the repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in the clause 10.1A.16.3, i.e., between RSTD_000000000 and RSTD_126083073.

A.16.10.2 PRS-RSRP Measurements

A.16.10.2.1 PRS-RSRP reporting delay test case for single positioning frequency layer in RRC_IDLE

A.16.10.2.1.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement without RX FH in RRC_IDLE in FR1 meets the delay requirements specified in clause 4.6.3.5 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.16.10.2.1.1-1.

Table A.16.10.2.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the DL slot next to slot #n, UE is released into RRC_IDLE. PRS RX FH is not requested in *NR-DL-AoD-RequestLocationInformation*.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.10.2.1.1-2, and cell specific test parameters are listed in table A.16.10.2.1.1-3.

Table A.16.10.2.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 2, 4	10: $N_{RB,c}$ = 52	
		3	20: $N_{RB,c}$ = 51	
SSB configuration		1, 2, 4	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 2, 3, 4	SMTC.1 RedCap	
CP length		1, 2, 3, 4	Normal	
DRX		1, 2, 3, 4	1.28s	
Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells
Expected RSTD	µs	1, 2, 3, 4	3	
Expected RSTD uncertainty	µs	1, 2, 3, 4	5	
T1	s	1, 2, 3, 4	2	
T2	s	1, 2, 3, 4	6	

Table A.16.10.2.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			

Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1, 4	PRS.1.3 FR1		PRS.1.3 FR1	
		2	PRS.1.3 FR1		PRS.1.3 FR1	
		3	PRS.2.3 FR1		PRS.2.3 FR1	
PRS muting info		1, 2, 3, 4	'10'		'01'	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/9.36 MHz	1, 4	N/A	-66.22	N/A	-66.22
	dBm/9.36 MHz	2		-66.22		-66.22
	dBm/18.72 MHz	3		-63.22		-63.22
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.10.2.1.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 4.6.3.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of correct events observed during repeated tests shall be at least 90%, where the reported PRS-RSRP measurement for each correct event shall be within the reporting range specified in clause 10.1A.17.3.

A.16.10.2.2 PRS-RSRP measurement without Rx FH reporting delay test case for single positioning frequency layer in FR1 SA in RRC_IDLE state with eDRX cycle > 10.24s

A.16.10.2.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement without Rx FH for RedCap UE in RRC_IDLE state with eDRX cycle > 10.24s meets the delay requirements specified in clause 4.6.3.5 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.16.10.2.2.1-1.

Table A.16.10.2.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The RedCap UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_IDLE. PRS RX hopping is not requested *in NR-DL-AoD-RequestLocationInformation.*

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource occasion occuring ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.10.2.2.1-2, and cell specific test parameters are listed in table A.16.10.2.2.1-3.

Table A.16.10.2.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 4	10: $N_{RB,c}$ = 52	
		2	10: $N_{RB,c}$ = 52	
		3	20: $N_{RB,c}$ = 51	
SSB configuration		1, 4	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 4	SMTC.1	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3, 4	Normal	
DRX	s	1, 2, 3, 4	1.28	
eDRX cycle length	s	1, 2, 3, 4	40.96	
PTW length	s	1, 2, 3, 4	1.28	

Reporting periodicity	s	1, 2, 3, 4	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34]
Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells
Expected RSTD	µs	1, 2, 3, 4	3	
Expected RSTD uncertainty	µs	1, 2, 3, 4	5	
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	10	

Table A.16.10.2.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1, 4	PRS.1.3 FR1		PRS.1.3 FR1	
		2	PRS.1.3 FR1		PRS.1.3 FR1	
		3	PRS.2.3 FR1		PRS.2.3 FR1	
PRS muting info		1, 2, 3, 3	‘10’		‘01’	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/9.36 MHz	1, 4	N/A	-67.92	N/A	-69.63
	dBm/9.36 MHz	2		-67.92		-69.63
	dBm/18.36 MHz	3		-65.01		-66.72
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.10.2.2.2 Test Requirements

The UE shall perform and report the PRS-RSRP measurements for Cell 1 and Cell 2, within the time limit specified in clause 4.6.3.5, starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

A test is considered complete after the UE has reported first set of results based on the configured reporting periodicity. The rate of the correct events for each cell observed during repeated tests shall be at least 90%, where the reported PRS-RSRP measurement for each correct event shall be within the reporting range specified in clause 10.1A.17.3.

A.16.11 Measurement Performance Requirements for RedCap in RRC_IDLE

A.16.11.1 RSTD Measurements

A.16.11.1.1 RSTD measurement accuracy test case for RedCap UE without FH in FR1 in RRC_IDLE state without eDRX

A.16.11.1.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC_IDLE state and without eDRX meets the accuracy requirements specified in clause 10.1A.16.2 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.16.11.1.1.1-1.

Table A.16.11.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The UE is configured with DRX cycle of 1.28 s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the RedCap UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 4.6.2.5.

The RSTD measurement accuracy in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

Table A.16.11.1.1.1-2: RSTD accuracy test parameters

Parameter	Config	Unit	Test 1

			Cell 1	Cell 2
PRS ARFCN	1,2,3,4		freq1	Freq1
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52	
	2		10: $N_{RB,c}$ = 52	
	3		20: $N_{RB,c}$ = 51	
	4		10: $N_{RB,c}$ = 52	
Duplex mode	1		FDD	
	2		TDD	
	3		TDD	
	4		HD-FDD	
TDD configuration	1		N/A	
	2		TDDConf.1.1	
	3		TDDConf.2.1	
	4		N/A	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-
	2		SR.1.1 TDD	
	3		SR.2.1 TDD	
	4		SR.1.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-
	2		CR.1.1 TDD	-
	3		CR.2.1 TDD	-
	4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-
	4		CCR.1.1 FDD	-
SSB configuration	1		SSB.1 FR1	
	2		SSB.1 FR1	
	3		SSB.1 RedCap FR1	
	4		SSB.1 FR1	
OCNG Patterns	1,2,3,4		OP.1	
TRS configuration	1		TRS.1.1 FDD	-
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
	4		TRS.1.1 FDD	
Initial BWP Configuration	1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Time offset with Cell 1	1,2,3,4	µs	-	3
	2,3		-	3
SMTC configuration	1,4		SMTC.2	
	2,3		SMTC.1	
PRS configuration	1		PRS.1.3 FR1	
	2		PRS.1.3 FR1	
	3		PRS.2.3 FR1	
	4		PRS.1.3 FR1	
PRS muting info	1,2,3,4		'10'	'01'
Expected RSTD	1,2,3,4	µs	N/A	3
Expected RSTD uncertainty	1,2,3,4	µs	N/A	5
EPRE ratio of PSS to SSS	1,2,3,4	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				

N_{oc} Note2	1,2,4	dBm/ SCS	-98	
	3		-95	
$\hat{E}_s/I_{ot}$	1,2,3,4	dB	-6	-13
PRS-RSRP Note3	1,2,4	dBm/SCS	-103.7	-109.9
	3		-100.7	-106.9
Io Note3	1,2,3,4	dBm/ 9.36MHz	-68.8	-68.8
	3	dBm/ 18.36MHz	-65.88	-65.88
$\hat{E}_s/N_{oc}$	1,2,3,4	dB	-5.7	-11.9
Propagation condition	1,2,3,4	-	AWGN	
Antenna configuration	1,2,3,4		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.11.1.1.2 Test Requirements

The RSTD measurement accuracy shall fulfil the absolute requirement in clause 10.1A.16.2.

A.16.11.1.2 RSTD measurement accuracy test case for RedCap UE without FH in FR1 in RRC_IDLE state with eDRX > 10.24s

A.16.11.1.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC_IDLE state with eDRX > 10.24s meets the accuracy requirements specified in clause 10.1A.16.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.16.11.1.2.1-1.

Table A.16.11.1.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The UE is configured with eDRX cycle of 40.96 s. The UE is configured to report positioning measurements every 20 s by setting the value of *reportingInterval* to "*ri20*" in *nr-DL-TDOA-RequestLocationInformation.* The *NR-DL-TDOA-ProvideAssistanceData* and *NR-DL-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the RedCap UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 4.6.2.5.

The RSTD measurement accuracy in this clause is valid for the cases where the RedCap UE is not configured by the LMF to perform RSTD measurement with RX FH in *NR-DL-TDOA-RequestLocationInformation.*

Table A.16.11.1.2.1-2: RSTD accuracy test parameters.

Parameter	Config	Unit	Cell 1	Cell 2
PRS ARFCN	1,2,3,4		freq1	freq1
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52	
	2		10: $N_{RB,c}$ = 52	
	3		20: $N_{RB,c}$ = 51	
	4		10: $N_{RB,c}$ = 52	
Duplex mode	1		FDD	
	2		TDD	
	3		TDD	
	4		HD-FDD	
TDD configuration	1		N/A	
	2		TDDConf.1.1	
	3		TDDConf.2.1	
	4		N/A	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-
	2		SR.1.1 TDD	
	3		SR.2.1 TDD	
	4		SR.1.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-
	2		CR.1.1 TDD	-
	3		CR.2.1 TDD	-
	4		CR.1.1 FDD	
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-
	4		CCR.1.1 FDD	-
SSB configuration	1		SSB.1 FR1	
	2		SSB.1 FR1	
	3		SSB.1 RedCap FR1	
	4		SSB.1 FR1	
OCNG Patterns	1,2,3,4		OP.1	
TRS configuration	1		TRS.1.1 FDD	-
	2		TRS.1.1 TDD	
	3		TRS.1.2 TDD	
	4		TRS.1.1 FDD	
Initial BWP Configuration	1,2,3,4		DLBWP.0.1 ULBWP.0.1	
Time offset with Cell 1	1,4	µs	-	3
	2,3		-	3
SMTC configuration	1,4		SMTC.2	
	2,3		SMTC.1	
PRS configuration	1		PRS.1.3 FR1	
	2		PRS.1.3 FR1	
	3		PRS.2.3 FR1	
	4		PRS.1.3 FR1	
PRS muting info	1,2,3,4		'10'	'01'
Expected RSTD	1, 2, 3, 4	µs	N/A	3
Expected RSTD uncertainty	1, 2, 3, 4	µs	N/A	5
EPRE ratio of PSS to SSS	1,2,3,4	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				

EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	1,2,4	dBm/ SCS	-98	
	3		-95	
$\hat{E}_s / I_{ot}$	1,2,3,4	dB	-6	-13
PRS-RSRP Note3	1,2,4	dBm/SCS	-103.7	-109.9
	3		-100.7	-106.9
Io Note3	1,2,4	dBm/ 9.36MHz	-68.8	-68.8
	3	dBm/ 18.36MHz	-65.88	-65.88
$\hat{E}_s / N_{oc}$	1,2,3,4	dB	-5.7	-11.9
Propagation condition	1,2,3,4	-	AWGN	
Antenna configuration	1,2,3,4		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.11.1.2.2 Test Requirements

The test is considered complete after the UE reports the first set of positioning measurements based on the configured *reportingInterval.* The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1A.16.2.

A.16.11.2 PRS-RSRP Measurements

A.16.11.2.1 PRS-RSRP measurement accuracy test case for RedCap UE in FR1 in RRC_IDLE state

A.16.11.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRP measurement accuracy for 1 Rx RedCap UE and 2 Rx RedCap UE, respectively, in RRC_IDLE is within the specified limits in FR1. This test will verify the requirements in clauses 10.1.A.17.2.1 for absolute accuracy and 10.1.A.17.2.2 for relative accuracy, when the PRS-RSRP measurement is performed without RX FH.

A.16.11.2.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.16.11.2.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in A.16.11.2.1.2-2. In all test cases, Cell 1 is the PCell.

Table A.16.11.2.1.2-1: PRS-RSRP supported test configurations

Config	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band.	

Table A.16.11.2.1.2-2: PRS-RSRP test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
	Config 4		HD-FDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		20: $N_{RB,c}$ = 51			
BWP BW	Config 1,4		10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		20: $N_{RB,c}$ = 51			
Downlink initial BWP configuration			DLBWP.0.1			
Uplink initial BWP configuration			ULBWP.0.1			
CP length	Config 1,2,3,4		Normal			
DRX Cycle	Config 1,2,3,4	s	1.28			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD	
PRS configuration	Config 1,4		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1
	Config 2		PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1	PRS.1.3 FR1
	Config 3		PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.3 FR1	PRS.2.3 FR1
PRS Resource slot offset (slot)	Config 1,2,3,4	slot	0	4	0	4
SSB configuration	Config 1,4		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.1	SSB.1	SSB.1	SSB.1

			RedCap FR1	RedCap FR1	RedCap FR1	RedCap FR1
Time offset with Cell 1	Config 1,4	ms	-	3	-	3
	Config 2,3	µs	-	3	-	3
SMTC configuration	Config 1,4		SMTC.1 RedCap			
	Config 2,3		SMTC.1 RedCap			
OCNG Patterns	Config 1,2,3,4		OCNG pattern 1			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4	kHz	15 kHz			
	Config 3		30 kHz			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	Config 1,2,4	dBm/15kHz	-98		-98	
	Config 3		-98		-98	
N_{oc} Note2	Config 1,2,4	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s/I_{ot}$		dB	-2.41	-12.12	-2.41	-12.12
$\hat{E}_s/N_{oc}$		dB	-2	-10	-2	-10
PRS-RSRP Note3	Config 1,2,4	dBm/SCS	-100	-108	-100	-108
	Config 3		-97	-105	-97	-105
Io Note3	Config 1,2,4	dBm/9.36MHz	-66.22		-66.22	
	Config 3	dBm/18.72MHz	-63.22		-63.22	
Propagation condition			AWGN			
Antenna configuration (1 Rx RedCap UE)			1x1			
Antenna configuration (2 Rx RedCap UE)			1x2			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over sub-carriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.16.11.2.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.17.2.1 when the PRS-RSRP measurement is performed without RX FH. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1A.17.2.2 when the PRS-RSRP measurement is performed without RX FH.

A.16.11.2.2 PRS-RSRP measurement without Rx FH accuracy test case for single positioning frequency layer in FR1 SA in RRC_IDLE state with eDRX cycle > 10.24s

A.16.11.2.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement without Rx FH for RedCap UE in RRC_IDLE state with eDRX cycle > 10.24s meets the accuracy requirements specified in clause 10.1A.17.2 in an environment with AWGN propagation conditions in FR1 in standalone scenario when single positioning frequency layer is configured. And both absolute and relative accuracy of PRS-RSRP measurements are tested.

The supported test configurations are specified in table A.16.11.2.2.1-1.

Table A.16.11.2.2.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The RedCap UE is only required to be tested in one of the supported test configurations.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR1. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_IDLE. PRS RX hopping is not requested *in NR-DL-AoD-RequestLocationInformation.*

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource occasion occuring ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The general test parameters are listed in table A.16.11.2.2.1-2, and cell specific test parameters are listed in table A.16.11.2.2.1-3.

Table A.16.11.2.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1, 2, 3, 4	Cell 1	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1, 2, 3, 4	Cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
RF Channel Number		1, 2, 3, 4	1: Cell 1 and Cell 2	
$BW_{channel}$	MHz	1, 4	10: $N_{RB,c}$ = 52	
		2	10: $N_{RB,c}$ = 52	
		3	20: $N_{RB,c}$ = 51	
SSB configuration		1, 4	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.1 RedCap FR1	
SMTC configuration		1, 4	SMTC.1	
		2	SMTC.1	
		3	SMTC.1	
CP length		1, 2, 3, 4	Normal	
DRX	s	1, 2, 3, 4	1.28	
eDRX cycle length	s	1, 2, 3, 4	40.96	
PTW length	s	1, 2, 3, 4	1.28	

Time offset between serving and neighbour cells	µs	1, 2, 3, 4	3	Synchronous cells
Expected RSTD	µs	1, 2, 3, 4	3	
Expected RSTD uncertainty	µs	1, 2, 3, 4	5	
T1	s	1, 2, 3, 4	5	
T2	s	1, 2, 3, 4	10	

Table A.16.11.2.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		N/A	
		2	CR.1.1 TDD			
		3	CR.2.1 TDD			
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		N/A	
		2	CCR.1.1 TDD			
		3	CCR.2.1 TDD			
OCNG Patterns		1, 2, 3, 4	OP.1		OP.1	
TRS Configuration		1, 4	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD			
		3	TRS.1.2 TDD			
Initial BWP configuration		1, 2, 3, 4	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1, 4	PRS.1.3 FR1		PRS.1.3 FR1	
		2	PRS.1.3 FR1		PRS.1.3 FR1	
		3	PRS.2.3 FR1		PRS.2.3 FR1	
PRS muting info		1, 2, 3, 3	‘10’		‘01’	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2				
		3				
PRS $\hat{E}_s/I_{ot}$	dB	1, 4	-Infinity	-2.41	-Infinity	-12.12
		2				
		3				
PRS $\hat{E}_s/N_{oc}$	dB	1, 4	-Infinity	-2	-Infinity	-10
		2				
		3				
PRS-RSRP Note 3	dBm/SCS kHz	1, 4	-Infinity	-100	-Infinity	-108
		2	-Infinity	-100	-Infinity	-108
		3	-Infinity	-97	-Infinity	-105
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-88	-88	-Infinity	-88
		2	-88	-88	-Infinity	-88
		3	-85	-85	-Infinity	-85
Io	dBm/9.36 MHz	1, 4	N/A	-67.92	N/A	-69.63
	dBm/9.36 MHz	2		-67.92		-69.63
	dBm/18.36 MHz	3		-65.01		-66.72
Propagation Condition		1, 2, 3, 4	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.16.11.2.2.2 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.17.2.1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1A.17.2.2.

A.17 NR standalone tests with one or more NR cells in FR2 for RedCap

A.17.1 SA: RRC_IDLE state mobility for RedCap

A.17.1.1 Cell re-selection to NR

A.17.1.1.1 Cell reselection to FR2 intra-frequency NR case for 2 Rx

A.17.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements specified in clause 4.2B.2.3.

A.17.1.1.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.17.1.1.1.2-1, A.17.1.1.1.2-2 and A.17.1.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.17.1.1.1.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.17.1.1.1.2-2: General test parameters for RedCap UE intra frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	
T2 end condition	Active cell		1, 2	Cell 2	
	Neighbour cell		1, 2	Cell 1	
Final condition	Active cell		1, 2	Cell 1	
	Neighbour cell		1, 2	Cell 2	
RF Channel Number			1, 2	1	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC.1	
DRX cycle length		s	1, 2	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, the intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2

Parameter	Unit	Test configuration	Value	Comment
T2	s	1, 2	135	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3	s	1, 2	35	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.17.1.1.1.2-3: Cell specific test parameters for RedCap UE intra frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 2	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1	SR.3.1 TDD			SR.3.1 TDD		
		2	SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
		2	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
		2	CCR.3.1 TDD			CCR.3.1 TDD		
SSB configuration		1	SSB.3 FR2			SSB.7 FR2		
		2	SSB.4 FR2			SSB.8 FR2		
OCNG Pattern		1, 2	OP.4			OP.4		
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		1, 2	66			66		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-138			-138		
		2	-135			-135		
Pcompensation	dB	1, 2	0			0		
$Qhyst_s$	dB	1, 2	0			0		
$Qoffset_{s,n}$	dB	1, 2	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2	SS-RSRP			SS-RSRP		
AoA setup		1, 2	Setup 1 defined in clause A.3.15.1			Setup 1 defined in clause A.3.15.1		
Beam assumption Note 4		1,2	Rough			Rough		
$\hat{E}_s/I_{ot\,\mathrm{BB}}$ Note 5	dB	1, 2	7.45	-3.55	0.95	-infinity	0.95	-3.55
N_{oc} Note2	dBm/SCS	1	-93					
		2	-90					
N_{oc} Note2	dBm/15 kHz	1, 2	-102					
$\hat{E}_s/N_{oc}$	dB	1, 2	8	-3	1.5	-infinity	1.5	-3
SSB_RP Note3	dBm/SCS	1	-85	-96	-91.5	-infinity	-91.5	-96
		2	-82	-93	-88.5	-infinity	-88.5	-93
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-60.53	-67.40	-65.34	-69.17	-65.34	-67.40
		2	-57.52	-64.39	-62.33	-66.16	-62.33	-64.39
Treselection	s	1, 2	0	0	0	0	0	0
SintrasearchP	dB	1, 2	50			50		
Propagation Condition		1, 2	AWGN					

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.								
NOTE 3: SSB_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation								
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.								

A.17.1.1.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2 and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration updateon Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 130 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1 and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration updateon Cell 1.

The cell re-selection delay to an already detected cell shall be less than 27 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI\text{-}NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR_ intra} + T_{SI\text{-}NR}$,

Where:

T_{detect, NR_Intra} See Table 4.2B.2.3-1 in clause 4.2B.2.3

$T_{evaluate, NR_ intra}$ See Table 4.2B.2.3-1 in clause 4.2B.2.3

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 129.28 s, allow 130 s for the cell re-selection delay to a newly detectable cell and 26.88 s for the cell re-selection delay to an already detected cell in the test case, which we allow 27 s.

A.17.1.1.2 Cell reselection to FR2 inter-frequency NR case

A.17.1.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2B.2.4.

A.17.1.1.2.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.17.1.1.2.2-1, A.17.1.1.2.2-2 and A.17.1.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas and Cell 2 is of higher priority than Cell 1. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

Table A.17.1.1.2.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.17.1.1.2.2-2: General test parameters for RedCap UE FR2 inter frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 2	The UE camps on Cell 2 in the initial phase and during T1 period the UE reselects to Cell 1
	Neighbour cell		1, 2	Cell 1	
T1 end condition	Active cell		1, 2	Cell 1	The UE shall perform reselection to Cell 1 during T1
	Neighbour cells		1, 2	Cell 2	
T3 end condition	Active cell		1, 2	Cell 2	The UE shall perform reselection to Cell 2 with higher priority during T3
	Neighbour cell		1, 2	Cell 1	
RF Channel Number			1, 2	1, 2	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
			2	SSB.2 FR2	
SMTC configuration			1, 2	SMTC.1	
DRX cycle length		s	1, 2	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	35	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3		s	1, 2	95	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.17.1.1.2.2-3: Cell specific test parameters for RedCap UE FR2 inter frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 2	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1, 2	SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET parameters		1, 2	CR.3.1 TDD			CR.3.1 TDD		
RMSI CORESET RMC configuration		1, 2	CCR.3.1 TDD			CCR.3.1 TDD		
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
RLM-RS		1, 2	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-140			-140		
		2	-137			-137		
Pcompensation	dB	1, 2	0			0		
$Qhyst_s$	dB	1, 2	0			0		
$Qoffset_{s,n}$	dB	1, 2	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2	SS-RSRP			SS-RSRP		
AoA setup		1, 2	Setup 1 defined in clause A.3.15.1			Setup 1 defined in clause A.3.15.1		
Beam assumption Note 4		1,2	Rough			Rough		
$\hat{E}_s/I_{ot\,\mathrm{BB}}$ Note 5	dB	1,2	9.95	9.95	7.45	-11.05	-infinity	7.95
N_{oc} Note2	dBm/SCS	1	-93			-93		
		2	-90			-90		
N_{oc} Note2	dBm/15 kHz	1, 2	-102			-102		
$\hat{E}_s/N_{oc}$	dB	1	10.5	10.5	8	-10.5	-infinity	8.5
SSB_RP Note3	dBm/SCS	1	—82.5	—82.5	-85	-103.5	-infinity	-84.5
		2	-79.5	-79.5	-82	-100.5	-infinity	-81.5
Io	dBm/95.04 MHz	1, 2	-53.11	-53.11	-55.34	-63.61	-63.98	-54.91
Treselection	s	1, 2	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2	50			50		
$Thresh_{x,highP}$	dB	1, 2	48			48		
$Thresh_{serving,lowP}$	dB	1, 2	44			44		
$Thresh_{x,lowP}$	dB	1, 2	50			50		
Propagation Condition		1, 2	AWGN			AWGN		

NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SSB_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.17.1.1.2.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 2 and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration updateon Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 87 s.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1 and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration updateon Cell 1.

The cell re-selection delay to a lower priority cell shall be less than 27 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search}$ + $T_{evaluate,\ NR_\ inter}$ + $T_{SI\text{-}NR}$, and to a lower priority cell can be expressed as: $T_{evaluate,\ NR_\ inter}$ + $T_{SI\text{-}NR}$,

Where:

$T_{higher_priority_search}$ See clause 4.2B.2.7

$T_{evaluate,\ NR_\ inter}$ See Table 4.2B.2.4-1 in clause 4.2B.2.4

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 86.88 s, allow 87 s for the cell re-selection delay to a higher priority cell and 26.88 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 27 s.

A.17.1.1.3 Cell reselection to FR2 intra-frequency NR case for UE fulfilling stationary relaxed measurement criterion for 2 Rx UE

A.17.1.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for UE configured with stationary relaxed measurement criterion specified in clause 4.2B.2.9.2.

A.17.1.1.3.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.17.1.1.3.2-1, A.17.1.1.3.2-2 and A.17.1.1.3.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. During T1 and T2, only criteria *stationaryMobilityEvaluation* is configured and fulfilled. UE has not registered with network for the tracking area containing cell2.

Table A.17.1.1.3.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.17.1.1.3.2-2: General test parameters for FR2 intra-frequency NR cell re-selection test case for UE fulfilling stationary criterion for 2 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 1	The UE camps on Cell 1 in the initial phase
	Neighbour cells		1, 2	Cell 2	
T1 end condition	Active cell		1, 2	Cell 2	The UE reselects to Cell 2 during T1 period
	Neighbour cells		1, 2	Cell 1	
Final condition	Active cell		1, 2	Cell 1	The UE reselects to Cell 1 during T2 period
	Neighbour cells		1,2	Cell 2	
RF Channel Number			1, 2	1	
Time offset between cells			1, 2	3 µs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC.1	
DRX cycle length		s	1, 2	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	

Parameter	Unit	Test configuration	Value	Comment
T1	s	1, 2	100	
T2	s	1, 2	100	

Table A.17.1.1.3.2-3: Cell specific test parameters for FR2 intra-frequency NR cell re-selection test case in AWGN for UE fulfilling stationary mobility criterion for 2 Rx UE

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		SR.3.1 TDD	
		2	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	
		2	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		CCR.3.1 TDD	
		2	CCR.3.1 TDD		CCR.3.1 TDD	
SSB configuration		1	SSB.3 FR2		SSB.7 FR2	
		2	SSB.4 FR2		SSB.8 FR2	
OCNG Pattern		1, 2	OP.4		OP.4	
Initial DL BWP configuration		1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Initial UL BWP configuration		1, 2	66		66	
RLM-RS		1, 2	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-137		-137	
$S_{SearchDeltaP-Stationary}$	dB	1, 2	6		6	
$T_{SearchDeltaP-Stationary}$	s	1,2	5		5	
Pcompensation	dB	1, 2	0		0	
$Qhyst_s$	dB	1, 2	0		0	
$Qoffset_{s,n}$	dB	1, 2	0		0	
Cell_selection_and_ reselection_quality_measurement		1, 2	SS-RSRP		SS-RSRP	
AoA setup		1, 2	Setup 1 defined in clause A.3.15.1		Setup 1 defined in clause A.3.15.1	
Beam assumption Note 4		1,2	Rough		Rough	
$\hat{E}_s/I_{ot\,\mathrm{BB}}$ Note 5	dB	1	-3.55	0.95	0.95	-3.55
		2				
N_{oc} Note2	dBm/SCS	1	-93			
		2	-90			
N_{oc} Note2	dBm/15 kHz	1	-102			
		2				
$\hat{E}_s/N_{oc}$	dB	1	-3	1.5	1.5	-3
		2				
SS-RSRP Note3	dBm/SCS	1	96	91.5	91.5	96
		2	93	-88.5	88.5	93
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-67.40	-65.34	-65.34	-67.40
		2	-64.40	-62.34	-62.34	-64.40
Treselection	s	1, 2	0	0	0	0
SintrasearchP	dB	1, 2	50		50	
Propagation Condition		1, 2	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.17.1.1.3.3 Test Requirements

The cell reselection delay to an already detected cell for UE fulfilling stationary relaxed criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected cell shall be less than 155 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to an already detectable cell can be expressed as: $T_{evaluate,NR_Intra_RedCap_Relax} + T_{SI-NR}$,

Where:

$T_{evaluate,NR_Intra_RedCap_Relax}$ See Table 4.2B.2.9.2-2 in clause 4.2B.2.9.2,

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 154.88 s, allow 155 s for the cell re-selection delay to an already detected cell for UE fulfilling stationary criterion in the test case.

A.17.1.1.4 Cell reselection to FR2 inter-frequency NR case for UE fulfilling stationary mobility relaxed measurement criterion for 2 Rx UE

A.17.1.1.4.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements for UE fulfilling stationary relaxed measurement criterion specified in clause 4.2B.2.10.2.

A.17.1.1.4.2 Test Parameters

The test scenario comprises of 2 cells (Cell 1 and Cell 2) on 2 different NR carriers respectively as given in tables A.17.1.1.4.2-1, A.17.1.1.4.2-2 and A.17.1.1.4.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. Cell 2 is of higher priority than Cell 1. The UE is configured with *stationaryMobilityEvaluation* criterion [2].

Table A.17.1.1.4.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.		

Table A.17.1.1.4.2-2: General test parameters for FR2 inter frequency NR cell re-selection test case for UE fulfilling stationary criterion for 2 Rx UE

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell 2	The UE camps on cell2 and fulfils stationary (*stationaryMobilityEvaluation* [2]) criterion.
	Neighbour cell		1, 2	Cell 1	

Parameter		Unit	Test configuration	Value	Comment
T1 final condition	Active cell		1, 2	Cell 1	The UE reselects to low priority cell1 during T1
	Neighbour cell		1, 2	Cell 2	
T2 final condition	Active cell		1, 2	Cell 2	The UE reselects to high priority cell2 during T2
	Neighbour cell			Cell 1	
RF Channel Number			1, 2	1, 2	
Time offset between cells			1, 2	3 µs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
			2	SSB.2 FR2	
SMTC configuration			1, 2	SMTC.1	
DRX cycle length		s	1, 2	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	85	T1 needs to be long enough to allow cell re-selection to already known cell1
T2		s	1, 2	85	T2 needs to be long enough to allow cell re-selection to already known cell2

Table A.17.1.1.4.2-3: Cell specific test parameters for FR2 inter frequency NR cell re-selection test case in AWGN for UE fulfilling stationary criterion for 2 Rx UE

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1, 2	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET parameters		1, 2	CR.3.1 TDD		CR.3.1 TDD	
RMSI CORESET RMC configuration		1, 2	CCR.3.1 TDD		CCR.3.1 TDD	
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-137		-137	
Pcompensation	dB	1, 2	0		0	
$Qhyst_s$	dB	1, 2	0		0	
$Qoffset_{s,n}$	dB	1, 2	0		0	
Cell_selection_and_reselection_quality_measurement		1, 2	SS-RSRP		SS-RSRP	
AoA setup		1, 2	Setup 1 defined in clause A.3.15.1		Setup 1 defined in clause A.3.15.1	
Beam assumption Note 4		1, 2	Rough		Rough	
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	9.95	7.45	-11.05	7.95
N_{oc} Note2	dBm/SCS	1	-93		-93	
		2	-90		-90	
N_{oc} Note2	dBm/15 kHz	1, 2	-102		-102	
$\hat{E}_s/N_{oc}$	dB	1, 2	10.5	8	-10.5	8.5
SSB_RP Note3	dBm/SCS	1	-82.5	-85	-103.5	-84.5

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		2	-79.5	-82	-100.5	-81.5
Io	dBm/95.04 MHz	1, 2	-53.14	-55.37	-63.64	-54.94
TreselectionNR	s	1, 2	0		0	
SnonintrasearchP	dB	1, 2	50		Not sent	
$S_{SearchDeltaP-Stationary}$	dB	1, 2	6		6	
$T_{SearchDeltaP-Stationary}$	s	1, 2	5		5	
$Thresh_{x, highP}$	dB	1, 2	48		48	
$Thresh_{serving, lowP}$	dB	1, 2	44		44	
$Thresh_{x, lowP}$	dB	1, 2	50		50	
Propagation Condition		1, 2	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

A.17.1.1.4.3 Test Requirements

The cell reselection delay to an already detected low priority cell (Cell 1) for UE fulfilling stationary criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected low priority cell, Cell 1, shall be less than 155 s.

The cell reselection delay to an already detected high priority cell (Cell 2) for UE fulfilling stationary criterion is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected high priority cell, Cell 2, shall be less than 155 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE 1: The cell re-selection delay to an already detected low priority cell can be expressed as:
$T_{evaluate,NR_Inter_RedCap_Relax} + T_{SI-NR}$

NOTE 2: The cell re-selection delay to an already detected higher priority cell can be expressed as:
$T_{evaluate,NR_Inter_RedCap_Relax} + T_{SI-NR}$

Where:

$T_{evaluate,NR_Inter_RedCap_Relax}$ See Table 4.2B.2.10.2-2 in clause 4.2B.2.10.2

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 154.88 s, allow 155 s for the cell re-selection delay to an already detected low priority cell for UE fulfilling stationary criterion in the test case.

This gives a total of 154.88 s, allow 155 s for the cell re-selection delay to an already detected high priority cell for UE fulfilling stationary criterion in the test case.

A.17.2 SA: RRC_INACTIVE state mobility for RedCap

A.17.2.1 Configured Grant based Small Data Transmissions (CG-SDT) for RedCap

A.17.2.1.1 TA validation for CG-SDT in FR2 for RedCap

A.17.2.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly perform TA validation for CG-SDT transmission in clause 5.2B.3. The test includes two sub-tests, Sub-test#1 for testing valid TA where UE can initiate CG-SDT transmission, and Sub-test#2 for testing invalid TA where UE does not initiate CG-SDT transmission. Sub−test#2 is only tested if Sub-test#1 is passed. For each sub-test, UE is configured with CG-SDT configurations when entering RRC Inactive state. Sub-test#1 consists of four successive time periods, with time duration of T1, T2, T3 and T4 respectively. Sub-test#2 consists of two successive time periods, with time duration of T5 and T6 respectively. There is one cell, which is the active NR cell in FR2. Figure A.17.1.1.2.1-1 shows the variation of the RSRP over the duration of Sub-test#1 and Figure A.17.1.1.2.1-2 shows the variation of the RSRP over the duration of Sub-test#2.

In Sub-test#1:

- Prior to the time point TA, the UE shall be fully synchronized to PCell (Cell 1), be registered to the cell and have entered RRC connected mode.
- Before starting the test at time point TA, test equipment configures RSRP to P0.
- At time point TB, RSRP is changed from P0 to P1.
- At time point TC which is W1 after time point TB, UE expect to receive RRC release with CG-SDT configuration and RRC status is changed to INACTIVE status.
- At time point TD, RSRP is changed from P1 to P0.
- At time point TE, RSRP is changed from P0 to P2. TE must be W2 before TF.
- Test equipment triggers UL data arrival at UE lower layer at time point TF. After time point TF, test equipment observes whether UE transmits with CG-SDT no later than TG which is W3 after TF.
- After time point TG, RRC status is changed from RRC INACTIVE to RRC CONNECTED.

In Sub-test#2:

- Prior to the time point TA, the UE shall pass Sub-test#1 and have entered RRC connected mode. Otherwise, Sub-test#2 shall not be executed.
- From time point TA to time point TD, RSRP is set to P2.
- At time point TC, which is W1 after time point TB, UE expect to receive RRC release with CG SDT configuration and RRC status is changed to INACTIVE status.
- At time point TD, RSRP is changed from P2 to P0.
- Test equipment triggers UL data arrival at UE lower layer at time point TF. TF is 3520 ms after TD. After time point TF, test equipment observes whether UE transmits with CG-SDT no later than TG which is W3 after TF.

W1 equals to 480 ms and W2 equals to 480 ms based on requirements in clause 5.2.B2.1. W3 is 1060 ms.

Table A.17.2.1.1.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	NR TDD, SSB SCS 120 kHz, data SCS 120KHz, BW 100 MHz

Table A.17.2.1.1.1-2: General test parameters for TA validation for CG-SDT in FR2

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 66
DL initial BWP configuration	Config 1		DLBWP.0.1
UL initial BWP configuration	Config 1		ULBWP.0.1
TDD Configuration	Config 1		TDDConf.3.1
RMSI CORESET Reference Channel	Config 1		CR.3.1 DD
SSB Configuration	Config 1		SSB.3 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1	kHz	120
PRACH Configuration	Config 1		Table A.3.8.3.4
OCNG parameters			OP.5
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
DRX		s	0.64
cg-SDT-RSRP-ThresholdSSB		dBm	-110
cg-SDT-RSRP-ChangeThreshold		dB	8
cg-SDT-TimeAlignmentTime			infinity
CG-SDT resource period		ms	320
T1		s	0.8
T2		s	0.96
T3		s	3.04
T4		s	1.54
T5		s	1.76
T6		s	4.58

Table A.17.2.1.1.1-3: Cell specific test parameters TA validation for CG-SDT in FR2

Parameter		Unit	SSB#0					
			T1	T2	T3	T4	T5	T6
AoA setup			Setup 1 defined in A.3.15					
Assumption for UE beams Note 4			Rough					
EPRE ratio of PDCCH DMRS to SSS		dB	4					
EPRE ratio of PDCCH to PDCCH DMRS		dB	0					
EPRE ratio of PBCH DMRS to SSS		dB	0					
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
N_{oc}	Config 1	dBm/15 kHz	-109					
N_{oc}	Config 1	dBm/SCS	-100					
$\hat{E}_s / I_{ot}$	Config 1	dB	0	13	0	24.5	24.5	0
$\hat{E}_s / N_{oc}$	Config 1	dB	0	13	0	24.5	24.5	0
SS-RSRP	Config 1	dBm/SCS	-100	-87	-100	-75.5	-75.5	-100
Io	Config 1	dBm/95.04 MHz	-68	-57.8	-68	-46.5	-46.5	-68

Parameter	Unit	SSB#0					
		T1	T2	T3	T4	T5	T6
Propagation condition		AWGN					
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							
NOTE 4: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.							

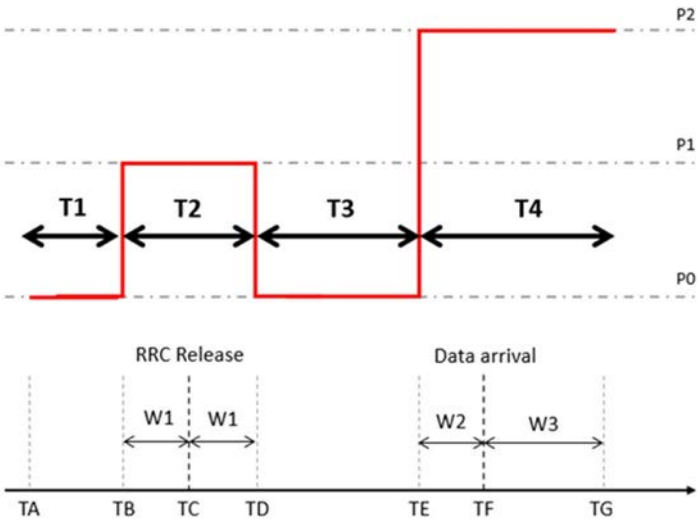


Figure A.17.2.1.1.1-1: RSRP variation model for CG-SDT Sub-test#1

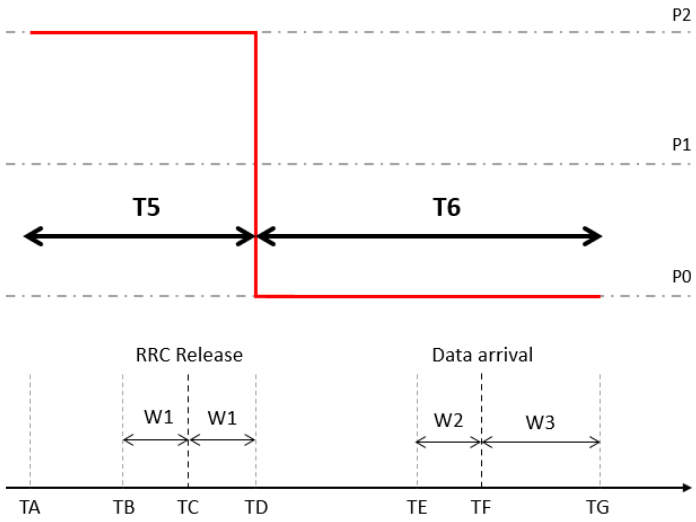


Figure A.17.2.1.1.1-2: RSRP variation model for CG-SDT Sub-test#2

A.17.2.1.1.2 Test Requirements

The UE behaviour in each test during time durations shall be as follows:

During Sub-test#1, UE shall transmit UL data with CG-SDT within 1060 ms after time point TF.

During Sub-test#2, after passing Sub-test#1, UE shall not transmit PUSCH at CG-SDT resources after TF until the end of the test at time point TG.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.2.2 Cell Reselection for Positioning

A.17.2.2.1 Cell reselection to FR2 intra-frequency NR case with RRC_INACTIVE eDRX and positioning SRS

A.17.2.2.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra-frequency NR cell reselection requirements specified in clause 5.6A.2.2, when a RedCap UE is in RRC_INACTIVE and configured with eDRX and to transmit SRS for positioning.

A.17.2.2.1.2 Test Parameters

The test procedure, supported test configurations, and test parameters in clause A.7.2.2.1.2 apply for this test.

A.17.2.2.1.3 Test Requirements

The test requirements in A.7.2.2.1.3 apply for this test.

A.17.3 RRC_CONNECTED state mobility for RedCap

A.17.3.1 Handover for RedCap

A.17.3.1.1 Intra-frequency handover from FR2 to FR2; unknown target cell for 2 Rx

A.17.3.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 intra frequency handover requirements specified in clause 6.1D.1.3.

A.17.3.1.1.2 Test Parameters

Supported test configurations are shown in table A.17.3.1.1.2-1. Both handover delay and interruption length are tested by using the parameters in table A.17.3.1.1.2-2, and A.17.3.1.1.2-3.

NR shall send a RRC message implying handover to Cell 2, then UE handover to Cell 2's intial BWP associated with CD-SSB.The test scenario comprises of carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.17.3.1.1.2-1: Intra-frequency handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.3.1.1.2-2: General test parameters Intra-frequency handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	

Access Barring Information	-	Not Sent	No additional delays in random access procedure.
Time offset between cells		3 μs	Synchronous cells
T1	s	5	
T2	s	≤10	

Table A.17.3.1.1.2-3: Cell specific test parameters for NR FR2-FR2 Intra frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]			Rough		Rough	
AoA setup			Setup 1 as defined in A.3.15			
NR RF Channel Number			**1**		**1**	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
Data PRBs allocated			66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
RMSI CORESET Reference Channel			CR3.1 TDD			
Control Channel RMC			CCR.3.1 TDD			
OCNG Patterns			OP. 1			
SMTC Configuration			SMTC.1			
SSB Configuration			SSB.3 FR2		SSB. 3 FR2	
PDSCH/PDCCH subcarrier spacing		kHz	120			
PUCCH/PUSCH subcarrier spacing		kHz	120			
PRACH configuration			PRACH.1 FR2			
TRS configuration			TRS.2.1 TDD			
PDSCH/PDCCH TCI state			TCI.State.2			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-104.7			
N_{oc} Note2		dBm/SCS	-95.7			
$\hat{E}_s / I_{ot}$		dB	6	-1.8	-Infinity	0
$\hat{E}_s / N_{oc}$		dB	6	6	-Infinity	7
Io[Note3]		dBm/ BW	-59.7	-56.7	-59.7	-56.7
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone

NOTE 6: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.17.3.1.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 232 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 222 ms in the test. $T_{interrupt}$ is defined in clause 6.1D.1.3.

This gives a total of 232 ms.

A.17.3.1.2 Inter-frequency handover from FR2 to FR2; unknown target cell for 2 Rx

A.17.3.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2 NCD-SSB to NR FR2 NCD-SSB inter frequency handover requirements specified in clause 6.1D.1.3.

A.17.3.1.2.2 Test Parameters

Supported test configurations are shown in table A.17.3.1.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.17.3.1.2.2-2, and A.17.3.1.2.2-3.

NR shall send a RRC message implying handover to Cell 2, then UE handover from Cell 1's NCD-SSB to Cell 2's specific RedCap BWP associated with NCD-SSB.The test scenario comprises of carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.17.3.1.2.2-1: Inter-frequency handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.3.1.2.2-2: General test parameters Inter-frequency handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.17.3.1.2.2-3: Cell specific test parameters for NR FR2-FR2 Inter frequency handover test case

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
Assumption for UE beams[Note 6]		Rough		Rough	
AoA setup		Setup 1as defined in A.3.15			
NR RF Channel Number		**1**		**2**	
Duplex mode		TDD			

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
Data PRBs allocated			66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR.3.1 TDD			
RMSI CORESET Reference Channel			CR.3.1 TDD			
Control Channel RMC			CCR.3.1 TDD			
OCNG Patterns			OP. 1			
SMTC Configuration for CD-SSB			SMTC.1			
SMTC Configuration for NCD-SSB			SMTC.2 RedCap			
CD-SSB Configuration			SSB.3 RedCap FR2		SSB.3 RedCap FR2	
NCD-SSB Configuration			SSB.3 RedCap FR2 Note 7		SSB.3 RedCap FR2 Note 7	
PDSCH/PDCCH subcarrier spacing		kHz	120			
PUCCH/PUSCH subcarrier spacing		kHz	120			
PRACH configuration			PRACH.1 FR2			
TRS configuration			TRS.2.1 TDD			
PDSCH/PDCCH TCI state			TCI.State.2			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.3 RedCap Note 8			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.3 RedCap Note 8			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-104.7		-104.7	
N_{oc} Note2		dBm/SCS	-95.7		-95.7	
$\hat{E}_s / I_{ot}$		dB	5	5	-Infinity	5
$\hat{E}_s / N_{oc}$		dB	5	5	-Infinity	5
Io Note3	Config 1,2	dBm/ BW	-60.5	-60.5	-66.7	-60.5
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 7: NCD-SSB is configured within dedicated RedCap DL BWP and CD-SSB is configured completely outside the dedicated RedCap DL BWP
NOTE 8: The starting PRB index for dedicated DL BWP corresponding to NCD-SSB PRB index
NOTE 9: The starting PRB index for dedicated UL BWP is the same as the dedicated DL BWP corresponding to NCD-SSB PRB index

A.17.3.1.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 2052 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 2042 ms in the test. $T_{interrupt}$ is defined in clause 6.1D.1.3.

This gives a total of 2052 ms.

A.17.3.2 RRC Connection Mobility Control for RedCap

A.17.3.2.1 SA: RRC Re-establishment

A.17.3.2.1.1 Intra-frequency RRC Re-establishment in FR2

A.17.3.2.1.1.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR2 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1B.

The test parameters are given in table A.17.3.2.1.1.1-1, table A.17.3.2.1.1.1-2 and table A.17.3.2.1.1.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure.

Table A.17.3.2.1.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.3.2.1.1.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell 1	
	Neighbour cells		1	Cell 2	
Final condition	Active cell		1	Cell 2	
RF Channel Number			1	1	
Time offset between cells			1	3 μs	Synchronous cells
N310		-	1	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1	0	Radio link failure timer; T310 is disabled
T311		ms	1	5000	RRC re-establishment timer
Access Barring Information		-	1	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.3 FR2	
SMTC configuration			1	SMTC pattern 1	
DRX cycle length		s	1	OFF	
PRACH configuration			1	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1		s	1	5	
T2		s	1	4.84	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133)
T3		s	1	5	

Table A.17.3.2.1.1.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 4			Rough			Rough		
TDD configuration		1	TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		1	24			24		
PDSCH RMC configuration		1	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration		1	TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI state		1	TCI.State.2			N/A		
OCNG Pattern		1	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1	SSB			SSB		
AoA setup		1	Setup 1 defined in clause A.3.15.1			Setup 1 defined in clause A.3.15.1		
$\hat{E}_s / I_{ot}$	dB	1	-0.12	-infinity	-infinity	-3.46	2	2
N_{oc} Note2	dBm/15 kHz	1	-104.7					
N_{oc} Note2	dBm/SCS	1	-95.7					
$\hat{E}_s / N_{oc}$	dB	1	4	-infinity	-infinity	2	2	2
SS-RSRP Note3	dBm/SCS	1	-91.7	-infinity	-infinity	-93.7	-93.7	-93.7
Io	dBm/95.04 MHz	1	-64.00	-66.95	-66.95	-64.00	-66.95	-66.95
Propagation Condition		1	AWGN					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.17.3.2.1.1.2 Test Requirements

he RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR intra frequency cell shall be less than 5 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$

$N_{freq} = 1$

$T_{identify_intra_NR}$ = 3520 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 4865 ms, allow 5 s in the test case.

A.17.3.2.1.2 Inter-frequency RRC Re-establishment in FR2

A.17.3.2.1.2.1 Test Purpose and Environment

The purpose is to verify that the NR inter-frequency RRC re-establishment delay in FR2 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1B.

The test parameters are given in table A.17.3.2.1.2.1-1, table A.17.3.2.1.2.1-2 and table A.17.3.2.1.2.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of Cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of Cell 2 by the end of T1.

Table A.17.3.2.1.2.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.3.2.1.2.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case in FR2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell 1	
	Neighbour cells		1	Cell 2	
Final condition	Active cell		1	Cell 2	
RF Channel Number			1	1, 2	
Time offset between cells			1	3 µs	Synchronous cells
N310		-	1	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1	0	Radio link failure timer; T310 is disabled
T311		ms	1	5000	RRC re-establishment timer
Access Barring Information		-	1	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.3 FR2	
SMTC configuration			1	SMTC pattern 1	
DRX cycle length		s	1	OFF	
PRACH configuration			1	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1		s	1	5	

Parameter	Unit	Test configuration	Value	Comment
T2	s	1	4.84	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133)
T3	s	1	6	

Table A.17.3.2.1.2.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case in FR2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 4			Rough			Rough		
AoA setup		1	Setup 3 as specified in clause A.3.15					
			AoA1			AoA2		
TDD configuration		1	TDDConf.3.1			TDDConf.3.1		
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66			100: $N_{PRB,c}$ = 66		
Data PRBs allocated		1	24			24		
PDSCH RMC configuration		1	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration		1	TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI state		1	TCI.State.2			N/A		
OCNG Pattern		1	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1	SSB			SSB		
N_{oc} Note2	dBm/15 kHz	1	-92.1			-92.1		
N_{oc} Note2	dBm/SCS	1	-83.1			-83.1		
$\hat{E}_s / N_{oc}$	dB	1	0	-infinity	-infinity	-infinity	-infinity	0
$\hat{E}_s / I_{ot\ BB}$ Note 5	dB	1	-1.01	-infinity	-infinity	-infinity	-infinity	-1.01
SSB_RP Note3	dBm/SCS	1	-83.1	-infinity	-infinity	-infinity	-infinity	-83.1
Io	dBm/95.04 MHz	1	-55.46	-58.51	-58.51	-58.51	-58.51	-55.46
Propagation Condition		1	AWGN			AWGN		

NOTE 1: OCNG shall be used such that a constant total transmitted power is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

A.17.3.2.1.2.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR inter frequency cell shall be less than 6 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 2$

$T_{identify_intra_NR}$ = 1600 ms

$T_{identify_inter_NR}$ = 2080 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target inter-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 5025 ms, allow 6 s in the test case.

A.17.3.2.1.3 Intra-frequency RRC Re-establishment in FR2 without serving cell timing

A.17.3.2.1.3.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR2 without serving cell timing is within the specified limits. These tests will verify the requirements in clause 6.2.1B.

The test parameters are given in table A.17.3.2.1.3.1-1, table A.17.3.2.1.3.1-2 and table A.17.3.2.1.3.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.17.3.2.1.3.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.3.2.1.3.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell 1	
	Neighbour cells		1	Cell 2	
Final condition	Active cell		1	Cell 2	
RF Channel Number			1	1	
Time offset between cells			1	3 μs	Synchronous cells
N310		-	1	1	Maximum consecutive out-of-sync indications from lower layers

Parameter	Unit	Test configuration	Value	Comment
N311	-	1	1	Minimum consecutive in-sync indications from lower layers
T310	ms	1	6000	Radio link failure timer configured by *RLF-TimersAndConstants*
T311	ms	1	5000	RRC re-establishment timer
Access Barring Information	-	1	Not Sent	No additional delays in random access procedure.
SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC pattern 1	
DRX cycle length	s	1	OFF	
PRACH configuration		1	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1	s	1	5	
T2	s	1	10.84	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1B in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1B.5 in TS 38.133)
T3	s	1	5	

Table A.17.3.2.1.3.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 4			Rough			Rough		
TDD configuration		1	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1	CR.3.1 FDD			CR.3.1 FDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 FDD			CCR.3.1 FDD		
TRS configuration		1	TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI state		1	TCI.State.2			N/A		
OCNG Pattern		1	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1	SSB			SSB		
AoA setup		1	Setup 1 defined in clause A.3.15.1			Setup 1 defined in clause A.3.15.1		
$\hat{E}_s / I_{ot}$	dB	1	5	-infinity	-infinity	-infinity	-infinity	5
N_{oc} Note2	dBm/15 kHz	1	-104.7					
N_{oc} Note2	dBm/SCS	1	-95.7					
$\hat{E}_s / N_{oc}$	dB	1	5	-infinity	-infinity	-infinity	-infinity	5
SS-RSRP Note3	dBm/SCS	1	-90.7	-infinity	-infinity	-infinity	-infinity	-90.7
Io	dBm/95.04 MHz	1	-60.52	-66.71	-60.52	-60.52	-66.71	-60.52
Propagation Condition		1	AWGN					

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.								
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.								
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								
NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation								

A.17.3.2.1.3.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR intra frequency cell without serving cell timing shall be less than 5 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50 \text{ ms} + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 1$

$T_{identify_intra_NR} = 3520$ ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 [2] for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 4865 ms, allow 5 s in the test case.

A.17.3.2.2 Random Access

A.17.3.2.2.1 4-step RA type contention based random access test in FR2 for NR Standalone

A.17.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2B.2 and clause 7.1A.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell in FR2. Supported test parameters are shown in table A.17.3.2.2.1.1-1. UE capable of SA with PCell in FR2 needs to be tested by using the parameters in table A.17.3.2.2.1.1-2 and table A.17.3.2.2.1.1-3.

Table A.17.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR2 for NR Standalone

Config	Description
1	NR PSCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.3.2.2.1.1-2: General test parameters for contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.1 FR2	As defined in A.3.10
CSI-RS for tracking	Config 1		TRS.2.1 TDD	
Duplex Mode for Cell 1	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	As defined in A.3.1.4
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 66	
Data PRBs allocated	Config 1		24	
OCNG Pattern Note 1			OCNG pattern 1	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR.3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD	As defined in A.3.1.2
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
PRACH Configuration			FR2 PRACH configuration 1	As defined in A.3.8B.3, with exceptions as defined below
rsrp-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88 dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

NOTE 3: The Δ_{UL} value is calculated as -ROUND(P_{PRACH0} -1), where P_{PRACH0} is the measured first PRACH power with -80.6 dBm/SCS applied, *preambleReceivedTargetPower* = -100 dBm and *ss-PBCH-BlockPower* = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.

NOTE 4: The Δ_{DL} value is calculated as ($RSRP_{REP}$ – RSRP_76), where $RSRP_{REP}$ is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.17.3.2.2.1.1-3: OTA-related test parameters for contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in clause A.3.15.1
Assumption for UE beams[Note 3]			Rough	
SSB with index 0	Es [Note1]	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es [Note1]	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	No external noise (Note 4)	

NOTE 1: No articial noise is applied in this test.
NOTE 2: Void.
NOTE 3: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 4: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].

A.17.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.17.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in clause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.17.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.17.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.17.3.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2.2.1.4 the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.17.3.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

A.17.3.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

A.17.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in clause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.17.3.2.2.2 4-step RA type non-contention based random access test in FR2 for NR Standalone

A.17.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell in FR2. Supported test parameters are shown in table A.17.3.2.2.2.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in table A.17.3.2.2.2.1-2 and table A.17.3.2.2.2.1-3 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports csi-RSRP-AndRSRQ-MeasWithSSB or csi-RSRP-AndRSRQ-MeasWithoutSSB.

Table A.17.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR2 for NR Standalone

Config	Description
1	NR PSCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Test-2	Comments
SSB Configuration	Config 1		SSB.1 FR2	SSB.1 FR2	As defined in A.3.10B
CSI-RS for tracking	Config 1		TRS.2.1 TDD	TRS.2.1 TDD	
CSI-RS Configuration	Config 1		N/A	CSI-RS.3.1 TDD	As defined in A.3.1B.4
Duplex Mode for Cell 2	Config 1		TDD	TDD	
TDD Configuration	Config 1		TDDConf.3.1	TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 66	100: $N_{PRB,c}$ = 66	
Data PRBs allocated	Config 1		24	24	
OCNG Pattern Note 1			OP.3	OP.3	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR3.1 TDD	SR3.1 TDD	As defined in A.3.1B.1.
NR RF Channel Number			1	1	
EPRE ratio of PSS to SSS		dB	0	0	
EPRE ratio of PBCH_DMRS to SSS		dB			
EPRE ratio of PBCH to PBCH_DMRS		dB			
EPRE ratio of PDCCH_DMRS to SSS		dB			
EPRE ratio of PDCCH to PDCCH_DMRS		dB			
EPRE ratio of PDSCH_DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH_DMRS		dB			
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)		dBm	maximum value configurable for certain power class	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
PRACH Configuration			FR2 PRACH configuration 2	FR2 PRACH configuration 3	As defined in A.3.8B.3, with exceptions as defined below.
rsrp-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88 dBm. Δ_{DL} is derived from the

Parameter	Unit	Test-1	Test-2	Comments
				downlink calibration process Note 4
preambleReceivedTargetPower	dBm	-100	-100	As defined in TS 38.331 [2]

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 3: The Δ_{UL} value is calculated as -ROUND(P_{PRACH0} -1), where P_{PRACH0} is the measured first PRACH power with -80.6 dBm/SCS applied, *preambleReceivedTargetPower* = -100 dBm and *ss-PBCH-BlockPower* = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.
NOTE 4: The Δ_{DL} value is calculated as ($RSRP_{REP}$ – RSRP_76), where $RSRP_{REP}$ is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.17.3.2.2.2.1-3: OTA-related test parameters for non-contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Test-2	Comments
AoA setup			Setup 1	Setup 1	As defined in clause A.3.15.1
Assumption for UE beams Note 3			Rough	Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	-80.6	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	-80.6	
	Es/Iot_{BB}	dB	21.09	21.09	
	Io	dBm/95.04 MHz	-56.01	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	-95.0	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	-95.0	
	Es/Iot_{BB}	dB	6.69	6.69	
	Io	dBm/95.04 MHz	-70.41	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	No external noise (Note 4)	No external noise (Note 4)	

NOTE 1: No articial noise is applied in this test.
NOTE 2: void.
NOTE 3: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 4: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].

A.17.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.17.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

To test the UE behavior specified in clause 6.2.2.2.2.1 for SSB-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.7.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in clause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.17.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.17.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in clause 7.1.2.

A.17.3.2.2.3 2-step RA type contention based random access test in FR2 for NR Standalone

A.17.3.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the 2-step RA type random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2B.2 and clause 7.1A.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in table A.17.3.2.2.3.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in table A.17.3.2.2.3.1-2 and table A.17.3.2.2.3.1-3.

Table A.17.3.2.2.3.1-1: Supported test configurations for 2-step RA type contention based random access test in FR2 for NR Standalone

Config	Description
1	NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.3.2.2.3.1-2: General test parameters for 2-step RA type contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.3 FR2	As defined in A.3.10
Duplex Mode for Cell 1	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	As defined in A.3.1.4
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 24	
OCNG Pattern Note 1			OCNG pattern 1	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR.3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD	As defined in A.3.1.2
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
MsgA Configuration			FR2 MsgA configuration 1	As defined in A.3.20.3, with exceptions as defined below
msgA-RSRP-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88 dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

Parameter	Unit	Test-1	Comments
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.			
NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.			
NOTE 3: The Δ_{UL} value is calculated as -ROUND(PMsgA0 -1), where PMsgA0 is the measured first MsgA PRACH power with -80.6 dBm/SCS applied, *msgA-PreambleReceivedTargetPower* = -100 dBm and *ss-PBCH-BlockPower* = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send MsgA.			
NOTE 4: The Δ_{DL} value is calculated as (RSRP_$_{REP}$ – RSRP_76), where RSRP_$_{REP}$ is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.			

Table A.17.3.2.2.3.1-3: OTA-related test parameters for 2-step RA type contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
AoA setup			Setup 2b	As defined in A.3.15.2
Assumption for UE beams[Note 2]			Rough	
SSB with index 0	Es [Note1]	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es [Note1]	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	No external noise (Note 3)	
NOTE 1: No articial noise is applied in this test.				
NOTE 2: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation				
NOTE 3: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].				

A.17.3.2.2.3.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.17.3.2.2.3.2.1 MsgA Transmission

To test the UE behavior specified in clause 6.2.2.3.1.1 the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB.*

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first MsgA preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.17.3.2.2.3.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.2 the System Simulator shall transmit a MsgB containing a fallbackRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit MsgA with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB's contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first MsgA PRACH shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.17.3.2.2.3.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.3 the System Simulator shall transmit a MsgB containing a fallbackRAR message and Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first MsgA PRACH shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.17.3.2.2.4 2-step RA type non-contention based random access test in FR2 for NR Standalone

A.17.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2B.2 and clause 7.1A.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in table A.17.3.2.2.4.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in table A.17.3.2.2.4.1-2 and table A.17.3.2.2.4.1-3.

Table A.17.3.2.2.4.1-1: Supported test configurations for non-contention based random access test for 2-step RA type in FR2 for NR Standalone

Config	Description
1	NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.3.2.2.4.1-2: General test parameters for non-contention based random access test for 2-step RA type in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.3 FR2	As defined in A.3.10
Duplex Mode for Cell 2	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: $N_{PRB,c}$ = 24	
OCNG Pattern Note 1			OP.3	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR3.1 TDD	As defined in A.3.1.1.
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,f,c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
MsgA Configuration			FR2 MsgA configuration 2	As defined in A.3.20.3, with exceptions as defined below.
msgA-RSRP-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88 dBm. Δ_{DL} is derived from the downlink calibration process Note 4
msgA-PreambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

NOTE 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

NOTE 3: The Δ_{UL} value is calculated as -ROUND(P_{MsgA0} -1), where P_{MsgA0} is the measured first MsgA PRACH power with -80.6 dBm/SCS applied, *msgA-PreambleReceivedTargetPower* = -100 dBm and *ss-PBCH-BlockPower* = 20 dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send MsgA.

NOTE 4: The Δ_{DL} value is calculated as ($RSRP_{REP}$ – RSRP_76), where $RSRP_{REP}$ is the SS-RSRP Reported value in table 10.1.6.1-1 with -80.6 dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.17.3.2.2.4.1-3: OTA-related test parameters for non-contention based random access test for 2-step RA type in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in clause A.3.15.1
Assumption for UE beams Note 2			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	

Parameter		Unit	Test-1	Comments
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	No external noise (Note 3)	

NOTE 1: No artificial noise is applied in this test.
NOTE 2: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 3: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].

A.17.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.17.3.2.2.4.2.1 MsgA Transmission

In Test-1, to test the UE behavior specified in clause 6.2.2.3.2.1 for MsgA transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.17.3.2.2.4.2.2 MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble after 3 MsgA transmissions have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB if the MsgB contains a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power if all received Random Access Response Reception has not been considered as successful.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.17.3.2.2.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA*.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be same as the first MsgA preamble with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in clause 7.1A.2.

A.17.3.2.3 SA: RRC Connection Release with Redirection

A.17.3.2.3.1 Redirection from NR in FR2 to NR in FR2

A.17.3.2.3.1.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to NR requirements specified in clause 6.2.3A.2.1.

A.17.3.2.3.1.2 Test Parameters

Supported test configurations are shown in table A.17.3.2.3.1.2-1. The time delay is tested by using the parameters in table A.17.3.2.3.1.2-2, and A.17.3.2.3.1.2-3.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2.

Table A.17.3.2.3.1.2-1: Redirection from NR to NR test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.3.2.3.1.2-2: General test parameters for Redirection from NR to NR test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	3.2	

Table A.17.3.2.3.1.2-3: Cell specific test parameters for Redirection from NR to NR test case

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2
Assumption for UE beams[Note 6]		Rough		Rough	

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup			Setup 1as defined in A.3.15			
NR RF Channel Number			1		2	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66			
BWP BW		MHz	100: $N_{PRB,c}$ = 66			
Data PRBs allocated			66			
DRX Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR.3.1 TDD			
RMSI CORESET Reference Channel			CR.3.1 TDD			
Control Channel RMC			CCR.3.1 TDD			
OCNG Patterns			OP.1			
SMTC configuration			SMTC.1			
SSB Configuration			SSB.3 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120			
PUCCH/PUSCH subcarrier spacing		kHz	120			
PRACH configuration			PRACH.1 FR2			
TRS configuration			TRS.2.1 TDD			
PDSCH/PDCCH TCI state			TCI.State.2			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15 kHz	-104.7		-104.7	
N_{oc} Note2		dBm/SCS	-95.7		-95.7	
$\hat{E}_s/I_{ot}$		dB	5	5	-Infinity	5
$\hat{E}_s/N_{oc}$		dB	5	5	-Infinity	5
Io Note3		dBm/ BW	-60.5	-60.5	-66.7	-60.5
Propagation condition		-	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.17.3.2.3.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 3160 ms from the beginning of time period T2.

The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_NR} = T_{RRC_procedure_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH},$$

where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}NR}$ = 1760 ms in the test.

$T_{SI\text{-}NR}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target NR cell.

T_{RACH} = 10 ms in the test.

This gives a total of 3160 ms.

A.17.4 Timing

A.17.4.1 UE transmit timing

A.17.4.1.1 NR UE Transmit Timing Test for FR2

A.17.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in table A.17.4.1.1.1-1.

Table A.17.4.1.1.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz

For this test a single NR cell is used. Tables A.17.4.1.1.1-2 and A.17.4.1.1.1-2A define the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in table A.17.4.1.1.1-3.

Table A.17.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2
SSB ARFCN		1	Freq1	Freq1
TDD configuration		1	TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	66	
Initial BWP Configuration		1	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1	DLBWP.1.1 ULBWP.1.1	
TRS Configuration		1	TRS.2.1 TDD	
PDSCH/PDCCH TCI state		1	TCI.State.2	
DRX Cycle	ms	1	N/A	DRX.8[Note5]
PDSCH Reference measurement channel		1	SR.3. 3 TDD	
RMSI CORESET Reference Channel		1	CR.3. 2 TDD	
Dedicated CORESET Reference Channel		1	CCR.3. 7 TDD	
OCNG Patterns		1	OP.1	
SSB Configuration		1	SSB.4 FR2	
SMTC Configuration		1	SMTC.1	

Parameter	Unit	Config	Test1	Test2
PDSCH/PDCCH subcarrier spacing	kHz	1	120	
EPRE ratio of PSS to SSS	dB	1	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation condition		1	AWGN	
SRS Config		1	SRSConf.1Note6	SRSConf.2Note6

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: DRX related parameters are given in table A.3.3.8-1
NOTE 6: SRS configs are given in table A.17.4.1.1.1-3

Table A.17.4.1.1.1-2A: OTA related test parameters

Parameter	Unit	Test 1	Test 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beamsNote 6		Fine	
N_{oc} Note1	dBm/15 kHzNote4	-112	
N_{oc} Note1	dBm/SCSNote3	-100	
$\hat{E}_s/N_{oc}$	dB	4	
SS-RSRPNote2	dBm/SCS Note4	-96	
$\hat{E}_s/I_{ot}$	dB	4	
IoNote2	dBm/95.04 MHz Note4	-68.5	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

Table A.17.4.1.1.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	

	Field	SRSConf.1	SRSConf.2	Comments
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	17	17	Matches $N_{PRB,c}$
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl2560, 4	Offset to align with DRX periodicity
	sequenceId	0	0	Any 10 bit number

Table A.17.4.1.1.1-4: Void

A.17.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test:

1) Setup NR PCell according to parameters given in table A.17.4.1.1.1-1.
2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.
   a. The N_{TA} offset value (in T_c units) is 13792
   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in table 7.1.2-1
3) The test system shall adjust the timing of the DL path by values given in table A.17.4.1.1.2-1

Table A.17.4.1.1.2-1 Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
240	$+8*64T_c$	$+4*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 Table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX confiured.
5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

A.17.4.2 UE timer accuracy

A.17.4.3 Timing advance

A.17.4.3.1 SA FR2 timing advance adjustment accuracy

A.17.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3A.

A.17.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.17.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.17.4.3.1.2-2, A.17.4.3.1.2-3 and A.17.4.3.1.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.17.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.17.4.3.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.17.4.3.1.2-1: Timing advance supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.4.3.1.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		1	
Initial DL BWP		DLBWP.0.1	As specified in table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA_new} = N_{TA_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	*For 120 kHz SCS* $N_{TA_new} = N_{TA_old} + 1024*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.17.4.3.1.2-3: Cell specific test parameters for timing advance

Parameter	Unit	Test1	
		T1	T2
Duplex mode		TDD	

Parameter	Unit	Test1	
		T1	T2
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66	
BWP BW	MHz	100: $N_{PRB,c}$ = 66	
DRX Cycle	ms	Not Applicable	
PDSCH Reference measurement channel		SR.3.1 TDD	
CORESET Reference Channel		CR.3.1 TDD	
OCNG Patterns		OP.1	
TRS configuration		TRS.2.1 TDD	
PDSCH/PDCCH TCI state		TCI.State.2	
SMTC configuration		SMTC.1	
SSB Configuration		SSB.1 FR2	
PDSCH/PDCCH subcarrier spacing	kHz	120	
PUCCH/PUSCH subcarrier spacing	kHz	120	
EPRE ratio of PSS to SSS	dB	0	
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation condition	-	AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone

Table A.17.4.3.1.2-3A: OTA related test parameters

Parameter	Unit	Test 1	
		T1	T2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams[Note 6]		Fine	
N_{oc} [Note1]	dBm/15 kHz[Note4]	-112	
N_{oc} [Note1]	dBm/SCS[Note3]	-103	
$\hat{E}_s / N_{oc}$	dB	4	
SS-RSRP[Note2]	dBm/SCS [Note4]	-99	
$\hat{E}_s / I_{ot}$	dB	4	
Io[Note2]	dBm/95.04 MHz [Note4]	-68.5	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

Table A.17.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance

Field	Value	Comment
c-SRS	16	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=0	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting. SRS on last symbol of slot, and 1 symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission
NOTE: For further information see clause 6.3.2 in TS 38.331 [2].		

A.17.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where *k* = 11.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.17.5 Signaling characteristics for RedCap

A.17.5.1 Radio link Monitoring for RedCap

A.17.5.1.1 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with SSB-based RLM RS in non-DRX mode

A.17.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1B.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.17.5.1.1 .1-1. The test parameters are given in tables A.17.5.1.1 .1-2, A.17.5.1.1 .1-3, and A.17.5.1.1 .1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.17.5.1.1 .1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.17.5.1.1 .1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In addition to RLM-RS radio link monitoring using SSB index 0 and SSB index 1, the UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

Table A.17.5.1.1 .1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.17.5.1.1 .1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		TDD
$BW_{channel}$		Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1		24
DL initial BWP configuration		Config 1		DLBWP.0.1
DL dedicated BWP configuration		Config 1		DLBWP.1.1
UL initial BWP configuration		Config 1		ULBWP.0.1
UL dedicated BWP configuration		Config 1		ULBWP.1.1
TDD Configuration		Config 1		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1		CCR.3.4 TDD
SSB Configuration		Config 1		SSB.1 FR2
SMTC Configuration		Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1		120 KHz
PRACH Configuration		Config 1		Table A.3.8.3.4
SSB index assigned as RLM RS		Config 1		0,1
OCNG parameters				OP.5
CP length				Normal
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				*gp0*
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1		TRS.2.1 TDD
T1			s	0.2
T2			s	9.68
T3			s	9.68
D1			s	9.64
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.17.5.1.1 .1-3: OTA related cell specific test parameters for FR2 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter	Unit	Test 1					
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 3 defined in A.3.15					
		AoA1			AoA2		
Assumption for UE beams Note 5		Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS	dB	4			Not sent		
EPRE ratio of PDCCH to PDCCH DMRS	dB	0					

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15			
ssb-Index 1 SNR	Config 1		Not sent			2 Note 6	-15	-15
N_{oc}	Config 1	dBm/ 15 kHz	-92.1			-92.1		
Time multiplexing of the downlink transmissions from each AoA			Defined in figure A.17.5.1.1 .1-2					
Propagation condition			TDL-A 30 ns 75 Hz			TDL-A 30 ns 75 Hz		

NOTE 1: OCNG shall be used such a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band..
NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.17.5.1.1 .1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0

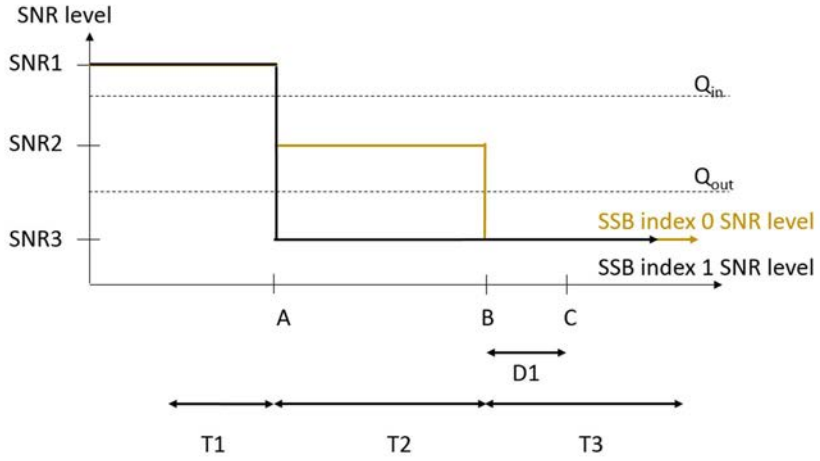


Figure A.17.5.1.1 .1-1: SNR variation for out-of-sync testing

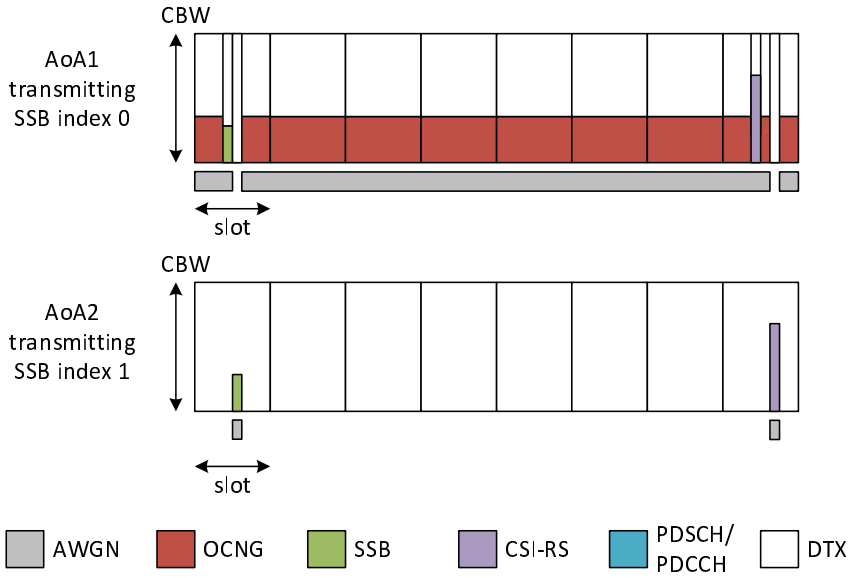


Figure A.17.5.1.1 .1-2: Time multiplexed downlink transmissions

A.17.5.1.1.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.1.2 Radio Link Monitoring In-sync Test for FR2 PCell configured with SSB-based RLM RS in non-DRX mode

A.17.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1B.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.17.5.1.2.1-1.The test parameters are given in tables A.17.5.1.2.1-2, and A.17.5.1.2.1-3 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.17.5.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.17.5.1.2.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Table A.17.5.1.2.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.17.5.1.2.1-2: General test parameters for FR2 in-sync testing in non-DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		TDD
$BW_{channel}$		Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1		24
DL initial BWP configuration		Config 1		DLBWP.0.1
DL dedicated BWP configuration		Config 1		DLBWP.1.1
UL initial BWP configuration		Config 1		ULBWP.0.1
UL dedicated BWP configuration		Config 1		ULBWP.1.1
TDD Configuration		Config 1		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1		CCR.3.1 TDD
SSB Configuration		Config 1		SSB.1 FR2
SMTC Configuration		Config 1		SMTC.3
PDSCH/PDCCH subcarrier spacing		Config 1		120 KHz
PRACH Configuration		Config 1		Table A.3.8.3.4
SSB index assigned as RLM RS		Config 1		0,1
OCNG parameters				OP.5
CP length				Normal
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	0
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				N.A.
Layer 3 filtering				*Enabled*
T310 timer			ms	4000
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1		TRS.2.1 TDD
T1			s	0.2
T2			s	0.2
T3			s	1.88
T4			s	0.2
T5			s	3.84
D1			s	3.8
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.17.5.1.2.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1									
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
AoA setup			Setup 3 defined in A.3.15									
			AoA1					AoA2				
Assumption for UE beams Note 5			Rough					Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0					Not sent				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0									
EPRE ratio of PBCH DMRS to SSS		dB										
EPRE ratio of PBCH to PBCH DMRS		dB										
EPRE ratio of PSS to SSS		dB										
EPRE ratio of PDSCH DMRS to SSS		dB										
EPRE ratio of PDSCH to PDSCH DMRS		dB										
EPRE ratio of OCNG DMRS to SSS		dB										
EPRE ratio of OCNG to OCNG DMRS		dB										
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15	-15	-15					
ssb-Index 1 SNR	Config 1		Not sent					2 Note 6	-15	-15	-4.5	2 Note 6
N_{oc}	Config 1	dBm/ 15 kHz	-92.1					-92.1				
Time multiplexing of the downlink transmissions from each AoA			Defined in figure A.17.5.1.2.1-2									
Propagation condition			TDL-A 30 ns 75 Hz					TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band.
NOTE 5: Information about types of UE beam is given inannex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.17.5.1.2.1-4: Void

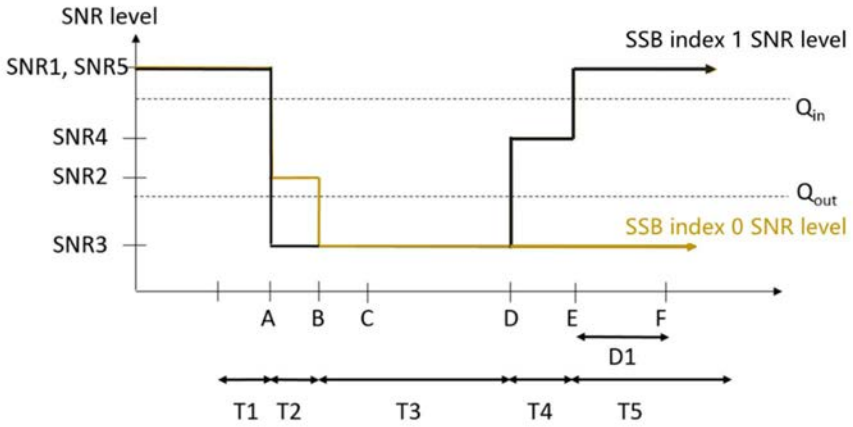


Figure A.17.5.1.2.1-1: SNR variation for in-sync testing

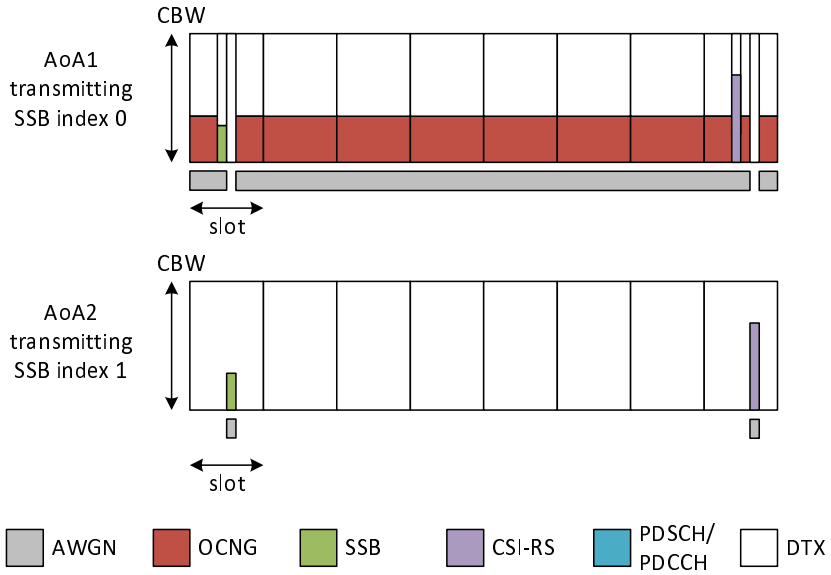


Figure A.17.5.1.2.1-2: Time multiplexed downlink transmissions

A.17.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.1.3 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with SSB-based RLM RS in DRX mode

A.17.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1B.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.17.5.1.3.1-1. The test parameters are given in tables A.17.5.1.3.1-2, and A.17.5.1.3.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.17.5.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.17.5.1.3.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.17.5.1.3.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.17.5.1.3.1-2: General test parameters for FR2 out-of-sync testing in DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		TDD
$BW_{channel}$		Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1		24
DL initial BWP configuration		Config 1		DLBWP.0.1
DL dedicated BWP configuration		Config 1		DLBWP.1.1
UL initial BWP configuration		Config 1		ULBWP.0.1
UL dedicated BWP configuration		Config 1		ULBWP.1.1
TDD Configuration		Config 1		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1		CCR.3.4 TDD
SSB Configuration		Config 1		SSB.1 FR2
SMTC Configuration		Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1		120 KHz
PRACH Configuration		Config 1		Table A.3.8.3.1
SSB index assigned as RLM RS		Config 1		0,1
OCNG parameters				OP.5
CP length				Normal
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX Configuration				DRX.3
Gap pattern ID				N.A.
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1		TRS.2.1 TDD
T1			s	0.2
T2			s	14.48
T3			s	14.48
D1			s	14.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.17.5.1.3.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for out-of-sync radio link monitoring tests in DRX mode

Parameter	Unit	Test 1					
		T1	T2	T3	T1	T2	T3
AoA setup		Setup 3 defined in A.3.15					
		AoA1			AoA2		
Assumption for UE beams Note 5		Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS	dB	4			Not sent		
EPRE ratio of PDCCH to PDCCH DMRS	dB	0					

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15			
ssb-Index 1 SNR	Config 1		Not sent			2 Note 6	-15	-15
N_{oc}	Config 1	dBm/ 15 kHz	-92.1			-92.1		
Time multiplexing of the downlink transmissions from each AoA			Defined in figure A.17.5.1.1 .1-2					
Propagation condition			TDL-A 30 ns 75 Hz			TDL-A 30 ns 75 Hz		

NOTE 1: OCNG shall be used such a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band..
NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband

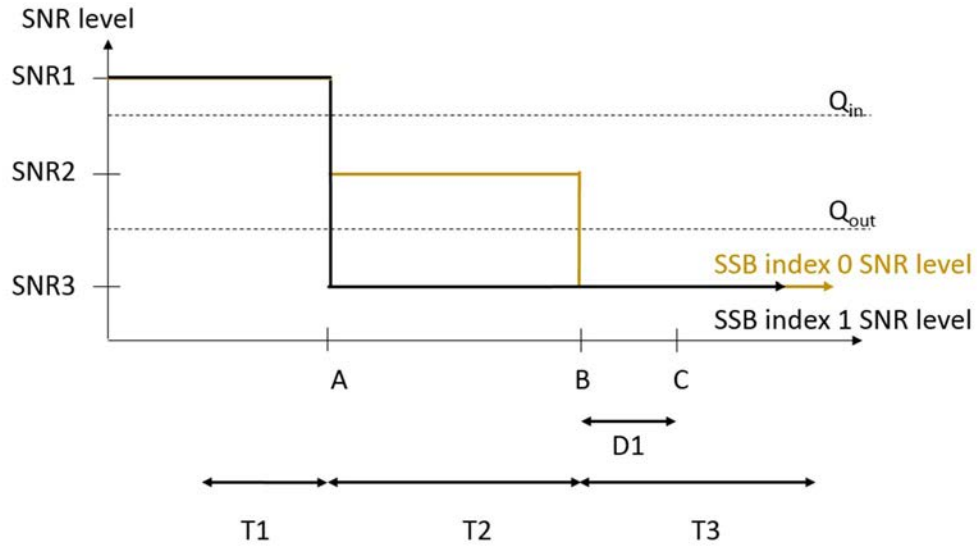


Figure A.17.5.1.3.1-1: SNR variation for out-of-sync testing

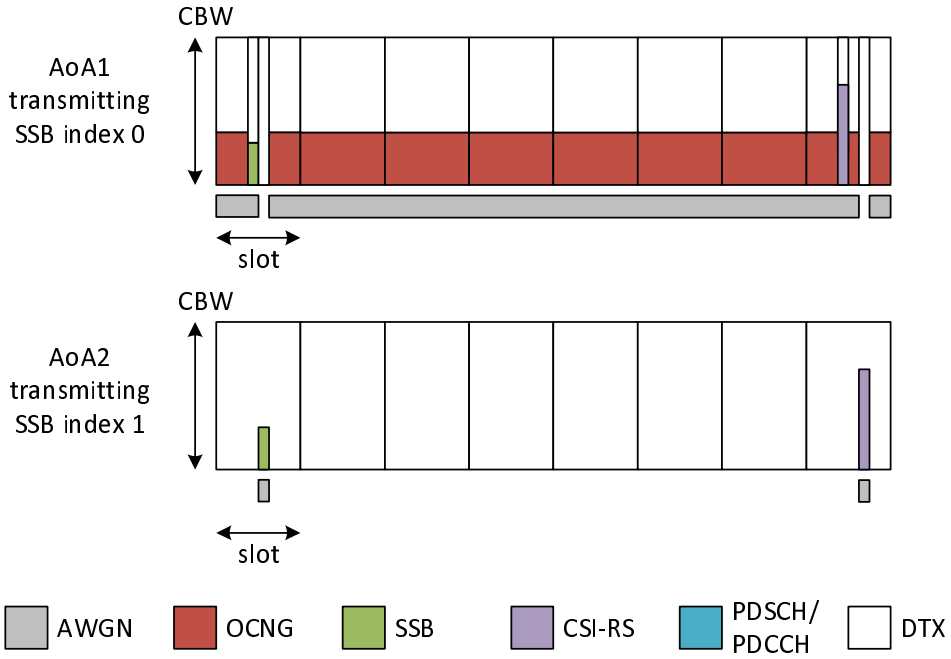


Figure A.17.5.1.3.1-2: Time multiplexed downlink transmissions

A.17.5.1.3.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.1.4 Radio Link Monitoring In-sync Test for FR2 PCell configured with SSB-based RLM RS in DRX mode

A.17.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1B.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.17.5.1.4.1-1. The test parameters are given in tables A.17.5.1.4.1-2, and A.17.5.1.4.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.17.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.17.5.1.4.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.17.5.1.4.1-2: General test parameters for FR2 in-sync testing in DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		TDD
$BW_{channel}$		Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated		Config 1		66
DL initial BWP configuration		Config 1		DLBWP.0.1
DL dedicated BWP configuration		Config 1		DLBWP.1.1
UL initial BWP configuration		Config 1		ULBWP.0.1
UL dedicated BWP configuration		Config 1		ULBWP.1.1
TDD Configuration		Config 1		TDDConf.3.1
RMSI CORESET Reference Channel		Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel		Config 1		CCR.3.1 TDD
SSB Configuration		Config 1		SSB.1 FR2
SMTC Configuration		Config 1		SMTC.3
PDSCH/PDCCH subcarrier spacing		Config 1		120 KHz
PRACH Configuration		Config 1		Table A.3.8.3.4
SSB index assigned as RLM RS		Config 1		0,1
OCNG parameters				OP.1
CP length				Normal
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	0
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX Configuration				DRX.11
Gap pattern ID				N.A.
Layer 3 filtering				*Enabled*
T310 timer			ms	4000
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1		CSI-RS.3.1 TDD
reportConfigType				periodic
reportQuantity				cri-RI-PMI-CQI
CSI reporting periodicity			slot	40
CSI reporting offset			slot	4
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1		TRS.2.1 TDD
T1			s	0.2
T2			s	0.2
T3			s	2.8
T4			s	0.2
T5			s	3.88
D1			s	3.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.17.5.1.4.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for in-sync radio link monitoring test in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams Note 5			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15	-4.5	2 Note 6
ssb-Index 1 SNR	Config 1		2 Note 6	-15	-15	-15	-15
N_{oc}	Config 1	dBm/15KHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.3
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4: The SNR values are specified for testing a UE which supports 2RX on at least one band.
NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 6: This value allows up to 1 dB degradation from applied SNR to UE baseband.

Table A.17.5.1.4.1-4: Void

Table A.17.5.1.4.1-5: Void

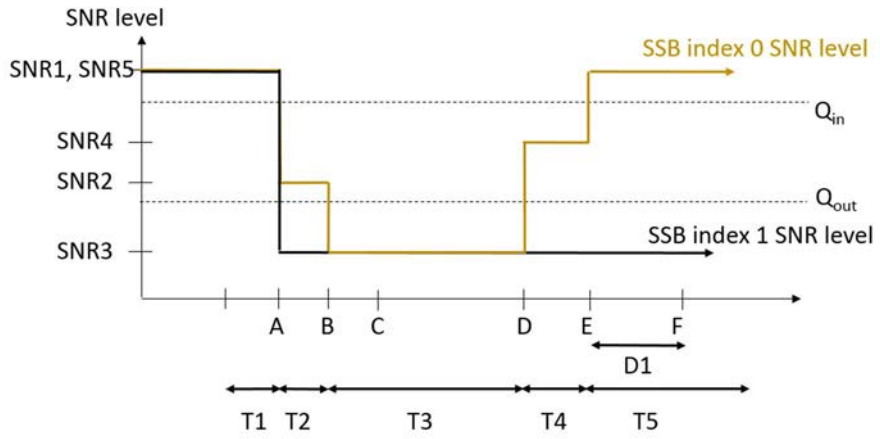


Figure A.17.5.1.4.1-1: SNR variation for in-sync testing

A.17.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.1.5 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with CSI-RS-based RLM in non-DRX mode

A.17.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR2 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1B.3.

The test parameters are given in tables A.17.5.1.5.1-1, A.17.5.1.5.1-2, A.17.5.1.5.1-3 and A.17.5.1.5.1-4 below. There is one cell, Cell 1 which is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.17.5.1.5.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 10 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test. In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.17.5.1.5.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.17.5.1.5.1-2: General test parameters for FR2 PCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
$BW_{channel}$	Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1		24
$BW_{occupied}$	Config 1		24
TDD Configuration	Config 1		TDDConf.3.1
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.4
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.4
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.4 TDD CCR.3.6 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.5
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4

Parameter		Unit	Value
			Test 1
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			*gp0
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	0.35
T3		s	0.35
D1		s	0.31
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.17.5.1.5.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
AoA setup			Setup 3 defined in A.3.15					
			AoA1			AoA2		
Assumption for UE beams Note 10			Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4			Not sent		
EPRE ratio of PDCCH to PDCCH DMRS		dB						
EPRE ratio of PBCH DMRS to SSS		dB	0					
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
SNR on RLM-RS1	Config 1	dB	2 Note 11	-6 Note 11	-15			
SNR on RLM-RS2	Config 1		Not sent			2 Note 11	-15	-15
N_{oc}	Config 1	dBm/ 15 kHz	-92.1			-92.1		
Propagation condition			TDL-A 30ns 75Hz			TDL-A 30ns 75Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.17.5.1.5.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band.
NOTE 10: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

Table A.17.5.1.5.1-4: Measurement gap configuration for FR2 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: RLM RS is partially overlapped with measurement gap	

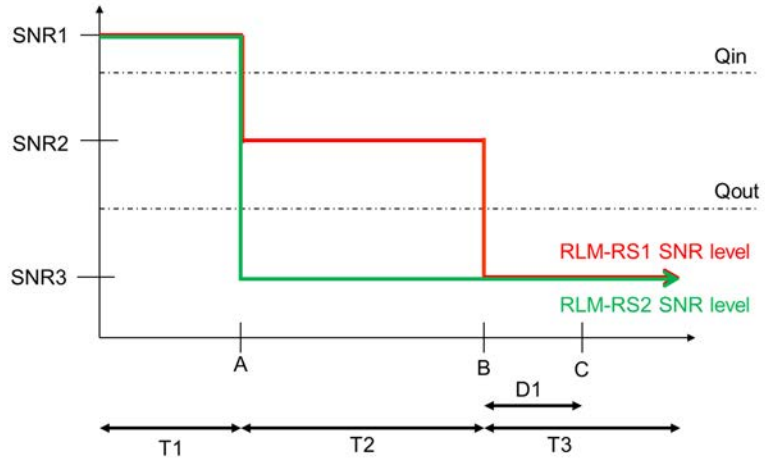


Figure A.17.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing

A.17.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 no later than time point C (D_1 second after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.1.6 Radio Link Monitoring In-sync Test for FR2 PCell configured with CSI-RS-based RLM in non-DRX mode

A.17.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR2 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1B.3.

The test parameters are given in tables A.17.5.1.6.1-1, A.17.5.1.6.1-2 and A.17.5.1.6.1-3 below. There is one cells, Cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.17.5.1.6.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 10 ms. In the test, DRX configuration is not enabled. In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.17.5.1.6.1-1: Supported test configurations for FR2 PCell

Configuration	Description

1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.17.5.1.6.1-2: General test parameters for FR2 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
$BW_{channel}$	Config 1		100: $N_{PRB,c}$ = 66
Data PRBs allocated	Config 1		24
$BW_{occupied}$	Config 1		24
TDD Configuration	Config 1		TDDConf.3.1
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.4
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.4
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.5
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD

Parameter	Unit	Value
		Test 1
reportConfigType		periodic
reportQuantity		cri-RI-PMI-CQI
CSI reporting periodicity	slot	40
CSI reporting offset	slot	4
T1	s	0.2
T2	s	0.2
T3	s	0.24
T4	s	0.2
T5	s	0.88
D1	s	0.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.		

Table A.17.5.1.6.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1									
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
AoA setup			Setup 3 defined in A.3.15									
			AoA1					AoA2				
Assumption for UE beams Note 10			Rough					Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	4					Not sent				
EPRE ratio of PDCCH to PDCCH DMRS		dB										
EPRE ratio of PBCH DMRS to SSS		dB	0									
EPRE ratio of PBCH to PBCH DMRS		dB										
EPRE ratio of PSS to SSS		dB										
EPRE ratio of PDSCH DMRS to SSS		dB										
EPRE ratio of PDSCH to PDSCH DMRS		dB										
EPRE ratio of OCNG DMRS to SSS		dB										
EPRE ratio of OCNG to OCNG DMRS		dB										
SNR on RLM-RS1	Config 1	dB	2 Note 11	-6 Note 11	-15	-15	-15					
SNR on RLM-RS2	Config 1		Not sent					2 Note 11	-15	-15	-4.5	2 Note 11
N_{oc}	Config 1	dBm/ 15KHz	-92.1					-92.1				
Propagation condition			TDL-A 30ns 75Hz					TDL-A 30ns 75Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.17.5.1.6.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band.
NOTE 10: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband.

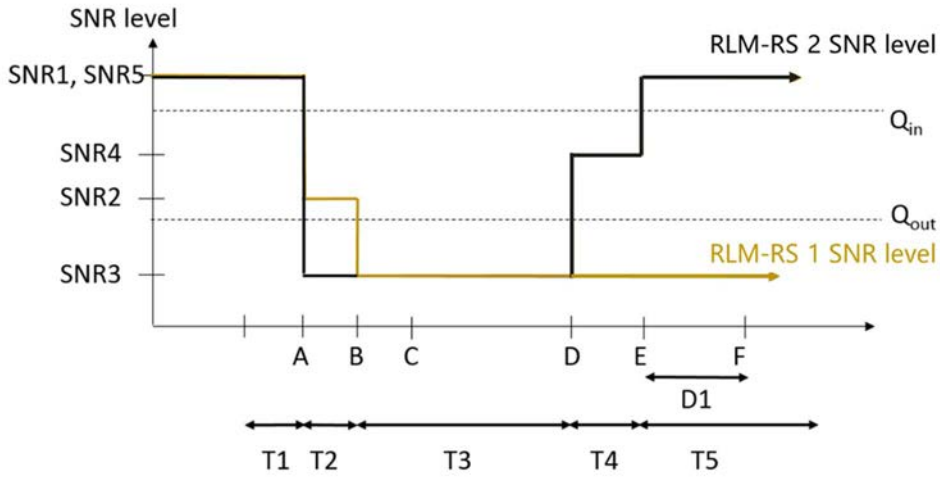


Figure A.17.5.1.6.1-1: SNR variation for CSI-RS in-sync testing

A.17.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.1.7 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with CSI-RS-based RLM in DRX mode

A.17.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR2 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1B.3.

The test parameters are given in tables A.17.5.1.7.1-1, A.17.5.1.7.1-2, and A.17.5.1.7.1-3 below. There is one cell, Cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.17.5.1.7.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 10 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.17.5.1.7.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.17.5.1.7.1-2: General test parameters for FR2 PCell for CSI-RS out-of-sync testing in DRX mode

Parameter	Unit	Value
		Test 1
Active PCell		Cell 1
RF Channel Number		1

Parameter		Unit	Value
			Test 1
Duplex mode	Config 1		TDD
TDD Configuration	Config 1		TDDConf.3.1
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.4 TDD CCR.3.6 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.17.5.1.7.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter	Unit	Test 1		
		T1	T2	T3
AoA setup	dB	Setup 1 defined in A.3.15		
Assumption for UE beams Note 10		Rough		
EPRE ratio of PDCCH DMRS to SSS	dB	4		
EPRE ratio of PDCCH to PDCCH DMRS	dB			

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS1	Config 1	dB	2 Note 11	-6 Note 11	-15
SNR on RLM-RS2	Config 1	dB	2 Note 11	-15	-15
N_{oc}	Config 1	dBm/15KHz	-104.7		
Propagation condition			TDL-A 30ns 75Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.17.5.1.7.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band.
NOTE 10: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband.

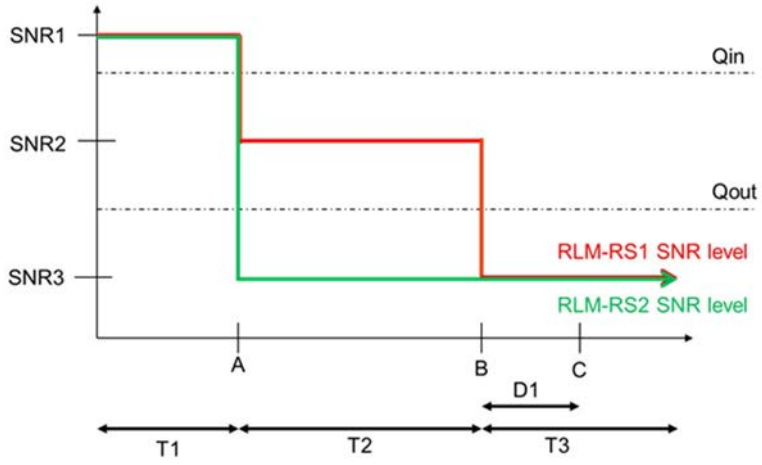


Figure A.17.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing

A.17.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on PCell.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C (D_1 secondafter the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.1.8 Radio Link Monitoring In-sync Test for FR2 PCell configured with CSI-RS-based RLM in DRX mode

A.17.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR2 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1B.

The test parameters are given in tables A.17.5.1.8.1-1, A.17.5.1.8.1-2, A.17.5.1.8.1-3 and A.17.5.1.8.1-4 below. There is one cells, Cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.17.5.1.8.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 10 ms. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test. In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.17.5.1.8.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.17.5.1.8.1-2: General test parameters for FR2 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
TDD Configuration	Config 1		TDDConf.3.1
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1

Parameter		Unit	Value
			Test 1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			*gp0
Layer 3 filtering			*Enabled*
T310 timer		ms	*2000*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
reportConfigType			periodic
reportQuantity			cri-RI-PMI-CQI
CSI reporting periodicity		slot	40
CSI reporting offset		slot	4
T1		s	0.2
T2		s	0.2
T3		s	1.64
T4		s	0.2
T5		s	1.88
D1		s	1.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.17.5.1.8.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
AoA setup	dB	Setup 1 defined in A.3.15				
Assumption for UE beams Note 10		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	4				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB	0				
EPRE ratio of PBCH to PBCH DMRS	dB					
EPRE ratio of PSS to SSS	dB					
EPRE ratio of PDSCH DMRS to SSS	dB					
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS						

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS1	Config 1	dB	2 Note 11	-6 Note 11	-15	-4.5	2 Note 11
SNR on RLM-RS2	Config 1	dB	2 Note 11	-15	-15	-15	-15
N_{oc}	Config 1	dBm/15KHz	-104.7				
Propagation condition			TDL-A 30ns 75Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.17.5.1.8.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band..
NOTE 10: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband.

Table A.17.5.1.8.1-4: Measurement gap configuration for FR2 CSI-RS in-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: RLM RS is partially overlapped with measurement gap	

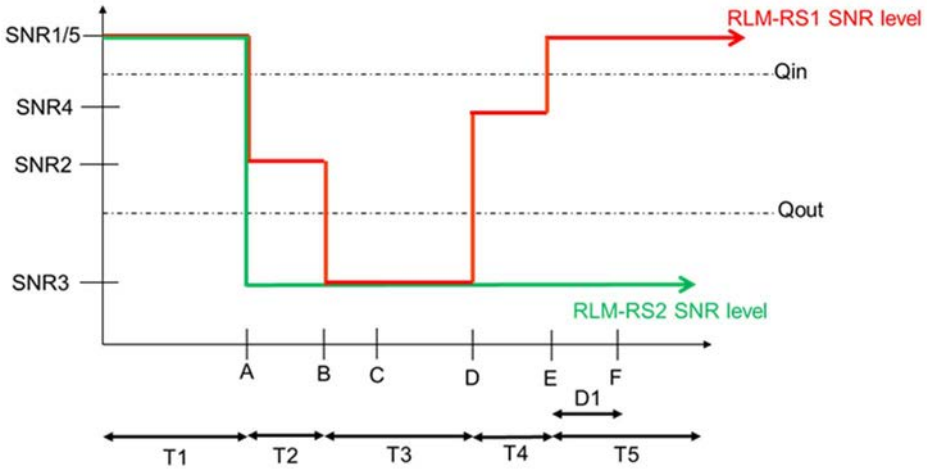


Figure A.17.5.1.8.1-1: SNR variation for CSI-RS in-sync testing

A.17.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.1.9 UE Radio Link Monitoring Scheduling Restrictions on FR2

A.17.5.1.9.1 Test Purpose and Environment

The purpose is to verify that the NR UE correctly follows the RLM scheduling restrictions requirements defined in clause 8.1B.7. This test verifies that the UE correctly receive the PDCCH scheduled on the symbols right before the RLM SSB symbols without overlap so that it sends ACK/NACK correctly. The test case is only applicable to UE which supports pdcch-MonitoringAnyOccasions or pdcch-MonitoringAnyOccasionsWithSpanGap.

The test parameters are given in table A.17.5.1.9.1-1, table A.17.5.1.9.1-2 and table A.17.5.1.9.1-3 below. The UE is required during time period T1 to transmit ACK/NACK correctly upon scheduling of PDSCH.

Table A.17.5.1.9.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 120 kHz RMC SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.5.1.9.1-2: General test parameters for NR RLM scheduling restriction test case in FR2

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		1	1	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC.3	
DRX cycle length	s	1	OFF	
T1	s	1	5	During T1 the UE is required to correctly transmit ACK/NACK

Table A.17.5.1.9.1-3: Cell specific test parameters for NR RLM scheduling restriction test case in FR2

Parameter	Unit	Test configuration	Cell 1	
AoA setup		1	Setup 3 defined in A.3.15.3	
			AoA1	AoA2
Assumption for UE beams Note 1			Rough	Rough
TDD configuration		1	TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24	
PDSCH Reference measurement channel		1	SR.3.2 TDD	Not sent
RMSI CORESET RMC configuration		1	CR.3.1 TDD	Not sent
Dedicated CORESET RMC configuration		1	CCR.3.2 TDD	Not sent
TRS configuration		1	TRS.2.1 TDD	TRS.2.2 TDD
PDCCH/PDSCH TCI state		1	TCI.State.2	N/A
OCNG Pattern		1	OP.5 defined in A.3.2.1	Not sent
Initial DL BWP configuration		1	DLBWP.0.1	
Initial UL BWP configuration		1	ULBWP.0.1	
RLM-RS		1	SSB with index 0	SSB with index 1
N_{oc}	dBm/15 kHz	1	-92.1	-92.1
N_{oc} Note2	dBm/SCS	1	-83.1	-83.1

Parameter	Unit	Test configuration	Cell 1	
$\hat{E}_s / N_{oc}$	dB	1	2	2
$\hat{E}_s / I_{ot}$ BB Note 4	dB	1	1	1
SSB_RP Note3	dBm/SCS	1	-81.1	-81.1
Io	dBm/95.04 MHz	1	-54.35	-54.35
Time multiplexing of the downlink transmissions from each AoA		1	Defined in figure A.17.5.1.9.1-1	
Propagation Condition		1	AWGN	AWGN

NOTE 1: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.

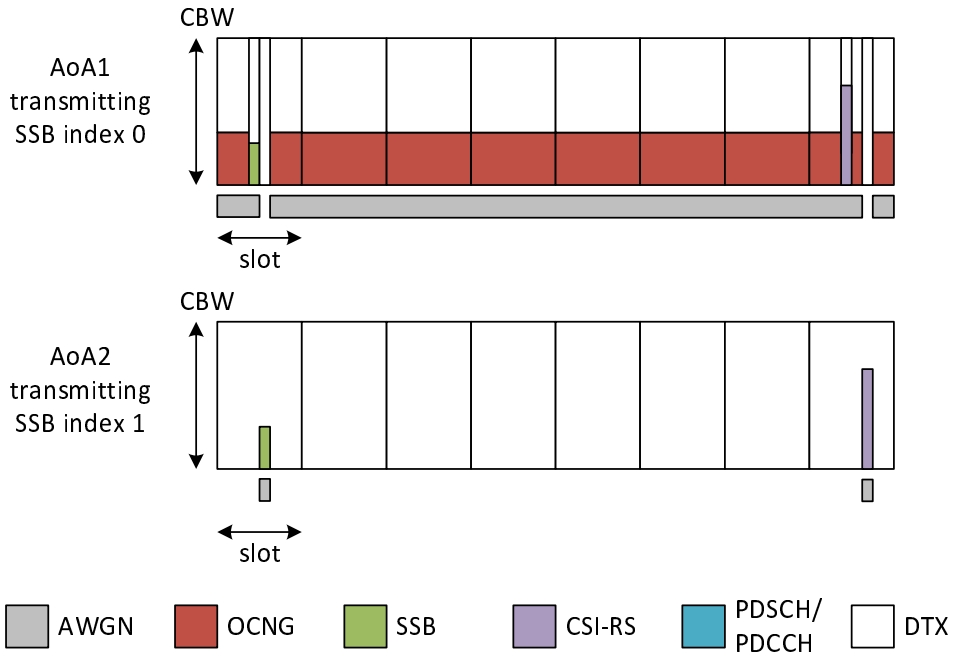


Figure A.17.5.1.9.1-1: Time multiplexed downlink transmissions

A.17.5.1.9.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.1B.7.3.

A.17.5.2 Beam Failure Detection and Link recovery procedures

A.17.5.2.1 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with SSB-based BFD and LR in non-DRX mode

A.17.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5B.

The test parameters are given in tables A.17.5.2.1.1-1, A.17.5.2.1.1-2 and A.17.5.2.1.1-3 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.17.5.2.1.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.17.5.2.1.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test 1.

Table A.17.5.2.1.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.17.5.2.1.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active PCell	1		Cell 1	
RF Channel Number	1		1	
Duplex mode	1		TDD	
TDD Configuration	1		TDDConf.3.1	
$BW_{channel}$	1		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1		66	
PDSCH/PDCCH subcarrier spacing	1	kHz	120	
DL initial BWP configuration	1		DLBWP.0.1	
DL dedicated BWP configuration	1		DLBWP.1.1	
UL initial BWP configuration	1		ULBWP.0.1	
UL dedicated BWP configuration	1		ULBWP.1.1	
PDSCH Reference Channel	1		SR.3.2 TDD	
RMSI CORESET Reference Channel	1		CR.3.1 TDD	
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	
OCNG parameters	1		OP.1	
CP length	1		Normal	
PDSCH/PDCCH TCI state	1		TCI.State.0	
CSI-RS for tracking	1		TRS.2.1 TDD	
SSB Configuration	1		SSB.1 FR2	
SMTC Configuration	1		SMTC.3	
PRACH Configuration	1		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration	1		OFF	
SSB index assigned as BFD RS (q_0)	1		0	
SSB index assigned as CBD RS (q_1)	1		1	
SSB index assigned as RLM RS	1		0,1	
DCI format	1		1-0	

Parameter		Test Config.	Unit	Value	Comment
Beam failure detection transmission parameters	Number of Control OFDM symbols	1		2	
	Aggregation level	1	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1	dB	0	
	DMRS precoder granularity	1		REG bundle size	
	REG bundle size	1		6	
Gap pattern ID		1		gp0	
gapOffset		1	ms	0	
rlmInSyncOutOfSyncThreshold		1		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1		CSI-RS.3.1 TDD	
reportConfigType		1		periodic	
reportQuantity		1		cri-RI-PMI-CQI	
CSI reporting periodicity		1	slot	40	
CSI reporting offset		1	slot	4	
T310		1	ms	1000	
N310		1		2	
T1		1	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2		1	s	2.61	
T3		1	s	1.64	
T4		1	s	0	
T5		1	s	1.01	
D1		1	s	0.97	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.17.5.2.1.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
AoA setup		Setup 1 defined in A.3.15				
Assumption for UE beams Note 10		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					
EPRE ratio of PSS to SSS	dB					
EPRE ratio of PDSCH DMRS to SSS	dB					
EPRE ratio of PDSCH to PDSCH DMRS	dB					
EPRE ratio of OCNG DMRS to SSS	dB					
EPRE ratio of OCNG to OCNG DMRS	dB					
SNR_SSB of set q_0	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_SSB of set q_1	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	dBm/120 KHz	-104.7				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
Propagation condition		TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.17.5.2.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band.
NOTE 10: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

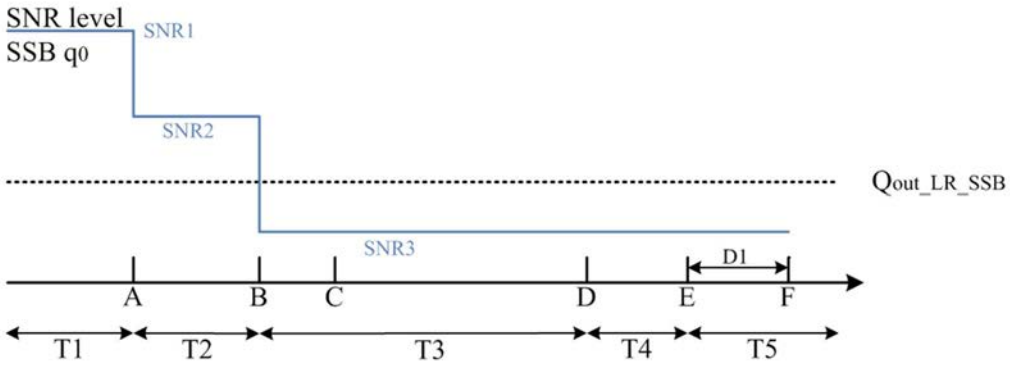


Figure A.17.5.2.1.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

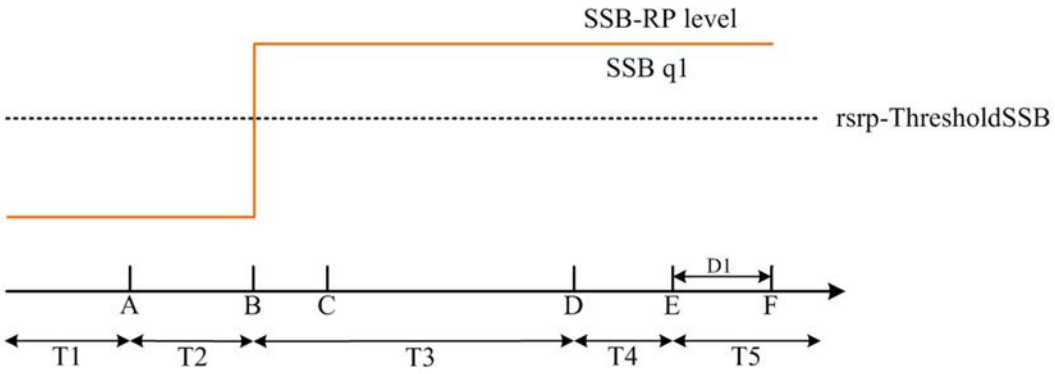


Figure A.17.5.2.1.1-2: SSB_RP level variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.17.5.2.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 960+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.2.2 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with SSB-based BFD and LR in DRX mode

A.17.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in tables A.17.5.2.2.1-1, A.17.5.2.2.1-2 and A.17.5.2.2.1-3 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.17.5.2.2.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.17.5.2.2.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.17.5.2.2.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.17.5.2.2.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active PCell	1		Cell 1	
RF Channel Number	1		1	
Duplex mode	1		TDD	
TDD Configuration	1		TDDConf.3.1	
$BW_{channel}$	1		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1		66	
PDSCH/PDCCH subcarrier spacing	1	kHz	120	
DL initial BWP configuration	1		DLBWP.0.1	
DL dedicated BWP configuration	1		DLBWP.1.1	
UL initial BWP configuration	1		ULBWP.0.1	
UL dedicated BWP configuration	1		ULBWP.1.1	
PDSCH Reference Channel	1		SR.3.2 TDD	
RMSI CORESET Reference Channel	1		CR.3.1 TDD	
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	
OCNG parameters	1		OP.1	
CP length	1		Normal	
PDSCH/PDCCH TCI state	1		TCI.State.0	
CSI-RS for tracking	1		TRS.2.1 TDD	
SSB Configuration	1		SSB.1 FR2	
SMTC Configuration	1		SMTC.3	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
PRACH Configuration		1		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration		1		DRX.3	A.3.3.3
SSB index assigned as BFD RS (q_0)		1		0	
SSB index assigned as CBD RS (q_1)		1		1	
SSB index assigned as RLM RS		1		0,1	
Beam failure detection transmission parameters	DCI format	1		1-0	
	Number of Control OFDM symbols	1		2	
	Aggregation level	1	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1	dB	0	
	DMRS precoder granularity	1		REG bundle size	
	REG bundle size	1		6	
Gap pattern ID		1		N/A	
rlmInSyncOutOfSyncThreshold		1		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1		CSI-RS.3.1 TDD	
reportConfigType		1		periodic	
reportQuantity		1		cri-RI-PMI-CQI	
CSI reporting periodicity		1	slot	40	
CSI reporting offset		1	slot	4	
T310		1	ms	1000	
N310		1		2	
T1		1	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2		1	s	3.37	
T3		1	s	2.8	
T4		1	s	0	
T5		1	s	0.61	
D1		1	s	0.57	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.17.5.2.2.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
AoA setup		Setup 1 defined in A.3.15				
Assumption for UE beams Note 9		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					
EPRE ratio of PSS to SSS	dB					
EPRE ratio of PDSCH DMRS to SSS	dB					
EPRE ratio of PDSCH to PDSCH DMRS	dB					

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
EPRE ratio of OCNG DMRS to SSS	dB					
EPRE ratio of OCNG to OCNG DMRS	dB					
SNR_SSB of set q_0	dB	5 Note 10	-3 Note 10	-12	-12	-12
SNR_SSB of set q_1	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	dBm/120 KHz	-104.7				
Propagation condition		TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 5: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 6: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 7: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.17.5.2.1.1-1.
NOTE 8: The SNR values are specified for testing a UE which supports 2RX on at least one band.
NOTE 9: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 10: This value allows up to 1 dB degradation from applied SNR to UE baseband.

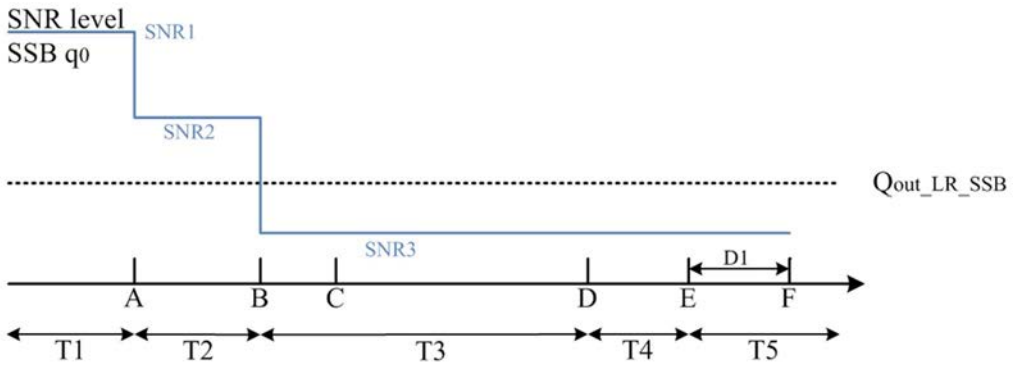


Figure A.17.5.2.2.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in DRX mode

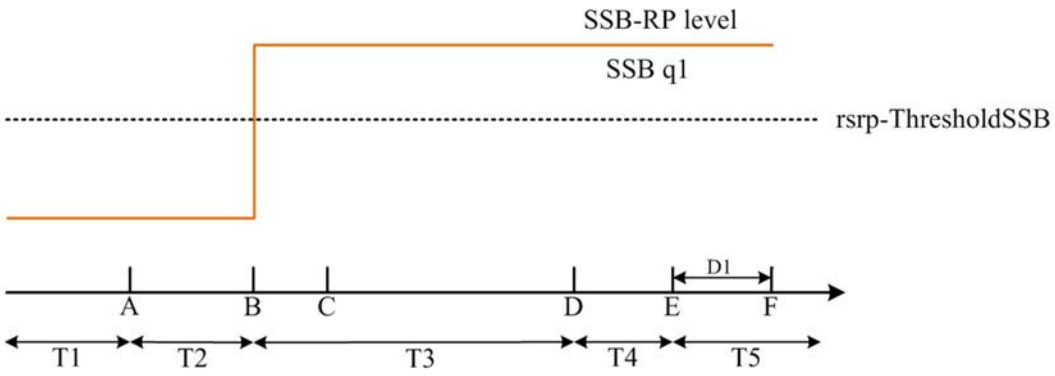


Figure A.17.5.2.2.1-2: SSB_RP level variation for SSB-based beam failure detection and link recovery testing in DRX mode

A.17.5.2.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 560+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.2.3 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.17.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5B.

The test parameters are given in tables A.17.5.2.3.1-1, A.17.5.2.3.1-2, and A.17.5.2.3.1-3 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.17.5.2.3.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.17.5.2.3.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

Table A.17.5.2.3.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.17.5.2.3.1-2: General test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active PCell	1		Cell 1	
RF Channel Number	1		1	
Duplex mode	1		TDD	
TDD Configuration	1		TDDConf.3.1	
$BW_{channel}$	1		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1		66	
PDSCH/PDCCH subcarrier spacing	1	kHz	120	
DL initial BWP configuration	1		DLBWP.0.1	
DL dedicated BWP configuration	1		DLBWP.1.1	
UL initial BWP configuration	1		ULBWP.0.1	
UL dedicated BWP configuration	1		ULBWP.1.1	
PDSCH Reference Channel	1		SR.3.2 TDD	
RMSI CORESET Reference Channel	1		CR.3.1 TDD	
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	
OCNG parameters	1		OP.1	
CP length	1		Normal	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
PDSCH/PDCCH TCI state		1		TCI.State.0	
CSI-RS for tracking		1		TRS.2.1 TDD	
SSB Configuration		1		SSB.1 FR2	
SMTC Configuration		1		SMTC.3	
PRACH Configuration		1		FR2 PRACH configuration 4	A.3.8.3.4
DRX configuration		1		OFF	
CSI-RS configuration for BFD/CBD/RLM		1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0)		1		0	
CSI-RS index assigned as CBD RS (q_1)		1		1	
CSI-RS index assigned as RLM RS		1		0,1	
Beam failure detection transmission parameters	DCI format	1		1-0	
	Number of Control OFDM symbols	1		2	
	Aggregation level	1	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1	dB	0	
	DMRS precoder granularity	1		REG bundle size	
	REG bundle size	1		6	
Gap pattern ID		1		N/A	
rlmInSyncOutOfSyncThreshold		1		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType		1		periodic	
reportQuantity		1		cri-RI-PMI-CQI	
CSI reporting periodicity		1	slot	40	
CSI reporting offset		1	slot	4	
T310		1	ms	1000	
N310		1		2	
T1		1	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2		1	s	1.17	
T3		1	s	0.9	
T4		1	s	0	
T5		1	s	0.31	
D1		1	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.17.5.2.3.1-3: Cell specific test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Unit	Test 1				
		T1	**T2**	**T3**	**T4**	**T5**
AoA setup		Setup 1 defined in A.3.15				
Assumptpion for UE beams Note 10		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.3.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band.
NOTE 10: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

Editor notes: The Figure A.17.5.2.3.1-1 is missing

Figure A.17.5.2.3.1-1: SNR variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

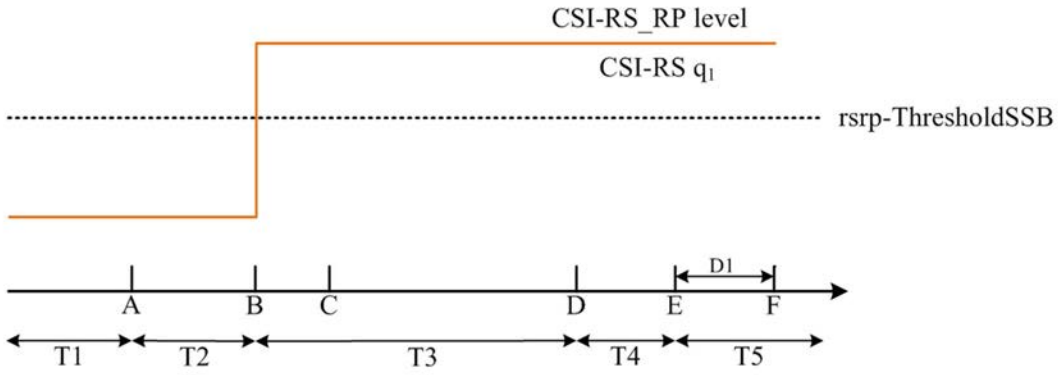


Figure A.17.5.2.3.1-2: CSI-RS_RP level variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

A.17.5.2.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.2.4 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with CSI-RS-based BFD and LR in DRX mode

A.17.5.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5B.

The test parameters are given in tables A.17.5.2.4.1-1, A.17.5.2.4.1-2, A.17.5.2.4.1-3, and A.17.5.2.4.1-4 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.17.5.2.4.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.17.5.2.4.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.17.5.2.4.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.17.5.2.4.1-2: General test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active PCell	1		Cell 1	
RF Channel Number	1		1	
Duplex mode	1		TDD	
TDD Configuration	1		TDDConf.3.1	
$BW_{channel}$	1		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1		66	
PDSCH/PDCCH subcarrier spacing	1	kHz	120	
DL initial BWP configuration	1		DLBWP.0.1	
DL dedicated BWP configuration	1		DLBWP.1.1	
UL initial BWP configuration	1		ULBWP.0.1	
UL dedicated BWP configuration	1		ULBWP.1.1	
PDSCH Reference Channel	1		SR.3.2 TDD	
RMSI CORESET Reference Channel	1		CR.3.1 TDD	
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	
OCNG parameters	1		OP.1	
CP length	1		Normal	
PDSCH/PDCCH TCI state	1		TCI.State.0	
CSI-RS for tracking	1		TRS.2.1 TDD	
SSB Configuration	1		SSB.1 FR2	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
SMTC Configuration		1		SMTC.3	
PRACH Configuration		1		FR2 PRACH configuration 4	A.3.8.3.4
DRX configuration		1		DRX.3	A.3.3.3
CSI-RS configuration for BFD/CBD/RLM		1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS index assigned as BFD RS (q_0)		1		0	
CSI-RS index assigned as CBD RS (q_1)		1		1	
CSI-RS index assigned as RLM RS		1		0,1	
Beam failure detection transmission parameters	DCI format	1		1-0	
	Number of Control OFDM symbols	1		2	
	Aggregation level	1	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1	dB	0	
	DMRS precoder granularity	1		REG bundle size	
	REG bundle size	1		6	
Gap pattern ID		1		N/A	
rlmInSyncOutOfSyncThreshold		1		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
powerControlOffsetSS		1		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1		CSI-RS.3.1 TDD	A.3.14.2
reportConfigType		1		periodic	
reportQuantity		1		cri-RI-PMI-CQI	
CSI reporting periodicity		1	slot	40	
CSI reporting offset		1	slot	4	
T310		1	ms	1000	
N310		1		2	
T1		1	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2		1	s	5.43	
T3		1	s	5.16	
T4		1	s	0	
T5		1	s	0.31	
D1		1	s	0.27	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.17.5.2.4.1-3: Cell specific test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
AoA setup		Setup 1 defined in A.3.15				
Assumption for UE beams Note 10		Rough				
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					
EPRE ratio of PSS to SSS	dB					
EPRE ratio of PDSCH DMRS to SSS	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.4.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band.
NOTE 10: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband

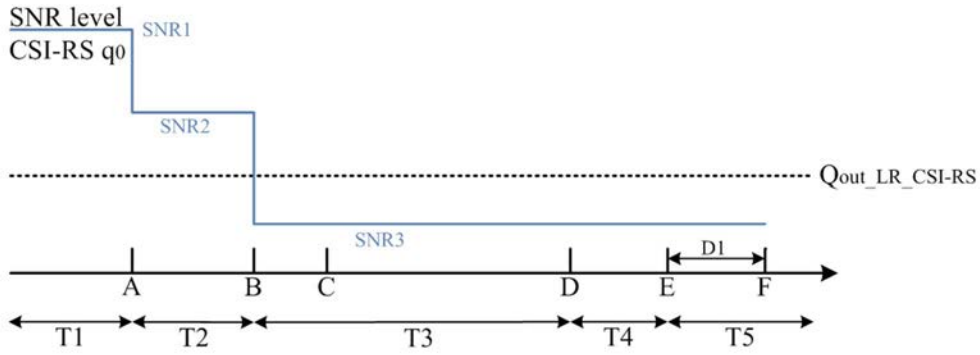


Figure A.17.5.2.4.1-1: SNR variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

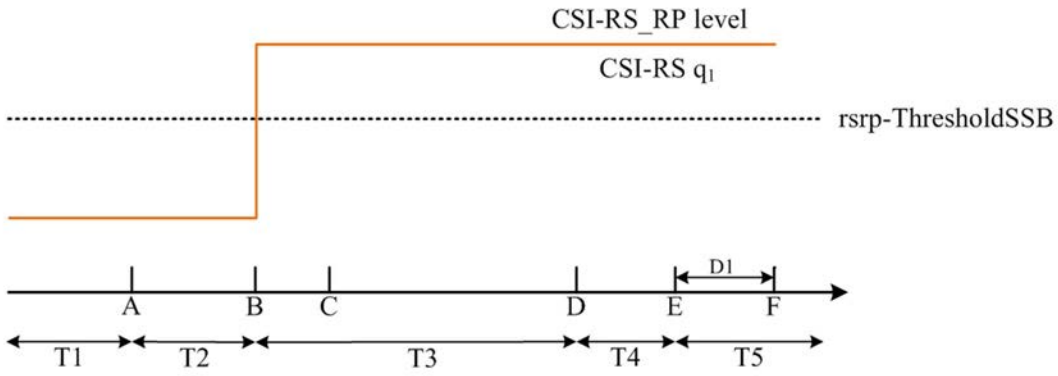


Figure A.17.5.2.4.1-2: CSI-RS_RP level variation for CSI-RS based beam failure detection and link recovery testing in DRX mode

A.17.5.2.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.2.5 Scheduling availability restriction during Beam Failure Detection and Link Recovery for FR2 PCell configured with SSB-based BFD and LR in non-DRX mode for 2 Rx UE

A.17.5.2.5.1 Test Purpose and Environment

The purpose is to test scheduling availability restrictions when the UE is performing beam failure detection or when the UE is performing L1-RSRP measurement for candidate beam detection, when no DRX is used. This test will verify the scheduling availability restriction requirements in clause 8.5B.7 and 8.5B.8.

The test parameters are given in tables A.17.5.2.5.1-1, A.17.5.2.5.1-2 and A.17.5.2.5.1-3 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.17.5.2.5.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.17.5.2.5.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. This test will focus on the scheduling availability during beam failure detection) and candidate beam detection. In the test, DRX configuration is not enabled. Test is to test the scheduling availability restriction of UE performing beam failure detection and candidate beam detection when SSB RS configured for Beam failure detection and candidate beam detection. During the test the UE is scheduled to transmit continuously in UL.

Table A.17.5.2.5.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.17.5.2.5.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
Active PCell	1-2		Cell 1	
RF Channel Number	1-2		1	
Duplex mode	1-2		TDD	
TDD Configuration	1-2		TDDConf.3.1	
$BW_{channel}$	1-2		100: $N_{PRB,c}$ = 66	
Data PRBs allocated	1-2		66	
PDSCH/PDCCH subcarrier spacing	1-2	kHz	120	
DL initial BWP configuration	1-2		DLBWP.0.1	
DL dedicated BWP configuration	1-2		DLBWP.1.1	

Parameter		Test Config.	Unit	Value	Comment
				Test 1	
UL initial BWP configuration		1-2		ULBWP.0.1	
UL dedicated BWP configuration		1-2		ULBWP.1.1	
PDSCH Reference Channel		1		SR.3.2 TDD	
		2		SR.3.3 TDD	
RMSI CORESET Reference Channel		1		CR.3.1 TDD	
		2		CR.3.2 TDD	
Dedicated CORESET Reference Channel		1		CCR.3.1 TDD	
		2		CCR.3.7 TDD	
OCNG parameters		1-2		OP.1	
CP length		1-2		Normal	
PDSCH/PDCCH TCI state		1-2		TCI.State.0	
CSI-RS for tracking		1-2		TRS.2.1 TDD	
SSB Configuration		1		SSB.1 FR2	
		2		SSB.2 FR2	
SMTC Configuration		1-2		SMTC.1	
PRACH Configuration		1-2		FR2 PRACH configuration 2	A.3.8.3.2
DRX configuration		1-2		OFF	
SSB index assigned as BFD RS (q_0)		1-2		0	
SSB index assigned as CBD RS (q_1)		1-2		1	
Beam failure detection transmission parameters	DCI format	1-2		1-0	
	Number of Control OFDM symbols	1-2		2	
	Aggregation level	1-2	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	1-2	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	1-2	dB	0	
	DMRS precoder granularity	1-2		REG bundle size	
	REG bundle size	1-2		6	
Gap pattern ID		1-2		N/A	
rlmInSyncOutOfSyncThreshold		1-2		absent	Value 0 is applied. (Table 8.1.1-1).
rsrp-ThresholdSSB		1	dBm/SCS	-95	Threshold used for $Q_{in_LR_SSB}$
		2		-92	
powerControlOffsetSS		1-2		db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount		1-2		n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer		1-2		pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting		1-2		CSI-RS.3.1 TDD	
reportConfigType		1-2		periodic	
reportQuantity		1-2		cri-RI-PMI-CQI	
CSI reporting periodicity		1-2	slot	40	
CSI reporting offset		1-2	slot	4	
T310		1-2	ms	1000	
N310		1-2		2	
T1		1-2	s	1	The UE shall be fully synchronized to Cell 1 during T1
T2		1-2	s	2.6	
T3		1-2	s	1.64	
T4		1-2	s	0	
T5		1-2	s	1.01	
D1		1-2	s	0.97	

Parameter	Test Config.	Unit	Value	Comment
			Test 1	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1.				
NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.17.5.2.5.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA Setup			Setup1 defined in clause A.3.15.1				
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1-2	dB	5 Note 11	-3 Note 11	-12	-12	-12
SNR_SSB of set q_1	Config 1-2	dB	0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	Config 1	dBm/SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 2		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1-2	dBm/120 kHz	-104.7				
Propagation condition			TDL-A 30 ns 75 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.							
NOTE 4: Void							
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.							
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.							
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.							
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.17.5.2.5.1-1.							
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band.							
NOTE 10: Information about types of UE beam given in annex B.2.1.3 and does not limit UE implementation or test system implementation							
NOTE 11: This value allows up to 1 dB degradation from applied SNR to UE baseband.							

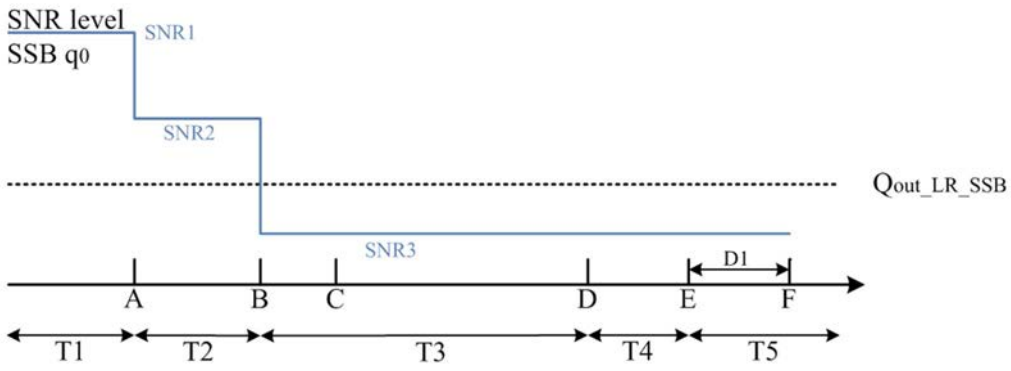


Figure A.17.5.2.5.1-1: SNR variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

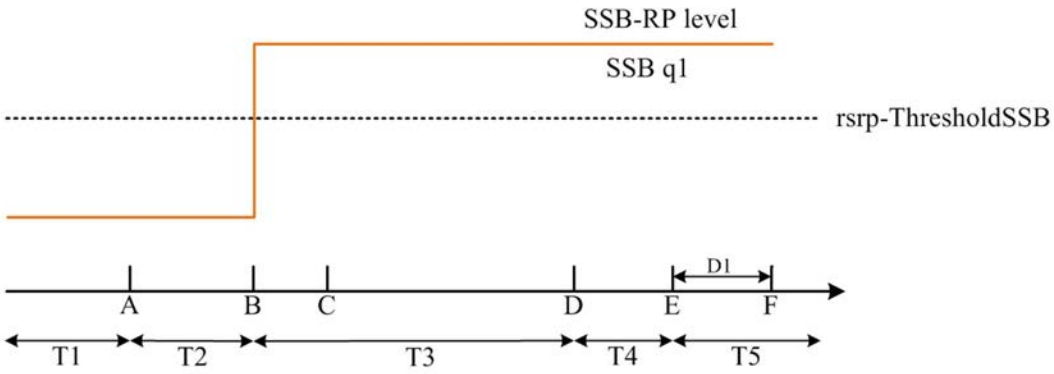


Figure A.17.5.2.5.1-2: SSB_RP level variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.17.5.2.5.2 Test Requirements

The UE behaviour during time duration T3 follows the requirements defined in clause 8.5B.7.3:

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on BFD-RS symbols to be measured for beam failure detection.

The UE behaviour during time durations T4 and T5 follows the requirements defined in clause 8.5B.8.3:

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on reference symbols to be measured for candidate beam detection.

A.17.5.3 Active BWP switch for RedCap

A.17.5.3.1 DCI-based and Timer-based Active BWP Switch

A.17.5.3.1.1 NR FR2 DL active BWP switch with non-DRX in SA

A.17.5.3.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6A. Supported test configurations are shown in table A.17.5.3.1.1.1-1.

The test scenario comprises of one cell (Cell 1) as given in table A.17.5.3.1.1.1-2. Cell-specific parameters of NR PCell is specified in table A.17.5.3.1.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.17.5.3.1.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with 2 different UE-specific downlink bandwidth parts, BWP-1 and BWP-2 before starting the test. BWP-1 include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1.
- UE is configured with a *bwp-InactivityTimer* timer value for Cell 1.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for DL BWP switch, sent from the test equipment to the UE, is received at the UE side in Cell 1's slot # denoted *i*. The UE should switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6A and starts to report valid ACK/NACK for the Cell 1 no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-2 starting from the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

During T2, the test equipment won't transmit DCI format for PDSCH reception on Cell 1.

During T3,

> The time period T3 starts from the slot #*j*, where j is the first slot of the half subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.
>
> The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6A and starts to report valid ACK/NACK for the Cell 1 at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-1 starting from the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The test equipment verifies the DL BWP switch time by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

Table A.17.5.3.1.1.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.5.3.1.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
bwp-InactivityTimer	ms	[200]	
T1	s	[0.2]	
T2	s	[0.2]	
T3	s	[0.2]	

Table A.17.5.3.1.1.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Active BWP ID		1, 2
Initial DL BWP Configuration		DLBWP.0.2 Note 2
Active DL BWP-1 Configuration		DLBWP.1.1 Note 2
Active DL BWP-2 Configuration		DLBWP.1.2 REDCAP Note 2
Initial UL BWP Configuration		ULBWP.0.2 Note 2
Active UL BWP-1 Configuration		ULBWP.1.1 Note 2
Active UL BWP-2 Configuration		DLBWP.1.2 REDCAP Note 2
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State		TCI.State.0
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.2 REDCAP is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

Table A.17.5.3.1.1.1-4: OTA related test parameters for DL BWP switch in SA

Parameter	Unit	Cell 2
Angle of arrival configuration		Setup 1 defined in clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note 1	dBm/15 kHz	-112
N_{oc} Note 1	dBm/SCS	-103
SS-RSRP Note 2	dBm/120 kHz Note3	-85
$\hat{E}_s/I_{ot}$	dB	18
$\hat{E}_s/N_{oc}$ Note 5	dB	18
Io Note2	dBm/95.04 MHz Note4	-56

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 6: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.

A.17.5.3.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6A.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after the beginning of DL slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.17.5.3.2 RRC-based Active BWP Switch

A.17.5.3.2.1 NR FR2 DL active BWP switch of PCell with non-DRX in SA

A.17.5.3.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6A.3. Supported test configurations are shown in table A.17.5.3.2.1.1-1.

The test scenario comprises of one Cell (Cell 1) as given in table A.17.5.3.2.1.1-2. Cell-specific parameters of Cell 1 are specified in table A.17.5.3.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in Cell 1.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to completely receive PDSCH on Cell 1 from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\mathrm{RRCprocessingDelay}}+T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}}$ as defined in clause 8.6A.3 and starts to report valid ACK/NACK for the Cell 1 from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\mathrm{RRCprocessingDelay}}+T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}}$ + k1. The UE shall be continuously scheduled on PSCell's BWP-1 starting from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\mathrm{RRCprocessingDelay}}+T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}}$.

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6A.3.

The test equipment verifies the DL BWP switch time in PSCell by counting the time from the time when the RRC Reconfiguration message including updated BWP configurationis sent till the time when RRC Reconfiguration Complete message is received.

Table A.17.5.3.2.1.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.17.5.3.2.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	
T1	s	[0.2]	

Table A.17.5.3.2.1.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1
Frequency Range			FR2
Duplex mode			TDD
TDD configuration			TDDConf.3.1
$BW_{channel}$			100 MHz: $N_{PRB,c}$ = 66
Active BWP ID			1
Initial Condition	Active DL BWP-1 Configuration		DLBWP.1.2 REDCAP
	Active UL BWP-1 Configuration		ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration		DLBWP.1.1
	Active UL BWP-1 Configuration		ULBWP.1.1
'PDSCH Reference measurement channel			SR.3.1 TDD
RMSI CORESET parameters			CR.3.1 TDD
Dedicated CORESET parameters			CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.1 FR2
SMTC Configuration			SMTC.1
TCI State			TCI.State.0
TRS Configuration			TRS.2.1 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			

Parameter	Unit	Cell 1
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.2 REDCAP is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].		

Table A.17.5.3.2.1.1-4: OTA related test parameters for BWP switching test case

Parameter		Unit	Cell 2
Angle of arrival configuration			Setup 1 according to table A.3.15
Assumption for UE beams Note 5			Fine
N_{oc} Note1	NR_TDD_FR2_A	dBm/15 kHz	-112
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS	-103
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
SS-RSRP Note2	NR_TDD_FR2_A	dBm/SCS Note3	-85
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
$\hat{E}_s/I_{ot}$		dB	18
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-56
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone			
NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.			

A.17.5.3.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PCell from the first DL slot that occurs after the beginning of slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.4 Active TCI state switch delay

A.17.5.4.1 MAC-CE based active TCI state switch

A.17.5.4.1.1 NR PCell FR2 active TCI state switch for a known TCI state

A.17.5.4.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10B.3. Supported test configuration is shown in table A.17.5.4.1.1.1-1.

The test scenario comprises of one NR PCell (Cell 1) as given in table A.17.5.4.1.1.1-2. Cell-specific parameters of NR PCell are specified in table A.17.5.4.1.1.1-3 below. The OTA related test parameters for FR2 are shown in table A.17.5.4.1.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is configured with 2 different TCI states for PCell, PDCCH TCI state 0 (QCL'd to SSB0) and TCIstate 1 (QCL'd to SSB1), in Cell 1 before starting the test.
- UE is indicated in TCI state 0 as the active PDCCH TCI state

The test consists of two time periods, T1 and T2. Figure A.17.5.4.1.1.1-1 and Figure A.17.5.4.1.1.1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which PDCCH-TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies that UE can be scheduled on PCell on TCI state 0 till n+ T_{HARQ} +3 ms. The test equipment also verifies the TCI state switch time in PCell by scheduling the UE on TCI state 1 after n+ T_{HARQ} +3 ms + ($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$).

Table A.17.5.4.1.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.5.4.1.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	
T2	s	0.2	

Table A.17.5.4.1.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TCI.State.0
TCI State 1		TCI.State.1
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		No external noise (Note 2)

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [29].

Table A.17.5.4.1.1.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
$\hat{E}_S$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	-Infinity	-80.6
$\hat{E}_s/I_{ot\ BB}$ Note 7	dB	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-56.0	-56.0	- Infinity	-56.0

NOTE 1: Void
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.
NOTE 6: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

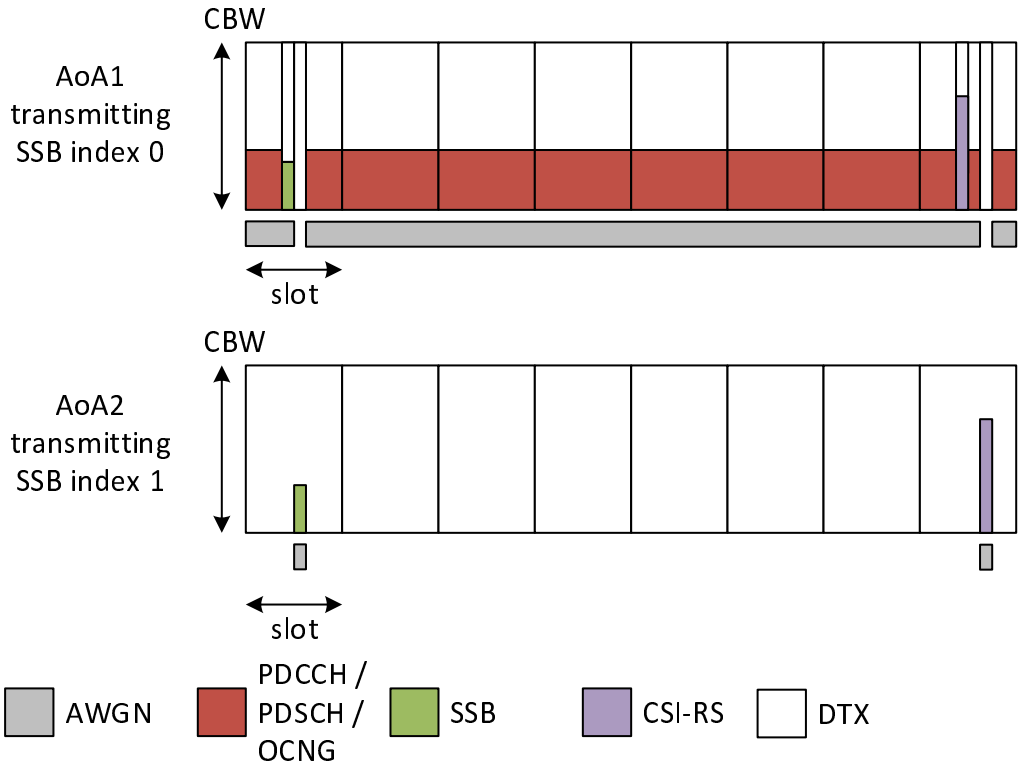


Figure A.17.5.4.1.1.1-1: Time multiplexed downlink transmissions during T1

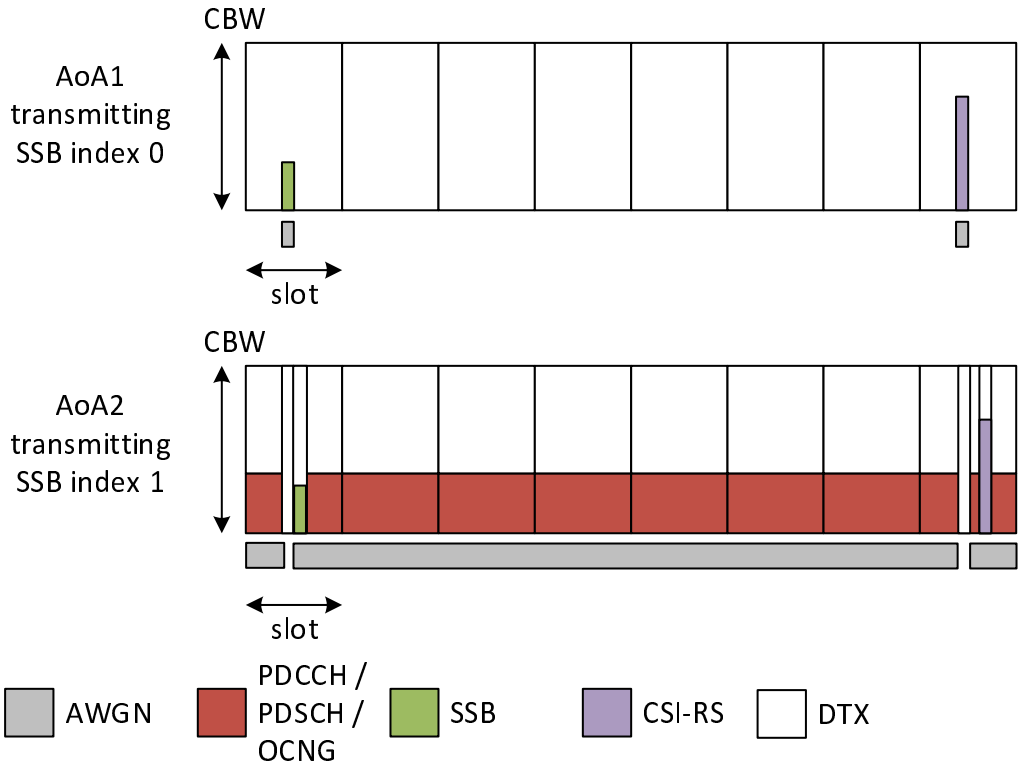


Figure A.17.5.4.1.1.1-2: Time multiplexed downlink transmissions during T2

A.17.5.4.1.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on TCI state 0 till n+ T_{HARQ} +3 ms
- be able to start receiving on TCI state 1 after n+ T_{HARQ} +5 ms + $T_{first-SSB}$

A.17.5.4.2 RRC based active TCI state switch

A.17.5.4.2.1 NR PCell FR2 active TCI state switch for a known TCI state

A.17.5.4.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10B.5. Supported test configuration is shown in table A.17.5.4.2.1.1-1.

The test scenario comprises of one NR PCell as given in table A.17.5.4.2.1.1-2. Cell-specific parameters of NR PCell is specified in table A.17.5.4.2.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.17.5.4.2.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is configured with 1 TCI state for PCell, PDCCH-TCI-state0 (QCL'd to SSB0)
- UE is indicated in TCI state0 as the active TCI state

The test consists of two time periods, T1 and T2. Figure A.17.5.4.2.1.1-1-1 and Figure A.17.5.4.2.1.1-1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI-state1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a RRC command indicating a switch to TCI-state1.

The test equipment verifies the TCI state switch time in PCell by scheduling the UE on TCI state 1 after n+ $T_{RRC_processing}$ + $T_{first-SSB}$ + 2 ms.

Table A.17.5.4.2.1.1-1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.5.4.2.1.1-1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	
T2	s	2	

Table A.17.5.4.2.1.1-1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Data PRBs allocated		24
Initial DL BWP Configuration		DLBWP.0.2

Parameter	Unit	
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.2 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.5
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TCI.State.0
TCI State 1		TCI.State.1
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
Number of reported RS		2
L1-RSRP reporting period	slot	640
timeRestrictionForChannelMeasurements		configured
TRS Configuration		TRS.2.1 TDD TRS.2.2 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		No external noise (Note 2)

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [29].

Table A.17.5.4.2.1.1-1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
$\hat{E}_S$	dBm/SCS	-80.6	-80.6	-Infinity	-80.6
SS B_RP Note 2	dBm/ SCS	-80.6	-80.6	-Infinity	-80.6
$\hat{E}_s/I_{ot\ BB}$ Note 7	dB	8.3	8.3	-Infinity	8.3
Io Note2	dBm/95.04 MHz Note4	-6.0	-56.0	- Infinity	-56.0

NOTE 1: Void
NOTE 2: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.
NOTE 6: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.

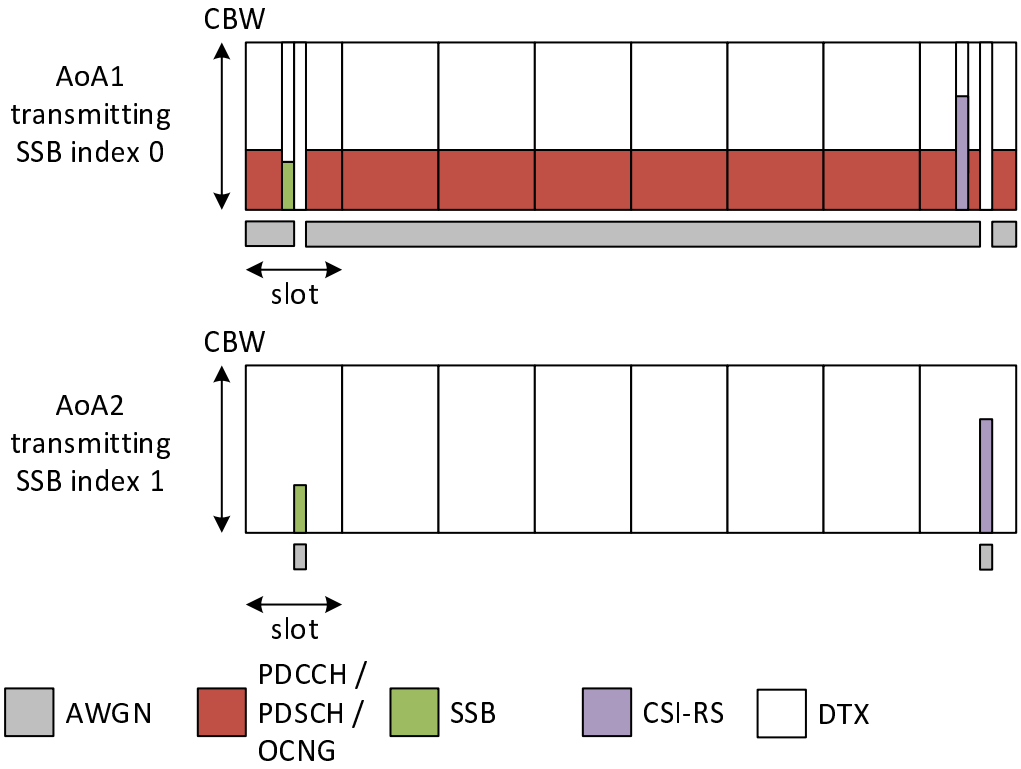


Figure A.17.5.4.2.1.1-1-1: Time multiplexed downlink transmissions during T1

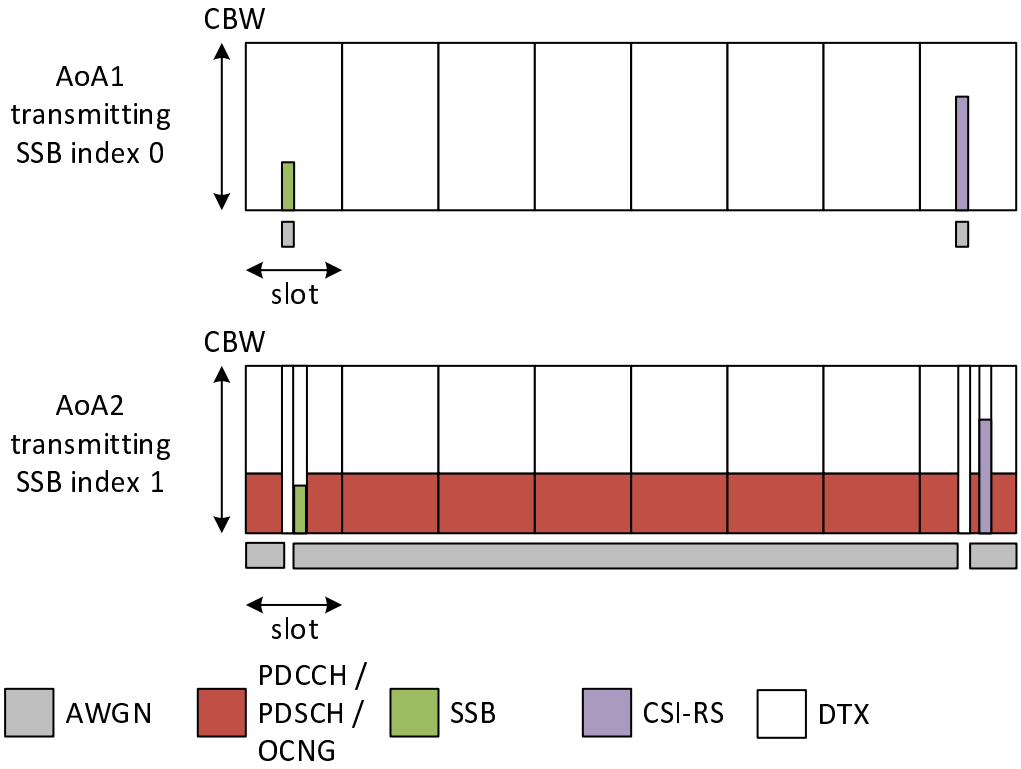


Figure A.17.5.4.2.1.1-1-2: Time multiplexed downlink transmissions during T2

A.17.5.4.2.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with both SSB0 and SSB1.

After receiving RRC command in slot n, UE shall be able to start receiving on TCI state 1 after n+ $T_{RRC_processing}$ + $T_{first-SSB}$ + 2 ms.

A.17.5.5 Uplink spatial relation switch delay

A.17.5.5.1 MAC-CE based Spatial Relation switch

A.17.5.5.1.1 NR PCell FR2 spatial relation associated with known DL-RS

A.17.5.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify fulfillment of the uplink spatial relation switch delay requirement defined in clause 8.12A.3 by a UE capable of beam correspondence without the need for UL beam sweeping. The supported test configurations are shown in table A.17.5.5.1.1.1-1.

The test scenario comprises one PCell (Cell 1) as outlined in table A.17.5.5.1.1.1-2. Cell-specific parameters are provided in table A.17.5.5.1.1.1-3. OTA-related test parameters are provided in table A.17.5.5.1.1.1-4.

Throughout the test, PDCCH indicating new transmissions shall ge sent continuously on PCell to ensure that the UE will send ACK/NACKs on PUCCH.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with a single TCI state, TCI State-0, which is QCLed with SSB0.
- UE is configured with two spatial relation information configurations Spatial Relation Info-0 and Spatial Relation Info-1 for PUCCH, each associated with SSB0 and SSB1, respectively.
- UE is indicated via MAC-CE activation of *PUCCH-SpatialRelationInfoId* corresponding to Spatial Relation Info-0
- UE is configured with a CSI measurement configuration indicating L1-RSRP measurements on SSB0 and SSB1 with periodic reporting. The L1-RSRP measurement period is influenced by the following: the higher layer parameter *timeRestrictionForChannelMeasurement* is configured, measured SSBs are fully overlapping with SMTC window, and there are no conflicts with measurement gaps.

The test consists of two time periods, T1 and T2. During T1 only the SSB associated with PDCCH TCI state-0 and PUCCH Spatial Relation Info-0 is transmitted. At the beginning of T2, transmission of the SSB associated with PUCCH Spatial Relation Info-1 starts. The UE conducts periodic L1-RSRP measurements and *SSB-Index-RSRP* reporting for SSB0 and SSB1. In slot *n*, which is within 1280 ms after UE receiving both SSB0 and SSB1, and after reporting valid results for both the SSB0 and the SSB1, the UE receives a MAC-CE indicating a switch of spatial relation to PUCCH Spatial Relation Info 1.

The test equipment verifies that the UE transmits according to PUCCH Spatial Relation Info 0 up until slot *n* + T_{HARQ}/NR slot length + $3N_{slot}^{subframe,\mu}$, and according to PUCCH Spatial Relation Info 1 from slot *n* + T_{HARQ}/NR slot length + $3N_{slot}^{subframe,\mu}$ + 1 and onwards.

Table A.17.5.5.1.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.5.5.1.1.1-2: General test parameters

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	

L1-RSRP reporting period	slot	160	Periodic L1-RSRP reporting configured
L1-RSRP measured RS		SSB0, SSB1	L1-RSRP measurements of SSB0 and SSB1.
Number of reported RS		2	L1-RSRP reporting of measurements on SSB0 and SSB1.
T1	s	[0.2]	
T2	s	[2]	

A.17.5.5.1.1.1: NR Cell specific test parameters

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State-0 Configuration		TCI.State.0
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
timeRestrictionForChannelMeasurements		configured
TRS Configuration		TRS.2.1 TDD
Spatial Relation Info-0 Configuration		PUCCH.SRI.0
Spatial Relation Info-1 Configuration		PUCCH.SRI.1
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS[Note 1]		
EPRE ratio of OCNG to OCNG DMRS[Note 1]		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.17.5.5.1.1.1-4: OTA related test parameters

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams [Note 6]		Rough			
N_{oc}[Note 1]	dBm/15 kHz	-92.1			
N_{oc}[Note 1]	dBm/SCS	-83.1			
$\hat{E}_s/N_{oc}$	dB	1		-infinity	1
SS-RSRP [Note 2]	dBm/120 kHz [Note3]	-82.1		-infinity	-82.1
Io[Note2]	dBm/95.04 MHz [Note4]	-50.6		-54.1	-50.6

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.					
NOTE 6: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.					

A.17.5.5.1.1.2 Test Requirements

During T2, the UE shall send L1-RSRP report with results for SSB0 and SSB1.

After receiving MAC-CE command in slot *n*, the UE shall:

- Continue transmitting using PUCCH spatial relation associated with SSB0 up to and including slot *n* + T_{HARQ}/NR slot length + $3N_{slot}^{subframe,\mu}$
- Start transmitting using PUCCH spatial relation associated with SSB1 from slot *n* + T_{HARQ}/NR slot length + $3N_{slot}^{subframe,\mu}$ + 1 and onwards.

The rate of correct events observed during repeated tests shall be at least [90]%.

A.17.5.5.2 RRC based spatial relation switch

A.17.5.5.2.1 NR PCell FR2 spatial relation switch associated with a known DL-RS

A.17.5.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the RRC based spatial relation switch delay requirement defined in clause 8.12A.5 by a UE capable of beam correspondence without the need for UL beam sweeping. In the test the higher layer parameter *timeRestrictionForChannelMeasurements* is configured. Supported test configuration is shown in table A.17.5.5.2.1.1-1.

The test scenario comprises of one PCell (Cell 1) as given in table A.17.5.5.2.1.1-2. Cell-specific parameters of PCell is specified in table A.17.5.5.2.1.1-3 below. The OTA related test parameters for FR2 is shown in table A.17.5.5.2.1.1-4.

Periodic SRS is transmitted on PCell (Cell 1), and the SRS configuration is SRSConf.1 given in table A.5.4.1.1.1-3.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is configured with 1 SRS-SpatialRelation0 associated with SSB0.
- UE is indicated SRS-SpatialRelation0 as the active SRS spatial relation.

The test consists of two time periods, T1 and T2. During T1 only SSB0 to which SRS-SpatialRelation0 associated is transmitted. UE shall transmit periodic SRS with SRS-SpatialRelation0 on the UL of the PCell.

T2 start when the tester initiates transmission of SSB1 corresponding to SRS-SpatialRelation1. The UE is configured to transmit periodic L1-RSRP reports.

In slot n, which is within [1280]ms of UE providing the L1-RSRP report with results for both SSB0 and SSB1, the UE receives an RRC command indicating a switch to transmit periodic SRS with target SRS-SpatialRelation1. The UE shall be able to transmit periodic SRS with target spatial relation (SRS-SpatialRelation1) on PCell in slot n + $T_{RRC_processing}$/NR slot length +1.

Table A.17.5.5.2.1.1-1: Supported test configurations

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.5.5.2.1.1-2: General test parameters for spatial relation switch associated with a known DL-RS

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
timeRestrictionForChannelMeasurements		configured	Time domain measurement restriction for the channel (signal) measurements (see TS 38.214 [19], clause 5.2.1.1)
T1	s	0.5	
T2	s	1.5	

Table A.17.5.5.2.1.1-3: NR Cell specific test parameters for spatial relation switch associated with a known DL-RS

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{PRB,c}$ = 66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
SRS-SpatialRelation0		SRS.SRI0
SRS-SpatialRelation1		SRS.SRI1
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
Number of reported RS		2
L1-RSRP reporting period	slot	160
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS (Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.17.5.5.2.1.1-4: OTA related test parameters for spatial relation switch associated with a known DL-RS

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough		Rough	
N_{oc} Note 1	dBm/15 kHz	-92.1			
N_{oc} Note 1	dBm/SCS	-83.1			
$\hat{E}_s/N_{oc}$	dB	1	1	-Infinity	1
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1	-82.1	-Infinity	-82.1
Io Note2,Note6	dBm/95.04 MHz Note4	-50.6	-50.6	-54.1	-50.6

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the center of the quiet zone.
NOTE 6: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.17.5.5.2.1.2 Test Requirements

During T1 UE shall send L1-RSRP report with SSB0 to which SRS-SpatialRelation0 is associated. During T2, UE shall send L1-RSRP report with SSB1 to which SRS-SpatialRelation1 is associated.

After receiving RRC command in slot n, UE shall be able to transmit target periodic SRS with SRS-SpatialRelation1 on the PCell in the slot n + $T_{RRC_processing}$/*NR slot length* + 1.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.5.6 UE specific CBW change

A.17.5.6.1 NR FR2 UE specific CBW change of PCell with non-DRX in SA

A.17.5.6.1.1 Test Purpose and Environment

The purpose of this test is to verify the UE specific CBW change delay requirement defined in clause 8.13A. Supported test configurations are shown in table A.17.5.6.1.1-1.

The test scenario comprises of one PCell (Cell 1) as given in table A.17.5.6.1.1-2. Cell-specific parameters of PCell are specified in table A.17.5.6.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK transmission.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell).
- UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-1 of initial condition in PCell.
- UE has been configured with UE-specific CBW (CBW-1)
- UE is indicated in SCS-SpecificCarrier [2] that the UE-specific CBW is CBW-1 as the initial condition in Cell 1 (PCell).

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated CBW configuration, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its CBW with the updated CBW of final condition.

The UE shall be able to completely receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{CBWchangeDelayRRC}}}{\text{NR Slot length}}$ as defined in clause 8.13.2 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{CBWchangeDelayRRC}}}{\text{NR Slot length}}$ + k1. The UE shall be continuously scheduled on PCell's new CBW starting from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{CBWchangeDelayRRC}}}{\text{NR Slot length}}$.

$T_{RRCprocessingDelay}$ and $T_{CBWchangeDelayRRC}$ are defined in clause 8.13A.

The test equipment verifies the UE specific CBW switch time in PCell by counting the time from the time when the RRC Reconfiguration message including updated CBW configurations sent till the time when RRC Reconfiguration Complete message is received.

Table A.17.5.6.1.1-1: UE specific CBW change supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.17.5.6.1.1-2: General test parameters for UE specific CBW change in NR SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
T1	s	[0.2]	

Table A.17.5.6.1.1-3: NR Cell specific test parameters for UE specific CBW change in NR SA

Parameter		Unit	Cell 1
Frequency Range			FR2
Duplex mode			TDD
TDD configuration			TDDConf.3.1
$BW_{channel}$			100 MHz: $N_{PRB,c}$ = 66
Active DL BWP ID			1
Initial DL BWP Configuration (BWP-1)			DLBWP.0.2
Initial UL BWP Configuration			ULBWP.0.2
Initial Condition	Active DL CBW-1 Configuration		DLCBW.1.1
	Active UL CBW-1 Configuration		ULCBW.1.1
Final Condition	Active DL CBW-1 Configuration		DLCBW.1.2
	Active UL CBW-1 Configuration		ULCBW.1.2
'PDSCH Reference measurement channel			SR.3.1 TDD
RMSI CORESET parameters			CR.3.1 TDD
Dedicated CORESET parameters			CCR.3.1 TDD

Parameter	Unit	Cell 1
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State		TCI.State.0
TRS Configuration		TRS.2.1 TDD
Antenna Configuration		1x2
Propagation Condition		AWGN
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.17.5.6.1.1-4: OTA related test parameters for UE specific CBW change test case

Parameter		Unit	Cell 2
Angle of arrival configuration			Setup 1 according to table A.3.15
Assumption for UE beams Note 5			Fine
N_{oc} Note1	NR_TDD_FR2_A	dBm/15 kHz	-112
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS	-103
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
SS-RSRP Note2	NR_TDD_FR2_A	dBm/SCS Note3	-85
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
$\hat{E}_s/I_{ot}$		dB	18
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-56
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.

A.17.5.6.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PCell from the first DL slot that occurs after the beginning of slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{CBWchangeDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{CBWchangeDelayRRC}}}{\text{NR Slot length}}$ + k1.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed PCell UE specific CBW change delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.6 Measurement procedure for RedCap

A.17.6.1 Intra-frequency Measurements

A.17.6.1.1 SA event triggered reporting test without gap under non-DRX

A.17.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements for RedCap in clause 9.2B.5.1 and 9.2B.5.2. Supported test configurations are shown in table A.17.6.1.1.1-1.

Table A.17.6.1.1.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.17.6.1.1.1-2, A.17.6.1.1.1-3 and A.17.6.1.1.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.17.6.1.1.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX for RedCap

Parameter	Unit	Config	Value	Comment
Active cell		1, 2	PCell (Cell 1)	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration		1, 2	SMTC.1	
A3-Offset	dB	1, 2	-11	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
TimeToTrigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	Synchronous cells
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.17.6.1.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX for RedCap

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
		2	48		48	
Intial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2	CCR.3.7 TDD		N/A	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.5		N/A	
cellIndividualOffset	dB	1~2	N/A		16	
SSB		1	SSB.1 FR2		SSB.7 FR2	
		2	SSB.2 FR2		SSB.8 FR2	
Propagation Condition		1, 2	No external noise (Note 1)		No external noise (Note 1)	
NOTE 1: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].						

Table A.17.6.1.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX for RedCap

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam assumption[Note 4]		1,2	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1	-64.41	-64.41	-Infinity	-64.41
		2	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1, 2	Defined in figure A.17.6.1.1.1-1			

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Void NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

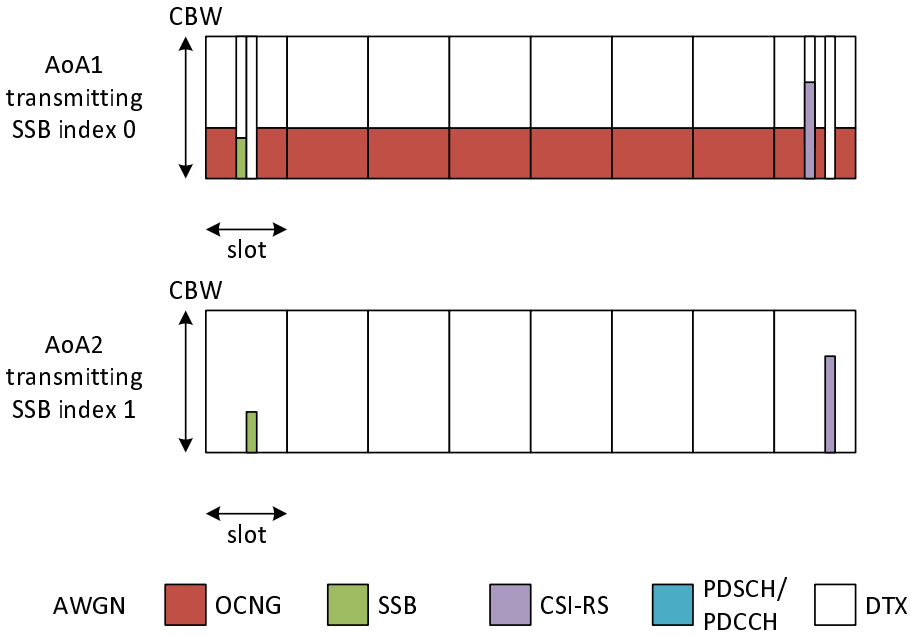


Figure A.17.6.1.1.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.17.6.1.1.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 2.4 s for a UE supporting power class 1 or 5,
- 1.44 s for a UE supporting power class 2, 3, 4 or 7.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.17.6.1.2 SA event triggered reporting test without gap under DRX

A.17.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2B.5.1 and 9.2B.5.2. Supported test configurations are shown in table A.7.6.1.2.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.7.6.1.2.1-2, A.7.6.1.2.1-3 and A.7.6.1.2.1-4.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

A.7.6.1.2.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2 s for a UE supporting power class 1 or 5,
- 4.32 s for a UE supporting power class 2, 3, 4, or 7.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2 s for a UE supporting power class 1 or 5,
- 30.72 s for a UE supporting power class 2, 3 4, or 7.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.17.6.1.3 SA event triggered reporting test with per-UE gaps under non-DRX

A.17.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2B.6.1 and 9.2B.6.2. Supported test configurations are shown in table A.17.6.1.3.1-1.

Table A.17.6.1.3.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.17.6.1.3.1-2 ~ 4 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.17.6.1.3.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1, 2	PCell (Cell 1)	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Gap type		1, 2	Per-UE gaps	
Measurement gap repitition periodicity	ms	1, 2	40	
Measurement gap length	ms	1, 2	6	
Measurement gap offset	ms	1, 2	4	
SMTC configuration for CD-SSB		1, 2	SMTC.1 RedCap	
SMTC configuration for NCD-SSB		1, 2	SMTC.2 RedCap	
CSI-RS parameters		1, 2	CSI-RS.3.2 TDD	
A3-Offset	dB	1, 2	-11	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	Synchronous cells
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.17.6.1.3.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1	24		24	
		2	48		48	
Intial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated DL BWP configuration		1, 2	DLBWP.1.3 RedCap Note 1		DLBWP.1.3 RedCap Note 1	
Dedicated UL BWP configuration		1, 2	ULBWP.1.3 RedCap Note 2		ULBWP.1.3 RedCap Note 2	
RLM-RS		1, 2	CSI-RS		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2	CCR.3.7 TDD		N/A	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.5		N/A	
cellIndividualOffset	dB	1~2	N/A		16	
CD-SSB		1	SSB.2 RedCap FR2		SSB.2 RedCap FR2	
		2	SSB.4 RedCap FR2		SSB.4 RedCap FR2	
NCD-SSB		1	SSB.3 RedCap FR2		SSB.3 RedCap FR2	
		2	SSB.5 RedCap FR2		SSB.5 RedCap FR2	
Propagation Condition		1, 2	No external noise (Note 3)		No external noise (Note 3)	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The starting PRB index for dedicated DL BWP1 corresponding to CD-SSB PRB index; the starting PRB index for dediacted DL BWP2 corresponding to NCD-SSB PRB index; NOTE 2: The starting PRB index for dedicated UL BWP1 is the same as the starting PRB index for dedicated DL BWP1; the starting PRB index for dedicated UL BWP2 is the same as the starting PRB index for dedicated DL BWP2. NOTE 3: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].						

Table A.17.6.1.3.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam Assumption Note 4		1,2	Rough		Rough	
E_s	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
$\hat{E}_s/I_{ot}$ BB Note 5	dB	1, 2	-0.12	-0.12	-Infinity	-0.12
SSB_RP	dBm/SCS	1	-89	-89	-Infinity	-89
		2	-86	-86	-Infinity	-86
Io	dBm/95.04 MHz	1	-64.41	-64.41	-Infinity	-64.41
		2	-61.41	-61.41	-Infinity	-61.41
Time multiplexing of the downlink transmissions from each AoA		1	Defined in figure A.17.6.1.3.1-1			
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Void NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

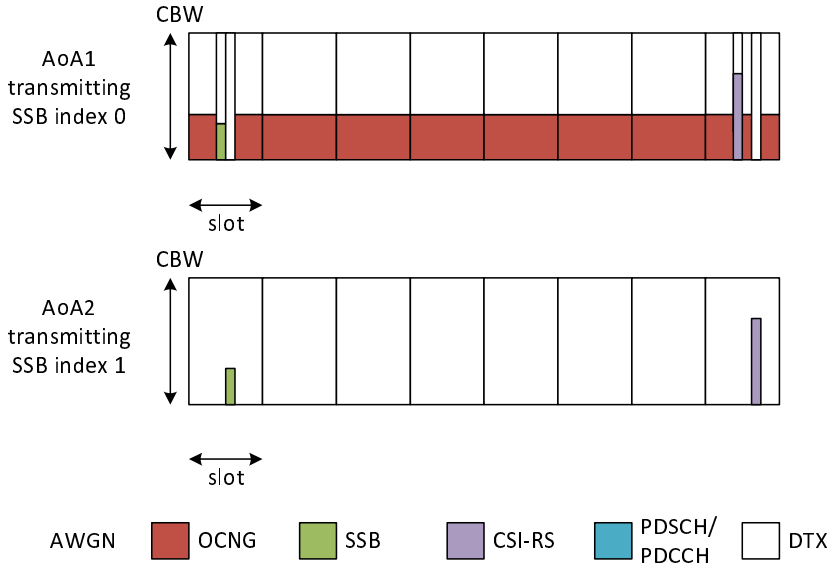


Figure A.17.6.1.3.1-1: Time multiplexed downlink transmissions (Config 1 example)

A.17.6.1.3.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 3.2 s for a UE supporting power class 1 or 5,
- 1.92 s for a UE supporting power class 2, 3 4 or 7

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.17.6.1.4 SA event triggered reporting test with per-UE gaps under DRX

A.17.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2B.6.1 and 9.2B.6.2. Supported test configurations are shown in table A.17.6.1.4.1-1.

Table A.17.6.1.4.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.17.6.1.4.1-2, A.17.6.1.4.1-3 and A.17.6.1.4.1-4 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.17.6.1.4.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1, 2	PCell (Cell 1)		
Neighbour cell		1, 2	Cell 2		Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2		One TDD carrier frequency is used for the NR cells.
Gap type		1, 2	Per-UE gaps		
Measurement gap repitition periodicity	ms	1, 2	40		
Measurement gap length	ms	1, 2	6		
Measurement gap offset	ms	1, 2	39		
SMTC configuration		1, 2	SMTC.1		
CSI-RS parameters		1, 2	CSI-RS.3.2 TDD		
A3-Offset	dB	1, 2	-6		

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
CP length		1, 2	Normal		
Hysteresis	dB	1, 2	0		
Time To Trigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	DRX.1	DRX.7	DRX related parameters are defined in table A.7.6.1.2.1-5
Time offset between Cell 1 and Cell 2		1, 2	3 µs		Synchronous cells
T1	s	1, 2	5		
T2	s	1, 2	10	52	

Table A.17.6.1.4.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1, 2	66		66	
Intial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	SCSI-RS		SSB	
PDSCH RMC configuration		1	SR.3.2 TDD		N/A	
		2	SR.3.3 TDD			
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
		2	CR.3.2 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
		2	CCR.3.7 TDD		N/A	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.1		OP.1	
SSB		1	SSB.3 FR2		SSB.3 FR2	
		2	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1, 2	AWGN		AWGN	

Table A.17.6.1.4.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 1 defined in clause A.3.15.1			
Beam Assumption[Note 4]		1,2	Rough			
$\hat{E}_s / I_{ot}$ [BB Note 5]	dB	1, 2	3.77	-1.52	-Infinity	-1.52
N_{oc} [Note 2]	dBm/15 KHz	1, 2	-98			
N_{oc} [Note 2]	dBm/SCS	1	-89			
		2	-86			
SSB_RP	dBm/SCS	1	-85	-85	-Infinity	-85
		2	-82	-82	-Infinity	-82
$\hat{E}_s / N_{oc}$	dB	1, 2	4	4	-Infinity	4
Io	dBm/95.04 MHz	1,2	-54.53	-52.18	See Cell 1 columns	

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.						
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: Es/Iot, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation						
NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.						

Table A.17.6.1.4.1-5: Void

Table A.17.6.1.4.1-6:Void

A.17.6.1.4.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2 s for a UE supporting power class 1 or 5,
- 4.32 s for a UE supporting power class 2, 3 4 or 7

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2 s for a UE supporting power class 1 or 5,
- 30.72 s for a UE supporting power class 2, 3 4 or 7

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.17.6.2 Inter-frequency Measurements

A.17.6.2.1 SA event triggered reporting tests For FR2 without SSB time index detection when DRX is not used (PCell in FR2)

A.17.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3B.4.

In this test, there are two cells: NR Cell 1 as PCell in FR2 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.17.6.2.1.1-1, A.17.6.2.1.1-2, and A.17.6.2.1.1-3.

Measurement gap pattern configuration # 13 as defined in table A.17.6.2.1.1-2 is provided for UE that does not support per-FR gap and for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Supported test configurations are shown in table A.17.6.2.1.1-1.

Table A.17.6.2.1.1-1 SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void.	

Table A.17.6.2.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR Cell 1 (Pcell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC-CD-SSB parameters		Config 1	SSB.2 RedCap FR2	As specified in clause A.3.10.2
NCD-SSB parameters		Config 1	SSB.3 RedCap FR2	
offsetMO	dB	Config 1	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	5.2 for PC1; 3.5 for other PC	

Table A.17.6.2.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam Assumption[Note 7]			1,2	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
	Dedicated DL BWP configuration			DLBWP.1.3 RedCap [Note 9]		N/A	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
	Dedicated UL BWP configuration			ULBWP.1.3 RedCap Note 10		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2 for CD-SSB			Config 1	SMTC.1		SMTC.1	
SMTC configuration for NCD-SSB			Config 1	SMTC.2 RedCap		SMTC.2 RedCap	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
$\hat{E}_s$		dBm/SCS	Config 1	-87	-87	-Infinity	-87
SSBRP Note 3		dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ BB Note 8		dB	Config 1	1.89	1.89	-Infinity	1.89
Io Note3		dBm/95.04 MHz Note5	Config 1	-58.01	-58.01	-Infinity	-58.01
Propagation Condition			Config 1	No external noise (Note 11)		No external noise (Note 11)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: VoidNOTE 3: SSBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The starting PRB index for dedicated DL BWP1 corresponding to CD-SSB PRB index; the starting PRB index for dediacted DL BWP2 corresponding to NCD-SSB PRB index;
NOTE 10: The starting PRB index for dedicated UL BWP1 is the same as the starting PRB index for dedicated DL BWP1; the starting PRB index for dedicated UL BWP2 is the same as the starting PRB index for dedicated DL BWP2.
NOTE 11: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].

A.17.6.2.1.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.17.6.2.2 SA event triggered reporting tests For FR2 without SSB time index detection when DRX is used (PCell in FR2)

A.17.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that RedCap UE makes correct reporting of an event in FR2. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3B.4.

In this test, there are two cells: NR Cell 1 as PCell in FR2 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.17.6.2.2.1-1, A.17.6.2.2.1-2, and A.17.6.2.2.1-3.

In test 1&2 measurement gap pattern configuration # 13 as defined in table A.17.6.2.2.1-2 is provided for RedCap UE that does not support per-FR gap and for RedCap UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Supported test configurations are shown in table A.17.6.2.2.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.17.6.2.2.1-1: SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void.	

Table A.17.6.2.2.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1	1, 2		Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR Cell 1 (Pcell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
SMTC-SSB parameters		Config 1	SSB.3 FR2		As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6		
Hysteresis	dB	Config 1	0		
CP length		Config 1	Normal		
TimeToTrigger	s	Config 1	0		
Filter coefficient		Config 1	0		L3 filtering is not used
DRX		Config 1	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3µs		Synchronous cells.
T1	s	Config 1	5		
T2	s	Config 1	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.17.6.2.2.1-3: Cell specific test parameters for CA inter-frequency event triggered reporting without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		-104.7		-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1	-95.7		-95.7	
SS-RSRP Note 3	dBm/SCS Note5	Config 1	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1	6	6	-Infinity	9
Io Note3	dBm/95.04 MHz Note5	Config 1	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1	AWGN		AWGN	
Antenna Configuration		Config 1	1x2		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.17.6.2.2.2 Test Requirements

In test 1 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.17.6.2.3 SA event triggered reporting tests For FR2 with SSB time index detection when DRX is not used (PCell in FR2)

A.17.6.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3B.4.

In this test, there are two cells: NR Cell 1 as PCell in FR2 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.17.6.2.3.1-1, A.17.6.2.3.1-2, and A.17.6.2.3.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Supported test configurations are shown in table A.17.6.2.3.1-1.

Table A.17.6.2.3.1-1: SA event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void.	

Table A.17.6.2.3.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR Cell 1 (Pcell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
offsetMO	dB	Config 1	16	Applied to NR Cell 2 measurement object
A3-Offset	dB	Config 1	-11	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	7 for PC1; 4.5 for other PC	

Table A.17.6.2.3.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam Assumption[Note 7]			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
$\hat{E}_s$		dBm/SCS	Config 1	-87	-87	-Infinity	-87
SSBRP Note 3		dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87
$\hat{E}_s / I_{ot}$ BB Note 8		dB	Config 1	1.89	1.89	-Infinity	1.89
Io Note3		dBm/95.04 MHz Note5	Config 1	-58.01	-58.01	-Infinity	-58.01
Propagation Condition			Config 1	No external noise (Note 9)		No external noise (Note 9)	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SBRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 9: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].

A.17.6.2.3.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

The UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.17.6.2.4 SA event triggered reporting tests For FR2 with SSB time index detection when DRX is used (PCell in FR2) for 2 RX UE

A.17.6.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3B.4.

In this test, there are two cells: NR Cell 1 as PCell in FR2 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.17.6.2.4.1-1, A.17.6.2.4.1-2, and A.17.6.2.4.1-3.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Supported test configurations are shown in table A.17.6.2.4.1-1.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.17.6.2.4.1-1: SA event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: Void.	

Table A.17.6.2.4.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1	1, 2		Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR Cell 1 (Pcell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR Cell 2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39		
SMTC-SSB parameters		Config 1	SSB.3 FR2		As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6		
Hysteresis	dB	Config 1	0		
CP length		Config 1	Normal		
TimeToTrigger	s	Config 1	0		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Filter coefficient		Config 1	0		L3 filtering is not used
DRX		Config 1	DRX.1	DRX.7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3μs		Synchronous cells.
T1	s	Config 1	5		
T2	s	Config 1	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	

Table A.17.6.2.4.1-3: Cell specific test parameters for CA inter-frequency event triggered reporting with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			Config 1	66		66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state			Config 1	TCI.State.2		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		-104.7		-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1	-95.7		-95.7	
SS-RSRP Note 3	dBm/SCS Note5	Config 1	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1	6	6	-Infinity	9
Io Note3	dBm/95.04 MHz Note5	Config 1	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1	AWGN		AWGN	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.17.6.2.4.2 Test Requirements

In test 1 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 1 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.17.6.3 L1-RSRP measurement for beam reporting

A.17.6.3.1 SSB based L1-RSRP measurement when DRX is not used

A.17.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.1, with the testing configurations for NR cells in table A.7.6.3.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

A.17.6.3.1.2 Test parameters

Test parameters are the same as in clause A.7.6.3.1.2.

A.17.6.3.1.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause [10.xx.xx.1], where X is

- 1680 for UE supporting power class 1 or 5.
- 1200 for UE supporting power class 2,3, 4 or 7.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.6.3.2 SSB based L1-RSRP measurement when DRX is used

A.17.6.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.1, with the testing configurations for NR cells in table A.17.6.3.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.17.6.3.2.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.17.6.3.2.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.17.6.3.2.2-1 and table A.17.6.3.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.17.6.3.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{PRB,c}$ = 66

Parameter	Config	Unit	Value
Data PRBs allocated	1~2		66
PDSCH Reference measurement channel	1		SR.3.2 TDD
	2		SR.3.3 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
	2		CR.3.2 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
	2		CCR.3.7 TDD
SSB configuration	1		SSB.1 FR2
	2		SSB.2 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		DRX.3
reportConfigType	1~2		periodic
reportQuantity	1~2		ssb-Index-RSRP
Number of reported RS	1~2		2
L1-RSRP reporting period	1~2	slot	320
T1	1~2	s	5
T2	1~2	s	3
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.17.6.3.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to clause A.3.15.1			
Beam Assumption Note 4	1-2		Rough			
N_{oc} Note2	1~2	dBm/15 kHz	-105			
N_{oc} Note2	1	dBm/SSB SCS	-96			
	2		-93			
$\hat{E}_s / I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB_RP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84
Io Note3	1	dBm/95.04 MHz	-63.97	-63.97	-66.98	-57.47
	2		-63.97	-63.97	-66.98	-57.47
$\hat{E}_s / N_{oc}$	1~2	dB	0	0	-Infinity	9
NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation						

A.17.6.3.2.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than X ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 2880 for UE supporting power class 1
- 1920 for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.17.6.3.3 CSI-RS based L1-RSRP measurement when DRX is not used

A.17.6.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.2, with the testing configurations for NR cells in table A.17.6.3.3.1-1.

Table A.17.6.3.3.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.17.6.3.3.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.17.6.3.3.2-1 and table A.17.6.3.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 480 ms from the beginning of the test, the DCI trigger comes in slot 1 of a frame and UE provides the report back based on the reporting configuration as defined in table A.17.6.3.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.17.6.3.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1		freq1
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
CSI-RS configuration	1		CSI-RS.3.3 TDD
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1

Parameter	Config	Unit	Value
			ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1		SMTC.1
TRS Configuration	1		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2
DRX configuration	1		Off
reportConfigType	1		aperiodic
reportQuantity	1		cri-RSRP
Number of reported RS	1		2
qcl-Info	1		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1		8
Propagation condition	1		AWGN
T1	1	s	5
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.17.6.3.3.2-1: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1		Setup 1 according to clause A.3.15.1	
Beam Assumption Note 4	1		Rough	Rough
N_{oc} Note1	1	dBm/15 kHz	-105	
N_{oc} Note1	1	dBm/SSB SCS	-95.97	
$\hat{E}_s / I_{ot}$	1	dB	0	9
CSI-RS RSRP Note2	1	dBm/SSB SCS	-95.97	-86.97
Io Note2	1	dBm/95.04 MHz	-63.97	-57.47
$\hat{E}_s / N_{oc}$	1	dB	0	9
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation				

A.17.6.3.3.3 Test Requirements

After 480 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.20.1. The reported L1-RSRP value shall include the Rx antenna gain in the range of [-10 ~ +20] dB.

For absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1, the UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.17.6.3.3.3-1.

For relative accuracy of CSI-RS0 compared with CSI-RS1, the UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

Table A.17.6.3.3.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}
NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.17.6.3.4 CSI-RS based L1-RSRP measurement when DRX is used

A.17.6.3.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5B.4.2, with the testing configurations for NR cells in table A.17.6.3.4.1-1.

Table A.17.6.3.4.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

A.17.6.3.4.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in table A.17.6.3.4.2-1 and table A.17.6.3.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 1440 ms from the beginning of the test, the DCI trigger comes in slot 1 of a frame and UE provides the report back based on the reporting configuration as defined in table A.17.6.3.4.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.17.6.3.4.2-1: General test parameters

Parameter	Config	Unit	Value
SSB ARFCN	1		freq1
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{PRB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
CSI-RS configuration	1		CSI-RS.3.3 TDD
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1		SMTC.1
TRS Configuration	1		TRS.2.1 TDD

Parameter	Config	Unit	Value
PDCCH/PDSCH TCI Configuration	1		TCI.State.2
DRX configuration	1		DRX.3
reportConfigType	1		aperiodic
reportQuantity	1		cri-RSRP
Number of reported RS	1		2
qcl-Info	1		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1		8
Propagation condition	1		AWGN
T1	1	s	5
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.17.6.3.4.2-1: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1		Setup 1 according to clause A.3.15.1	
Beam Assumption Note 4	1		Rough	Rough
N_{oc} Note1	1	dBm/15 kHz	-105	
N_{oc} Note1	1	dBm/SSB SCS	-95.97	
$\hat{E}_s / I_{ot}$	1	dB	0	9
CSI-RS RSRP Note2	1	dBm/SSB SCS	-95.97	-86.97
Io Note2	1	dBm/95.04 MHz	-63.97	-57.47
$\hat{E}_s / N_{oc}$	1	dB	0	9
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation				

A.7.6.3.3.3 Test Requirements

After 1440 ms from the beginning of the test, the UE shall send L1-RSRP report at slot 8 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.20.1. The reported L1-RSRP value shall include the Rx antenna gain in the range of [-10 ~ +20] dB.

For absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1, the UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.17.6.3.4.3-1.

For relative accuracy of CSI-RS0 compared with CSI-RS1, the UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table 10.1.20.2.2-1.

Table A.17.6.3.4.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}

NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class

A.17.6.4 NR Measurements with autonomous gaps

A.17.6.4.1 SA interfrequency CGI reporting in autonomous gaps test (PCell in FR2) for 2 RX UE

A.17.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an CGI. This test will partly verify the SA inter-frequency NR cell search requirements in clause 8.2.1.2.16 and 9.11

In this test, there are two cells: NR Cell 1 as PCell in FR2 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in tables A.17.6.4.1.1-1, A.17.6.4.1.1-2, and A.17.6.4.1.1-3.

Measurement gap patterns are configured. During T1 the UE shall report event A3 for Cell 2. Within 3 seconds of the event report, the test equipment shall add a measurement reporting configuration using *ReportConfigNR* which containsa ReportCGI IE with cellForWhichToReportCGI set to the physical Cell ID of Cell 2 and including the optional IE useAutonomousGaps-r16

In the measurement control information, it is indicated to the UE to decode the CGI of the neighbour cell using autonomous gaps. The test consists of two time phases, T1 and T2. Time period T2 begins 10 ms after the test equipment has transmitted the RRC reconfiguration message containing the ReportCGI IE.

Supported test configurations are shown in table A.17.6.4.1.1-1.

Table A.17.6.4.1.1-1 SA interfrequency CGI reporting test in autonomous gaps

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.6.4.1.1-2: General test parameters for SA interfrequency CGI reporting in autonomous gaps

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR Cell 1 (Pcell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR Cell 2	NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
SI-RNTI scheduling rate	ms		40 ms	S-RNTI scheduled on four occasions per 160 ms transmission period
A3-Offset	dB	Config 1	-30	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used

Parameter	Unit	Test configuration	Value	Comment
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	<10	UE expected to report event A3 for Cell 2 within 5,2 s (PC1)or 3.5 s (other PC) of the start of T1. Test equipment shall configure CGI reporting within 3 s after receiving the event A3 report. T2 begins 10 ms after test equipment has transmitted the RRC reconfiguration to configure CGI reporting.
T2	s	Config 1	1	

Table A.17.6.4.1.1-3: Cell specific test parameters SA interfrequency CGI reporting in autonomous gaps

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam Assumption[Note 7]			1,2	Rough			
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		Not sent	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
TCI configuration			Config 1	CSI-RS.Config.0		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		-99.03		-99.03	
N_{oc} Note2	dBm/SCS Note4	Config 1	-90		-90	
SS-RSRP Note 3	dBm/SCS Note5	Config 1	-87		-93	
$\hat{E}_s/I_{ot}$	dB	Config 1	3		-3	
$\hat{E}_s/N_{oc}$	dB	Config 1	3		-3	
Io Note3	dBm/95.04 MHz Note5	Config 1	-56.25		-59.25	
Propagation Condition		Config 1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.17.6.4.1.2 Test Requirements

The UE shall report the CGI of Cell 2 within 25*Tsmtc + 6*Tsi-rnti+20 ms +2 ms= 762 ms from the start of T2, allow 765 ms. The rate of correct events observed during repeated tests shall be at least 90 %.

The UE shall be scheduled continuously throughout the test, and from the start of T3 until 775 ms the number of interrupted slots shall not exceed the allowed number as defined in clause 8.2.2.2.14.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.17.6.5 RSTD measurements

A.17.6.5.1 NR RSTD measurement reporting delay test case for RedCap UE without FH in FR2 SA

A.17.6.5.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC CONNECTED state meets the requirements specified in clause 9.9A.2 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

Supported test configurations are shown in table A.17.6.5.1.1-1. The test parameters are as given in table A.17.6.5.1.1-2, Table A.17.6.5.1.1-3, and table A.17.6.5.1.1-4.

Table A.17.6.5.1.1-1: Supported test configurations for NR RSTD

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layers.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the RedCap UE during T1. The measurement reporting delay test in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #13 before T2.

Table A.17.6.5.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.3 FR2	
SMTC configuration	Config 1		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CCR.1.1 FDD	

PRS Configuration	Config 1		PRS.1.1 FR2	As specified in clause A.3.31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#13	GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			3	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test
T2		s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup			Setup 1	As defined in clause A.3.15.1
Beam assumption			Rough	Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

Table A.17.6.5.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter	Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number		1	1	1
Positiong frequency layer		1	1	1
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1		OP.1	N/A	N/A

EPRE ratio of PSS to SSS		dB	0	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 95.04MHz	-57	-57	-57
SSB_RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$	Config 1	dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB_RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.17.6.5.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
RF Channel Number		1	1	1
Positiong frequency layer		1	1	1
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1		OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	0	0	0

EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
EPRE ratio of PRS to SSS					
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.45	-11.67	-11.67
Io Note4	Config 1	dBm/ 95.04MHz	-58.49	-58.49	-58.49
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
PRP Note 4		dBm/SCS	-94.45	-100.67	-100.67
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.

NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 4: PRP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.

NOTE 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.6.5.1.2 Test Requirements

The RSTD measurement time without FH for RedCap fulfils the requirements specified in clause 9.9A.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 9.9.2A.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.17.6.5.2 NR RSTD measurement reporting delay test case with PRS frequency hopping

A.17.6.5.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 9.9A.2.6 in FR2 in standalone scenario when PRS frequency hopping is configured.

Supported test configurations are shown in table A.17.6.5.2.1-1. The test parameters are as given in table A.17.6.5.2.1-2, table A.17.6.5.2.1-3, and table A.17.6.5.2.1-4.

Table A.17.6.5.2.1-1: Supported test configurations for NR RSTD

Configuration	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layers.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall not have any timing information of Cell 2 and Cell 3. All three cells transmit PRS during T2.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The test requirements apply when *frequencyHopping* is configured to UE.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID # 24 or #13 before T2.

Table A.17.6.5.2.1-2: General test parameters for RSTD measurement reporting delay

Parameter	Unit	Value	Comment
Reference cell		Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.

Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
SSB configuration	Config 1		SSB.1 RedCap FR2	
SMTC configuration	Config 1		SMTC.1 RedCap	
PDSCH RMC configuration	Config 1		SR.3.2 TDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CCR.3.1 TDD	
PRS Configuration	Config 1		PRS.1.6 FR2	PRS configured with frequency hopping as specified in clause A.3.31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX			OFF	
Measurement gap			GP#24 or GP#13	GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			3	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1		s	3	The length of the time interval from the beginning of each test

T2	s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup		Setup 1	As defined in clause A.3.15.1
Beam assumption		Rough	Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

Table A.17.6.5.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
$BW_{channel}$		MHz	400: $N_{RB,c}$ = 264	400: $N_{RB,c}$ = 264	400: $N_{RB,c}$ = 264
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 380.16MHz	-53.99	-53.99	-53.99
SSB_RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$	Config 1	dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB_RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.17.6.5.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
RF Channel Number		1	1	1
Positiong frequency layer		1	1	1
$BW_{channel}$	MHz	400: $N_{RB,c}$ = 264	400: $N_{RB,c}$ = 264	400: $N_{RB,c}$ = 264
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low

OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.44	-11.67	-11.67
Io Note4	Config 1	dBm/ 380.16MHz	-52.68	-52.68	-52.68
PRS $\hat{E}_s/I_{ot}$		dB	dB	-6	-13
PRP Note 4		dBm/SCS	dBm/SCS	-94.44	-100.67
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.

NOTE 2: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 4: PRP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters. The Io is calculated based only on the symbols in which PRS is transmitted.

NOTE 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.6.5.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 9.9A.2.6.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 9.9A.2.6 starting from the beginning of time interval T2.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.17.6.6 UE Rx-Tx Measurements

A.17.6.6.1 UE Rx-Tx measurement reporting delay for single positioning frequency layer in FR2 SA without RX FH in RRC_CONNECTED mode

A.17.6.6.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement without RX FH in RRC_CONNECTED mode meets the requirements specified in clause 9.9A.4.5 in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configuration is listed in table A.17.6.6.1.1-1.

Table A.17.6.6.1.1-1: Supported test configurations.

Config	Description
1	120 kHz SSB and PRS SCS, 100 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. In *nr-Multi-RTT-RequestLocationInformation, nr-DL-PRS-RxHoppingRequest* is not present.

The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID #13 or ID #24 before T2.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.17.6.6.1.1-2 and table A.17.6.6.1.1-3 respectively.

Table A.17.6.6.1.1-2: General test parameters.

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	100: $N_{RB,c}$ = 66	
SSB configuration		1	SSB.2 RedCap FR2	
SMTC configuration		1	SMTC.1 RedCap	
Measurement gap		1	GP#24 or GP#13 Note 1	
CP length		1	Normal	
DRX		1	OFF	
Time offset between serving and neighbour cells	µs	1	3	Synchronous cells
Expected RSTD	µs	1	3	
Expected RSTD uncertainty	µs	1	5	
T1	s	1	5	
T2	s	1	20	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.17.6.6.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	

Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1 RedCap		N/A	
Active UL BWP configuration		1	ULBWP.1.1 RedCap		N/A	
PRS configuration		1	PRS.1.5 FR2		PRS.1.5 FR2	
PRS muting info		1	'10'		'01'	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
N_{oc} Note 2	dBm/SCS	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
PRP Note 3	dBm/SCS kHz	1	-Infinity	-91	-Infinity	-99
Io	dBm/92.16 MHz	1	N/A	-54.62	N/A	-54.62
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over sub-carriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone

NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.6.6.1.2 Test requirements

The UE Rx-Tx time difference measurement time fulfills the requirements specified in clause 9.9A.4.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1A.18.3.

A.17.6.6.2 UE Rx-Tx time difference measurement with Rx FH for single positioning frequency layer in FR2 SA in RRC_CONNECTED state

A.17.6.6.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement with Rx FH meets the requirements specified in clause 9.9A.4.8 in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.17.6.6.2.1-1.

Table A.17.6.6.2.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the multi-RTT assistance data and location information request.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources.

The UE is configured with measurement gap pattern ID #13 or ID #24 before T2.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.17.6.6.2.1-2 and table A.17.6.6.2.1-3, respectively.

Table A.17.6.6.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	400: $N_{RB,c} = 264$	
SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC.1	

Measurement gap		1	GP#24 or GP#13 Note 1	
CP length		1	Normal	
DRX		1	OFF	
Time offset between serving and neighbour cells	μs	1	3	Synchronous cells
PRS RX hopping request		1	requested	
T1	s	1	5	
T2	s	1	10	
NOTE 1: GP#24 is configured if RedCap UE supports MG#24, otherwise GP#13 is configured.				

Table A.17.6.6.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
Active DL BWP configuration		1	DLBWP.1.1 RedCap		N/A	
Active UL BWP configuration		1	ULBWP.1.1 RedCap		N/A	
PRS configuration		1	PRS.1.6 FR2		PRS.1.6 FR2	
PRS muting info		1	'10'		'01'	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
N_{oc} Note 2	dBm/15 kHz	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
PRP Note 3	dBm/SCS	1	-Infinity	-91	-Infinity	-99
Io	dBm/ 380.16MHz	1	N/A	-51.61	N/A	-51.61

Propagation Condition		1	AWGN

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.6.6.2.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 9.9A.4.8.

The RedCap UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1A.18.3.

A.17.6.7 PRS-RSRP measurements

A.17.6.7.1 PRS-RSRP measurement delay test case for RedCap positioning without Rx FH in RRC_CONNECTED state in FR2

A.17.6.7.1.1 PRS-RSRP measurement delay test case for single positioning frequency layer

A.17.6.7.1.1.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in clause 9.9.3.5 for single positioning frequency layer under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.17.6.7.1.1.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. The measurement reporting delay test in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform PRS-RSRP measurement with RX FH via *NR-DL-AoD-RequestLocationInformation* or the UE is configured by the LMF to perform PRS-RSRP measurement with RX FH but reports the PRS-RSRP measurement based on the single hop in *NR-DL-AoD-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.17.6.7.1.1.1-2 and table A.17.6.7.1.1.1-3.

Table A.17.6.7.1.1.1-1: supported test configurations for PRS RSRP measurement for FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.6.7.1.1.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		1	NR cell 1 (Pcell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		1	GP#13 or GP#24[Note1]	As specified in clause 9.1.2-1.
Measurement gap offset		1	39	
SMTC parameters		1	SMTC.1	As specified in clause A.3.11
SSB parameters		1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	1	-6	
Hysteresis	dB	1	0	
CP length		1	Normal	
TimeToTrigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX		1	OFF	DRX is not used
Time offset between serving and neighbour cells		1	3μs	Synchronous cells.
Expected RSTD	μs	1	3	
Expected RSTD uncertainty	μs	1	5	
T1	s	1	5	
T2	s	1	7	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.17.6.7.1.1.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			1	Rough		Rough	
TDD configuration			1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			1	TDD		TDD	
$BW_{channel}$		MHz	1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		1	DLBWP.0.1		N/A	

	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			1	OP.1		OP.1	
PDSCH Reference measurement channel			1	SR.3.1 TDD		-	
CORESET Reference Channel			1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			1	CCR.3.1 TDD		-	
TRS configuration			1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	1	120		120	
PRS configuration			1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting configuration			1	'10'		'01'	
EPRE ratio of PSS to SSS		dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note5		-98		-98	
N_{oc} Note2		dBm/SCS Note4	1	-89		-89	
SSB_RP Note 3		dBm/SCS Note5	1	-91	-91	-Infinity	-99
PRP Note 3		dBm/SCS Note5	1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s / I_{ot}$		dB	1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s / N_{oc}$		dB	1	-Infinity	-2	-Infinity	-10
SSB $\hat{E}_s / N_{oc}$		dB	1	-2	-2	-Infinity	-10
Io Note3		dBm/95.04 MHz Note5	1	-57.89	-57.63	-57.89	-57.63
Propagation Condition			1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP/PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.6.7.1.1.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 9.9.3.5. The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9.3.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1A.17.3.

A.17.6.7.1.2 PRS-RSRP measurement delay test case for dual positioning frequency layer

A.17.6.7.1.2.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in clause 9.9.3.5 for dual positioning frequency layers under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.17.6.7.1.2.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the different frequency from the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.17.6.7.1.2.1-2, and table A.17.6.7.1.2.1-3.

Table A.17.6.7.1.2.1-1: supported test configurations for PRS RSRP measurement for FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.6.7.1.2.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	NR cell 1 (Pcell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		1	GP#13 or GP#24[Note1]	As specified in clause 9.1.2-1.
Measurement gap offset		1	39	
SMTC parameters		1	SMTC.1	As specified in clause A.3.11
SSB parameters		1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	1	-6	
Hysteresis	dB	1	0	
CP length		1	Normal	
TimeToTrigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX		1	OFF	DRX is not used
Time offset between serving and neighbour cells		1	3μs	Synchronous cells.
Expected RSTD	μs	1	3	
Expected RSTD uncertainty	μs	1	5	
T1	s	1	5	
T2	s	1	7	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.17.6.7.1.2.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			1	Rough		Rough	
NR RF Channel Number			1	1		2	
TDD configuration			1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			1	TDD		TDD	
$BW_{channel}$		MHz	1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			1	OP.1		OP.1	
PDSCH Reference measurement channel			1	SR.3.1 TDD		-	
CORESET Reference Channel			1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			1	CCR.3.1 TDD		-	
TRS configuration			1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	1	120		120	
PRS configuration			1	PRS.1.1 FR2		PRS.1.2 FR2	

PRS muting configuration		1	'10'		'01'	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		-98		-98	
N_{oc} Note2	dBm/SCS Note4	1	-89		-89	
SSB_RP Note 3	dBm/SCS Note5	1	-92	-92	-Infinity	-102
PRP Note 3	dBm/SCS Note5	1	-Infinity	-92	-Infinity	-102
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-3	-Infinity	-13
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-3	-Infinity	-13
SSB $\hat{E}_s/N_{oc}$	dB	1	-3	-3	-Infinity	-13
Io Note3	dBm/95.04 MHz Note5	1	-58.25	-58.25	-60.01	-59.80
Propagation Condition		1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP/PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.6.7.1.2.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 9.9.3.5.The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9.3.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1A.17.3.

A.17.6.7.2 PRS-RSRP measurement delay with FH in RRC_CONNECTED state in FR2

A.17.6.7.2.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement with FH by a RedCap UE meets requirements specified in clause 9.9A.3.5 for single positioning frequency layer under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.17.6.7.2.1-1

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.17.6.7.2.1-2, and table A.17.6.7.2.1-3.

Table A.17.6.7.2.1-1: Supported test configurations for PRS RSRP measurement

Config	Description
1	120 kHz SSB SCS, UE bandwidth 100 MHz, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

Table A.17.6.7.2.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		Config 1	GP#13 or GP#24[Note1]	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
CP length		Config 1	Normal	
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.

Expected RSTD	µs	Config 1	3	
Expected RSTD uncertainty	µs	Config 1	5	
PRS RX hopping request		Config 1	Present	
T1	s	Config 1	5	
T2	s	Config 1	7	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.17.6.7.2.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	400: $N_{RB,c}$ = 264		400: $N_{RB,c}$ = 264	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.6 FR2		PRS.1.6 FR2	
PRS muting configuration			Config 1	'10'		'01'	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note5		-98		-98	
N_{oc} Note2		dBm/SCS Note4	Config 1	-89		-89	

SSB_RP Note 3	dBm/SCS Note5	Config 1	-91	-91	-Infinity	-99
PRP Note 3	dBm/SCS Note5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$	dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	Config 1	-Infinity	-2	-Infinity	-10
SSB $\hat{E}_s/N_{oc}$	dB	Config 1	-2	-2	-Infinity	-10
Io Note3	dBm/380.16 MHz Note5	Config 1	-53.99	-51.61	-53.99	-51.61
Propagation Condition		Config 1	AWGN			

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP/PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.6.7.2.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 9.9A.3.5. The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9A.3.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1A.17.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

A.17.6.8 PRS-RSRPP Measurements

A.17.6.8.1 PRS-RSRPP measurement delay without FH in RRC_CONNECTED state in FR2

A.17.6.8.1.1 Test Purpose and Environment

The purpose of the test is to verify that the PRS RSRPP measurement without FH by a RedCap UE meets requirements specified in clause 9.9A.5.5 for single positioning frequency layer under 2-tap channel propagation conditions in standalone scenario. Supported test configurations are shown in table A.17.6.8.1.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.17.6.8.1.1-2, and table A.17.6.8.1.1-3.

Table A.17.6.8.1.1-1: supported test configurations for PRS RSRPP measurement for FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.6.8.1.1-2: General test parameters for PRS RSRPP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PVell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		Config 1	GP#13 or GP#24[Note1]	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
CP length		Config 1	Normal	
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
PRS RX hopping request		1, 2, 3, 4	NOT present	
T1	s	Config 1	5	
T2	s	Config 1	7	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.17.6.8.1.1-3: Cell-specific test parameters for PRS RSRPP measurement reporting delay

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]		Config 1	Rough		Rough	

TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.3 FR2		PRS.1.3 FR2	
PRS muting configuration			Config 1	'10'		'01'	
EPRE ratio of PSS to SSS							
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS			Config 1	0		0	
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note5		-98		-98	
N_{oc} Note2		dBm/SCS Note4	Config 1	-89		-89	
SS-RSRP Note 3		dBm/SCS Note5	Config 1	-89	-89	-Infinity	-89
PRS-RSRP Note 3		dBm/SCS Note5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s / I_{ot}$		dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s / N_{oc}$		dB	Config 1	-Infinity	-2	-Infinity	-10
Io Note3		dBm/95.04 MHz Note5	Config 1	-60.01	-57.63	-60.01	-57.63
Propagation Condition			Config 1	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ μs and $f_D = 5$ Hz			

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.6.8.1.2 Test Requirements

The PRS RSRPP measurement time fulfils the requirements specified in clause 9.9A.5.5. The UE shall perform and report the PRS RSRPP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9A.5.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRPP measurement for each correct event shall be within the PRS RSRPP reporting range specified in clause 10.1A.19, i.e., between PRS RSRPP_0 and PRS RSRPP_126.

A.17.6.8.2 PRS-RSRPP measurement with Rx FH reporting delay test case for single positioning frequency layer in FR2 SA in RRC_CONNECTED state

A.17.6.8.2.1 Test Purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement requirements with Rx FH in RRC_CONNECTED state meets the delay requirements specified in clause 9.9A.5.8 in an environment with two-tap channel propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.17.6.8.2.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the Pcell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.17.6.8.2.1-2, and table A.17.6.8.2.1-3.

Table A.17.6.8.2.1-1: supported test configurations for PRS-RSRPP measurement for FR2

Config	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

Table A.17.6.8.2.1-2: General test parameters for PRS-RSRPP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		Config 1	GP#13 or GP#24[Note1]	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
PRS RX hopping request		1	requested	
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	7	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.17.6.8.2.1-3: Cell-specific test parameters for PRS-RSRPP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	400: $N_{RB,c}$ = 264		400: $N_{RB,c}$ = 264	
BWP BW		MHz	Config 1	400: $N_{RB,c}$ = 264		400: $N_{RB,c}$ = 264	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1 RedCap		N/A	
	Dedicated UL BWP			ULBWP.1.1 RedCap		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	

CORESET Reference Channel		Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration		Config 1	CCR.3.1 TDD		-	
TRS configuration		Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1	120		120	
PRS configuration		Config 1	PRS.1.6 FR2		PRS.1.6 FR2	
PRS muting configuration		Config 1	'10'		'01'	
EPRE ratio of PSS to SSS						
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS		Config 1	0		0	
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		-98		-98	
N_{oc} Note2	dBm/SCS Note4	Config 1	-89		-89	
SS-RSRP Note 3	dBm/SCS Note5	Config 1	-89	-89	-Infinity	-89
PRS-RSRP Note 3	dBm/SCS Note5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$	dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	Config 1	-Infinity	-2	-Infinity	-10
Io Note3	dBm/380.16 MHz Note5	Config 1	-50.98	-51.61	-50.98	-51.61
Propagation Condition		Config 1	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ µs and $f_D = 5$ Hz			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.

NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.

NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.

NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.6.8.2.2 Test Requirements

The PRS-RSRPP measurement time fulfils the requirements specified in clause 9.9A.5.8. The UE shall perform and report the PRS-RSRPP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9A.5.8 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS-RSRPP measurement for each correct event shall be within the PRS-RSRPP reporting range specified in clause 10.1A.19, i.e., between PRS RSRPP_0 and PRS RSRPP_126.

A.17.7 Measurement Performance requirements

A.17.7.1 SS-RSRP

A.17.7.1.1 SA intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.17.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy for RedCap UE is within the specified limits. This test will verify the requirements in clauses 10.1.3A.3 for intra-frequency measurements.

A.17.7.1.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.17.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in table A.17.7.1.1.2-2 and A.17.7.1.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1. The test consists of two time phases T1 and T2.

Table A.17.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.7.1.1.2-2: SS-RSRP Intra frequency general test parameters

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		24		24	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-

Parameter	Unit	T1		T2	
PDSCH Reference measurement channel		SR.3. 2TDD	-	SR.3. 2 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Reference channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void

Table A.17.7.1.1.2-3: SS-RSRP Intra frequency OTA related test parameters

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 7		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-91.6		N/A	
N_{oc} Note1	dBm/SCS Note4	-82.6		N/A	
$\hat{E}_s / N_{oc}$	dB	6.0	1.0	N/A	N/A
E_s	dBm/SCS Note4			(Table B.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2-2 Rx Beam Peak +2.1 dB)
SSB_RP Note2	dBm/SCS	-76.6	-81.6	(Table B.2.2-2 Rx Beam Peak +2.1 dB)	(Table B.2.2-2 Rx Beam Peak +2.1 dB)
$\hat{E}_s / I_{ot}$ BB Note6	dB	2.44	-5.98	-5.98	-5.98
Io Note2	dBm/95.04 MHz Note4	-50.05		(Table B.2.2-2 Rx Beam Peak +29.70 dB)	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
NOTE 5: Void NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4. NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation					

A.17.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1A.3.1.1 and relative accuracy requirements in clause 10.1A.3.1.2. The following requirements are to be verified:

During T1:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.17.7.1.1.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1A.3.1.2-1.

During T2:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.17.7.1.1.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1A.3.1.2-1.

During T1 and T2:

Relative accuracy of Cell 1 during T2 compared with Cell 1 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1A.3.1.2-1

Relative accuracy of Cell 2 during T2 compared with Cell 2 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table 10.1A.3.1.2-1.

Table A.17.7.1.1.3-1: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	$SSB_RP1 - \delta + G_{min} \leq$ Reported RSRP(dBm) $\leq SSB_RP1 + \delta + G_{max}$
Cell 2	$SSB_RP2 - \delta + G_{min} \leq$ Reported RSRP(dBm) $\leq SSB_RP2 + \delta + G_{max}$
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.3.1.1-1, selected according to the Io used in the test NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.17.7.1.2 SA inter-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.17.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1A.5.1.1 and 10.1.5A.1.2 for intrer-frequency measurements with the testing configurations for NR cells in table A.17.7.1.2.1-1.

Table A.17.7.1.2.1-1: Applicable NR configurations for FR2 inter-frequency SS-RSRP accuracy test

Configuration	Description

1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

A.17.7.1.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 1 and Cell 2 are given in table A.17.7.1.2.2-1 and table A.17.7.1.2.2-2 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in A.17.7.1.2.2-1

The inter-frequency measurements are supported by a measurement gap.

Table A.17.7.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		1~2		freq1	freq2	freq1	freq2
$BW_{channel}$		1~2		100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		1		24		24	
		2		48		48	
Gap pattern ID				0		0	
Duplex mode		1~2		TDD		TDD	
TDD configuration		1~2		TDDConf.3.1		TDDConf.3.1	
PDSCH Reference measurement channel		1		SR.3. 2 TDD	-	SR.3. 2 TDD	-
		2		SR.3.3 TDD		SR.3.3 TDD	
RMSI CORESET Reference Channel		1		CR.3.1 TDD	-	CR.3.1 TDD	-
		2		CR.3.2 TDD		CR.3.2 TDD	
Dedicated CORESET Reference Channel		1		CCR.3.1 TDD	-	CCR.3.1 TDD	-
		2		CCR.3.7 TDD		CCR.3.7 TDD	
SSB configuration		1		SSB.3 FR2		SSB.3 FR2	
		2		SSB.4 FR2		SSB.4 FR2	
PDSCH/PDCCH subcarrier spacing		1~2	kHz	120		120	
OCNG Patterns		1~2		OP.3		OP.3	
Initial BWP Configuration		1~2		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration		1~2		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration		1~2		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration		1~2		TCI.State.2		TCI.State.2	
SMTC configuration		1~2		SMTC.1		SMTC.1	
Time offset between Cell 2 and Cell 1		1~2	µs	3		3	
EPRE ratio of PSS to SSS		1~2	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
Propagation condition		1~2	-	AWGN	AWGN	AWGN	AWGN
Antenna configuration		1~2	-	1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.							

Parameter		Config	Unit	Test 1		Test 2	
				Cell 1	Cell 2	Cell 1	Cell 2
NOTE 2: Void.							

Table A.17.7.1.2.2-2: SS-RSRP inter frequency OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration	1~2		Setup 4b according to clause A.3.15.4.2		Setup 4b according to clause A.3.15.4.2	
			AoA1 Spherical coverage	AoA2 Rx Beam Peak	AoA1 Spherical coverage	AoA2 Rx Beam Peak
Assumption for UE beams[Note 7]	1~2		Rough		Rough	
N_{oc} [Note1]	1	dBm/15 kHz[Note4]	-90.6	-90.6	(Table B.2.3-2 Rx Beam Peak[Note 8] +1.97 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] - 3.03 dB)
	2		-93.7	-93.7		
N_{oc} [Note1]	1	dBm/SCS[Note4]	-81.6	-81.6	(Table B.2.3-2 Rx Beam Peak[Note 8] +11.0 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +6.0 dB)
	2		-81.7	-81.7	(Table B.2.3-2 Rx Beam Peak[Note 8] +14.0 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +9.0 dB)
$\hat{E}_s / N_{oc}$	1~2	dB	6.0	6.0	17.0	-1.0
SSB_RP[Note2]	1	dBm/SCS	-75.6	-75.6	(Table B.2.3-2 Rx Beam Peak[Note 8] +28.0 dB)	(Table B.2. 3-2 Rx Beam Peak[Note 8] +5.0 dB)
	2		-75.7	-75.7	(Table B.2.3-2 Rx Beam Peak[Note 8] +31.0 dB)	(Table B.2. 3-2 Rx Beam Peak[Note 8] +8.0 dB)
($SSB_RP_{Cell\ 1}$ – $SSB_RP_{Cell\ 2}$)	1~2	dB	0		23.00	
$\hat{E}_s / I_{ot\ BB}$[Note6]	1	dB	5.26	5.96	9.53	-3.46
	2		4. 61	5.91		
Io[Note2]	1	dBm/95.04 MHz [Note4]	-50.00	-50.00	(Table B.2.3-2 Rx Beam Peak[Note 8] +52.68 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +33.13 dB)
	2		-50.09	-50.09	(Table B.2.3-2 Rx Beam Peak[Note 8] +55.69 dB)	(Table B.2.3-2 Rx Beam Peak[Note 8] +36.14 dB)
($Io_{freq\ 1}$ – $Io_{freq\ 2}$)	1~2	dB	0		19.55	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, Es/Iot, Io, ($SSB_RP_{Cell\ 2}$ – $SSB_RP_{Cell\ 1}$) and ($Io_{freq\ 2}$ – $Io_{freq\ 1}$) levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Void
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: Void
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P or ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
NOTE 8: The value in table B.2.3-2 is the Minimum SSB_RP for SCS_{SSB} = 120 kHz, selected according to the operating band of Cell 2 and UE power class, without $\Delta MB_{P,n}$ adjustment.						

A.17.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirements in clause 10.1A.5.1.1 and the relative requirements in clause 10.1.5A.1.2.

Test 1:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.17.7.1.2.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table A.17.7.1.2.3-2.

Test 2:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.17.7.1.2.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in table A.17.7.1.2.3-2.

Table A.17.7.1.2.3-1: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 1	SSB_RP1 -δ +G_{min} +X ≤ Reported RSRP(dBm) ≤ SSB_RP1 +δ +G_{max}
Cell 2	SSB_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP2 +δ +G_{max}
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table 10.1.5.1.1-1, selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	
NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.	

Table A.17.7.1.2.3-2: SS-RSRP relative accuracy test requirement

	Test requirement Notes1,2,3,4, 5, 6
Cell 2 – Cell 1	SSB_RP2 - SSB_RP1 -δ - D - G_{inter} ≤ Reported RSRP(dB) ≤ SSB_RP2 - SSB_RP1 +δ + G_{inter} –(X)
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration	
NOTE 2: δ is the RSRP relative accuracy requirement from Table 10.1.5.1.2-1	
NOTE 3: Void	
NOTE 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.	
NOTE 5: D = [5.5 dB]. D is the margin due to mis-alignment between fine beam and rough beam.	
NOTE 6: G_{inter} = [3 dB]. G_{inter} is the margin due to different antenna gain caused by frequency separation.	

A.17.7.2 SS-RSRQ

A.17.7.2.1 SA intra-frequency measurement accuracy with FR2 serving cell and FR2 target cell

A.17.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1A.7.

A.17.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A.17.7.2.1.2-1. . The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in table A.17.7.2.1.2-2 and table A.17.7.2.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell.

Table A.17.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.7.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			Freq1		Freq1	
Duplex mode			TDD		TDD	
TDD configuration			TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated			66		66	
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
TRS configuration			TRS.2.1 TDD		TRS.2.1 TDD	
TCI state			TCI.State.0		TCI.State.0	
PDSCH Reference measurement channel			SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel			CR.3.1 TDD	-	CR.3.1 TDD	
Control channel RMC			CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns			OP.1	OP.1	OP.1	OP.1
SMTC configuration			SMTC.1			
SSB configuration			SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
PDSCH/PDCCH subcarrier spacing		kHz	120	120	120	120
SS-RSSI-Measurement			Not Applicable			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition			AWGN		AWGN	
Antenna configuration			1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void
NOTE 5: Void.

Table A.17.7.2.1.2-3: SS-RSRQ Intra frequency OTA related test parameters

	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1according to clause A.3.15.1	
Assumption for UE beams Note 9		Rough			
N_{OC} Note1	dBm/15 kHz Note4	-95		-95	
N_{OC} Note1	dBm/SCS Note3	-86		-86	
$\hat{E}_s / N_{oc}$	dB	3		3	
SSB_RP Note2	dBm/SCS Note4	-83	-83	-89	-89
SS-RSRQ Note2	dB	-14.77	-14.77	-16.81	-16.81
$\hat{E}_s / I_{ot}$	dB	-1.76	-1.76	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-50		-54	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRQ, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Void
NOTE 7: Void
NOTE 8: Void
NOTE 9: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.17.7.2.1.3 Test Requirements

The SS-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal SS-RSRQ+2.5 dB to Nominal SS-RSRQ-2.5 dB and the SS-RSRQ measurement accuracy in test 2 shall be within the range Nominal RSRQ+3.5 dB to Nominal RSRQ-3.5 dB according to the requirements in clause 10.1.8.1.1.Nominal RSRQ is the value shown in table A.17.7.2.1.2-3.

A.17.7.2.2 SA Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell for 2 Rx UE

A.17.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1A.9.1.1 and 10.1A.9.1.2 for inter-frequency measurement.

A.17.7.2.2.2 Test parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.17.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in table A.17.7.2.2.2-2 and table A.17.7.2.2.2-3. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.17.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.7.2.2.2-2: SS-RSRQ Inter frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			Freq1	freq2	freq1	Freq2
SSB Configuration			SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
Duplex mode			TDD		TDD	
TDD configuration			TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
TRS configuration			TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state			TCI.State.0	-	TCI.State.0	-
Data PRBs allocated			66		66	
PDSCH Reference measurement channel			SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel			CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns			OP.1	OP.1	OP.1	OP.1
SMTC configuration			SMTC.1	SMTC.1	SMTC.1	SMTC.1
PDSCH/PDCCH subcarrier spacing		kHz	120	120	120	120
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation conditions			AWGN	AWGN	AWGN	AWGN
Antenna configuration			1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void

Table A.17.7.2.2.2-3 SS-RSRQ Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
AoA setup		Setup 1 in clause A.3.15.		Setup 1 in clause A.3.15.	
Assumption for UE beams Note 8		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-94.03	-94.03	-94.03	-94.03
N_{oc} Note1	dBm/SCS Note3	-85.0	-85.0	-85.0	-85.0
$\hat{E}_s / N_{oc}$	dB	-1.75		-1.75	
SSB_RP Note2	dBm/SCS Note4	-86.75	-86.75	-88	-88
SS-RSRQ Note2	dB	-14.75	-14.75	-15.56	-15.56
$\hat{E}_s / I_{ot}$	dB	-1.75	-1.75	-3	-3
Io Note2	dBm/95.04 MHz Note4	-53.8	-53.8	-54.25	-54.25

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-RSRQ, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
NOTE 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone					
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone					
NOTE 6: Void					
NOTE 7: Void					
NOTE 8: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation					

A.17.7.2.2.3 Test Requirements

The SS-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal SS-RSRQ+2.5 dB to Nominal SS-RSRQ -2.5 dB and the SS-RSRQ measurement accuracy in test 2 shall be within the range Nominal SS-RSRQ +3.5 dB to Nominal SS-RSRQ -3.5 dB according to the requirements in clause 10.1A.10.1.1.

The SS-RSRQ relative measurement accuracy shall fulfil the requirements in clause 10.1A.10.1.2.

A.17.7.2.3 SA Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.17.7.3 L1-RSRP measurement for beam reporting

A.17.7.3.1 SSB based L1-RSRP measurement

A.17.7.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.5B.2 and clause [10.xx.xx.1] for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.7.7.4.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

A.17.7.3.1.2 Test parameters

Test parameters are the same as in clause A.7.7.4.1.2.

A.17.7.3.1.3 Test Requirements

After 320 ms from the beginning of the test, the L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 2 shall fulfil the requirements in clauses [10.xx.xx.1]. The following requirements are to be verified:

For Test 1:

Absolute accuracy of SSB0 and absolute accuracy of SSB1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.17.7.3.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table [10.xx.xx.1.2-1].

For Test 2:

Absolute accuracy of SSB0 and absolute accuracy of SSB1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.17.7.3.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table [10.xx.xx.1.2-1].

Table A.17.7.3.1.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
SSB0	SSB_RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP0 +δ + G_{max}
SSB1	SSB_RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP1 +δ + G_{max}
NOTE 1: SSB_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the SSB n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table [10.xx.xx.1.1-1], selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.17.7.3.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.17.7.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.5.3 and clause [10.1.xx.2] for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in table A.7.7.4.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

A.17.7.3.2.2 Test parameters

Test parameters are the same as in clause A.7.7.4.2.2.

A.17.7.3.2.3 Test Requirements

After 640 ms from the beginning of the test, the L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 1 shall fulfil the requirements in clause [10.1.xx.2]. The following requirements are to be verified:

For Test 1:

Absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.17.7.3.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table [10.1.xx.2.2-1].

For Test 2:

Absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in table A.17.7.3.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in table [10.1.xx.2.2-1].

Table A.17.7.3.2.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}
NOTE 1: CSI-RS_RPn is the equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration	
NOTE 2: δ is the RSRP absolute accuracy requirement from Table [10.1.xx.2.1-1], selected according to the Io used in the test	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.17.7.4 SS-SINR

A.17.7.4 SA intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell for 2Rx UE

A.17.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1A.13.1.1.

A.17.7.4.1.2 Test parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A A.17.7.4.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is test by using the parameters in table A.17.7.4.1.2-2 and table Table A.17.7.4.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.17.7.4.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.7.4.1.2-2: SS-SINR Intra frequency test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		Freq2		Freq2	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{PRB,c}$ = 66		100: $N_{PRB,c}$ = 66	
Data PRBs allocated		66		66	
Downlink initial BWP configuration		DLBWP.0.1			
Downlink dedicated BWP configuration		DLBWP.1.1			
Uplink initial BWP configuration		ULBWP.0.1			
Uplink dedicated BWP configuration		ULBWP.1.1			
DRX cycle configuration	ms	Not applicable			
TRS configuration		TRS.2.1 TDD			
TCI state		TCI.State.0			
PDSCH Reference measurement channel		SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	
Dedicated RMSI CORESET Reference Channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1			
SSB configuration		SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
SS-RSSI-Measurement		Not Applicable			
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: Void
NOTE 4: Void

Table A.17.7.4.1.2-3: SS-SINR Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 9		Rough		Rough	
N_{oc} Note1	dBm/15 kHz Note4	-105		-105	
N_{oc} Note1	dBm/SCS Note3	-96		-96	
$\hat{E}_s / N_{oc}$	dB	4.54		2.66	
SSB_RP Note2	dBm/SCS Note4	-91.46	-93.34	-99	-99
SS-SINR Note2	dB	0	-3.2	-4.76	-4.76
$\hat{E}_s / I_{ot}$	dB	0	-3.2	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-59.2		-64	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SS-SINR, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Void
NOTE 7: Void
NOTE 8: Void
NOTE 9: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.17.7.4.1.3 Test Requirements

The SS-SINR absolute measurement accuracy in test 1 shall be within the range Nominal SS-SINR+3B to Nominal SS-SINR -3 dB and the SS-SINR measurement accuracy in test 2 shall be within the range Nominal SS-SINR +3.5 dB to Nominal SS-SINR -3.5 dB according to the requirements in clause 10.1A.10.13.1.

A.17.7.5 RSTD measurements

A.17.7.5.1 RSTD measurement accuracy test case for RedCap UE without FH

A.17.7.5.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC CONNECTED state meets the accuracy requirements specified in clause 10.1A.16.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.17.7.5.1.1-1.

Table A.17.7.5.1.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cells. Both cells are on the same NR RF channel in FR2. GP#24 is configured if UE supports GP#24,

otherwise, GP#13 is configured for the test. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the RedCap UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 9.9A.2.

The RSTD measurement accuracy in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The accuracy test parameters and OTA related test parameters are as given in table A.17.7.5.1.1-2 and table A.17.7.5.1.1-3, respectively.

Table A.17.7.5.1.1-2: RSTD accuracy test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
PRS ARFCN		freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66	
Measurement gap		GP#24 or GP#13	
Downlink initial BWP configuration		DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-
DRX cycle configuration		Not applicable	-
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2
PRS Resource slot offset	slot	0	4
Expected RSTD	µs	N/A	3
Expected RSTD uncertainty	µs	N/A	5
Time offset with Cell 1	µs	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			

EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
EPRE ratio of PRS to SSS	dB	0	0
Propagation conditions		AWGN	AWGN
Antenna configuration		1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.			

Table A.17.7.5.1.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 5		Rough	
N_{OC} Note1	dBm/SCS Note3	-89	
PRS $\hat{E}_s/N_{oc}$	dB	-5.7	-11.9
PRP Note2	dBm/SCS	-94.7	-100.9
PRS $\hat{E}_s/I_{ot}$	dB	-6	-13
Io Note2	dBm/95.04 MHz Note3	-58.76	-58.76
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.			
NOTE 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.			
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.			
NOTE 4: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.			
NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.			

A.17.7.5.1.2 Test Requirements

The RSTD measurement accuracy shall fulfil the absolute requirement in clause 10.1A.16.2.

A.17.7.5.2 RSTD measurement accuracy test case for RedCap UE with FH in RRC_CONNECTED state

A.17.7.5.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the accuracy requirements specified in clause 10.1A.16.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.17.7.5.2.1-1. The test parameters are as given in table A.17.7.5.2.1-2, table A.17.7.5.2.1-3, and table A.17.7.5.2.1-4.

Table A.17.7.5.2.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR2. GP#24 is configured if UE supports GP#24, otherwise, GP#13 is configured for the test. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the UE before the start of the test.

The RSTD measurement accuracy in this clause is valid for the cases where the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* as specified in TS 37.355 [34], clause 6.5.12. The frequency hopping configurations are specified in clause A.3.31.

Table A.17.7.5.2.1-2: RSTD accuracy test parameters

Parameter	Unit	Cell 1	Cell 2
PRS ARFCN		freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	400: $N_{RB,c}$ = 264	
Measurement gap		GP#24 or GP#13	
Downlink initial BWP configuration		DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-
DRX cycle configuration		Not applicable	-
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1
PRS configuration		PRS.1.6 FR2	PRS.1.6 FR2
PRS Resource slot offset	slot	0	4
Expected RSTD	µs	N/A	3
Expected RSTD uncertainty	µs	N/A	5
Time offset with Cell 1	µs	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
EPRE ratio of PRS to SSS	dB	0	0
Propagation conditions		AWGN	AWGN
Antenna configuration		1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.			

Table A.17.7.5.2.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 5		Rough	
N_{OC} Note1	dBm/SCS Note3	-89	
PRS $\hat{E}_s / N_{oc}$	dB	-5.7	-11.9
PRP Note2	dBm/SCS	-94.7	-100.9
PRS $\hat{E}_s / I_{ot}$	dB	-6	-13
Io Note2	dBm/380.16MHz Note3	-52.74	-52.74

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{OC} to be fulfilled.

NOTE 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. The Io is calculated based only on the symbols in which PRS is transmitted.

NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.

NOTE 4: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.

A.17.7.5.2.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1A.16.2.

A.17.7.6 UE Rx-Tx Measurements

A.17.7.6.1 UE Rx-Tx measurement accuracy for single positioning frequency layer in FR2 SA without RX FH in RRC_CONNECTED mode

A.17.7.6.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy without RX FH in RRC_CONNECTED state is within the specified limits. This test will verify the requirements in clause 10.1A.18.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configuration is listed in table A.17.7.6.1.1-1.

Table A.17.7.6.1.1-1: Supported test configurations.

Config	Description
1	120 kHz SSB and PRS SCS, 100 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE before the start of the test. In *nr-Multi-RTT-RequestLocationInformation*, *nr-DL-PRS-RxHoppingRequest* is not present.

The UE is configured with measurement gap pattern ID #13 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.17.7.6.1.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.17.7.6.1.2-1.

Table A.17.7.6.1.2-1: UE Rx-Tx time difference measurement accuracy test parameters.

Parameter	Unit	Test configuration	Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15	
Beam Assumption Note 6		1	Rough	Rough
Measurement gap		1	GP#24 or GP#13 Note 7	
DRX		1	OFF	
Time offset with Cell 1	µs	1	N/A	3
TDD configuration		1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A
OCNG Patterns		1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS				

EPRE ratio of OCNG to OCNG DMRS				
EPRE ratio of PRS to SSS				
TRS Configuration		1	TRS.2.1 TDD	N/A
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1	DLBWP.1.1 RedCap	N/A
Active UL BWP configuration		1	ULBWP.1.1 RedCap	N/A
PRS configuration		1	PRS.1.5 FR2	PRS.1.5 FR2
PRS Resource slot offset	slot	1	0	4
SRS configuration		1	POS-SRS.3	N/A
N_{oc} Note 1	dBm/SCS	1	-89	
N_{oc} Note 1	dBm/15 kHz	1	-98	
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-2	-10
PRP Note 2	dBm/SCS kHz	1	-91	-99
Io	dBm/92.16 MHz	1	-54.62	-54.62
Propagation Condition		1	AWGN	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over sub-carriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 3: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.

NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone

NOTE 6: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.

NOTE 7: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.

NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.7.6.1.3 Test requirements

The UE Rx-Tx time difference measurement fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1A.18.3 for both Cell 1 and Cell 2.

A.17.7.6.2 SA: UE Rx-Tx time difference measurement accuracy with Rx FH in RRC_CONNECTED state in FR2

A.17.7.6.2.1 Test purpose and Environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy with FH by a RedCap UE in RRC_CONNECTED is within the specified limits. This test will verify the requirements in clause 10.1A.18.2.3 and 10.1A.18.2.4. The test is conducted in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configuration is listed in table A.17.7.6.2.1-1.

Table A.17.7.6.2.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE before the start of the test. The test requirements apply when *frequencyHopping* is configured to UE.

The UE is configured with measurement gap pattern ID #13 or ID #24 before the test.

The UE is configured to transmit positioning SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.17.7.6.2.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.17.7.6.2.2-1.

Table A.17.7.6.2.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]		1	Rough	Rough	Rough	Rough
Measurement gap		1	GP#24 or GP#13 [Note 8]		GP#24 or GP#13 [Note 8]	
DRX		1	OFF		OFF	
Time offset with Cell 1	μs	1	N/A	3	N/A	3
TDD configuration		1	TDDConf.3.1	TDDConf.3.1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A	CR.3.1 TDD	N/A

Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A	CCR.3.1 TDD	N/A
OCNG Patterns		1	OP.1	OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	1	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD	N/A	TRS.2.1 TDD	N/A
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A	DLBWP.0.1 ULBWP.0.1	N/A
Active DL BWP configuration		1	DLBWP.1.1	N/A	DLBWP.1.1	N/A
Active UL BWP configuration		1	ULBWP.1.1	N/A	ULBWP.1.1	N/A
PRS configuration		1	PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2
PRS Resource slot offset	slot	1	0	4	0	4
SRS configuration		1	POS-SRS.3	N/A	POS-SRS.3	N/A
N_{oc} Note 2	dBm/SCS	1	-89		-89	
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	-12.12	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-2	-10	-2	-10
PRP Note 3	dBm/SCS	1	-91	-99	-91	-99
Io	dBm/380.16MHz	1	-51.61	-51.61	-51.61	-51.61
Propagation Condition		1	AWGN		AWGN	

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.
NOTE 9: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.7.6.2.3 Test requirements

The UE Rx-Tx time difference measurement fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1A.18.2.3 and 10.1A.18.2.4 for both Cell 1 and Cell 2.

A.17.7.7 PRS-RSRP Measurements

A.17.7.7.1 PRS-RSRP measurement accuracy without FH in RRC_CONNECTED state in FR2

A.17.7.7.1.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRP measurement without FH by a RedCap UE is within the specified limits. This test will verify the requirements in clauses 10.1A.17.2.1 and 10.1A.17.2.2.

A.17.7.7.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.17.7.7.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in table A.17.7.7.1.2-2 and A.17.7.7.1.2-3. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.17.7.7.1.2-1: PRS-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.7.7.1.2-2: PRS-RSRP general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-

Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
Measurement gap		GP#13 or GP#24 Note2			
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
Expected RSTD	µs	3			
Expected RSTD uncertainty	µs	5			
PRS configuration		PRS.1.3 FR2	PRS.1.3 FR2	PRS.1.5 FR2	PRS.1.5 FR2
PRS Resource slot offset	slot	0	4	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
EPRE ratio of PRS to SSS	dB	0	0	0	0
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS. NOTE 2: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.					

Table A.17.7.7.1.2-3: PRS-RSRP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note 3	-98		-98	
N_{oc} Note1	dBm/SCS Note 3	-89		-89	
PRS $\hat{E}_s / N_{oc}$	dB	-2	-10	-2	10

PRP[Note 2]	dBm/SCS	-91	-99	-91	-99
PRS $\hat{E}_s/I_{ot}$	dB	-2.41	-12.12	-2.41	-12.12
Io[Note 2]	dBm/95.04 MHz [Note 3]	-57.63		-57.63	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 4: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
NOTE 5: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.

A.17.7.7.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.17.2.1 if the reported PRS-RSRP is in the range shown in table A.17.7.7.1.3-1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1A.17.2.2.

Table A.17.7.7.1.3-1: PRS-RSRP absolute accuracy test requirement

	Test requirement [Notes1,2,3]
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}

NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.
NOTE 2: δ is the RSRP absolute accuracy requirement from table 10.1.24.2.1-2, selected according to the Io used in the test.
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from table B.2.1.6.1-1, selected according to the UE power class.

A.17.7.7.2 PRS-RSRP measurement accuracy with FH in RRC_CONNECTED state in FR2

A.17.7.7.2.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRP measurement with FH by a RedCap UE is within the specified limits. This test will verify the requirements in clauses 10.1A.17.2.1 and 10.1A.17.2.2.

A.17.7.7.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.17.7.7.2.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in table A.17.7.7.2.2-2 and A.17.7.7.2.2-3. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1. PRS RX hopping is present in *NR-DL-AoD-RequestLocationInformation*.

Table A.17.7.7.2.2-1: PRS-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode

NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.

Table A.17.7.7.2.2-2: PRS-RSRP general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	400: $N_{RB,c}$ = 264		400: $N_{RB,c}$ = 264	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
Measurement gap		GP#13 or GP#24 Note2			
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
Expected RSTD	µs	3			
Expected RSTD uncertainty	µs	5			
PRS configuration		PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2
PRS Resource slot offset	Slot	0	4	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
EPRE ratio of PRS to SSS	dB	0	0	0	0
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.

Table A.17.7.7.2.2-3: PRS-RSRP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2

Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams[Note 5]		Rough		Rough	
N_{oc} [Note1]	dBm/15kHz[Note 3]	-98		-98	
N_{oc} [Note1]	dBm/SCS[Note 3]	-89		-89	
PRS $\hat{E}_s / N_{oc}$	dB	-2	-10	-2	10
PRP[Note 2]	dBm/SCS	-91	-99	-91	-99
PRS $\hat{E}_s / I_{ot}$	dB	-2.41	-12.12	-2.41	-12.12
Io[Note 2]	dBm/380.16MHz [Note 3]	-51.61		-51.61	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PRP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 4: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.

A.17.7.7.2.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.17.2.1 if the reported PRS-RSRP is in the range shown in table A.17.7.7.2.3-1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1A.17.2.2.

Table A.17.7.7.2.3-1: PRS-RSRP absolute accuracy test requirement

	Test requirement [Notes1,2,3]
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}

NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.
NOTE 2: δ is the RSRP absolute accuracy requirement from table 10.1.24.2.1-2, selected according to the Io used in the test.
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from table B.2.1.6.1-1, selected according to the UE power class.

A.17.7.8 PRS-RSRPP Measurements

A.17.7.8.1 PRS-RSRPP measurement accuracy without FH in RRC_CONNECTED state in FR2

A.17.7.8.1.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRPP measurement without FH by a RedCap UE in RRC_CONNECTED is within the specified limits. This test will verify the requirements in clauses 10.1A.19.2.

A.17.7.8.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.17.7.8.1.2-1. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.17.7.8.1.2-1: PRS-RSRPP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.7.8.1.2-2: PRS-RSRPP general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
Measurement gap		GP#13 or GP#24 Note2			
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.1 RedCap FR2	SSB.1 RedCap FR2	SSB.1 RedCap FR2	SSB.1 RedCap FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	μs	-	3	-	3
PRS configuration		PRS.1.5 FR2	PRS.1.5 FR2	PRS.1.5 FR2	PRS.1.5 FR2
PRS Resource slot offset	slot	0	4	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					

Propagation conditions		Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ μs and $f_D = 5$ Hz			
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.					

Table A.17.7.8.1.2-3: PRS-RSRPP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note3	-98		Same as Test 1	
N_{oc} Note1	dBm/SCS Note3	-89		Same as Test 1	
$\hat{E}_s / N_{oc}$	dB	-2	-10	-2	-10
E_s	dBm/SCS Note3	-	-	-	-
PRS_RP Note2	dBm/SCS	-91	-99	-91	-99
$\hat{E}_s / I_{ot}$ BB Note4	dB	-2.41	-12.12	-2.41	-12.12
Io Note2	dBm/190.08 MHz Note3	-54.62		-54.62	
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone. NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4. NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.					

A.17.7.8.1.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.19.2 if the reported PRS-RSRPP is in the range shown in table A.17.7.8.1.3-1.

Table A.17.7.8.1.3-1: PRS-RSRPP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}
NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration. NOTE 2: δ is the RSRP absolute accuracy requirement from table 10.1.24.2.1-2, selected according to the Io used in the test. NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from table B.2.1.6.1-1, selected according to the UE power class.	

A.17.7.8.2 SA: PRS-RSRPP measurement accuracy with Rx FH in RRC_CONNECTED state in FR2

A.17.7.8.2.1 Test purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRPP measurement with FH by a RedCap UE in RRC_CONNECTED is within the specified limits. This test will verify the requirements in clauses 10.1A.19.2.

A.17.7.8.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.17.7.8.2.2-1. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.3.17.2.1-1.

Table A.17.7.8.2.2-1: PRS-RSRPP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

Table A.17.7.8.2.2-2: PRS-RSRPP general test parameters

Parameter	Unit	Cell 1	Cell 2
Cell ID		489	0
SSB ARFCN		freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	400: $N_{RB,c}$ = 264	
Downlink initial BWP configuration		DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-
DRX cycle configuration		Not applicable	-
Measurement gap		GP#13 or GP#24 Note2	
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3
SSB configuration		SSB.1 RedCap FR2	SSB.1 RedCap FR2
SMTC configuration		SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3
PRS configuration		PRS.1.6 FR2	PRS.1.6 FR2
PRS Resource slot offset	slot	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			

EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation conditions		Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, $\tau_d = 0.45$ μs and $f_D = 5$ Hz	
Antenna configuration		1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.			

Table A.17.7.8.2.2-3: PRS-RSRPP OTA related test parameters

Parameter	Unit	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 5		Rough	
N_{oc} Note 1	dBm/15kHz Note 3	-98	
N_{oc} Note 1	dBm/SCS Note 3	-89	
$\hat{E}_s / N_{oc}$	dB	-2	-10
PRS_RP Note 2	dBm/SCS	-91	-99
$\hat{E}_s / I_{ot}$ BB Note 4	dB	-2.41	-12.12
Io Note2	dBm/380.16MHz Note3	-51.61	
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone. NOTE 4: Calculation of Es/Iot$_{BB}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4. NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.			

A.17.7.8.2.3 Test requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1.38.2 if the reported PRS-RSRPP is in the range shown in table A.17.7.8.2.3-1.

Table A.17.7.8.2.3-1: PRS-RSRPP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}

Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}
NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.	
NOTE 2: δ is the RSRP absolute accuracy requirement from table 10.1.24.2.1-2, selected according to the Io used in the test.	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from table B.2.1.6.1-1, selected according to the UE power class.	

A.17.8 Measurement Procedure for RedCap in RRC_INACTIVE

A.17.8.1 RSTD Measurements

A.17.8.1.1 NR RSTD measurement reporting delay test case for RedCap UE without FH in FR2 SA in RRC_INACTIVE state

A.17.8.1.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC INACTIVE state meets the requirements specified in clause 5.6A.4.5 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.17.8.1.1.1-1.

Table A.17.8.1.1.1-1: Supported test configurations for NR RSTD

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layers.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell3. During T2 UE shall be in RRC_INACTIVE state and all cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the RedCap UE during T1. The measurement reporting delay test in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The last TTI containing the two messages shall be provided to the RedCap UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s).

The UE is configured with DRX cycle of 0.64 s.

The general test parameters are listed in table A.17.8.1.1.1-2, and cell specific test parameters are listed in table A.17.8.1.1.1-3 and table A.17.8.1.1.1-4.

Table A.17.8.1.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter	Unit	Value	Comment

Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.	
$BW_{channel}$		MHz	100: $N_{RB,c}$ = 66	
SSB configuration	Config 1		SSB.2 FR2	
SMTC configuration	Config 1		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.5 FR2	As specified in clause A.3.31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	0.64	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data			3	Including the reference cell
PRS muting info			Cell 1: ‘10’ Cell 2: ‘01’ Cell 3: ‘10’	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset			Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets

T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup		Setup 1	As defined in clause A.3.15.1
Beam assumption		Rough	Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

Table A.17.8.1.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.5 FDD	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 95.04MHz	-57	-57	-57
SSB RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
$\hat{E}_s/N_{oc}$		dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.17.8.1.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
RF Channel Number		1	1	1
Positiong frequency layer		1	1	1
Correlation Matrix and Antenna Configuration		1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1		OP.1	OP.1	OP.1

PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.44	-11.67	-11.67
Io	Config 1	dBm/ 95.04MHz	-58.49	-58.49	-58.49
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T2) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

A.17.8.1.1.2 Test Requirements

The RSTD measurement time without FH for RedCap fulfils the requirements specified in clause 5.6A.4.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6A.4.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.17.8.1.2 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA in RRC_INACTIVE state

A.17.8.1.2.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement meets the requirements specified in clause 5.6A.4.6 in FR2 in standalone scenario when PRS frequency hopping is configured.

The supported test configurations are specified in table A.17.8.1.2.1-1.

Table A.17.8.1.2.1-1: Supported test configurations for NR RSTD

Configuration	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layers.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell3. During T2 UE shall be in RRC_INACTIVE state and all cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. The last TTI containing the two messages shall be provided to the UE ΔT ms before the start of T2, where $\Delta T = 50$ ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The test requirements apply when *frequencyHopping* is configured to UE.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s).

The UE is configured with DRX cycle of 0.64 s.

The general test parameters are listed in table A.17.8.1.2.1-2, and cell specific test parameters are listed in table A.17.8.1.2.1-3 and table A.17.8.1.2.1-4.

Table A.17.8.1.2.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
$BW_{channel}$		MHz	400: $N_{RB,c} = 264$	
SSB configuration	Config 1		SSB.1 RedCap FR2	
SMTC configuration	Config 1		SMTC.1 RedCap	
PDSCH RMC configuration	Config 1		SR.3.2 TDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	
Dedicated CORESET RMC configuration	Config 1		CCR.3.1 TDD	
PRS Configuration	Config 1		PRS.1.6 FR2	PRS configured with frequency hopping as specified in clause A.3.31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	0.64	

Radio frame receive time offset between the cells at the UE antenna connector	µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD	µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells	µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index
Number of cells provided in DL-TDOA assistance data		3	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup		Setup 1	As defined in clause A.3.15.1
Beam assumption		Rough	Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

Table A.17.8.1.2.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.5 FDD	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 380.16MHz	-50.98	-53.99	-53.99
SSB RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
SSB $\hat{E}_s/N_{oc}$		dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.17.8.1.2.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter		Unit	Cell 1	Cell 2	Cell 3
			T2	T2	T2
RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.44	-11.67	-11.67
Io	Config 1	dBm/ 380.16MHz	-52.46	-52.46	-52.46
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T3) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

A.17.8.1.2.2 Test Requirements

The RSTD measurement time fulfils the requirements specified in clause 5.6A.4.6.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 5.6A.4.6 starting from the beginning of time interval T2.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.17.8.1.3 NR RSTD measurement reporting delay test case for single positioning frequency layer in FR2 SA in RRC_INACTIVE state with eDRX > 10.24s

A.17.8.1.3.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 5.6A.4.5 for RSTD measurements in RRC_INACTIVE with eDRX. Refer to clause A.7.8.1.4.1 for test configuration and procedure.

A.17.8.1.3.2 Test requirements

The RSTD measurement time shall fulfill the requirements specified in clause 5.6A.4.5.

The UE shall perform and report the RSTD measurements for Cell 1, Cell 2 and Cell 3 within the specified measurement period duration starting from the beginning of time interval T2. The requirement shall be evaluated based on the first measurement report received from the UE.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3.

A.17.8.2 UE Rx-Tx Measurements

A.17.8.2.1 UE Rx-Tx measurement reporting delay for single positioning frequency layer in FR2 SA without RX FH in RRC_INACTIVE mode

A.17.8.2.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement without RX FH in RRC_INACTIVE state meets the requirements specified in clause 5.6A.4.5 in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configuration is listed in table A.17.8.2.1.1-1.

Table A.17.8.2.1.1-1: Supported test configurations.

Config	Description
1	120 kHz SSB and PRS SCS, 100 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE during T1. In *nr-Multi-RTT-RequestLocationInformation, nr-DL-PRS-RxHoppingRequest* is not present.

The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE state.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.17.8.2.1.1-2 and table A.17.8.2.1.1-3, respectively.

Table A.17.8.2.1.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in NR-Multi-RTT-ProvideAssistanceData [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in NR-Multi-RTT-ProvideAssistanceData [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	100: $N_{RB,c}$ = 66	
SSB configuration		1	SSB.2 RedCap FR2	
SMTC configuration		1	SMTC.1 RedCap	
CP length		1	Normal	
DRX cycle		1	0.64 s	
Time offset between serving and neighbour cells	μs	1	3	Synchronous cells
T1	s	1	5	
T2	s	1	20	

Table A.17.8.2.1.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS[Note 1]						
EPRE ratio of OCNG to OCNG DMRS[Note 1]						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1	PRS.1.5 FR2		PRS.1.5 FR2	
PRS muting info		1	‘10’		‘01’	

SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
N_{oc} Note 2	dBm/15 kHz	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
PRP Note 3	dBm/SCS kHz	1	-Infinity	-91	-Infinity	-99
Io	dBm/92.16 MHz	1	N/A	-54.62	N/A	-54.62
Propagation Condition		1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

A.17.8.2.1.2 Test requirements

The UE Rx-Tx time difference measurement time in RRC_INACTIVE state fulfills the requirements specified in clause 5.6A.4.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time specified in clause 5.6A.4 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1A.18.3.

A.17.8.2.2 UE Rx-Tx time difference measurement with Rx FH for single positioning frequency layer in FR2 SA in RRC_INACTIVE state

A.17.8.2.2.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx measurement with Rx FH meets the requirements specified in clause 5.6A.6.6 in AWGN propagation condition in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are listed in table A.17.8.2.2.1-1.

Table A.17.8.2.2.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). Both cells are on the same RF channel in FR2.

The test consists of two consecutive time intervals, with duration of T1 and T2. Cell 1 and Cell 2 mute PRS transmission during T1 and transmit PRS during T2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the RedCap UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, RedCap UE is released into RRC_INACTIVE state.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The UE is configured to transmit positioning SRS during T2.

The general test parameters and cell specific test parameters are as given in table A.17.8.2.2.1-2 and table A.17.8.2.2.1-3, respectively.

Table A.17.8.2.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	Cell 1 is the PCell in *NR-Multi-RTT-ProvideAssistanceData* [34].
Neighbour cell		1	Cell 2	Cell 2 is a neighbour cell in *NR-Multi-RTT-ProvideAssistanceData* [34].
RF Channel Number		1	1	For both Cell 1 and Cell 2
$BW_{channel}$	MHz	1	400: $N_{RB,c}$ = 264	
SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX		1	1.28s	
Time offset between serving and neighbour cells	μs	1	3	Synchronous cells
PRS RX hopping request		1	requested	
T1	s	1	5	
T2	s	1	10	

Table A.17.8.2.2.1-3: Cell specific test parameters

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]		1	Rough		Rough	
TDD configuration		1	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		N/A	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		N/A	
OCNG Patterns		1	OP.1		OP.1	
EPRE ratio of PSS to SSS	dB	1	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						

EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
EPRE ratio of PRS to SSS						
TRS Configuration		1	TRS.2.1 TDD		N/A	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		N/A	
PRS configuration		1	PRS.1.6 FR2		PRS.1.6 FR2	
PRS muting info		1	'10'		'01'	
SRS configuration		1	POS-SRS.3		N/A	
N_{oc} Note 2	dBm/SCS	1	-89			
N_{oc} Note 2	dBm/15 kHz	1	-98			
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
PRP Note 3	dBm/SCS	1	-Infinity	-91	-Infinity	-99
Io	dBm/380.16MHz	1	N/A	-51.61	N/A	-51.61
Propagation Condition		1	AWGN			

NOTE 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.8.2.2.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 5.6A.6.6.

The RedCap UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1A.18.3.

A.17.8.2.3 UE Rx-Tx time difference measurements for single positioning frequency layer with eDRX > 10.24s in FR2 SA

A.17.8.2.3.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 5.6A.6.5 for UE Rx-Tx measurements in RRC_INACTIVE with eDRX. Refer to clause A.7.8.3.3.1 for test configuration and procedure.

A.17.8.2.3.2 Test requirements

The UE Rx-Tx time difference measurement time fulfils the requirements specified in clause 5.6A.6.5.

The UE shall perform and report the UE Rx-Tx time difference measurements for Cell 1 and Cell 2 within the specified UE Rx-Tx time difference measurement time starting from the beginning of time interval T2.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported UE Rx-Tx measurement for each correct event shall be within the UE Rx-Tx reporting range specified in clause 10.1A.18.3.

A.17.8.3 PRS-RSRP Measurements

A.17.8.3.1 PRS-RSRP reporting delay test case for single positioning frequency layer in RRC_INACTIVE

A.17.8.3.1.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in clause 9.9A.3.5 for single positioning frequency layer under AWGN propagation conditions in RRC_INACTIVE. Supported test configurations are shown in table A.17.8.3.1.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

During T1 UE is in RRC_CONNECTED, the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The measurement reporting delay test in this clause is valid in the cases where the RedCap UE is either not configured by the LMF to perform PRS-RSRP measurement with RX FH via *NR-DL-AoD-RequestLocationInformation* or the UE is configured by the LMF to perform PRS-RSRP measurement with RX FH and reports the PRS-RSRP measurement based on the single hop in *NR-DL-AoD-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.17.8.3.1.1-2, and table A.17.8.3.1.1-3.

Table A.17.8.3.1.1-1: supported test configurations for PRS RSRP measurement for FR2

Config	Description

1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.8.3.1.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
CP length		Config 1	Normal	
DRX		Config 1	0.64 s	
Time offset between serving and neighbour cells		Config 1	3 μs	Synchronous cells.
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	41	

Table A.17.8.3.1.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.5 FR2		PRS.1.5 FR2	
PRS muting configuration			Config 1	‘10’		‘01’	
EPRE ratio of PSS to SSS							

EPRE ratio of PBCH DMRS to SSS		Config 1	0		0	
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		-98		-98	
N_{oc} Note2	dBm/SCS Note4	Config 1	-89		-89	
SS-RSRP Note 3	dBm/SCS Note5	Config 1	-91	-91	-Infinity	-99
PRS-RSRP Note 3	dBm/SCS Note5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$	dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	Config 1	-Infinity	-2	-Infinity	-10
Io Note3	dBm/95.04 MHz Note5	Config 1	-57.89	-57.63	-57.89	-57.63
Propagation Condition		Config 1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.

A.17.8.3.1.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 9.9A.3.5. The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 9.9A.3.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1A.17, i.e., between PRS RSRP_0 and PRS RSRP_126.

A.17.8.3.2 PRS-RSRP measurement delay with FH in RRC_INACTIVE state in FR2

A.17.8.3.2.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement with FH by a RedCap UE meets requirements specified in clause 5.6A.5.5 for single positioning frequency layer under AWGN propagation conditions in RRC_INACTIVE. Supported test configurations are shown in table A.17.8.3.2.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

During T1 UE is in RRC_CONNECTED, the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.7.8.1.2.1.1-2, and table A.17.8.3.2.1-3.

Table A.17.8.3.2.1-1: supported test configurations for PRS RSRP measurement for FR2-FR2

Config	Description
1	120 kHz SSB SCS, cell bandwidth 100 MHz, cell bandwidth 400 MHz, TDD duplex mode

Table A.17.8.3.2.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (Pcell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
CP length		Config 1	Normal	
DRX		Config 1	0.64 s	
Time offset between serving and neighbour cells		Config 1	3 μs	Synchronous cells.
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
PRS RX hopping request		Config 1	Present	

T1	s	Config 1	5	
T2	s	Config 1	41	

Table A.17.8.3.2.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.6 FR2		PRS.1.6 FR2	
PRS muting configuration			Config 1	'10'		'01'	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note5		-98		-98	
N_{oc} Note2		dBm/SCS Note4	Config 1	-89		-89	
SS-RSRP Note 3		dBm/SCS Note5	Config 1	-91	-91	-Infinity	-99
PRS-RSRP Note 3		dBm/SCS Note5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$		dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$		dB	Config 1	-Infinity	-2	-Infinity	-10
Io Note3		dBm/95.04 MHz Note5	Config 1	-60.01	-57.63	-60.01	-57.63
Propagation Condition			Config 1	AWGN			

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.

A.17.8.3.2.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 5.6A.5.5. The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 5.6A.5.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1A.17.3, i.e., between PRS RSRP_0 and PRS RSRP_126.

A.17.8.3.3 PRS-RSRP reporting delay in RRC_INACTIVE with eDRX

A.17.8.3.3.1 Test Purpose and Environment

The purpose of the test is to verify a RedCap UE can meet the PRS RSRP measurement requirements specified in clause 5.6A.5.5 for single positioning frequency layer under AWGN propagation conditions in RRC_INACTIVE, when configured with eDRX and without FH. Supported test configurations are shown in table A.17.8.3.3.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

During T1 UE is in RRC_CONNECTED, the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The beginning of the time interval T2 is the first PRS resource occasion occurring ΔT after the slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.17.8.3.3.1-2, and table A.17.8.3.3.1-3.

Table A.17.8.3.3.1-1: supported test configurations for PRS RSRP measurement for FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.8.3.3.1-2: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (Pcell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
CP length		Config 1	Normal	
DRX		Config 1	0.64 s	
CN and RAN eDRX configuration		Config 1	eDRX cycle = 40.96 s PTW length = 1.28 s	
Reporting periodicity	s	Config 1	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34].
Time offset between serving and neighbour cells		Config 1	3 μs	Synchronous cells.
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	41	

Table A.17.8.3.3.1-3: Cell-specific test parameters for PRS RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting configuration			Config 1	‘10’		‘01’	
EPRE ratio of PSS to SSS							

EPRE ratio of PBCH DMRS to SSS		Config 1	0		0	
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		-98		-98	
N_{oc} Note2	dBm/SCS Note4	Config 1	-89		-89	
SS-RSRP Note 3	dBm/SCS Note5	Config 1	-91	-91	-Infinity	-99
PRS-RSRP Note 3	dBm/SCS Note5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s / I_{ot}$	dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s / N_{oc}$	dB	Config 1	-Infinity	-2	-Infinity	-10
Io Note3	dBm/95.04 Note5	Config 1	-57.89		-57.89	
Propagation Condition		Config 1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.

A.17.8.3.3.2 Test Requirements

The PRS RSRP measurement time fulfils the requirements specified in clause 5.6A.5.5. The UE shall perform and report the PRS RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 5.6A.5.5 with $T_{available_PRS}$ = 0.64 s starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

A test is considered complete after the UE reports the first set of positioning measurements based on the configured *reportingInterval*.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRP measurement for each correct event shall be within the PRS RSRP reporting range specified in clause 10.1A.17.3.

A.17.8.4 PRS-RSRPP Measurements

A.17.8.4.1 PRS-RSRPP measurement delay without FH in RRC_INACTIVE state in FR2

A.17.8.4.1.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRPP measurement without FH by a RedCap UE meets requirements specified in clause 5.6A.7.5 for single positioning frequency layer under a 2-tap channel propagation conditions in standalone scenario. Supported test configurations are shown in table A.17.8.4.1.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the Pcell.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2. During T2 UE shall be in RRC_INACTIVE state and both cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n.

The beginning of the time interval T2 shall be aligned with the beginning of the first DRX cycle containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.17.8.4.1.1-2, and table A.17.8.4.1.1-3.

Table A.17.8.4.1.1-1: supported test configurations for PRS RSRPP measurement for FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.8.4.1.1-2: General test parameters for PRS RSRPP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (Pcell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
CP length		Config 1	Normal	
DRX	s	Config 1	0.64	ON

Time offset between serving and neighbour cells	µs	Config 1	3	Synchronous cells.
Expected RSTD	µs	Config 1	3	
Expected RSTD uncertainty	µs	Config 1	5	
PRS RX hopping request		Config 1	NOT present	
T1	s	Config 1	5	
T2	s	Config 1	7	

Table A.17.8.4.1.1-3: Cell-specific test parameters for PRS RSRPP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			Config 1	Rough		Rough	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.3 FR2		PRS.1.3 FR2	
PRS muting configuration			Config 1	‘10’		‘01’	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note5		-98		-98	
N_{oc} Note2		dBm/SCS Note4	Config 1	-89		-89	

SS-RSRP Note 3	dBm/SCS Note5	Config 1	-89	-91	-Infinity	-99
PRS-RSRP Note 3	dBm/SCS Note5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$	dB	Config 1	-Infinity	-2.12	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	Config 1	-Infinity	-2	-Infinity	-10
Io Note3	dBm/95.04 MHz Note5	Config 1	-60.01	-57.63	-60.01	-57.63
Propagation Condition		Config 1	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, τ_d = 0.45 μs and f_D = 5 Hz			

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.

A.17.8.4.1.2 Test Requirements

The PRS RSRPP measurement time fulfils the requirements specified in clause 5.6A.7.5. The UE shall perform and report the PRS RSRPP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 5.6A.7.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS RSRPP measurement for each correct event shall be within the PRS RSRPP reporting range specified in clause 10.1A.19.3, i.e., between PRS RSRPP_0 and PRS RSRPP_126.

A.17.8.4.2 PRS-RSRPP measurement with Rx FH reporting delay test case for single positioning frequency layer in FR2 SA in RRC_INACTIVE state

A.17.8.4.2.1 Test Purpose and Environment

The purpose of the test is to verify that the PRS-RSRPP measurement requirements with Rx FH in RRC_INACTIVE state meets the delay requirements specified in clause 5.6A.7.6 in an environment with two-tap channel propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.17.8.4.2.1-1.

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR2. The test consists of two consecutive time intervals, with duration of T1 and T2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data

and location information request is denoted as #n. In the next DL slot after slot #n, UE is released into RRC_INACTIVE.

The test requirements apply when *frequencyHopping* is configured to UE.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource occasion occuring ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.17.8.4.2.1-2, and table A.17.8.4.2.1-3.

Table A.17.8.4.2.1-1: supported test configurations for PRS-RSRPP measurement for FR2

Config	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

Table A.17.8.4.2.1-2: General test parameters for PRS-RSRPP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		Config 1	NR cell 1 (PCell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.
Neighbour cell		Config 1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
SMTC parameters		Config 1	SMTC.1	As specified in clause A.3.11
SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX	s	Config 1	1.28	
Time offset between serving and neighbour cells	μs	Config 1	3	Synchronous cells.
PRS RX hopping request		1	requested	
Expected RSTD	μs	Config 1	3	
Expected RSTD uncertainty	μs	Config 1	5	
T1	s	Config 1	5	
T2	s	Config 1	7	

Table A.17.8.4.2.1-3: Cell-specific test parameters for PRS-RSRPP measurement reporting delay

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]		Config 1	Rough		Rough	
TDD configuration		Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode		Config 1	TDD		TDD	

$BW_{channel}$		MHz	Config 1	400: $N_{RB,c}$ = 264		400: $N_{RB,c}$ = 264	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1 RedCap		N/A	
	Dedicated UL BWP			ULBWP.1.1 RedCap		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			Config 1	CCR.3.1 TDD		-	
TRS configuration			Config 1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
PRS configuration			Config 1	PRS.1.6 FR2		PRS.1.6 FR2	
PRS muting configuration			Config 1	'10'		'01'	
EPRE ratio of PSS to SSS							
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS			Config 1	0		0	
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note5		-98		-98	
N_{oc} Note2		dBm/SCS Note4	Config 1	-89		-89	
SS-RSRP Note 3		dBm/SCS Note5	Config 1	-89	-89	-Infinity	-89
PRS-RSRP Note 3		dBm/SCS Note5	Config 1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$		dB	Config 1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$		dB	Config 1	-Infinity	-2	-Infinity	-10
Io Note3		dBm/38 0.16MHz Note5	Config 1	-50.98	-51.61	-50.98	-51.61
Propagation Condition			Config 1	Two-tap channel defined in 38.101-4 annex B.2.4, a = 1, τ_d = 0.45 μs and f_D = 5 Hz			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: SS-RSRP/PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.8.4.2.2 Test Requirements

The PRS-RSRPP measurement time fulfils the requirements specified in clause 5.6A.7.6. The UE shall perform and report the PRS-RSRPP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 5.6A.7.6 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS-RSRPP measurement for each correct event shall be within the PRS-RSRPP reporting range specified in clause 10.1A.19.3, i.e., between PRS RSRPP_0 and PRS RSRPP_126.

A.17.8.4.3 PRS-RSPP reporting delay in RRC_INACTIVE state with eDRX > 10.24s

A.17.8.4.3.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 5.6A.7.5 for PRS-RSRPP measurements in RRC_INACTIVE with eDRX. Refer to clause A.7.8.4.3.1 for test configuration and procedure.

A.17.8.4.3.2 Test requirements

The PRS-RSRPP measurement time fulfils the requirements specified in clause 5.6A.7.5.

The UE shall perform and report the PRS-RSRPP measurements for Cell 1 and Cell 2 within the specified measurement period duration starting from the beginning of time interval T2. The requirement shall be evaluated based on the first measurement report received from the UE.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS-RSRPP measurement for each correct event shall be within the PRS-RSRPP reporting range specified in clause 10.1A.19.3.

A.17.9 Measurement Performance Requirements for RedCap in RRC_INACTIVE

A.17.9.1 RSTD Measurements

A.17.9.1.1 RSTD measurement accuracy test case for RedCap UE without FH in FR2 in RRC_INACTIVE state

A.17.9.1.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC_INACTIVE state meets the accuracy requirements specified in clause 10.1A.16.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.17.9.1.1.1-1.

Table A.17.9.1.1.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR2. The UE is configured with DRX cycle of 0.64 s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the RedCap UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 5.6A.4.5.

The RSTD measurement accuracy in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The accuracy test parameters and OTA related test parameters are as given in table A.17.9.1.1.1-2 and table A.17.9.1.1.1-3, respectively.

Table A.17.9.1.1.1-2: RSTD accuracy test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
PRS ARFCN		freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2
PRS Resource slot offset	slot	0	4

Table

Expected RSTD	µs	N/A	3
Expected RSTD uncertainty	µs	N/A	5
Time offset with Cell 1	µs	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation conditions		AWGN	AWGN
Antenna configuration		1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

A.17.9.1.1.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 5		Rough	
N_{oc} Note1	dBm/SCS Note3	-89	
PRS $\hat{E}_s / N_{oc}$	dB	-5.7	-11.9
PRS-RSRP Note2	dBm/SCS	-94.7	-100.9
PRS $\hat{E}_s / I_{ot\ BB}$ Note4	dB	-6	-13
Io Note2	dBm/95.04 MHz Note3	-58.76	-58.76

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.

NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

NOTE 5: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.

A.17.9.1.1.2 Test Requirements

The RSTD measurement accuracy shall fulfil the absolute requirement in clause 10.1A.16.2.

A.17.9.1.2 RSTD measurement accuracy test case for RedCap UE with FH in FR2 in RRC_INACTIVE state

A.17.9.1.2.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement in RRC_INACTIVE state meets the accuracy requirements specified in clause 10.1A.16.2 in an environment with AWGN propagation conditions.

The supported test configurations are specified in table A.17.9.1.2.1-1. The test parameters are as given in table A.17.9.1.2.1-2, table A.17.9.1.2.1-3 and table A.17.9.1.2.1-4.

Table A.17.9.1.2.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR2. The UE is configured with DRX cycle of 0.64s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the UE before the start of the test.

The RSTD measurement accuracy in this clause is valid for the cases where the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* as specified in TS 37.355 [34], clause 6.5.12. The frequency hopping configurations are specified in clause A.3.31.

Table A.17.9.1.2.1-2: RSTD accuracy test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
PRS ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	400: $N_{RB,c}$ = 264		400: $N_{RB,c}$ = 264	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
PRS configuration		PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2
PRS Resource slot offset	slot	0	4	0	4
Expected RSTD	µs	N/A	3	N/A	3
Expected RSTD uncertainty	µs	N/A	5	N/A	5
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					

EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.17.9.1.2.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/SCS Note3	-89		-89	
PRS $\hat{E}_s / N_{oc}$	dB	-5.7	-11.9	-5.7	-11.9
PRS-RSRP Note2	dBm/SCS	-94.7	-100.9	-94.7	-100.9
$\hat{E}_s / I_{ot}$ BB Note4	dB	-6	-13	-6	-13
Io Note2	dBm/380.16MHz Note3	-52.74	-52.74	-52.74	-52.74
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.					
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.					
NOTE 5: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.					

A.17.9.1.2.2 Test Requirements

The RSTD measurement accuracy for Cell 2 shall fulfil the absolute requirement in clause 10.1A.16.2.

A.17.9.2 UE Rx-Tx Measurements

A.17.9.2.1 UE Rx-Tx measurement accuracy for single positioning frequency layer in FR2 SA without RX FH in RRC_INACTIVE mode

A.17.9.2.1.1 Test purpose and environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement accuracy without RX FH in RRC_INACTIVE mode is within the specified limits. This test will verify the requirements in clause 10.1A.18.2. The test is conducted in AWGN propagation condition in FR2 in standalone scenario.

The supported test configuration is listed in table A.17.9.2.1.1-1.

Table A.17.9.2.1.1-1: Supported test configurations.

Config	Description
1	120 kHz SSB and PRS SCS, 100 MHz bandwidth, TDD duplex mode

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE before the start of the test. In *nr-Multi-RTT-RequestLocationInformation, nr-DL-PRS-RxHoppingRequest* is not present.

The UE is configured to transmit SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.17.9.2.1.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.17.9.2.1.2-1.

Table A.17.9.2.1.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 6]		1	Rough	Rough
DRX	s	1	0.64	
Time offset with Cell 1	µs	1	N/A	3
TDD configuration		1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A
OCNG Patterns		1	OP.1	OP.1
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A
PRS configuration		1	PRS.1.5 FR2	PRS.1.5 FR2
PRS Resource slot offset	slot	1	0	4
SRS configuration		1	POS-SRS.3	N/A
N_{oc} Note 1	dBm/SCS	1	-89	
N_{oc} Note 1	dBm/15 kHz	1	-98	
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-2	-10

PRS-RSRP Note 2	dBm/SCS kHz	1	-91	-99
Io	dBm/92.16 MHz	1	-54.62	-54.62
Propagation Condition		1	AWGN	

NOTE 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over sub-carriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
NOTE 6: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 7: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.9.2.1.3 Test requirements

The UE Rx-Tx time difference measurement time fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1A.18.2 for both Cell 1 and Cell 2.

A.17.9.2.2 SA: UE Rx-Tx time difference measurement accuracy with Rx FH in RRC_INACTIVE state in FR2

A.17.9.2.2.1 Test purpose and Environment

The purpose of the test is to verify that the UE Rx-Tx time difference measurement requirements with FH by RedCap UE in RRC_INACTIVE state are within the specified limits. This test will verify the requirements in clause 10.1A.18.2.3 and 10.1A.18.2.4. The test is conducted in AWGN propagation condition in FR2 in standalone scenario.

The supported test configuration is listed in table A.17.9.2.2.1-1.

Table A.17.9.2.2.1-1: Supported test configurations

Config	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

There are two cells in the test: PCell (Cell 1) and a neighbour cell (Cell 2). All cells are on the same RF channel in FR2.

The *NR-Multi-RTT-ProvideAssistanceData* and *nr-Multi-RTT-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the UE before the start of the test. The test requirements apply when *frequencyHopping* is configured to UE.

The UE is configured to transmit SRS on Cell 1 during the test.

The test equipment measures the transmit timing of the UE using the transmitted SRS and measures the receive timing using the PRS. The test equipment then compares the difference of these two timings to the UE Rx-Tx measurement reported by the UE for each cell.

A.17.9.2.2.2 Test parameters

The UE Rx-Tx time difference accuracy test parameters are given in table A.17.9.2.2.2-1.

Table A.17.9.2.2.2-1: UE Rx-Tx time difference measurement accuracy test parameters

Parameter	Unit	Test configuration	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
AoA setup		1	Setup 1 as specified in clause A.3.15		Setup 1 as specified in clause A.3.15	
Beam Assumption Note 7		1	Rough	Rough	Rough	Rough
DRX	s	1	0.64		0.64	
Time offset with Cell 1	μs	1	N/A	3	N/A	3
TDD configuration		1	TDDConf.3.1	TDDConf.3.1	TDDConf.3.1	TDDConf.3.1
PDSCH RMC configuration		1	SR.3.1 TDD	N/A	SR.3.1 TDD	N/A
RMSI CORESET RMC configuration		1	CR.3.1 TDD	N/A	CR.3.1 TDD	N/A
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	N/A	CCR.3.1 TDD	N/A
OCNG Patterns		1	OP.1	OP.1	OP.1	OP.1
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	N/A	DLBWP.0.1 ULBWP.0.1	N/A
PRS configuration		1	PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2
PRS Resource slot offset	slot	1	0	4	0	4
SRS configuration		1	POS-SRS.3	N/A	POS-SRS.3	N/A
N_{oc} Note 2	dBm/SCS	1	-89		-89	
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
PRS $\hat{E}_s/I_{ot}$	dB	1	-2.41	-12.12	-2.41	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-2	-10	-2	-10
PRS-RSRP Note 3	dBm/SCS	1	-91	-99	-91	-99
Io Note 3	dBm/380.16MHz	1	-51.61	-51.61	-51.61	-51.61
Propagation Condition		1	AWGN		AWGN	

NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.9.2.2.3 Test requirements

The UE Rx-Tx time difference measurement time fulfils the UE Rx-Tx measurement accuracy requirements specified in clause 10.1A.18.2.3 and 10.1A.18.2.4 for both Cell 1 and Cell 2.

A.17.9.3 PRS-RSRP Measurements

A.17.9.3.1 PRS-RSRP measurement accuracy without FH in RRC_INACTIVE state in FR2

A.17.9.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRP measurement without FH by a RedCap UE in RRC_INACTIVE is within the specified limits. This test will verify the requirements in clauses 10.1A.17.2.1 for absolute accuracy and 10.1A.17.2.2 for relative accuracy.

A.17.9.3.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.17.9.3.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in table A.17.9.3.1.2-2 and A.17.9.3.1.2-3. In all test cases, Cell 1 is the PCell.

Table A.17.9.3.1.2-1: PRS-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.9.3.1.2-2: PRS-RSRP general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
DRX cycle configuration		1.28s	-	1.28s	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-

Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
PRS configuration		PRS.1.5 FR2	PRS.1.5 FR2	PRS.1.5 FR2	PRS.1.5 FR2
PRS Resource slot offset	slot	0	4	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that active cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.					

Table A.17.9.3.1.2-3: PRS-RSRP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note 3	-98		Same as Test 1	
N_{oc} Note1	dBm/SCS Note 3	-89		Same as Test 1	
$\hat{E}_s / N_{oc}$	dB	-2	-10	-2	-10
E_s	dBm/SCS Note 3	-	-	-	-
PRS_RP Note2	dBm/SCS	-91	-99	-91	-99
$\hat{E}_s / I_{ot}$ BB Note 4	dB	-2.41	-12.12	-2.41	-12.12
Io Note2	dBm/95.04 MHz Note3	-57.63		-57.63	
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.					
NOTE 4: Calculation of Es/Iot$_{BB}$ includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.					
NOTE 5: Information about types of UE beam is given in anex B.2.1.3 and does not limit UE implementation or test system implementation.					

A.17.9.3.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.17.2.1 if the reported PRS-RSRP is in the range shown in table A.17.9.3.1.3-1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1A.17.2.2.

Table A.17.9.3.1.3-1: PRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}
NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.	
NOTE 2: δ is the RSRP absolute accuracy requirement from table 10.1.24.2.1-2, selected according to the Io used in the test.	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from table B.2.1.6.1-1, selected according to the UE power class.	

A.17.9.3.2 PRS-RSRP measurement accuracy with FH in RRC_INACTIVE state in FR2

A.17.9.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the accuracy of PRS-RSRP measurement with FH by a RedCap UE in RRC_INACTIVE is within the specified limits. This test will verify the requirements in clauses 10.1A.17.2.1 for absolute accuracy and 10.1A.17.2.2 for relative accuracy.

A.17.9.3.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.17.9.3.2.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in table A.17.9.3.2.2-2 and A.17.9.3.2.2-3. In all test cases, Cell 1 is the PCell. PRS RX hopping is present in *NR-DL-AoD-RequestLocationInformation*.

Table A.17.9.3.2.2-1: PRS-RSRP supported test configurations

Configuration	**Description**
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

Table A.17.9.3.2.2-2: PRS-RSRP general test parameters

Parameter	**Unit**	**Test 1**		**Test 2**	
		Cell 1	**Cell 2**	**Cell 1**	**Cell 2**
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	400: $N_{RB,c}$ = 264		400: $N_{RB,c}$ = 264	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
DRX cycle configuration		1.28s	-	1.28s	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2

SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
PRS configuration		PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2
PRS Resource slot offset	slot	0	4	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that active cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the subframes with transmitted PRS.					

Table A.17.9.3.2.2-3: PRS-RSRP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note 3	-98		Same as Test 1	
N_{oc} Note1	dBm/SCS Note 3	-89		Same as Test 1	
PRS $\hat{E}_s / N_{oc}$	dB	-2	-10	-2	-10
PRS_RP Note2	dBm/SCS	-91	-99	-91	-99
$\hat{E}_s / I_{ot}$ BB Note 4	dB	-2.41	-12.12	-2.41	-12.12
Io Note2	dBm/380.16MHz Note3	-51.61		-51.61	
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.					
NOTE 4: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] table 6.2.1.3-4.					
NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.					

A.17.9.3.2.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.17.2.1 if the reported PRS-RSRP is in the range shown in table A.17.9.3.2.3-1. The relative PRS-RSRP

measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1A.17.2.2.

Table A.17.9.3.2.3-1: PRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}
NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.	
NOTE 2: δ is the RSRP absolute accuracy requirement from table 10.1.24.2.1-2, selected according to the Io used in the test.	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from table B.2.1.6.1-1, selected according to the UE power class.	

A.17.9.4 PRS-RSRPP Measurements

A.17.9.4.1 SA: PRS-RSRPP measurement accuracy with Rx FH in RRC_INACTIVE state in FR2

A.17.9.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRPP measurement accuracy in RRC_INACTIVE state is within the specified limits. This test will verify the requirements in clauses 10.1A.19.2.

A.17.9.4.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.17.9.4.1.2-1. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.17.9.4.1.2-2 and TRS configuration for Cell 1 is defined in table A.17.9.4.1.2-2.

Table A.17.9.4.1.2-1: PRS-RSRPP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

Table A.17.9.4.1.2-2: PRS-RSRPP general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	400: $N_{RB,c}$ = 264		400: $N_{RB,c}$ = 264	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
DRX cycle configuration	Ms	640			
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2

SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
PRS configuration		PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2	PRS.1.6 FR2
PRS Resource slot offset	slot	0	4	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		Two-tap channel Note 2			
Antenna configuration		1x2			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: The two-tap channel model is defined in 38.101-4 annex B.2.4 (a = 1, τ_d=0.45 µs and f_D=5 Hz).					

TableA.17.9.4.1.2-3: PRS-RSRPP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 5		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note 3	-98		Same as Test 1	
N_{oc} Note1	dBm/SCS Note 3	-89		Same as Test 1	
$\hat{E}_s / N_{oc}$	dB	-2	-10	-2	-10
PRS_RP Note2	dBm/SCS	-91	-99	-91	-99
$\hat{E}_s / I_{ot}$ BB Note 4	dB	-2.41	-12.12	-2.41	-12.12
Io Note2	dBm/380.16MHz Note3	-51.61		-51.61	
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.					
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.					
NOTE 5: Information about types of UE beam is given in annex B.2.1.3 and does not limit UE implementation or test system implementation.					

A.17.9.4.1.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.19.2. if the reported PRS-RSRPP is in the range shown in table A.17.9.4.1.3-1.

Table A.17.9.4.1.3-1: PRS-RSRPP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRPP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRPP(dBm) ≤ PRS_RP2 +δ +G_{max}
NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.	
NOTE 2: δ is the RSRPP absolute accuracy requirement from table 10.1A.19.2, selected according to the Io used in the test.	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from table B.2.1.6.1-1, selected according to the UE power class.	

A.17.9.4.2 SA: PRS-RSRPP measurement accuracy with Rx FH in RRC_INACTIVE state in FR2

A.17.9.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRPP measurement accuracy in RRC_INACTIVE state with FH by a RedCap UE is within the specified limits. This test will verify the requirements in clauses 10.1A.19.2.

A.17.9.4.2.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.17.9.4.2.2-1. In all test cases, Cell 1 is the PCell. The TCI status for Cell 1 is defined in table A.3.16.2-1 and TRS configuration for Cell 1 is defined in table A.17.9.4.2.2-1.

Table A.17.9.4.2.2-1: PRS-RSRPP supported test configurations

Configuration	**Description**
1	120 kHz SSB SCS, cell bandwidth 400 MHz, TDD duplex mode
NOTE 1: This test case is applicable to the UE supporting per hop bandwidth = 100 MHz for SCS 120 kHz.	

Table A.17.9.4.2.2-2: PRS-RSRPP general test parameters

Parameter	**Unit**	**Cell 1**	**Cell 2**
Cell ID		489	0
SSB ARFCN		freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	400: $N_{RB,c}$ = 264	
Downlink initial BWP configuration		DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
DRX cycle configuration	ms	640	
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3
SSB configuration		SSB.3 RedCap FR2	SSB.3 RedCap FR2
SMTC configuration		SMTC.1	SMTC.1
Time offset with Cell 1	μs	-	3

PRS configuration		PRS.1.6 FR2	PRS.1.6 FR2
PRS Resource slot offset	slot	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation conditions		Two-tap channel Note 2	
Antenna configuration		1x2	

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The two-tap channel model is defined in TS 38.101-4 annex B.2.4 (a = 1, τ_d=0.45 μs and f_D=5 Hz).

Table A.17.9.4.2.2-3: PRS-RSRPP OTA related test parameters

Parameter	Unit	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 5		Rough	
N_{oc} Note1	dBm/15kHz Note 3	-98	
N_{oc} Note1	dBm/SCS Note 3	-89	
$\hat{E}_s / N_{oc}$	dB	-2	-10
PRS_RP Note 2	dBm/SCS	-91	-99
$\hat{E}_s / I_{ot}$ BB Note 4	dB	-2.41	-12.12
Io Note 2	dBm/380.16MHz Note3	-51.16	

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
NOTE 5: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.

A.17.9.4.2.3 Test Requirements

In each test, the absolute PRS-RSRPP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.19.2, if the reported PRS-RSRPP is in the range shown in table A.17.9.4.2.3-1.

Table A.17.9.4.2.3-1: PRS-RSRPP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRPP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRPP(dBm) ≤ PRS_RP2 +δ +G_{max}
NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.	
NOTE 2: δ is the RSRPP absolute accuracy requirement from table 10.1.38.2.1, selected according to the Io used in the test.	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from table B.2.1.6.1-1, selected according to the UE power class.	

A.17.10 Measurement Procedure for RedCap in RRC_IDLE

A.17.10.1 RSTD Measurements

A.17.10.1.1 NR RSTD measurement reporting delay test case for RedCap UE without FH in FR2 SA in RRC_IDLE state without eDRX

A.17.10.1.1.1 Test Purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC IDLE state and without eDRX meets the requirements specified in clause 4.6.2.5 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.17.10.1.1.1-1.

Table A.17.10.1.1.1-1: Supported test configurations for NR RSTD

Configuration	**Description**
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

In the test there are three synchronous cells: Cell 1, Cell 2 and Cell 3. Cell 1 is the reference as well as the PCell. Cell 2 and Cell 3 are the neighbour cells. All cells are on the same RF channel distributed in single positioning frequency layers.

The test consists of two consecutive time intervals, with duration of T1 and T2. During time duration T1, the UE shall be in RRC_CONNECTED state and shall not have any timing information of Cell 2 and Cell3. During T2 UE shall be in RRC_IDLE state and all cells transmit PRS resources within initial DL BWP of the UE and with the same numerology as the initial DL BWP.

Note: The information on when PRS is muted is conveyed to the UE using PRS muting information.

The *NR-DL-TDOA-ProvideAssistanceData* and *nr-DL-TDOA-RequestLocationInformation* as defined in TS 37.355 [34], clause 6.5.12.1, shall be provided to the RedCap UE during T1. The measurement reporting delay test in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The last TTI containing the two messages shall be provided to the RedCap UE ΔT ms before the start of T2, where ΔT = 50 ms is the maximum processing time of the *DL-TDOA assistance* data and location information request.

The beginning of the time interval T2 shall be aligned with the first DRX cycle containing a DL PRS resource(s).

The UE is configured with DRX cycle of 0.64 s.

The general test parameters are listed in table A.17.10.1.1.1-2, and cell specific test parameters are listed in table A.17.10.1.1.1-3 and table A.17.10.1.1.1-4.

Table A.17.10.1.1.1-2: General test parameters for RSTD measurement reporting delay

Parameter		Unit	Value	Comment
Reference cell			Cell 1	Reference cell is the cell in the DL-TDOA assistance data with respect to which the RSTD measurement is defined, as specified in TS 38.215 [4] and TS 37.355 [34]. The reference cell is the PCell in this test case.
Neighbor cells			Cell 2 and Cell 3	Cell 2 and Cell 3 appear at the first and second places in the neighbour cell list in the DL-TDOA assistance data.
$BW_{channel}$		MHz	100: $N_{RB,c}$ = 66	
SSB configuration	Config 1		SSB.2 FR2	
SMTC configuration	Config 1		SMTC.1	
PDSCH RMC configuration	Config 1		SR.1.1 FDD	
RMSI CORESET RMC configuration	Config 1		CR.3.1 TDD	As specified in clause A.3.1.2.1
Dedicated CORESET RMC configuration	Config 1		CR.1.1 FDD	
PRS Configuration	Config 1		PRS.1.5 FR2	As specified in clause A.3.31
Physical cell ID PCI			(PCI of Cell 1 – PCI of Cell 2)mod6=0 and (PCI of Cell 1 – PCI of Cell 3)mod6=0	The cell PCIs are selected such that the relative shifts of PRS patterns among cells are as given by the test parameters
CP length			Normal	
DRX		s	0.64	
Radio frame receive time offset between the cells at the UE antenna connector		µs	Cell 2 to Cell 1: 0 Cell 3 to Cell 1: 3	PRS are transmitted from synchronous cells
Expected RSTD		µs	Cell 2: 3 Cell 3: 3 Other neighbour cells: randomly between -3 and 3	The expected RSTD is what is expected at the receiver. The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD indicator
Expected RSTD uncertainty for all neighbour cells		µs	5	The corresponding parameter in the DL-TDOA assistance data specified in TS 37.355 [34] is the expectedRSTD-Uncertainty index

Number of cells provided in DL-TDOA assistance data		3	Including the reference cell
PRS muting info		Cell 1: '10' Cell 2: '01' Cell 3: '10'	Correponds to prs-MutingInfo defined in TS 37.355 [34]
PRS resource RE offset		Cell 1: 0 Cell 2: 0 Cell 3: 1	Cell 1 and Cell 3 are configured with different resource offsets
T1	s	3	The length of the time interval from the beginning of each test
T2	s	1.28	The length of the time interval that follows immediately after time interval T1
AoA setup		Setup 1	As defined in clause A.3.15.1
Beam assumption		Rough	Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

Table A.17.10.1.1.1-3: Cell-specific test parameters for RSTD measurement reporting delay during T1

Parameter		Unit	Cell 1	Cell 2	Cell 3
NR RF Channel Number			1	1	1
Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.5 FDD	N/A	N/A
N_{oc} Note 3	Config 1	dBm/SCS	-89		
PRS $\hat{E}_s/N_{oc}$		dB	-Infinity	-Infinity	-Infinity
Io Note 4	Config 1	dBm/ 95.04MHz	-57	-57	-57
SSB RP Note4	Config 1	dBm/SCS	-89	-Infinity	-Infinity
$\hat{E}_s/N_{oc}$		dB	0	-Infinity	-Infinity
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 4: SSB RP and Io levels have been derived from other parameters and are given for information purpose. These are not settable test parameters.

Table A.17.10.1.1.1-4: Cell-specific test parameters for RSTD measurement reporting delay during T2

Parameter	Unit	Cell 1	Cell 2	Cell 3
		T2	T2	T2
RF Channel Number		1	1	1

Positiong frequency layer			1	1	1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low	1x2 Low
OCNG patterns defined in A.3.2.1			OP.1	OP.1	OP.1
PRACH configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	FR2 PRACH configuration 1
N_{oc} Note 3	Config 1	dBm/SCS	-89	-89	-89
PRS $\hat{E}_s/N_{oc}$	Config 1	dB	-5.44	-11.67	-11.67
Io	Config 1	dBm/ 95.04MHz	-58.49	-58.49	-58.49
PRS $\hat{E}_s/I_{ot}$		dB	-6	-13	-13
Propagation Condition			AWGN		

NOTE 1: OCNG shall be used such that active cells (all, except Cell 3 in T2) are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols other than those in the slots with transmitted PRS.
NOTE 2: The resources for uplink transmission are assigned after the end of time period T2 to UEs that do not support SDT for measurement reporting.
NOTE 3: Interference from other cells and noise sources not specified in the test are assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

A.17.10.1.1.2 Test Requirements

The RSTD measurement time without FH for RedCap fulfils the requirements specified in clause 4.6.2.5.

The UE shall perform and report the RSTD measurements for Cell 2 and Cell 3 with respect to the reference cell in the DL-TDOA assistance data, Cell 1, within the time duration specified in clause 4.6.2.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3, i.e., between RSTD_0000000 and RSTD_1970049.

A.17.10.1.2 NR RSTD without FH measurement reporting delay test case for single positioning frequency layer in FR2 SA in RRC_IDLE state with eDRX > 10.24s

A.17.10.1.2.1 Test purpose and environment

The purpose of the test is to verify the measurement requirements specified in clause 4.6.2.5 for RSTD measurements in RRC_IDLE with eDRX and periodic reporting. Refer to clause A.7.10.1.2.1 for test configuration and procedure.

A.17.10.1.2.2 Test requirements

The RSTD measurement time shall fulfill the requirements specified in clause 4.6.2.5.

The UE shall perform and report the RSTD measurements for Cell 1, Cell 2 and Cell 3 within the specified measurement period duration starting from the beginning of time interval T2. The requirement shall be evaluated based on the first measurement report received from the UE.

NOTE 1: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

NOTE 2: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the time duration above because of TTI insertion uncertainty of the measurement report in DCCH.

The rate of the correct events for each neighbour cell observed during repeated tests shall be at least 90%, where the reported RSTD measurement for each correct event shall be within the RSTD reporting range specified in clause 10.1A.16.3.

A.17.10.2 PRS-RSRP Measurements

A.17.10.2.1 PRS-RSRP measurement delay test case for single positioning frequency layer in RRC_IDLE

A.17.10.2.1.1 Test Purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement without RX FH in RRC_IDLE in FR2 meets the delay requirements specified in clause 4.6.3.5 for single positioning frequency layer under AWGN propagation conditions in standalone scenario. Supported test configurations are shown in table A.17.10.2.1.1-1.

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2. Both cells transmit PRS during T2.

The *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message as defined in TS 37.355 [34] shall be provided to the UE during T1. The last slot containing the two messages for the assistance data and location information request is denoted as #n. In the DL slot next to slot #n, UE is released into RRC_IDLE. PRS RX FH is not requested in *NR-DL-AoD-RequestLocationInformation*.

The beginning of the time interval T2 shall be aligned with the beginning of the first MG instance containing the PRS resources that is ΔT after slot #n, where ΔT = 50 ms is the maximum processing time of the assistance data and location information request.

The test parameters are as given in table A.17.10.2.1.1-2 and table A.17.10.2.1.1-3.

Table A.17.10.2.1.1-1: Supported test configurations for PRS-RSRP measurement reporting delay

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.10.2.1.1-2: General test parameters for PRS-RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		1	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Active cell		1	NR cell 1 (Pcell)	Cell 1 is the PCell and the DL-AoD reference cell in the positioning assistance data.

Neighbour cell		1	NR cell 2	Cell 2 is a neighbour cell in the positioning assistance data.
Gap Pattern Id		1	GP#13 or GP#24[Note1]	As specified in clause 9.1.2-1.
Measurement gap offset		1	39	
SMTC parameters		1	SMTC.1 RedCap	As specified in clause A.3.11A
SSB parameters		1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	1	-6	
Hysteresis	dB	1	0	
CP length		1	Normal	
TimeToTrigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX		1	OFF	DRX is not used
Time offset between serving and neighbour cells		1	3μs	Synchronous cells.
Expected RSTD	μs	1	3	
Expected RSTD uncertainty	μs	1	5	
T1	s	1	5	
T2	s	1	41	
NOTE 1: GP#24 is configured if UE supports MG#24, otherwise GP#13 is configured.				

Table A.17.10.2.1.1-3: Cell-specific test parameters for PRS-RSRP measurement reporting delay

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			1	Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 7]			1	Rough		Rough	
TDD configuration			1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			1	TDD		TDD	
$BW_{channel}$		MHz	1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			1	OP.1		OP.1	
PDSCH Reference measurement channel			1	SR.3.1 TDD		-	
CORESET Reference Channel			1	CR.3.1 TDD		-	
Dedicated CORESET RMC configuration			1	CCR.3.1 TDD		-	
TRS configuration			1	TRS.2.1 TDD		-	
PDSCH/PDCCH subcarrier spacing		kHz	1	120		120	
PRS configuration			1	PRS.1.1 FR2		PRS.1.1 FR2	
PRS muting configuration			1	‘10’		‘01’	
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							

EPRE ratio of PDCCH DMRS to SSS		1	0		0	
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		-98		-98	
N_{oc} Note2	dBm/SCS Note4	1	-89		-89	
SSB_RP Note 3	dBm/SCS Note5	1	-91	-91	-Infinity	-99
PRP Note 3	dBm/SCS Note5	1	-Infinity	-91	-Infinity	-99
PRS $\hat{E}_s/I_{ot}$	dB	1	-Infinity	-2.41	-Infinity	-12.12
PRS $\hat{E}_s/N_{oc}$	dB	1	-Infinity	-2	-Infinity	-10
SSB $\hat{E}_s/N_{oc}$	dB	1	-2	-2	-Infinity	-10
Io Note3	dBm/95.04 MHz Note5	1	-57.89	-57.63	-57.89	-57.63
Propagation Condition		1	AWGN			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SSB_RP/PRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: PRS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
NOTE 6: As observed with 0 dBi gain antenna at the centre of the quiet zone.
NOTE 7: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 8: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.

A.17.10.2.1.2 Test Requirements

The PRS-RSRP measurement time fulfils the requirements specified in clause 4.6.3.5. The UE shall perform and report the PRS-RSRP measurements for Cell 2 with respect to the reference cell in the DL-AoD assistance data, Cell 1, within the time duration specified in clause 4.6.3.5 starting from the beginning of time interval T2.

NOTE: The actual overall delays measured in the test may be higher than the time duration above because of the uncertainty in acquiring the first available PRACH occasion to transition to RRC_CONNECTED state to report the measurements.

The rate of the correct events for the neighbour cell observed during repeated tests shall be at least 90%, where the reported PRS-RSRP measurement for each correct event shall be within the PRS-RSRP reporting range specified in clause 10.1.24.3, i.e., between PRS-RSRP_0 and PRS-RSRP_126.

A.17.10.2.2 PRS-RSRP reporting delay test case in RRC_IDLE state in FR2 when eDRX cycle > 10.24s

A.17.10.2.2.1 Test Purpose and Environment

The purpose of the test is to verify the PRS RSRP measurement requirements specified in clause 4.6.3.5 for single positioning frequency layer under AWGN propagation conditions in RRC_IDLE when configured with eDRX.

The supported test configurations in table A.17.8.3.3.1-1 apply for this test.

The test procedure in clause A.17.8.3.3.1 apply for this test, except that during T2, UE is in RRC_IDLE state.

The general test parameters as specified in table A.17.8.3.3.1-2 apply for this test, except those specified in table A.17.10.2.2.1-1.

The cell specific test parameters as specified in table A.17.8.3.3.1-3 apply for this test.

Table A.17.10.2.2.1-1: General test parameters for PRS RSRP measurement reporting delay

Parameter	Unit	Test configuration	Value	Comment
CN eDRX configuration		Config 1	eDRX cycle = 40.96s PTW length = 1.28s	

A.17.10.2.2.2 Test Requirements

The test requirements in clause A.17.8.3.3.2 apply for this test, except that the time limits are specified in clause 4.6.3.5.

A.17.11 Measurement Performance Requirements for RedCap in RRC_IDLE

A.17.11.1 RSTD Measurements

A.17.11.1.1 RSTD measurement accuracy test case for RedCap UE without FH in FR2 in RRC_IDLE state without eDRX

A.17.11.1.1.1 Test purpose and Environment

The purpose of the test is to verify that the RSTD measurement for RedCap UE without FH in RRC_IDLE state and without eDRX meets the accuracy requirements specified in clause 10.1A.16.2 in an environment with AWGN propagation conditions in FR2 in standalone scenario when single positioning frequency layer is configured.

The supported test configurations are specified in table A.17.11.1.1.1-1.

Table A.17.11.1.1.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

In the test there are two synchronous cells: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR2. The UE is configured with DRX cycle of 0.64 s. The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the RedCap UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 4.6.2.5.

The RSTD measurement accuracy in this clause is valid for the cases where the RedCap UE is either not configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* or the RedCap

UE is configured by the LMF to perform RSTD measurement with RX FH via *NR-DL-TDOA-RequestLocationInformation* but reports the RSTD measurement based on the single hop in *NR-DL-TDOA-SignalMeasurementInformation* as specified in TS 37.355 [34], clause 6.5.12.

The accuracy test parameters and OTA related test parameters are as given in table A.17.11.1.1.1-2 and table A.17.11.1.1.1-3, respectively.

Table A.17.11.1.1.1-2: RSTD accuracy test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
PRS ARFCN		freq1	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-
TRS configuration		TRS.2.1 TDD	-
TCI state		TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2
PRS Resource slot offset	slot	0	4
Expected RSTD	µs	N/A	3
Expected RSTD uncertainty	µs	N/A	5
Time offset with Cell 1	µs	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation conditions		AWGN	AWGN
Antenna configuration		1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.17.11.1.1.1-3: RSTD accuracy OTA related test parameters

Parameter	Unit	Test 1	
		Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 5		Rough	
N_{OC} Note1	dBm/SCS Note3	-89	
PRS $\hat{E}_s / N_{OC}$	dB	-5.7	-11.9
PRS-RSRP Note2	dBm/SCS	-94.7	-100.9

PRS $\hat{E}_s/I_{ot}$ BB Note4	dB	-6	-13
Io Note2	dBm/95.04 MHz Note3	-58.76	-58.76

NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
NOTE 5: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.

11.1.1.2 Test Requirements

The RSTD measurement accuracy shall fulfil the absolute requirement in clause 10.1A.16.2.

A.17.11.1.2 RSTD without FH measurement accuracy test case for single positioning frequency layer in FR2 SA in RRC_IDLE state with eDRX > 10.24s

A.17.11.1.2.1 Test purpose and environment

The purpose of this test is to verify that RSTD measurements performed in RRC_IDLE with eDRX and periodic reporting satisfy the measurement accuracy requirements specified in clause 10.1A.16.2. The tests are conducted under AWGN propagation condition with the UE operating in FR2 stand-alone mode and configured to perform RSTD measurements on a single positioning frequency layer (PFL) in FR2.

The supported test configurations are listed in table A.17.11.1.2.1-1.

Table A.17.11.1.2.1-1: Supported test configurations

PCell configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

There are two synchronous cells in the test: Cell 1 and Cell 2. Cell 1 is the reference as well as the PCell. Cell 2 is a neighbour cell. Both cells are on the same NR RF channel in FR2.

The *NR-TDOA-ProvideAssistanceData* and *NR-TDOA-RequestLocationInformation* message as defined in TS 37.355 [34] shall be provided to the UE before the start of the test. The test duration should be larger than the UE measurement period as defined in clause 4.5.2.5.

The general test parameters and cell specific test parameters are as given in table A.17.11.1.2.1-2 and table A.17.11.1.2.1-3, respectively.

Table A.17.11.1.2.1-2: General test parameters

Parameter	Unit	Test configuration	Value	Comment
Reference cell		1	Cell 1	
Neighbour cell		1	Cell 2	
RF Channel Number		1	1	For Cell 1 and Cell 2
$BW_{channel}$	MHz	1	100: $N_{RB,c}$ = 66	

SSB configuration		1	SSB.3 FR2	
SMTC configuration		1	SMTC.1	
CP length		1	Normal	
DRX	s	1	0.64	
eDRX cycle length	s	1	40.96	
PTW length	s	1	1.28	
Reporting periodicity	s	1	20	*reportingInterval* for periodic reporting defined in TS 37.355 [34].
Time offset between serving and neighbour cell	μs	1	3	Synchronous cells
Expected RSTD	μs	1	3	
Expected RSTD uncertainty	μs	1	5	

Table A.17.11.1.2.1-3: Cell specific test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
AoA setup		Setup 1 as specified in clause A.3.15			
Beam Assumption[Note 4]		Rough		Rough	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET RMC configuration		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET RMC configuration		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS[Note 1]					
EPRE ratio of OCNG to OCNG DMRS[Note 1]					
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
Initial BWP configuration		DLBWP.0.1 ULBWP.0.1	-	DLBWP.0.1 ULBWP.0.1	-
Dedicated BWP configuration		DLBWP.1.1 ULBWP.1.1	-	DLBWP.1.1 ULBWP.1.1	-
PRS configuration		PRS.1.1 FR2	PRS.1.1 FR2	PRS.1.2 FR2	PRS.1.2 FR2
PRS num PRB		32	32	64	64
PRS Resource slot offset	slot	0	4	0	4
N_{oc} [Note 2]	dBm/SCS	-89			
PRS $\hat{E}_s/I_{ot}$	dB	-6	-13	-6	-13
PRS $\hat{E}_s/N_{oc}$	dB	-6	-13	-6	-13
PRP[Note 3]	dBm/SCS kHz	-95	-102	-95	-102
Io[Note 3] (on symbols where PRS is not allocated)	dBm/95.04 MHz	-58.7	-58.7	-58.7	-58.7

Propagation conditions		AWGN			
Antenna configuration		1x2	1x2	1x2	1x2

NOTE 1: OCNG shall be used such that active cell (Cell 1) is fully allocated and a constant total transmitted power spectral density is achieved on all OFDM symbols except those in which PRS is allocated.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: PRP and Io levels have been derived from other parameters and they are provided for information only. They are not settable parameters themselves.
NOTE 4: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.
NOTE 5: Calculation of Es/Iot includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
NOTE 6: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
NOTE 7: As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.17.11.1.2.2 Test requirements

The reported RSTD measurements shall fulfill the absolute accuracy requirements specified in clause 10.1A.16.2.

A.17.11.2 PRS-RSRP Measurements

A.17.11.2.1 PRS-RSRP measurement accuracy test case for RedCap UE in FR2 in RRC_IDLE state

A.17.11.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the PRS-RSRP measurement accuracy for 2Rx RedCap UE in RRC_IDLE is within the specified limits in FR2. This test will verify the requirements in clauses 10.1A.17.2.1 and 10.1A.17.2.2, when the PRS-RSRP measurement is performed without RX FH.

A.17.11.2.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.17.11.2.1.2-1. Both absolute and relative accuracy of PRS-RSRP measurements are tested by using the parameters in table A.17.11.2.1.2-2 and A.17.11.2.1.2-3. In all test cases, Cell 1 is the PCell.

Table A.17.11.2.1.2-1: PRS-RSRP supported test configurations

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.17.11.2.1.2-2: PRS-RSRP general test parameters.

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c} = 66$		100: $N_{RB,c} = 66$	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
DRX cycle configuration		1.28s	-	1.28s	-
TCI state		TCI.State.0	-	TCI.State.0	-

PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1 RedCap	SMTC.1 RedCap	SMTC.1 RedCap	SMTC.1 RedCap
Time offset with Cell 1	μs	-	3	-	3
PRS configuration		PRS.1.3 FR2	PRS.1.3 FR2	PRS.1.5 FR2	PRS.1.5 FR2
PRS Resource slot offset	slot	0	4	0	4
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					

Table A.17.11.2.1.2-3: PRS-RSRP OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 6		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note3	-98		Same as Test 1	
N_{oc} Note1	dBm/SCS Note3	-89		Same as Test 1	
$\hat{E}_s / N_{oc}$	dB	-2	-10	-2	-10
E_s	dBm/SCS Note3	-	-	-	-
PRS_RP Note2	dBm/SCS	-91	-99	-91	-99
$\hat{E}_s / I_{ot}$ BB Note5	dB	-2.41	-12.12	-2.41	-12.12
Io Note2	dBm/95.04 MHz Note3	-57.63		-57.63	
NOTE 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 2: PRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					
NOTE 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.					

NOTE 5: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] table 6.2.1.3-4.
NOTE 6: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation.

A.17.11.2.1.3 Test Requirements

In each test, the absolute PRS-RSRP measurement for each cell shall fulfil the absolute accuracy requirement in clause 10.1A.17.2.1 when the PRS-RSRP measurement is performed without RX FH and if the reported PRS-RSRP is in the range shown in table A.17.11.2.1.3-1. The relative PRS-RSRP measurement between the two PRS resources within the same cell shall fulfil the relative accuracy requirement in clause 10.1A.17.2.2 when the PRS-RSRP measurement is performed without RX FH.

Table A.17.11.2.1.3-1: PRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	PRS_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP1 +δ +G_{max}
Cell 2	PRS_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ PRS_RP2 +δ +G_{max}
NOTE 1: PRS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration.	
NOTE 2: δ is the RSRP absolute accuracy requirement from table 10.1.24.2.1-2, selected according to the Io used in the test.	
NOTE 3: G_{min} and G_{max} are the minimum and maximum UE gain values from table B.2.1.6.1-1, selected according to the UE power class.	

A.17.11.2.2 PRS-RSRP measurement accuracy test case in RRC_IDLE state in FR2 when eDRX cycle > 10.24s

A.17.11.2.2.1 Test purpose and Environment

The purpose of the test is to verify that the PRS-RSRP measurement in RRC_IDLE with eDRX meets the accuracy requirements specified in clause 10.1A.17.2.1 and 10.1A.17.2.2 in an environment with AWGN propagation conditions.

A.17.11.2.2.1 Test parameters

The supported test configurations in table A.17.9.3.1.2-1 apply for this test.

The test procedure in clause A.17.9.3.1.2 apply for this test, except that UE is in RRC_IDLE state.

The general test parameters as specified in table A.17.9.3.1.2-2 apply for this test, except those additionally specified in table A.17.11.2.2.1-1.

The OTA related test parameters in table A.17.9.3.1.2-3 apply for this test.

Table A.17.11.2.2.1-1: PRS-RSRP test parameters

Parameter	Unit	Test configuration	Value	Comment
eDRX cycle length (for CN eDRX)	s	1, 2, 3	40.96	
PTW window length	s	1, 2, 3	1.28	

A.17.11.2.2.2 Test Requirements

The test requirements in clause A.17.9.3.1.3 apply for this test.

A.18 E-UTRA standalone tests for NR RRM for RedCap

A.18.1 RRC_IDLE state mobility

A.18.1.1 Inter-RAT NR Cell re-selection

A.18.1.1.1 E-UTRA Cell reselection to higher priority NR target Cell in FR1

A.18.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the E-UTRAN to NR inter-RAT cell reselection requirements for 2Rx RedCap specified in clause 4.2.2.5.8 in TS 36.133 [15].

The test scenario comprises of 1 E-UTRA cell and 1 NR cell as given in tables A.18.1.1.1.1-1, A.18.1.1.1.1-2, A.18.1.1.1.1-3 and A.18.1.1.1.1-4. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. E-UTRA Cell 1 is already identified by the UE prior to the start of the test. Cell 2 is of higher priority than Cell 1.

Table A.18.1.1.1.1-1: Supported test configurations

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
7	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
8	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.18.1.1.1.1-2: General test parameters for E-UTRA cell re-selection FR1 NR cell test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	The UE camps on Cell 2 in the initial phase
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	
T1 end condition	Active cell			Cell 1	During T1 period the UE reselects to Cell 1
	Neighbour cell			Cell 2	
T3 end condition	Active cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 2	The UE shall perform reselection to Cell 2 during T3
	Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	Cell 1	
RF Channel Number			1, 2, 3, 4, 5, 6, 7, 8	1, 2	E-UTRAN radio channel (1) and NR radio channel (2) are used for this test
Time offset between cells			1, 4, 7, 8	3 ms	Asynchronous cells
			2, 5	3 μs	Synchronous cells
			3, 6	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4, 5, 6, 7, 8	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6, 7, 8	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6, 7, 8	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
T1		s	1, 2, 3, 4, 5, 6, 7, 8	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.

Parameter	Unit	Test configuration	Value	Comment
T2	s	1, 2, 3, 4, 5, 6, 7, 8	>7	During T2, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T3.
T3	s	1, 2, 3, 4, 5, 6, 7, 8	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.18.1.1.1.1-3: Cell specific test parameters for NR Cell 2

Parameter	Unit	Test configuration	Cell 2		
			T1	T2	T3
TDD configuration		1, 4, 7, 8	N/A		
		2, 5	TDDConf.1.1		
		3, 6	TDDConf.2.1		
PDSCH Reference measurement channel		1, 4, 7, 8	SR.1.1 FDD		
		2, 5	SR.1.1 TDD		
		3, 6	SR.2.1 TDD		
RMSI CORESET Reference Channel		1, 4, 7, 8	CR.1.1 FDD		
		2, 5	CR.1.1 TDD		
		3, 6	CR.2.1 TDD		
RMC CORESET Reference Channel		1, 4, 7, 8	CCR.1.1 FDD		
		2, 5	CCR.1.1 TDD		
		3, 6	CCR.2.1 TDD		
OCNG Patterns		1, 2, 3, 4, 5, 6, 7, 8	OP.1		
SMTC configuration		1, 2, 3, 4, 5, 6, 7, 8	SMTC.1		
SSB configuration		1, 4, 7, 8	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.1 RedCap FR1		
Initial DL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4, 5, 6, 7, 8	ULBWP.0.1		
RLM-RS		1, 2, 3, 4, 5, 6, 7, 8	SSB		
Qrxlevmin	dBm/SCS	1, 2, 4, 5, 7, 8	-140		
		3, 6	-137		
Pcompensation	dB	1, 2, 3, 4, 5, 6, 7, 8	0		
$Qhyst_s$	dB	1, 2, 3, 4, 5, 6	0		
$Qoffset_{s,n}$	dB	1, 2, 3, 4, 5, 6, 7, 8	0		
Cell_selection_and_ reselection_quality_measurement		1, 2, 3, 4, 5, 6, 7, 8	SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1, 4, 7, 8	-4	-infinity	12
		2, 5			
		3, 6			
N_{oc} Note2	dBm/SCS	1, 4, 7, 8	-98		
		2, 5	-98		
		3, 6	-95		
N_{oc} Note2	dBm/15 kHz	1, 4, 7, 8	-98		
		2, 5			
		3, 6			
$\hat{E}_s / N_{oc}$	dB	1, 4, 7, 8	-4	-infinity	12
		2, 5			
		3, 6			
SS-RSRP Note3	dBm/SCS	1, 4, 7, 8	-102	-infinity	-86
		2, 5	-102	-infinity	-86
		3, 6	-99	-infinity	-83
Io	dBm/9.36 MHz	1, 4, 7, 8	-68.60	-70.05	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-70.05	-57.78
	dBm/18.36 MHz	3, 6	-65.67	-67.12	-54.86
Treselection	s	1, 2, 3, 4, 5, 6, 7, 8	0	0	0
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6, 7, 8	50		
$Thresh_{x, highP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	48		
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	44		

Parameter	Unit	Test configuration	Cell 2		
			T1	T2	T3
$Thresh_{x, lowP}$	dB	1, 2, 3, 4, 5, 6, 7, 8	50		
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.					
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.					

Table A.18.1.1.1.1-4: Cell specific test parameters for E-UTRA Cell 1

Parameter	Unit	Cell 1		
		T1	T2	T3
E-UTRA RF Channel number		1		
$BW_{channel}$	MHz	10		
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 FDD for test configuration 1, 2, 3, 7; OP.2 TDD for test configuration 4, 5, 6, 8		
PBCH_RA	dB	0		
PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			
PHICH_RA	dB			
PHICH_RB	dB			
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA Note 1	dB			
OCNG_RB Note 1	dB			
Qrxlevmin	dBm	-140		
N_{oc} Note 2	dBm/15 kHz	-98		
RSRP Note 3	dBm/15 KHz	-84	-84	-84
$\hat{E}_s / I_{ot}$	dB	14	14	14
$\hat{E}_s / N_{oc}$	dB	14	14	14
$Treselection_{EUTRAN}$	S	0		
SnonintrasearchP	dB	50		
$Thresh_{x, highP}$	dB	48		
$Thresh_{serving, lowP}$	dB	44		
$Thresh_{x, lowP}$	dB	50		
Propagation Condition		AWGN		
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.18.1.1.1.2 Test Requirements

The cell reselection delay to a higher priority NR cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 2 and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher_priority_search}$ + $T_{evaluate, NR}$ + $T_{SI-NR,}$ and to a lower priority cell can be expressed as: $T_{evaluate, NR}$ + $T_{SI-NR,}$

Where:

$T_{higher_priority_search}$ See clause 4.2.2 in TS 36.133 [15]

$T_{evaluate, NR}$ See Table 4.2.2.5.6-1 in clause 4.2.2.5.6 in TS 36.133 [15]

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority NR cell and 7.68 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 8 s.

A.18.2 RRC_CONNECTED state mobility

A.18.2.1 Handover

A.18.2.1.1 E-UTRAN - NR handover in FR1

A.18.2.1.1.1 Test Purpose and Environment

This test shall verify the E-UTRAN to NR FR1 handover requirements for 2RX RedCap as specified in clause 5.3.4B in TS 36.133 [15].

The test comprises of one E-UTRA carrier and one NR carrier. There are two cells and one cell on each carrier. Cell 1 is the E-UTRAN and Cell 2 is an inter-RAT NR neighbour cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in table 8.1.2.1-1 of TS 36.133 [15] is configured before T2 begins to enable inter-RAT frequency monitoring.

A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.18.2.1.1-1. General test parameters are provided in table A.18.2.1.1-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in tables A.18.2.1.1-3 and A.18.2.1.1-4 respectively.

Table A.18.2.1.1-1: Supported test configurations for E-UTRAN inter-RAT NR handover

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
6	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
7	LTE TDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
8	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.18.2.1.1-2: General test parameters for E-UTRAN inter-RAT NR handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	E-UTRAN cell

Parameter		Unit	Value	Comment
	Neighbouring cell		Cell 2	NR cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
b2-Threshold1		dBm	-83	Absolute E-UTRAN RSRP threshold for event B2
b2-Threshold2NR		dBm	As specified in table A.18.2.1.1-4	Absolute NR SS-RSRP threshold for event B2
Hysteresis		dB	0	
TimeToTrigger		s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
Gap pattern configuration Id			0	As specified in table 8.1.2.1-1 started before T2 starts [15]
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.18.2.1.1-3: Cell specific test parameters for E-UTRAN inter-RAT NR handover (Cell 1)

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6,7,8	2		
Duplex mode		1, 2, 3,4	FDD		
		5, 6,7, 8	TDD		
TDD special subframe configuration[Note1]		5, 6,7, 8	6		
TDD uplink-downlink configuration[Note1]		5, 6,7, 8	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100		
PRACH Configuration[Note2]		1, 2, 3,4	4		
		5, 6,7, 8	53		
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3,4	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD		
		5, 6,7, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3,4	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
		5, 6,7, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note3]		1, 2, 3,4	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD		
		5, 6,7, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA Note4					
OCNG_RB Note4					
N_{oc} Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	7	7	7
$\hat{E}_s/I_{ot}$ Note6	dB	1, 2, 3, 4, 5, 6, 7, 8	7	7	7
RSRP Note6	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-91	-91	-91
SCH_RP Note6	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-91	-91	-91
Io Note6	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-62.43	-62.43	-62.43
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN		
Antenna Configuration and Correlation Matrix Note7		1, 2, 3, 4, 5, 6, 7, 8	1x2 Low		

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.18.2.1.1-4: Cell specific test parameters E-UTRAN inter-RAT NR handover (Cell 2)

Parameter		Unit	Configuration	Cell 2		
				T1	T2	T3
RF channel number			1, 2, 3, 4, 5, 6, 7, 8	1		
Duplex mode			1, 5	FDD		
			2, 3, 6, 7	TDD		
			4,8	HD-FDD		
TDD Configuration			2, 6	TDDConf.1.1		
			3, 7	TDDConf.2.1		
$BW_{channel}$		MHz	1, 4,5,8	10: $N_{PRB,c}$ = 52 (FDD)		
			2, 6	10: $N_{PRB,c}$ = 52 (TDD)		
			3, 7	20: $N_{PRB,c}$ = 51 (TDD)		
PDSCH reference measurement channel			1, 4,5,8	SR.1.1 FDD		
			2, 6	SR.1.1 TDD		
			3, 7	SR.2.1 TDD		
CORSET reference channel			1, 4,5,8	CR.1.1 FDD		
			2, 6	CR.1.1 TDD		
			3, 7	CR.2.1 TDD		
PRACH configuration			1, 2, 3, 4, 5, 6, 7, 8	FR1 PRACH configuration 1		
OCNG pattern Note1			1, 2, 3, 4, 5, 6, 7, 8	OP.1		
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6, 7, 8	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		

Parameter		Unit	Configuration	Cell 2		
				T1	T2	T3
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2, 3, 4, 5, 6, 7, 8	SMTC.1 RedCap		
SSB configuration			1,2,4,5,6,8	SSB.4 RedCap FR1		
			3,7	SSB.2 RedCap FR1		
b2-Threshold2NR		dBm	1,2,4,5,6,8	-106		
			3,7	-103		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6, 7, 8	0		
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6, 7, 8	-98		
N_{oc}[Note2]		dBm/SCS	1,2,4,5,6,8	-98		
			3,7	-95		
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6, 7, 8	-inifinity	0	0
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6, 7, 8	-inifinity	0	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5, 6,8	-inifinity	-98	-98
			3, 7	-inifinity	-95	-95
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5, 6,8	-70.05	-67.04	-67.04
		dBm/18.36 MHz	3, 7	-67.13	-60.94	-64.12
Propagation condition			1, 2, 3, 4, 5, 6, 7, 8	AWGN		
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6, 7, 8	1x2 Low		

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.18.2.1.1.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 112 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in TS36.133.

$T_{interrupt}$ = 62 ms in the test; $T_{interrupt}$ is defined in TS36.133 clause 5.3.4.3.

This gives a total of 112 ms.

A.18.2.2 RRC connection release with redirection

A.18.2.2.1 Redirection from E-UTRA to NR FR1 for redcap UE

A.18.2.2.1.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from E-UTRA to NR requirements for 2Rx RedCap specified in 36.133 clause 6.3.2.6.

A.18.2.2.1.2 Test Parameters

Supported test configurations are shown in table A.18.2.2.1.2-1. The time delay is tested by using the parameters in table A.18.2.2.1.2-2, A.18.2.2.1.2-3, and A.18.2.2.1.2-4.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCConnectionRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2.

Table A.18.2.2.1.2-1: Redirection from E-UTRAN to NR test configurations

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode, LTE TDD
7	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE FDD
8	NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode, LTE TDD
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.18.2.2.1.2-2: General test parameters for Redirection from E-UTRAN to NR test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	E-UTRAN cell
	Neighbouring cell		Cell 2	NR cell
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	2.3	

Table A.18.2.2.1.2-3: Cell specific test parameters for Redirection from E-UTRAN to NR test case (Cell 1)

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6,7,8	2	
Duplex mode		1, 2, 3,7	FDD	
		4, 5, 6,8	TDD	
TDD special subframe configuration[Note1]		4, 5, 6,8	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6,8	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6,7,8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PRACH Configuration[Note2]		1, 2, 3,7	4	
		4, 5, 6,8	53	
PDSCH parameters:		1, 2, 3,7	5 MHz: R.7 FDD	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
DL Reference Measurement Channel[Note3]			10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6,8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3,7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6,8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note3]		1, 2, 3,7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6,8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6,7,8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note4]				
OCNG_RB[Note4]				
N_{oc}[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6,7,8	-98	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6,7,8	4	4
$\hat{E}_s/I_{ot}$[Note6]	dB	1, 2, 3, 4, 5, 6,7,8	4	4
RSRP[Note6]	dBm/15 kHz	1, 2, 3, 4, 5, 6,7,8	-94	-94
SCH_RP[Note6]	dBm/15 kHz	1, 2, 3, 4, 5, 6,7,8	-94	-94
Io[Note6]	dBm/9 MHz	1, 2, 3, 4, 5, 6,7,8	-64.76	-64.76
Propagation Condition		1, 2, 3, 4, 5, 6,7,8	AWGN	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
NOTE 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.18.2.2.1.2-4: Cell specific test parameters for Redirection from E-UTRAN to NR test case (Cell 2)

Parameter		Unit	Cell 2	
			T1	T2
RF Channel Number			1	
Duplex mode	Config 1,4		FDD	
	Config 2,3,5,6		TDD	
	Config 7,8		HD-FDD	
SSB Configuration	Config 1,2,4,5,7,8		SSB.1 FR1	
	Config 3,6		SSB.1 RedCap FR1	
TDD configuration	Config 1,4,7,8		Not Applicable	
	Config 2,5		TDDConf.1.1	
	Config 3,6		TDDConf.2.1	
$BW_{channel}$	Config 1,4,7,8	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5		10: $N_{PRB,c}$ = 52	
	Config 3,6		20: $N_{PRB,c}$ = 51	
BWP BW	Config 1,4,7,8	MHz	10: $N_{PRB,c}$ = 52	
	Config 2,5		10: $N_{PRB,c}$ = 52	
	Config 3,6		20: $N_{PRB,c}$ = 51	
DRX Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4,7,8		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD	
CORESET Reference Channel	Config 1,4,7,8		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD	
OCNG Patterns			OCNG pattern 1	
SMTC configuration	Config 1,2,4,5,7,8		SMTC.1 RedCap FR1	
	Config 3,6		SMTC.1 RedCap FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz	
	Config 3,6		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz	
	Config 3,6		30 kHz	
PRACH configuration			FR1 PRACH configuration 1	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15 kHz	-98	
N_{oc} Note2	Config 1,2,4,5,7,8	dBm/SCS	-98	
	Config 3,6		-95	
$\hat{E}_s/I_{ot}$		dB	-infinity	4
$\hat{E}_s/N_{oc}$		dB	-infinity	4
Io Note3	Config 1,2,4,5,7,8	dBm/ 9.36 MHz	-70.05	-64.59
	Config 3,6	dBm/ 18.36 MHz	-67.12	-61.67
Propagation condition		-	AWGN	

Parameter	Unit	Cell 2	
		T1	T2
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

A.18.2.2.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 2240 ms from the beginning of time period T2.
The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$T_{connection_release_redirect_NR_RedCap} = T_{RRC_procedure_delay} + T_{identify\text{-}NR_Redcap} + T_{SI\text{-}NR_RedCap} + T_{RACH_RedCap}$,

where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}NR_Redcap}$ = 680 ms.

$T_{SI\text{-}NR_RedCap}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target NR cell.

T_{RACH_RedCap} = 170 ms in the test.

This gives a total of 2240 ms.

A.18.3 Measurement procedure

A.18.3.1 E-UTRA – NR Inter-RAT Measurements

A.18.3.1.1 NR Inter-RAT event triggered reporting tests for FR1 without SSB time index detection when DRX is not used

A.18.3.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the RedCap UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements for 2Rx RedCap specified in clause 8.20.2.2 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.20.2.3 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in tables A.18.3.1.1.1-1, A.18.3.1.1.1-2, A.18.3.1.1.1-3 and A.18.3.1.1.1-4.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.18.3.1.1.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
7	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
8	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.18.3.1.1.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6, 7, 8	1	One E-UTRAcarrier frequency is used.
NR RF Chanel Number		1, 2, 3, 4, 5, 6, 7, 8	1	One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6, 7, 8	E-UTRA Cell 1 (PCell)	E-UTRA Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	NR Cell 2	NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6, 7, 8	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6, 7, 8	39	As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6, 7, 8	Note 1	E-UTRA RSRP threshold for E-UTRA RSRP measurement on Cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6, 7, 8	Note 2	SS-RSRP threshold for SS-RSRP measurement on Cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
CP length		1, 2, 3, 4, 5, 6, 7, 8	Normal	
TimeToTrigger	s	1, 2, 3, 4, 5, 6, 7, 8	0	
Filter coefficient		1, 2, 3, 4, 5, 6, 7, 8	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6, 7, 8	OFF	DRX is not used
Time offset between serving and neighbour cells		1, 4, 7, 8	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3µs	Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6, 7, 8	5	
T2	s	1, 2, 3, 4, 5, 6, 7, 8	1	
NOTE 1: The value of b2-Threshold1 is defined in table A.18.3.1.1.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.18.3.1.1.1-4				

Table A.18.3.1.1.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	
TDD special subframe configuration[Note1]		4, 5, 6, 8	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
			20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6, 7, 8	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	17	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6, 7, 8	17	17
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-87	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-87	-87
Io[Note5]	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition [Note6]		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix [Note6]		1, 2, 3, 4, 5, 6, 7, 8	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.18.3.1.1.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
		7, 8	HD-FDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5, 7, 8	10: $N_{PRB,c}$ = 52	
		3, 6	20: $N_{PRB,c}$ = 51	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6, 7, 8	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4, 7, 8	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5, 7, 8	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5, 7, 8	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6, 7, 8	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5, 7, 8	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5, 7, 8	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
Io Note3	dBm/9.36 MHz	1, 2, 4, 5, 7, 8	-70.05	-62.26
	dBm/18.36 MHz	3, 6	-67.13	-59.34
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6, 7, 8	1x2	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.18.3.1.1.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement

reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1, the UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.18.3.1.2 NR Inter-RAT event triggered reporting tests for FR1 without SSB time index detection when DRX is used

A.18.3.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the RedCap UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements for 2Rx RedCap specified in clause 8.20.2.2 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.20.2.3 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in tables A.18.3.1.2.1-1, A.18.3.1.2.1-2, A.18.3.1.2.1-3 and A.18.3.1.2.1-4.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.18.3.1.2.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
7	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
8	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.18.3.1.2.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6, 7, 8	1		One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2, 3, 4, 5, 6, 7, 8	1		One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6, 7, 8	E-UTRA Cell 1 (PCell)		E-UTRA Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	NR Cell 2		NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6, 7, 8	0		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6, 7, 8	39		As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6, 7, 8	Note 1		E-UTRA RSRP threshold for E-UTRA RSRP measurement on Cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6, 7, 8	Note 2		SS-RSRP threshold for SS-RSRP measurement on Cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6, 7, 8	0		

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
CP length		1, 2, 3, 4, 5, 6, 7, 8	Normal		
TimeToTrigger	s	1, 2, 3, 4, 5, 6, 7, 8	0		
Filter coefficient		1, 2, 3, 4, 5, 6, 7, 8	0		L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6, 7, 8	DRX.9	DRX.12	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 4, 7, 8	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3µs		Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6, 7, 8	5		
T2	s	1, 2, 3, 4, 5, 6, 7, 8	2	11	
NOTE 1: The value of b2-Threshold1 is defined in table A.18.3.1.2.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.18.3.1.2.1-4					

Table A.18.3.1.2.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	
TDD special subframe configuration[Note1]		4, 5, 6, 8	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6, 7, 8	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				

Parameter	Unit	Configuration	Cell 1	
			T1	T2
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	17	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2, 3, 4, 5, 6, 7, 8	17	17
RSRP Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-87	-87
SCH_RP Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-87	-87
Io Note5	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2, 3, 4, 5, 6, 7, 8	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.18.3.1.2.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
		7, 8	HD-FDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5, 7, 8	10: $N_{PRB,c}$ = 52	
		3, 6	20: $N_{PRB,c}$ = 51	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6, 7, 8	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4, 7, 8	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5, 7, 8	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6, 7, 8	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5, 7, 8	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5, 7, 8	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
Io Note3	dBm/9.36 MHz	1, 2, 4, 5, 7, 8	-70.05	-62.26
	dBm/18.36 MHz	3, 6	-67.13	-59.34
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6, 7, 8	1x2	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.18.3.1.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1 and 2, the UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.18.3.1.3 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection when DRX is not used

A.18.3.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the RedCap UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements for 2Rx RedCap specified in clause 8.20.2.2of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.20.2.3 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in tables A.18.3.1.3.1-1, A.18.3.1.3.1-2, A.18.3.1.3.1-3 and A.18.3.1.3.1-4.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2..

Table A.18.3.1.3.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
7	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
8	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.18.3.1.3.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6, 7, 8	1	One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2, 3, 4, 5, 6, 7, 8	1	One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6, 7, 8	E-UTRA Cell 1 (PCell)	E-UTRA Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	NR Cell 2	NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6, 7, 8	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6, 7, 8	39	As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6, 7, 8	Note 1	E-UTRA RSRP threshold for E-UTRA RSRP measurement on Cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6, 7, 8	Note 2	SS-RSRP threshold for SS-RSRP measurement on Cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
CP length		1, 2, 3, 4, 5, 6, 7, 8	Normal	
TimeToTrigger	s	1, 2, 3, 4, 5, 6, 7, 8	0	
Filter coefficient		1, 2, 3, 4, 5, 6, 7, 8	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6, 7, 8	OFF	DRX is not used
Time offset between serving and neighbour cells		1, 4, 7, 8	3 ms	Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3µs	Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6, 7, 8	5	
T2	s	1, 2, 3, 4, 5, 6, 7, 8	2	

Parameter	Unit	Test configuration	Value	Comment
			Test 1	
NOTE 1: The value of b2-Threshold1 is defined in table A.18.3.1.3.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.18.3.1.3.1-4				

Table A.18.3.1.3.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	
TDD special subframe configuration[Note1]		4, 5, 6, 8	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6, 7, 8	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	17	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6, 7, 8	17	17
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-87	-87

Parameter	Unit	Configuration	Cell 1	
			T1	T2
SCH_RP Note5	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-87	-87
Io Note5	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition Note6		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix Note6		1, 2, 3, 4, 5, 6, 7, 8	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.18.3.1.3.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
		7, 8		
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5, 7, 8	10: $N_{PRB,c}$ = 52	
		3, 6	20: $N_{PRB,c}$ = 51	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6, 7, 8	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4, 7, 8	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5, 7, 8	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5, 7, 8	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6, 7, 8	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
$N_{_}$ Note2	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98	
$N_{_}$ Note2	dBm/SCS	1, 2, 4, 5, 7, 8	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5, 7, 8	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
Io Note3	dBm/9.36 MHz	1, 2, 4, 5, 7, 8	-70.05	-62.26

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
	dBm/18.36 MHz	3, 6	-67.13	-59.34
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6, 7, 8	1x2	
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for to be fulfilled. NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				

A.18.3.1.3.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 1040 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1, the UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.18.3.1.4 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection when DRX is used

A.18.3.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the RedCap UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements for 2Rx RedCap specified in clause 8.20.2.2of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.20.2.3 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in tables A.18.3.1.4.1-1, A.18.3.1.4.1-2, A.18.3.1.4.1-3 and A.18.3.1.4.1-4.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2

Table A.18.3.1.4.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 20 MHz bandwidth, TDD duplex mode
7	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
8	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, HD-FDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.18.3.1.4.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6, 7, 8	1		One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2, 3, 4, 5, 6, 7, 8	1		One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6, 7, 8	E-UTRA Cell 1 (PCell)		E-UTRA Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6, 7, 8	NR Cell 2		NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6, 7, 8	0		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6, 7, 8	39		As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6, 7, 8	Note 1		E-UTRA RSRP threshold for E-UTRA RSRP measurement on Cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6, 7, 8	Note 2		SS-RSRP threshold for SS-RSRP measurement on Cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6, 7, 8	0		
CP length		1, 2, 3, 4, 5, 6, 7, 8	Normal		
TimeToTrigger	s	1, 2, 3, 4, 5, 6, 7, 8	0		
Filter coefficient		1, 2, 3, 4, 5, 6, 7, 8	0		L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6, 7, 8	DRX.9	DRX.12	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 4, 7, 8	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3µs		Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6, 7, 8	5		
T2	s	1, 2, 3, 4, 5, 6, 7, 8	2	13	
NOTE 1: The value of b2-Threshold1 is defined in table A.18.3.1.4.1-3 NOTE 2: The value of b2-Threshold2NR is defined in table A.18.3.1.4.1-4					

Table A.18.3.1.4.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6, 7, 8	1	
Duplex mode		1, 2, 3, 7	FDD	
		4, 5, 6, 8	TDD	
TDD special subframe configuration[Note1]		4, 5, 6, 8	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6, 8	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6, 7, 8	5 MHz: $N_{PRB,c}$ = 25 10 MHz: $N_{PRB,c}$ = 50 20 MHz: $N_{PRB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6, 8	5 MHz: R.4 TDD 10 MHz: R.0 TDD	

Parameter	Unit	Configuration	Cell 1	
			T1	T2
			20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3, 7	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6, 8	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3, 7	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6, 8	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6, 7, 8	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6, 7, 8	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	17	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6, 7, 8	17	17
RSRP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-87	-87
SCH_RP[Note5]	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-87	-87
Io[Note5]	dBm/9 MHz	1, 2, 3, 4, 5, 6, 7, 8	-59.13+10log ($N_{PRB,c}$ /50)	-59.13+10log ($N_{PRB,c}$ /50)
Propagation Condition [Note6]		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix [Note6]		1, 2, 3, 4, 5, 6, 7, 8	1x2	

NOTE 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
NOTE 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
NOTE 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.18.3.1.4.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6, 7, 8	1	

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
		7, 8	HD-FDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5, 7, 8	10: $N_{PRB,c}$ = 52	
		3, 6	20: $N_{PRB,c}$ = 51	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6, 7, 8	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4, 7, 8	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5, 7, 8	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5, 7, 8	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6, 7, 8	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1, 2, 3, 4, 5, 6, 7, 8	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5, 7, 8	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5, 7, 8	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6, 7, 8	-Infinity	7
Io Note3	dBm/9.36 MHz	1, 2, 4, 5, 7, 8	-70.05	-62.26
	dBm/18.36 MHz	3, 6	-67.13	-59.34
Propagation Condition		1, 2, 3, 4, 5, 6, 7, 8	AWGN	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6, 7, 8	1x2	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.18.3.1.4.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 12160 ms from the beginning of time period T2. The UE shall not send event triggered measurement

reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1 and 2, the UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.18.3.1.5 NR Inter-RAT event triggered reporting tests for FR2 without SSB time index detection when DRX is not used

A.18.3.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the RedCap UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.20.2.2 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.20.2.3 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in tables A.18.3.1.5.1-1, A.18.3.1.5.1-2 and A.18.3.1.5.1-3.

The cell specific test parameters for E-UTRA cell1 as PCell are defined in clause A.3.7.2.2.

In test 1 measurement gap pattern configuration # 0 as defined in table A.18.3.1.5.1-2 is provided for RedCap UE that does not support per-FR gap and in test 2 no measurement gap pattern configuration is provided for RedCap UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have timing information of NR Cell 2.

Table A.18.3.1.5.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR2 in non-DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.18.3.1.5.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2	1		One E-UTRAcarrier frequency is used.
NR RF Channel Number		1, 2	1		One FR2 NR carrier frequency is used.
Active cell		1, 2	E-UTRA Cell 1 (PCell)		E-UTRA Cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2	NR Cell 2		NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0	N/A	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39	N/A	As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1		SS-RSRP threshold for SS-RSRP measurement on Cell 2 for event B1 [16]
Hysteresis	dB	1, 2	0		
CP length		1, 2	Normal		
TimeToTrigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	OFF		DRX is not used

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Time offset between serving and neighbour cells		1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3µs		Synchronous cells.
T1	s	1, 2	10		
T2	s	1, 2	6	3	
NOTE 1: The value of b1-ThresholdNR is defined in table A.18.3.1.5.1-3					

Table A.18.3.1.5.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
AoA setup defined in A.3.15.2.1		1, 2	Setup 2a	
Assumption for UE beams[Note 5]		1, 2	Rough	
NR RF Channel Number		1, 2	1	
Duplex mode		1, 2	TDD	
TDD configuration		1, 2	TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 24	
OCNG patterns defined in A.3.2.1.1		1, 2	OP. 3	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1	SMTC.2	
		2	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120	
b1-ThresholdNR UE power class 3	dBm/SCS	1, 2	-112	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} $\hat{E}_s$	dBm/SCS	1, 2	- Infinity	-80.6
SS B_RP [Note 3]	dBm/SCS	1, 2	-Infinity	-80.6
$\hat{E}_s/I_{ot}$ BB [Note 6]	dB	1, 2	-Infinity	8.3
Io[Note3]	dBm/95.04 MHz	1, 2	-Infinity	-56.0
Propagation Condition		1, 2	No external noise (Note 7)	

NOTE 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Void
NOTE 3: SS B_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: Void
NOTE 5: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation
NOTE 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1 dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
NOTE 7: The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects as specified in TS 38.521-2 B.0 [38].

A.18.3.1.5.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms from the beginning of time period T2. The UE shall not send event triggered measurement

reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-FR gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D2 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and test 2, the UE is not required to report SSB time index.

Table A.18.3.1.5.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in non-DRX

Test case	Measurement reporting delay (ms)	
	Test 1: D1 ms	Test 2: D2 ms
UE power class 3	3200	1600

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.18.3.1.6 NR Inter-RAT event triggered reporting tests for FR2 without SSB time index detection when DRX is used

A.18.3.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the RedCap UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.20.2.2 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.20.2.3 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in tables A.18.3.1.6.1-1, A.18.3.1.6.1-2 and A.18.3.1.6.1-3.

The cell specific test parameters for E-UTRA cell1 as PCell are defined in clause A.3.7.2.2.

In tests 1 and 2, measurement gap pattern configuration # 0 as defined in table A.18.3.1.6.1-2 is provided for RedCap UE that does not support per-FR gap and in tests 3 and 4, no measurement gap pattern configuration is provided for RedCap UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have timing information of NR Cell 2.

Table A.18.3.1.6.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR2 in DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.18.3.1.6.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in DRX

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		1, 2	1				One E-UTRA carrier frequency is used.

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
NR RF Channel Number		1, 2	1				One FR2 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA Cell 1 (PCell)				E-UTRA Cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 2				NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0		N/A		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39		N/A		As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1				SS-RSRP threshold for SS-RSRP measurement on Cell 2 for event B1 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0				
CP length		1, 2, 3, 4, 5, 6	Normal				
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0				
Filter coefficient		1, 2, 3, 4, 5, 6	0				L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.9	DRX.12	DRX.9	DRX.12	As specified in clause A.3.3
Time offset between serving and neighbour cells		1	3 ms				Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3µs				Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5				
T2	s	1, 2, 3, 4, 5, 6	6	83	6	83	
NOTE 1: The value of b1-ThresholdNR is defined in table A.18.3.1. 6.1-3							

Table A.18.3.1.6.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in DRX

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
AoA setup defined in clause A.3.15.1		1, 2	Setup 1	
Assumption for UE beams[Note 5]		1, 2	Rough	
NR RF Channel Number		1, 2	1	
Duplex mode		1, 2	TDD	
TDD configuration		1, 2	TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66	
OCNG patterns defined in A.3.2.1.1 (OP.1)		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1	SMTC.2	
		2	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120	
b1-ThresholdNR UE power class 3	dBm/SCS	1, 2	-106	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} [Note2]	dBm/15 kHz	1, 2	-104.7	
N_{oc} [Note2]	dBm/SCS	1, 2	-95.7	
SS-RSRP [Note 3]	dBm/SCS	1, 2	-Infinity	-87.7
$\hat{E}_s/I_{ot}$	dB	1, 2	-Infinity	8

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
$\hat{E}_s/N_{oc}$	dB	1, 2	-Infinity	8
Io[Note3]	dBm/95.04 MHz	1, 2	-66.7	-58. 0
Propagation Condition		1, 2	AWGN	
NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.				
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				
NOTE 5: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation				

A.18.3.1.6.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-UE gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D2 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 3 with per-FR gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D3 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 4 with per-FR gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D4 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1, 2, 3 and 4, the UE is not required to report SSB time index.

Table A.18.3.1.6.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in DRX

Test case	Measurement reporting delay (ms)			
	Test 1: D1 ms	Test 2: D2 ms	Test 3: D3 ms	Test 4: D4 ms
UE power class 3	4800	51200	4800	51200

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.18.3.1.7 NR Inter-RAT event triggered reporting tests for FR2 with SSB time index detection when DRX is not used

A.18.3.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the RedCap UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.20.2.2 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.20.2.3 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in tables A.18.3.1.7.1-1, A.18.3.1.7.1-2 and A.18.3.1.7.1-3.

The cell specific test parameters for E-UTRA cell1 as PCell are defined in clause A.3.7.2.2.

In test 1 measurement gap pattern configuration # 0 as defined in table A.18.3.1.7.1-2 is provided for RedCap UE that does not support per-FR gap and in test 2 no measurement gap pattern configuration is provided for RedCap UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.18.3.1.7.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR2 in non-DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.18.3.1.7.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Numbers		1, 2	1		One E-UTRA carrier frequency is used.
NR RF Channel Numbers		1, 2	1		One FR2 NR carrier frequency is used.
Active cell		1, 2	E-UTRA Cell 1 (PCell)		E-UTRA Cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2	NR Cell 2		NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0	N/A	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39	N/A	As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1		SS-RSRP threshold for SS-RSRP measurement on Cell 2 for event B1 [16]
Hysteresis	dB	1, 2	0		
CP length		1, 2	Normal		
TimeToTrigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	OFF		DRX is not used
Time offset between serving and neighbour cells		1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3µs		Synchronous cells.
T1	s	1, 2	5		
T2	s	1, 2	5	3	
NOTE 1: The value of b1-ThresholdNR is defined in table A.18.3.1. 7.1-3					

Table A.18.3.1.7.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
AoA setup defined in clause A.3.15.1		1, 2	Setup 1	
Assumption for UE beams[Note 5]		1, 2	Rough	
NR RF Channel Number		1, 2	1	

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
Duplex mode		1, 2	TDD	
TDD configuration		1, 2	TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66	
OCNG patterns defined in A.3.2.1.1		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1	SMTC.2	
		2	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120	
b1-ThresholdNR UE power class 3	dBm/SCS	1, 2	-106	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N Note2	dBm/15 kHz	1, 2	-104.7	
N_{oc} Note2	dBm/SCS	1, 2	-95.7	
SS-RSRP Note 3	dBm/SCS	1, 2	-Infinity	-87.7
$\hat{E}_s/I_{ot}$	dB	1, 2	-Infinity	8
$\hat{E}_s/N_{oc}$	dB	1, 2	-Infinity	8
Io Note3	dBm/95.04 MHz	1, 2	-66.7	-58. 0
Propagation Condition		1, 2	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.18.3.1.7.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-FR gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D2 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 1 and test 2, the UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

Table A.18.3.1.7.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in non-DRX

Test case	Measurement reporting delay (ms)	
	Test 1: D1 ms	Test 2: D2 ms

UE power class 3	4160	2080

A.18.3.1.8 NR Inter-RAT event triggered reporting tests for FR2 with SSB time index detection when DRX is used

A.18.3.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the RedCap UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.20.2.2 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.20.2.3 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA Cell 1 as PCell on E-UTRA RF channel 1 and NR Cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in tables A.18.3.1.8.1-1, A.18.3.1.8.1-2 and A.18.3.1.8.1-3.

The cell specific test parameters for E-UTRA cell1 as PCell are defined in clause A.3.7.2.2.

In tests 1 and 2, measurement gap pattern configuration # 0 as defined in table A.18.3.1.8.1-2 is provided for RedCap UE that does not support per-FR gap and in tests 3 and 4, no measurement gap pattern configuration #4 is provided for RedCap UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

Table A.18.3.1.8.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR2 in DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.18.3.1.8.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in DRX

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		1, 2	1				One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2	1				One FR2 NR carrier frequency is used.
Active cell		1, 2	E-UTRA Cell 1 (PCell)				E-UTRA Cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2	NR Cell 2				NR Cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0		N/A		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39		N/A		As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1				SS-RSRP threshold for SS-RSRP measurement on Cell 2 for event B1 [16]
Hysteresis	dB	1, 2	0				
CP length		1, 2	Normal				
TimeToTrigger	s	1, 2	0				
Filter coefficient		1, 2	0				L3 filtering is not used
DRX			DRX.9	DRX.12	DRX.9	DRX.12	As specified in clause A.3.3

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
Time offset between serving and neighbour cells		1	3 ms				Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2	3μs				Synchronous cells.
T1	s	1, 2	5				
T2	s	1, 2	7	70	7	70	
NOTE 1: The value of b1-ThresholdNR is defined in table A.18.3.1. 8.1-3							

Table A.18.3.1.8.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
AoA setup defined in clause A.3.15.1		1, 2	Setup 1	
Assumption for UE beams Note 5		1, 2	Rough	
NR RF Channel Number		1, 2	1	
Duplex mode		1, 2	TDD	
TDD configuration		1, 2	TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{PRB,c}$ = 66	
OCNG patterns defined in A.3.2.1.1		1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1	SMTC.2	
		2	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120	
b1-ThresholdNR UE power class 3	dBm/SCS	1, 2	-206	
EPRE ratio of PSS to SSS		1, 2	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1, 2	-104.7	
N_{oc} Note2	dBm/SCS	1, 2	-95.7	
SS-RSRP Note 3	dBm/SCS	1, 2	-Infinity	-87.7
$\hat{E}_s/I_{ot}$	dB	1, 2	-Infinity	8
$\hat{E}_s/N_{oc}$	dB	1, 2	-Infinity	8
Io Note3	dBm/95.04 MHz	1, 2	-66.7	-58. 0
Propagation Condition		1, 2	AWGN	

NOTE 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: Information about types of UE beam is given in annex B.2.1.3, and does not limit UE implementation or test system implementation

A.18.3.1.8.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 2 with per-UE gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D2 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 3 with per-FR gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D3 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In test 4 with per-FR gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D4 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90 %.

In tests 1, 2, 3 and 4, the UE is required to report SSB time index.

Table A.18.3.1.8.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in DRX

Test case	Measurement reporting delay (ms)			
	Test 1: D1 ms	Test 2: D2 ms	Test 3: D3 ms	Test 4: D4 ms
UE power class 3	6240	66560	6240	66560

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.19 NR standalone tests for ATG

A.19.1 RRC_IDLE state mobility

A.19.1.1 Cell reselection to FR1 intra-frequency NR case

A.19.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for ATG specified in clause 4.2D.2.3.

A.19.1.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells, supported test configurations are shown in table A.19.1.1.2-1. The test parameters from table A.6.1.1.1.2-2 and table A.6.1.1.1.2-3 are used except those described in the tables A.19.1.1.2-2 and A.19.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.1.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.19.1.1.2-2: General test parameters for intra frequency NR cell re-selection test case

Parameter	Unit	Test configuration	Value	Comment
Access Barring Information	-	1, 2, 3	not barred	No additional delays in random access procedure.
T2	s	1, 2, 3	40	T2 needs to be defined so that cell re-selection reaction time is taken into account. The value applies for UEs that don't support *antennaArrayType-r18* and UEs that support *antennaArrayType-18*
T3	s	1, 2, 3	15	T3 needs to be defined so that cell re-selection reaction time is taken into account. The value applies for UEs that don't support *antennaArrayType-r18* and UEs that support *antennaArrayType-18*

Table A.19.1.1.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Propagation Condition		1, 2	AWGN+220 Hz					
		3	AWGN+500 Hz					

A.19.1.1.3 Test Requirements

For UEs that don't support *antennaArrayType-r18* and UEs that support *antennaArrayType-18*:

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 34 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Intra} + T_{SI-NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR_ intra} + T_{SI-NR}$,

Where:

T_{detect, NR_Intra} See Table 4.2D.2.3-1 in clause 4.2D.2.3

$T_{evaluate, NR_ intra}$ See Table 4.2D.2.3-1 in clause 4.2D.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case provided that SIB1 and SIB22 are scheduled with 20 ms period and 80 ms period, respectively.

For the cell re-selection delay to a newly detectable cell, $T_{detect, NR_ intra} + T_{SI-NR} = 33.28$ s, allow 34 s.

For the cell re-selection delay to an already detected cell in the test case, $T_{evaluate, NR_Intra} + T_{SI-NR} = 7.68$ s, allow 8 s.

A.19.1.2 Cell reselection to FR1 inter-frequency NR case

A.19.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements for ATG specified in clause 4.2D.2.4.

A.19.1.2.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.19.1.2.2-1, A.19.1.2.2-2 and A.19.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.1.2.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.19.1.2.2-2: General test parameters for FR1 inter frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	
T2 end condition	Active cell		1, 2, 3	Cell 2	
	Neighbour cells		1, 2, 3	Cell 1	
T3 end condition	Active cell		1, 2, 3	Cell 1	
	Neighbour cell		1, 2, 3	Cell 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	not barred	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC.2	Configured in SIB4 of Cell 1
				SMTC.6	Configured in SIB4 of Cell 2
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	1, 2, 3	40	T2 needs to be defined so that cell re-selection reaction time is taken into account. The value applies for UEs that don't support antennaArrayType-r18 and UEs that support antennaArrayType-18
T3		s	1, 2, 3	15	T3 needs to be defined so that cell re-selection reaction time is taken into account. The value applies for UEs that don't support antennaArrayType-r18 and UEs that support antennaArrayType-18

Table A.19.1.2.2-3: Cell specific test parameters for FR1 inter frequency NR cell re-selection test case

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
RF Channel Number		1, 2, 3	1			2		
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-140			-140		
		3	-137			-137		
Pcompensation	dB	1, 2, 3	0			0		
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
$\hat{E}_s / I_{ot}$	dB	1	16	-3.11	2.79	-infinity	2.79	-3.11
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s / N_{oc}$	dB	1	16	13	16	-infinity	16	13
		2						
		3						
SS-RSRP Note3	dBm/SCS	1, 2	-82	-85	-82	-infinity	-82	-85
		3	-79	-82	-79	-infinity	-79	-82
Io	dBm/9.36 MHz	1, 2	-53.94	-52.21	-52.21	Same as parameters specified in Cell 1 columns-		
	dBm/38.16 MHz	3	-47.85	-46.12	-46.12			
Treselection	s	1, 2, 3	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2, 3	60			60		
Propagation Condition		1, 2	AWGN+220 Hz					
		3	AWGN+500 Hz					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.19.1.2.3 Test Requirements

For UEs that don't support antennaArrayType-r18 and UEs that support antennaArrayType-18:

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 34 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Inter} + T_{SI-NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR_ intrer} + T_{SI-NR}$,

Where:

T_{detect, NR_Inter} See Table 4.2D.2.4-1 in clause 4.2D.2.4

$T_{evaluate, NR_ inter}$ See Table 4.2D.2.4-1 in clause 4.2D.2.4

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case provided that SIB1 and SIB22 are scheduled with 20 ms period and 80 ms period, respectively.

For the cell re-selection delay to a newly detectable cell, $T_{detect, NR_ inter} + T_{SI-NR} = 33.28$ s, allow 34 s.

For the cell re-selection delay to an already detected cell in the test case, $T_{evaluate, NR_Inter} + T_{SI-NR} = 7.68$ s, allow 8 s.

A.19.1.3 Cell reselection to FR1 inter-frequency NR case for UE configured with *hs-ATG-cellReselectionSet-r18*

A.19.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements for ATG UE configured with *hs-ATG-cellReselectionSet-r18* and for ATG UE supporting the feature for enhanced RRM requirements *(Enhanced RRM requirements for measurements in IDLE and INACTIVE modes for ATG)* specified in clause 4.2D.2.4.

A.19.1.3.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.19.1.3.2-1, A.19.1.3.2-2 and A.19.1.3.2-3. The test consists of two successive time periods, with time duration of T1 and T2. Only Cell 1 is already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.1.3.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.19.1.3.2-2: General test parameters for FR1 inter frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	
T2 end condition	Active cell		1, 2, 3	Cell 2	
	Neighbour cells		1, 2, 3	Cell 1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	not barred	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	

Parameter	Unit	Test configuration	Value	Comment
SMTC configuration		1	SMTC.2	Configured in SIB4 of Cell 1
			SMTC.6	Configured in SIB4 of Cell 2
		2	SMTC.1	
		3	SMTC.1	
DRX cycle length	s	1, 2, 3	1.28	The value shall be used for all cells in the test.
PRACH configuration index		1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell		1, 2, 3	Not configured	
T1	s	1, 2, 3	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2	s	1, 2, 3	20	T2 needs to be defined so that cell re-selection reaction time is taken into account. The value applies for UEs that don't support antennaArrayType-r18 and UEs that support antennaArrayType-18

Table A.19.1.3.2-3: Cell specific test parameters for FR1 inter frequency NR cell re-selection test case

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
RF Channel Number		1, 2, 3	1		2	
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC		1	SR.1.1 FDD		SR.1.1 FDD	
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3	0		0	
Cell_selection_and_ reselection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1	16	-3.11	-infinity	2.79
		2				
		3				
N_{oc} Note2	dBm/SCS	1, 2	-98			
		2	-95			
N_{oc} Note2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s / N_{oc}$	dB	1	16	13	-infinity	16
		2				
		3				
SS-RSRP Note3	dBm/SCS	1, 2	-82	-85	-infinity	-82

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
		3	-79	-82	-infinity	-79
Io	dBm/9.36 MHz	1, 2	-53.94	-52.21	Same as parameters specified in Cell 1 columns-	
	dBm/38.16 MHz	3	-47.85	-46.12		
Treselection	s	1, 2, 3	0	0	0	0
SnonintrasearchP	dB	1, 2, 3	60		60	
Propagation Condition		1, 2	AWGN+220 Hz			
		3	AWGN+500 Hz			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.19.1.3.3 Test Requirements

For UEs that don't support antennaArrayType-r18 and UEs that support antennaArrayType-18:

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 12 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90 %.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR_Inter_enh} + T_{SI-NR}$

Where:

T_{detect, NR_Inter_enh} See Table 4.2D.2.4-2 in clause 4.2D.2.4

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case provided that SIB1 and SIB22 are scheduled with 20 ms period and 80 ms period, respectively.

For the cell re-selection delay to a newly detectable cell, $T_{detect, NR_ inter_enh} + T_{SI-NR} = 11.52$ s, allow 12 s.

A.19.2 RRC_CONNECTED state mobility

A.19.2.1 Handover

A.19.2.1.1 Intra-frequency handover from FR1 to FR1; known target cell

A19.2.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra frequency handover requirements for ATG specified in clause 6.1E.1.2.

A.19.2.1.1.2 Test Parameters

Supported test configurations are shown in table A.19.2.1.1.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.1.2-2 and table A.6.3.1.1.2-3 except those described in the table A.19.2.1.1.2-2 and A.19.2.1.1.2-3.

The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2.

NR shall send a RRC message implying handover to Cell 2. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3. T3 is defined as the end of the last TTI containing the RRC message implying handover.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.2.1.1.2-1: Intra-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.19.2.1.1.2-2: General test parameters Intra-frequency handover from FR1 to FR1

Parameter	Unit	Value	Comment
Access Barring Information	-	not barred	No additional delays in random access procedure.

Table A.19.2.1.1.2-3: Cell specific test parameters for NR FR1-FR1 Intra frequency handover test case

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Propagation condition	Config 1, 2	-	AWGN+220 Hz			AWGN+220 Hz		
	Config 3		AWGN+500 Hz			AWGN+500 Hz		

A.19.2.1.2.3 Test Requirements

For UEs that don’t support antennaArrayType-r18 and UEs that support antennaArrayType-18:

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 62 ms in the test. $T_{interrupt}$ is defined in clause 6.1E.1.2.2.

A.19.2.1.2 Inter-frequency handover from FR1 to FR1; unknown target cell

A.19.2.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 inter frequency handover requirements for ATG specified in clause 6.1E.1.2.

A.19.2.1.2.2 Test Parameters

Supported test configurations are shown in table A.19.2.1.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.3.2-2 and table A.6.3.1.3.2-3 except those described in the table A.19.2.1.2.2-2 and A.19.2.1.2.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.2.1.2.2-1: Inter-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.19.2.1.2.2-2: General test parameters Inter-frequency handover from FR1 to FR1

Parameter	Unit	Value	Comment
Access Barring Information	-	not barred	No additional delays in random access procedure.
Time offset between cells		3 μs	Synchronous cells

Table A.19.2.1.2.2-3: Cell specific test parameters for NR FR1-FR1 Inter frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation condition	Config 1, 2	-	AWGN + 220 Hz		AWGN + 220 Hz	
	Config 3		AWGN + 500 Hz		AWGN + 500 Hz	

A.19.2.1.2.3 Test Requirements

For UEs that don't support antennaArrayType-r18 and UEs that support antennaArrayType-18:

The UE shall start to transmit the PRACH to Cell 2 less than 132 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 122 ms in the test. $T_{interrupt}$ is defined in clause 6.1E.1.2.2.

This gives a total of 132 ms.

A.19.2.2 Conditional Handover

A.19.2.2.1 Intra-frequency distance-based conditional Handover from FR1 to FR1

A.19.2.2.1.1 Test Purpose and Environment

This test is to verify the requirement for intra-frequency distance-based conditional handover from FR1 to FR1 for ATG specified in clause 6.1E.2.

A.19.2.2.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in table A.19.2.2.1.2-1, and A.19.2.2.1.2-2. Both handover delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, the UE is configured to measure intra-frequency neighbour cell. The RRC message implying distance-based handover to Cell 2 with Event D1 shall be sent to UE, at a time earlier than T_{RRC} (10 ms) before the beginning of T2.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1 and location condition event condEventD1-r17 is fulfilled.

The specific gNB reference location is emulated by test system.

Table A.19.2.2.1.2-1: Supported test configurations

Configuration	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.19.2.2.1.2-2: General test parameters for Intra-frequency distance-based conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
RF Channel Number			1	
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
UE position (N,S, H) at T1 start			(0, 0, 3000)	Set by AT command
UE moving speed		km/h	(1200, 0, 0)	Set by AT command
referenceLocation1-r17.condEventD1-r17		m	(-4600, 0, 0)	Reference location for serving cell
referenceLocation2-r17.condEventD1-r17		m	(14479, 0, 0)	Reference location for target cell
distanceThreshFromReference1-r17.condEventD1-r17		50m	200	D1-1 Location condition is fulfilled at T2
distanceThreshFromReference2-r17.condEventD1-r17		50m	200	D1-2 Location condition is fulfilled at T2
hysteresis-r17.condEventD1-r17		10m	0	
timeToTrigger-r17.condEventD1-r17		s	0	
A3-Offset in condition		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	not barred	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	15	
T2		s	≤ 6	

Table A.19.2.2.1.2-3: Cell specific test parameters for Intra-frequency distance-based conditional handover from FR1 to FR1

Parameter	Test configuration	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Duplex mode	Config 1		FDD			

Parameter		Test configuration	Unit	Cell 1		Cell 2	
				T1	T2	T1	T2
		Config 2, 3		TDD			
TDD configuration		Config 1		Not Applicable			
		Config 2		TDDConf.1.1			
		Config 3		TDDConf.2.1			
$BW_{channel}$		Config 1, 2	MHz	10: $N_{PRB,c}$ = 52			
		Config 3		40: $N_{PRB,c}$ = 106			
BWP BW		Config 1, 2	MHz	10: $N_{PRB,c}$ = 52			
		Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle		Config 1, 2, 3	ms	Not Applicable			
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD			
		Config 2		SR.1.1 TDD			
		Config 3		SR.2.1 TDD			
CORESET Reference Channel		Config 1		CR.1.1 FDD			
		Config 2		CR.1.1 TDD			
		Config 3		CR.2.1 TDD			
TRS configuration		Config 1		TRS.1.1 FDD			
		Config 2		TRS.1.1 TDD			
		Config 3		TRS.1.2 TDD			
OCNG Patterns		Config 1, 2, 3		OP.1			
SMTC Configuration		Config 1, 2, 3		SMTC.1			
SSB Configuration		Config 1, 2		SSB.1 FR1			
		Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing		Config 1, 2	kHz	15 kHz			
		Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing		Config 1, 2	kHz	15 kHz			
		Config 3		30 kHz			
PRACH configuration		Config 1, 2, 3		FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP	Config 1, 2, 3		DLBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1			
	Initial UL BWP			ULBWP.0.1			
	Dedicated UL BWP			ULBWP.1.1			
EPRE ratio of PSS to SSS		Config 1, 2, 3	dB	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		Config 1, 2	dBm/ SCS	-98			
		Config 3		-95			
$\hat{E}_s / I_{ot}$		Config 1, 2, 3	dB	8	-3.3	-Infinity	2.36
$\hat{E}_s / N_{oc}$		Config 1, 2, 3	dB	8	8	-Infinity	11
SSB_RP		Config 1, 2	dBm/ SCS	-90	-90	-Infinity	-87
		Config 3		-87	-87	-Infinity	-84
Io Note3		Config 1, 2	dBm/ 9.36 MHz	-61.41	-57.06	-61.41	-57.06
		Config 3	dBm/ 38.16 MHz	-55.31	-50.96	-55.31	-50.96
Propagation condition		Config 1, 2	-	AWGN + 2412 Hz Note4			
		Config 3		AWGN + 5556 Hz Note5			
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.							

Parameter	Test configuration	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						
NOTE 4: 2412 Hz is the maximum value of doppler with carrier frequency of 2170 MHz. The specific doppler shift trajectory is up to test system's design considering of BS location and UE GNSS emulation.						
NOTE 5: 5556 Hz is the maximum value of doppler with carrier frequency of 5 GHz. The specific doppler shift trajectory is up to test system's design considering of BS location and UE GNSS emulation.						

A.19.2.2.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 872 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay is defined in clause 6.1E.2, can be expressed as:

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{interrupt} + T_{CHO_execution}$$

where:

RRC procedure delay T_{RRC} = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{Event_DU} = start of T2

At start of T2,

distance to source cell reference location is $\sqrt{(3000)^2 + (1200 * 1000/3600 * 15 - (-4600))^2}$ = 10057.8m, and D1-1 = 10000m

distance to target cell reference location is $\sqrt{(3000)^2 + (1200 * 1000/3600 * 15 - (14479))^2}$ = 9942.4m, and D1-2 = 10000m

i.e. D1-1 and D1-2 conditions are fulfilled at start of T2 with >=50m location margin.

$T_{measure}$ = max(600 + 200 ms, 0) = 800 ms;

$T_{interrupt}$ = 62 ms; $T_{CHO_execution}$ = 10 ms.

This gives a total of 800 ms + 62 ms + 10 ms = 872 ms.

A.19.2.2.2 Inter-frequency distance-based conditional Handover from FR1 to FR1

A.19.2.2.2.1 Test Purpose and Environment

This test is to verify the requirement for inter-frequency distance-based conditional handover from FR1 to FR1 for ATG specified in clause 6.1E.2.

A.19.2.2.2.2 Test Parameters

The test scenario comprises of 2 NR carrier and one cell on each carrier as given in table A.19.2.2.2.2-1, and A.19.2.2.2.2-2. Both handover delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of Cell 2. During T1, the UE is configured to measure inter-frequency neighbour cell and Gap pattern ID gp0. The RRC message implying distance-based handover to Cell 2 with Event D1 shall be sent to UE, at a time earlier than T_{RRC} (10 ms) before the beginning of T2.

Starting T2, Cell 2 becomes detectable and offset better than Cell 1 and after 9976 ms of T2, location condition event condEventD1-r17 is fulfilled.

The specific gNB reference location is emulated by test system.

Table A.19.2.2.2.2-1: Supported test configurations

Configuration	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.19.2.2.2.2-2: General test parameters for Inter-frequency distance-based conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
UE position (N,S, H) at T1 start			(0, 0, 3000)	Set by AT command
UE moving speed		km/h	(1200, 0, 0)	Set by AT command
referenceLocation1-r17.condEventD1-r17		m	(-4600, 0, 0)	Reference location for serving cell
referenceLocation2-r17.condEventD1-r17		m	(14479, 0, 0)	Reference location for target cell
distanceThreshFromReference1-r17.condEventD1-r17		50m	200	D1-1 Location condition is fulfilled at T2
distanceThreshFromReference2-r17.condEventD1-r17		50m	200	D1-2 Location condition is fulfilled at T2
hysteresis-r17.condEventD1-r17		10m	0	
timeToTrigger-r17.condEventD1-r17		s	0	
A3-Offset in condition		dB	-4	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	not barred	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤ 16	

Table A.19.2.2.2.2-3: Cell specific test parameters for Inter-frequency distance-based conditional handover from FR1 to FR1

Parameter	Test configuration	Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
RF channel number	Config 1, 2, 3		1		2	
Duplex mode	Config 1		FDD			
	Config 2, 3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1, 2	MHz	10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
BWP BW	Config 1, 2	MHz	10: $N_{PRB,c}$ = 52			
	Config 3		40: $N_{PRB,c}$ = 106			
DRX Cycle	Config 1, 2, 3	ms	Not Applicable			
Gap pattern ID			gp0			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR.2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			

Parameter		Test configuration	Unit	Cell 1		Cell 2	
				T1	T2	T1	T2
		Config 3		CR.2.1 TDD			
TRS configuration		Config 1		TRS.1.1 FDD			
		Config 2		TRS.1.1 TDD			
		Config 3		TRS.1.2 TDD			
OCNG Patterns		Config 1, 2, 3		OP.1			
SMTC Configuration		Config 1, 2, 3		SMTC.1			
SSB Configuration		Config 1, 2		SSB.1 FR1			
		Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing		Config 1, 2	kHz	15 kHz			
		Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing		Config 1, 2	kHz	15 kHz			
		Config 3		30 kHz			
PRACH configuration		Config 1, 2, 3		FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP	Config 1, 2, 3		DLBWP.0.1			
	Dedicated DL BWP			DLBWP.1.1			
	Initial UL BWP			ULBWP.0.1			
	Dedicated UL BWP			ULBWP.1.1			
EPRE ratio of PSS to SSS		Config 1, 2, 3	dB	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH DMRS							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		Config 1, 2	dBm/ SCS	-98			
		Config 3		-95			
$\hat{E}_s / I_{ot}$		Config 1, 2, 3	dB	4	4	-Infinity	5
$\hat{E}_s / N_{oc}$		Config 1, 2, 3	dB	4	4	-Infinity	5
SSB_RP		Config 1, 2	dBm/ SCS	-94	-94	-Infinity	-93
		Config 3		-91	-91	-Infinity	-90
Io Note3		Config 1, 2	dBm/ 9.36 MHz	-64.59	-64.59	-70.05	-63.85
		Config 3	dBm/ 38.16 MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		Config 1, 2	-	AWGN + 2412 Hz Note4			
		Config 3		AWGN + 5556 Hz Note5			

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: 2412 Hz is the maximum value of doppler with carrier frequency of 2170 MHz. The specific doppler shift trajectory is up to test system's design considering of BS location and UE GNSS emulation.
NOTE 5: 5556 Hz is the maximum value of doppler with carrier frequency of 5 GHz. The specific doppler shift trajectory is up to test system's design considering of BS location and UE GNSS emulation.

A.19.2.2.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 later than 9976 ms and less than 10048 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90 %.

NOTE: The handover delay is defined in clause 6.1E.2, can be expressed as:

$$D_{CHO} = T_{RRC} + T_{Event_DU} + T_{measure} + T_{interrupt} + T_{CHO_execution}$$

where:

RRC procedure delay T_{RRC} = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{Event_DU} = start of T2

At 9976 ms after start of T2,

distance to source cell reference location is $\sqrt{(3000)^2 + (1200 * 1000/3600 * 14.976 - (-4600))^2}$ = 10050.2m, and D1-1 = 10000m

distance to target cell reference location is $\sqrt{(3000)^2 + (1200 * 1000/3600 * 14.976 - (14479))^2}$ = 9949.08m, and D1-2 = 10000m

i.e. D1-1 and D1-2 conditions are fulfilled at start of T2 with >=50m location margin.

$T_{measure}$ = max(600 + 200 ms, 9976 ms) = 9976 ms;

$T_{interrupt}$ = 62 ms; $T_{CHO_execution}$ = 10 ms.

This gives a total of 9976 ms + 62 ms + 10 ms = 10048 ms.

A.19.2.3 RRC Connection Mobility Control

A.19.2.3.1 SA: RRC Re-establishment

A.19.2.3.1.1 Intra-frequency RRC Re-establishment in FR1 for ATG

A.19.2.3.1.1.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR1 with known target cell is within the specified limits for ATG. These tests will verify the requirements in clause 6.2D.1.

The test configurations are given in table A.19.2.3.1.1.1-1, and the test parameters are given in table A.6.3.2.1.1.1-2 and table A.6.3.2.1.1.1-3, except those described in the table A.19.2.3.1.1.1-2. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.2.3.1.1.1-1: Supported test configurations for ATG

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.19.2.3.1.1.1-2: Modified test parameters for ATG for UE with omnidirectional antenna

Parameter	Config	Unit	Value	Comment
Propagation condition	1,2		AWGN + 220 Hz	
	3		AWGN + 500 Hz	
DRX	1,2,3		OFF	Only non-DRX tests apply
T2	1,2,3	ms	240	The value applies for UEs that don't

Parameter	Config	Unit	Value	Comment
				support *antennaArrayType-r18* and UEs that support *antennaArrayType-18*
T3	1,2,3	s	2	The value applies for UEs that don't support *antennaArrayType-r18* and UEs that support *antennaArrayType-18*

A.19.2.3.1.1.2 Test Requirements

For ATG UEs that don't support antennaArrayType-r18 and UEs that support antennaArrayType-18:

The test requirements of this test case are the same as those defined in clause A.6.3.2.1.1.2.

A.19.2.3.1.2 Inter-frequency RRC Re-establishment in FR1 with unknown target cell without serving cell timing for ATG

A.19.2.3.1.2.1 Test Purpose and Environment

The purpose is to verify that the NR inter-frequency RRC re-establishment delay in FR1 with unknown target cell and without serving cell timing are within the specified limits. These tests will verify the requirements in clause 6.2D.1.

The test parameters are given in table A.19.2.3.1.2.1-1, table A.19.2.3.1.2.1-2 and table A.19.2.3.1.2.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, Cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of Cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of Cell 2 by the end of T1.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.2.3.1.2.1-1: Supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.19.2.3.1.2.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell 1	
	Neighbour cells		1, 2, 3	Cell 2	
Final condition	Active cell		1, 2, 3	Cell 2	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2, 3	3 μs	Synchronous cells
N310		-	1, 2, 3	1	Maximum consecutive out-of-sync indications from lower layers

Parameter	Unit	Test configuration	Value	Comment
N311	-	1, 2, 3	1	Minimum consecutive in-sync indications from lower layers
T310	ms	1, 2, 3	0	Radio link failure timer;
T311	ms	1, 2, 3	5000	RRC re-establishment timer
Access Barring Information	-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
DRX cycle length	s	1, 2, 3	OFF	
PRACH configuration		1, 2, 3	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1	s	1, 2, 3	5	
T2	ms	1, 2, 3	240	Time for the UE to detect RLF (Summation of $T_{Evaluate_out_SSB}$ defined in clause 8.1 in TS 38.133, T310 and the period for UE turns off transmitter defined in clause 8.1.5 in TS 38.133) The value applies for UEs that don't support *antennaArrayType-r18* and UEs that support *antennaArrayType-18*
T3	s	1, 2, 3	5	The value applies for UEs that don't support *antennaArrayType-r18* and UEs that support *antennaArrayType-18*

Table A.19.2.3.1.2.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
RF Channel Number		1, 2, 3	1			2		
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
TRS configuration		1	TRS.1.1 FDD			TRS.1.1 FDD		
		2	TRS.1.1 TDD			TRS.1.1 TDD		
		3	TRS.2.1 TDD			TRS.2.1 TDD		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
Active DL BWP confgiuration		1, 2, 3	DLBWP. 1.1	N/A	N/A	N/A	N/A	DLBWP. 1.1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Active UL BWP configuration		1, 2, 3	ULBWP. 1.1	N/A	N/A	N/A	N/A	ULBWP. 1.1
RLM-RS		1, 2, 3	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	7
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
$\hat{E}_s/N_{oc}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	7
		2						
		3						
SS-RSRP Note3	dBm/SCS	1, 2	-94	-infinity	-infinity	-infinity	-infinity	-91
		3	-91	-infinity	-infinity	-infinity	-infinity	-88
Io	dBm/9.36 MHz	1	-64.59	-70. 05	-70.05	-70.05	-70.05	-62.26
	dBm/9.36 MHz	2	-64.59	-70. 05	-70.05	-70.05	-70.05	-62.26
	dBm/38.16 MHz	3	-58.50	-63.94	-63.94	-63.94	-63.94	-56.15
Propagation Condition		1, 2	AWGN + 220 Hz					
		3	AWGN + 500 Hz					

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.19.2.3.1.2.2 Test Requirements

For UEs that don't support *antennaArrayType-r18* and UEs that support *antennaArrayType-18*:

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to Cell 2 for sending the *RRCReestablishmentRequest* message to Cell 2.

The RRC re-establishment delay to an unknown NR inter frequency cell without serving cell timing shall be less than 3 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90 %.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish_delay} = T_{UL_grant} + T_{UE_re\text{-}establish_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE_re-establish_delay} = 50\,ms + T_{identify_intra_NR} + \sum_{i=1}^{Nfreq-1} T_{identify_inter_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 2$

$T_{identify_intra_NR}$ = 800 ms

$T_{identify_inter_NR}$ = 800 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target inter-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 2945 ms, allow 3 s in the test case.

A.19.2.3.2 Random Access for ATG UE

A.19.2.3.2.1 4-step RA type contention based random access test in FR1 for NR standalone

A.19.2.3.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2D.2.2 and clause 7.1D.2 in an AWGN with constant residual doppler model.

For this test one cell is used and configured as PCell in FR1. Supported test configurations are shown in table A.19.2.3.2.1.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.6.3.2.2.1.1-2, except those described in the Table A.19.2.3.2.1.1-2.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.2.3.2.1.1-1: Supported test configurations for contention based random access test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode,
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.19.2.3.2.1.1-2: General test parameters for contention based random access test in FR1 for NR Standalone

Parameter	Test configuration	Unit	Test 1	Comments
Propagation Condition	Config 1	-	AWGN+220 Hz	
	Config 2	-	AWGN+500 Hz	

A.19.2.3.2.1.2 Test Requirements

The test requirements defined in clause A.6.3.2.2.1.2 shall apply for ATG.

A.19.2.3.2.2 4-step RA type non-contention based random access test in FR1 for NR standalone

A.19.2.3.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2D.2.2 and clause 7.1D.2 in an AWGN with constant residual doppler model.

For this test one cell is used and configured as PCell in FR1. Supported test configurations are shown in table A.19.2.3.2.2.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.6.3.2.2.2.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2), except those described in the Table A.19.2.3.2.2.1-2. Test 2 is only applicable to UE which supports csi-RSRP-AndRSRQ-MeasWithSSB or csi-RSRP-AndRSRQ-MeasWithoutSSB.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.2.3.2.2.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.19.2.3.2.2.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone

Parameter	Test configuration	Unit	Test 1	Test 2	Comments
Propagation Condition	Config 1	-	AWGN+220 Hz	AWGN+220 Hz	
	Config 2	-	AWGN+500 Hz	AWGN+500 Hz	

A.19.2.3.2.2.2 Test Requirements

The test requirements defined in clause A.6.3.2.2.2.2 shall apply for ATG.

A.19.2.3.2.3 2-step RA type contention based random access test in FR1 for NR standalone

A.19.2.3.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the 2-step RA type random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2D.2.3 and clause 7.1D.2 in an AWGN with constant residual doppler model.

For this test one cell is used and configured as PCell in FR1. Supported test configurations are shown in table A.19.2.3.2.3.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.6.3.2.2.3.1-2, except those described in the Table A.19.2.3.2.3.1-2.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.2.3.2.3.1-1: Supported test configurations for 2-step RA type contention based random access with successRAR test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.19.2.3.2.3.1-2: General test parameters for 2-step RA type contention based random access with successRAR test in FR1 for NR standalone

Parameter	Test configuration	Unit	Test 1	Comments
Propagation Condition	Config 1	-	AWGN+220 Hz	
	Config 2	-	AWGN+500 Hz	

A.19.2.3.2.3.2 Test Requirements

The test requirements defined in clause A.6.3.2.2.3.2 shall apply for ATG.

A.19.2.3.2.4 2-step RA type non-contention based test in FR1 for NR standalone

A.19.2.3.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2D.2.3 and clause 7.1D.2 in an AWGN with constant residual doppler model.

For this test one cell is used and configured as PCell in FR1. Supported test configurations are shown in table A.19.2.3.2.4.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in table A.6.3.2.2.4.1-2, except those described in the Table A.19.2.3.2.4.1-2.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.2.3.2.4.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone

Config	Description
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.19.2.3.2.4.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone

Parameter	Test configuration	Unit	Test 1	Comments
Propagation Condition	Config 1	-	AWGN+220 Hz	
	Config 2	-	AWGN+500 Hz	

A.19.2.3.2.4.2 Test Requirements

The test requirements defined in clause A.6.3.2.2.4.2 shall apply for ATG.

A.19.2.3.3 SA: RRC Connection Release with Redirection for ATG UE

A.19.2.3.3.1 Redirection from NR in FR1 to NR in FR1

A.19.2.3.3.1.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to NR requirements specified in clause 6.2D.3.2.1.

A.19.2.3.3.1.2 Test Parameters

Supported test configurations are shown in table A.19.2.3.3.1.2-1. The time delay is tested by using the parameters in table A.6.3.2.3.1.2-2 and table A.6.3.2.3.1.2-3, except those described in the Table A.19.2.3.3.1.2-2 and table A.19.2.3.3.1.2-3.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2. Cell 1 and Cell 2 belong to different tracking areas.

Table A.19.2.3.3.1.2-1: Redirection from NR to NR test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.19.2.3.3.1.2-2: General test parameters for Redirection from NR to NR test case

Parameter	Unit	Value	Comment
Access Barring Information	-	not barred	No additional delays in random access procedure.
T2	s	2.3	The value applies for UEs that don't support antennaArrayType-r18 and UEs that support antennaArrayType-18

Table A.19.2.3.3.1.2-3: Cell specific test parameters for Redirection from NR to NR test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation condition	Config 1, 2	-	AWGN + 220 Hz		AWGN + 220 Hz	
	Config 3		AWGN + 500 Hz		AWGN + 500 Hz	

A.19.2.3.3.1.3 Test Requirements

For UEs that don't support *antennaArrayType-r1*8 and UEs that support antennaArrayType-18:

The UE shall start to transmit the PRACH to Cell 2 less than 2240 ms from the beginning of time period T2.
The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90 %.

NOTE: The redirection delay can be expressed as:

$$T_{connection_release_redirect_NR} = T_{RRC_procedure_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH},$$

where:

$T_{RRC_procedure_delay}$ = 110 ms in the test.

$T_{identify\text{-}NR}$ = 680 ms in the test.

$T_{SI\text{-}NR}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target NR cell.

T_{RACH} = 170 ms in the test.

A.19.3 Timing

A.19.3.1 UE transmit timing

A.19.3.1.1 ATG UE Transmit Timing Test for FR1

A.19.3.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1D.2.

Supported test configurations refer to Table A.6.4.1.1.1-1.

A single NR cell is used during the test. Table A.19.3.1.1.1-1 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration SRSconfig.1 defined in table A.6.4.1.1.1-3.

Changed UE location with the mobility assumption of 1200km/h, the specific UE location should be emulated by test system and provided to UE by AT command or GNSS simulator.

The specific gNB reference location is emulated by test system.

Table A.19.3.1.1.1-1: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1
SSB ARFCN		1,2,3	1
TDD configuration		1	Not Applicable
		2	TDDConf.1.1
		3	TDDConf.2.1
$BW_{channel}$	MHz	1	10: $N_{PRB,c}$ = 52
		2	10: $N_{PRB,c}$ = 52
		3	40: $N_{PRB,c}$ = 106
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1
DRx Cycle	ms	1,2,3	N/A
PDSCH Reference measurement channel		1	SR.1.1 FDD
		2	SR.1.1 TDD
		3	SR.2.1 TDD
RMSI CORESET Reference Channel		1	CR.1.1 FDD
		2	CR.1.1 TDD
		3	CR.2.1 TDD
Dedicated CORESET Reference Channel		1	CCR.1.1 FDD
		2	CCR.1.1 TDD
		3	CCR.2.1 TDD
OCNG Patterns		1,2,3	OP.1
SSB configuration		1,2	SSB.1 FR1
		3	SSB.2 FR1
SMTC Configuration		1,2	SMTC.1
		3	SMTC.2
TRS configuration		1	TRS.1.1 FDD
		2	TRS.1.1 TDD
		3	TRS.1.2 TDD
EPRE ratio of PSS to SSS	dB	1,2,3	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			

Parameter	Unit	Config	Test1
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2	dBm/15 kHz	1,2,3	-98
N_{oc} Note2	dBm/SCS	1,2	-98
		3	-95
$\hat{E}_s / I_{ot}$		1,2,3	3
$\hat{E}_s / N_{oc}$		1,2,3	3
SS-RSRP Note3	dBm/SCS	1,2	-95
		3	-92
Io Note3	dBm/9.36 MHz	1,2	-65.2
	dBm/38.1 MHz	3	-59.2
Propagation condition		1,2	AWGN + 2412 Hz Note6
		3	AWGN + 5556 Hz Note7
SRS Config		1,2	SRSConf.1 Note5
		3	SRSConf.1 Note5

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
NOTE 5: SRS configs are given in table A.6.4.1.1.1-3
NOTE 6: 2412 Hz is the maximum value of doppler with carrier frequency of 2170 MHz. The specific doppler shift trajectory is up to test system's design considering of BS location and UE GNSS emulation.
NOTE 7: 5556 Hz is the maximum value of doppler with carrier frequency of 5 GHz. The specific doppler shift trajectory is up to test system's design considering of BS location and UE GNSS emulation.

A.19.3.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Setup NR PCell according to parameters given in table A.19.3.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within (N_{TA} + N_{TA_offset}+$N_{TA,adj}^{UE}$) ×T_c ± T_{e_ATG} of the first detected path of DL SSB.

   a. The N_{TA} offset value (in T_c units) is 25600

   b. The T_{e_ATG} values depend on the DL and UL SCS for which the test is being run and are given in table 7.1D.2-1

   c. The $N_{TA,adj}^{UE}$ value is computed by the UE based on UE position and BS location.

3) The test system shall adjust the timing of the DL path by values given in table A.19.3.1.1.2-1

Table A.19.3.1.1.2-1: Adjustment Value for DL Timing

SCS of SSB signals (KHz)	Adjustment Value

	Test1	Test2
15	+64*64T_c	+32*64T_c
30	+32*64T_c	+16*64T_c

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1D.2 Table 7.1D.2.1-1 until the UE transmit timing offset is within (N_{TA} + N_{TA_offset}+$N_{TA,adj}^{UE}$) ×T_c ± T_{e_ATG} respective to the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna.

5) The test system shall verify that the UE transmit timing offset stays within (N_{TA} + N_{TA_offset}+$N_{TA,adj}^{UE}$) ×T_c ± T_{e_ATG} of the first path (in time) of DL SSB used by the UE to determine downlink timing is received from the reference cell at the UE antenna.

A.19.3.2 UE timer accuracy

A.19.3.3 Timing advance

A.19.3.3.1 SA FR1 timing advance adjustment accuracy

A.19.3.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3D.

A.19.3.3.1.2 Test Parameters

Supported test configurations refer to table A.6.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.6.4.3.1.2-2, A.6.4.3.1.2-3 and A.6.4.3.1.2-4, except those defined in table A.19.3.3.1.2-1.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.6.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.6.4.3.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3D.2.1, the UE adjusts its uplink timing at slot n+k+$2^{\mu} \cdot K_{\text{offset}}$ for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Changed UE location with the mobility assumption of 1200km/h, the specific UE location should be emulated by test system and provided to UE by AT command or GNSS simulator.

The specific gNB reference location is emulated by test system.

Table A.19.3.3.1.2-1 Cell specific test parameters for timing advance

Parameter	Unit	Test1

			T1	T2
Propagation condition	Config 1 , 2	-	AWGN + 220 Hz	
	Config 3		AWGN + 500 Hz	
Cell specific k_{offset}			3	

A.19.3.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. $k+1+2^{\mu} \cdot K_{\text{offset}}$ slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3D.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90 %.

A.19.4 Signalling characteristics

A.19.4.1 Radio link Monitoring

In the following clause, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

For UE with multiple transmit antennas, transmit OFF power is measured as the mean power at each transmit connector.

- UE output power higher than Transmit OFF power -50 dBm (as defined in TS 38.101-1 [18]) means uplink signal
- UE output power equal to or less than Transmit OFF power -50 dBm (as defined in TS 38.101-1 [18]) means no uplink signal.

A.19.4.1.1 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode

A.19.4.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1D.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.19.4.1.1.1-1. The test parameters are given in tables A.19.4.1.1.1-2, A.19.4.1.1.1-3, and A.19.4.1.1.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.19.4.1.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40 ms) in test 1.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.4.1.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz

NOTE: The UE is only required to pass in one of the supported test configurations in FR1

Table A.19.4.1.1.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.3 FDD
	Config 2		CCR.1.3 TDD
	Config 3		CCR.2.2 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD

Parameter		Unit	Value
			Test 1
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.19.4.1.1.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	Config 1	dBm/SCS	-98		
	Config 2		-98		
	Config 3		-95		
Propagation condition	Config 1, 2		AWGN+220 Hz		
	Config 3		AWGN+500 Hz		
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.19.4.1.1.1-1. NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.					

Table A.19.4.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE: Ensure that RLM RS is partially overlapped with measurement gap	

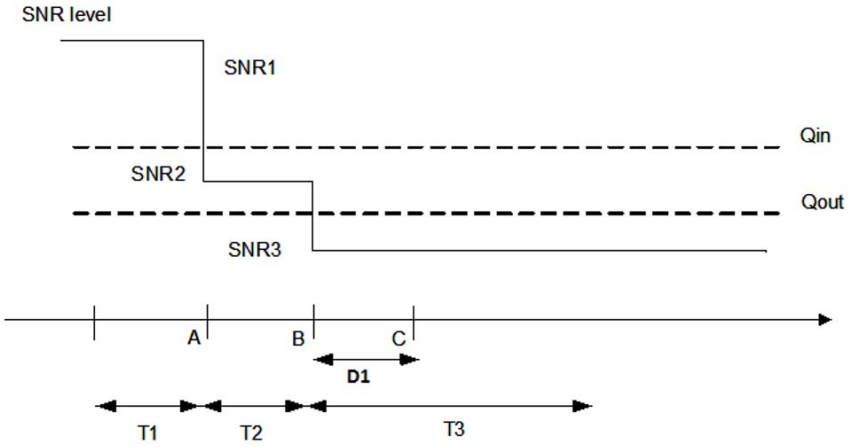


Figure A.19.4.1.1.1-1: SNR variation for out-of-sync testing

A.19.4.1.1.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90 %.

A.19.4.1.2 Radio Link Monitoring In-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode

A.19.4.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1D.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.19.4.1.2.1-1. The test parameters are given in tables A.19.4.1.2.1-2, and A.19.4.1.2.1-3 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.19.4.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.4.1.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.19.4.1.2.1-2: General test parameters for FR1 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
$BW_{channel}$	Config 1	MHz	10: $N_{PRB,c}$ = 52
	Config 2		10: $N_{PRB,c}$ = 52
	Config 3		40: $N_{PRB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4

Parameter		Unit	Value
			Test 1
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.19.4.1.2.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
N_{oc}	Config 1	dBm/SCS	-98				
	Config 2		-98				
	Config 3		-95				
Propagation condition	Config 1, 2		AWGN +220 Hz				
	Config 3		AWGN +500 Hz				
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs. NOTE 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.19.4.1.2.1-1. NOTE 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in clause A.3.6.								

Table A.19.4.1.2.1-4: Void

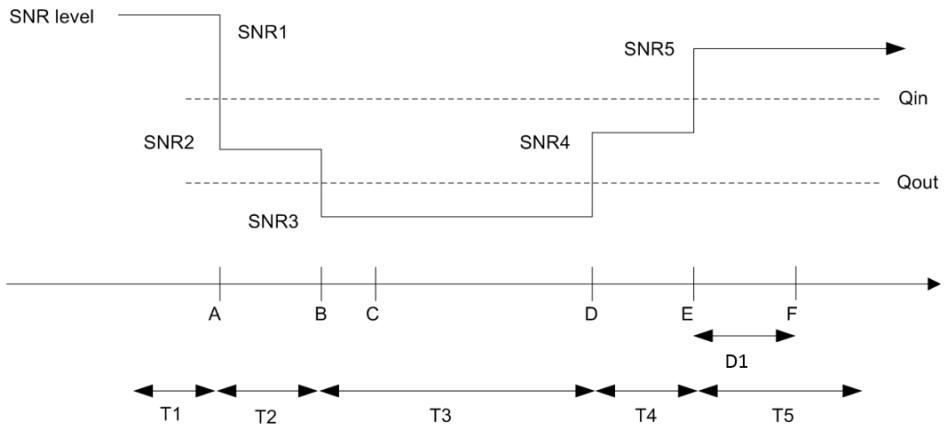


Figure A.19.4.1.2.1-1: SNR variation for in-sync testing

A.19.4.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.19.4.1.3 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode

A.19.4.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1D.

The test parameters are given in tables A.19.4.1.3.1-1, A.19.4.1.3.1-2, A.19.4.1.3.1-3, and A.19.4.1.3.1-3A below. There is one cell, Cell 1 which is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.19.4.1.3.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test. In the test, SSB0 is configured as the BFD-RS.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.4.1.3.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.19.4.1.3.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.3 FDD
	Config 2		CCR.1.3 TDD
	Config 3		CCR.2.2 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD

Parameter		Unit	Value
			Test 1
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.19.4.1.3.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4		
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta		dB			
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB	0		
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB			
EPRE ratio of PSS to SSSSSS_beta		dB			
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
N_{oc}	Config 1	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
Propagation condition	Config 1, 2		AWGN +220 Hz		
	Config 3		AWGN +500 Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.19.4.1.3.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.

Table A.19.4.1.3.1-3A: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
NOTE 1: Void	

Table A.19.4.1.3.1-4: Void

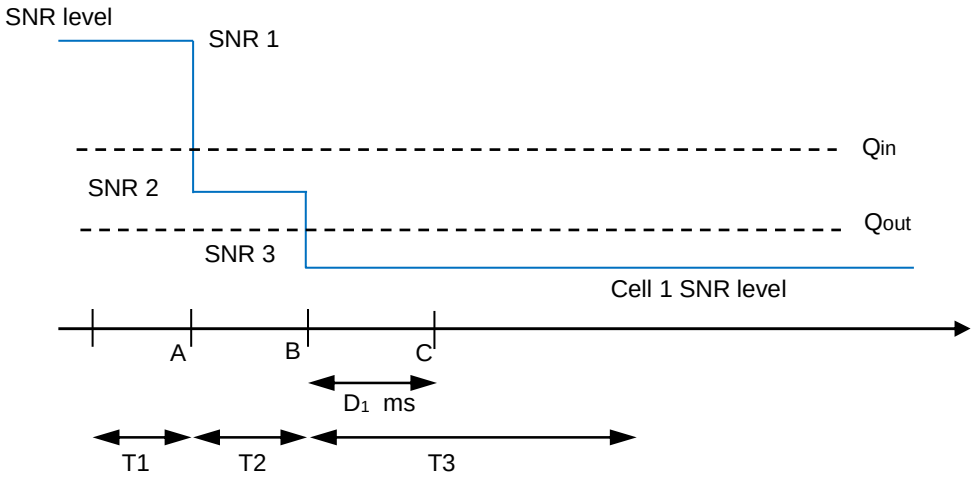


Figure A.19.4.1.3.1-1: SNR variation for CSI-RS out-of-sync testing

A.19.4.1.3.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.19.4.1.4 Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode

A.19.4.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1D.

The test parameters are given in tables A.19.4.1.4.1-1, A.19.4.1.4.1-2, and A.19.4.1.4.1-3 below. There is one cell (Cell 1), which is the PCell in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.19.4.1.4.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. In the test, SSB0 is configured as the BFD-RS.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.4.1.4.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth

3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.19.4.1.4.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State. 2
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4

Parameter		Unit	Value
			Test 1
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.44
T4		s	0.2
T5		s	0.88
T6		s	0.84
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.19.4.1.4.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSSPDCCH_beta		dB	4				
EPRE ratio of PDCCH to PDCCH DMRSPDCCH_DMRS_beta		dB					
EPRE ratio of PBCH DMRS to SSSPBCH_beta		dB	0				
EPRE ratio of PBCH to PBCH DMRSPSS_beta		dB					
EPRE ratio of PSS to SSSSSS_beta		dB					
EPRE ratio of PDSCH DMRS to SSS PDSCH_beta		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition	Config 1, 2		AWGN +220 Hz				
	Config 3		AWGN +500 Hz				

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.						
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.						
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.						
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.						
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.						
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.19.4.1.4.1-1.						
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.						

Table A.19.4.1.4.1-4: Void

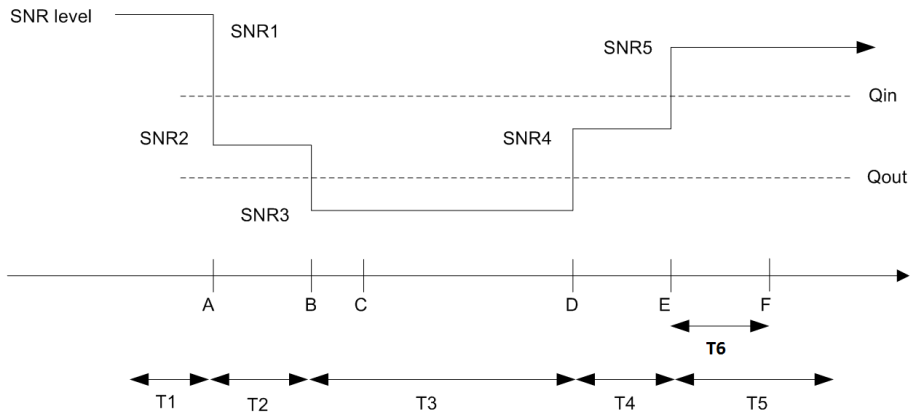


Figure A.19.4.1.4.1-1: SNR variation for CSI-RS in-sync testing

A.19.4.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.19.4.2 Beam Failure Detection and Link recovery procedures

A.19.4.2.1 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in non-DRX mode

A.19.4.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5D.

The test parameters are given in tables A.19.4.2.1.1-1, A.19.4.2.1.1-2, A.19.4.2.1.1-3 and A.19.4.2.1.1-4 below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time

duration of T1, T2, T3, T4 and T5 respectively. Figure A.19.4.2.1.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.19.4.2.1.1-2 shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40 ms) in test 1.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.4.2.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.19.4.2.1.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PSCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
BWchannel	Config 1	MHz	10: $N_{PRB,c}$ = 52	
	Config 2		10: $N_{PRB,c}$ = 52	
	Config 3		40: $N_{PRB,c}$ = 106	
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
SSB Configuration	Config 1		SSB.3 FR1	
	Config 2		SSB.3 FR1	
	Config 3		SSB.4 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
PRACH Configuration	Config 1, 2		Table A.3.8.2.2-1	
	Config 3		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	

Parameter		Unit	Value	Comment
			Test 1	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			gp0	
gapOffset			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_SSB}$
	Config 3		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
SSB Index assigned as RLM RS			0, 1	
T310 Timer		ms	1000	
N310			2	
T1		s	0.2	During this time the the UE shall be fully synchronized to Cell 1
T2		s	0.37	
T3		s	0.24	
T4		s	0	
T5		s	0.17	
D1		s	0.13	
NOTE 1: All configurations are assigned to the UE prior to the start of time period T1. NOTE 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.19.4.2.1.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter	Unit	Test 1				
		T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS	dB	0				
EPRE ratio of PDCCH to PDCCH DMRS	dB					
EPRE ratio of PBCH DMRS to SSS	dB					
EPRE ratio of PBCH to PBCH DMRS	dB					

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
SSB_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition	Config 1, 2		AWGN +220 Hz				
	Config 3		AWGN +500 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.19.4.2.1.1-4: Void

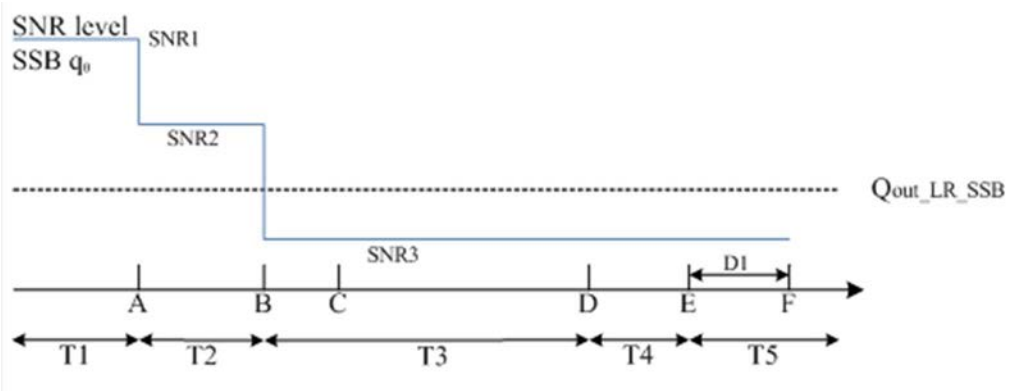


Figure A.19.4.2.1.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

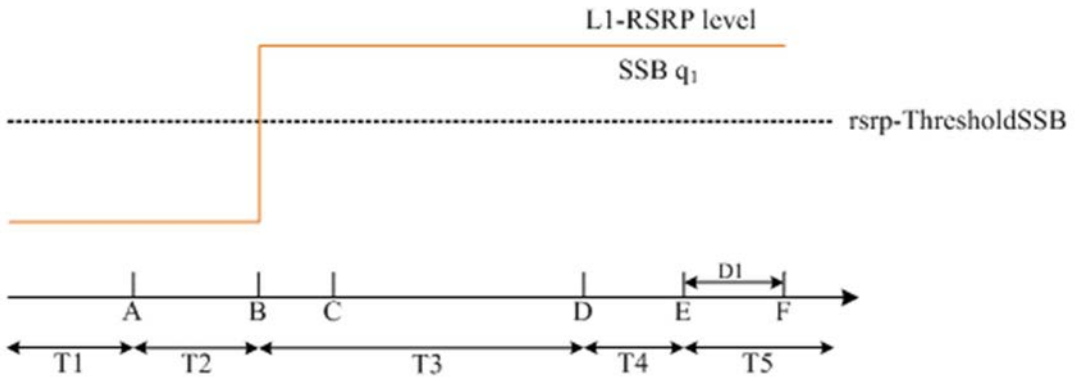


Figure A.19.4.2.1.1-2: L1-RSRP level variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.19.4.2.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.19.4.2.2 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.19.4.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5D.

The test parameters are given in tables A.19.4.2.2.1-1, A.19.4.2.2.1-2, and below. There is one cell, Cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.19.4.2.2.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.19.4.2.2.1-2 shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is not enabled.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.4.2.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
NOTE: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.19.4.2.2.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	A.3.1.3
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
SSB Configuration	Config 1		SSB.3 FR1	A.3.10
	Config 2		SSB.3 FR1	
	Config 3		SSB.4 FR1	
SSB Configuration	Config 1		SSB. 3 FR1	A.3.10
	Config 2		SSB. 3 FR1	
	Config 3		SSB. 4 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	A.3.11
	Config 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
PRACH Configuration	Config 1, 2		FR1 PRACH configuration 4	A.3.8.2
	Config 3		FR1 PRACH configuration 4	A.3.8.2
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	

Parameter			Unit	Value	Comment
				Test 1	
	DMRS precoder granularity			REG bundle size	
	REG bundle size			6	
DRX				OFF	
Gap pattern ID				N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1				1	N
rlmInSyncOutOfSyncThreshold				absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdCSI-RS	Config 1, 2		dBm/SCS kHz	-98	Threshold used for $Q_{in_LR_CSI-RS}$
	Config 3			-95	
powerControlOffsetSS				db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount				n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer				pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1		Config 1		CSI-RS.1.2 FDD	A.3.14
		Config 2		CSI-RS.1.2 TDD	
		Config 3		CSI-RS.2.2 TDD	
CSI-RS configuration for CSI reporting		Config 1		CSI-RS.1.1 FDD	A.3.14
		Config 2		CSI-RS.1.1 TDD	
		Config 3		CSI-RS.2.1 TDD	
TRS configuration		Config 1		TRS.1.1 FDD	
		Config 2		TRS.1.1 TDD	
		Config 3		TRS.1.2 TDD	
CSI-RS-Index assigned as RLM RS		Config 1		CSI-RS.1.2 FDD	A.3.14
		Config 2		CSI-RS.1.2 TDD	
		Config 3		CSI-RS.2.2 TDD	
T310 Timer			ms	1000	
N310				2	
T1			s	0.2	During this time the the UE shall be fully synchronized to Cell 1
T2			s	0.18	
T3			s	0.14	
T4			s	0	
T5			s	0.08	
D1			s	0.04	
NOTE 1: UE-specific PDCCH is not transmitted after T1 starts.					

Table A.19.4.2.2.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
	Config 3		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition	Config 1, 2		AWGN +220 Hz				
	Config 3		AWGN +500 Hz				

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
NOTE 4: Void
NOTE 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
NOTE 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
NOTE 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
NOTE 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.19.4.2.2.1-4: Void

Table A.19.4.2.2.1-5: Void

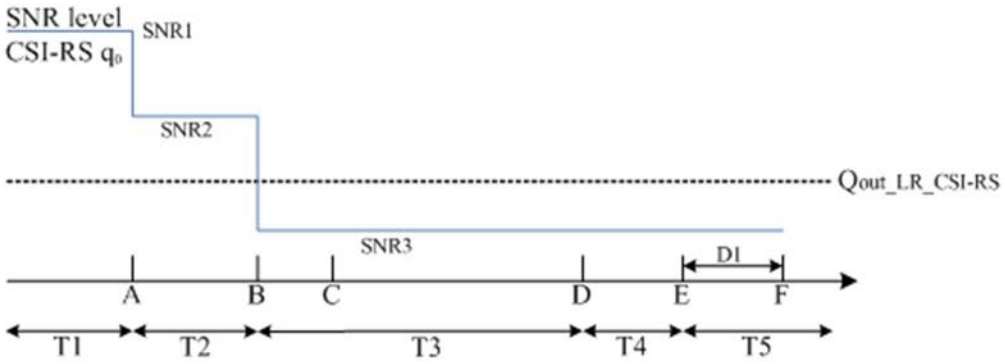


Figure A.19.4.2.2.1-1: SNR variation for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

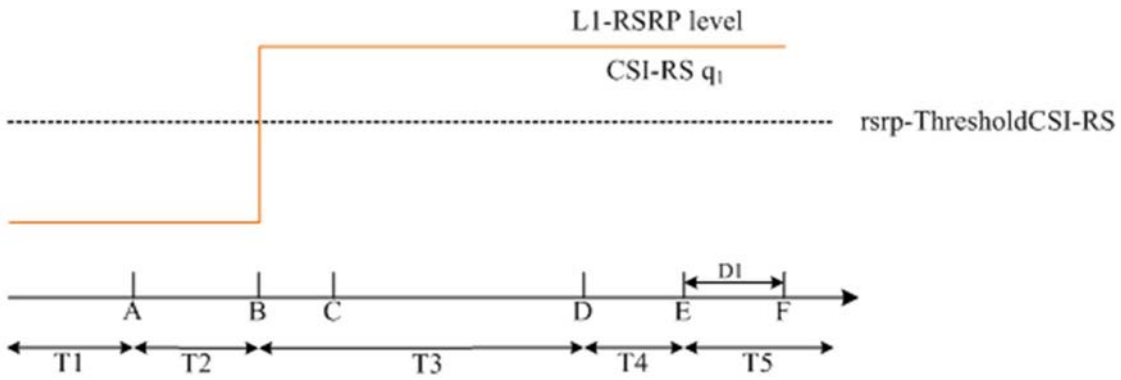


Figure A.19.4.2.2.1-2: L1-RSRP level variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

A.19.4.2.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 30+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90 %.

A.19.4.3 Active BWP switch

A.19.4.3.1 DCI-based and Timer-based Active BWP Switch

A.19.4.3.1.1 NR FR1 DL active BWP switch with non-DRX in SA

A.19.4.3.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6D.

The supported test configurations are shown in table A.19.4.3.1.1.1-1. The test scenario comprises of one cell (Cell 1) as given in table A.19.4.3.1.1.1-2. Cell-specific parameters of the cell are specified in table A.19.4.3.1.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with 2 different UE-specific downlink bandwidth parts, BWP-1 and BWP-2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1.

- UE is configured with a *bwp-InactivityTimer* timer value for Cell 1.

The cell has constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for DL BWP switch, sent from the test equipment to the UE, is received at the UE side in Cell 1's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell 1 no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-2 starting from the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

During T2, the test equipment won't transmit DCI format for PDSCH reception on Cell 1.

During T3,

> The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.
>
> The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell 1 at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-1 starting from the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The test equipment verifies the DL BWP switch time by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.4.3.1.1.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations. NOTE 2: A UE which fulfils the requirements in test case A.19.4.3.1.1 can skip the test cases in A.19.4.3.1.1.	

Table A.19.4.3.1.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell 1 on RF channel number 1.
CP length		Normal	
DRX		OFF	
bwp-InactivityTimer	ms	200	
PDCCH and PDSCH maximum number of HARQ transmission		1	
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.19.4.3.1.1.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
$BW_{channel}$	Config 1		10 MHz: $N_{PRB,c}$ = 52
	Config 2		10 MHz: $N_{PRB,c}$ = 52
	Config 3		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID			1, 2
Initial DL BWP Configuration	Config 1,2,3		DLBWP.0.2 Note 4
Active DL BWP-1 Configuration	Config 1,2,3		DLBWP.1.1 Note 4
Active DL BWP-2 Configuration	Config 1,2,3		DLBWP.1.3 Note 4
Initial UL BWP Configuration	Config 1,2,3		ULBWP.0.2 Note 4
Active UL BWP-1 Configuration	Config 1,2,3		ULBWP.1.1 Note 4
Active UL BWP-2 Configuration	Config 1		N/A
	Config 2,3		ULBWP.1.3 Note 4
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.2 FDD
	Config 2		CCR.1.2 TDD
	Config 3		CCR.2.4 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1,2	dBm/SCS	-104
	Config 3		-101
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86
Propagation condition	Config 1, 2		AWGN +220 Hz
	Config 3		AWGN +500 Hz

Parameter	Unit	Cell 1
NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.		
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].		

A.19.4.3.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed Cell 1 active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after beginning of DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.19.4.3.2 RRC-based Active BWP Switch

A.19.4.3.2.1 NR FR1 DL active BWP switch of Cell with non-DRX in SA

A.19.4.3.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6D.

The supported test configurations are shown in table A.19.4.3.2.1.1-1. The test scenario comprises of one Cell (Cell 1) as given in table A.19.4.3.2.1.1-2. Cell-specific parameters of Cell are specified in table A.19.4.3.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in Cell 1.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ as defined in clause 8.6.3 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1 on BWP-1 of final condition. The UE shall be continuously scheduled on PCell's BWP-1 of final condition starting from the first DL slot right after slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$.

$T_{\text{RRCprocessingDelay}}$ and $T_{\text{BWPswitchDelayRRC}}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in Cell by counting the time from the time when the RRC Reconfiguration message including updated BWP configuration is sent till the time when a vaild ACK/NACK is received is received.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.4.3.2.1.1-1: DL BWP switch supported test configurations in SA scenario

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.19.4.3.2.1.1-2: General test parameters for DL BWP switch in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
PDCCH and PDSCH maximum number of HARQ transmission		1	
T1	s	0.2	

Table A.19.4.3.2.1.1-3: NR Cell specific test parameters for DL BWP switch in SA scenario

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1		FDD
		Config 2,3		TDD
TDD configuration		Config 1		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
$BW_{channel}$		Config 1		10 MHz: $N_{PRB,c}$ = 52
		Config 2		10 MHz: $N_{PRB,c}$ = 52
		Config 3		40 MHz: $N_{PRB,c}$ = 106
Active BWP ID				1
Initial DL BWP Configuration		Config 1,2, 3		DLBWP.0.2
Initial UL BWP Configuration		Config 1,2, 3		ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration	Config 1, 2, 3		DLBWP.1.3

Parameter			Unit	Cell 1
	Active UL BWP-1 Configuration	Config 1, 2, 3		ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration	Config 1, 2, 3		DLBWP.1.1
	Active UL BWP-1 Configuration	Config 1, 2, 3		ULBWP.1.1
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD
		Config 2		SR.1.1 TDD
		Config 3		SR2.1 TDD
RMSI CORESET parameters		Config 1		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR2.1 TDD
Dedicated CORESET parameters		Config 1		CCR.1.2 FDD
		Config 2		CCR.1.2 TDD
		Config 3		CCR.2.4 TDD
OCNG Patterns				OP.1
SSB Configuration		Config 1,2		SSB.1 FR1
		Config 3		SSB.2 FR1
SMTC Configuration				SMTC.1
TRS Configuration		Config 1		TRS.1.1 FDD
		Config 2		TRS.1.1 TDD
		Config 3		TRS.1.2 TDD
Propagation condition		Config 1, 2		AWGN +220 Hz
		Config 3		AWGN +500 Hz
Antenna Configuration				1x2 Low
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		Config 1,2	dBm/SCS	-104
		Config 3		-101
SS-RSRP Note 3		Config 1,2	dBm/SCS	-87
		Config 3		-84
$\hat{E}_s/I_{ot}$			dB	17
$\hat{E}_s/N_{oc}$			dB	17
Io Note3		Config 1,2	dBm/ 9.36 MHz	-58.96
		Config 3	dBm/ 38.16 MHz	-52.86

NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

A.19.4.3.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the Cell from the first DL slot that occurs right after the begining of slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot i + $\frac{T_{\text{RRCprocessingDelay}}+T_{\text{BWPswitchDelayRRC}}}{\text{NR Slot length}}$ + k1.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed Cell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.19.4.4 UE specific CBW change

A19.4.4.1 UE specific CBW change on PCell in FR1 in non-DRX

A19.4.4.1.1 Test Purpose and Environment

The purpose of this test is to verify the UE specific CBW change delay requirement defined in clause 8.13D.

The supported test configurations are shown in table A.19.4.4.1.1-1. The test scenario comprises of one Cell (Cell 1), which is PCell as given in table A.19.4.4.1.1-2. Cell-specific parameters are specified in table A.19.4.4.1.1-3.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE sends ACK/NACK during the test.

Before the test starts:

- UE is connected to Cell 1 (PCell) on radio channel 1.
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PCell.
- UE has been configured with UE specific CBW (CBW-1).
- UE is indicated in *SCS-SpecificCarrier* [2] that the UE specific CBW is CBW-1 as the initial condition in Cell 1 (PCell).

Cell 1 (PCell) has constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* containing *SCS-SpecificCarrier* with updated UE specific CBW, sent from the test equipment to the UE, is completely received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its UE specific CBW with the updated CBW-2 for the final condition.

The UE shall be able to receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ as defined in clause 8.13 and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length} + k1$ on the PCell's BWP-1 on CBW-2 for the final condition. The UE shall be continuously scheduled on the PCell's BWP-1 on CBW-2 for the final condition starting from the first DL slot right after slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$.

$T_{RRCprocessingDelay}$ and $T_{CBWchangeDelayRRC}$ are defined in clause 8.13.

The test equipment verifies the UE specific CBW switching delay in PCell by estimating the time from the moment the RRC Reconfiguration message including updated UE specific CBW configuration is sent until the moment a vaild ACK/NACK is received.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.4.4.1.1-1: Supported test configurations for UE specific CBW change in SA scenario

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

Table A.19.4.4.1.1-2: General test parameters for UE specific CBW change in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	

Table A.19.4.4.1.1-3: NR Cell specific test parameters for UE specific CBW change in SA scenario

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1		FDD
		Config 2,3		TDD
TDD configuration		Config 1		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
$BW_{channel}$		Config 1		10 MHz: $N_{PRB,c}$ = 52
		Config 2		10 MHz: $N_{PRB,c}$ = 52
		Config 3		40 MHz: $N_{PRB,c}$ = 106
Active DL BWP ID		Config 1,2, 3		1
Initial DL BWP Configuration (BWP-1)		Config 1,2, 3		DLBWP.0.2
Initial UL BWP Configuration		Config 1,2, 3		ULBWP.0.2
Initial Condition	Active DLCBW-1 Configureation	Config 1, 2, 3		DLCBW.1.1
	Active UL CBW-1 Configuration	Config 1, 2, 3		ULCBW.1.1
Final Condition	Active DLCBW-1 Configureation	Config 1, 2, 3		DLCBW.1.2
	Active UL CBW-1 Configuration	Config 1, 2, 3		ULCBW.1.2
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD
		Config 2		SR.1.1 TDD
		Config 3		SR2.1 TDD
RMSI CORESET parameters		Config 1		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR2.1 TDD
Dedicated CORESET parameters		Config 1		CCR.1.1 FDD
		Config 2		CCR.1.1 TDD
		Config 3		CCR.2.1 TDD
OCNG Patterns				OP.1
SSB Configuration		Config 1,2		SSB.1 FR1
		Config 3		SSB.2 FR1
SMTC Configuration				SMTC.1
TRS Configuration		Config 1		TRS.1.1 FDD
		Config 2		TRS.1.1 TDD
		Config 3		TRS.1.2 TDD
Propagation condition		Config 1, 2		AWGN +220 Hz
		Config 3		AWGN +500 Hz
Antenna Configuration				1x2 Low

Parameter		Unit	Cell 1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS(Note 1)			
N_{oc} Note 2	Config 1,2	dBm/SCS	-104
	Config 3		-101
SS-RSRP Note 3	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2	dBm/ 9.36 MHz	-58.96
	Config 3	dBm/ 38.16 MHz	-52.86
NOTE 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
NOTE 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
NOTE 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.1 is linked with ULBWP.0.1; DLBWP.1.1 is linked with ULBWP.1.1; as defined in clause 12 of TS 38.213 [3].			

A.19.4.4.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the PCell from the first DL slot that occurs right after the begining of slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot $i + \frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length} + k1$.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed UE specific CBW change delay on the PCell to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

A.19.4.5 Pathloss reference signal switching delay

A.19.4.5.1 MAC-CE based pathloss reference signal switch delay

A.19.4.5.1.1 Test Purpose and Environment

The purpose of this test is to verify the MAC-CE based pathloss reference signal switch delay requirement defined in clause 8.14D.

The supported test configurations are shown in table A.19.4.5.1.1-1. The test scenario comprises of one cell (Cell 1) as given in table A.19.4.5.1.1-2. Cell-specific parameters of the cell are specified in table A.19.4.5.1.1-3 below.

The test consists of 3 successive time periods, with duration of T1, T2 and T3, respectively.

Prior to the start of the time duration T1,

- UE is connected to Cell 1 on radio channel 1.
- UE shall be fully synchronized to SSB #0.

During T1,

- The UE shall track SSB #1 so that SSB #1 as a pathloss reference signal is known to the UE.

Time period T2 starts when the UE is configured of the power headroom reporting functionality by upper layers by the test equipment and the UE shall transmit a PHR during T2.

During T2,

- UE is configured with a *phr-ProhibitTimer* timer value for Cell 1.
- UE is configured with a *phr-Tx-PowerFactorChange* value for Cell 1.

During T3,

Time period T3 starts when a PDSCH carrying MAC-CE activation for pathloss reference signal switch, sent from the test equipment to the UE to swicth the pathloss reference signal from SSB 0 to SSB 1, is received at the UE side in Cell 1's slot # denoted *i*. The UE shall switch its pathloss reference signal to the target one and send PHR.

The UE shall be able to apply the target pathloss reference signal of the serving cell on which pathloss reference signal switch occurs no later than the slot $i + T_{HARQ} + \left\lceil \frac{3\text{ ms} + 5 * T_{target_PL-RS} + 2\text{ ms}}{NR\ slot\ length} \right\rceil$ as defined in clause 8.14. The UE shall be able to apply old pathloss reference signals until the slot $i + T_{HARQ} + 3\text{N}_{\text{slot}}^{\text{subframe},\mu}$ as defined in clause 8.14.

The test equipment verifies the pathloss RS switch time by counting the slots from the time when the pathloss RS switch command is transmitted till a PHR is received during T3.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.4.5.1.1-1: MAC-CE based pathloss reference signal switch supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.19.4.5.1.1-2: General test parameters for MAC-CE based pathloss reference signal switch in SA

Parameter		Unit	Value	Comment
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
SSB Configuration	Config 1		SSB.1 FR1	

Parameter		Unit	Value	Comment
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz	
	Config 3		30 kHz	
SSB index assigned as pathloss RS			0 in T1, 0 in T2, 1 in T3	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			1x2 Low	
DRX			OFF	
Gap pattern ID			gp0	
phr-ProhibitTimer		sub frame	0	
phr-Tx-PowerFactorChange		dB	5	
phr-PeriodicTimer		sub frame	infinity	
Filter coefficient			0	L3 filtering is not used
T1		s	2	
T2		s	2	
T3		s	0.2	

Table A.19.4.5.1.1-3: NR Cell specific test parameters for MAC-CE based pathloss reference signal switch in SA

Parameter			Unit	Test 1		
				T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS			dB	4		
EPRE ratio of PDCCH to PDCCH DMRS			dB	0		
EPRE ratio of PBCH DMRS to SSS			dB	0		
EPRE ratio of PBCH to PBCH DMRS			dB			
EPRE ratio of PSS to SSS			dB			
EPRE ratio of PDSCH DMRS to SSS			dB			
EPRE ratio of PDSCH to PDSCH DMRS			dB			
EPRE ratio of OCNG DMRS to SSS			dB			
EPRE ratio of OCNG to OCNG DMRS			dB			
SSB with index 0	$\hat{E}_s / I_{ot}$		dB	7		
	N_{oc}	Config 1, 2, 3	dBm/15 kHz	-101		
	$\hat{E}_s / N_{oc}$		dB	7		
	SS-RSRP Note 4	Config 1, 2	dBm/ SCS	-94		
		Config 3		-91		
SSB with index 1	$\hat{E}_s / I_{ot}$		dB	-3		
	N_{oc}	Config 1, 2, 3	dBm/15 kHz	-101		
	$\hat{E}_s / N_{oc}$		dB	-3		
	SS-RSRP Note 4	Config 1, 2	dBm/ SCS	-104		
		Config 3		-101		
SSB with index 0 Io Note 5	Config 1, 2		dBm	-65.3/9.36 MHz		
	Config 3			-59.2/38.16 MHz		
SSB with index 1 Io Note 5	Config 1, 2		dBm	-71.28/9.36 MHz		
	Config 3			-65.18/38.16 MHz		
Propagation condition	Config 1, 2			AWGN +220 Hz		
	Config 3			AWGN +500 Hz		

NOTE 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
NOTE 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
NOTE 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
NOTE 5: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.

A.19.4.5.1.2 Test Requirements

During T3, the UE shall start to send the PHR for PCell no later than the slot $i + T_{HARQ} + \left\lceil \frac{3\text{ ms} + 5 * T_{target_PL-RS} + 2\text{ ms}}{NR\ slot\ length} \right\rceil$.

During T3, the UE shall start to send the PHR for PCell no earlier than the slot $i + T_{HARQ} + 3\mathrm{N}_{\mathrm{slot}}^{\mathrm{subframe},\mu}$.

Where, T_{HARQ} is the timing between pathloss reference MAC-CE activation command and acknowledgement as specified in [7], T_{target_PL-RS} is the periodicity of the target pathloss reference signal which is SSB in this test.

During T3, UE shall send L1-RSRP report with measurement results for both SSB0 and SSB1.

All of the above test requirements shall be fulfilled in order for the observed pathloss RS switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The UE shall be given proper uplink transmission grant during T2 and T3.

A.19.5 Measurement procedure

A.19.5.1 Intra-frequency Measurements

A.19.5.1.1 SA event triggered reporting tests without gap without SSB index reading under non-DRX

A.19.5.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2D.5.1 and 9.2D.5.2.

A.19.5.1.1.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test configurations are given in the Table A.19.5.1.1.2-1, the test parameters for PCell and neighbour cell refer to Table A.6.6.1.1.1.2-2 and A.6.6.1.1.1.2-3 except those described in the table A.19.5.1.1.2-2. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.5.1.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations.	

Table A.19.5.1.1.2-2: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1, 2	AWGN+220 Hz			
		3	AWGN+500 Hz			

A.19.5.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.19.5.1.2 SA event triggered reporting tests with per-UE gaps under non-DRX

A.19.5.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2D.6.2 and 9.2D.6.3.

A.19.5.1.2.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test configuration refer to Table A.6.6.1.3.2-1, the test parameters refer to Table A.6.6.1.3.2-2 and A.6.6.1.3.2-3, except those described in the table A.19.5.1.2.2-1. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.5.1.2.2-1: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1, 2	AWGN+220 Hz			
		3	AWGN+500 Hz			

A.19.5.1.2.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.19.5.1.3 SA event triggered reporting tests without gap under non-DRX with SSB index reading

A.19.5.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2D.5.1 and 9.2D.5.2.

A.19.5.1.3.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test configuration refer to Table A.6.6.1.5.2-1, the test parameters for FDD PCell and neighbour cell refer to Table A.6.6.1.5.2-2 and A.6.6.1.5.2-3 except those described in the table A.19.5.1.3.2-1. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.5.1.3.2-1: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1	AWGN+220 Hz			

A.19.5.1.3.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.19.5.1.4 SA event triggered reporting tests with per-UE gaps under non-DRX with SSB index reading

A.19.5.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2D.6.2 and 9.2D.6.3.

A.19.5.1.4.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test configuration refer to Table A.6.6.1.6.2-1, the test parameters refer to Table A.6.6.1.6.2-2 and A.6.6.1.6.2-3 except those described in the table A.19.5.1.4.2-1. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.5.1.4.2-1: NR Cell specific test parameters for SA intra-frequency event triggered reporting with gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1	AWGN+[220 Hz]			

A.19.5.1.4.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.19.5.2 Inter-frequency Measurements

A.19.5.2.1 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is used

A.19.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3D.4.

A.19.5.2.1.2 Test parameters

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test configuration refer to Table A.6.6.1.3.2-1. The general test parameters are given in table A.19.5.2.1.2-1. The cell specific test parameters refer to A.6.6.2.2.1-3, except those described in the table A.19.5.2.1.2-2.The DRX configuration is given in table A.19.5.2.1.2-3. The *TimeAlignmentTimer* configuration refers to Table A.6.6.2.2.1-5.

Measurement gap pattern configuration defined in table A.19.5.2.1.2-1 is per-UE gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE needs to be provided with new Timing Advance Command MAC control element at least once during each time alignment timer period to maintain uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.5.2.1.2-1: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR Cell 1 (Pcell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell2		NR Cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9		
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX. 7	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3 ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		Config 2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	1.1	11	

Table A.19.5.2.1.2-2: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1, 2	AWGN+220 Hz			
		3	AWGN+500 Hz			

Table A.19.5.2.1.2-3: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test1	Test2	Comment
	Value	Value	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

A.19.5.2.1.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.19.5.2.2 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is not used

A.19.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3D.4 and 9.3D.5.

A.19.5.2.2.2 Test parameters

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The test configurations refer to Tables A.6.6.2.5.1-1. The test parameters refer to Table A.6.6.2.5.1-2 and A.6.6.2.5.1-3 except those described in table A.19.5.2.2.2-1.

Measurement gap pattern configuration defined in table A.6.6.2.5.1-2 is per-UE gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.5.2.2.2-1: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1, 2	AWGN+220 Hz			
		3	AWGN+500 Hz			

A.19.5.2.2.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1040 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.19.5.2.3 SA event triggered reporting tests for FR1 without gap when DRX is not used

A.19.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3D.9.

A.19.5.2.3.2 Test parameters

In this test, there are two cells: NR Cell 1 as PCell in FR1 on NR RF channel 1 and NR Cell 2 as neighbour cell in FR1 on NR RF channel 2. The SSB of Cell 2 is completely within UE's active BWP BW. The RBs containing SSB from Cell 1 and Cell 2 should be different in frequency location within the cell bandwidth. The test configuration refer to Table A.6.6.2.11.1-1. The test parameters refer to Tables A.6.6.2.11.1-2 and A.6.6.2.11.1-3 except those described in table A.19.5.2.3.2-1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR Cell 2.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.5.2.3.2-1: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without gap

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
Propagation Condition		1, 2	AWGN+220 Hz			
		3	AWGN+500 Hz			

A.19.5.2.3.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90 %.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.19.5.3 L1-RSRP measurement for beam reporting for ATG

A.19.5.3.1 SSB based L1-RSRP measurement when DRX is not used

A.19.5.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5D.4.1, with the testing configurations for NR ATG cells in table A.19.5.3.1.1-1.

Table A.19.5.3.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test for ATG

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

A.19.5.3.1.2 Test parameters

There is one cell in the test, the FR1 PCell (Cell 1). The test parameters from Table A.6.6.4.1.2-1 and table A.6.6.4.1.2-2 are used except those described in table A.19.5.3.1.2-1.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.19.5.3.1.2-1: General test parameters

Parameter	Config	Unit	Value
Propagation condition	1,2		AWGN+220 Hz
	3		AWGN+500 Hz

A.19.5.3.1.3 Test Requirements

The test requirements of this test case are the same as those defined in clause A.6.6.4.1.3.

A.19.5.3.2 CSI-RS based L1-RSRP measurement when DRX is not used

A.19.5.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5D.4.2, with the testing configurations for NR ATG cells in table A.19.5.3.2.1-1.

Table A.19.5.3.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test for ATG

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

A.19.5.3.2.2 Test parameters

There is one cell in the test, the FR1 PCell (Cell 1). The test parameters from Table A.6.6.4.3.2-1 and table A.6.6.4.3.2-2 are used except those described in table A.19.5.3.2.2-1.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (0 for Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.6.6.4.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.19.5.3.2.2-1: General test parameters

Parameter	Config	Unit	Value
Propagation condition	1,2		AWGN+220 Hz
	3		AWGN+500 Hz

A.19.5.3.2.3 Test Requirements

The test requirements of this test case are the same as those defined in clause A.6.6.4.3.3.

A.19.5.4 L1-SINR measurement for beam reporting for ATG

A.19.5.4.1 L1-SINR measurement with CSI-RS based CMR and no dedicated IMR configured when DRX is not used

A.19.5.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements in clause 9.8D.4.1, with the testing configurations for NR ATG cells in table A.19.5.4.1.1-1.

Table A.19.5.4.1.1-1: Applicable NR configurations for FR1 CSI-RS based L1-SINR test for ATG

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

A.19.5.4.1.2 Test parameters

There is one cell in the test, the FR1 PCell (Cell 1). The test parameters from Table A.6.6.8.1.2-1 and table A.6.6.8.1.2-2 are used except those described in table A.19.5.4.1.2-1.

In the CSI-RS measurement configuration, UE is indicated to perform L1-SINR measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (1 Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.6.6.8.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.19.5.4.1.2-1: General test parameters

Parameter	Config	Unit	Value
DRX configuration	1~3		Off
Propagation condition	1,2		AWGN+220 Hz
	3		AWGN+500 Hz

A.19.5.4.1.3 Test Requirements

The test requirements of this test case are the same as those defined in clause A.6.6.8.1.3.

A.19.5.4.2 L1-SINR measurement with SSB based CMR and dedicated IMR when DRX is not used

A.19.5.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements in clause 9.8D.4.2, with the testing configurations for NR ATG cells in table A.19.5.4.2.1-1.

Table A.19.5.4.2.1-1: Applicable NR configurations for FR1 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR for ATG

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

A.19.5.4.2.2 Test parameters

There is one cell in the test, the FR1 PCell (Cell 1). The test parameters from Table A.6.6.8.2.2-1, table A.6.6.8.2.2-2, and table A.6.6.8.2.2-3 are used except those described in table A.19.5.4.2.2-1.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the SSBs and the associated CSI-RS resources, and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD measurements based on the SSBs, and UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-RS resources as IMR.

Table A.19.5.4.2.2-1: General test parameters

Parameter	Config	Unit	Value
Propagation condition	1,2		AWGN+220 Hz
	3		AWGN+500 Hz

A.19.5.4.2.3 Test Requirements

The test requirements of this test case are the same as those defined in clause A.6.6.8.2.3.

A.19.5.4.3 L1-SINR measurement with CSI-RS based CMR and dedicated IMR configured when DRX is not used

A.19.5.4.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-SINR measurement. This test will partly verify the L1-SINR measurement requirements with CSI-RS based CMR and dedicated IMR configured in clause 9.8D.4.3, with the testing configurations for NR ATG cells in table A.19.5.4.3.1-1.

Table A.19.5.4.3.1-1: Applicable NR configurations for FR1 L1-SINR test with CMR and dedicated IMR for ATG

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

A.19.5.4.3.2 Test parameters

There is one cell in the test, the FR1 PCell (Cell 1). The test parameters from Table A.6.6.8.3.2-1 and table A.6.6.8.3.2-2 are used except those described in table A.19.5.4.3.2-1.

In CSI measurement configuration, UE is indicated to perform L1-SINR measurement on the configured CSI-RS as CMR and an associated CSI-IM as IMR, and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-SINR on aperiodic CSI-RS resources. UE is also configured to measure L1-SINR based on SSB. After 80 ms from the beginning of the test, the DCI trigger comes in slot n (1 Config 1,2 and 8

for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in table A.6.6.8.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs, and UE is configured to perform L1-SINR measurement based on the CSI-RS as CMR and the CSI-IM as IMR.

Table A.19.5.4.3.2-1: General test parameters

Parameter	Config	Unit	Value
Propagation condition	1,2		AWGN+220 Hz
	3		AWGN+500 Hz

A.19.5.4.3.3 Test Requirements

The test requirements of this test case are the same as those defined in clause A.6.6.8.3.3

A.19.5.5 NR measurements with autonomous gaps for ATG

A.19.5.5.1 SA intra-frequency CGI identification of NR neighbor cell in FR1

A.19.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of intra-frequency CGI identification of an NR neighbour ATG cell in FR1 with autonomous gaps. This test shall partly verify the measurement requirements in clause 9.11D, with the testing configurations for NR ATG cells in table A.19.5.5.1.1-1

Table A.19.5.5.1.1-1: Supported test configurations for ATG

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE 1: The UE is only required to be tested in one of the supported test configurations	

A.19.5.5.1.2 Test Parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the FR1 PCell and Cell 2 is an FR1 neighbour cell on the same frequency as the PCell. The test parameters from Table A.6.6.7.1.2-2 and table A.6.6.7.1.2-3 are used except those described in A.19.5.5.1.2-1.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable. A measurement object is configured for the frequency of the PCell and it is indicated to the UE that event-triggered reporting with Event A3 is used. The UE is expected to detect and send a measurement report with Event A3.

A new RRC message triggering CGI identification shall be sent to the UE during period T2, after the UE has reported Event A3. The RRC message shall create a measurement report configuration with purpose *reportCGI* and *useAutonomousGaps* set to TRUE. The start of T3 is the instant when the last TTI containing the RRC message implying CGI identification is sent to the UE.

The test equipment verifies that potential interruption is carried out correctly by monitoring ACK/NACK sent in PCell during T3 until a measurement report with CGI is sent.

Table A.19.5.5.1.2-1: NR Cell specific test parameters for SA intra-frequency CGI identification of NR neighbor cell in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Propagation Condition		1,2	AWGN+220 Hz					

		3	AWGN+500 Hz

A.19.5.5.1.3 Test Requirements

The test requirements of this test case are the same as those defined in clause A.6.6.7.1.3

A.19.6 Measurement Performance requirements

Unless explicitly stated otherwise:

- Reported measurements shall be within defined range of accuracy limits defined in clause 10 for at least 90 % of the reported cases. If multiple measurement performance requirements are verified in the same test, the reported measurements for each requirement shall be within defined range of accuracy limits of the corresponding requirement defined in clause 10 for at least 90 % of the reported cases.
- Measurements are performed in RRC_CONNECTED state.
- The reference channels assume transmission of PDSCH with a maximum number of 5 HARQ transmissions unless otherwise specified.

A.19.6.1 SS-RSRP for ATG UE

A.19.6.1.1 SA: intra-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.2.1.1 and 10.1.2.1.2 for intra-frequency measurements.

A.19.6.1.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.19.6.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in table A.6.7.1.1.2-2, except those described in the Table A.19.6.1.1.2-2. In all test cases, Cell 1 is the PCell, and Cell 2 is the target cell.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.19.6.1.1.2-2: SS-RSRP Intra frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz		AWGN+500 Hz	

A.19.6.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil absolute requirement in clause 10.1.2.1.1 and relative requirement in clause 10.1.2.1.2.

A.19.6.1.2 SA inter-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.4.1.1 and 10.1.4.1.2 for inter-frequency measurements with the testing configurations for NR cells in table A.19.6.1.2.1-1.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.1.2.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.19.6.1.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters for the Cell 1 and Cell 2 are given in table A.19.6.1.2.2-1 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in table A.6.7.1.2.2-1, except those described in the Table A.19.6.1.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.19.6.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz	

A.19.6.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirement in clause 10.1.4.1.1 and relative requirement in clause 10.1.4.1.2.

A.19.6.2 SS-RSRQ for ATG UE

A.19.6.2.1 SA: Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.7.1.1.

A.19.6.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in table A.19.6.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is tested by using the parameters in table A.6.7.2.1.2-2, except those described in the given in table A.19.6.2.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.19.6.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz		AWGN+500 Hz	

A.19.6.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.7.1.1.

A.19.6.2.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.9.1.1 and 10.1.9.1.2.

A.19.6.2.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.19.6.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in table A.6.7.2.2.2-2 except those described in the Table A.19.6.2.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.19.6.2.2.2-2: SS-RSRQ Inter frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz		AWGN+500 Hz	

A.19.6.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.9.1.1 and 10.1.9.1.2.

A.19.6.3 SS-SINR for ATG UE

A.19.6.3.1 SA intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.12.1.1.

A.19.6.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A.19.6.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in table A.6.7.3.1.2-2, except those described in the Table A.19.6.3.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.19.6.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz	

A.19.6.3.1.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.12.1.1.

A.19.6.3.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.14.1.1 and 10.1.14.1.2.

A.19.6.3.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.19.6.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in table A.6.7.3.2.2-2, except those described in the Table A.19.6.3.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.19.6.3.2.2-2: SS-SINR Inter frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz		AWGN+500 Hz	

A.19.6.3.2.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.14.1.1 and 10.1.14.1.2.

A.19.6.4 L1-RSRP measurement for beam reporting for ATG UE

A.19.6.4.1 SSB based L1-RSRP measurement

A.19.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.5D.2 and clause 10.1.19.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in table A.19.6.4.1.1-1.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.19.6.4.1.2 Test parameters

In this set of test cases there one cell in the test, PCell (Cell 1).. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.6.7.4.1.2-1, except those described in the Table A.19.6.4.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.19.6.4.1.2-1: FR1 SSB based L1-RSRP test parameters

Parameter	Test configuration	Unit	Test 1	Test 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz	AWGN+220 Hz
	Config 3	-	AWGN+500 Hz	AWGN+500 Hz

A.19.6.4.1.3 Test Requirements

The L1-RSRP measurement accuracy for SSB resource reported by UE in L1-RSRP report (SSB#0 or SSB#1) of Cell 2 shall fulfil the requirements in clauses 10.1.19.1.

A.19.6.4.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.19.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.5D.3 and clause 10.1.19.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in table A.19.6.4.2.1-1.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.19.6.4.2.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in table A.6.7.4.2.2-2 is used except those described in the Table A.19.6.4.2.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.19.6.4.2.2-1: FR1 CSI-RS based L1-RSRP test parameters

Parameter	Test configuration	Unit	Test 1	Test 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz	AWGN+220 Hz
	Config 3	-	AWGN+500 Hz	AWGN+500 Hz

A.19.6.4.2.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS resource reported by UE in L1-RSRP report (CSI-RS#0 or CSI-RS#1) of Cell 1 shall fulfil the requirements in clause 10.1.19.2.

A.19.6.5 L1-SINR measurement for beam reporting based CMR for ATG UE

A.19.6.5.1 L1-SINR measurement with CSI-RS based CMR and no dedicated IMR configured and CSI-RS resource set with repetition off

A.19.6.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.8D.4.1 and clause 10.1.27.1 for L1-SINR measurements based on CSI-RS with the testing configurations for NR cells in table A.19.6.5.1.1-1.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.5.1.1-1: Applicable NR configurations for FR1 L1-SINR test with CSI-RS based CMR and no dedicated IMR configured

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.19.6.5.1.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1).The absolute and relative accuracy of L1-SINR measurements are tested by using the parameters in table A.6.7.9.1.2-1 except those described in table A.19.6.5.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.19.6.5.1.2-1: FR1 CSI-RS based L1-SINR test parameters

Parameter	Config	Unit	Test 1	Test 2
Propagation condition	1, 2		AWGN+220 Hz	AWGN+220 Hz
	3		AWGN+500 Hz	AWGN+500 Hz

A.19.6.5.1.3 Test Requirements

The L1-SINR measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 1 shall fulfil the requirements in clause 10.1.27.1.

A.19.6.5.2 L1-SINR measurement with SSB based CMR and dedicated IMR

A.19.6.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.8D.4.2 and clause 10.1.27.2 for L1-SINR measurements with SSB based CMR and dedicated CSI-RS based IMR, with the testing configurations for NR cells in table A.19.6.5.2.1-1.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.5.2.1-1: Applicable NR configurations for FR1 L1-SINR measurement test with SSB based CMR and CSI-RS based IMR

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.19.6.5.2.2 Test parameters

In this set of test cases there one cell in the test, PCell (Cell 1). The absolute accuracy of L1-SINR measurements are tested by using the parameters in table A.6.7.9.2.2-1 except those described in the Table A.19.6.5.2.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources and one CSI-RS resource set with two CSI-RS resource. UE is configured to perform RLM and BFD measurement based on the SSB resources 0 and 1. UE is configured to perform L1-SINR measurement based on the SSBs as CMR and the CSI-RS resources as IMR.

Table A.19.6.5.2.2-1: FR1 SSB based L1-SINR test parameters

Parameter	Config	Unit	Test 1	Test 2
Propagation condition	1, 2		AWGN+220 Hz	AWGN+220 Hz
	3		AWGN+500 Hz	AWGN+500 Hz

A.19.6.5.2.3 Test Requirements

The L1-SINR measurement accuracy for SSB#0+CSI-RS#0 and SSB#1+CSI-RS#1 of Cell 1 shall fulfil the requirements in clauses 10.1.27.2.

A.19.6.5.3 L1-SINR measurement with CSI-RS based CMR and dedicated IMR

A.19.6.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-SINR measurement accuracy is within the specified limits. This test will partly verify the requirements in clauses 9.8D.4.3 and clause 10.1.27.3 for L1-SINR measurements based on CSI-RS as CMR and CSI-IM as IMR with the testing configurations for NR cells in table A.19.6.5.3.1-1.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.5.3.1-1: Applicable NR configurations for FR1 L1-SINR measurement test with CSI-RS based CMR and CSI-IM based IMR

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.19.6.5.3.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The absolute and relative accuracy of L1-SINR measurements are tested by using the parameters in table A.6.7.9.3.2-1 except those described in table A.19.6.5.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources and one CSI-IM resource set with two CSI-IM resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB. UE is configured to perform L1-SINR measurement based on the configured CSI-RS as CMR and CSI-IM as IMR.

Table A.19.6.5.3.2-1: FR1 L1-SINR measurement test with CSI-RS based CMR and CSI-IM based IMR

Parameter	Config	Unit	Test 1	Test 2
Propagation condition	1, 2		AWGN+220 Hz	AWGN+220 Hz
	3		AWGN+500 Hz	AWGN+500 Hz

A.19.6.5.3.3 Test Requirements

The L1-SINR measurement accuracy for CSI-RS#0+CSI-IM#0 and CSI-RS#1+CSI-IM# of Cell 1 shall fulfil the requirements in clause 10.1.27.3.

A.19.6.6 CSI-RSRP for ATG UE

A.19.6.6.1 SA: intra-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.2.3.1 and 10.1.2.3.2 for CSI-RS intra-frequency measurements.

A.19.6.6.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.19.6.6.1.2-1. Both absolute and relative accuracy of CSI-RSRP intra-frequency measurements are tested by using the parameters in table A.6.7.10.1.2-2, except those described in the Table A.19.6.6.1.2-2. In all test cases, Cell 1 is the PCell, and Cell 2 is the target cell.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.6.1.2-1: CSI-RSRP intra frequency supported test configurations

Config	Description
1	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.19.6.6.1.2-2: CSI-RSRP intra frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz		AWGN+500 Hz	

A.19.6.6.1.3 Test Requirements

The CSI-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil absolute requirement in clause 10.1.2.3.1 and relative requirement in clause 10.1.2.3.2.

A.19.6.6.2 SA inter-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.4.3.1 and 10.1.4.3.2 for CSI-RS inter-frequency measurements with the testing configurations for NR cells in table A.19.6.6.2.1-1.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.6.2.1-1: Applicable NR configurations for FR1 inter-frequency CSI-RSRP accuracy test

Config	Description
1	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.19.6.6.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on a different frequency than the PCell. Both absolute and relative accuracy of CSI-RSRP inter-frequency measurements are tested by using the parameters in table A.6.7.10.2.2-1, except those described in the Table A.19.6.6.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.19.6.6.2.2-1: CSI-RSRP inter-frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz	

A.19.6.6.2.3 Test Requirements

The CSI-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirement in clause 10.1.4.3.1 and relative requirement in clause 10.1.4.3.2.

A.19.6.7 CSI-RSRQ for ATG UE

A.19.6.7.1 SA: Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.7.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.7.2.

A.19.6.7.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A.19.6.7.1.2-1. The absolute accuracy of CSI-RSRQ intra-frequency measurement is tested by using the parameters in table A.6.7.11.1.2-2, except those described in the Table A.19.6.7.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.7.1.2-1: Intra frequency CSI-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.19.6.7.1.2-2: CSI-RSRQ Intra frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz		AWGN+500 Hz	

A.19.6.7.1.3 Test Requirements

The CSI-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.7.2.

A.19.6.7.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.7.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.9.2.1 and 10.1.9.2.2.

A.19.6.7.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.19.6.7.2.2-1. Both absolute accuracy and relative accuracy requirements of CSI-RSRQ inter-frequency measurement are tested by using test parameters in table A.7.11.2.2-2, except those described in the Table A.19.6.7.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.7.2.2-1: CSI-RSRQ Inter frequency CSI-RSRQ supported test configurations

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.19.6.7.2.2-2: CSI-RSRQ Inter frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz		AWGN+500 Hz	

A.19.6.7.2.3 Test Requirements

The CSI-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.9.2.1 and 10.1.9.2.2.

A.19.6.8 CSI-SINR for ATG UE

A.19.6.8.1 SA intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.8.1.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.12.2.1.

A.19.6.8.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in table A.19.6.8.1.2-1. The absolute accuracy of CSI-SINR intra-frequency measurement is tested by using the parameters in table A.6.7.12.1.2-2, except those described in the Table A.19.6.8.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.8.1.2-1: CSI-SINR Intra frequency CSI-SINR supported test configurations

Config	Description
1	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.19.6.8.1.2-2: CSI-SINR Intra frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz	

A.19.6.8.1.3 Test Requirements

The CSI-SINR measurement accuracy shall fulfil the requirements in clause 10.1.12.2.1.

A.19.6.8.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.19.6.8.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CSI-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.14.2.1 and 10.1.14.2.2.

A.19.6.8.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in table A.19.6.8.2.2-1. Both absolute accuracy and relative accuracy requirements of CSI-SINR inter-frequency measurement are tested by using test parameters in table A.6.7.12.2.2-2, except those described in the Table A.19.6.8.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

UE positioning and UE speed are set by AT command. UE speed is 0km/h, UE specific positioning is emulated by test system.

The specific gNB reference location is emulated by test system.

Table A.19.6.8.2.2-1: CSI-SINR Inter frequency CSI-SINR supported test configurations

Config	Description
1	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB and CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB and CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
NOTE: The UE is only required to be tested in one of the supported test configurations	

Table A.19.6.8.2.2-2: CSI-SINR Inter frequency test parameters

Parameter	Test configuration	Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Propagation Condition	Config 1,2	-	AWGN+220 Hz		AWGN+220 Hz		AWGN+220 Hz	
	Config 3	-	AWGN+500 Hz		AWGN+500 Hz		AWGN+500 Hz	

A.19.6.8.2.3 Test Requirements

The CSI-SINR measurement accuracy shall fulfil the requirements in clause 10.1.14.2.1 and 10.1.14.2.2.

Annex B (normative): Conditions for RRM requirements applicability for operating bands

B.1 Conditions for NR RRC_IDLE state mobility

B.1.1 Introduction

In annex B.1, the following conditions are specified:

- UE conditions which shall apply for UE intra-frequency measurements procedures and requirements in clause 4,
- UE conditions which shall apply for UE inter-frequency measurements procedures and requirements in clause 4.

B.1.2 Conditions for measurements on NR intra-frequency cells for cell re-selection

This clause defines the following conditions for NR intra-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.1.2-1 for FR1 NR cells.

The conditions are defined in table B.1.2-2 for FR2 NR cells.

Table B.1.2-1: Conditions for intra-frequency cell re-selection in FR1

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	dB
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-121	≥ -4
	NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-120.5	
	NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-120	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-119.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-119	
	NR_FDD_FR1_F	-121.5	-118.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-118	
	NR_FDD_FR1_H	-120.5	-117.5	
	NR_FDD_FR1_N	-117.5	-114.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.1.2-2: Conditions for intra-frequency cell re-selection in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3						SSB Ês/Iot
			dBm / SCS_{SSB}						dB
			SCS_{SSB} = 120 kHz					SCS_{SSB} = 240 kHz	
			UE Power class					UE Power class	
			1	2	3	4	5	6	1, 2, 3, 4, 5, 6	
Conditions	Rx Beam Peak	n257	-107.3	-110.8	-109.1	-124.8+Y_4	-104.9	-104.9	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-4
		n258	-107.3	-110.8	-109.1	-124.8+Y_4	-105.1	-105.1		
		n259			-105.5		-102.0			
		n260	-104.3		-106.5	-122.8+Y_4				
		n261	-107.3	-110.8	-109.1	-124.8+Y_4		-104.9		
		n262	-102.3	-105.6	-103.6	-118.8+Y_4				
	Spherical coverage Note 1	n257	-99.3	-99.8	-98.2	-115.8+Z_4	-96.9	-96.9	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-4
		n259			-92.7					
		n258	-99.3	-99.8	-98.2	-115.8+Z_4	-97.1	-97.1		
		n260	-96.3		-93.9	-110.8+Z_4				
		n261	-99.3	-99.8	-98.2	-115.8+Z_4		-96.9		
		n262	-94.1	-93.7	-90.5	-106.7+Z_4				

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.1.2-2:

- The value of Y for Power class 4 is FFS, where Y_4 is the rough/fine beam gain difference in Rx beam peak direction for Power class 4

- The value of Z for Power class 4 is FFS, where Z_4 is the rough/fine beam gain difference in spherical coverage directions for Power class 4.

B.1.2A Conditions for measurements on NR intra-frequency cells under CCA for cell re-selection

This clause defines the following conditions for NR intra-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.1.2A-1 for FR1 NR cells under CCA.

Table B.1.2A-1: Conditions for intra-frequency cell re-selection in FR1 under CCA

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_CCA_FR1_I	-120	-117	≥ -4
	NR_CCA_FR1_J	-119.5	-116.5	
NOTE 1: NR operating band groups are as defined in clause 3.5.2.				

B.1.3 Conditions for measurements on NR inter-frequency cells for cell re-selection

This clause defines the following conditions for NR inter-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions defined in table B.1.2-1 for FR1 NR intra-frequency cell re-selection shall also apply for FR1 NR inter-frequency cells in this clause.

The conditions defined in table B.1.2-2 for FR2 NR intra-frequency cell re-selection shall also apply for FR2 NR inter-frequency cells in this clause.

B.1.3A Conditions for measurements on NR inter-frequency cells under CCA for cell re-selection

This clause defines the following conditions for NR inter-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions defined in table B.1.2A-1 for FR1 NR intra-frequency cells under CCA shall also apply to FR1 NR inter-frequency cells under CCA in this clause.

B.1.4 Conditions for measurements on NR intra-frequency cells for cell re-selection for RedCap

This clause defines the following conditions for RedCap NR intra-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.1.4-1 and table B.1.4-2 for 2 Rx and 1 Rx RedCap respectively for FR1 NR cells.

The conditions are defined in table B.1.4-3 for FR2 NR cells.

Table B.1.4-1: Conditions for intra-frequency cell re-selection in FR1 for 2Rx RedCap

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	dB
Conditions	NR_FDD_ FR1_A, NR_TDD_ FR1_A, NR_SDL_FR1_A	-124	-121	≥ -4
	NR_FDD_ FR1_B, NR_TDD_FR1_B	-123.5	-120.5	
	NR_FDD_ FR1_C NR_TDD_ FR1_C	-123	-120	
	NR_FDD_ FR1_D, NR_TDD_ FR1_D	-122.5	-119.5	
	NR_FDD_ FR1_E, NR_TDD_ FR1_E	-122	-119	
	NR_FDD_ FR1_F	-121.5	-118.5	
	NR_FDD_ FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-118	
	NR_FDD_ FR1_H	-120.5	-117.5	
	NR_FDD_ FR1_N	-117.5	-114.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.1.4-2: Conditions for intra-frequency cell re-selection in FR1 for 1Rx RedCap

Parameter	NR operating band groups Note1	Minimum SSB_RP	SSB Ês/Iot

		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	**SCS_{SSB} = 30 kHz**	
Conditions	NR_FDD_ FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-121	≥ -4
	NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-120.5	
	NR_FDD_ FR1_C NR_TDD_FR1_C	-123	-120	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-119.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-119	
	NR_FDD_FR1_F	-121.5	-118.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-118	
	NR_FDD_FR1_H	-120.5	-117.5	
	NR_FDD_ FR1_N	-117.5	-114.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.1.4-3: Conditions for intra-frequency cell re-selection in FR2 for RedCap

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3						SSB Ês/Iot
			dBm / SCS_{SSB}						dB
			SCS_{SSB} = 120 kHz					SCS_{SSB} = 240 kHz	
			UE Power class					UE Power class	
			1	2	3	4	5	7	1, 2, 3, 4, 5, 7
Conditions	Rx Beam Peak	n257	-107.3	-110.8	-109.1	-124.8+Y_4	-120.4+Y_5	-113.1+Y_7	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-4
		n258	-107.3	-110.8	-109.1	-124.8+Y_4	-120.6+Y_5	-113.1+Y_7		
		n261	-107.3	-110.8	-109.1	-124.8+Y_4		-113.1+Y_7		
	Spherical coverage Note 1	n257	-99.3	-99.8	-98.2	-115.8+Z_4	-112.4+Z_5	-102.2+Z_7	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-4
		n258	-99.3	-99.8	-98.2	-115.8+Z_4	-112.6+Z_5	-102.2+Z_7		
		n261	-99.3	-99.8	-98.2	-115.8+Z_4		-102.2+Z_7		

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.1.2-2:

- The value of Y for Power classes 4, 5 and 7 is FFS, where Y_4, Y_5 and Y_7 are the rough/fine beam gain differences in Rx beam peak direction for Power classes 4, 5 and 7 respectively

- The value of Z for Power classes 4, 5 and 7 is FFS, where Z_4 and Z_5 are the rough/fine beam gain differences in spherical coverage directions for Power classes 4, 5, and 7 respectively

B.1.5 Conditions for measurements on NR inter-frequency cells for cell re-selection for RedCap

This clause defines the following conditions for RedCap NR inter-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions defined in table B.1.4-1 and table B.1.4-2 for 2 Rx and 1 Rx RedCap respectively for FR1 RedCap NR intra-frequency cell re-selection shall also apply for FR1 RedCap NR inter-frequency cells in this clause.

The conditions defined in table B.1.4-3 for FR2 RedCap NR intra-frequency cell re-selection shall also apply for FR2 RedCap NR inter-frequency cells in this clause.

B.1.6 Conditions for measurements on NR intra-frequency cells for cell re-selection for satellite access

This clause defines the following conditions for NR intra-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band for satellite access.

The conditions are defined in table B.1.6-1 for FR1 NR cells.

Table B.1.6-1: Conditions for intra-frequency cell re-selection in FR1 for satellite access

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_SAB_FR1_A	-124	-121	≥ -4
NOTE 1: NR operating band groups for satellite access are defined in clause 3.5.2A.				

B.1.7 Conditions for measurements on NR inter-frequency cells for cell re-selection for satellite access

This clause defines the following conditions for NR inter-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band for satellite access.

The conditions defined in table B.1.6-1 for FR1 NR intra-frequency cell re-selection for satellite access shall also apply for FR1 NR inter-frequency cells for satellite access in this clause.

B.2 Conditions for UE measurements procedures and performance requirements in RRC_CONNECTED state

B.2.1 Introduction

B.2.1.1 General

In annex B.2, the following conditions are specified:

- The conditions for RRC connection release with redirection to NR requirements in clause 6.2.3.2.1,
- The conditions for UE transmit timing adjustment in clause 7.1
- UE conditions which shall apply for UE intra-frequency measurements procedures and requirements in clause 9,

UE conditions which shall apply for UE inter-frequency measurements procedures and requirements in clause 9,

- UE conditions which shall apply for UE intra-frequency measurements performance requirements in clause 10,
- UE conditions which shall apply for UE inter-frequency measurements performance requirements in clause 10.

B.2.1.2 Derivation of Minimum SSB_RP values for FR1

[FFS]

B.2.1.3 Derivation of Minimum SSB_RP values for FR2

Editor's note:

- The Assumption for UE beams (fine or rough) in annex A RRM test cases is defined based on power class 3, and unless otherwise stated also applies for other UE power classes

B.2.1.3.1 Minimum SSB_RP values for Rx Beam Peak angle of arrival

Minimum SSB_RP values in tables B.2.2-2 and B.2.3-2 are based on Reference sensitivity for the Operating band and for the UE power class, taking a baseline of UE Power class 3 in Band n260 with 50 MHz channel bandwidth.

Minimum SSB_RP = Reference sensitivity $_{PC3, n260, 50 MHz}$ +Y -10Log$_{10}$(PRB$_{Refsens}$ x 12) – SNR$_{Refsens}$ + SSB Ês/Iot + $\Delta MB_{P,n}$

where:

Reference sensitivity $_{PC3, n260, 50 MHz}$ is the reference sensitivity value in dBm specified for power class 3 in Band n260 for 50 MHz Channel bandwidth in table 7.3.2.3-1 of TS 38.101-2 [19];

Y is the gain difference between fine and rough beams, which is defined in table B.2.1.3.1-1;

Table B.2.1.3.1-1: Gain difference Y between fine and rough beams, Rx beam peak direction

Value "Y" in dB, for each UE power class						
1	**2**	**3**	**4**	**5**	**6**	**7**
18	9.0	7.0	FFS	15.5	15.5	FFS

PRB$_{Refsens}$ is N$_{PRB}$ associated with subcarrier spacing 120 kHz for 50 MHz in TS 38.101-2 [19] Table 5.3.2-1, and is 32;

12 is the number of subcarriers in a PRB;

SNR$_{Refsens}$ is the SNR used for simulation of Refsens and EIS spherical coverage, and is -1 dB;

SSB Ês/Iot is the minimum value required by the UE to perform measurements, and is -6 dB for intra-frequency measurements and -4 dB for inter-frequency measurements. The only contribution to Iot is the UE internal noise;

$\Delta MB_{P,n}$ is the UE multi-band relaxation factor value in dB specified in TS 38.101-2 [19] clause 6.2.1.

The calculated Minimum SSB_RP value for the baseline of UE power class 3 in Band n260 is (-109.5+$\Delta MB_{P,n}$) dBm/120 kHz for intra-frequency measurements and (-107.5+$\Delta MB_{P,n}$) dBm/120 kHz for inter-frequency measurements.

The following methodology to define the Minimum SSB_RP level for power class X (PC_X) and operating band Y (Band_Y) is used:

For Intra-frequency: Minimum SSB_RP (PC_X, Band_Y) = -109.5 dBm/120 kHz + Refsens $_{PC_X, Band_Y, 50 MHz}$ – Refsens $_{PC3, n260, 50 MHz}$ + Y $_{PC_X}$ – Y $_{PC3}$ +$\Delta MB_{P,n}$,

For Inter-frequency: Minimum SSB_RP (PC_X, Band_Y) = -107.5 dBm/120 kHz + Refsens $_{PC_X, Band_Y, 50 MHz}$ – Refsens $_{PC3, n260, 50 MHz}$ + Y $_{PC_X}$ – Y $_{PC3}$ +$\Delta MB_{P,n}$.

B.2.1.3.2 Minimum SSB_RP values for angle of arrival within Spherical coverage

Minimum SSB_RP values in tables B.2.2-2 and B.2.3-2 are based on EIS spherical coverage for the Operating band and for the UE power class, taking a baseline of UE power class 3 in Band n260 with 50 MHz channel bandwidth.

Minimum SSB_RP = EIS spherical coverage $_{PC3, n260, 50 MHz}$ +Z -10Log$_{10}$(PRB$_{Refsens}$ x 12) – SNR$_{Refsens}$ + SSB Ês/Iot + $\Delta MB_{S,n}$

where:

EIS spherical coverage $_{PC3, n260, 50 MHz}$ is the EIS spherical coverage value in dBm specified for power class 3 in Band n260 for 50 MHz Channel bandwidth in TS 38.101-2 [19] Table 7.3.4.3-1;

Z is the gain difference between fine and rough beams, and is defined in table B.2.1.3.2-1;

Table B.2.1.3.2-1: Gain difference Z between fine and rough beams, Spherical coverage directions

Value "Z" in dB, for each UE power class						
1	**2**	**3**	**4**	**5**	**6**	**7**
18	9.0	7.0	FFS	15.5	15.5	FFS

PRB$_{Refsens}$ is N_{PRB} associated with subcarrier spacing 120 kHz for 50 MHz in TS 38.101-2 [19] Table 5.3.2-1, and is 32;

12 is the number of subcarriers in a PRB;

SNR$_{Refsens}$ is the SNR used for simulation of Refsens and EIS spherical coverage, and is -1 dB;

SSB Ês/Iot is the minimum value required by the UE to perform measurements, and is -6 dB for intra-frequency measurements and -4 dB for inter-frequency measurements. The only contribution to Iot is the UE internal noise;

$\Delta MB_{S,n}$ is the UE multi-band relaxation factor value in dB specified in TS 38.101-2 [19] clause 6.2.1.

The calculated Minimum SSB_RP value for the baseline of UE power class 3 in Band n260 is (-96.9+$\Delta MB_{S,n}$) dBm/120 kHz for intra-frequency measurements and is (-94.9+$\Delta MB_{S,n}$) dBm/120 kHz for inter-frequency measurements.

The following methodology to define the Minimum SSB_RP level for power class X (PC_X) and operating band Y (Band_Y) is used:

For Intra-frequency: Minimum SSB_RP (PC_X, Band_Y) = -96.9 dBm/120 kHz + EIS spherical coverage $_{PC_X, Band_Y, 50 MHz}$ – EIS spherical coverage $_{PC3, n260, 50 MHz}$ + Z $_{PC_X}$ – Z $_{PC3}$ +$\Delta MB_{S,n}$

For Inter-frequency: Minimum SSB_RP (PC_X, Band_Y) = -94.9 dBm/120 kHz + EIS spherical coverage $_{PC_X, Band_Y, 50 MHz}$ – EIS spherical coverage $_{PC3, n260, 50 MHz}$ + Z $_{PC_X}$ – Z $_{PC3}$ +$\Delta MB_{S,n}$

B.2.1.4 Gain to SS-RSRP and CSI-RSRP measurement point for FR1

In FR1 conducted requirements are specified at the UE antenna connector, which is also the SS-RSRP and CSI-RSRP measurement point.

B.2.1.5 Gain to SS-RSRP and CSI-RSRP measurement point for FR2

B.2.1.5.1 Gain to SS-RSRP and CSI-RSRP measurement point for Rx Beam Peak angle of arrival

In clause 5.1.1 of TS 38.215 [4] SS-RSRP and CSI-RSRP is defined to be measured based on the combined signal from antenna elements corresponding to a given receiver branch. The reference point for requirement parameters from the UE perspective is the input of the UE antenna array. The gain “G” relates the combined signal from antenna elements corresponding to a given receiver branch to the reference point for requirement parameters.

The gain “G” affects absolute signal level values reported by the UE.

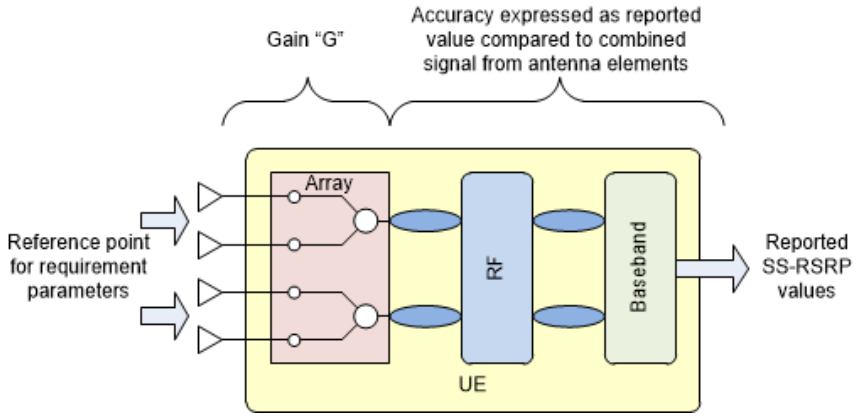


Figure B.2.1.5.1-1: Gain and Reference point for requirement parameters

Table B.2.1.5.1-1: UE gain G, Rx beam peak direction

	UE Power class						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Minimum, dBi	0	FFS	-10	FFS	-5	-5	FFS
Maximum, dBi	+50	FFS	+20	FFS	+44	+44	FFS

Gain range in spherical coverage directions may be lower than in Rx beam peak direction, according to the difference between the EIS spherical coverage value specified in TS 38.101-2 [19] clause 7.3.4 and the Reference sensitivity level specified in TS 38.101-2 [19] clause 7.3.2.

B.2.1.5.2 Gain to SS-RSRP measurement point for different frequency

In any specific direction, the UE gain G may be different depending on frequencies. The gain "G_{inter}" affects relative signal level values reported by the UE when measuring between different frequencies and is specified in table B.2.1.5.2-1 for each power class.

Table B.2.1.5.2-1: UE gain difference between inter-frequencies G_{inter}

	UE Power class						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Maximum difference, dB	3	FFS	3	FFS	[3]	[3]	FFS

B.2.1.5.3 Alignment of Rough beam to Rx beam Peak

The definition of Rx Beam Peak in TS 38.101-2 [19] clause 7.3.2 is based on Throughput at Reference sensitivity power level, and assumes use of Fine beams. In many RRM scenarios the UE can use Rough beams, but the largest Rough beam gain direction may not be aligned to the Fine beam Peak direction.

When the Rx Beam Peak is selected and defined based on Fine Beams, the rough beam gain in that direction may be lower than the largest rough beam gain in another direction within Spherical Coverage. The term "D" is the maximum allowed rough beam gain reduction, and is specified in table B.2.1.5.3-1 for each power class.

Table B.2.1.5.3-1: Rough Beam gain reduction "D" in Rx Beam Peak direction

	1	**2**	**3**	**4**	**5**	**6**	**7**
Maximum gain reduction, dB	11.5	FFS	5.5	FFS	10	10	FFS

B.2.1.6 Gain to PRS-RSRP measurement point for FR2

B.2.1.6.1 Gain to PRS-RSRP measurement point for Rx Beam Peak angle of arrival

In clause 5.1.28 of TS 38.215 [4] PRS-RSRP is defined to be measured based on the combined signal from antenna elements corresponding to a given receiver branch. The reference point for requirement parameters from the UE perspective is the input of the UE antenna array. The gain "G" relates the combined signal from antenna elements corresponding to a given receiver branch to the reference point for requirement parameters.

The gain "G" affects absolute signal level values reported by the UE.

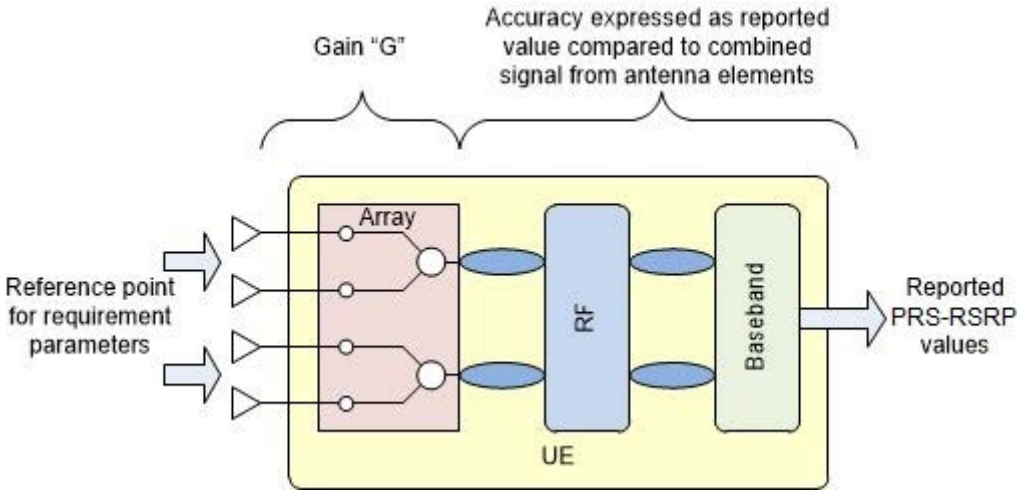


Figure B.2.1.6.1-1: Gain and Reference point for requirement parameters

The gain range for each power class is specified in table B.2.1.61-1.

Table B.2.1.6.1-1: UE gain G, Rx beam peak direction

	UE Power class				
	1	2	3	4	7
Minimum, dBi	FFS	FFS	-10	FFS	FFS
Maximum, dBi	FFS	FFS	+20	FFS	FFS

Gain range in spherical coverage directions may be lower than in Rx beam peak direction, according to the difference between the EIS spherical coverage value specified in TS 38.101-2 [19] clause 7.3.4 and the Reference sensitivity level specified in TS 38.101-2 [19] clause 7.3.2.

B.2.1.7 Derivation of Minimum SSB_RP values for FR2-NTN for satellite access

B.2.1.7.1 Minimum SSB_RP values for Rx Beam

Minimum SSB_RP values to be used in clauses B.2.17 and B.2.18 are based on Reference sensitivity for the Operating band and for the UE VSAT Type, taking as baseline Band n512 with 50 MHz channel bandwidth.

Minimum SSB_RP = Reference sensitivity $_{UE_Type,\ n512,\ 50\ MHz}$ +Y -10Log$_{10}$(PRB$_{Refsens}$ x 12) – SNR$_{Refsens}$ + SSB Ês/Iot + $\Delta MB_{P,n}$

where:

Reference sensitivity $_{UE_Type,\ n512,\ 50\ MHz}$ is the reference sensitivity value in dBm declared for each UE vendor and following the range specified for each VSAT UE type in Band n512 for 50 MHz Channel bandwidth in table 10.3.2-2 of TS 38.101-5 [42];

Y is the gain difference between fine and rough beams, which is defined in table B.2.1.7.1-1;

Table B.2.1.7.1-1: Gain difference Y between fine and rough beams, Rx beam peak direction

UE VSAT Type	1 and 4 (mechanically steered antenna)	2, 3 and 5 (electronically steered antenna)
Gain "Y" (dB)	0	[FFS]

$PRB_{Refsens}$ is N_{PRB} associated with subcarrier spacing 120 kHz for 50 MHz in TS 38.101-5 [41] Table 5.3.2-2, and is 32;

12 is the number of subcarriers in a PRB;

$SNR_{Refsens}$ is the SNR used for simulation of Refsens and EIS spherical coverage, and is -1 dB;

SSB $\hat{E}s/Iot$ is the minimum value required by the UE to perform measurements, and is -6 dB for intra-frequency measurements and -4 dB for inter-frequency measurements. The only contribution to Iot is the UE internal noise;

$\Delta MB_{P,n}$ is 0.

The following methodology to define the Minimum SSB_RP level for VSAT UE Type X(VSAT_X) and operating band Y (Band_Y) is used:

For Intra-frequency: Minimum SSB_RP (VSAT_X, Band_Y) = Intra-frequency Minimum SSB_RP (VSAT_X, Band_512) + $Refsens_{VSAT_X,\ Band_Y,\ 50\ MHz} - Refsens_{VSAT_X,\ n512,\ 50\ MHz}$;

For Inter-frequency: Minimum SSB_RP (VSAT_X, Band_Y) = Inter-frequency Minimum SSB_RP (VSAT_X, Band_512) + $Refsens_{VSAT_X,\ Band_Y,\ 50\ MHz} - Refsens_{VSAT_X,\ n512,\ 50\ MHz}$;

B.2.1.8 Gain to SS-RSRP for FR2-NTN for satellite access

In clause 5.1.1 of TS 38.215 [4] SS-RSRP and CSI-RSRP is defined to be measured based on the combined signal from antenna elements corresponding to a given receiver branch. The reference point for requirement parameters from the UE perspective is the input of the UE antenna array. The gain "G" relates the combined signal from antenna elements corresponding to a given receiver branch to the reference point for requirement parameters.

The gain "G" affects absolute signal level values reported by the UE.

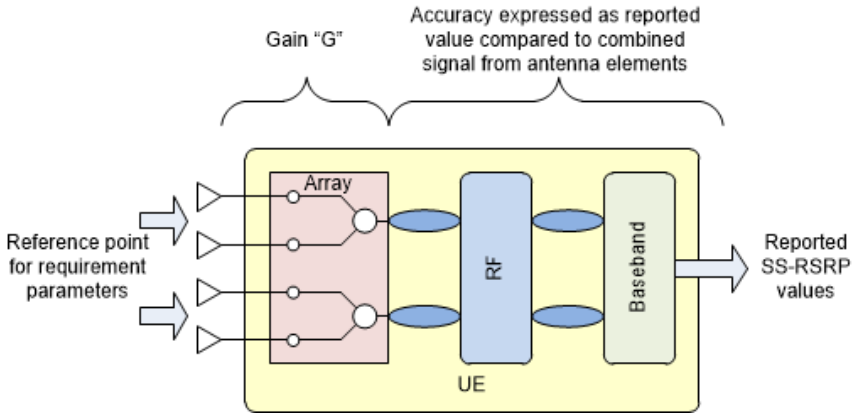


Figure B.2.1.8.1-1: Gain and Reference point for requirement parameters

The gain range for each type of VSAT equipment is specified in table B.2.1.8.1-1.

Table B.2.1.8.1-1: NTN gain G

	VSAT type 3	VSAT type 1/2/4/5
Minimum, dBi	25.6	28.5

Maximum, dBi	From 45 to 55	From 45 to 55

B.2.2 Conditions for NR intra-frequency measurements

This clause defines the following conditions for NR intra-frequency measurements and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.2-1 for FR1 NR cells.

The conditions are defined in table B.2.2-2 for FR2 NR cells.

Table B.2.2-1: Conditions for intra-frequency measurements in FR1

Parameter	NR operating band groups [Note1]	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	dB
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	≥ -6
	NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-123.5	
	NR_TDD_FR1_C	-126	-123	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	
	NR_FDD_FR1_F	-124.5	-121.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	
	NR_FDD_FR1_H	-123.5	-120.5	
	NR_FDD_ FR1_N	-120.5	-117.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.2-2: Conditions for intra-frequency measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3							SSB Ês/Iot
			dBm / SCS_{SSB}							dB
			SCS_{SSB} = 120 kHz						SCS_{SSB} = 240 kHz	
			UE Power class						UE Power class	
			1	2	3	4	5	6	1, 2, 3, 4, 5, 6	
Conditions	Rx Beam Peak	n257	-110.3	-113.8	-112.1	-127.8+Y_4	-123.4+Y_5	-107.9	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-6
		n258	-110.3	-113.8	-112.1	-127.8+Y_4	-123.6+Y_5	-108.1		
		n259			-108.5		-120.5+Y_5			
		n260	-107.3		-109.5	-125.8+Y_4				
		n261	-110.3	-113.8	-112.1	-127.8+Y_4		-107.9		
		n262	-105.3	-108,6	-106.6	-121.8+Y_4				
	Spherical coverage Note 1	n257	-102.3	-102.8	-101.2	-118.8+Z_4	-115.4+Z_5	-99.9	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-6
		n258	-102.3	-102.8	-101.2	-118.8+Z_4	-115.6+Z_5	-100.1		
		n259			-95.7					
		n260	-99.3		-96.9	-113.8+Z_4				
		n261	-102.3	-102.8	-101.2	-118.8+Z_4		-99.9		
		n262	-97.1	-96.7	-93.5	-109.7+Z_4				

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.2.2-2:

- The value of Y for power classes 4 and 5 is FFS, where Y_4 and Y_5 are the rough/fine beam gain differences in Rx beam peak direction for power classes 4 and 5 respectively

- The value of Z for power classes 4 and 5 is FFS, where Z_4 and Z_5 are the rough/fine beam gain differences in spherical coverage directions for power classes 4 and 5 respectively.

B.2.3 Conditions for NR inter-frequency measurements

This clause defines the following conditions for NR inter-frequency measurements and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.3-1 for FR1 NR cells.

The conditions are defined in table B.2.3-2 for FR2 NR cells.

Table B.2.3-1: Conditions for inter-frequency measurements in FR1

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-125	-122	≥ -4
	NR_FDD_FR1_B, NR_TDD_FR1_B	-124.5	-121.5	
	NR_FDD_FR1_C , NR_TDD_FR1_C	-124	-121	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-124.5	-120.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-123	-120	
	NR_FDD_FR1_F	-122.5	-119.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-122	-119	
	NR_FDD_FR1_H	-121.5	-118.5	
	NR_FDD_ FR1_N	-118.5	-115.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.3-2: Conditions for inter-frequency measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3							SSB Ês/Iot
			dBm / SCS_{SSB}							dB
			SCS_{SSB} = 120 kHz						SCS_{SSB} = 240 kHz	
			UE Power class						UE Power class	
			1	2	3	4	5	6	1, 2, 3, 4, 5, 6	
Conditions	Rx Beam Peak	n257	-108.3	-111.8	-110.1	-125.8+Y_4	-121.4+Y_5	-105.9	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-4
		n258	-108.3	-111.8	-110.1	-125.8+Y_4	-121.6+Y_5	-106.1		
		n259			-106.5		-118.5+Y_5			
		n260	-105.3		-107.5	-123.8+Y_4				
		n261	-108.3	-111.8	-110.1	-125.8+Y_4		-105.9		
		n262	-103.3	-106.6	-104.6	-119.8+Y_4				
	Spherical coverage Note 1	n257	-100.3	-100.8	-99.2	-116.8+Z_4	-113.4+Z_5	-97.9	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-4
		n258	-100.3	-100.8	-99.2	-116.8+Z_4	-113.6+Z_5	-98.1		
		n259			-93.7					
		n260	-97.3		-94.9	-111.8+Z_4				
		n261	-100.3	-100.8	-99.2	-116.8+Z_4		-97.9		
		n262	-95.1	-94.7	-91.5	-107.7+Z_4				

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.2.3-2:

- The value of Y for power classes 4 and 5 is FFS, where Y_4 and Y_5 are the rough/fine beam gain differences in Rx beam peak direction for power classes 4 and 5 respectively

- The value of Z for power classes 4 and 5 is FFS, where Z_4 and Z_5 are the rough/fine beam gain differences in spherical coverage directions for power classes 4 and 5 respectively

B.2.4 Conditions for NR L1-RSRP reporting

B.2.4.1 Conditions for SSB based L1-RSRP reporting

This clause defines the following conditions for NR L1-RSRP measurement reporting and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.4.1-1 for FR1 NR cells.

The conditions are defined in table B.2.4.1-2 for FR2 NR cells.

Table B.2.4.1-1: Conditions for SSB based L1-RSRP measurements in FR1

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-121	≥ -3
	NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-120.5	
	NR_TDD_FR1_C	-123	-120	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-119.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-119	
	NR_FDD_FR1_F	-121.5	-118.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-118	
	NR_FDD_FR1_H	-120.5	-117.5	
	NR_FDD_ FR1_N	-117.5	-114.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.4.1-2: Conditions for SSB based L1-RSRP measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3							SSB Ês/Iot
			dBm / SCS_{SSB}							dB
			SCS_{SSB} = 120 kHz						SCS_{SSB} = 240 kHz	
			UE Power class						UE Power class	
			1	2	3	4	5	6	1, 2, 3, 4, 5	
Conditions	Rx Beam Peak	n257	-107.3	-110.8	-109.1	-124.8+Y_4	-120.4+Y_5	-120.4+ Y_6	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-3
		n258	-107.3	-110.8	-109.1	-124.8+Y_4	-120.6+Y_5	-120.6+ Y_6		
		n259			-105.5		-117.5+Y_5			
		n260	-104.3		-106.5	-122.8+Y_4				
		n261	-107.3	-110.8	-109.1	-124.8+Y_4		-120.4+ Y_6		
		n262	-102.3	-105.6	-103.6	-118.8+Y_4				
	Spherical coverage Note 1	n257	-99.3	-99.8	-98.2	-115.8+Z_4	-112.4+Z_5	-112.4+Z_6	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-3
		n258	-99.3	-99.8	-98.2	-115.8+Z_4	-112.6+Z_5	-112.6+Z_6		
		n259			-92.7					
		n260	-96.3		-93.9	-110.8+Z_4				
		n261	-99.3	-99.8	-98.2	-115.8+Z_4		-112.4+Z_6		
		n262	-94.3	-93.7	-90.5	-106.7+Z_4				

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.2.4.1-2:

- The value of Y for power classes 4 and 5 is FFS, where Y_4 and Y_5 are the rough/fine beam gain differences in Rx beam peak direction for power classes 4 and 5 respectively

- The value of Z for power classes 4 and 5 is FFS, where Z_4 and Z_5 are the rough/fine beam gain differences in spherical coverage directions for power classes 4 and 5 respectively

B.2.4.2 Conditions for CSI-RS based L1-RSRP reporting

This clause defines the following conditions for NR L1-RSRP measurement reporting and corresponding procedures performed based on CSI-RS: CSI-RS_RP and CSI-RS Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.4.2-1 for FR1 NR cells.

The conditions are defined in table B.2.4.2-2 for FR2 NR cells.

Table B.2.4.2-1: Conditions for CSI-RS based L1-RSRP measurements in FR1

Parameter	NR operating band groups Note1	Minimum CSI-RS_RP			CSI-RS Ês/Iot
		dBm / SCS_{CSI-RS}			dB
		SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-121	-118	≥ -3
	NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-120.5	-117.5	
	NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-120	-117	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-119.5	-116.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-119	-116	
	NR_FDD_FR1_F	-121.5	-118.5	-115.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-118	-115	
	NR_FDD_FR1_H	-120.5	-117.5	-114.5	
	NR_FDD_ FR1_N	-117.5	-114.5	-111.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.					

Table B.2.4.2-2: Conditions for CSI-RS based L1-RSRP measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum CSI-RS_RP Note 2, Note 3						CSI-RS Ês/Iot
			dBm / SCS_{CSI-RS}						dB
			SCS_{CSI-RS} = 60 kHz					SCS_{CSI-RS} = 120 kHz	
			UE Power class					UE Power class	
			1	2	3	4	5	1, 2, 3, 4, 5	
Conditions	Rx Beam Peak	n257	-110.3	-113.8	-112.1	-127.8+Y_4	-123.4+Y_5	(Value for SCS_{CSI-RS} = 60 kHz) +3 dB	≥-3
		n258	-110.3	-113.8	-112.1	-127.8+Y_4	-123.6+Y_5		
		n259			-108.5		-120.5+Y_5		
		n260	-107.3		-109.5	-125.8+Y_4			
		n261	-110.3	-113.8	-112.1	-127.8+Y_4			
		n262	-105.3	-108.6	-106.6	-121.8+Y_4			
	Spherical coverage Note 1	n257	-102.3	-102.8	-101.2	-118.8+Z_4	-115.4+Z_5	(Value for SCS_{CSI-RS} = 60 kHz) +3 dB	≥-3
		n258	-102.3	-102.8	-101.2	-118.8+Z_4	-115.6+Z_5		
		n259			-95.7				
		n260	-99.3		-96.9	-113.8+Z_4			
		n261	-102.3	-102.8	-101.2	-118.8+Z_4			
		n262	-97.1	-96.7	-93.5	-109.7+Z_4			

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum CSI-RS Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.2.4.2-2:

- The value of Y for power classes 4 and 5 is FFS, where Y_4 and Y_5 are the rough/fine beam gain differences in Rx beam peak direction for power classes 4 and 5 respectively

- The value of Z for power classes 4 and 5 is FFS, where Z_4 and Z_5 are the rough/fine beam gain differences in spherical coverage directions for power classes 4 and 5 respectively

B.2.5 Conditions for RRC connection release with redirection to NR

This clause defines the following conditions for RRC connection release with redirection to NR: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.5-1 for FR1 NR cells.

The conditions are defined in table B.2.5-2 for FR2 NR cells.

Table B.2.5-1: Conditions for for RRC connection release with redirection to NR in FR1

Parameter	NR operating band groups [Note1]	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-125	-122	≥ -4
	NR_FDD_FR1_B, NR_TDD_FR1_B	-124.5	-121.5	
	NR_FDD_FR1_C, NR_TDD_FR1_C	-124	-121	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-124.5	-120.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-123	-120	
	NR_FDD_FR1_F	-122.5	-119.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-122	-119	
	NR_FDD_FR1_H	-121.5	-118.5	
	NR_FDD_ FR1_N	-118.5	-115.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.5-2: Conditions for RRC connection release with redirection to NR in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3						SSB Ês/Iot
			dBm / SCS_{SSB}						dB
			SCS_{SSB} = 120 kHz					SCS_{SSB} = 240 kHz	
			UE Power class					UE Power class	
			1	2	3	4	5	1, 2, 3, 4, 5	
Conditions	Rx Beam Peak	n257	-108.3	-111.8	-110.1	-125.8+Y_4	-121.4+Y_5	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-4
		n258	-108.3	-111.8	-110.1	-125.8+Y_4	-121.6+Y_5		
		n259			-106.5		-118.5+Y_5		
		n260	-105.3		-107.5	-123.8+Y_4			
		n261	-108.3	-111.8	-110.1	-125.8+Y_4			
		n262	-103.3	-106.6	-104.6	-119.8+Y_4			
	Spherical coverage Note 1	n257	-100.3	-100.8	-99.2	-116.8+Z_4	-113.4+Z_5	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-4
		n258	-100.3	-100.8	-99.2	-116.8+Z_4	-113.6+Z_5		
		n259			-93.7				
		n260	-97.3		-94.9	-111.8+Z_4			
		n261	-100.3	-100.8	-99.2	-116.8+Z_4			
		n262	-95.1	-94.7	-91.5	-107.7+Z_4			

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.2.5.2-2:

- The value of Y for power classes 4 and 5 is FFS, where Y_4 and Y_5 are the rough/fine beam gain differences in Rx beam peak direction for power classes 4 and 5 respectively

- The value of Z for power classes 4 and 5 is FFS, where Z_4 and Z_5 are the rough/fine beam gain differences in spherical coverage directions for power classes 4 and 5 respectively

B.2.6 Void

B.2.6.1 Void

Table B.2.6.1-1: Void

Table B.2.6.1-2: Void

B.2.6.2 Void

B.2.7 Conditions for SRS-RSRP measurements

This clause defines the following conditions for SRS-RSRP measurement and corresponding procedures performed based on SRSs: SRS_RP and SRS Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.7-1 for FR1 NR cells.

The conditions are defined in table B.2.7-2 for FR2 NR cells.

Table B.2.7-1: Conditions for SRS-RSRP measurements in FR1

Parameter	NR operating band groups Note1	Minimum SRS_RP			SRS Ês/Iot
		dBm / SCS_{SRS}			dB
		SCS_{SRS} = 15 kHz	SCS_{SRS} = 30 kHz	SCS_{SRS} = 60 kHz	
Conditions	NR_TDD_FR1_A	-120	-117	-114	≥ 1
	NR_TDD_FR1_C	-119	-116	-113	
	NR_TDD_FR1_D	-118.5	-115.5	-112.5	
	NR_TDD_FR1_E	-118	-115	-112	
	NR_TDD_FR1_F	-117.5	-114.5	-111.5	
	NR_TDD_FR1_G	-117	-114	-111	
NOTE 1: NR operating band groups are defined in clause 3.5.2.					

Table B.2.7-2: Conditions for SRS-RSRP measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SRS_RP Note 2, Note 3						SRS Ês/Iot
			dBm / SCS_{SRS}						dB
			SCS_{SRS} = 60 kHz					SCS_{SRS} = 120 kHz	
			UE Power class					UE Power class	
			1	2	3	4	5	1, 2, 3, 4, 5	
Conditions	Rx Beam Peak	n257	-124.5	-119.0	-115.3	-124.0	-119.6	(Value for SCS_{SRS} = 60 kHz) +3 dB	≥1
		n258	-124.5	-119.0	-115.3	-124.0	-119.8		
		n260	-121.5		-112.7	-122.0			
		n261	-124.5	-119.0	-115.3	-124.0			
	Spherical coverage Note 1	n257	-116.5	-108.0	-104.4	-115.0	-111.6	(Value for SCS_{SRS} = 60 kHz) +3 dB	≥1
		n258	-116.5	-108.0	-104.4	-115.0	-111.8		
		n260	-113.5		-100.1	-110.0			
		n261	-116.5	-108.0	-104.4	-115.0			
NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met. NOTE 2: Values specified at the Reference point to give minimum SRS Ês/Iot, with no applied noise. NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].										

B.2.8 Conditions for NR L1-SINR reporting

B.2.8.1 Conditions for L1-SINR reporting with CSI-RS based CMR and no dedicated IMR configured

This clause defines the following conditions for NR L1-SINR measurement reporting and corresponding procedures performed based on CSI-RSs: CSI-RS_RP and CSI-RS Ês/Iot, applicable for a corresponding operating band.

The conditions defined in table B.2.8.1-1 for FR1 NR cells.

The conditions defined in table B.2.8.1-2 for FR2 NR cells.

Table B.2.8.1-1: Conditions for L1-SINR measurements with CSI-RS based CMR only in FR1

Parameter	NR operating band groups Note1	Minimum CSI-RS_RP			CSI-RS CMR Ês/Iot
		dBm / SCS_{CSI-RS}			dB
		SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-121	-118	≥ -3
	NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-120.5	-117.5	
	NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-120	-117	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-119.5	-116.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-119	-116	
	NR_FDD_FR1_F	-121.5	-118.5	-115.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-118	-115	
	NR_FDD_FR1_H	-120.5	-117.5	-114.5	
	NR_FDD_ FR1_N	-117.5	-114.5	-111.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.					

Table B.2.8.1-2: Conditions for L1-SINR measurements with CSI-RS based CMR only in FR2

Parameter	Angle of arrival	NR operating bands	Minimum CSI-RS_RP Note 2, Note 3						CSI-RS CMR Ês/Iot
			dBm / SCS_{CSI-RS}						dB
			SCS_{CSI-RS} = 60 kHz					SCS_{CSI-RS} = 120 kHz	
			UE Power class					UE Power class	
			1	2	3	4	5	1, 2, 3, 4, 5	
Conditions	Rx Beam Peak	n257	-110.3	-113.8	-112.1	-127.8+Y_4	-123.4+Y_5	(Value for SCS_{CSI-RS} = 60 kHz) +3 dB	≥-3
		n258	-110.3	-113.8	-112.1	-127.8+Y_4	-123.6+Y_5		
		n259			-108.5		-120.5+Y_5		
		n260	-107.3		-109.5	-125.8+Y_4			
		n261	-110.3	-113.8	-112.1	-127.8+Y_4			
	Spherical coverage Note 1	n257	-102.+	-102.8	-101.2	-118.8+Z_4	-115.4+Z_5	(Value for SCS_{CSI-RS} = 60 kHz) +3 dB	≥-3
		n258	-102.3	-102.8	-101.2	-118.8+Z_4	-115.6+Z_5		
		n259			-95.7		-112.5+Z_5		
		n260	-99.3		-96.9	-113.8+Z_4			
		n261	-102.3	-102.8	-101.2	-118.8+Z_4			

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum CSI-RS Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

B.2.8.2 Conditions for L1-SINR reporting with SSB based CMR and dedicated IMR configured

B.2.8.2.1 L1-SINR reporting with SSB based CMR and dedicated ZP-IMR configured

This clause defines the following conditions for NR L1-SINR measurement reporting and corresponding procedures performed based on SSBs and ZP-IMRs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions defined in table B.2.8.2.1-1 for FR1 NR cells.

The conditions defined in table B.2.8.2.1-2 for FR2 NR cells.

Table B.2.8.2.1-1: Conditions for L1-SINR measurements with SSB based CMR and ZP-IMR in FR1

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	dB
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-121	≥ -3
	NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-120.5	
	NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-120	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-119.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-119	
	NR_FDD_FR1_F	-121.5	-118.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-118	
	NR_FDD_FR1_H	-120.5	-117.5	
	NR_FDD_ FR1_N	-117.5	-114.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.8.2.1-2: Conditions for L1-SINR measurements with SSB based CMR and ZP-IMR in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3						SSB Ês/Iot
			dBm / SCS_{SSB}						dB
			SCS_{SSB} = 120 kHz					SCS_{SSB} = 240 kHz	
			UE Power class					UE Power class	
			1	2	3	4	5	1, 2, 3, 4, 5	
Conditions	Rx Beam Peak	n257	-107.3	-110.8	-109.1	-124.8+Y_4	-120.4+Y_5	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-3
		n258	-107.3	-110.8	-109.1	-124.8+Y_4	-120.6+Y_5		
		n259			-105.5		-117.5+Y_5		
		n260	-104.3		-106.5	-122.8+Y_4			
		n261	-107.3	-110.8	-109.1	-124.8+Y_4			
	Spherical coverage Note 1	n257	-99.3	-99.8	-98.2	-115.8+Z_4	-112.4+Z_5	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-3
		n258	-99.3	-99.8	-98.2	-115.8+Z_4	-112.6+Z_5		
		n259			-92.7		-109.5+Z_5		
		n260	-96.3		-93.9	-110.8+Z_4			
		n261	-99.3	-99.8	-98.2	-115.8+Z_4			

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

B.2.8.2.2 L1-SINR reporting with SSB based CMR and dedicated NZP-IMR configured

This clause defines the following conditions for NR L1-SINR measurement reporting and corresponding procedures performed based on SSBs and NZP-IMRs: SSB_RP, SSB Ês/Iot and NZP-IMR Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.8.2.2-1 for FR1 NR cells.

The conditions are defined in table B.2.8.2.2-2 for FR2 NR cells.

Table B.2.8.2.2-1: Conditions for L1-SINR measurements with SSB based CMR and NZP-IMR in FR1

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot	NZP-IMR Ês/Iot
		dBm / SCS_{SSB}			
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	dB	dB
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	≥ 0	≥ 0
	NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5		
	NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117		
	NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5		
	NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116		
	NR_FDD_FR1_F	-118.5	-115.5		
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115		
	NR_FDD_FR1_H	-117.5	-114.5		
	NR_FDD_ FR1_N	-114.5	-111.5		
NOTE 1: NR operating band groups are defined in clause 3.5.2.					

Table B.2.8.2.2-2: Conditions for L1-SINR measurements with SSB based CMR and NZP-IMR in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3						SSB Ês/Iot	NZP-IMR Ês/Iot
			dBm / SCS_{SSB}						dB	dB
			SCS_{SSB} = 120 kHz					SCS_{SSB} = 240 kHz		
			UE Power class					UE Power class		
			1	2	3	4	5	1, 2, 3, 4, 5		
Conditions	Rx Beam Peak	n257	-104.3	-107.8	-106.1	-121.8+Y_4	-117.4+Y_5	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥0	≥0
		n258	-104.3	-107.8	-106.1	-121.8+Y_4	-117.6+Y_5			
		n259			-102.5		-114.5+Y_5			
		n260	-101.3		-103.5	-119.8+Y_4				
		n261	-104.3	-107.8	-106.1	-121.8+Y_4				
	Spherical coverage Note 1	n257	-96.3	-96.8	-95.2	-112.8+Z_4	-109.4+Z_5	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥0	≥0
		n258	-96.3	-96.8	-95.2	-112.8+Z_4	-109.6+Z_5			
		n259			-88.7		-106.5+Z_5			
		n260	-93.3		-90.9	-107.8+Z_4				
		n261	-96.3	-96.8	-95.2	-112.8+Z_4				

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.2.8.2.2-2:

- The value of Y for power classes 4 and 5 is FFS, where Y_4 and Y_5 are the rough/fine beam gain differences in Rx beam peak direction for power classes 4 and 5 respectively

- The value of Z for power classes 4 and 5 is FFS, where Z_4 and Z_5 are the rough/fine beam gain differences in spherical coverage directions for power classes 4 and 5 respectively

B.2.8.3 Conditions for L1-SINR reporting with CSI-RS based CMR and dedicated IMR configured

B.2.8.3.1 L1-SINR reporting with CSI-RS based CMR and dedicated ZP-IMR configured

This clause defines the following conditions for NR L1-SINR measurement reporting and corresponding procedures performed based on CSI-RSs and ZP-IMRs: CSI-RS_RP and CSI-RS Ês/Iot, applicable for a corresponding operating band.

The conditions defined in table B.2.8.3.1-1 for FR1 NR cells.

The conditions defined in table B.2.8.3.1-2 for FR2 NR cells.

Table B.2.8.3.1-1: Conditions for L1-SINR measurements with CSI-RS based CMR and ZP-IMR in FR1

Parameter	NR operating band groups Note1	Minimum CSI-RS_RP			CSI-RS Ês/Iot
		dBm / SCS_{CSI-RS}			dB
		SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-121	-118	≥ -3
	NR_FDD_FR1_B, NR_TDD_FR1_B	-123.5	-120.5	-117.5	
	NR_FDD_FR1_C, NR_TDD_FR1_C	-123	-120	-117	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-119.5	-116.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-119	-116	
	NR_FDD_FR1_F	-121.5	-118.5	-115.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-121	-118	-115	
	NR_FDD_FR1_H	-120.5	-117.5	-114.5	
	NR_FDD_FR1_N	-117.5	-114.5	-111.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.					

Table B.2.8.3.1-2: Conditions for L1-SINR measurements with CSI-RS based CMR and ZP-IMR in FR2

Parameter	Angle of arrival	NR operating bands	Minimum CSI-RS_RP Note 2, Note 3						CSI-RS Ês/Iot
			dBm / SCS_{CSI-RS}						dB
			SCS_{CSI-RS} = 60 kHz					SCS_{CSI-RS} = 120 kHz	
			UE Power class					UE Power class	
			1	2	3	4	5	1, 2, 3, 4, 5	
Conditions	Rx Beam Peak	n257	-110.3	-113.8	-112.1	-127.8+Y_4	-123.4+Y_5	(Value for SCS_{CSI-RS} = 60 kHz) +3 dB	≥-3
		n258	-110.3	-113.8	-112.1	-127.8+Y_4	-123.6+Y_5		
		n259			-108.5		-120.5+Y_5		
		n260	-107.3		-109.5	-125.8+Y_4			
		n261	-110.3	-113.8	-112.1	-127.8+Y_4			
	Spherical coverage Note 1	n257	-102.3	-102.8	-101.2	-118.8+Z_4	-115.4+Z_5	(Value for SCS_{CSI-RS} = 60 kHz) +3 dB	≥-3
		n258	-102.3	-102.8	-101.2	-118.8+Z_4	-115.6+Z_5		
		n259			-95.7		-112.5+Z_5		
		n260	-99.3		-96.9	-113.8+Z_4			
		n261	-102.3	-102.8	-101.2	-118.8+Z_4			

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum CSI-RS Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

B.2.8.3.2 L1-SINR reporting with CSI-RS based CMR and dedicated NZP-IMR configured

This clause defines the following conditions for NR L1-SINR measurement reporting and corresponding procedures performed based on CSI-RSs and NZP-IMRs: CSI-RS_RP, CSI-RS Ês/Iot and NZP-IMR Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.8.3.2-1 for FR1 NR cells.

The conditions are defined in table B.2.8.3.2-2 for FR2 NR cells.

Table B.2.8.3.2-1: Conditions for L1-SINR measurements with CSI-RS based CMR and NZP-IMR in FR1

Parameter	NR operating band groups Note1	Minimum CSI-RS_RP			CSI-RS Ês/Iot	NZP-IMR Ês/Iot
		dBm / SCS_{SSB}			dB	dB
		SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	≥ 0	≥ 0
	NR_FDD_FR1_B, NR_TDD_FR1_B	-120.5	-117.5	-114.5		
	NR_FDD_FR1_C, NR_TDD_FR1_C	-120	-117	-114		
	NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5		
	NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113		
	NR_FDD_FR1_F	-118.5	-115.5	-112.5		
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-118	-115	-112		
	NR_FDD_FR1_H	-117.5	-114.5	-111.5		
	NR_FDD_ FR1_N	-114.5	-111.5	-108.5		
NOTE 1: NR operating band groups are defined in clause 3.5.2.						

Table B.2.8.3.2-2: Conditions for L1-SINR measurements with CSI-RS based CMR and NZP-IMR in FR2

Parameter	Angle of arrival	NR operating bands	Minimum CSI-RS_RP Note 2, Note 3						CSI-RS Ês/Iot	NZP-IMR Ês/Iot
			dBm / SCS_{CSI-RS}						dB	dB
			SCS_{CSI-RS} = 60 kHz					SCS_{CSI-RS} = 120 kHz		
			UE Power class					UE Power class		
			1	2	3	4	5	1, 2, 3, 4, 5		
Conditions	Rx Beam Peak	n257	-107.3	-110.8	-109.1	-124.8+Y_4	-120.4+Y_5	(Value for SCS_{CSI-RS} = 60 kHz) +3 dB	≥0	≥0
		n258	-107.3	-110.8	-109.1	-124.8+Y_4	-120.6+Y_5			
		n259			-105.5		-117.5+Y_5			
		n260	-104.3		-106.5	-122.8+Y_4				
		n261	-107.3	-110.8	-109.1	-124.8+Y_4				
	Spherical coverage Note 1	n257	-99.3	-99.8	-98.2	-115.8+Z_4	-112.4+Z_5	(Value for SCS_{CSI-RS} = 60 kHz) +3 dB	≥0	≥0
		n258	-99.3	-99.8	-98.2	-115.8+Z_4	-112.6+Z_5			
		n259			-92.7		-109.5+Z_5			
		n260	-96.3		-93.9	-110.8+Z_4				
		n261	-99.3	-99.8	-98.2	-115.8+Z_4				

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum CSI-RS Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.2.8.3.2-2:

- The value of Y for power classes 4 and 5 is FFS, where Y_4 and Y_5 are the rough/fine beam gain differences in Rx beam peak direction for power classes 4 and 5 respectively

- The value of Z for power classes 4 and 5 is FFS, where Z_4 and Z_5 are the rough/fine beam gain differences in spherical coverage directions for power classes 4 and 5 respectively

B.2.9 Conditions for NR intra-frequency measurements under CCA

This clause defines the following conditions for NR intra-frequency measurements unde CCA and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.9-1 for NR cells under CCA.

Table B.2.9-1: Conditions for intra-frequency measurements under CCA

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_CCA_FR1_I	-123	-120	≥ -6
	NR_CCA_FR1_J	-122.5	-119.5	
NOTE 1: NR operating band groups are as defined in clause 3.5.2.				

B.2.10 Conditions for NR inter-frequency measurements under CCA

This clause defines the following conditions for NR inter-frequency measurements and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.10-1 for NR cells under CCA.

Table B.2.10-1: Conditions for inter-frequency measurements under CCA

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_CCA_FR1_I	-121	-118	≥ -4
	NR_CCA_FR1_J	-120.5	-117.5	
NOTE 1: NR operating band groups are as defined in clause 3.5.2.				

B.2.11 Conditions for NR L1-RSRP reporting under CCA

B.2.11.1 Conditions for SSB based L1-RSRP reporting

This clause defines the following conditions for NR L1-RSRP measurement reporting and corresponding procedures performed based on SSBs under CCA: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.11.1-1 for NR cells under CCA.

Table B.2.11.1-1: Conditions for SSB based L1-RSRP measurements under CCA

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_CCA_FR1_I	-120	-117	≥ -3
	NR_CCA_FR1_J	-119.5	-116.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

B.2.12 Conditions for NR CSI-RS based intra-frequency measurements

This clause defines the following conditions for NR CSI-RS based intra-frequency measurements and corresponding procedures performed based on CSI-RS: CSI_RP and CSI-RS Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.12-1 for FR1 NR cells.

The conditions are defined in table B.2.12-2 for FR2 NR cells.

Table B.2.12-1: Conditions for CSI-RS based intra-frequency measurements in FR1

Parameter	NR operating band groups Note1	Minimum CSI_RP dBm / SCS_{CSI-RS}			CSI-RS Ês/Iot dB
		SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	-121	≥ -6
	NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-123.5	-120.5	
	NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-123	-120	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	-119.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119	
	NR_FDD_FR1_F	-124.5	-121.5	-118.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	-118	
	NR_FDD_FR1_H	-123.5	-120.5	-117.5	
	NR_FDD_ FR1_N	-120.5	-117.5	-114.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.					

Table B.2.12-2: Conditions for CSI-RS based intra-frequency measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum CSI_RP Note 2, Note 3 dBm / SCS_{CSI-RS}					CSI-RS Ês/Iot dB
			SCS_{CSI-RS} = 120 kHz				SCS_{CSI-RS} = 60 kHz	
			UE power class				UE power class	
			1	2	3	4	1, 2, 3, 4	
Conditions	Rx Beam Peak	n257	-110.3	-113.8	-112.1	-127.8+Y_4	(Value for SCS_{CSI-RS} = 120 kHz) - 3 dB	≥-6
		n258	-110.3	-113.8	-112.1	-127.8+Y_4		
		n259			-108.5	-124.7+Y_4		
		n260	-107.3		-109.5	-125.8+Y_4		
		n261	-110.3	-113.8	-112.1	-127.8+Y_4		
	Spherical coverage Note 1	n257	-102.3	-102.8	-101.2	-118.8+Z_4	(Value for SCS_{CSI-RS} = 120 kHz) - 3 dB	≥-6
		n258	-102.3	-102.8	-101.2	-118.8+Z_4		
		n259			-95.7	-115.7+Z_4		
		n260	-99.3		-96.9	-113.8+Z_4		
		n261	-102.3	-102.8	-101.2	-118.8+Z_4		
NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met. NOTE 2: Values specified at the Reference point to give minimum CSI-RS Ês/Iot, with no applied noise. NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].									

Editor's notes for Table B.2.12-2:

- *The value of Y for power class 4 is FFS, where Y_4 is the rough/fine beam gain difference in Rx beam peak direction for power class 4*

- *The value of Z for power class 4 is FFS, where Z_4 is the rough/fine beam gain difference in spherical coverage directions for power class 4*

B.2.13 Conditions for NR CSI-RS based inter-frequency measurements

This clause defines the following conditions for NR CSI-RS based inter-frequency measurements and corresponding procedures performed based on CSI-RS: CSI_RP and CSI-RS Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.13-1 for FR1 NR cells.

The conditions are defined in table B.2.13-2 for FR2 NR cells.

Table B.2.13-1: Conditions for CSI-RS based inter-frequency measurements in FR1

Parameter	NR operating band groups Note1	Minimum CSI_RP			CSI-RS Ês/Iot
		dBm / SCS_{CSI-RS}			dB
		SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-125	-122	-119	≥ -6
	NR_FDD_FR1_B, NR_TDD_FR1_B	-124.5	-121.5	-118.5	
	NR_FDD_FR1_C, NR_TDD_FR1_C	-124	-121	-118	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-124.5	-120.5	-117.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-123	-120	-117	
	NR_FDD_FR1_F	-122.5	-119.5	-116.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-122	-119	-116	
	NR_FDD_FR1_H	-121.5	-118.5	-115.5	
	NR_FDD_ FR1_N	-118.5	-115.5	-112.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.					

Table B.2.13-2: Conditions for CSI-RS based inter-frequency measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum CSI_RP Note 2, Note 3					CSI-RS Ês/Iot
			dBm / SCS_{CSI-RS}					dB
			SCS_{CSI-RS} = 120 kHz				SCS_{CSI-RS} = 60 kHz	
			UE power class				UE power class	
			1	2	3	4	1, 2, 3, 4	
Conditions	Rx Beam Peak	n257	-108.3	-111.8	-110.1	-125.8+Y_4	(Value for SCS_{CSI-RS} = 120 kHz) - 3 dB	≥-4
		n258	-108.3	-111.8	-110.1	-125.8+Y_4		
		n259			-106.5	-122.7+Y_4		
		n260	-105.3		-107.5	-123.8+Y_4		
		n261	-108.3	-111.8	-110.1	-125.8+Y_4		
	Spherical coverage Note 1	n257	-100.3	-100.8	-99.2	-116.8+Z_4	(Value for SCS_{CSI-RS} = 120 kHz) - 3 dB	≥-4
		n258	-100.3	-100.8	-99.2	-116.8+Z_4		
		n259			-93.7	-113.7+Z_4		
		n260	-97.3		-94.9	-111.8+Z_4		

		n261	-100.3	-100.8	-99.2	-116.8+Z_4		

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum CSI-RS Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.2.13-2:

- *The value of Y for power class 4 is FFS, where Y_4 is the rough/fine beam gain difference in Rx beam peak direction for power class 4*

- *The value of Z for power class 4 is FFS, where Z_4 is the rough/fine beam gain difference in spherical coverage directions for power class 4.*

B.2.14 Conditions for NR PRS-based measurements

This clause defines the following conditions for NR PRS-based measurements and corresponding procedures performed based on PRS: PRP and PRS Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.14-1 for FR1 NR cells.

The conditions are defined in table B.2.14-2 for FR2 NR cells.

Table B.2.14-1: Conditions for NR PRS-based measurements in FR1

Parameter	NR operating band groups Note1	Minimum PRP1,2 dBm / SCS_{PRS}			PRS Ês/Iot dB	
		SCS_{PRS} = 15 kHz	SCS_{PRS} = 30 kHz	SCS_{PRS} = 60 kHz		
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	-121	≥ -6 Note2 ≥ -13 Note3 ≥ -3 Note4 ≥ -10 Note8	≥ -6 Note5 ≥ -3 Note6 ≥ 0 Note7
	NR_FDD_FR1_B, NR_TDD_FR1_B	-126.5	-123.5	-120.5		
	NR_FDD_FR1_C, NR_TDD_FR1_C	-126	-123	-120		
	NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	-119.5		
	NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	-119		
	NR_FDD_FR1_F	-124.5	-121.5	-118.5		
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	-118		
	NR_FDD_FR1_H	-123.5	-120.5	-117.5		
	NR_FDD_FR1_N	-120.5	-117.5	-114.5		

NOTE 1: NR operating band groups are defined in clause 3.5.2.
NOTE 2: PRS Ês/Iot for RSTD measurement reference cell PRS resource, and RSCPD measurement reference cell PRS resource.
NOTE 3: PRS Ês/Iot for RSTD measurement neighbor cell PRS resource, and RSCPD measurement neighbor cell PRS resource, PRS-RSRP measurement, PRS-RSRPP measurement and UE Rx-Tx time difference measurement, and DL RSCP measurement.
NOTE 4: PRS Ês/Iot for PRS-RSRP measurement, PRS-RSRPP measurement, UE Rx-Tx time difference measurement, DL RSCP measurement, and PRS-RSRP measurement when performed by 1Rx RedCap UE.
NOTE 5: PRS Ês/Iot for RSTD measurement neighbor cell PRS resource, RSCPD measurement neighbor cell PRS resource, PRS-RSRP measurement, PRS-RSRPP measurement, UE Rx-Tx time difference measurement when performed with reduced number of samples, and DL RSCP measurement.

NOTE 6: PRS Ês/Iot for RSTD measurement reference cell PRS resource when performed with reduced number of samples, and DL RSCPD measurement reference cell PRS resource.
NOTE 7: PRS Ês/Iot for PRS-RSRP measurement, PRS-RSRPP measurement, UE Rx-Tx time difference measurement when performed with reduced number of samples, and DL RSCP measurement.
NOTE 8: PRS Ês/Iot for RSTD measurement neighbor cell PRS resource, UE Rx-Tx measurements when performed by 1Rx RedCap UE, and PRS-RSRPP measurement when performed by 1Rx RedCap UE.

Table B.2.14-2: Conditions for NR PRS-based measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum PRP1,2 Note 2, Note 3 dBm / SCS_{PRS}						PRS Ês/Iot dB	
			SCS_{PRS} = 120 kHz					SCS_{PRS} = 60 kHz		
			UE power class					UE power class		
			1	2	3	4	5	1, 2, 3, 4		
Conditions	Rx Beam Peak	n257	-110.3	-113.8	-112.1	-127.8+Y_4	-117.4+Y5	(Value for SCS_{PRS} = 120 kHz) - 3 dB	≥ -6 Note4	≥ -6 Note7
		n258	-110.3	-113.8	-112.1	-127.8+Y_4	-117.6+Y5		≥ -13 Note5	≥ -3 Note8
		n259			-108.5	-124.7+Y_4	-114.5+Y5		≥ -3 Note6	≥ 0 Note9
		n260	-107.3		-109.5	-125.8+Y_4			≥ -10 Note8	
		n261	-110.3	-113.8	-112.1	-127.8+Y_4				
		n262	-105.3	-108.6	-106.6	-121.8+Y_4				
	Spherical coverage Note 1	n257	-102.3	-102.8	-101.2	-118.8+Z_4	-109.4+Z5	(Value for SCS_{PRS} = 120 kHz) - 3 dB	≥ -6 Note4	≥ -6 Note7
		n258	-102.3	-102.8	-101.2	-118.8+Z_4			≥ -13 Note5	≥ -3 Note8
		n259			-95.7	-115.7+Z_4	-101.6+Z5		≥ -3 Note6	≥ 0 Note9
		n260	-99.3		-96.9	-113.8+Z_4			≥ -10 Note8	
		n261	-102.3	-102.8	-101.2	-118.8+Z_4				
		n262	-97.1	-94.7	-93.5	-109.7+Z_4				

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum PRS Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].
NOTE 4: PRS Ês/Iot for RSTD measurement reference cell PRS resource, and RSCPD measurement reference cell PRS resource.
NOTE 5: PRS Ês/Iot for RSTD measurement neighbor cell PRS resource, and RSCPD measurement neighbor cell PRS resource, PRS-RSRP measurement, PRS-RSRPP measurement and UE Rx-Tx time difference measurement, and DL RSCP measurement.
NOTE 6: PRS Ês/Iot for PRS-RSRP measurement, PRS-RSRPP measurement and UE Rx-Tx time difference measurement, DL RSCP measurement, and PRS-RSRP measurement when performed by 1Rx RedCap UE.
NOTE 7: PRS Ês/Iot for RSTD measurement neighbor cell PRS resource, RSCPD measurement neighbor cell PRS resource, PRS-RSRP measurement, PRS-RSRPP measurement, UE Rx-Tx time difference measurement when performed with reduced number of samples, and DL RSCP measurement.
NOTE 8: PRS Ês/Iot for RSTD measurement reference cell PRS resource when performed with reduced number of samples, and DL RSCPD measurement reference cell PRS resource.
NOTE 9: PRS Ês/Iot for PRS-RSRP measurement, PRS-RSRPP measurement, and UE Rx-Tx time difference measurement when performed with reduced number of samples, and DL RSCP measurement.
NOTE 10: PRS Ês/Iot for RSTD measurement neighbor cell PRS resource, UE Rx-Tx measurements when performed by 1Rx RedCap UE, and PRS-RSRPP measurement when performed by 1Rx RedCap UE.

Editor's notes for Table B.2.14-2:

- *The value of Y for power classes 4 and 1 is FFS, where Y_4 and Y_5 are the rough/fine beam gain differences in Rx beam peak direction for power classes 4 and 5 respectively*

- The value of Z for power classes 4 and 5 is FFS, where Z_4 and Z_5 are the rough/fine beam gain differences in spherical coverage directions for power classes 4 and 5 respectively

B.2.15 Conditions for NR intra-frequency measurements for RedCap

This clause defines the following conditions for RedCap NR intra-frequency measurements and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.15-1 and table B.2.15-2 for 1 Rx and 2 Rx RedCap respectively for FR1 NR cells.

The conditions are defined in table B.2.15-3 for FR2 NR cells.

Table B.2.15-1: Conditions for intra-frequency cell re-selection in FR1 for 1Rx RedCap

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_ FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	≥ -6
	NR_FDD_ FR1_B, NR_TDD_FR1_B	-126.5	-123.5	
	NR_FDD_FR1_C, NR_TDD_ FR1_C	-126	-123	
	NR_FDD_ FR1_D, NR_TDD_ FR1_D	-125.5	-122.5	
	NR_FDD_ FR1_E, NR_TDD_ FR1_E	-125	-122	
	NR_FDD_ FR1_F	-124.5	-121.5	
	NR_FDD_ FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	
	NR_FDD_ FR1_H	-123.5	-120.5	
	NR_FDD_FR1_N	-120.5	-117.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.15-2: Conditions for intra-frequency cell re-selection in FR1 for 2Rx RedCap

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_ FR1_A, NR_TDD_ FR1_A, NR_SDL_FR1_A	-127	-124	≥ -6
	NR_FDD_ FR1_B, NR_TDD_FR1_B	-126.5	-123.5	
	NR_FDD_FR1_C, NR_TDD_ FR1_C	-126	-123	
	NR_FDD_ FR1_D, NR_TDD_ FR1_D	-125.5	-122.5	
	NR_FDD_ FR1_E, NR_TDD_ FR1_E	-125	-122	
	NR_FDD_ FR1_F	-124.5	-121.5	
	NR_FDD_ FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-124	-121	
	NR_FDD_ FR1_H	-123.5	-120.5	
	NR_FDD_FR1_N	-120.5	-117.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.15-3: Conditions for intra-frequency measurements in FR2 for RedCap

Parameter	AoA	NR opt. bands	Minimum SSB_RP Note 2, Note 3 (dBm / SCS_{SSB})		SSB Ês/Iot (dB)
			SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz	

Parameter	AoA	NR opt. bands	Minimum SSB_RP Note 2, Note 3 (dBm / SCS_{SSB})							SSB Ês/Iot (dB)
			UE Power class						UE Power class	
			1	2	3	4	5	7	1, 2, 3, 4, 5	
Conditions	Rx Beam Peak	n257	-110.3	-113.8	-112.1	-127.8 +Y_4	-123.4 +Y_5	-116.1 +Y_7	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-6
		n258	-110.3	-113.8	-112.1	-127.8 +Y_4	-123.6 +Y_5	-116.1 +Y_7		
		n261	-110.3	-113.8	-112.1	-127.8 +Y_4		-116.1 +Y_7		
	Sph. cov. Note 1	n257	-102.3	-102.8	-101.2	-118.8 +Z_4	-115.4 +Z_5	-105.2 +Z_7	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-6
		n258	-102.3	-102.8	-101.2	-118.8 +Z_4	-115.6 +Z_5	-105.2 +Z_7		
		n261	-102.3	-102.8	-101.2	-118.8 +Z_4		-105.2 +Z_7		

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.2.2-2:

- *The value of Y for power classes 4, 5 and 7 is FFS, where Y_4, Y_5 and Y_7 are the rough/fine beam gain differences in Rx beam peak direction for power classes 4, 5 and 7 respectively*

- *The value of Z for power classes 4, 5 and 7 is FFS, where Z_4, Z_5 and Z_7 are the rough/fine beam gain differences in spherical coverage directions for power classes 4, 5 and 7 respectively*

B.2.16 Conditions for NR inter-frequency measurements for RedCap

This clause defines the following conditions for RedCap NR inter-frequency measurements and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.2.16-1 and table B.2.16-2 for 1 Rx and 2 Rx RedCap for FR1 NR cells.

The conditions are defined in table B.2.16-3 for FR2 NR cells.

Table B.2.16-1: Conditions for inter-frequency measurements in FR1 for 1 Rx RedCap

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-125	-122	≥ -4
	NR_FDD_FR1_B, NR_TDD_FR1_B	-124.5	-121.5	
	NR_FDD_FR1_C, NR_TDD_FR1_C	-124	-121	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-124.5	-120.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-123	-120	
	NR_FDD_FR1_F	-122.5	-119.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-122	-119	
	NR_FDD_FR1_H	-121.5	-118.5	

NOTE 1: NR operating band groups are defined in clause 3.5.2.

Table B.2.16-2: Conditions for inter-frequency measurements in FR1 for 2 Rx RedCap

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-125	-122	≥ -4
	NR_FDD_FR1_B, NR_TDD_FR1_B	-124.5	-121.5	
	NR_FDD_FR1_C, NR_TDD_FR1_C	-124	-121	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-124.5	-120.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-123	-120	
	NR_FDD_FR1_F	-122.5	-119.5	
	NR_FDD_FR1_G, NR_TDD_FR1_G, NR_SDL_FR1_G	-122	-119	
	NR_FDD_FR1_H	-121.5	-118.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.16-3: Conditions for inter-frequency measurements in FR2 for RedCap

Parameter	AoA	NR opt. bands	Minimum SSB_RP Note 2, Note 3 (dBm / SCS_{SSB})							SSB Ês/Iot (dB)
			SCS_{SSB} = 120 kHz						SCS_{SSB} = 240 kHz	
			UE Power class						UE Power class	
			1	2	3	4	5	7	1, 2, 3, 4, 5	
Conditions	Rx Beam Peak	n257	-108.3	-111.8	-110.1	-125.8 +Y_4	-121.4 +Y_5	-114.1 +Y_7	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-4
		n258	-108.3	-111.8	-110.1	-125.8 +Y_4	-121.6 +Y_5	-114.1 +Y_7		
		n261	-108.3	-111.8	-110.1	-125.8 +Y_4		-114.1 +Y_7		
	Sph. cov. Note 1	n257	-100.3	-100.8	-99.2	-116.8 +Z_4	-113.4 +Z_5	-103.2 +Z_7	(Value for SCS_{SSB} = 120 kHz) +3 dB	≥-4
		n258	-100.3	-100.8	-99.2	-116.8 +Z_4	-113.6 +Z_5	-103.2 +Z_7		
		n261	-100.3	-100.8	-99.2	-116.8 +Z_4		-103.2 +Z_7		
NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met. NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise. NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].										

Editor's notes for Table B.2.3-2:

- *The value of Y for power classes 4, 5 and 7 is FFS, where Y_4, Y_5 and Y_7 are the rough/fine beam gain differences in Rx beam peak direction for power classes 4, 5 and 7 respectively*

- *The value of Z for power classes 4, 5 and 7 is FFS, where Z_4, Z_5 and Z_7 are the rough/fine beam gain differences in spherical coverage directions for power classes 4, 5 and 7 respectively*

B.2.17 Conditions for NR intra-frequency measurements for satellite access

This clause defines the following conditions for NR intra-frequency measurements and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band for satellite access.

The conditions are defined in table B.2.17-1 for FR1 NR cells.

Table B.2.17-1: Conditions for intra-frequency measurements in FR1 for satellite access

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_SAB_FR1_A	-127	-124	≥ -6
NOTE 1: NR operating band groups for satellite access are defined in clause 3.5.2A.				

The conditions for FR2-NTN NR cells depend on the $EIS_{REFSENS_50M}$ declared by the vendor as described in clause 10.3.2 in [42] and on the UE VSAT Type. The minimum SSB_RP for the different bands shall be calculated for intra frequency measurements according to the formulation provided in clause B.2.1.7 of this specification.

B.2.18 Conditions for NR inter-frequency measurements for satellite access

This clause defines the following conditions for NR inter-frequency measurements and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band for satellite access.

The conditions are defined in table B.2.18-1 for FR1 NR cells.

Table B.2.18-1: Conditions for inter-frequency measurements in FR1 for satellite access

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_SAB_FR1_A	-125	-122	≥ -4
NOTE 1: NR operating band groups for satellite access are defined in clause 3.5.2A.				

The conditions for FR2-NTN NR cells depend on the $EIS_{REFSENS_50M}$ declared by the vendor as described in clause 10.3.2 in [42] and on the UE VSAT Type. The minimum SSB_RP for the different bands shall be calculated for intra requency measurements according to the formulation provided in clause B.2.1.7 of this specification.

B.2.19 Conditions for NR L1-RSRP reporting for satellite access

B.2.19.1 Conditions for SSB based L1-RSRP reporting for satellite access

This clause defines the following conditions for NR L1-RSRP measurement reporting and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band for satellite access.

The conditions are defined in table B.2.19.1-1 for FR1 NR cells.

Table B.2.19.1-1: Conditions for SSB based L1-RSRP measurements in FR1 for satellite access

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_SAB_FR1_A	-124	-121	≥ -3
NOTE 1: NR operating band groups for satellite access are defined in clause 3.5.2A.				

B.2.19.2 Conditions for CSI-RS based L1-RSRP reporting for satellite access

This clause defines the following conditions for NR L1-RSRP measurement reporting and corresponding procedures performed based on CSI-RS: CSI-RS_RP and CSI-RS Ês/Iot, applicable for a corresponding operating band for satellite access.

The conditions are defined in table B.2.19.2-1 for FR1 NR cells.

Table B.2.19.2-1: Conditions for CSI-RS based L1-RSRP measurements in FR1 for satellite access

Parameter	NR operating band groups Note1	Minimum CSI-RS_RP			CSI-RS Ês/Iot
		dBm / SCS_{CSI-RS}			dB
		SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz	
Conditions	NR_FDD_SAB_FR1_A	-124	-121	-118	≥ -3
NOTE 1: NR operating band groups for satellite access are defined in clause 3.5.2A.					

B.2.20 Conditions for RRC connection release with redirection to NR for satellite access

This clause defines the following conditions for RRC connection release with redirection to NR: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band for satellite access.

The conditions are defined in table B.2.20-1 for FR1 NR cells.

Table B.2.20-1: Conditions for for RRC connection release with redirection to NR in FR1 for satellite access

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_SAB_FR1_A	-125	-122	≥ -4
NOTE 1: NR operating band groups for satellite access are defined in clause 3.5.2A.				

B.3 RRM Requirements Exceptions

B.3.1 Introduction

annex B.3 covers exceptions for side conditions based on receiver sensitivity for CA, DC, and SUL.

B.3.2 Receiver sensitivity relaxation for CA

B.3.2.1 Receiver sensitivity relaxation for UE supporting CA in FR1

For a UE supporting inter-band carrier aggregation configuration with uplink in NR band, if there is a relaxation of receiver sensitivity $\Delta R_{IB,c}$>0 dB as defined in clause 7.3A.3 of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB,c}$ defined for the corresponding downlink NR bands.

For a ATG UE supporting inter-band carrier aggregation configuration with uplink in NR band, if there is a relaxation of receiver sensitivity $\Delta R_{IB,c}$>0 dB as defined in clause 7.3J.2A.2 of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB,c}$ defined for the corresponding downlink NR bands.

For a UE supporting CA configuration in FR1, the requirement in this clause applies for both SC and CA operation.

B.3.2.2 Receiver sensitivity relaxation for UE configured with CA in FR1

B.3.2.2.1 Inter-band carrier aggregation

For a UE configured with inter-band carrier aggregation with active uplink in NR band, if there is a relaxation of receiver sensitivity $\Delta R_{IB,c}$>0 dB as defined in clause 7.3A.3 of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB,c}$ defined for the corresponding downlink NR bands.

For a ATG UE configured with inter-band carrier aggregation with active uplink in NR band, if there is a relaxation of receiver sensitivity $\Delta R_{IB,c}$>0 dB as defined in clause 7.3J.2A.2 of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB,c}$ defined for the corresponding downlink NR bands.

If the relaxation Δ specified in this clause applies, then the relaxation specified in clause B.3.2.1 should not be applied.

B.3.2.2.2 Reference sensitivity exceptions due to UL harmonic interference for CA

In this clause, requirements exceptions are described for the UE configured with a band in FR1 when it is impacted by UL harmonic interference from another band in FR1 of the same CA configuration.

A relevant side condition (SSB_RP and Io) in a requirement shall be increased by the amount Δ=L2-L1, where L1 is the reference sensitivity level specified in clause 7.3.2 of TS 38.101-1 [18], and L2 is the reference sensitivity level based on the requirements in clause 7.3A.4 of TS 38.101-1 [18], when the following conditions are fulfilled,

- corresponding downlink component carriers on different NR bands are configured with CA and active,
- the upling is configured in the NR low operating band and is active,
- the uplink configuration is as specified in clause 7.3A.4 of TS 38.101-1 [18], and
- the exception requirements specified in clause 7.3A.4 of TS 38.101-1 [18] apply.

If the relaxation Δ specified in this clause applies, then the relaxation specified in clause B.3.2.1 should not be applied.

B.3.2.2.3 Reference sensitivity exceptions due to intermodulation interference due to 2UL CA

In this clause, requirements exceptions are described for the UE with an inter-band carrier aggregation with uplink assigned to two NR bands.

A relevant side condition (SSB_RP and Io) in a requirement shall be increased by the amount Δ=L2-L1, where L1 is the reference sensitivity level specified in clause 7.3.2 of TS 38.101-1 [18], and L2 is the reference sensitivity level based on the requirements in clause 7.3A.5 of TS 38.101-1 [18], when the following conditions are fulfilled,

- corresponding downlink component carriers on different bands are configured with CA and active,
- uplinks are assigned to two NR bands,
- the exception requirements specified in clause 7.3A.5 of TS 38.101-1 [18] apply.

If the relaxation Δ specified in this clause applies, then the relaxation specified in clause B.3.2.1 should not be applied.

B.3.2.3 Receiver sensitivity relaxation for UE supporting CA in FR2

B.3.2.4 Receiver sensitivity relaxation for UE configured with CA in FR2

B.3.2.4.1 Intra-band contiguous carrier aggregation

For a UE configured with intra-band contiguous carrier aggregation in NR band in FR2, if there is a relaxation of receiver sensitivity ΔR_{IB}>0 dB as defined in clause 7.3A.2.1 of TS 38.101-2 [19] depending on the aggregated channel

bandwidth, the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB}$ defined for the corresponding downlink NR bands.

B.3.2.4.2 Intra-band non-contiguous carrier aggregation

For a UE configured with intra-band non-contiguous carrier aggregation in NR band in FR2, if there is a relaxation of receiver sensitivity $\Delta R_{IB}>0$ dB as defined in clause 7.3A.2.1 of TS 38.101-2 [19] depending on the aggregated channel bandwidth, the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB}$ defined for the corresponding downlink NR bands.

B.3.3 Receiver sensitivity relaxation for DC

B.3.3.1 Receiver sensitivity relaxation for EN-DC

Editor's note: TBD

B.3.3.2 Receiver sensitivity relaxation for NE-DC

Editor's note: TBD

B.3.4 Receiver sensitivity relaxation for SUL

B.3.4.1 Receiver sensitivity relaxation for UE supporting SUL in FR1

For a UE supporting a SUL configuration in FR1, if there is a relaxation of receiver sensitivity $\Delta R_{IB,c}>0$ dB as defined in clause 7.3C.3 of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB,c}$ defined for the corresponding downlink NR bands.

For a UE supporting a SUL configuration in FR1, the requirement in this clause applies for both SC and SUL operation.

B.3.4.2 Receiver sensitivity relaxation for UE configured with SUL in FR1

B.3.4.2.1 Reference sensitivity exceptions due to UL harmonic interference for SUL

In this clause, requirements exceptions are described for the UE with a band in FR1 when it is impacted by UL harmonic interference from another band in FR1 of the same SUL configuration.

A relevant side condition (SSB_RP and Io) in a requirement shall be increased by the amount Δ=L2-L1, where L1 is the reference sensitivity level specified in clause 7.3.2 of TS 38.101-1 [18], and L2 is the reference sensitivity level based on the requirements in clause 7.3C.2 of TS 38.101-1 [18], when the following conditions are fulfilled,

- a downlink component carrier is configured in NR band and is active,
- the upling is configured in the NR low operating band and is active,
- the uplink configuration is as specified in clause 7.3C.2 of TS 38.101-1 [18], and
- the exception requirements specified in clause 7.3C.2 of TS 38.101-1 [18] apply.

If the relaxation Δ specified in this clause applies, then the relaxation specified in clause B.3.4.1 should not be applied.

B.4 Conditions for V2X

B.4.1 Test parameters for GNSS signals

This clause defines the reference signal power levels of generated salellites for a corresponding GNSS, which will be used in V2X test cases.

Table B.4.1-1: GNSS Referenece Signal Power Parameters

System	Parameters	Unit	Value
	Number of generated satellites per system	-	6
GPS(1)	Reference signal power level for all satellites	dBm	-128.5
Galileo	Reference signal power level for all satellites	dBm	-127
GLONASS	Reference signal power level for all satellites	dBm	-131
BDS	Reference signal power level for all satellites	dBm	-133
NOTE 1: "GPS" here means GPS L1 C/A, Modernized GPS, or both, dependent on UE capabilities. NOTE 2: The DUT UE does not need to support all systems. The DUT UE shall support at least one system and will be test for the supported systems.			

B.4.2 Conditions for PSBCH-RSRP Accuracy Requirements

This clause defines the following conditions for PSBCH-RSRP measurement accuracy requirements applicable for a corresponding operating band.

The conditions are defined in table B.4.2-1 for FR1.

Table B.4.2-1: Conditions for PSBCH-RSRP measurements in FR1

Parameter	NR V2X operating band groups Note1	Minimum S-SSB_RP			S-SSB Ês/Iot
		dBm/SCS_{S-SSB}			dB
		SCS_{S-SSB} = 15 kHz	SCS_{S-SSB} = 30 kHz	SCS_{S-SSB} = 60 kHz	
	NR_TDD_FR1_B	-126.5	-123.5	-120.5	≥ -6
	NR_TDD_FR1_J	-122.5	-119.5	-116.5	
NOTE 1: NR V2X operating band groups are as defined in section 3.5 for the corresponding NR operating bands.					

B.4.3 Conditions for Selection/Reselection to Intra-frequency SyncRef UE

This clause defines the S-SSB_RP and S-SSB Ês/Iot applicable for a corresponding operating band.

The conditions for selection/reselection to intra-frequency SyncRef UE are defined in table B.4.3-1 for FR1.

Table B.4.3-1: V2X synchronization measurements in FR1

Parameter	NR V2X operating band groups Note1	Minimum S-SSB_RP			S-SSB Ês/Iot
		dBm/SCS_{S-SSB}			dB
		SCS_{S-SSB} = 15 kHz	SCS_{S-SSB} = 30 kHz	SCS_{S-SSB} = 60 kHz	
	NR_TDD_FR1_B	-120.5	-117.5	-114.5	≥ 0
	NR_TDD_FR1_J	-116.5	-113.5	-110.5	≥ 0
NOTE 1: NR V2X operating band groups are as defined in section 3.5 for the corresponding NR operating bands. NOTE 2: The SyncRef UE transmission frequency shall be accurate to within ±5 PPM compared to the absolute frequency.					

B.4.4 Conditions for L1 SL-RSRP Accuracy Requirements

This clause defines the following condtions for L1 SL-RSRP measurement accuracy requirements applicable for a corresponding operating band.

The conditions are defined in table B.4.4-1 for FR1.

Table B.4.4-1: Conditions for L1 SL-RSRP measurements in FR1

Parameter	NR V2X operating band groups Note1	Minimum L1 SL-RSRP			Ês/Iot
		dBm/SCS			dB
		SCS= 15 kHz	SCS= 30 kHz	SCS = 60 kHz	
	NR_TDD_FR1_B	-120.5	-117.5	-114.5	≥ 0
	NR_TDD_FR1_J	-116.5	-113.5	-110.5	
NOTE 1: NR V2X operating band groups are as defined in section 3.5 for the corresponding NR operating bands. NOTE 2: The parameter Ês/Iot is the Ês/Iot of PSCCH-DMRS and/or PSSCH-DMRS. NOTE 3: The SCS is for PSCCH and/or PSSCH.					

B.4.5 Conditions for PSBCH-RSRP Accuracy Requirements under CCA

This clause defines the following conditions for PSBCH-RSRP measurement accuracy requirements applicable for a corresponding operating band under CCA.

The conditions are defined in table B.4.5-1 for FR1.

Table B.4.5-1: Conditions for PSBCH-RSRP measurements in FR1

Parameter	NR sidelink operating band groups Note1	Minimum S-SSB_RP		S-SSB Ês/Iot
		dBm/SCS_{S-SSB}		dB
		SCS_{S-SSB} = 15 kHz	SCS_{S-SSB} = 30 kHz	
	NR_CCA_FR1_I	-123	-120	≥ -6
	NR_CCA_FR1_J	-122.5	-119.5	
NOTE 1: NR sidelink operating band groups are as defined in section 3.5 for the corresponding NR operating bands.				

B.4.6 Conditions for Selection/Reselection to Intra-frequency SyncRef UE under CCA

This clause defines the S-SSB_RP and S-SSB Ês/Iot applicable for a corresponding operating band under CCA.

The conditions for selection/reselection to intra-frequency SyncRef UE are defined in table B.4.6-1 for FR1.

Table B.4.6-1: Sidelink synchronization measurements in FR1

Parameter	NR sidelink operating band groups Note1	Minimum S-SSB_RP		S-SSB Ês/Iot
		dBm/SCS_{S-SSB}		dB
		SCS_{S-SSB} = 15 kHz	SCS_{S-SSB} = 30 kHz	
	NR_CCA_FR1_I	-117	-114	≥ 0
	NR_CCA_FR1_J	-116.5	-113.5	≥ 0
NOTE 1: NR sidelink operating band groups are as defined in section 3.5 for the corresponding NR operating bands. NOTE 2: The SyncRef UE transmission frequency shall be accurate to within ±5 PPM compared to the absolute frequency.				

B.4.7 Conditions for L1 SL-RSRP Accuracy Requirements under CCA

This clause defines the following conditions for L1 SL-RSRP measurement accuracy requirements applicable for a corresponding operating band under CCA.

The conditions are defined in table B.4.7-1 for FR1.

Table B.4.7-1: Conditions for L1 SL-RSRP measurements in FR1

Parameter	NR sidelink operating band groups Note1	Minimum L1 SL-RSRP		Ês/Iot
		dBm/SCS		dB
		SCS= 15 kHz	SCS= 30 kHz	
	NR_CCA_FR1_I	-117	-114	≥ 0
	NR_CCA_FR1_J	-116.5	-113.5	
NOTE 1: NR sidelink operating band groups are as defined in section 3.5 for the corresponding NR operating bands. NOTE 2: The parameter Ês/Iot is the Ês/Iot of PSCCH-DMRS and/or PSSCH-DMRS. NOTE 3: The SCS is for PSCCH and/or PSSCH.				

B.4A Conditions for NR Sidelink Positioning Measurement Procedures and Performance Requirements

B.4A.1 Conditions for NR SL-PRS based measurements

This clause defines the following condtions for NR SL-PRS based measurement procedures and accuracy requirements: SL-PRP and SL-PRS Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in table B.4A.1-1 for FR1.

Table B.4A.1-1: Conditions for NR SL-PRS based measurements in FR1

Parameter	NR operating band groups Note1	Minimum SL-PRP1,2			SL-PRS Ês/Iot
		dBm / SCS_{SL-PRS}			dB
		SCS_{SL-PRS} = 15 kHz	SCS_{SL-PRS} = 30 kHz	SCS_{SL-PRS} = 60 kHz	
Conditions	NR_TDD_FR1_B	-123.5	-120.5	-117.5	≥ 0 Note2 ≥ -3 Note3
	NR_TDD_FR1_C	-123	-120	-117	
	NR_FDD_FR1_G	-121	-118	-115	
	NR_TDD_FR1_J	-119.5	-116.5	-113.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2. NOTE 2: SL-PRS Ês/Iot for SL-PRS resource of the reference UE for SL RSTD measurement. NOTE 3: SL-PRS Ês/Iot for SL-PRS resource of the anchor UE, which is not the reference UE, for SL RSTD measurement, SL PRS-RSRP measurement, SL PRS-RSRPP measurement, SL Rx-Tx time difference measurement, SL AoA measurement, and SL RTOA measurement.					

B.5 High level test procedure for SAN RRM tests

The following high level steps are conducted for test cases for SAN defined in clause A.14.

- A set of ephemeris information are pre-defined for each satellite corresponding to respective epoch times in TS 38.508-1 [38].

- The same ephemeris information will be maintained during the test (constant ephemerisInfo in all SIB19 updates), i.e. SAN RRM test cases are defined with fixed constant Delay and Doppler shift from Satellite access node to UE unless otherwise stated.

The range from which the constant Delay is selected is as follows:

  - For GSO an altitude of 35,786km is considered. The range of the one-way delay between UE and satellite is from 119.375 ms to 128.79 ms.

  - For NGSO an altitude of 600km and 1200km on a circular orbit are considered. The range of the one-way delay between UE and satellite is from 2 ms (lowest value for LEO orbit 600km) to 6.67 ms (highest value for LEO orbit 1200km).

- The constant Doppler shift (i.e. frequency offset) is derived from the same ephemeris (i.e. orbit emulation) as the Delay.

- UE location is determined for the test. During the test, the test system shall provide the UE location to the DUT using AT commands.

- The ephemeris and the UE location should be designed such that elevation angle relative to the UE position shall not be smaller than 30 deg during entire test time.

- Test equipment adjusts the time and frequency of transmission according to the pre-defined ephemeris (constant in all SIB19 updates) and UE location.

Annex C (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2017-05	RAN4#83	R4-1706324				Specification skeleton	0.0.1
2017-09						Email approved	0.1.0
2017-09	RAN4-NR AH #3	R4-1709413				Capture TPs approved in the meeting	0.2.0
2017-10	RAN4#84-Bis	R4-1711985				Capture TPs approved in the meeting	0.3.0
2017-12	RAN4#85	R4-1714546				Capture TPs approved in RAN4#85	0.4.0
2017-12	RAN#78	RP-172407				v1.0.0 submitted for plenary approval	1.0.0
2017-12	RAN#78					Approved by plenary – Rel-15 spec under change control	15.0.0
2018-03	RAN#79	RP-180264	0032		B	CR to TS38.133	15.1.0
2018-06	RAN#80	RP-181075	0037		B	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4 #86bis and RAN4 #87	15.2.0
2018-09	RAN#81	RP-181896	0043		B	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4-AH-1807 and RAN4 #88	15.3.0
2018-12	RAN#82	RP-182763	0057	3	B	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4-88bis and RAN4-89	15.4.0
2019-03	RAN#83	RP-190569	0064	1	B	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4#90	15.5.0
2019-06	RAN#84	RP-191240	0072	1	F	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4#90bis and RAN4#91	15.6.0
2019-06	RAN#84	RP-191248	0066		B	Introduction of band n48	16.0.0
2019-06	RAN#84	RP-191242	0067		B	Introduction of band n14 - CR to TS 38.133	16.0.0
2019-06	RAN#84	RP-191246	0068		B	Introduction of band n30 - CR to TS 38.133	16.0.0
2019-06	RAN#84	RP-191244	0069		B	introduce n18 into TS38.133	16.0.0
2019-06	RAN#84	RP-191250	0070	1	B	n65 introduction to 38.133	16.0.0
2019-09	RAN#85	RP-192034	0077		B	n29 introduction to 38.133	16.1.0
2019-09	RAN#85	RP-192022	0085		A	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4#92 (Rel-16) - Mirrors changes in R4-1910356 for Rel-15 TS 38.133	16.1.0
2019-12	RAN#86	RP-192997	0093		A	Specification of UE antenna gain range	16.2.0
2019-12	RAN#86	RP-192992	0095	1	A	Add RRM Test case setup for 1 AoA in Rx beam peak and 1 in non Rx beam peak	16.2.0
2019-12	RAN#86	RP-192997	0097		A	Update of Parameters, Test case A.7.7.1.1 FR2 Intra-frequency SS-RSRP accuracy	16.2.0
2019-12	RAN#86	RP-192997	0099		A	Update of Parameters, Test case A.5.7.1.1 FR2 Intra-frequency SS-RSRP accuracy	16.2.0
2019-12	RAN#86	RP-192997	0101		A	Update of Parameters, Test case A.7.7.1.2 FR2 Inter-frequency SS-RSRP accuracy	16.2.0
2019-12	RAN#86	RP-192997	0103		A	Update of Parameters, Test case A.5.7.1.2 FR2 Inter-frequency SS-RSRP accuracy	16.2.0
2019-12	RAN#86	RP-192992	0105		A	Correction to Random access test case in FR1 for PSCell in EN-DC	16.2.0
2019-12	RAN#86	RP-193040	0107		A	CR on handover 38.133 - R16	16.2.0
2019-12	RAN#86	RP-192994	0112	1	A	CR on the BWP switch test cases EN-DC FR1 (clause A.4.5.6)	16.2.0
2019-12	RAN#86	RP-192994	0113	1	A	CR on the BWP switch test cases EN-DC FR2 (clause A.5.5.6)	16.2.0
2019-12	RAN#86	RP-192994	0114	1	A	CR on the BWP switch test cases SA FR1 (clause A.6.5.6)	16.2.0
2019-12	RAN#86	RP-192994	0115	1	A	CR on the BWP switch test cases SA FR2 (clause A.7.5.6)	16.2.0
2019-12	RAN#86	RP-193042	0117		A	CR to TS38.133 on correction for BWP switching with SCS changing (section 8.2.1.2.7, 8.2.2.2.5 and 8.6.2)	16.2.0
2019-12	RAN#86	RP-193040	0121		A	CR on handover RRM requirement (clause 6.1.1.5) (R16)	16.2.0
2019-12	RAN#86	RP-192994	0123		A	CR on test cases for EN-DC FR2 inter-frequency measurement (clause A.5.6.2) (R16)	16.2.0
2019-12	RAN#86	RP-192994	0127	1	A	CR on test cases for Redirection from NR in FR2 to NR in FR2 (clause A.7.3.2.3) (R16)	16.2.0
2019-12	RAN#86	RP-192994	0129	1	A	CR on test cases for FR2 handover (clause A.7.3.1) (R16)	16.2.0
2019-12	RAN#86	RP-193042	0131		A	CR to 38.133 on TCI state switching (section 8.10) (R16)	16.2.0
2019-12	RAN#86	RP-193009	0133		F	CR on measurement gap applicability requirement for SRVCC	16.2.0
2019-12	RAN#86	RP-192994	0137		A	CR on TC with monitoring PDCCH not in first 3 OFDM symbols R16	16.2.0
2019-12	RAN#86	RP-193021	0139		F	CR to add n90 in the NR operating bands in FR1 (3.5.2)	16.2.0
2019-12	RAN#86	RP-193040	0148	1	A	CR on inter-RAT measurement in TS38.133 (clause 9.4.2, 9.4.3)	16.2.0
2019-12	RAN#86	RP-193042	0151		A	CR to 38.133 R16 Add the missing units to DRX cycle values (Cat A)	16.2.0

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2019-12	RAN#86	RP-193005	0152	1	B	CR for Abbreviations for cross link interference (clause 3)	16.2.0
2019-12	RAN#86	RP-193005	0153	1	B	CR for cross link interference measurements (clause 9)	16.2.0
2019-12	RAN#86	RP-193041	0156		A	CR on NR MTTD and MRTD definition for R16	16.2.0
2019-12	RAN#86	RP-193042	0157	1	A	Editorial correction for SCell activation and deactivation delay	16.2.0
2019-12	RAN#86	RP-193039	0159		A	CR for SCell activation delay in FR2	16.2.0
2019-12	RAN#86	RP-193040	0161		A	CR for scheduling restriction due to L1-RSRP measurement	16.2.0
2019-12	RAN#86	RP-192993	0167		A	CR on SSB setting for new gap and SMTC setting (section A.3.10)	16.2.0
2019-12	RAN#86	RP-192995	0169		A	CR on TS38.133 for EN-DC SS-SINR tests with PSCell in FR1 (section A.4.7.3)	16.2.0
2019-12	RAN#86	RP-192995	0171		A	CR on TS38.133 for SA SS-SINR tests with PCell in FR1 (section A.6.7.3)	16.2.0
2019-12	RAN#86	RP-192993	0185		A	CR on cell-reselection test cases for NR SA FR2 R16	16.2.0
2019-12	RAN#86	RP-192995	0187		A	endorsed CR on intra-frequency measurement and reporting for EN-DC FR2 R16	16.2.0
2019-12	RAN#86	RP-192996	0189		A	endorsed CR on intra-frequency measurement and reporting for NR SA FR2 R16	16.2.0
2019-12	RAN#86	RP-192996	0191		A	endorsed CR on RLM scheduling restrictions for EN-DC FR2 R16	16.2.0
2019-12	RAN#86	RP-192996	0193		A	endorsed CR on RLM scheduling restrictions for NR SA FR2 R16	16.2.0
2019-12	RAN#86	RP-192992	0201		A	Correction to PRACH configuration index in test cases_r16	16.2.0
2019-12	RAN#86	RP-193009	0205		B	CR on UMTS inter-RAT measurement requirements	16.2.0
2019-12	RAN#86	RP-193009	0206		B	CR on CSSF for SRVCC	16.2.0
2019-12	RAN#86	RP-193009	0207		B	CR on measurement capability for NR- UMTS for SRVCC	16.2.0
2019-12	RAN#86	RP-193039	0209		A	Correction on the TCI state switching (clause 8.10)	16.2.0
2019-12	RAN#86	RP-193039	0219		A	CR for 38133 editorial for clause 8.1,8.8,8.9,8.10,8.11 in Rel-16	16.2.0
2019-12	RAN#86	RP-193039	0220		A	CR for 38133 editorial for clause 8.5 in Rel-16	16.2.0
2019-12	RAN#86	RP-193039	0221		A	CR for 38133 editorial for clause 9.3 in Rel-16	16.2.0
2019-12	RAN#86	RP-193040	0222		A	CR on 38133 for removal the duplicated reference in clause 2	16.2.0
2019-12	RAN#86	RP-193040	0223		A	CR on 38133 for clause 11 in Rel-16	16.2.0
2019-12	RAN#86	RP-192994	0225	1	A	CR on TC of UE transmit timing (A.4.4.1.1, A.5.4.1.1, A.6.4.1.1, A.7.4.1.1) Rel-16	16.2.0
2019-12	RAN#86	RP-193042	0230		A	Update on requirements related to inter-band EN-DC and NE-DC synchronous requirements	16.2.0
2019-12	RAN#86	RP-193008	0231	1	B	MRTD and MTTD requirements for asynchronous NR-NR DC	16.2.0
2019-12	RAN#86	RP-192995	0233	1	A	Editorial corrections to measurement accuracy tests	16.2.0
2019-12	RAN#86	RP-192992	0235		A	Corrections to SS-RSRQ and SS-SINR OTA tests with SA	16.2.0
2019-12	RAN#86	RP-192992	0237	1	A	Corrections to SS-RSRQ and SS-SINR OTA tests with EN-DC	16.2.0
2019-12	RAN#86	RP-193042	0239	1	A	Editorial corrections to clause 9.2	16.2.0
2019-12	RAN#86	RP-193009	0240		B	Introduction of handover requirements for SRVCC in clause 6.1.2	16.2.0
2019-12	RAN#86	RP-192992	0242		A	Corrections to band applicability of measurement accuracy tests	16.2.0
2019-12	RAN#86	RP-192996	0244		A	Introduction of bandwidth limited OCNG for OTA testing	16.2.0
2019-12	RAN#86	RP-192992	0248		A	Corrections to test cases for SA FR2 inter-frequency measurement (clause A.7.6.2)	16.2.0
2019-12	RAN#86	RP-193041	0250		A	CR to 38.133 NR reporting criteria	16.2.0
2019-12	RAN#86	RP-192993	0264		A	CR on correcting CSI-RS based BFD and link recovery tests for EN-DC in FR1	16.2.0
2019-12	RAN#86	RP-192993	0266		A	CR on correcting CSI-RS based BFD and link recovery tests for SA in FR1	16.2.0
2019-12	RAN#86	RP-192993	0268		A	CR on correcting CSI-RS based BFD and link recovery tests for EN-DC in FR2	16.2.0
2019-12	RAN#86	RP-192993	0270		A	CR on correcting CSI-RS based BFD and link recovery tests for SA in FR2	16.2.0
2019-12	RAN#86	RP-193004	0274	1	B	CR on introducing L1-SINR mapping in TS38.133 R16	16.2.0
2019-12	RAN#86	RP-193040	0276		A	CR on delay uncertainty of RRC Release with redirection requirements in TS 38.133 (Cat A)	16.2.0
2019-12	RAN#86	RP-193040	0278		A	CR on known condition of PSCell addition requirement in NE-DC (Cat A)	16.2.0
2019-12	RAN#86	RP-193041	0280		A	CR on known condition of PSCell addition requirement in NR DC (Cat A)	16.2.0
2019-12	RAN#86	RP-193041	0282		A	CR on RRC Re-establishment requirements in TS 38.133 (Cat A)	16.2.0
2019-12	RAN#86	RP-193041	0284		A	CR on scope of interruption requirements of EN-DC in TS 38.133 (Cat A)	16.2.0
2019-12	RAN#86	RP-193041	0286		A	CR on scope of MTTD requirements in TS 38.133 (Cat A)	16.2.0
2019-12	RAN#86	RP-192994	0288		A	CR on SSB-based RLM test case for EN-DC FR1 (Cat A)	16.2.0
2019-12	RAN#86	RP-192994	0290		A	CR on SSB-based RLM test case for NR SA FR1 (Cat A)	16.2.0
2019-12	RAN#86	RP-193042	0292		A	Editorial CR on clause 8.2 (Cat A)	16.2.0
2019-12	RAN#86	RP-193041	0296		A	CR on NR inter-frequency identification (Cat A)	16.2.0

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2019-12	RAN#86	RP-193041	0298		A	CR on NR intra-frequency measurements (Cat A)	16.2.0
2019-12	RAN#86	RP-193039	0312		A	Correction on CSSF within measurement gap (clause 9.1.5.2) (cat-A)	16.2.0
2019-12	RAN#86	RP-193041	0314		A	CR on RLM scheduling restriction (clause 8.1.7) (cat-A)	16.2.0
2019-12	RAN#86	RP-193041	0316		A	CR on SCell activation requirements (clause 8.3.2) (cat-A)	16.2.0
2019-12	RAN#86	RP-193042	0318		A	CR to add QCL definition (clause 3.6) (cat-A)	16.2.0
2019-12	RAN#86	RP-192993	0320		A	CR on power offset in TRS RMC (A.3.17) (cat-A)	16.2.0
2019-12	RAN#86	RP-192995	0322		A	CR to introduce new PDCCH RMC (A.3.1.3.2) (cat-A)	16.2.0
2019-12	RAN#86	RP-192997	0324		A	Maintenance CR for measurement accuracy (clause 10.1) (cat-A)	16.2.0
2019-12	RAN#86	RP-192996	0326		A	FR1 CSI-RS RLM test OOS/IS non-DRX for EN-DC (clause A.4.5.1) (cat-A)	16.2.0
2019-12	RAN#86	RP-192996	0328		A	FR2 CSI-RS RLM test OOS/IS non-DRX for EN-DC (clause A.4.5.1) (cat-A)	16.2.0
2019-12	RAN#86	RP-192996	0330		A	FR1 CSI-RS RLM test OOS/IS non-DRX for SA (clause A.6.5.1) (cat-A)	16.2.0
2019-12	RAN#86	RP-192996	0332		A	FR2 CSI-RS RLM test OOS/IS non-DRX for SA (clause A.6.5.1) (cat-A)	16.2.0
2019-12	RAN#86	RP-192997	0334		A	L1-RSRP delay test FR1 EN-DC (clause A.4.6.3) (cat-A)	16.2.0
2019-12	RAN#86	RP-192997	0336		A	L1-RSRP delay test FR2 EN-DC (clause A.5.6.3) (cat-A)	16.2.0
2019-12	RAN#86	RP-192997	0338		A	L1-RSRP delay test FR1 SA (clause A.6.6.4) (cat-A)	16.2.0
2019-12	RAN#86	RP-192997	0340		A	L1-RSRP delay test FR2 SA (clause A.7.6.3) (cat-A)	16.2.0
2019-12	RAN#86	RP-192996	0344		A	L1-RSRP accuracy test FR2 EN-DC (clause A.5.7.4) (cat-A)	16.2.0
2019-12	RAN#86	RP-192996	0346		A	L1-RSRP accuracy test FR2 SA (clause A.7.7.4) (cat-A)	16.2.0
2019-12	RAN#86	RP-193005	0347	1	B	CR to introduce CLI measurement accuracy requirements	16.2.0
2019-12	RAN#86	RP-193008	0348		B	CR on measurement gap interruption due to async NR-DC	16.2.0
2019-12	RAN#86	RP-193008	0349		B	CR on Interruptions at PSCell/SCell addition/release in async NR-DC	16.2.0
2019-12	RAN#86	RP-193008	0350		B	Introducing euCA related interruption requirements for EN-DC in 38.133 (clause 8.2.1)	16.2.0
2019-12	RAN#86	RP-193008	0351		B	Introducing euCA related interruption requirements for NE-DC in 38.133 (clause 8.2.3)	16.2.0
2019-12	RAN#86	RP-193008	0352	1	B	CR on direct SCell activation delay	16.2.0
2019-12	RAN#86	RP-193039	0358		A	CR 38.133 (8.3.2) Amendment of requirements depending on T_SMTC_Max	16.2.0
2019-12	RAN#86	RP-193039	0360		A	CR 38.133 (8.3.3) Correction of SCell deactivation delay	16.2.0
2019-12	RAN#86	RP-192992	0362	1	A	CR 38.133 (A.7.5.7) TCs for PSCell addition and release delay	16.2.0
2019-12	RAN#86	RP-192995	0366		A	CR to TS 38.133: New common clause with OTA related definitions for FR2 testing (Rel-16)	16.2.0
2019-12	RAN#86	RP-192995	0368		A	CR to TS 38.133: Configuration of NR FR1 cell in NR FR1-FR2 tests (Rel-16)	16.2.0
2019-12	RAN#86	RP-192995	0370		A	CR to TS 38.133: Clarificatins to Antenna Configurations for FR2 (Rel-16)	16.2.0
2019-12	RAN#86	RP-192995	0372		A	CR to TS 38.133: Corrections to CORESET RMCs (Rel-16)	16.2.0
2019-12	RAN#86	RP-192995	0374		A	CR to TS 38.133: Corrections to FR2 test configurations (Rel-16)	16.2.0
2019-12	RAN#86	RP-193042	0376	1	A	Editorial updates (clause 9.4)	16.2.0
2019-12	RAN#86	RP-193039	0378		A	Correction in interruption requirements (clause 8.2)	16.2.0
2019-12	RAN#86	RP-193042	0380	1	A	Editorial updates (annex B)	16.2.0
2019-12	RAN#86	RP-193040	0382		A	CR on 38133 for MRTD and MTTD in intra-band EN-DC	16.2.0
2019-12	RAN#86	RP-193039	0390		A	Correction to the starting point of the DRX cycle length interval	16.2.0
2019-12	RAN#86	RP-192992	0391		A	CR for MAC-CE based TCI State switch for ENDC (section A.5.5.8)	16.2.0
2019-12	RAN#86	RP-192993	0392		A	CR for MAC-CE based TCI State switch for NR SA (section A.7.5.7)	16.2.0
2019-12	RAN#86	RP-192993	0393		A	CR for RRC based TCI State switch for NR SA (section A.7.5.7)	16.2.0
2019-12	RAN#86	RP-192993	0394		A	CR for RRC based TCI State switch for EN-DC (section A.5.5.8)	16.2.0
2019-12	RAN#86	RP-192992	0395		A	CR for FR1 handover test cases (section A.6.3.1.1, A.6.3.1.2, A.6.3.1.3)	16.2.0
2019-12	RAN#86	RP-193041	0396		A	CR on MTTD for intra-band EN-DC	16.2.0
2019-12	RAN#86	RP-193040	0398		A	CR on corrections on NR intra frequency measurement reporting requirements (section 9.2.4)	16.2.0
2020-03	RAN#87	RP-200401	0405	1	A	[CR] handover requirements 38.133 R16 (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0412	1	A	[CR] SCell activation delay 38.133 R16 (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0417		A	Corrections to RRM Test case A.7.1.1.2	16.3.0
2020-03	RAN#87	RP-200401	0419		A	Correction to Active UL BWP for SA intra-frequency event triggered reporting with per-UE gaps	16.3.0
2020-03	RAN#87	RP-200401	0421		A	Correction to FR1-E-UTRA Inter-RAT cell re-selection test cases	16.3.0
2020-03	RAN#87	RP-200401	0423		A	Removal of Time offset between PCell and PSCell in SA RRM Test cases	16.3.0
2020-03	RAN#87	RP-200401	0425		A	Correction to SRS periodicity and Offset for UL transit timing with DRX config	16.3.0

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2020-03	RAN#87	RP-200401	0427		A	Update of Test Requirements, FR2 Intra-frequency SS-RSRP accuracy Test cases	16.3.0
2020-03	RAN#87	RP-200401	0429		A	Update of Test requirements, FR2 Inter-frequency SS-RSRP accuracy Test cases	16.3.0
2020-03	RAN#87	RP-200401	0439	1	A	CR on test cases for SA FR2 inter-frequency measurement R16 (section A.7.6.2)	16.3.0
2020-03	RAN#87	RP-200401	0441		A	Editorial corrections for 38.133 Core Part R16 (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0445	1	A	Editorial corrections for 38.133 Perf Part R16 (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0454		A	Editorial correction for active TCI state switching delay	16.3.0
2020-03	RAN#87	RP-200401	0462	1	A	Corrections for BWP switch delay R16 (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0464		A	CR for reference correction on L1-RSRP measurement period (section 9.5.3)	16.3.0
2020-03	RAN#87	RP-200401	0466		A	CR for measurement restriction in FR2 across CCs (section 8.1.2.3, 8.1.3.3, 8.5.2.3, 8.5.3.3, 8.5.5.3, 8.5.6.3, 9.5.5.1, 9.5.5.2)	16.3.0
2020-03	RAN#87	RP-200401	0468		A	CR for SSB based candidate beam detection (section 8.5.5.2)	16.3.0
2020-03	RAN#87	RP-200401	0488		A	CR to TS 38.133: Corrections to FR1-FR2 event triggered test cases annex A.5 (Rel-16)	16.3.0
2020-03	RAN#87	RP-200401	0490		A	CR to TS 38.133: Corrections to FR1-FR2 event triggered test cases annex A.7 (Rel-16)	16.3.0
2020-03	RAN#87	RP-200401	0492		A	CR to TS 38.133: Clarifications to AoA setup and AoA cell assignement annex A.5 (Rel-16)	16.3.0
2020-03	RAN#87	RP-200401	0494		A	CR to TS 38.133: Clarifications to AoA setup annex A.8 (Rel-16)	16.3.0
2020-03	RAN#87	RP-200401	0496		A	CR to TS 38.133: Addition of TC A.4.7.2.2 (Rel-16)	16.3.0
2020-03	RAN#87	RP-200401	0500		A	Editorial correction of EN-DC FR1 L1-RSRP measurement for beam reporting	16.3.0
2020-03	RAN#87	RP-200401	0502		A	Editorial correction of NR SA FR1 L1-RSRP measurement for beam reporting	16.3.0
2020-03	RAN#87	RP-200401	0509		A	CR on removing one-shot timing adjustment requirements (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0516		A	Correction to BWP switching delay_r16	16.3.0
2020-03	RAN#87	RP-200401	0518		A	Correction to inter-RAT measurement on LTE serving carrrier_r16	16.3.0
2020-03	RAN#87	RP-200401	0520		A	Correction to configurations for TRS_r16	16.3.0
2020-03	RAN#87	RP-200401	0522		A	Correction to FR1 SA inter-RAT measurement TCs_r16 NOTE The CR is not implemented because the corresponding Cat F CR is not implementable.	16.3.0
2020-03	RAN#87	RP-200401	0524		A	Correction to interruption TCs_r16 NOTE The CR is not implemented because the corresponding Cat F CR is not implementable.	16.3.0
2020-03	RAN#87	RP-200401	0528		A	Correction to RF channels configuration_r16	16.3.0
2020-03	RAN#87	RP-200401	0530		A	Correction to RRC release with redirection TCs_r16	16.3.0
2020-03	RAN#87	RP-200401	0532		A	Correction to UL reconfiguration delay TCs_r16	16.3.0
2020-03	RAN#87	RP-200401	0538		A	CR on SSB RLM test cases EN-DC R16	16.3.0
2020-03	RAN#87	RP-200401	0540		A	CR on SSB RLM test cases SA R16	16.3.0
2020-03	RAN#87	RP-200401	0542		A	CR on cell reselection test cases for FR2 SA R16	16.3.0
2020-03	RAN#87	RP-200401	0544		A	OCNG pattern for TDM-ed SSB R16	16.3.0
2020-03	RAN#87	RP-200401	0564		A	NR editorial correction	16.3.0
2020-03	RAN#87	RP-200401	0580		A	CR 38.133 (8.11) Corrections to PSCell change delay requirements	16.3.0
2020-03	RAN#87	RP-200401	0587		A	PRACH configurations in FR1 SSB based RLM tests	16.3.0
2020-03	RAN#87	RP-200401	0589		A	PRACH configurations in FR1 SSB based BFR tests	16.3.0
2020-03	RAN#87	RP-200375	0437	1	B	CR for Conditional PSCell addition/change RRM requirement	16.3.0
2020-03	RAN#87	RP-200381	0440		B	n26 introduction to 38.133	16.3.0
2020-03	RAN#87	RP-200374	0452	1	B	CR on interruption requirements for NR V2X	16.3.0
2020-03	RAN#87	RP-200372	0455		B	CR on RRM requirement for maximum MIMO layer adaptation	16.3.0
2020-03	RAN#87	RP-200389	0460	1	F	introduce n18 into TS38.133	16.3.0
2020-03	RAN#87	RP-200374	0473	1	B	CR of NR V2X RRM(introduction & reliability of GNSS signal)	16.3.0
2020-03	RAN#87	RP-200374	0476	2	B	CR on NR V2X initiation SLSS 38.133 -R16	16.3.0
2020-03	RAN#87	RP-200401	0479		F	CR to 38.133 NR reporting criteria	16.3.0
2020-03	RAN#87	RP-200382	0486		B	Introduction of n53 into 38.133	16.3.0
2020-03	RAN#87	RP-200371	0498		B	Updates to SA NR interruption requirements for NR-U	16.3.0
2020-03	RAN#87	RP-200401	0510		F	CR on inter-band EN-DC and NE-DC synchronous requirements	16.3.0
2020-03	RAN#87	RP-200375	0511	1	B	CR on DAPS handover requirements	16.3.0
2020-03	RAN#87	RP-200374	0512		B	CR on introducing UE sidelink timing requirements for NR V2X	16.3.0
2020-03	RAN#87	RP-200370	0545	1	F	CR on CLI measurement requirements	16.3.0
2020-03	RAN#87	RP-200370	0546	1	F	CR on CLI measurement accuracy requirements	16.3.0

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Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2020-03	RAN#87	RP-200406	0547		B	CR on Interruptions at SCell activation/deactivation in async NR-DC	16.3.0
2020-03	RAN#87	RP-200406	0548	1	F	CR on direct SCell activation delay	16.3.0
2020-03	RAN#87	RP-200376	0551	1	F	Correction on handover requirements for SRVCC	16.3.0
2020-03	RAN#87	RP-200371	0558	1	B	CR to 38.133 to address NR-U inter-RAT measurements	16.3.0
2020-03	RAN#87	RP-200401	0578		F	CR 38.133 (8.3.2) Correction of error in Rel-16 SCell activation	16.3.0
2020-03	RAN#87	RP-200370	0582		B	CR for conditions for cross link interference measurements (section B)	16.3.0
2020-06	RAN#88	RP-200987	0595		A	[CR] Editorial corrections for 38.133 R16 Core Part - Cat A	16.4.0
2020-06	RAN#88	RP-200987	0596		F	[CR] Editorial corrections for 38.133 R16 Core Part - Cat F	16.4.0
2020-06	RAN#88	RP-200987	0598		A	[CR] Editorial corrections for 38.133 R16 Perf Part - Cat A	16.4.0
2020-06	RAN#88	RP-200966	0599		F	[CR] Delay requirements for direct SCell activation	16.4.0
2020-06	RAN#88	RP-200987	0600		F	[CR] Editorial corrections for 38.133 R16 Perf Part - Cat F	16.4.0
2020-06	RAN#88	RP-200987	0602		A	CR to Intra-frequency handover from FR1 to FR1	16.4.0
2020-06	RAN#88	RP-200987	0606		A	CR to A.6.1.2.1 Cell reselection to higher priority E-UTRAN	16.4.0
2020-06	RAN#88	RP-200987	0608		A	Correction to General test parameters in A.6.6.1.2	16.4.0
2020-06	RAN#88	RP-200987	0620		A	CR on CSSF correction for R16 TS38.133	16.4.0
2020-06	RAN#88	RP-201047	0625	1	B	CR on multiple SCell activation deactivation requirement for R16	16.4.0
2020-06	RAN#88	RP-201047	0626	1	B	CR on multiple SCell activation interruption requirement for R16	16.4.0
2020-06	RAN#88	RP-200987	0629		A	CR on Active TCI State Switching requirements - Rel16	16.4.0
2020-06	RAN#88	RP-201055	0632	2	F	Rapportuer CR for TS38.133	16.4.0
2020-06	RAN#88	RP-201048	0635	2	B	CR on minimum requirement at transition period for UE power saving	16.4.0
2020-06	RAN#88	RP-200958	0636	1	F	CR on interruption requirements for NR V2X	16.4.0
2020-06	RAN#88	RP-200975	0641	1	B	CR on cell identification requirements for NR HST	16.4.0
2020-06	RAN#88	RP-201044	0642	2	B	CR on PRS-RSRP measurement report mapping	16.4.0
2020-06	RAN#88	RP-201044	0645	1	B	CR on SRS RSRP measurement report mapping	16.4.0
2020-06	RAN#88	RP-200973	0646	2	B	CR to TS38.133 on introduction of L1-SINR Measurement Requirement (section 3.3 and 9)	16.4.0
2020-06	RAN#88	RP-200973	0648	1	B	CR to TS38.133 on introduction of SCell BFRQ Procedure (section 8.5)	16.4.0
2020-06	RAN#88	RP-200987	0651		A	Add UE Beam assumption for RRM Test cases in A.7.3, A.7.4, A.7.7	16.4.0
2020-06	RAN#88	RP-200987	0653		A	Add UE Beam assumption for RRM Test cases in A.5.3, A.5.4, A.5.7	16.4.0
2020-06	RAN#88	RP-200987	0655		A	Update of FR2 RLM Test cases with 2 Angles of Arrival	16.4.0
2020-06	RAN#88	RP-200987	0657		F	Update of Tx Timing Test cases	16.4.0
2020-06	RAN#88	RP-200987	0659		A	Update of FR2 RLM and BFD-LR Test cases	16.4.0
2020-06	RAN#88	RP-200987	0661		A	Update of FR2 SS-RSRP Test cases	16.4.0
2020-06	RAN#88	RP-200987	0663	1	A	CR on TCI state switch	16.4.0
2020-06	RAN#88	RP-200987	0665		A	CR on PDSCH RMC	16.4.0
2020-06	RAN#88	RP-201047	0668	1	B	CR on active spatial relation switch	16.4.0
2020-06	RAN#88	RP-200976	0671	1	B	CR to TS 38.133: CHO RRM requirement	16.4.0
2020-06	RAN#88	RP-201047	0672	1	B	CR to TS 38.133: RRM requirement for UE-specific CBW change delay	16.4.0
2020-06	RAN#88	RP-201047	0673		B	CR to TS 38.133: RRM requirement for interruption due to UE-specific CBW change	16.4.0
2020-06	RAN#88	RP-200969	0678	1	B	CR to TS 38.133: introducing 2-step RACH core requirements	16.4.0
2020-06	RAN#88	RP-200987	0680		A	Correction of CFRA RSRP threshold	16.4.0
2020-06	RAN#88	RP-200970	0682		B	CR for event triggered reporting tests for CLI	16.4.0
2020-06	RAN#88	RP-200958	0685		B	CR of NR V2X abbreviations	16.4.0
2020-06	RAN#88	RP-200958	0686	1	B	CR of interruption for switching between NR SL and LTE SL	16.4.0
2020-06	RAN#88	RP-200958	0687	2	F	CR of NR V2X editorial correction	16.4.0
2020-06	RAN#88	RP-200971	0689	1	B	38.133 CR on cell re-selection requirements for Rel-16 NR HST	16.4.0
2020-06	RAN#88	RP-201047	0690	1	B	CR on introducing inter-frequency measurements without measurement gap (9.1.5, 9.1.6, 9.3.1, 9.3.4, 9.3.5)	16.4.0
2020-06	RAN#88	RP-200987	0696		A	CR on SMTC period for beam management requirements	16.4.0
2020-06	RAN#88	RP-200987	0698		A	CR for CSI-RS based L1-RSRP measurement period	16.4.0
2020-06	RAN#88	RP-200987	0700		A	CR on RACH test cases with CSI-RS resource R16	16.4.0
2020-06	RAN#88	RP-200987	0704		A	CR on TS38.133 for modification of the layer 3 and layer 1 measurement sharing factor when both SSB and RSSI symbol to be measured are considered	16.4.0
2020-06	RAN#88	RP-200987	0706		A	CR on TS38.133 for modification on number of cells and number of SSB to be measured for FR2 intra-frequency measurement	16.4.0
2020-06	RAN#88	RP-200987	0708		A	[CR] TCI state switch delay 38.133 R16 Cat A	16.4.0
2020-06	RAN#88	RP-201047	0709	1	F	LTE CGI measurements with autonomous gaps for 38.133	16.4.0
2020-06	RAN#88	RP-201042	0710	3	B	Updates to general section for NR-U in 38.133	16.4.0
2020-06	RAN#88	RP-200976	0711	1	F	Correction to DAPS HO requirements in 38.133	16.4.0
2020-06	RAN#88	RP-201049	0712	2	F	SRVCC test case for event triggered reporting	16.4.0
2020-06	RAN#88	RP-201049	0713		F	Gap applicability errors corrected for SRVCC	16.4.0
2020-06	RAN#88	RP-200987	0715		A	Correction of NR SA FR2 inter-freq measurement reporting	16.4.0

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2020-06	RAN#88	RP-200968	0717		F	NTA_offset setting for NR coexistence with NB-IoT	16.4.0
2020-06	RAN#88	RP-201042	0718	2	B	CR to TS 38.133: adding NR-U Handover.	16.4.0
2020-06	RAN#88	RP-200975	0723	1	B	CR on cell re-selection requirement for NR-EUTRAN measurement in TS38.133	16.4.0
2020-06	RAN#88	RP-201042	0725	1	B	CR: Introduction of L1-RSRP measurement requirements with CCA	16.4.0
2020-06	RAN#88	RP-200987	0727		A	CR: Correction of L1-RSRP measurement period	16.4.0
2020-06	RAN#88	RP-200987	0729		A	CR to TS 38.133: Correction to CSI-RS configurations in A.3.14 (Rel-16)	16.4.0
2020-06	RAN#88	RP-200987	0731		A	CR to TS 38.133: Correction to SMTC configuration in measurement accuracy tests (Rel-16)	16.4.0
2020-06	RAN#88	RP-200987	0733		A	CR to TS 38.133: Clarifications to AoA setup annex A.5 (Rel-16)	16.4.0
2020-06	RAN#88	RP-200987	0735		A	CR to TS 38.133: Clarifications to AoA setup annex A.7 (Rel-16)	16.4.0
2020-06	RAN#88	RP-201048	0736		F	CR for maximum MIMO layer adaptation	16.4.0
2020-06	RAN#88	RP-200987	0738	1	F	Applicability of QCL	16.4.0
2020-06	RAN#88	RP-201047	0741	1	B	CR to 38.133 on SRS carrier switching interruption requirements	16.4.0
2020-06	RAN#88	RP-201047	0742	1	B	CR to 38.133 on impact to measurement requirements due to LTE SRS carrier switching	16.4.0
2020-06	RAN#88	RP-200969	0743	1	B	CR to 38.133 on UE transmit timing requirements for 2-step RACH	16.4.0
2020-06	RAN#88	RP-200987	0744	1	F	CR to 38.133 on intra frequency measurements without gaps	16.4.0
2020-06	RAN#88	RP-200987	0748		A	CR on Psharingfactor_r16	16.4.0
2020-06	RAN#88	RP-200987	0750		A	CR on E-UTRAN Serving Cell Parameters_r16	16.4.0
2020-06	RAN#88	RP-200987	0752		A	CR on Modified parameters for BFD TCs with 4Rx antenna_r16	16.4.0
2020-06	RAN#88	RP-200987	0754		A	CR on BFD TCs_r16	16.4.0
2020-06	RAN#88	RP-200987	0756		A	CR on UL carrier RRC reconfiguration Delay TC_r16	16.4.0
2020-06	RAN#88	RP-200987	0758		A	CR to FR1 SCell activation delay test cases_r16	16.4.0
2020-06	RAN#88	RP-200987	0760		A	CR to inter-frequency measurement TCs_r16	16.4.0
2020-06	RAN#88	RP-200987	0762	1	F	CR to interruption TCs_r16	16.4.0
2020-06	RAN#88	RP-200987	0763	1	F	CR to FR1 SA inter-RAT measurement TCs_r16	16.4.0
2020-06	RAN#88	RP-201047	0764	1	B	CR on introduction of RRM requirements for BWP switching delay on multiple CCs	16.4.0
2020-06	RAN#88	RP-201042	0767	1	B	CR on introduction of Active TCI state switching delay with CCA Requirements for NR-U	16.4.0
2020-06	RAN#88	RP-201042	0768	2	B	CR on introduction of reporting criteria for NR-U	16.4.0
2020-06	RAN#88	RP-201042	0770	1	B	CR on introduction of RRC_INACTIVE state moblity requirements for NR-U	16.4.0
2020-06	RAN#88	RP-200987	0775		A	CR on interruption due to Acitve BWP switch (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0779		A	CR on UE transmit timing (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0781		A	Editoral CR on TS 38.133 Rel-16 (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0783		A	CR on RRC Connection Release with Redirection (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0785		A	CR on RRC Re-establishment test cases (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0787		A	CR on Timing advance test cases for EN-DC (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0789		A	CR on Timing test cases for NR SA (Cat A)	16.4.0
2020-06	RAN#88	RP-201045	0792	1	B	CR on DL interruption Tx switching between two uplink carriers	16.4.0
2020-06	RAN#88	RP-200975	0796	1	B	Cell identification in connected mode for NR-EUTRAN measurement in HST	16.4.0
2020-06	RAN#88	RP-200987	0799		A	Correction onTCI state switching R16	16.4.0
2020-06	RAN#88	RP-200987	0801		A	Accuracy of carrier aggregation in NR R16	16.4.0
2020-06	RAN#88	RP-201049	0802	1	B	Test case for NR to UTRA FDD Inter-RAT handover	16.4.0
2020-06	RAN#88	RP-200976	0804		F	CR on conditional PSCell change requirements	16.4.0
2020-06	RAN#88	RP-200973	0806	1	B	CR on SCell BFD and CBD requirements	16.4.0
2020-06	RAN#88	RP-201047	0808	1	B	CR on interruption requirements for FR2 inter-band CA	16.4.0
2020-06	RAN#88	RP-201047	0809		B	CR on scaling factor CSSFoutside_gap for FR2 inter-band CA	16.4.0
2020-06	RAN#88	RP-201047	0810	1	B	CR on scheduling availability requirements for FR2 inter-band CA	16.4.0
2020-06	RAN#88	RP-200987	0813		A	CR 38.133 (8.10.5) Corrections to RRC-based TCI state change	16.4.0
2020-06	RAN#88	RP-200966	0814		F	CR 38.133 (8.3.4-5) Corrections to Direct SCell activation	16.4.0
2020-06	RAN#88	RP-200987	0816		A	CR 38.133 (8.3.2) Corrections to SCell Activation delay requirements	16.4.0
2020-06	RAN#88	RP-200966	0817	1	F	CR 38.133 (8.3.4-5) Addition of interruption windows for Direct SCell Activation	16.4.0
2020-06	RAN#88	RP-200978	0818	1	B	CR to 38.133 for Introduction of band n259	16.4.0
2020-06	RAN#88	RP-201047	0819	1	B	CR on SCell activation requirements for FR2 inter-band CA	16.4.0
2020-06	RAN#88	RP-200987	0821		A	CR on FR2 measurement requirements outside gaps R16	16.4.0
2020-06	RAN#88	RP-200987	0823		A	CR on inter-RAT RSTD requirements for NE-DC in 38.133 R16	16.4.0
2020-06	RAN#88	RP-200987	0825		A	CR on SCell activation requirements R16	16.4.0
2020-06	RAN#88	RP-200987	0827		A	CR on SSB based L1-RSRP measurement R16	16.4.0
2020-06	RAN#88	RP-200987	0829		A	CR on L1-RSRP delay tests for FR2 R16	16.4.0
2020-06	RAN#88	RP-200987	0831		A	CR to L1-RSRP accuracy TC for FR2 EN-DC R16	16.4.0
2020-06	RAN#88	RP-200987	0833		A	CR to L1-RSRP accuracy TC for FR2 SA R16	16.4.0

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2020-06	RAN#88	RP-200987	0835		A	CR to TCI state switch TC R16	16.4.0
2020-06	RAN#88	RP-200970	0836		F	CR on CLI measurement requirements	16.4.0
2020-06	RAN#88	RP-200970	0837	1	F	CR on CLI measurement performance requirements	16.4.0
2020-06	RAN#88	RP-200970	0838		B	CR on test cases for SRS-RSRP measurement accuracy in FR1	16.4.0
2020-06	RAN#88	RP-200970	0839	1	B	CR on test cases for SRS-RSRP measurement accuracy in FR2	16.4.0
2020-06	RAN#88	RP-200970	0840		B	CR on test cases for CLI-RSSI measurement accuracy in FR1	16.4.0
2020-06	RAN#88	RP-200970	0841	1	B	CR on test cases for CLI-RSSI measurement accuracy in FR2	16.4.0
2020-06	RAN#88	RP-200966	0843		B	CR on interruption requirements for direct SCell activation for 38.133	16.4.0
2020-06	RAN#88	RP-200966	0844	1	B	CR on delay requirements for SCell dormancy	16.4.0
2020-06	RAN#88	RP-200966	0845	1	B	CR on interruption requirements for SCell dormancy	16.4.0
2020-06	RAN#88	RP-201044	0847	1	B	CR for gNB Rx-Tx time difference and UL-RTOA report mapping	16.4.0
2020-06	RAN#88	RP-201044	0849	1	B	CR for AoA/ZoA report mapping	16.4.0
2020-06	RAN#88	RP-201048	0854	2	B	Measurement requirements for UEs under power saving mode	16.4.0
2020-06	RAN#88	RP-201044	0857	1	B	NR E-CID reporting criteria requirements	16.4.0
2020-06	RAN#88	RP-201044	0858	1	B	NR E-CID measurement requirements	16.4.0
2020-06	RAN#88	RP-201044	0862	1	B	Positioning measurement accuracy requirements structure in section 10	16.4.0
2020-06	RAN#88	RP-201044	0863	2	B	Reporting criteria for NR RSTD	16.4.0
2020-06	RAN#88	RP-200987	0867		A	Clarification on RLM	16.4.0
2020-06	RAN#88	RP-201042	0869		B	BWP switching interruption requirement due to consistent UL failure in 38.133	16.4.0
2020-06	RAN#88	RP-200969	0871	1	B	Applicability of 2-step RA and 4-step RA in RRM requirements in 38.133	16.4.0
2020-06	RAN#88	RP-200975	0874	1	B	CR to TS 38.133: NR HST beam management requirements	16.4.0
2020-06	RAN#88	RP-201047	0875	1	B	CR on 38133 interruption requirements for BWP switching on multiple CCs	16.4.0
2020-06	RAN#88	RP-200966	0879	1	B	Big CR Introduction of UE requirement for MR-DC early measurement reporting in 38.133	16.4.0
2020-06	RAN#88	RP-201042	0885		B	RRC release with redirection requirements in NR-U in 38.133	16.4.0
2020-06	RAN#88	RP-200988	0886	1	A	Rapportuer CR for TS38.133	16.4.0
2020-06	RAN#88	RP-201047	0887		B	CR: mandatory gap pattern	16.4.0
2020-09	RAN#88	RP-201512	0889		A	CR to Redirection from NR in FR1 to E-UTRAN	16.5.0
2020-09	RAN#88	RP-201512	0891		A	CR to timing advance adjustment accuracy in FR1	16.5.0
2020-09	RAN#88	RP-201512	0895		A	CR to SS-RSRQ Intra-Frequency and Inter-frequency FR1 measurement accuracy	16.5.0
2020-09	RAN#88	RP-201512	0897		A	Update to FR2 240 kHz SSB Configurations	16.5.0
2020-09	RAN#88	RP-201512	0899		A	Update of FR2 Random Access Test cases	16.5.0
2020-09	RAN#88	RP-201512	0901		A	Update to FR2 event-triggered reporting RRM Test cases in A.5.6 and A.7.6	16.5.0
2020-09	RAN#88	RP-201512	0903		A	Update to FR2 SS-RSRP RRM Test cases in A.5.7 and A.7.7	16.5.0
2020-09	RAN#88	RP-201512	0905		A	CR to EN-DC timing advance adjustment accuracy in FR2	16.5.0
2020-09	RAN#88	RP-201512	0907		A	CR to configuration of CSI-RS for tracking	16.5.0
2020-09	RAN#88	RP-201512	0909		A	Update of RRC-based Active BWP Switch test cases	16.5.0
2020-09	RAN#88	RP-201512	0911		A	Update to FR2 annex B RRM side conditions	16.5.0
2020-09	RAN#88	RP-201512	0913		A	Add UE Beam assumption for RRM Test cases in A.5.5	16.5.0
2020-09	RAN#88	RP-201496	0914	1	B	Introduction of the P-MPR 2 bits report mapping in 38.133	16.5.0
2020-09	RAN#88	RP-201512	0922		A	Add UE Beam assumption for RRM Test cases in A.7.5 Rel-16	16.5.0
2020-09	RAN#88	RP-201489	0924	1	F	Maintenance CR for 2-step RA	16.5.0
2020-09	RAN#88	RP-201491	0925	2	B	CR to TS 38.133: PRS RSTD requirements	16.5.0
2020-09	RAN#88	RP-201498	0928	1	F	CR on capabilities for support of event triggering and reporting criteria	16.5.0
2020-09	RAN#88	RP-201512	0931		F	CR for TS38.133 Rel-16, Corrction for SCell activation delay requirement	16.5.0
2020-09	RAN#88	RP-201512	0933		A	CR for TS38.133 Rel-16, Correction for RRM core requirements	16.5.0
2020-09	RAN#88	RP-201512	0935		A	CR for TS38.133 Rel-16, Correction for test cases of BWP switching	16.5.0
2020-09	RAN#88	RP-201498	0937	1	B	CR on CSI-RS based intra-frequency measurement requirement (Introduction, requirement applicability and number of cell and beams)	16.5.0
2020-09	RAN#88	RP-201500	0939	1	B	CR on uplink spatial relation switch delay (section 8.12)	16.5.0
2020-09	RAN#88	RP-201506	0940	1	B	Introduction of SCell activation/deactivation delay requirements for SCells operating with CCA	16.5.0
2020-09	RAN#88	RP-201491	0941	2	B	Revision of CSSF within gap to include NR positioning measurements with gap sharing	16.5.0
2020-09	RAN#88	RP-201491	0942	3	B	Introduction of new MG patterns for NR positioning	16.5.0
2020-09	RAN#88	RP-201491	0943	2	B	Introduction of UE Rx-Tx time difference measurement requirements for NR positioning	16.5.0
2020-09	RAN#88	RP-201512	0946		A	CR on TS38.133 for handover test cases	16.5.0
2020-09	RAN#88	RP-201512	0948		A	CR on TS38.133 for introducing the PDSCH RMC configuration in cell re-selection test cases	16.5.0

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2020-09	RAN#88	RP-201493	0950	2	F	CR on TS38.133 for dual active protocol stack handover (section 6.1.3)	16.5.0
2020-09	RAN#88	RP-201507	0952		F	CR on TS38.133 for intra-frequency measurement definition (section 9.2.1)	16.5.0
2020-09	RAN#88	RP-201512	0956		A	CR on FR2 measurement capability for R16	16.5.0
2020-09	RAN#88	RP-201506	0957		B	CR on UE measurement capability of NR-U for R16	16.5.0
2020-09	RAN#88	RP-201507	0958	1	B	CR on RRM requirement based on dual DRX for FR1+FR2 CA	16.5.0
2020-09	RAN#88	RP-201506	0959		F	Update NR Frequency Band Groups to include Band n30	16.5.0
2020-09	RAN#88	RP-201506	0960		F	Update NR Frequency Band Groups to include Band n14	16.5.0
2020-09	RAN#88	RP-201506	0961		F	CR for Table number mismatch for CLI performance tests	16.5.0
2020-09	RAN#88	RP-201512	0963		A	CR on Inter-RAT RSTD measurements (section 9.4.4)	16.5.0
2020-09	RAN#88	RP-201512	0965		A	CR on active BWP switch in R16	16.5.0
2020-09	RAN#88	RP-201500	0968	1	F	CR on multiple SCells activation (section 8.3.7)	16.5.0
2020-09	RAN#88	RP-201496	0969	1	F	CR on MRTD and MTTD for FR2 inter-band CA	16.5.0
2020-09	RAN#88	RP-201498	0970	1	B	CR on MRTD for FR2 inter-band CA	16.5.0
2020-09	RAN#88	RP-201498	0971	1	B	38.133 CR on UE measurement capability on the number of frequency layers to be monitored for CSI-RS measurement	16.5.0
2020-09	RAN#88	RP-201497	0972		F	38.133 CR on cell re-selection requirements for Rel-16 NR HST	16.5.0
2020-09	RAN#88	RP-201492	0973	1	F	CR of missed requirements based on the agreed CRs in RAN4#95-e	16.5.0
2020-09	RAN#88	RP-201492	0974	1	F	CR of interruption requirements	16.5.0
2020-09	RAN#88	RP-201500	0976	1	F	CR on definition of inter-frequency measurements without measurement gap (9.3.1)	16.5.0
2020-09	RAN#88	RP-201500	0984		F	CR on BWP switch on multiple CCs	16.5.0
2020-09	RAN#88	RP-201512	0986		A	CR for SCell activation delay in FR2 in R16	16.5.0
2020-09	RAN#88	RP-201512	0988		A	CR on TCI state switch delay in R16	16.5.0
2020-09	RAN#88	RP-201506	0991	1	B	CR for timing requirement for NR-U	16.5.0
2020-09	RAN#88	RP-201488	0992	1	B	CR for introduction of pathloss reference signal switching delay	16.5.0
2020-09	RAN#88	RP-201488	0993	1	F	CR for L1-SINR requirement	16.5.0
2020-09	RAN#88	RP-201498	0996	2	B	CR on introduction, applicability and capability for CSI-RS inter-frequency measurement requirements	16.5.0
2020-09	RAN#88	RP-201500	0999	1	B	Impact of CGI reading on L1 and L3 measurement	16.5.0
2020-09	RAN#88	RP-201498	1003	1	B	38.133 CR on introduction of CSI-RS based measurement	16.5.0
2020-09	RAN#88	RP-201488	1006		F	Correction of L1-SINR reporting requirements	16.5.0
2020-09	RAN#88	RP-201506	1007	2	B	CR: Beam management requirements with CCA	16.5.0
2020-09	RAN#88	RP-201507	1008		F	[CR] Corrections to DAPS Handover	16.5.0
2020-09	RAN#88	RP-201500	1010	2	F	CR for FR2 inter-band CA requirements	16.5.0
2020-09	RAN#88	RP-201506	1011	1	D	CR to TS 38.133 - Handover requirements in NR-U	16.5.0
2020-09	RAN#88	RP-201506	1012	2	B	CR to TS 38.133 to address NR-U inter-frequency measurements	16.5.0
2020-09	RAN#88	RP-201512	1015	1	F	CR 38.133 (8.3.2-3) Corrections to SCell activation delay requirements	16.5.0
2020-09	RAN#88	RP-201494	1016	1	B	CR 38.133 (8.3.9-8.3.11) Direct SCell activation delay for multiple downlink SCells	16.5.0
2020-09	RAN#88	RP-201494	1017	2	F	CR 38.133 SCell dormancy switching of multiple SCells	16.5.0
2020-09	RAN#88	RP-201494	1018		B	CR on delay requirements for SCell dormancy	16.5.0
2020-09	RAN#88	RP-201498	1020	1	B	CR on inter-frequency CSI-RS L3 measurement requirements	16.5.0
2020-09	RAN#88	RP-201512	1023		A	Clarification of SNR values in RLM Test cases	16.5.0
2020-09	RAN#88	RP-201512	1025		A	CR to TS 38.133: Corrections to CSI-RS configurations in A.3.14 (Rel-16)	16.5.0
2020-09	RAN#88	RP-201512	1027		A	CR to TS 38.133: Corrections to event triggered test cases (Rel-16)	16.5.0
2020-09	RAN#88	RP-201512	1029		A	CR to TS 38.133: Corrections to inter-RAT test cases (Rel-16)	16.5.0
2020-09	RAN#88	RP-201512	1031		A	CR to TS 38.133: Corrections to AoA setup information in some test cases (Rel-16)	16.5.0
2020-09	RAN#88	RP-201512	1033		A	CR on maintaining handover tests in Rel-16	16.5.0
2020-09	RAN#88	RP-201500	1039	1	F	CR on maintaining measurement restriction requirements for NR CA	16.5.0
2020-09	RAN#88	RP-201500	1041	3	F	CR on BWP switching delay on mulitple CCs	16.5.0
2020-09	RAN#88	RP-201506	1042	2	F	CR on active TCI state switching for NR-U	16.5.0
2020-09	RAN#88	RP-201506	1043	2	B	CR on introduction of intra-frequency measurements requirements for NR-U	16.5.0
2020-09	RAN#88	RP-201506	1044	1	B	CR on introduction of Active BWP switching delay requirements for NR-U	16.5.0
2020-09	RAN#88	RP-201506	1045	1	B	CR on introduction of RRC_IDLE state moblity requirements for NR-U	16.5.0
2020-09	RAN#88	RP-201506	1046	1	B	Discussion on RRC re-establishment for NR-U	16.5.0
2020-09	RAN#88	RP-201512	1048		A	CR on reporting criteria for EN-DC in 38.133 R15	16.5.0
2020-09	RAN#88	RP-201512	1050		A	CR on test cases for Active TCI state switch delay R15	16.5.0
2020-09	RAN#88	RP-201512	1052		A	Addition of new default configurations for RMC scheduling_r16	16.5.0

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2020-09	RAN#88	RP-201512	1054		A	Correction to beam failure detection and link recovery test cases_r16	16.5.0
2020-09	RAN#88	RP-201512	1056		A	Correction to BWP switching delay test cases_r16	16.5.0
2020-09	RAN#88	RP-201512	1058		A	Correction to FR1 intra-frequency measurement with gap test cases_r16	16.5.0
2020-09	RAN#88	RP-201512	1060		A	Correction to inter-RAT HO test cases_r16	16.5.0
2020-09	RAN#88	RP-201498	1064	2	B	CR on CSI-RS based intra-frequency measurement requirements	16.5.0
2020-09	RAN#88	RP-201500	1066	1	F	Correction on the interruption requirements due to SRS carrier switching	16.5.0
2020-09	RAN#88	RP-201500	1067	1	F	CSSF for inter-frequency measurement without gap in FR2 inter-band CA sceneario	16.5.0
2020-09	RAN#88	RP-201512	1070		A	CR on correction to CSSF within gap R16	16.5.0
2020-09	RAN#88	RP-201512	1072		A	CR on SCell activation requirements R16	16.5.0
2020-09	RAN#88	RP-201512	1075		A	CR on UL BWP configuration for RRM test cases R16	16.5.0
2020-09	RAN#88	RP-201512	1077		A	CR to add UE beam assumption for TC in A.5.6 R16	16.5.0
2020-09	RAN#88	RP-201506	1078		F	CR on reporting criteria for CLI	16.5.0
2020-09	RAN#88	RP-201494	1080	1	B	CR on direct SCell activation	16.5.0
2020-09	RAN#88	RP-201494	1081	2	F	CR on requirements for SCell dormancy	16.5.0
2020-09	RAN#88	RP-201491	1082	1	B	CR for general applicability of PRS measurement requirements	16.5.0
2020-09	RAN#88	RP-201491	1083	2	B	CR for measurement requirements for PRS-RSRP	16.5.0
2020-09	RAN#88	RP-201491	1085	2	B	CR to add CSI-RS related reporting criteria for ECID	16.5.0
2020-09	RAN#88	RP-201490	1088	2	F	Correction CR to Rel-16 UE power saving requirements	16.5.0
2020-09	RAN#88	RP-201506	1090		F	Correction to RACH delay in RRC release requirements in NR-U in 38.133	16.5.0
2020-09	RAN#88	RP-201512	1097		A	CR to 38.133 correction to RRC based BWP switch delay requirements	16.5.0
2020-09	RAN#88	RP-201512	1099		A	CR to 38.133 correction to interruption requirements for per-FR gap in FR2	16.5.0
2020-09	RAN#88	RP-201500	1100		B	CR to 38.133 on CGI reading of NR cell	16.5.0
2020-09	RAN#88	RP-201497	1101		F	CR to TS 38.133: Corrections to Table 9.4.3.3-2 in subclause 9.4.3.3 (Requirements when DRX is used)	16.5.0
2020-09	RAN#88	RP-201506	1102	2	B	Introduction of RLM requirements for NR-U	16.5.0
2020-09	RAN#88	RP-201491	1103	2	B	Measurement report mapping and additional path reporting for UE Rx-Tx	16.5.0
2020-09	RAN#88	RP-201491	1104	2	B	Measurement report mapping and additional path reporting for RSTD	16.5.0
2020-09	RAN#88	RP-201491	1106	1	F	Reporting criteria for NR positioning measurements	16.5.0
2020-09	RAN#88	RP-201491	1107		F	General introduction of NR positioning measurements	16.5.0
2020-09	RAN#88	RP-201498	1108	1	B	CR on scheduling restriction for CSI-RS based intra-frequency measurement	16.5.0
2020-09	RAN#88	RP-201507	1111		F	[CR] Replacing x in references with correct numbers (Core R16 Cat F)	16.5.0
2020-09	RAN#88	RP-201512	1113		A	[CR] Replacing x in references with correct numbers (Core R16 Cat A)	16.5.0
2020-09	RAN#88	RP-201512	1114		A	[CR] Replacing x in references with correct numbers (Perf R16 Cat A)	16.5.0
2020-09	RAN#88	RP-201512	1116		A	Fine/rough beam assumption for idle mode and measurement procedure test case	16.5.0
2020-09	RAN#88	RP-201512	1117		A	CR on BWP switching delay requirements R16	16.5.0
2020-12	RAN#90	RP-202433	1108	4	B	CR on scheduling restriction for CSI-RS based intra-frequency measurement	17.0.0
2020-12	RAN#90	RP-202487	1119		A	RB allocation and Noc level in RLM Test cases	17.0.0
2020-12	RAN#90	RP-202487	1121		A	Update FR2 event-triggered reporting Test cases in A.5.6, A.7.6	17.0.0
2020-12	RAN#90	RP-202487	1123		A	240 kHz SSB SCS Configuration for FR2 SS-RSRP Test cases	17.0.0
2020-12	RAN#90	RP-202487	1125		A	Correct UE beam assumption for Test Cases in A.5.6	17.0.0
2020-12	RAN#90	RP-202487	1127		A	Aggregation level of CORESET for RMC scheduling	17.0.0
2020-12	RAN#90	RP-202487	1129		A	Claify FR1 NSA SS-SINR measurement TCs	17.0.0
2020-12	RAN#90	RP-202487	1131		A	FR1 Inter-frequency Event triggered Reporting tests in DRX	17.0.0
2020-12	RAN#90	RP-202487	1133		A	E-UTRAN	17.0.0
2020-12	RAN#90	RP-202419	1138		F	CR for DAPS HO test applicability	17.0.0
2020-12	RAN#90	RP-202487	1139		F	Maintenance CR on SA inter-frequency event triggered reporting tests for FR1	17.0.0
2020-12	RAN#90	RP-202433	1140	1	F	CR on CSSF with both CSI-RS and SSB	17.0.0
2020-12	RAN#90	RP-202444	1146		A	CR on CSI-RS BW condition for BFD/CBD R16	17.0.0
2020-12	RAN#90	RP-202444	1148		A	CR on AP-CSI-RS based L1-RSRP measurement R16	17.0.0
2020-12	RAN#90	RP-202427	1152	1	F	CR of NR V2X operating band group	17.0.0
2020-12	RAN#90	RP-202436	1155	1	F	CR on TS38.133 for dual active protocol stack handover	17.0.0
2020-12	RAN#90	RP-202430	1156	2	F	CR on TS38.133 interruption time for CA with non-aligned frame boundaries	17.0.0

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2020-12	RAN#90	RP-202444	1158		F	CR on TS38.133 for inter-frequency measurement requirement without gap	17.0.0
2020-12	RAN#90	RP-202487	1160		A	CR on TS38.133 for cell activation and deactivation test case	17.0.0
2020-12	RAN#90	RP-202487	1162		A	CR on TS38.133 for cell reselection test case	17.0.0
2020-12	RAN#90	RP-202487	1164		A	CR on TS38.133 for active BWP switch test cases	17.0.0
2020-12	RAN#90	RP-202487	1165		F	CR on TS38.133 for E-UTRAN	17.0.0
2020-12	RAN#90	RP-202509	1166		F	CR on TS38.133 for SCell activation and deactivation delay test cases	17.0.0
2020-12	RAN#90	RP-202487	1168		A	CR for TS38.133 Rel-16, Correction for RRM core and test cases	17.0.0
2020-12	RAN#90	RP-202433	1171	1	F	CR on abbreviations about CSI-RS based measurement in 38.133.	17.0.0
2020-12	RAN#90	RP-202442	1184		F	CR to TS 38.133: Add information on the inter-band EN-DC and UL CA configurations with no DL interruption	17.0.0
2020-12	RAN#90	RP-202433	1186	1	F	CR on R16 CSI-RS based L3 measurements	17.0.0
2020-12	RAN#90	RP-202419	1187	2	B	Intra-band Inter-frequency sync DAPS handover test in SA for FR1	17.0.0
2020-12	RAN#90	RP-202427	1191	1	F	CR: Interruption requirement for NR V2X synchronization source chang	17.0.0
2020-12	RAN#90	RP-202432	1193		F	Fine/rough beam assumption for CLI performance test cases	17.0.0
2020-12	RAN#90	RP-202435	1194	1	F	38.133 CR on CSSFintra for measurement period for intra-frequency measurements in connected mode for Rel-16 NR HST	17.0.0
2020-12	RAN#90	RP-202486	1196		A	CR on carrier frequency range of PCell/PSCell for the maximum number of RLM-RS resources	17.0.0
2020-12	RAN#90	RP-202487	1209		A	Correction on beamFailureInstanceMaxCount for test cases of availability restriction during FR2 BFR in R16	17.0.0
2020-12	RAN#90	RP-202444	1212	1	F	Correction on unknown SCell activation in FR2.	17.0.0
2020-12	RAN#90	RP-202415	1213	1	B	Big CR on 2-step RA type RRM performance requirements	17.0.0
2020-12	RAN#90	RP-202431	1214	1	F	CR Maintenance 2-step RACH RRM requirements	17.0.0
2020-12	RAN#90	RP-202487	1216		A	Correction of RRM tests	17.0.0
2020-12	RAN#90	RP-202435	1217	1	F	CR on IDLE state cell re-selection requirements for HST in 38.133	17.0.0
2020-12	RAN#90	RP-202487	1225		A	Correction to types of requirements in annex A	17.0.0
2020-12	RAN#90	RP-202487	1227		A	Corrections to frequency range in interfrequency measurement procedures tests	17.0.0
2020-12	RAN#90	RP-202487	1230		A	Correction on TBD values in FR1+FR2 interfrequency RSRP accuracy tests	17.0.0
2020-12	RAN#90	RP-202486	1232		A	Addition of symbol definitions	17.0.0
2020-12	RAN#90	RP-202487	1236		A	Square bracket removal in 38.133 section A.1 to A.5	17.0.0
2020-12	RAN#90	RP-202487	1238		A	Square bracket removal in 38.133 section A.6 to A.8	17.0.0
2020-12	RAN#90	RP-202419	1240	1	B	Conditional handover test cases for NR	17.0.0
2020-12	RAN#90	RP-202414	1241		B	Updates to general section for NR-U in 38.133	17.0.0
2020-12	RAN#90	RP-202486	1250		A	CR on MO merge	17.0.0
2020-12	RAN#90	RP-202444	1252	1	F	CR to TS 38.133 on DCI based BWP switch requirements for cross carrier scheduling	17.0.0
2020-12	RAN#90	RP-202441	1254	1	B	CR on PRS-RSRP report mapping	17.0.0
2020-12	RAN#90	RP-202487	1259		A	Correction to CSI-RS RMC configuration R16	17.0.0
2020-12	RAN#90	RP-202487	1261		A	Correction to cell reselection test cases R16	17.0.0
2020-12	RAN#90	RP-202487	1263		A	Correction to inter-RAT handover test cases R16	17.0.0
2020-12	RAN#90	RP-202487	1265		A	Correction to NR measurement under LTE SA test cases R16	17.0.0
2020-12	RAN#90	RP-202487	1267		A	Correction to inter-RAT SFTD measurement test cases R16	17.0.0
2020-12	RAN#90	RP-202487	1271		A	CR on maintaining BFD/CBD measurements test cases in TS38.133 R16	17.0.0
2020-12	RAN#90	RP-202487	1273		F	CR on maintaining L1-RSRP measurements test cases R16	17.0.0
2020-12	RAN#90	RP-202446	1275	1	F	Correction CR to Rel-16 UE power saving requirements	17.0.0
2020-12	RAN#90	RP-202442	1276		F	Correction on DL interruption on Tx Switching between two uplink carriers	17.0.0
2020-12	RAN#90	RP-202433	1277	1	F	CR on CSI-RS based intra-frequency measurement requirements	17.0.0
2020-12	RAN#90	RP-202444	1281		F	Correction on RRC based spatial relation switch delay	17.0.0
2020-12	RAN#90	RP-202487	1282		F	Correction on SA inter-RAT measurement FR1 test case	17.0.0
2020-12	RAN#90	RP-202444	1283	1	F	CR on BWP switching delay on mulitple CCs	17.0.0
2020-12	RAN#90	RP-202444	1284	1	F	CR on interruption due to active BWP switching on mulitple CCs	17.0.0
2020-12	RAN#90	RP-202414	1288	1	F	CR on TCI state switching requirements for NR-U	17.0.0
2020-12	RAN#90	RP-202414	1291		F	CR on intra-frequency measurement requirements for NR-U	17.0.0
2020-12	RAN#90	RP-202486	1296		A	CR on RRC-based BWP switch requirements_R16	17.0.0
2020-12	RAN#90	RP-202487	1298		A	CR on RRC-based active TCI state switch test case Rel-16	17.0.0
2020-12	RAN#90	RP-202425	1299		F	Update NR Frequency Band Groups to include Band n48	17.0.0
2020-12	RAN#90	RP-202439	1300		F	Update NR Frequency Band Groups to include Band n65	17.0.0
2020-12	RAN#90	RP-202446	1305		F	CR to 38.133: Correction to relaxed measurement requirements	17.0.0
2020-12	RAN#90	RP-202444	1306	1	F	CR to 38.133: Correction to relaxed measurement requirements	17.0.0

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2020-12	RAN#90	RP-202444	1307	1	F	CR to 38.133: Correction to SRS carrier based switching requirements	17.0.0
2020-12	RAN#90	RP-202444	1308	1	F	CR to 38.133: Correction to mandatory gap pattern	17.0.0
2020-12	RAN#90	RP-202509	1309		F	[CR] NR Perf Maintenance R16 Cat F	17.0.0
2020-12	RAN#90	RP-202486	1311		A	[CR] Specify RRC processing delay in TCI state switching delay (Cat A)	17.0.0
2020-12	RAN#90	RP-202486	1317		A	CR on SCell activation requirements R16	17.0.0
2020-12	RAN#90	RP-202487	1319		A	CR on FR2 unkown SCell activation test cases R16	17.0.0
2020-12	RAN#90	RP-202487	1321		A	CR on BWP in L1-RSRP delay and accuracy test cases R16	17.0.0
2020-12	RAN#90	RP-202430	1322	1	F	CR on BWP switching and SCell dormancy	17.0.0
2020-12	RAN#90	RP-202441	1324	1	F	CR to update PRS-RSRP measurement requirements	17.0.0
2020-12	RAN#90	RP-202444	1328	1	F	CR on CGI reading requirements 38.133	17.0.0
2020-12	RAN#90	RP-202509	1330		F	[CR] Specify RRC processing delay in TCI state switching delay for R16 NR-U	17.0.0
2020-12	RAN#90	RP-202442	1331		F	Correction of CR0972 implementation	17.0.0
2020-12	RAN#90	RP-202487	1333		F	CR: Correction of CFRA test in FR2 SA	17.0.0
2020-12	RAN#90	RP-202434	1334	1	F	CR: Clarification of L1-SINR reporting with CSI-RS based CMR and dedicated IMR configured	17.0.0
2020-12	RAN#90	RP-202486	1336		A	Introducing reference to the source of the Lmax and NRLM.	17.0.0
2020-12	RAN#90	RP-202430	1338	2	F	CR on UE requirement for MR-DC early measurement reporting in 38.133	17.0.0
2020-12	RAN#90	RP-202444	1340		F	CR on measurement restrictions for FR2 inter-band CA	17.0.0
2020-12	RAN#90	RP-202487	1342		A	CR to TS 38.133: Corrections to inter-RAT FR1 test cases (Rel-16)	17.0.0
2020-12	RAN#90	RP-202487	1344		A	CR to TS 38.133: Corrections to inter-RAT FR2 test cases (Rel-16)	17.0.0
2020-12	RAN#90	RP-202436	1346		F	CR 38.133 Corrections to Conditional PSCell Change delay requirement	17.0.0
2020-12	RAN#90	RP-202444	1347		F	CR 38.133 Removal of brackets for Multiple SCell activation	17.0.0
2020-12	RAN#90	RP-202430	1348	1	F	CR 38.133 Removal of brackets for SCell Dormancy and Direct SCell Activation	17.0.0
2020-12	RAN#90	RP-202487	1350		A	CR 38.133 Correction to test case for TCI state switching (Rel-16)	17.0.0
2020-12	RAN#90	RP-202418	1358	1	F	gNB timing positioning measurement report mapping update for k	17.0.0
2020-12	RAN#90	RP-202446	1360	1	F	Corrections to UE power saving requirements	17.0.0
2020-12	RAN#90	RP-202487	1364		A	Removal of annex B.2.6 on one shot timing adjustment in 38.133	17.0.0
2020-12	RAN#90	RP-202487	1366		F	Correction to NR FR1 DL active BWP switch of Cell with non-DRX in SA (A.6.5.6.2.1)	17.0.0
2020-12	RAN#90	RP-202444	1367	1	F	Correction to RRC based non-simultaneous multiple CC BWP	17.0.0
2020-12	RAN#90	RP-202414	1369		F	Requirements for known cell in RRC re-establishment with CCA	17.0.0
2020-12	RAN#90	RP-202435	1370		F	CR to TS 38.133: Corrections to Tables 9.5.4.1-1 and 9.5.4.2-1.	17.0.0
2020-12	RAN#90	RP-202486	1372	1	A	CR to 38.133 on Active BWP switch and Active TCI State Switching requirements - Rel16	17.0.0
2020-12	RAN#90	RP-202441	1375	2	F	UE positioning measurements: RSTD	17.0.0
2020-12	RAN#90	RP-202414	1384	1	F	Terminology updates for NR-U	17.0.0
2020-12	RAN#90	RP-202414	1387		F	clause numbering correction	17.0.0
2020-12	RAN#90	RP-202414	1390	1	F	Measurement requirements for NR-U	17.0.0
2020-12	RAN#90	RP-202444	1391		F	Correction in NR SRS carrier-based switching requirements	17.0.0
2020-12	RAN#90	RP-202419	1393	1	B	Introduction of intra-frequency sync and async DAPS HO test cases in FR1	17.0.0
2020-12	RAN#90	RP-202430	1400	1	F	CR to Multi-SCell activation for FR1 intra-band contiguous CA	17.0.0
2020-12	RAN#90	RP-202430	1401		F	CR to Staring point of an Interruption window at Direct SCell activation	17.0.0
2020-12	RAN#90	RP-202414	1403	1	F	Interruption windows and applicability of Scell activation/deactivation requirements for SCells operating with CCA	17.0.0
2020-12	RAN#90	RP-202419	1406		B	CR on inter-band DAPS handover tests	17.0.0
2020-12	RAN#90	RP-202414	1407		F	Correction to timing requirements in NR-U	17.0.0
2020-12	RAN#90	RP-202417	1409		B	Big CR: Introduction of Rel-16 NR UE Power Saving RRM Performance requirements (TS 38.133)	17.0.0
2020-12	RAN#90	RP-202421	1410		B	Big CR: Introduction of Rel-16 NR FR1 RF WI RRM performance requirements	17.0.0
2020-12	RAN#90	RP-202422	1411		B	Big CR: NR HST RRM performance requirements	17.0.0
2020-12	RAN#90	RP-202487	1413		A	[CR] NR Perf Maintenance R16 Cat A	17.0.0
2021-03	RAN#91	RP-210116	1418		A	[CR] RRM test case maintenance R17 Cat A	17.1.0
2021-03	RAN#91	RP-210116	1424		A	Update FR2 Reference channels and OCNG for FR2 RRM Test cases	17.1.0
2021-03	RAN#91	RP-210116	1427		A	CR to FR1 SA SS-SINR measurement TCs	17.1.0
2021-03	RAN#91	RP-210116	1430		A	CR on E-UTRA carrier for EN-DC event triggered reporting tests	17.1.0
2021-03	RAN#91	RP-210116	1433		A	Add missing FR2 Test case setups and Beam assumptions	17.1.0

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2021-03	RAN#91	RP-210091	1437		A	[CR] Core maintenance for 38.133 (Cat A)	17.1.0
2021-03	RAN#91	RP-210071	1446		A	CR on maintenance for inter-band FR2 CA RRM R17	17.1.0
2021-03	RAN#91	RP-210071	1448		A	CR on UE behavior for UE specific CBW change R17	17.1.0
2021-03	RAN#91	RP-210091	1450		A	CR on IDLE/INACTIVE RRM requirement with SMTC2-LP R17	17.1.0
2021-03	RAN#91	RP-210070	1456		A	CR to 38.133 on Link Recovery requirements (R17)	17.1.0
2021-03	RAN#91	RP-210070	1458		A	CR to 38.133 on Pathloss activation delay requirements (R17)	17.1.0
2021-03	RAN#91	RP-210097	1469		B	CR for TS 38.133 introduction of NR band n24	17.1.0
2021-03	RAN#91	RP-210076	1482		A	CR on CSI-RS based L3 measurement	17.1.0
2021-03	RAN#91	RP-210081	1489		A	CR on PRS RSTD measurement requirements	17.1.0
2021-03	RAN#91	RP-210116	1496		A	Correction to cell reselection test case	17.1.0
2021-03	RAN#91	RP-210066	1498		A	Correction to cell reselection test case for UE Power saving	17.1.0
2021-03	RAN#91	RP-210073	1502		A	2-step RACH RRM performance requirements corrections	17.1.0
2021-03	RAN#91	RP-210116	1505		F	Update of DRX configuration in FR1 Event-triggered Test cases	17.1.0
2021-03	RAN#91	RP-210072	1507		A	Big CR-Introduction of NR V2X RRM performance requirements (Rel-17)	17.1.0
2021-03	RAN#91	RP-210070	1511		A	Correction on the measurement restriction for CSI-IM resource in R17	17.1.0
2021-03	RAN#91	RP-210116	1514		A	Correction on PRACH configuration for FR2 Non-Contention based Random Access in R17	17.1.0
2021-03	RAN#91	RP-210116	1517		A	Correction on PRACH configuration for Beam Failure Detection and Link Recovery Test in R17	17.1.0
2021-03	RAN#91	RP-210116	1520		A	Correction on PRACH RMC for FR1 CSI-RS based Non-Contention based Random Access for BFR in R17	17.1.0
2021-03	RAN#91	RP-210071	1522		A	Correction on scheduling availability and measurement restriction on FR2 inter-band CA in R17	17.1.0
2021-03	RAN#91	RP-210077	1527		A	CR on HST RRM requirements in connected mode	17.1.0
2021-03	RAN#91	RP-210070	1534		A	CR to TS38.133 on L1-SINR measurement requirement	17.1.0
2021-03	RAN#91	RP-210064	1536		A	Big CR: Introduction of Rel-16 NR eMIMO RRM performance requirements and test cases	17.1.0
2021-03	RAN#91	RP-210117	1539		A	CR on Scell activation delay maintenance (R17)	17.1.0
2021-03	RAN#91	RP-210091	1542		A	Interruption requirements maintenance in NR-DC (R17)	17.1.0
2021-03	RAN#91	RP-210077	1544		A	CR on HST core part maintenance (R17)	17.1.0
2021-03	RAN#91	RP-210116	1547		A	CR for test requirements correction of SA event triggered reporting tests for FR1 inter-frequency measurements with SSB time index detection when DRX is used	17.1.0
2021-03	RAN#91	RP-210117	1550		A	CR on R15 remaining issues	17.1.0
2021-03	RAN#91	RP-210072	1552		A	CR on V2X interruption	17.1.0
2021-03	RAN#91	RP-210091	1556		A	CR for measurement period requirements correction	17.1.0
2021-03	RAN#91	RP-210122	1560		A	Update on interruption test cases for Tx switching R17	17.1.0
2021-03	RAN#91	RP-210076	1562		A	Maintenance CR for CSI-RS based L3 measurement requirements R17	17.1.0
2021-03	RAN#91	RP-210116	1565		A	Correction on the power of the first preamble for random access in EN-DC and SA in R17	17.1.0
2021-03	RAN#91	RP-210116	1568		A	Correction on the time for Scell activation and CSI-report in R17	17.1.0
2021-03	RAN#91	RP-210116	1571		A	Correction on the Noc level in TS38.133 in R17	17.1.0
2021-03	RAN#91	RP-210079	1578		A	CR on TS38.133 for Pcell change	17.1.0
2021-03	RAN#91	RP-210071	1586		A	CR on TS38.133 for inter-frequency measurement requirement without gap	17.1.0
2021-03	RAN#91	RP-210122	1600		A	Big CR: Introduction of Rel-16 NR RRM enhancements WI performance requirements and test cases (Rel-17)	17.1.0
2021-03	RAN#91	RP-210084	1602		A	CR: Introduction of random access requirements with CCA	17.1.0
2021-03	RAN#91	RP-210084	1604		A	CR: Beam management requirements with CCA	17.1.0
2021-03	RAN#91	RP-210117	1607		A	CR on the filter for beam failure indications in 38.133	17.1.0
2021-03	RAN#91	RP-210116	1616		A	Correction to Aperiodic CSI-RS configurations R17	17.1.0
2021-03	RAN#91	RP-210116	1619		A	Correction to radio link monitoring test cases R17	17.1.0
2021-03	RAN#91	RP-210116	1622		A	Correction to beam failure recovery test cases R17	17.1.0
2021-03	RAN#91	RP-210116	1625		A	Correction to L1-RSRP reporting delay test cases R17	17.1.0
2021-03	RAN#91	RP-210084	1631		A	CR on measurement requirements for NR-U	17.1.0
2021-03	RAN#91	RP-210122	1636		A	CR on maintaining Antenna configurations in TS38.133 R17	17.1.0
2021-03	RAN#91	RP-210122	1639		A	CR on test requirements for measurement performance tests R17	17.1.0
2021-03	RAN#91	RP-210070	1643		A	CR on maintaining L1-SINR measurent requirements Rel-17	17.1.0
2021-03	RAN#91	RP-210093	1646	1	F	CR on condition requirements for UE power class 5 in TS38.133	17.1.0
2021-03	RAN#91	RP-210071	1648		A	Correction on interruptions of SRS carrier switching	17.1.0
2021-03	RAN#91	RP-210071	1652		A	UL spatial relation switching to an unknown DL RS	17.1.0
2021-03	RAN#91	RP-210116	1655		A	Correction on test cases of inter-frequency Measurements R17	17.1.0
2021-03	RAN#91	RP-210122	1660		A	Correction on test cases of DL interruptions at switching between two uplink carriers	17.1.0
2021-03	RAN#91	RP-210081	1670		A	CR to 38.133 correction on CCSF for NR measurements for positioning	17.1.0

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2021-03	RAN#91	RP-210072	1672		A	CR to 38.133 correction on reselection of V2X synchronization reference source requirements	17.1.0
2021-03	RAN#91	RP-210066	1675		A	Test case for cell reselection to FR2 intra-frequency NR case for UE configured with relaxed measurement	17.1.0
2021-03	RAN#91	RP-210076	1679		A	Correction on CSSFoutsidegap	17.1.0
2021-03	RAN#91	RP-210077	1683		A	Correction on inter-RAT measurement in high speed scenario	17.1.0
2021-03	RAN#91	RP-210085	1690		A	Correction on inter-RAT E-UTRAN cells for UE configured with relaxed measurement criterion	17.1.0
2021-03	RAN#91	RP-210084	1691		A	Maintenance CR for NR-U core requirements	17.1.0
2021-03	RAN#91	RP-210091	1697		A	Correction of band group notation for FR2	17.1.0
2021-03	RAN#91	RP-210087	1699		A	Correction to Idle Mode CA/DC Measurements for Inactive mode	17.1.0
2021-03	RAN#91	RP-210087	1701		A	CR clarifying the UE measurement requirements for an SCell with dormant BWP	17.1.0
2021-03	RAN#91	RP-210087	1703		A	Correction to simultaneous DCI based BWP switch delay on multiple CCs	17.1.0
2021-03	RAN#91	RP-210116	1714		A	CR to TS 38.133: Redundant and incorrect TCI state in tests with TRS (Rel-17)	17.1.0
2021-03	RAN#91	RP-210071	1721		A	CR 38.133 (8.6.2A) Clarification on DCI-triggered BWP switch on multiple CCs	17.1.0
2021-03	RAN#91	RP-210084	1723		A	Updates in RLM requirements for NR-U	17.1.0
2021-03	RAN#91	RP-210084	1727		A	Terminology updates for NR-U in 38.133	17.1.0
2021-03	RAN#91	RP-210081	1733		A	PRS-RSRP measurement requirements	17.1.0
2021-03	RAN#91	RP-210076	1737		A	38.133 CR on the CSI-RS based measurement requirements	17.1.0
2021-03	RAN#91	RP-210084	1739		A	Applicability of RA with CCA on RRM requirements in NR-U in 38.133	17.1.0
2021-03	RAN#91	RP-210084	1744		A	CR on Active TCI state switching for NR-U (cat A)	17.1.0
2021-03	RAN#91	RP-210071	1746		A	CR on maintenance on BWP switch requirements on multiple CCs (cat A)	17.1.0
2021-03	RAN#91	RP-210116	1751		A	CR on test cases for inter-RAT measurement r17	17.1.0
2021-03	RAN#91	RP-210117	1754		A	CR on SCell activation delay, cell idenfication requirements on deactivated SCell and inter-RAT ECID requirements for NE-DC R17	17.1.0
2021-03	RAN#91	RP-210116	1757		A	CR on SCell activation TCs R17	17.1.0
2021-03	RAN#91	RP-210087	1759		A	CR on EMR requirement maintenance in 38.133 R17	17.1.0
2021-03	RAN#91	RP-210087	1761		A	CR on SCell dormancy switching R17	17.1.0
2021-03	RAN#91	RP-210071	1771		A	CR on multiple SCell activation requirements R17	17.1.0
2021-03	RAN#91	RP-210071	1773		A	CR on CGI reading requirements 38.133 R17	17.1.0
2021-03	RAN#91	RP-210116	1781		A	Cat-A CR to addition of TRS Configurations in Rel-17 Test Cases	17.1.0
2021-03	RAN#91	RP-210091	1788		A	Cat-A CR to addition of TRS Configurations in Rel-17 Test Case	17.1.0
2021-03	RAN#91	RP-210116	1790		A	CR on correcting SSB and RACH configuration in CSI-RS based beam failure detection and link recovery tests	17.1.0
2021-03	RAN#91	RP-210084	1792		A	CR on Interruptions during Scell activation in NR-U	17.1.0
2021-03	RAN#91	RP-210076	1796		A	CR on core requirement for CSI-RS L3 measurement	17.1.0
2021-03	RAN#91	RP-210091	1797		A	Maintenance CR on interruption at EUTRA SRS carrier switching in 38.133	17.1.0
2021-03	RAN#91	RP-210091	1798		A	Maintenance CR on SCell activation delay requirement in TS38.133	17.1.0
2021-03	RAN#91	RP-210081	1799		A	CR to TS 38.133 on UE Rx-Tx time difference measurements (section 9.9.4)	17.1.0
2021-03	RAN#91	RP-210077	1801		F	CR on introduction of missing HST test cases	17.1.0
2021-06	RAN#92	RP-211083	1809		A	CR to A.3.14 CSI-RS configurations for nzp-CSI-RS-ResourceId values	17.2.0
2021-06	RAN#92	RP-211083	1812		A	CR to Interruptions during measurements on deactivated NR SCC	17.2.0
2021-06	RAN#92	RP-211083	1815		A	CR to CSI-RS based L1-RSRP measurement on resource set with repetition off TCs	17.2.0
2021-06	RAN#92	RP-211084	1818		A	CR to the notation of SMTC in the general test parameters of Re-establishment TCs	17.2.0
2021-06	RAN#92	RP-211084	1821		A	CR to BWP configuration for interruption test case.	17.2.0
2021-06	RAN#92	RP-211084	1827		A	Update of DRX configuration in Event-triggered Test cases	17.2.0
2021-06	RAN#92	RP-211084	1833		A	Update RRM Test cases where 66RBs gives insufficient dB range	17.2.0
2021-06	RAN#92	RP-211084	1836		A	Update Reference channels and OCNG for FR2 240 kHz SSB SCS RRM Test cases	17.2.0
2021-06	RAN#92	RP-211084	1839		A	Cat-A CR to Cell Reselection Tests with Async Cells in Rel-17	17.2.0
2021-06	RAN#92	RP-211085	1841		A	Cat-A CR to Cell Reselection Tests with Async Cells in Rel-17	17.2.0
2021-06	RAN#92	RP-211085	1844		A	Cat-A CR to FR2 CORESET and Search Space RMC in Rel-17	17.2.0
2021-06	RAN#92	RP-211085	1847		A	Cat-A CR to PDSCH RMC in Rel-17	17.2.0
2021-06	RAN#92	RP-211085	1850		A	Cat-A CR to TRS Configuration in Rel-17 Test Case	17.2.0

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2021-06	RAN#92	RP-211085	1852		A	Cat-A CR to FR1 Single SCell activation requirement with TCI activation in Rel-17	17.2.0
2021-06	RAN#92	RP-211085	1857		A	Maintenance CR for test cases - R17 Cat A	17.2.0
2021-06	RAN#92	RP-211104	1859		A	Correction to cell reselection test case for HST	17.2.0
2021-06	RAN#92	RP-211104	1861		A	Correction to cell reselection test case for UE Power saving	17.2.0
2021-06	RAN#92	RP-211085	1864		A	CR on BFD and link recovery test cases	17.2.0
2021-06	RAN#92	RP-211101	1867		A	CR on CSI-RS intra-frequency requirement and scheduling restriction	17.2.0
2021-06	RAN#92	RP-211101	1868		A	CR on CSI-RS based measurement requirements	17.2.0
2021-06	RAN#92	RP-211103	1872		A	CR on PRS RSTD measurement requirements	17.2.0
2021-06	RAN#92	RP-211101	1876		A	CR for clarification on frequency layer merging R17	17.2.0
2021-06	RAN#92	RP-211104	1878		A	CR on legacy Rel-16 HST NR UE measurement requirements (R17)	17.2.0
2021-06	RAN#92	RP-211097	1880		A	CR on RRC based BWP switching on multiple CCs of EN-DC for FR1 (R17)	17.2.0
2021-06	RAN#92	RP-211104	1882		A	Correction on the power of the first preamble for 2-step RACH	17.2.0
2021-06	RAN#92	RP-211095	1883		A	Terminology update for NR-U	17.2.0
2021-06	RAN#92	RP-211086	1887		A	Maintenance on CSSF for EN-DC and deactivated SCell measurement R17	17.2.0
2021-06	RAN#92	RP-211095	1889		A	CR on reference cell availability for NR-U R17	17.2.0
2021-06	RAN#92	RP-211095	1891		A	CR on SCell activation requirement for NR-U R17	17.2.0
2021-06	RAN#92	RP-211097	1893		A	CR on interruption for SCell addition/release R17	17.2.0
2021-06	RAN#92	RP-211086	1898		A	Core requirement maintenance on signal characteristics (R17)	17.2.0
2021-06	RAN#92	RP-211104	1902		A	CR to 38.133 on Link recovery requirements - R17	17.2.0
2021-06	RAN#92	RP-211097	1907		A	CR to introduce testcase for RRC based BWP switch on multiple CCs- SA in FR2 -R17	17.2.0
2021-06	RAN#92	RP-211097	1908		A	CR to 38.133 on Uplink Spatial relation switch for PUCCH - R17	17.2.0
2021-06	RAN#92	RP-211102	1912	1	A	CR on CSSFintra for HST measurement requirements	17.2.0
2021-06	RAN#92	RP-211102	1914	1	F	CR on test case on NR intra-frequency cell reselection for HST	17.2.0
2021-06	RAN#92	RP-211097	1924		A	CR for test cases for simultaneous DCI and Timer based BWP switch on multiple CCs for NR SA	17.2.0
2021-06	RAN#92	RP-211081	1930	1	A	Correction on the SS-RSRP difference value for SS-RSRP measurement TC in R17	17.2.0
2021-06	RAN#92	RP-211081	1933	1	A	Correction on the CSI-reporting period for SCell activation delay in R17	17.2.0
2021-06	RAN#92	RP-211103	1935	1	A	Introduce the SCell beam failure recovery without the dedicated PUCCH resource in R17	17.2.0
2021-06	RAN#92	RP-211086	1940		A	CR on scheduling restriction of UE during intra-frequency measurements on FR2 in R17	17.2.0
2021-06	RAN#92	RP-211119	1942		A	CR on TS38.133 for direct Scell activation	17.2.0
2021-06	RAN#92	RP-211097	1944		A	CR on TS38.133 for typo modifications on intra frequency and inter frequency measurement requirement	17.2.0
2021-06	RAN#92	RP-211097	1946		A	CR to 38.133 correction on SRS carrier based switching core requirements	17.2.0
2021-06	RAN#92	RP-211097	1948		A	CR to 38.133 correction on SRS carrier based switching test cases	17.2.0
2021-06	RAN#92	RP-211101	1950		A	CR to 38.133 Correction on core requirements for CSI-RS based measurement	17.2.0
2021-06	RAN#92	RP-211105	1954		A	CR to 38.133 correction on CCSF for NR measurements for positioning	17.2.0
2021-06	RAN#92	RP-211097	1959		A	CR on TS38.133 inter-frequency without gap -r17 NOTE Part of the CR is not implemented because changes to clause 9.1.5.1 have no track marks.	17.2.0
2021-06	RAN#92	RP-211105	1970		A	CR to 38.133 Correction on the requirement of FR2 L1-SINR measurement accuracy (Rel-17)	17.2.0
2021-06	RAN#92	RP-211116	1974		B	CR to TS 38.133: Introduction of band n67	17.2.0
2021-06	RAN#92	RP-211116	1975		B	CR to TS 38.133: Introduction of band n85	17.2.0
2021-06	RAN#92	RP-211106	1977		A	CR on UE Rx-Tx time difference measurement period	17.2.0
2021-06	RAN#92	RP-211087	1983		A	CR to TS 38.133: Correction of TDD Configuration for several TCs (Rel-17)	17.2.0
2021-06	RAN#92	RP-211087	1986		A	CR to TS 38.133: Correction of OCNG pattern for several TCs (Rel-17)	17.2.0
2021-06	RAN#92	RP-211087	1989		A	CR to TS 38.133: Correction of IRAT TCs (Rel-17)	17.2.0
2021-06	RAN#92	RP-211087	1992		A	CR to TS 38.133: Corrections to SS-RSRP/RSRQ/SINR accuracy TCs (Rel 17)	17.2.0
2021-06	RAN#92	RP-211087	1995		A	CR to TS 38.133: Several corrections to TCs (Rel 17)	17.2.0
2021-06	RAN#92	RP-211087	1997		F	CR on maintaining condition requirements in TS38.133 R17	17.2.0
2021-06	RAN#92	RP-211106	1999		A	CR on maintaining L1-SINR measurent accuracy requirements R17	17.2.0
2021-06	RAN#92	RP-211106	2001		A	CR on maintaining L1-SINR measurement accuracy tests R17	17.2.0

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2021-06	RAN#92	RP-211106	2003		A	CR on maintaining L1-SINR measurent requirements R17	17.2.0
2021-06	RAN#92	RP-211097	2005		A	CR on maintaining SCell activation and deactication delay test for FR2 inter-band CA R17	17.2.0
2021-06	RAN#92	RP-211106	2007		A	CR on maintaining sync conditions for intra-band DAPS handover R17	17.2.0
2021-06	RAN#92	RP-211106	2009		A	CR on maintaining interruptions for intra-band DAPS handover R17	17.2.0
2021-06	RAN#92	RP-211107	2014		F	CR on maintaining condition requirements for UE power class 5	17.2.0
2021-06	RAN#92	RP-211095	2020		A	CR on Active TCI state switching for NR-U R17	17.2.0
2021-06	RAN#92	RP-211095	2022		A	CR on RLM requirements NR-U R17	17.2.0
2021-06	RAN#92	RP-211095	2024		A	CR on beam management requirements for NR-U R17	17.2.0
2021-06	RAN#92	RP-211095	2026		A	CR on measurement requirements for NR-U R17	17.2.0
2021-06	RAN#92	RP-211095	2028		A	CR on CSSF for NR-U R17	17.2.0
2021-06	RAN#92	RP-211098	2030		A	CR on maintenance of BWP Switch on multiple CCs 38133 R17	17.2.0
2021-06	RAN#92	RP-211087	2033		A	CR on measurement on deactivated SCell and interruption to NR serving cells for measurements on deactivated NR SCell	17.2.0
2021-06	RAN#92	RP-211101	2037		A	CR on time validity of the detected associatedSSB	17.2.0
2021-06	RAN#92	RP-211107	2041		A	Correction on test cases for inter-RAT cell identification in connected mode for HST	17.2.0
2021-06	RAN#92	RP-211101	2045		A	Adding intra-frequency CSI-RS measurement in CSSF	17.2.0
2021-06	RAN#92	RP-211098	2051		A	Correction on SRS carrier switching	17.2.0
2021-06	RAN#92	RP-211103	2053	1	F	CR on condition requirements for L1-SINR measurements R17	17.2.0
2021-06	RAN#92	RP-211109	2055		A	Correction of test case of link recovery with link recovery requests	17.2.0
2021-06	RAN#92	RP-211088	2058		A	Correction to CSI-RS reference configuration_R17	17.2.0
2021-06	RAN#92	RP-211088	2062		A	Correction to reference configurations related to DLBWP.0.2_R17	17.2.0
2021-06	RAN#92	RP-211089	2065		A	Correction to TRS reference configuration_R17	17.2.0
2021-06	RAN#92	RP-211089	2068		A	Correction to interruption during measurement on deactivated SCell test cases_R17	17.2.0
2021-06	RAN#92	RP-211089	2071		A	Correction to FR1 test cases using DLBWP.0.2_R17	17.2.0
2021-06	RAN#92	RP-211089	2076		A	Correction of test parameters for SA inter-frequency event triggered reporting TCs	17.2.0
2021-06	RAN#92	RP-211089	2078		A	CR on Rel-15 SCell activation, SMTC determination and UL timing 38133 R17	17.2.0
2021-06	RAN#92	RP-211119	2080		A	CR on EMR requirements correction 38133 R17	17.2.0
2021-06	RAN#92	RP-211119	2082		A	CR on direct SCell activation R17	17.2.0
2021-06	RAN#92	RP-211119	2084		A	CR on SCell dormancy requirements R17	17.2.0
2021-06	RAN#92	RP-211109	2086		A	CR on MG for PRS measurement 38.133 R17	17.2.0
2021-06	RAN#92	RP-211109	2094		A	CR on CSSF and measurement capability for PRS measurement 38.133 R17	17.2.0
2021-06	RAN#92	RP-211098	2096		A	CR on SSB offset in multiple SCell activation R17	17.2.0
2021-06	RAN#92	RP-211098	2098		A	CR on SMTC alignment in multiple SCell activation R17	17.2.0
2021-06	RAN#92	RP-211101	2100		A	CR on CSI-RS measurement window R17	17.2.0
2021-06	RAN#92	RP-211119	2105		A	Big CR 38.133: Introduction of Rel-16 MR-DC Direct SCell activation and SCell dormancy RRM performance requirements NOTE Part of the CR is not implemented because CCR.2.3 TDD" are already exist	17.2.0
2021-06	RAN#92	RP-211090	2111		A	CR on NR-DC PSCell addition and release delay in Rel17 - Cat A	17.2.0
2021-06	RAN#92	RP-211090	2114		A	Maintenance CR for RRM test cases in Rel17 - Cat A	17.2.0
2021-06	RAN#92	RP-211098	2118		A	CR on test case for RRC-based BWP switch on multiple CCs - TC3 in Rel-17 - Cat A	17.2.0
2021-06	RAN#92	RP-211110	2121		A	Changes to cell reselection tests under power saving	17.2.0
2021-06	RAN#92	RP-211119	2127		A	CR for Direct SCell activation delay	17.2.0
2021-06	RAN#92	RP-211119	2131		A	CR Correction of activation delay for Direct activated SCell	17.2.0
2021-06	RAN#92	RP-211091	2139		A	Correction to AoA setup in FR2	17.2.0
2021-06	RAN#92	RP-211091	2141		A	Correction to AoA setup and beam assumptions in FR2 tests in Rel-16	17.2.0
2021-06	RAN#92	RP-211110	2143		A	Correction to beam assumptions in L1-SINR FR2 tests	17.2.0
2021-06	RAN#92	RP-211098	2145		A	Correction to beam assumptions in FR2 tests on Rel-16 Mandatory gaps	17.2.0
2021-06	RAN#92	RP-211098	2147		A	Correction to beam assumptions in FR2 tests on UL spatial relation	17.2.0
2021-06	RAN#92	RP-211110	2149		A	Correction to HO tests in FR2 under mobility enhancements	17.2.0
2021-06	RAN#92	RP-211110	2153		A	PRS-RSRP measurement requirements	17.2.0
2021-06	RAN#92	RP-211101	2159		A	(R17mirror) CR: RRM congestion control test cases for NR V2X	17.2.0
2021-06	RAN#92	RP-211098	2160		A	(R17mirror) CR: CGI reading test	17.2.0
2021-06	RAN#92	RP-211098	2161		A	(R17mirror) CR: UL spatial relation test	17.2.0

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2021-06	RAN#92	RP-211095	2163		A	Interruption during Scell activation requirements for SCells operating with CCA	17.2.0
2021-06	RAN#92	RP-211095	2165		A	SI reading time in RRC mobility control	17.2.0
2021-06	RAN#92	RP-211095	2169		A	Updates in SCell activation in NR-U	17.2.0
2021-06	RAN#92	RP-211095	2171		A	NR-U bands	17.2.0
2021-06	RAN#92	RP-211095	2173		A	Big CR: Introduction of Rel-16 NR-U RRM performance	17.2.0
2021-06	RAN#92	RP-211119	2175		A	CR for core requirement maintenance on direct SCell activation R17	17.2.0
2021-06	RAN#92	RP-211119	2177		A	Big CR: Introduction of Rel-16 MR-DC EMR RRM performance requirements (TS 38.133) NOTE Part of the CR is not implemented because new clause have no reference point	17.2.0
2021-06	RAN#92	RP-211097	2179		A	CR on introducing RRC based Active BWP Switch on multiple CCs in EN-DC FR2	17.2.0
2021-06	RAN#92	RP-211101	2182		A	Big CR: Introduction of Rel-16 CSI-RS based L3 measurement RRM performance requirements	17.2.0
2021-06	RAN#92	RP-211096	2184		A	Big CR: Introduction of Rel-16 NR Positioning RRM performance requirements and test cases	17.2.0
2021-06	RAN#92	RP-211121	2185		B	Big CR: RRM requirements for band n262 in 38.133	17.2.0
2021-09	RAN#93	RP-211902	2196		B	RRM requirements for FR2 FWA for band n259 in 38.133	17.3.0
2021-09	RAN#93	RP-211922	2199		A	Big CR to TS 38.133: NR_newRAT-Core maintenance (Rel-17)	17.3.0
2021-09	RAN#93	RP-211925	2202		A	Big CR to TS 38.133: NR_newRAT-Perf maintenance Part 1 (Rel-17)	17.3.0
2021-09	RAN#93	RP-211925	2205		F	Big CR to TS 38.133: NR_newRAT-Perf maintenance Part 2 (Rel-17)	17.3.0
2021-09	RAN#93	RP-211925	2208		F	Big CR to TS 38.133: NR_newRAT-Perf maintenance Part 3 (Rel-17)	17.3.0
2021-09	RAN#93	RP-211890	2210		A	Big CR to TS 38.133: NR_unlic maintenance Part 1 (Rel-17)	17.3.0
2021-09	RAN#93	RP-211890	2212		A	Big CR to TS 38.133: NR_unlic maintenance Part 2 (Rel-17)	17.3.0
2021-09	RAN#93	RP-211893	2214		F	Big CR to TS 38.133: NR_pos maintenance (Rel-17)	17.3.0
2021-09	RAN#93	RP-211891	2216		A	Big CR to TS 38.133: Rel-16 WIs RRM maintenance Part 1 (Rel-17)	17.3.0
2021-09	RAN#93	RP-211893	2218		F	Big CR to TS 38.133: Rel-16 WIs RRM maintenance Part 2 (Rel-17)	17.3.0
2021-12	RAN#94	RP-212833	2225		F	Missing RRM performance requirements for n259 FWA in Rel-17	17.4.0
2021-12	RAN#94	RP-212854	2239		A	Big CR to TS 38.133: NR_newRAT-Core maintenance (Rel-17)	17.4.0
2021-12	RAN#94	RP-212846	2242		F	Big CR to TS 38.133: NR_newRAT-Perf maintenance (Rel-17)	17.4.0
2021-12	RAN#94	RP-212847	2244		A	Big CR to TS 38.133: Rel-16 WIs RRM maintenance Part 1 (Rel-17)	17.4.0
2021-12	RAN#94	RP-212849	2246		A	Big CR to TS 38.133: Rel-16 WIs RRM maintenance Part 2 (Rel-17)	17.4.0
2021-12	RAN#94	RP-212847	2248		A	Big CR to TS 38.133: Rel-16 WIs RRM maintenance Part 3 (Rel-17)	17.4.0
2021-12	RAN#94	RP-212847	2250		A	Big CR to TS 38.133: Rel-16 WIs RRM maintenance Part 4 (Rel-17)	17.4.0
2022-03	RAN#95	RP-220365	2251		B	Big CRs : RRM requirements for Rel-17 NR SL enhancement	17.5.0
2022-03	RAN#95	RP-220364	2252	1	B	Big CR: RRM requirements for Rel-17 NR SL Relay	17.5.0
2022-03	RAN#95	RP-220342	2253	1	B	Big CR: RRM requirements for Rel-17 NR FR1 RF	17.5.0
2022-03	RAN#95	RP-220373	2258		B	Big CR to TS 38.133 on HST FR2 RRM Core Requirements	17.5.0
2022-03	RAN#95	RP-220372	2259		B	Big CR: RRM requirements for Rel-17 NR FR1 HST enhancements	17.5.0
2022-03	RAN#95	RP-220368	2260		B	Big CR: RRM requirements for Rel-17 NR FeRRM (TS 38.133)	17.5.0
2022-03	RAN#95	RP-220378	2261	1	B	Big CR: RRM requirements for Rel-17 NR MG enhancements	17.5.0
2022-03	RAN#95	RP-220366	2263		B	Big CR: RRM requirements Rel-17 NR UE Power Saving Enhancements	17.5.0
2022-03	RAN#95	RP-220362	2265		B	Big CR: RRM requirements for Rel-17 NR feMIMO	17.5.0
2022-03	RAN#95	RP-220379	2266		B	Big CR: RRM requirements for Rel-17 NR Positioning Enhancements	17.5.0
2022-03	RAN#95	RP-220346	2267		B	Big CR: RRM requirements for Rel-17 Further Multi-RAT Dual-Connectivity enhancements (TS 38.133)	17.5.0
2022-03	RAN#95	RP-220375	2268		B	Big CR: RRM requirements for Rel-17 Enhanced IIoT and URLLC support	17.5.0
2022-03	RAN#95	RP-220367	2269		B	Big CR: RRM requirements for Rel-17 NR SDT in INACTIVE state	17.5.0
2022-03	RAN#95	RP-220337	2272		A	Big CR to TS 38.133: NR_newRAT-Core maintenance (Rel-17)	17.5.0
2022-03	RAN#95	RP-220337	2275	1	F	Big CR to TS 38.133: NR_newRAT-Perf maintenance (Rel-17)	17.5.0
2022-03	RAN#95	RP-220334	2277		A	Big CR to TS 38.133: Rel-16 WIs RRM maintenance Part 1 (Rel-17)	17.5.0
2022-03	RAN#95	RP-220339	2279		A	Big CR to TS 38.133: Rel-16 WIs RRM maintenance Part 2 (Rel-17)	17.5.0

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2022-03	RAN#95	RP-220339	2281		F	Big CR to TS 38.133: Rel-16 WIs RRM maintenance Part 3 (Rel-17)	17.5.0
2022-03	RAN#95	RP-220345	2282		B	Big CR: RRM requirements for Rel-17 NR MUSIM	17.5.0
2022-03	RAN#95	RP-220909	2284	1	B	Introduction of band n101	17.5.0
2022-06	RAN#96	RP-221681	2286	2	F	FR2 HST neighboring cell measurement requirement correction	17.6.0
2022-06	RAN#96	RP-221677	2288	1	F	SL enhancement core requirement correction	17.6.0
2022-06	RAN#96	RP-221681	2289		F	CR on SRS antenna port switching in TS38.133	17.6.0
2022-06	RAN#96	RP-221681	2290	1	F	CR on HO with PSCell for NE-DC to NE-DC in TS38.133 R17	17.6.0
2022-06	RAN#96	RP-221682	2293	1	F	Maintenance CR for SCG activation on 38.133 R17	17.6.0
2022-06	RAN#96	RP-221677	2294	1	F	Maintenance CR for RRM requirements for NR Uu and SL intra-band con-current operation	17.6.0
2022-06	RAN#96	RP-221681	2295	2	F	CR to TS 38.133 on UL Timing Adjustment	17.6.0
2022-06	RAN#96	RP-221681	2296		B	38.133 CR on introduction of SRS antenna port switching (resubmission)	17.6.0
2022-06	RAN#96	RP-221681	2301	1	F	Completing requirement of HO with PSCell	17.6.0
2022-06	RAN#96	RP-221677	2303	1	F	CR on PRS-RSRP measurement period without gaps	17.6.0
2022-06	RAN#96	RP-221677	2304	1	F	CR on PRS-RSRPP measurement period requirements	17.6.0
2022-06	RAN#96	RP-221677	2305	1	F	CR on the PRS and RRM measurement requirements in RRC_INACTIVE state	17.6.0
2022-06	RAN#96	RP-221682	2307		F	Maintenance CR on TS38.133 for L1 impact due to concurrent MG	17.6.0
2022-06	RAN#96	RP-221682	2308	1	F	Maintenance CR on TS38.133 for L1 impact due toNCSG	17.6.0
2022-06	RAN#96	RP-221682	2309	1	F	CR on TA validation for Rel-17 NR SDT in INACTIVE sate	17.6.0
2022-06	RAN#96	RP-221682	2315	1	F	CR to maintain concurrent measurement gap in TS 38.133	17.6.0
2022-06	RAN#96	RP-221682	2316	1	F	CR to maintain measurements with NCSG in TS 38.133	17.6.0
2022-06	RAN#96	RP-221682	2317		F	CR to maintain Selection Reselection of relay UE in TS 38.133	17.6.0
2022-06	RAN#96	RP-221681	2318	1	F	CR on PUCCH SCell activation and deactivation delay requirements	17.6.0
2022-06	RAN#96	RP-221677	2319		F	CR on known condition of unified TCI for UL	17.6.0
2022-06	RAN#96	RP-221677	2320	1	F	CR on measurement restriction and scheduling availability for inter cell L1-RSRP measurement	17.6.0
2022-06	RAN#96	RP-221680	2322		B	CR on RRM requirements for IBM inter-band FR2 UL CA	17.6.0
2022-06	RAN#96	RP-221682	2324	1	F	CR on concurrent measurement gaps	17.6.0
2022-06	RAN#96	RP-221682	2325		F	CR on inter-frequency measurement with NCSG	17.6.0
2022-06	RAN#96	RP-221681	2327	1	F	CR on enhanced requirements for SCell measurement for Rel-17 FR1 HST requirements	17.6.0
2022-06	RAN#96	RP-221682	2328	1	F	CR on Efficient activation/de-activation mechanism for Scells	17.6.0
2022-06	RAN#96	RP-221682	2329	1	F	CR on Efficient activation/de-activation mechanism for one SCG (section 8)	17.6.0
2022-06	RAN#96	RP-221682	2330	1	F	CR on Efficient activation/de-activation mechanism for one SCG (section 9)	17.6.0
2022-06	RAN#96	RP-221682	2331	1	F	CR for TCI state indication with direct SCell activation	17.6.0
2022-06	RAN#96	RP-221682	2332	1	F	CR for remaining aspects of concurrent measurement gaps (section 8)	17.6.0
2022-06	RAN#96	RP-221682	2333	1	F	CR for remaining aspects of concurrent measurement gaps (section 9)	17.6.0
2022-06	RAN#96	RP-221682	2334	1	F	CR to maintain SCG activation and deactivation delay requirements in TS 38.133	17.6.0
2022-06	RAN#96	RP-221677	2335	1	F	CR to 38.133 on positioning measurement requirements in RRC_INACTIVE state	17.6.0
2022-06	RAN#96	RP-221747	2336	2	F	CR 38.133 corrections on L1/L3 measurement requirements for deactivated SCG	17.6.0
2022-06	RAN#96	RP-221677	2337	1	F	CR to TS 38.133 Correction to sidelink core requirements	17.6.0
2022-06	RAN#96	RP-221682	2338	1	F	CR to TS 38.133 Correction to measurements requirements for PDC	17.6.0
2022-06	RAN#96	RP-221681	2339	1	F	CR to TS38.133 for the applicability of requirement for FR2 HST	17.6.0

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2022-06	RAN#96	RP-221673	2343	1	B	CR to TS 38.133 - Introduction of licensed 6 GHz band n104	17.6.0
2022-06	RAN#96	RP-221684	2344	1	B	CR to TS 38.133: RMR 900 MHz band introduction	17.6.0
2022-06	RAN#96	RP-221680	2345		F	Correction on singaling name for FR1 HST	17.6.0
2022-06	RAN#96	RP-221682	2347	1	F	Draft CR on A-TRS based SCell activation and deactivated delay requirements with multiple downlink Scell	17.6.0
2022-06	RAN#96	RP-221682	2348		F	Correction on beam failure detection on deactived PSCell	17.6.0
2022-06	RAN#96	RP-221681	2351	1	F	CR on maintenance for PUCCH SCell activation	17.6.0
2022-06	RAN#96	RP-221677	2353	1	F	CR on maintaining RRM core requirements for R17 NR SL	17.6.0
2022-06	RAN#96	RP-221677	2356	1	F	DraftCR on maintaining L1-RSRP measurement requirements for R17 inter-cell beam managements	17.6.0
2022-06	RAN#96	RP-221677	2357	1	F	DraftCR on maintaining R17 TRP specific BFR requirements	17.6.0
2022-06	RAN#96	RP-221682	2358	1	F	CR on pre-MG related requirements	17.6.0
2022-06	RAN#96	RP-221682	2359	1	F	CR on collision handling for concurrent MGs	17.6.0
2022-06	RAN#96	RP-221682	2360	1	F	CR on maintenance of NCSG requirements	17.6.0
2022-06	RAN#96	RP-221677	2361	1	F	CR on measurement period requirements with multiple Rx TEGs	17.6.0
2022-06	RAN#96	RP-221677	2362	1	F	CR on requirements for UE Rx-Tx measurement with reduced latency	17.6.0
2022-06	RAN#96	RP-221677	2363	1	F	CR on RSTD measurement period requirements without gaps	17.6.0
2022-06	RAN#96	RP-221677	2365		F	CR on inter-frequency RRM requirements due to PRS measurement in INACTIVE	17.6.0
2022-06	RAN#96	RP-221677	2366		F	CR to introduce per-FR MG for PRS measurement	17.6.0
2022-06	RAN#96	RP-221677	2367	1	F	CR on scheduling restriction for PRS-RSRPP measurement	17.6.0
2022-06	RAN#96	RP-221682	2369	1	F	CR on SDT RRM requirements	17.6.0
2022-06	RAN#96	RP-221654	2370	1	B	CR on mapping table for NR TADV [NRTADV]	17.6.0
2022-06	RAN#96	RP-221682	2371		B	CR update SDT RRM core requirements	17.6.0
2022-06	RAN#96	RP-221681	2373		F	CR on FR2 HST core requirements	17.6.0
2022-06	RAN#96	RP-221682	2374	1	F	CR on core requirements for UE power saving enhancement	17.6.0
2022-06	RAN#96	RP-221682	2375	1	F	CR on New gap pattern for MUSIM	17.6.0
2022-06	RAN#96	RP-221681	2379	1	F	CR on R17 core requirements for HO with PSCell	17.6.0
2022-06	RAN#96	RP-221677	2381	1	F	CR on unified TCI in R17 feMIMO	17.6.0
2022-06	RAN#96	RP-221677	2382	1	F	CR on L1-RSRP measurement requirements for inter-cell BM in R17	17.6.0
2022-06	RAN#96	RP-221681	2383		B	CR to TS 38.133: intra-frequency measurements with gaps for for FR2 NR HST	17.6.0
2022-06	RAN#96	RP-221681	2384	1	B	CR to TS 38.133: SSB-based L1-SINR measurements for FR2 NR HST	17.6.0
2022-06	RAN#96	RP-221682	2386	1	F	CR on TS38.133 for applicability of RLM measurement relaxation	17.6.0
2022-06	RAN#96	RP-221682	2389	1	F	Changes to SDT requirements	17.6.0
2022-06	RAN#96	RP-221676	2390		B	Big CR for RedCap for TS 38.133	17.6.0
2022-06	RAN#96	RP-221681	2393	1	F	CR on requirements for HO with PSCell when PSCell is on CCA in NR SA to EN-DC scenario	17.6.0
2022-06	RAN#96	RP-221681	2394	1	F	CR on SCell activation/deactivation with PUCCH	17.6.0
2022-06	RAN#96	RP-221677	2397	1	F	CR on TRP specific CBD and BFR requirements	17.6.0
2022-06	RAN#96	RP-221682	2398	1	F	Correction to Pre-MG requirements in TS 38.133	17.6.0
2022-06	RAN#96	RP-221682	2399	1	F	Correction to NCSG requirements in TS 38.133	17.6.0
2022-06	RAN#96	RP-221677	2400	1	F	Correction to PRS measurement requirements in RRC inactive state	17.6.0
2022-06	RAN#96	RP-221655	2406		F	Big CR for TS 38.133 Core Maintenance Part-2 (Rel-17)	17.6.0
2022-06	RAN#96	RP-221655	2409		A	Big CR for TS 38.133 Core Maintenance Part-2 (Rel-17)	17.6.0
2022-06	RAN#96	RP-221660	2412		F	Big CR for TS 38.133 Perf Maintenance Part-1 (Rel-17)	17.6.0
2022-06	RAN#96	RP-221660	2415		F	Big CR for TS 38.133 Perf Maintenance Part-2 (Rel-17)	17.6.0
2022-06	RAN#96	RP-221676	2416		B	Big CR on extending NR to 71 GHz for TS38.133	17.6.0
2022-06	RAN#96	RP-221661	2417		B	Big CR on RRM requirements for FR2 RF enhancement	17.6.0
2022-06	RAN#96	RP-221682	2418		B	Big CR on RRM requirements for NTN	17.6.0

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2022-09	RA|N#97	RP-222031	2419	2	F	CR: FR2 HST Scheduling restriction on SSB	17.7.0
2022-09	RA|N#97	RP-222032	2420	1	F	CR: Power Saving Multiple RS Handling Clarification	17.7.0
2022-09	RA|N#97	RP-222034	2421	1	F	Completing PUCCH SCell activation requirement	17.7.0
2022-09	RA|N#97	RP-222043	2422		B	Big CR for test cases of Rel-17 FeRRM - PUCCH SCell activation (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222031	2423	2	F	CR on RRM core requirements for measurement procedure requirements for HST FR2	17.7.0
2022-09	RA|N#97	RP-222035	2424	1	F	CR on NCSG core requirements maintenance	17.7.0
2022-09	RA|N#97	RP-222032	2425	1	F	CR on PRS measurement period requirements	17.7.0
2022-09	RA|N#97	RP-222032	2426	1	F	CR on PRS measurement period requirements in RRC_INACTIVE state	17.7.0
2022-09	RA|N#97	RP-222050	2430		F	TS38.133 CR on SCG activation/deactivation	17.7.0
2022-09	RAN#97	RP-222035	2431	1	F	CR on measurement requirements for FR1 HST	17.7.0
2022-09	RA|N#97	RP-222043	2433	1	B	CR on test case for Handover with PSCell from NR SA to EN-DC with sequential processing	17.7.0
2022-09	RA|N#97	RP-222035	2434		B	CR on active TCI state switching delay	17.7.0
2022-09	RA|N#97	RP-222049	2447	1	B	CR on TC for Selection_Reselection of sidelink relay UE	17.7.0
2022-09	RA|N#97	RP-222035	2448	1	F	Maintenance CR on TS38.133 for Pre-MG core part	17.7.0
2022-09	RA|N#97	RP-222035	2449	1	F	Maintenance CR on TS38.133 for concurrent gaps core part	17.7.0
2022-09	RA|N#97	RP-222035	2450	1	F	Maintenance CR on TS38.133 for NCSG core part	17.7.0
2022-09	RA|N#97	RP-222050	2453		F	Interruptions due to RRM measurements on deactivated SCG	17.7.0
2022-09	RA|N#97	RP-222050	2454	1	F	CR on T1 definition of TA validation for Rel-17 NR SDT in INACTIVE sate	17.7.0
2022-09	RAN#97	RP-222053	2455		B	Big CR for SL enhancement RRM test cases	17.7.0
2022-09	RAN#97	RP-222035	2456		F	CR on Abbreviations for NTN	17.7.0
2022-09	RA|N#97	RP-222051	2457	1	F	CR on QCL-ed assumption for RSSI measurement in FR2-2	17.7.0
2022-09	RA|N#97	RP-222034	2460	1	F	38133CR on SRS antenna switching in MR-DC	17.7.0
2022-09	RA|N#97	RP-222034	2461	1	F	38133CR on PUCCH SCell activation delay	17.7.0
2022-09	RA|N#97	RP-222032	2463	1	F	CR on carrier-specific scaling factor for RedCap (9.1A.5)	17.7.0
2022-09	RA|N#97	RP-222051	2464	1	B	CR on Intra-frequency measurement requirements with CCA in FR2-2	17.7.0
2022-09	RA|N#97	RP-222032	2467	1	B	CR on applicability of requirements for RedCap Ues	17.7.0
2022-09	RA|N#97	RP-222035	2468		F	CR on TS38.133 NR NTN RRM requirements	17.7.0
2022-09	RA|N#97	RP-222051	2469	1	B	CR on TS38.133 RRM requirements in FR2-2	17.7.0
2022-09	RAN#97	RP-222032	2470	1	F	Maintenance CR for Rel-17 SL on 38.133	17.7.0
2022-09	RAN#97	RP-222035	2471		F	Maintenance CR for Rel-17 HST in FR1 on 38.133	17.7.0
2022-09	RA|N#97	RP-222050	2472	1	F	Maintenance CR for fast scell activation on 38.133 R17	17.7.0
2022-09	RA|N#97	RP-222050	2473	1	F	Maintenance CR for SCG activation on 38.133 R17	17.7.0
2022-09	RA|N#97	RP-222036	2474		F	CR on scheduling availability for inter cell beam management	17.7.0
2022-09	RA|N#97	RP-222036	2476	1	F	CR on unified TCI in R17 feMIMO	17.7.0
2022-09	RA|N#97	RP-222036	2477	1	F	CR on inter-cell beam managements in R17 feMIMO	17.7.0
2022-09	RA|N#97	RP-222032	2479	1	F	draftCR on RedCap RLM	17.7.0
2022-09	RA|N#97	RP-222032	2480	1	F	CR on RedCap measurement	17.7.0
2022-09	RA|N#97	RP-222035	2484	1	F	CR to TS 38.133: Corrections to cell re-selection for NR UE for satellite access	17.7.0
2022-09	RA|N#97	RP-222028	2486		F	CR on Number of serving carriers in SA	17.7.0
2022-09	RA|N#97	RP-222042	2487		B	CR for testcase of UE UL carrier RRC reconfiguration in FR2	17.7.0
2022-09	RA|N#97	RP-222035	2488	1	F	CR to TS 38.133: Corrections to UE transmit timing and timing advance for satellite access	17.7.0
2022-09	RA|N#97	RP-222035	2489	1	F	CR for concurrent measurement gaps	17.7.0
2022-09	RA|N#97	RP-222035	2490		F	CR for remaining aspects of NCSG measurement gaps (section 8 and 9)	17.7.0
2022-09	RA|N#97	RP-222050	2493	1	F	CR on Efficient activation/de-activation mechanism for one SCG	17.7.0
2022-09	RA|N#97	RP-222048	2494	1	F	DraftCR TC#13 PSCell activation and deactivation delay	17.7.0
2022-09	RA|N#97	RP-222034	2496		F	CR on SRS antenna port switching requirements 36.133 NOTE This CR is not implemented due to being a CR number for 38.133 but the spec is 36.133	17.7.0
2022-09	RA|N#97	RP-222042	2498	1	B	Test case for R17 Tx switching enhancement	17.7.0
2022-09	RA|N#97	RP-222050	2500	1	F	Correction on efficient activation for one SCG	17.7.0
2022-09	RAN#97	RP-222032	2501	1	F	Correction on Ranking for 1RX RedCap UE	17.7.0
2022-09	RAN#97	RP-222032	2502	1	F	Correction on Trs definition for RedCap UE	17.7.0
2022-09	RA|N#97	RP-222032	2503		F	Clarification on SSB in RLM and BFD for RedCap UE	17.7.0
2022-09	RA|N#97	RP-222032	2505	1	F	Correction on measurement with eDRX for RedCap UE	17.7.0
2022-09	RA|N#97	RP-222032	2506	1	F	CR on higher priority inter-frequency measurement relaxation for RedCap	17.7.0
2022-09	RA|N#97	RP-222032	2507	1	F	Corrections on measurement relaxations mixed with eDRX for Redcap UE	17.7.0
2022-09	RA|N#97	RP-222035	2508		F	CR on the enhancement for inter-frequency measurement in idle mode for HST	17.7.0
2022-09	RA|N#97	RP-222050	2509	1	F	CR on SCG activation delay and intra-frequency measurement	17.7.0

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2022-09	RA|N#97	RP-222051	2510	1	B	CR on introduction of cell Re-selection, inter-frequency and intra-frequency measurments requirements for FR2-2	17.7.0
2022-09	RA|N#97	RP-222035	2512	1	F	Corrections to Pre-configured MG	17.7.0
2022-09	RA|N#97	RP-222035	2513		F	Corrections to deriveSSB-IndexFromCellInter parameter naming	17.7.0
2022-09	RA|N#97	RP-222036	2514		F	CR to TS38.133 Corrections on R17 unified TCI state switching requirement	17.7.0
2022-09	RA|N#97	RP-222032	2517	1	F	CR to 38.133 scheduling restriction when PRS has lower priority than other DL signals/CCs	17.7.0
2022-09	RA|N#97	RP-222032	2518	1	F	CR to 38.133 clarification on measurement period requirement in RRC_INACTIVE state	17.7.0
2022-09	RA|N#97	RP-222032	2522	1	F	Changes to SDT requirements for NR RedCap	17.7.0
2022-09	RA|N#97	RP-222035	2524	1	F	CR on UE transmit timing requirements for NTN	17.7.0
2022-09	RA|N#97	RP-222032	2525	1	F	CR on maintaining RLM/BFD relaxation requirements	17.7.0
2022-09	RA|N#97	RP-222032	2526	1	F	CR on maintaining RRM core requirements for R17 NR SL	17.7.0
2022-09	RA|N#97	RP-222036	2527	1	F	CR on maintaining TCI state switching requirements for R17 unified TCI	17.7.0
2022-09	RA|N#97	RP-222036	2529	1	F	CR on maintaining R17 TRP specific BFR requirements	17.7.0
2022-09	RAN#97	RP-222035	2530	1	F	CR on pre-MG related requirements	17.7.0
2022-09	RAN#97	RP-222035	2531	1	F	CR on concurrent MG related requirements	17.7.0
2022-09	RA|N#97	RP-222035	2532	1	F	CR on maintenance of NCSG requirements	17.7.0
2022-09	RA|N#97	RP-222035	2533	1	F	CR on on other RRM requirements for NTN	17.7.0
2022-09	RA|N#97	RP-222035	2534	1	F	CR on intra-frequency measurement requirements for NTN	17.7.0
2022-09	RA|N#97	RP-222035	2535	1	F	CR on cell reselection requirements for NTN	17.7.0
2022-09	RA|N#97	RP-222032	2536	1	F	CR on measurement period requirements with multiple Rx TEGs	17.7.0
2022-09	RA|N#97	RP-222032	2538	1	F	CR on applicability of measurement requirements with POS MG	17.7.0
2022-09	RA|N#97	RP-222032	2539	1	F	CR on PRS measurement requirements in INACTIVE	17.7.0
2022-09	RA|N#97	RP-222036	2543	1	F	CR on requirements for UE Rx-Tx measurement for PDC	17.7.0
2022-09	RA|N#97	RP-222050	2544	1	F	CR on SDT RRM requirements	17.7.0
2022-09	RA|N#97	RP-222032	2545	1	F	CR on TS38.133 for applicability of RLM measurement relaxation	17.7.0
2022-09	RA|N#97	RP-222032	2546	1	F	CR on RedCap maintenance in TS 38.133	17.7.0
2022-09	RA|N#97	RP-222036	2547		F	CR on reporting mapping for URLLC in TS 38.133	17.7.0
2022-09	RA|N#97	RP-222036	2548		F	Formal CR to 38.133: Corrections on MUSIM gaps	17.7.0
2022-09	RA|N#97	RP-222032	2549	1	F	CR to 38.133 clarification on measurement period requirements in RRC_CONNECTED state	17.7.0
2022-09	RA|N#97	RP-222050	2553	1	F	Formal CR on Rel-17 SCG activation requirements	17.7.0
2022-09	RA|N#97	RP-222036	2557	1	F	CR on unified TCI state switching requirements	17.7.0
2022-09	RA|N#97	RP-222036	2558	1	F	Maintenance CR on inter-cell beam management	17.7.0
2022-09	RAN#97	RP-222036	2559		F	CR on corrections for TRP specific BFR	17.7.0
2022-09	RAN#97	RP-222034	2560	1	F	CR on correction of fine timing for HO with PSCell when PSCell is on CCA in NR SA to EN-DC scenario	17.7.0
2022-09	RA|N#97	RP-222035	2563	1	F	Correction to NCSG core requirements	17.7.0
2022-09	RA|N#97	RP-222035	2564		F	Satellite access band grouping for RRM requirements in TS 38.133	17.7.0
2022-09	RA|N#97	RP-222055	2565		B	Big CR for NR positioning enh RRM (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222049	2566		B	BigCR for R17 NR_SL_relay tests	17.7.0
2022-09	RA|N#97	RP-222032	2567		F	CR for RRM relaxation on R16 not at cell edge and R17 stationary for idle and inactive state mobility for Redcap	17.7.0
2022-09	RA|N#97	RP-222023	2570		F	Big CR for 38.133 maintenance part1 (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222558	2572	1	F	Big CR for 38.133 maintenance part2 (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222041	2573		B	Big CR for NR HST FR1 (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222041	2574		B	Big CR for NR HST FR2 (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222043	2575		B	Big CR for test cases of Rel-17 FeRRM - SRS antenna port switching (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222043	2576	1	B	Big CR for test cases of Rel-17 FeRRM - HO with PSCell (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222043	2577		B	Big CR for NR MG enh (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222046	2578		B	Big CR for NR NTN solutions RRM (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222047	2579		B	Big CR for NR UE power saving enh (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222051	2580		B	Big CR for NR extending to 71 GHz RRM (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222052	2581		B	Big CR for NR feMIMO RRM (Rel-17)	17.7.0
2022-09	RA|N#97	RP-222056	2582		B	Big CR for NR RedCap RRM (Rel-17)	17.7.0
2022-09	RAN#97	RP-222048	2583		B	Big CR for MR-DC enh RRM (Rel-17)	17.7.0
2022-09	RAN#97	RP-222045	2584		F	Big CR for NR IIoT and URLLC enh (Rel-17)	17.7.0
2022-09	RAN#97	RP-222541	2586	2	F	Changes Idle mode requirements for NR RedCap	17.7.0
2022-12	RAN#98-e	RP-223306	2593	1	F	CR on correction to cell re-selection requirement for satellite access	17.8.0
2022-12	RAN#98-e	RP-223306	2594	1	F	CR on scheduling restrictions for L3 measurements in FR1 for NTN	17.8.0
2022-12	RAN#98-e	RP-223307	2597	1	F	CR on scheduling restrictions for L3 measurements in FR1 for RedCap	17.8.0

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2022-12	RAN#98-e	RP-223306	2598	1	F	CR on intra-frequency and inter-frequency measurement requirement without MG for NTN	17.8.0
2022-12	RAN#98-e	RP-223306	2600		F	Correction on requirements for TRP specific link recovery procedures	17.8.0
2022-12	RAN#98-e	RP-223306	2603		F	CR on applicability of R17 inter cell beam management for FR2-2	17.8.0
2022-12	RAN#98-e	RP-223306	2604	1	F	CR on cell re-selection, MDT and timing requirements for NTN	17.8.0
2022-12	RAN#98-e	RP-223307	2612		F	CR on RLM requirements for FR2-2	17.8.0
2022-12	RAN#98-e	RP-223307	2613	1	F	CR on SCell activation requirements of FR2-2	17.8.0
2022-12	RAN#98-e	RP-223307	2614	1	F	CR on LBT assumption for FR2-2	17.8.0
2022-12	RAN#98-e	RP-223307	2615	1	F	CR on RSSI measurement for FR2-2	17.8.0
2022-12	RAN#98-e	RP-223307	2618	1	F	Correction to idle measurement requirements for RedCap Ues	17.8.0
2022-12	RAN#98-e	RP-223307	2620	1	F	Clarification on measurement for inactive mode RedCap UE	17.8.0
2022-12	RAN#98-e	RP-223307	2621	1	F	Correction on relaxed measurement for RedCap	17.8.0
2022-12	RAN#98-e	RP-223306	2623	1	F	CR on UL spatial relation switch requirements for NTN	17.8.0
2022-12	RAN#98-e	RP-223306	2624	1	F	CR on RLM and BFR requirements for NTN	17.8.0
2022-12	RAN#98-e	RP-223306	2625	1	F	CR on MG requirements for NTN	17.8.0
2022-12	RAN#98-e	RP-223306	2627	1	F	CR on SDT RRM requirements	17.8.0
2022-12	RAN#98-e	RP-223306	2630	1	B	Requirements for DRX case	17.8.0
2022-12	RAN#98-e	RP-223307	2631		F	CR on RedCap eDRX	17.8.0
2022-12	RAN#98-e	RP-223306	2634	1	F	CR for Cell Reselection requirements with distance trigger	17.8.0
2022-12	RAN#98-e	RP-223306	2636	1	F	CR on SFN based RLM and LRP	17.8.0
2022-12	RAN#98-e	RP-223306	2641	1	D	Editorial CR To TS 38.133 Handover requirements	17.8.0
2022-12	RAN#98-e	RP-223307	2644	1	F	Changes to RRC_IDLE mode requirements for RedCap for TS 38.133	17.8.0
2022-12	RAN#98-e	RP-223306	2647	1	F	Maintenance CR on inter-cell BM	17.8.0
2022-12	RAN#98-e	RP-223303	2652		B	Big CR for NTN RRM performance requirements	17.8.0
2022-12	RAN#98-e	RP-223302	2655		B	Big CR for NR IIoT and URLLC enh performance requirements	17.8.0
2022-12	RAN#98-e	RP-223304	2656		B	Big CR for NR SDT performance requirements	17.8.0
2022-12	RAN#98-e	RP-223311	2625	3	F	CR on MG requirements for NTN	17.8.0
2022-12	RAN#98-e	RP-223311	2630	2	B	Requirements for DRX case	17.8.0
2022-12	RAN#98-e	RP-223299	2653	1	B	Big CR for NR operation to 71 GHz RRM performance requirements Note: Partially implemented; some clauses had no revision marks and no changes were implemented on these clauses	17.8.0
2022-12	RAN#98-e	RP-223297	2661		A	CR to TS 38.133: Corrections to NR positioning and high speed train test cases (Rel 17)	17.8.0
2022-12	RAN#98-e	RP-223290	2664		A	CR on NR RRM maintenance R17	17.8.0
2022-12	RAN#98-e	RP-223309	2665	1	F	CR on CG-SDT with RedCap eDRX R17	17.8.0
2022-12	RAN#98-e	RP-223310	2666	1	F	CR on NCSG test case	17.8.0
2022-12	RAN#98-e	RP-223310	2667	1	F	CR on R17 HST test case - SA event triggered reporting tests without gap under DRX for UE configured with highSpeedMeasCA-Scell-r17	17.8.0
2022-12	RAN#98-e	RP-223308	2669		F	CR on removing the redundancy from TS 38.133 in response to RAN2 LS	17.8.0
2022-12	RAN#98-e	RP-223290	2671		A	Editorial CR on scheduling restrictions for L3 measurements in FR2 (Rel-17)	17.8.0
2022-12	RAN#98-e	RP-223309	2672	1	F	CR for Unified TCI State switching requirements	17.8.0
2022-12	RAN#98-e	RP-223309	2673	1	F	CR for Inter-cell Beam Management	17.8.0
2022-12	RAN#98-e	RP-223292	2676		A	CR to CSI-RS, RLM and BWP switching in annex	17.8.0
2022-12	RAN#98-e	RP-223292	2679		A	Update on Scell activation and deactivation and Control Channel RMC for RLM FR2 (Rel-17)	17.8.0
2022-12	RAN#98-e	RP-223292	2682		A	Update to L1-RSRP test scenarios (Rel-17)	17.8.0
2022-12	RAN#98-e	RP-223298	2683	1	F	CR on Tidentify_inter_without_index when deriveSSB-IndexFromCellInter is configured	17.8.0
2022-12	RAN#98-e	RP-223297	2686		A	Modification on TS38.133 for Rel-16	17.8.0
2022-12	RAN#98-e	RP-223297	2691		A	CR on positioning measurement accuracy requirements in R16	17.8.0
2022-12	RAN#98-e	RP-223292	2695		A	R17 Cat-A CR testcase correction from R15 TS 38.133	17.8.0
2022-12	RAN#98-e	RP-223292	2697		A	R17 Cat-A CR testcase correction from R16 TS 38.133	17.8.0
2022-12	RAN#98-e	RP-223309	2699	1	F	CR on QCL-ed assumption for inter-frequency RSSI measurement in FR2-2	17.8.0
2022-12	RAN#98-e	RP-223292	2702		A	CR on test case correction for timing advance	17.8.0
2022-12	RAN#98-e	RP-223296	2705		A	38133 Cat. A CR on SRS configuration for SRS carrier based switching	17.8.0
2022-12	RAN#98-e	RP-223310	2708	1	F	CR on TC for R17 HST CA enhancement on deactivated SCell (EN-DC) in FR1	17.8.0
2022-12	RAN#98-e	RP-223292	2711		A	CR on TC for known PSCell addition in R17	17.8.0
2022-12	RAN#98-e	RP-223292	2714		A	CR on TC for inter-RAT NR Cell reselection in R17	17.8.0
2022-12	RAN#98-e	RP-223311	2715	2	F	CR to TS 38.133 Correction to measurements core requirements for PDC	17.8.0

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2022-12	RAN#98-e	RP-223308	2720		F	CR to TS 38.133 Correction to conditional PSCell addition requirements(Rel-17)	17.8.0
2022-12	RAN#98-e	RP-223308	2721	1	F	CR on RLM/BFD requirement for deactivated PSCell and SCG Activation Delay requirement	17.8.0
2022-12	RAN#98-e	RP-223309	2723	1	F	CR on corrections to RedCap Core requirements	17.8.0
2022-12	RAN#98-e	RP-223311	2725		F	CR on intra-frequency cell reselection in NTN	17.8.0
2022-12	RAN#98-e	RP-223311	2726		F	CR on intra-frequency measurements in NTN	17.8.0
2022-12	RAN#98-e	RP-223310	2727		B	Big CR for NR feMIMO RRM performance requirements	17.8.0
2022-12	RAN#98-e	RP-223302	2730		B	BigCR to 38.133: measurement accuracy requirements for RTT-based PDC	17.8.0
2022-12	RAN#98-e	RP-223311	2731	1	F	CR on correction to CHO requirement for satellite access	17.8.0
2022-12	RAN#98-e	RP-223311	2732	1	F	CR on correction to cell re-selection requirement for satellite access	17.8.0
2022-12	RAN#98-e	RP-223296	2734		A	Correction of L1 L3 measurenent measurement sharing factors for inter-frequency L3 measurement performed outside gaps in R17	17.8.0
2022-12	RAN#98-e	RP-223310	2735	1	F	L1-SINR and SS-SINR measurement accuracy requirements in R17 FR1 HST	17.8.0
2022-12	RAN#98-e	RP-223309	2737	2	F	CR on R17 feMIMO RRM requirements	17.8.0
2022-12	RAN#98-e	RP-223309	2739		F	CR on cell reselection requirements for FR2-2	17.8.0
2022-12	RAN#98-e	RP-223309	2741	1	F	CR on maintaining RRM requirements for R17 FeMIMO	17.8.0
2022-12	RAN#98-e	RP-223309	2746		F	Correction on measurement requirements for RedCap UE	17.8.0
2022-12	RAN#98-e	RP-223293	2749		A	Correction on Aperiodic CSI-RS RMCs and RLM in-sync test cases for R17	17.8.0
2022-12	RAN#98-e	RP-223311	2750	1	F	Corrections to Rel.17 positioning test cases	17.8.0
2022-12	RAN#98-e	RP-223311	2754		F	CR on Clarification of Ttrigger Requirements for Cell Reselection	17.8.0
2022-12	RAN#98-e	RP-223297	2757		A	CR on positioning requirements R17	17.8.0
2022-12	RAN#98-e	RP-223311	2758	1	F	CR on core requirements for Rel-17 positioning	17.8.0
2022-12	RAN#98-e	RP-223311	2759	1	F	CR on performance requirements for Rel-17 positioning	17.8.0
2022-12	RAN#98-e	RP-223311	2760	1	F	CR on RRC re-establishment requirements for NTN	17.8.0
2022-12	RAN#98-e	RP-223311	2762	1	F	CR on L1-RSRP measurement requirements	17.8.0
2022-12	RAN#98-e	RP-223309	2764	1	F	CR on conditions for PL-RS maintenance	17.8.0
2022-12	RAN#98-e	RP-223310	2765	2	F	CR to 38.133 on Rel-17 HST FR2 RRM Requirements	17.8.0
2022-12	RAN#98-e	RP-223311	2766	1	F	CR - Corrections to core requirements for NR positioning	17.8.0
2022-12	RAN#98-e	RP-223310	2767		F	Pre-MG test case No 1-1	17.8.0
2022-12	RAN#98-e	RP-223311	2768	2	F	Performance requirements for PRS Measurement with reduced number of samples	17.8.0
2022-12	RAN#98-e	RP-223311	2769	1	F	CR on R17 positioning measurement accuracy requirements	17.8.0
2022-12	RAN#98-e	RP-223301	2770		B	Big CR for Performance part of RedCap - TS 38.133	17.8.0
2022-12	RAN#98-e	RP-223308	2772		A	Correction to Idle Mode CA/DC Measurement Tests in TS 38.133	17.8.0
2022-12	RAN#98-e	RP-223308	2776	1	F	Formal CR to 38.133 Corrections on Handover with PSCell from NR SA to EN-DC with PSCell using CCA	17.8.0
2022-12	RAN#98-e	RP-223309	2777		F	CR on RedCap maintenance in TS 38.133	17.8.0
2022-12	RAN#98-e	RP-223297	2779		A	CR on Rel-17 measurements and UE specific CBW switch maintenance	17.8.0
2022-12	RAN#98-e	RP-223308	2780	1	F	Maintenance CR on SCell activation/deactivation with PUCCH	17.8.0
2022-12	RAN#98-e	RP-223309	2784	1	B	CR on measurement procedures for RedCap UEs	17.8.0
2022-12	RAN#98-e	RP-223309	2785	1	F	CR on timing requirements with measurement gaps for RedCap UEs	17.8.0
2022-12	RAN#98-e	RP-223309	2786	1	B	CR on RRC Connection mobility control	17.8.0
2022-12	RAN#98-e	RP-223309	2787	1	B	CR on Measurement Procedures	17.8.0
2022-12	RAN#98-e	RP-223298	2788		F	CR to TS 38.133: Remedy the incorrect implementation in the section 4.2.2.4	17.8.0
2022-12	RAN#98-e	RP-223303	2789		B	Big CR for NR NTN RRM performance requirements	17.8.0
2022-12	RAN#98-e	RP-223304	2790		B	Big CR for NR small data transmissions in INACTIVE state RRM performance requirements	17.8.0

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Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2022-12	RAN#98-e	RP-223319	2692	1	B	CR to TS 38.133: Introduction of NR band n105	18.0.0
2023-03	RAN#99	RP-230514	2792		A	CR on R17 feMIMO for scheduling restriction in inter cell beam management in R18	18.1.0
2023-03	RAN#99	RP-230504	2796		A	CR on TC for FR2 inter-frequency relative accuracy in R18	18.1.0
2023-03	RAN#99	RP-230504	2800		A	CR on TC for known PSCell addition in R18	18.1.0
2023-03	RAN#99	RP-230504	2804		A	CR to SNR on RLM-RS2 for FR2 CSI-RS based RLM OOS/IS tests	18.1.0
2023-03	RAN#99	RP-230506	2808		A	CR to SNR of q0 level for BFD and LR in FR2	18.1.0

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2023-03	RAN#99	RP-230504	2812		A	CR to ConfigNo of SSB Configuration and CSI-RS for tracking in redirection test	18.1.0
2023-03	RAN#99	RP-230514	2818		A	CR on L3-RSSI measurement for NR up to 71 GHz	18.1.0
2023-03	RAN#99	RP-230518	2822		A	CR on NR RedCap measurement requirement in IDLE mode with eDRX R18	18.1.0
2023-03	RAN#99	RP-230516	2826		A	CR on SMTC collision in R18	18.1.0
2023-03	RAN#99	RP-230514	2835		A	CR for Unified TCI State switching requirements for UL	18.1.0
2023-03	RAN#99	RP-230518	2837		A	CR on CG-SDT test cases for RedCap UEs	18.1.0
2023-03	RAN#99	RP-230519	2839		A	CR correction of SDT test cases	18.1.0
2023-03	RAN#99	RP-230517	2841		A	CR on requirements applicability of PRS measurement	18.1.0
2023-03	RAN#99	RP-230507	2843		A	CR on PUCCH SCell activation requirement	18.1.0
2023-03	RAN#99	RP-230516	2845		A	CR on clarification for UE acquiring system information during handover	18.1.0
2023-03	RAN#99	RP-230517	2847		A	CR on the applicability of timing error margin in positioning accuracy requirements	18.1.0
2023-03	RAN#99	RP-230506	2850		A	CR on positioning test case in R16	18.1.0
2023-03	RAN#99	RP-230519	2854		A	CR on FR2 PSCell SSB-based BFD and CBD test maintenance for UE fulfilling relaxed measurement criterion	18.1.0
2023-03	RAN#99	RP-230499	2859		A	Sidelinek R16 resource selection test configuration correction R18 mirror	18.1.0
2023-03	RAN#99	RP-230519	2861		A	Sidelinek R17 resource selection test configuration correction R18 mirror	18.1.0
2023-03	RAN#99	RP-230514	2866		A	FR1 HST L1-RSRP test configuration correction R18 mirror	18.1.0
2023-03	RAN#99	RP-230509	2868		A	CR on scheduling restriction when deriveSSB-IndexFromCellInter is configured	18.1.0
2023-03	RAN#99	RP-230512	2871		A	CR for R17 MR-DC Enh on R18 38.133	18.1.0
2023-03	RAN#99	RP-230519	2875		A	CR on test case for R17 SL in SL-DRX mode on R18 38.133	18.1.0
2023-03	RAN#99	RP-230500	2878		A	Correction on TCs for direct scell activation in R18(Cat-A)	18.1.0
2023-03	RAN#99	RP-230516	2882		A	Maintenance core part CR on of MG enh R18	18.1.0
2023-03	RAN#99	RP-230516	2884		A	Maintenance perf part CR on of MG enh R18	18.1.0
2023-03	RAN#99	RP-230516	2889		A	CR on editorial change for CSI-RS based intra-frequency measurements	18.1.0
2023-03	RAN#99	RP-230535	2903		B	CR related to Introduction of NR TDD Band n54	18.1.0
2023-03	RAN#99	RP-230507	2908		A	Correction on SRS configurations for SRS antenna switching test cases in R18	18.1.0
2023-03	RAN#99	RP-230507	2911		A	CR on TC maintenance for NR-U R18	18.1.0
2023-03	RAN#99	RP-230510	2915		A	CR on CCA model for FR2-2 R18	18.1.0
2023-03	RAN#99	RP-230510	2917		A	CR on test case maintenance for FR2-2 R18	18.1.0
2023-03	RAN#99	RP-230518	2923		A	Correction on measurement requirements with eDRX for RedCap UE R18	18.1.0
2023-03	RAN#99	RP-230518	2925		A	Correction on measurement requirement in idle mode and connected mode for RedCap UE for RedCap R18	18.1.0
2023-03	RAN#99	RP-230518	2927		A	Correction to FR2 RedCap test cases_R18	18.1.0
2023-03	RAN#99	RP-230518	2929		A	Correction to RedCap RMCs and FR1 RedCap test cases_R18	18.1.0
2023-03	RAN#99	RP-230516	2930	1	B	DL interruption for Tx switching across 3/4 bands	18.1.0
2023-03	RAN#99	RP-230519	2933		A	Adding relaxation factor on measurement relaxation requirements R18	18.1.0
2023-03	RAN#99	RP-230506	2936		A	PRS measurement period for Deferred MT-LR with event “Periodic Location”	18.1.0
2023-03	RAN#99	RP-230509	2938		A	Correction of table reference for NR Timing Advance	18.1.0
2023-03	RAN#99	RP-230517	2940		A	CR to 38.133 correction of measurement period requirements for positioning measurements	18.1.0
2023-03	RAN#99	RP-230517	2942		A	CR to 38.133 performance requirements for positioning measurements	18.1.0
2023-03	RAN#99	RP-230503	2946		A	CR on measurement requirements with per-FR gap R18	18.1.0
2023-03	RAN#99	RP-230506	2952		A	CR on positioning test cases R18	18.1.0
2023-03	RAN#99	RP-230506	2955		A	CR on positioning accuracy requirements R18	18.1.0
2023-03	RAN#99	RP-230516	2957		A	CR on pre-MG related requirements R18	18.1.0
2023-03	RAN#99	RP-230516	2959		A	CR on NCSG related requirements R18	18.1.0
2023-03	RAN#99	RP-230516	2961		A	CR on HO requirements for NTN R18	18.1.0
2023-03	RAN#99	RP-230516	2963		A	CR on MG requirements for NTN R18	18.1.0
2023-03	RAN#99	RP-230517	2965		A	CR on PRS measurement requirements for INACTIVE R18	18.1.0
2023-03	RAN#99	RP-230517	2969		A	CR on accuracy requirements for Rel-17 positioning R18	18.1.0
2023-03	RAN#99	RP-230515	2971		A	CR on requirements for UE Rx-Tx measurement for PDC R18	18.1.0
2023-03	RAN#99	RP-230515	2973		A	CR on TCs for PDC measurement R18	18.1.0
2023-03	RAN#99	RP-230515	2975		A	CR on SDT RRM test case for FR2 R18	18.1.0
2023-03	RAN#99	RP-230507	2978		A	Correction to CBW change TCs_R18	18.1.0
2023-03	RAN#99	RP-230513	2984		A	CR on correction of eMIMO test cases R18	18.1.0
2023-03	RAN#99	RP-230514	2986		A	CR on maintaining RRM requirements for NR FeMIMO R18	18.1.0
2023-03	RAN#99	RP-230515	2990	1	A	CR on test cases for HST FR1	18.1.0

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2023-03	RAN#99	RP-230518	2992		A	CR on RedCap Idle mode(38.133)	18.1.0
2023-03	RAN#99	RP-230518	2994		A	CR on RedCap Measurement	18.1.0
2023-03	RAN#99	RP-230518	3008		A	Corrections to inter-frequency NR and inter-RAT E-UTRAN measurements for RedCap	18.1.0
2023-03	RAN#99	RP-230518	3014		A	Formal CR to Rel-18 TS 38.133: on missing Rel-16 relaxation for RedCap IDLE mode	18.1.0
2023-03	RAN#99	RP-230519	3020		A	Formal CR to Rel-18 38.133: correction on CG-SDT transmission	18.1.0
2023-03	RAN#99	RP-230505	3028		A	R18 Cat-A CR CLI measurement testcase correction	18.1.0
2023-03	RAN#99	RP-230505	3029		A	R18 Cat-A CR SA NR-LTE HO testcase correction	18.1.0
2023-03	RAN#99	RP-230513	3044		A	Correction to FR1 band groups in 38.133	18.1.0
2023-03	RAN#99	RP-230513	3046		A	Conditions for missing FR2 band and power class for positioning in 38.133	18.1.0
2023-03	RAN#99	RP-230500	3051		A	Correction to Idle Mode CA/DC Measurement Tests in TS 38.133	18.1.0
2023-03	RAN#99	RP-230516	3057		A	CR on TS 38.133 (Rel-18) Corrections on cell reselection for NTN (CAT. A)	18.1.0
2023-03	RAN#99	RP-230517	3059		A	CR - Correction to UE scheduling availability for PRS measurements without gaps	18.1.0
2023-03	RAN#99	RP-230510	3065		A	CR on TC - L1 RSRP measurement for beam reporting	18.1.0
2023-03	RAN#99	RP-230507	3072		A	CR on RLM OOS and IS tests with no DRX in NR-U standalone mode	18.1.0
2023-03	RAN#99	RP-230507	3073		A	CR on BFD and LR tests in NR-U standalone mode	18.1.0
2023-03	RAN#99	RP-230515	3076		A	FR2 HST TCI state switch test case maintenance CR R18 mirror	18.1.0
2023-03	RAN#99	RP-230505	3079		A	CR to TS 38.133: Corrections to NR RRM test cases (Rel 18)	18.1.0
2023-03	RAN#99	RP-230506	3082		A	CR to TS 38.133: Corrections to NR positioning requirements (Rel 18)	18.1.0
2023-03	RAN#99	RP-230518	3084		A	CR to TS 38.133: Corrections to NR RedCap test cases (Rel 18)	18.1.0
2023-03	RAN#99	RP-230518	3087		A	CR on active BWP switch test cases	18.1.0
2023-03	RAN#99	RP-230514	3088		A	CR for Unified TCI State switching requirements-R18	18.1.0
2023-03	RAN#99	RP-230507	3089		A	CR on SRS antenna port switching corrections in TS38.133 R17	18.1.0
2023-03	RAN#99	RP-230515	3090		A	CR to 38.133 on Rel-17 HST FR2 RRM and Measurement Accuracy	18.1.0
2023-03	RAN#99	RP-230515	3091	1	A	CR on R17 HST FR2 test case of SSB based L1-RSRP measurement	18.1.0
2023-03	RAN#99	RP-230516	3092		A	CR Removal of editors note from concurrent gaps	18.1.0
2023-03	RAN#99	RP-230514	3097		A	CR on applicability of requirements for measurement restriction	18.1.0
2023-03	RAN#99	RP-230516	3098		A	CR on R17 Measurement Gap enhancement	18.1.0
2023-03	RAN#99	RP-230506	3099		A	CR to TS38.133: Revise the Measured quantity value(ZoA)	18.1.0
2023-03	RAN#99	RP-230506	3100		A	CR to TS38.133:Revise the abbreviation of AoA, A-AoA and ZoA	18.1.0
2023-03	RAN#99	RP-230516	3101	2	A	Maintenance CR on cell reselection requirements for satellite access	18.1.0
2023-03	RAN#99	RP-230515	3102		A	CR to 38.133 on Rel-17 HST FR2 UL TX Timing	18.1.0
2023-03	RAN#99	RP-230511	3104		A	Big CR for NR NTN RRM performance requirements (Rel-18)	18.1.0
2023-03	RAN#99	RP-230516	3105	2	A	CR to38.133: Complement the assistance information for NTN neighbour cell measurement	18.1.0
2023-03	RAN#99	RP-230514	3106		A	CR on RRM core requirements of FeMIMO	18.1.0
2023-06	RAN#100	RP-231358	3112		A	CR on relationship between SNR, RSRP level and thresholds for FR1 BFD and LR	18.2.0
2023-06	RAN#100	RP-231357	3116		A	CR (CAT-A) on R15 NR Inter-RAT measurements testcase correction	18.2.0
2023-06	RAN#100	RP-231346	3118		A	CR (CAT-A) on R17 TRP specific BFD testcase correction	18.2.0
2023-06	RAN#100	RP-231357	3124		A	CR to TS 38.133: Corrections to NR RRM test cases (Rel 18)	18.2.0
2023-06	RAN#100	RP-231354	3131		A	Corrections to RRM HST A.6.1.1.7 (Rel-18)	18.2.0
2023-06	RAN#100	RP-231357	3143		A	CR to FR2 RLM In-syn test cases (Cat-A Rel-18)	18.2.0
2023-06	RAN#100	RP-231341	3145		A	CR on updates for R17 per-FR gap capability	18.2.0
2023-06	RAN#100	RP-231343	3147		A	38133 Cat.A CR on PUCCH SCell activation delay	18.2.0
2023-06	RAN#100	RP-231345	3149		A	CR on R17 positioning performance requirements	18.2.0
2023-06	RAN#100	RP-231355	3157		A	CR of known cell condition for HO on 38.133 R18	18.2.0
2023-06	RAN#100	RP-231341	3161		A	Clarification on MRTD/MTTD and interruption requirement for EN-DC in Rel-18	18.2.0
2023-06	RAN#100	RP-231340	3163		A	CR on Interruption requirements at SCG activation/deactivation(Rel-18)	18.2.0
2023-06	RAN#100	RP-231344	3168		A	CR on measurement capability for NR NTN	18.2.0
2023-06	RAN#100	RP-231350	3174		A	CR on test cases for HST FR1	18.2.0

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2023-06	RAN#100	RP-231344	3176		A	CR for editorial modification for 4.2C.2.3 Measurements of intra-frequency NR cells in 38.133	18.2.0
2023-06	RAN#100	RP-231341	3178		A	CR on UE capability when deriveSSB-IndexFromCellInter is configured	18.2.0
2023-06	RAN#100	RP-231345	3182		A	CR to TS 38.133: Supplement the impact of the measurement period(RSTD, PRS-RSRP, UE Rx-Tx) in general aspects of gapless measurement	18.2.0
2023-06	RAN#100	RP-231350	3192	1	A	CR on eDRX requirements	18.2.0
2023-06	RAN#100	RP-231346	3194		A	CR on maintenance of feMIMO RRM requirements in R18	18.2.0
2023-06	RAN#100	RP-231357	3198		A	Correction to inter-RAT NR measurement TCs_R18	18.2.0
2023-06	RAN#100	RP-231357	3202		A	Correction to inter-frequency NR measurement TCs_R18	18.2.0
2023-06	RAN#100	RP-231343	3205		A	Correction to UE specific CBW RMCs_R18	18.2.0
2023-06	RAN#100	RP-231350	3207		A	Correction to FR1 RedCap test cases RMCs and side conditions_R18	18.2.0
2023-06	RAN#100	RP-231350	3209		A	Correction to FR2 RedCap test cases_R18	18.2.0
2023-06	RAN#100	RP-231347	3214		A	CR on Random access on carrier with CCA in FR2-2 R18	18.2.0
2023-06	RAN#100	RP-231347	3216		A	CR on test case maintenance for FR2-2 R18	18.2.0
2023-06	RAN#100	RP-231389	3219	1	F	DL interruption for Tx switching across 3/4 bands	18.2.0
2023-06	RAN#100	RP-231354	3223		A	Correction on Nserv for FR2 HST R18	18.2.0
2023-06	RAN#100	RP-231340	3225		A	clause number update for MRDC	18.2.0
2023-06	RAN#100	RP-231344	3227		A	CR on Cell Reselection for RRC Inactive in NTN (Cat. A)	18.2.0
2023-06	RAN#100	RP-231344	3229		A	CR on Duration for reselection test cases in NGSO scenarios (Cat. A)	18.2.0
2023-06	RAN#100	RP-231350	3231		A	CR: Correction of Measurement conditions for RedCap for 1Rx	18.2.0
2023-06	RAN#100	RP-231350	3233		A	CR on RedCap L1-RSRP	18.2.0
2023-06	RAN#100	RP-231350	3235		A	CR on RedCap HO	18.2.0
2023-06	RAN#100	RP-231343	3237		A	CR on ConMGs	18.2.0
2023-06	RAN#100	RP-231343	3242		A	Maintenance core part CR on of MG enh R18	18.2.0
2023-06	RAN#100	RP-231343	3244		A	Maintenance core part CR on of MG enh R18	18.2.0
2023-06	RAN#100	RP-231344	3252		A	(Cat A) CR on NTN specific parameters configuration for NTN test cases	18.2.0
2023-06	RAN#100	RP-231340	3257		A	CR on direct SCell activation requirements R18	18.2.0
2023-06	RAN#100	RP-231343	3259		A	CR on NCSG related requirements R18	18.2.0
2023-06	RAN#100	RP-231343	3261		A	CR on concurrent MG related requirements R18	18.2.0
2023-06	RAN#100	RP-231344	3263		A	CR on mobility requirements for NTN R18	18.2.0
2023-06	RAN#100	RP-231344	3265		A	CR on MG requirements for NTN R18	18.2.0
2023-06	RAN#100	RP-231345	3267		A	CR on PRS measurement requirements for INACTIVE R18	18.2.0
2023-06	RAN#100	RP-231345	3269		A	CR on measurement requirements for TEG R18	18.2.0
2023-06	RAN#100	RP-231345	3271		A	CR on accuracy requirements for Rel-17 positioning R18	18.2.0
2023-06	RAN#100	RP-231343	3273		A	CR on SDT RRM test case R18	18.2.0
2023-06	RAN#100	RP-231358	3277		A	CR on maintaining antenna connections for 4Rx capable UEs R18	18.2.0
2023-06	RAN#100	RP-231354	3280		A	CR on maintaining PL-RS switching delay requirements R18	18.2.0
2023-06	RAN#100	RP-231343	3285		A	CR on correction to interruption requirements for inter-band CA R18	18.2.0
2023-06	RAN#100	RP-231346	3287		A	CR on maintaining RRM requirements for NR FeMIMO R17	18.2.0
2023-06	RAN#100	RP-231344	3295		A	CR on R17 NTN CHO	18.2.0
2023-06	RAN#100	RP-231355	3297		A	CR on R15 SCell activation requirements	18.2.0
2023-06	RAN#100	RP-231354	3300		A	CR for definition of PL-RS maintained in section 8.14	18.2.0
2023-06	RAN#100	RP-231342	3304		A	CR for Measurement period requirements	18.2.0
2023-06	RAN#100	RP-231340	3312		A	CR correcting RRM DCCA SCell activation and deactivation test case	18.2.0
2023-06	RAN#100	RP-231358	3314		A	CR to 38.133 Corrections to PRS-RSRPP measurement accuracy requirements	18.2.0
2023-06	RAN#100	RP-231345	3316		A	CR to 38.133 Corrections to positioning measurement core requirements	18.2.0
2023-06	RAN#100	RP-231340	3325		A	Update (Rel-18) of RRM DCCA SCell activation and deactivation test cases	18.2.0
2023-06	RAN#100	RP-231356	3331		A	38.133 R18 Cat.A CR on interruptions at SCell activation and deactivation	18.2.0
2023-06	RAN#100	RP-231346	3351		A	CR for Unified TCI State switching requirements (Rel-18)	18.2.0
2023-06	RAN#100	RP-231354	3352		A	Update to RRM idle mode HST test cases	18.2.0
2023-06	RAN#100	RP-231343	3354		A	Formal CR to Rel-18 TS 38.133 on SDT maintenance (Mirror)	18.2.0
2023-06	RAN#100	RP-231350	3356		A	Formal CR to Rel-18 TS 38.133: on RedCap maintenance in TS 38.133	18.2.0
2023-06	RAN#100	RP-231350	3358		A	Formal CR to Rel-18 TS 38.133: on RedCap Perf maintenance in TS 38.133	18.2.0
2023-06	RAN#100	RP-231346	3360		A	CR on maintenance of FeMIMO	18.2.0
2023-06	RAN#100	RP-231350	3364		A	Corrections to RedCap Measurement Requirements	18.2.0

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2023-06	RAN#100	RP-231350	3366		A	Correction to offset for cell specific RSRP thresholds for 1Rx Redcap UE in 38.133	18.2.0
2023-06	RAN#100	RP-231350	3370		A	Corrections of SDT Test Case Parameters for RedCap	18.2.0
2023-09	RAN#101	RP-232497	3374		A	[NR_redcap-Perf] CR (CAT-A) NR Inter-RAT measurements testcase correction for redcap UE	18.3.0
2023-09	RAN#101	RP-232487	3378		A	CR (CAT-A) on FR2 Active TCI state switch delay testcase correction	18.3.0
2023-09	RAN#101	RP-232493	3380		A	NR_MG_enh-Core Maintenance core part CR R18	18.3.0
2023-09	RAN#101	RP-232493	3382		A	NR_MG_enh-Perf Maintenance core part CR R18	18.3.0
2023-09	RAN#101	RP-232488	3385		A	LTE_NR_DC_CA_enh-Perf Update of RRM DCCA SCell activation and deactivation test cases	18.3.0
2023-09	RAN#101	RP-232492	3387		A	NR_IIOT_URLLC_enh-Perf Update (Rel-18) of RRM propagation delay compensation test cases	18.3.0
2023-09	RAN#101	RP-232488	3389		A	LTE_NR_DC_enh2-Perf Update of MR_DC test cases for fast Scell activation test cases	18.3.0
2023-09	RAN#101	RP-232488	3391		A	LTE_NR_DC_enh2-Perf Update of CPAC test cases	18.3.0
2023-09	RAN#101	RP-232498	3393		A	NR_RF_FR1_enh-Perf Corrections in test parameters of DL interruptions at switching between UL carriers testcase	18.3.0
2023-09	RAN#101	RP-232503	3395		F	[NR_newRAT-Perf] CR to FR1 Beam failure detection requirement	18.3.0
2023-09	RAN#101	RP-232503	3399		A	[NR_newRAT-Perf] CR to BWP Switch Delay TCs	18.3.0
2023-09	RAN#101	RP-232497	3403		A	[NR_redcap-Perf] CR to event triggered reporting tests with per-UE gaps under DRX for RedCap	18.3.0
2023-09	RAN#101	RP-232500	3406		A	On NE-DC requirement	18.3.0
2023-09	RAN#101	RP-232502	3412		A	[NR_newRAT-Perf] CR for Active TCI State switch test requirements - Rel18	18.3.0
2023-09	RAN#101	RP-232499	3415		A	[NR_RRM_enh-Perf] Editorial CR for Spatial relation info switch test requirements - Rel18	18.3.0
2023-09	RAN#101	RP-232500	3420		A	CR on additional UE gain - R18	18.3.0
2023-09	RAN#101	RP-232493	3426		A	CR on NCSG interruption requirement [NR_MG_enh-Core] - R18	18.3.0
2023-09	RAN#101	RP-232491	3432		A	NR_HST-Perf Clarification to RRM HST A.6.1.1.7 (Rel-18)	18.3.0
2023-09	RAN#101	RP-232495	3437		A	CR on R17 positioning performance requirements	18.3.0
2023-09	RAN#101	RP-232495	3448		A	[NR_pos_enh-Core] PRS-RSRPP shall be captured in measurement procedure.	18.3.0
2023-09	RAN#101	RP-232495	3452		A	[NR_pos_enh-Core] The correction of IE for positioning core requirements.	18.3.0
2023-09	RAN#101	RP-232494	3454		A	[NR_NTN_solutions -Core] Modify the condition for collision between concurrent measurement gaps.	18.3.0
2023-09	RAN#101	RP-232497	3468	1	A	[NR_redcap-Core] CR to Rel-18 TS 38.133: on NR RedCap Re-establishment	18.3.0
2023-09	RAN#101	RP-232513	3469	1	F	CR on DL interruption for Tx switching across 3/4 bands	18.3.0
2023-09	RAN#101	RP-232489	3472		A	[NR_feMIMO-Perf] CR of correction on parameter typos in TC4.5.5.7, TC5.5.5.8, TC6.5.5.7, TC7.5.5.9, TC7.5.5.10 for R18	18.3.0
2023-09	RAN#101	RP-232501	3475		A	[NR_newRAT-Core] Correction to P factor for RLM BFD CBD and L1RSRP_R18	18.3.0
2023-09	RAN#101	RP-232496	3478		A	[NR_UE_pow_sav-Perf] Correction to relaxed idle measurement TCs_R18	18.3.0
2023-09	RAN#101	RP-232499	3481		A	[NR_RRM_Enh-Perf] Correction to simultaneous BWP switching TCs_R18	18.3.0
2023-09	RAN#101	RP-232497	3483		A	[NR_redcap-Core] Cleaning up of RedCap measurement reporting requirements_R18	18.3.0
2023-09	RAN#101	RP-232497	3485		A	[NR_redcap-Perf] Cleaning up of RedCap measurement accuracy requirements_R18	18.3.0
2023-09	RAN#101	RP-232499	3488		A	[NR_unlic-Perf] CR on TC maintenance for NR-U R18	18.3.0
2023-09	RAN#101	RP-232491	3497		A	[NR_HST_FR2-Core]Correction on measurement period for R17 FR2 HST	18.3.0
2023-09	RAN#101	RP-232488	3499		A	[LTE_NR_DC_enh2-Perf]Correction on PSCell activation and conditional PSCell addition tests	18.3.0
2023-09	RAN#101	RP-232497	3505		F	Correction to RedCap core requirements	18.3.0
2023-09	RAN#101	RP-232497	3507		F	Correction to performance part requirements for RedCap NOTE: Partially CR Implementation. Some table values were not related to current specification and could not be all implemented.	18.3.0
2023-09	RAN#101	RP-232495	3510		A	[NR_pos_enh] CR on per FR PRS gap in case of concurrent gaps in Rel-18	18.3.0
2023-09	RAN#101	RP-232500	3514	1	A	CR 38.133 Correction of normative text in requirements	18.3.0
2023-09	RAN#101	RP-232499	3517		A	[NR_RRM_Enh-Perf] CR: Correction of SRS configuration for SRS carrier based switching tests	18.3.0
2023-09	RAN#101	RP-232495	3520		A	[NR_pos-Perf] CR on Rx-Tx accuracy requirements R18	18.3.0
2023-09	RAN#101	RP-232493	3522		A	[NR_MG_enh-Core] CR on Rel-17 MGE requirements R18	18.3.0

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2023-09	RAN#101	RP-232494	3524		A	[NR_NTN_solutions-Core] CR on MG and scheduling restriction in NTN R18	18.3.0
2023-09	RAN#101	RP-232494	3526		A	[NR_NTN_solutions-Core] CR on NTN measurement requirements R18	18.3.0
2023-09	RAN#101	RP-232495	3528		A	[NR_pos_enh-Core] CR on requirements for PRS measurement outside MG R18	18.3.0
2023-09	RAN#101	RP-232495	3531		A	[NR_pos_enh-Perf] CR on positioning measurement reporting R18	18.3.0
2023-09	RAN#101	RP-232488	3533		A	[NR_CSIRS_L3meas-Core] Correction to requirements for CSI-RS measurement R18	18.3.0
2023-09	RAN#101	RP-232487	3537		A	CR on maintaining SS-RSRQ/SS-SINR measurement accuracy tests R18	18.3.0
2023-09	RAN#101	RP-232494	3541		A	CR on maintaining UE transmit timing tests for NTN R18	18.3.0
2023-09	RAN#101	RP-232516	3542		B	BigCR on RRM requirements for supporting intra-band non-collocated NR-CA	18.3.0
2023-09	RAN#101	RP-232497	3544		A	NR_redcap-Core Formal CR to Rel-18 TS 38.133: on RedCap maintenance in TS 38.133	18.3.0
2023-09	RAN#101	RP-232497	3546	1	A	NR_redcap-Perf Formal CR to Rel-18 TS 38.133: on RedCap Perf maintenance in TS 38.133	18.3.0
2023-09	RAN#101	RP-232500	3549		A	TEI16:CR on MRTD-MTTD and interruption requirements for non-collocated inter-band EN-DC R18	18.3.0
2023-09	RAN#101	RP-232494	3555		A	[NR_NTN_solutions-Core] CR on R17 NTN	18.3.0
2023-09	RAN#101	RP-232489	3560		A	[NR_feMIMO-Core]CR on maintenance of feMIMO RRM requirements in R18	18.3.0
2023-09	RAN#101	RP-232497	3570		A	NR_redcap-Core: CR 38.133 Corrections to Inter-RAT measurements for RedCap	18.3.0
2023-09	RAN#101	RP-232497	3572		A	NR_redcap-Perf: CR 38.133 Corrections of SDT Test Case Parameters for RedCap	18.3.0
2023-09	RAN#101	RP-232497	3574		A	NR_redcap-Perf: CR 38.133 Corrections to NR measurements with autonomous gaps for RedCap	18.3.0
2023-09	RAN#101	RP-232500	3576		A	TEI17: CR 38.133 Correction to report mapping description for NR Timing Advance	18.3.0
2023-09	RAN#101	RP-232493	3578		A	NR_MG_enh-Core: Corrections to L1 measurement impact for Rel-17 MG enhancements	18.3.0
2023-09	RAN#101	RP-232493	3580		A	NR_MG_enh-Core: Corrections to Inter frequency measurements for Rel-17 MG enhancements	18.3.0
2023-09	RAN#101	RP-232495	3582		A	NR_pos_enh-Core: CR 38.133 Correction to MG patterns for independent measurement gaps	18.3.0
2023-09	RAN#101	RP-232495	3584		A	NR_pos_enh-Core: CR 38.133 Clean-up of NR positioning requirements in RRC_INACTIVE	18.3.0
2023-09	RAN#101	RP-232490	3586		A	NR_ext_71 GHz CR 38.133 - RRM timing requirements	18.3.0
2023-09	RAN#101	RP-232496	3588		A	NR_SmallData_INACTIVE CR 38.133 Test cases	18.3.0
2023-09	RAN#101	RP-232499	3591		A	NR_unlic CR correcting NR-U infra frequency RSRP test cases	18.3.0
2023-09	RAN#101	RP-232499	3594		A	NR_unlic CR correcting NR-U RRC re-establishment RSRP test cases	18.3.0
2023-09	RAN#101	RP-232494	3597		A	[NR_NTN_Solutions] CR 38.133 (Cat. A) on Transmit Timing Requirements	18.3.0
2023-09	RAN#101	RP-232494	3598		A	[NR_NTN_Solutions] CR 38.133 (Cat. A) on Time and Location Based Measurement Initiation	18.3.0
2023-09	RAN#101	RP-232502	3602		A	[NR_newRAT-Perf] Correction in A.8.4.2.8 (Rel-18)	18.3.0
2023-09	RAN#101	RP-232497	3604		A	[NR_redcap-Perf] Correction in Redcap Radio Link Monitoring In-sync Test in DRX mode for 2 Rx (Rel-18)	18.3.0
2023-09	RAN#101	RP-232515	3609		B	Big CR to TS38.133 on enhanced NR support for FR2 HST	18.3.0
2023-09	RAN#101	RP-232503	3617		A	[NR_newRAT-Perf] Inter-frequency measurement for UE capable of independentGapConfig (Cat-A Rel-18)	18.3.0
2023-09	RAN#101	RP-232490	3621		A	[NR_ext_to_71 GHz-Perf] Inter-frequency measurement for FR2-2 UE capable of independentGapConfig (Cat-A Rel-18)	18.3.0
2023-09	RAN#101	RP-232494	3625		A	[NR_NTN_solutions-Perf] Editorial correction in NTN section of A.3.36.3 (Cat-A Rel-18)	18.3.0
2023-09	RAN#101	RP-232503	3631		A	2AoA Relative angular offset between active probes for PC1 devices (Rel-18)	18.3.0
2023-09	RAN#101	RP-232497	3633		A	[NR_redcap-Perf] CR on RedCap test-cases R18	18.3.0
2023-09	RAN#101	RP-232499	3638		A	[NR_unlic-Perf] CR to correct NR-U test cases R18	18.3.0
2023-09	RAN#101	RP-232514	3646	1	B	CR on introduction of the requirements for IDC enhancements for NR and MR-DC	18.3.0
2023-09	RAN#101	RP-232494	3649		A	CR for TS 38.133 - Correction of satellite access clause for Timing Advance adjustment	18.3.0
2023-09	RAN#101	RP-232516	3650		B	Big CR to TS 38.133 on NR ATG RRM core requirements	18.3.0
2023-09	RAN#101	RP-232515	3651		B	Big CR to TS 38.133 on RRM core requirements for NR support for dedicated spectrum less than 5 MHz for FR1	18.3.0
2023-09	RAN#101	RP-232493	3653		A	[NR_MG_enh2-Core] CR on R17 NCSG	18.3.0

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2023-09	RAN#101	RP-232493	3655		A	[NR_MG_enh2-Core] CR on R17 Concurrent MGs	18.3.0
2023-12	RAN#102	RP-233342	3663		A	CR on R16 positioning test cases	18.4.0
2023-12	RAN#102	RP-233349	3665		A	CR on R17 positioning test cases	18.4.0
2023-12	RAN#102	RP-233349	3667		A	[NR_NTN_solutions-Perf] CR to TS 38.133 annex for NTN test condition (CAT A, Rel-18)	18.4.0
2023-12	RAN#102	RP-233341	3671		A	[NR_RRM_Enh-Perf] Maintenance perf part CR on event triggered reporting tests with additional mandatory gap pattern R18	18.4.0
2023-12	RAN#102	RP-233347	3674		A	[NR_MG_enh-Core] Update on scheduling availability requirements for NCSG R18	18.4.0
2023-12	RAN#102	RP-233347	3676		A	[NR_MG_enh-Perf] Maintenance CR for MGE perf part R18	18.4.0
2023-12	RAN#102	RP-233341	3678		A	[NR_RRM_enh-Perf] CR for Spatial relation info switch test requirements - Rel18	18.4.0
2023-12	RAN#102	RP-233330	3689		A	On MRTD/MTTD requirement for inter-band non-collocated EN-DC/NE-DC (R18)	18.4.0
2023-12	RAN#102	RP-233364	3696	1	B	Big CR to TS 38.133 on R18 SCell activation enhancement	18.4.0
2023-12	RAN#102	RP-233361	3701	1	B	Big CR for RRM requirements for NR sidelink evolution	18.4.0
2023-12	RAN#102	RP-233364	3702	1	F	Big CR to TS 38.133 on Air-to-ground network for NR	18.4.0
2023-12	RAN#102	RP-233346	3704		A	[NR_HST_FR1_enh] Inter-frequency measurement for NR FR1 HST-R18mirror	18.4.0
2023-12	RAN#102	RP-233363	3705	1	B	Big CR to TS 38.133 for RRM requirements for NR FR2 multi-Rx chain DL reception	18.4.0
2023-12	RAN#102	RP-233333	3707		A	[NR_newRAT-Perf, NR_feMIMO-Perf] CR to FR1 Beam failure detection requirement	18.4.0
2023-12	RAN#102	RP-233350	3715		A	[NR_redcap-Perf] CR to CSI-RS-based RLM for 2Rx RedCap	18.4.0
2023-12	RAN#102	RP-233364	3718	1	F	CR on measurement requirement in ATG	18.4.0
2023-12	RAN#102	RP-233347	3722		A	Draft CR on ConMGs capability	18.4.0
2023-12	RAN#102	RP-233342	3725		A	CR on CSSF in NR-U	18.4.0
2023-12	RAN#102	RP-233338	3728		A	Draft CR on inter-frequency measurement without gap in CHO	18.4.0
2023-12	RAN#102	RP-233333	3732		A	[NR_newRAT-Perf] CR of correction in TC A.6.5.5.4	18.4.0
2023-12	RAN#102	RP-233346	3734		A	[NR_feMIMO-Perf] CR of correction in TC A.6.5.5.7	18.4.0
2023-12	RAN#102	RP-233340	3737		A	Correction on measurements for UE configured with relaxed measurement criterion	18.4.0
2023-12	RAN#102	RP-233362	3738	1	B	Big CR to TS 38.133 on Dual TxRx Multi-SIM for NR	18.4.0
2023-12	RAN#102	RP-233350	3740		A	[NR_redcap-Core] CR to Rel-18 TS 38.133: on NR RedCap HO	18.4.0
2023-12	RAN#102	RP-233366	3741		B	CR to TS 38.133: Introduction of 900 MHz NR Band in the US	18.4.0
2023-12	RAN#102	RP-233333	3746		A	[NR_newRAT-Perf] Correction to CORESET RMC and SS-RSRQ accuracy test cases_R18	18.4.0
2023-12	RAN#102	RP-233350	3751		A	[NR_redcap-Perf] Correction to FR1 RedCap test cases	18.4.0
2023-12	RAN#102	RP-233361	3754		F	Modification on DL interruption for Tx switching across 3/4 bands	18.4.0
2023-12	RAN#102	RP-233361	3756	1	B	Big CR on network energy saving	18.4.0
2023-12	RAN#102	RP-233344	3759		A	Correction to Fast SCell activation and PSCell activation tests	18.4.0
2023-12	RAN#102	RP-233350	3761		A	Modification on interruption in paging reception for HD-FDD RedCap UEs	18.4.0
2023-12	RAN#102	RP-233364	3762	1	B	Big CR for R18 RRM enhancement - FR1+FR1 NR-DC	18.4.0
2023-12	RAN#102	RP-233366	3765		B	CR to TS 38.133 - Introduction of band n109	18.4.0
2023-12	RAN#102	RP-233346	3767		A	CR on relative angular offsets between 2 active probes for FR2 HST PC6	18.4.0
2023-12	RAN#102	RP-233366	3770		B	CR to TS 38.133: Introduction of NR bands n31 and n72	18.4.0
2023-12	RAN#102	RP-233334	3772		A	[NR_newRAT-Perf] Draft CR on FR1-FR2 test cases for HO with PSCell	18.4.0
2023-12	RAN#102	RP-233346	3776		A	[NR_HST_FR2] CR for 38.133: Corrections in HST FR2 RRM requirements and test (Rel-18, Cat A)	18.4.0
2023-12	RAN#102	RP-233351	3779		A	[NR_UE_pow_sav_enh-Perf] CR to TS 38.133: Corrections to Enhanced Power Saving test cases (Rel 18)	18.4.0
2023-12	RAN#102	RP-233350	3781		A	[NR_redcap-Perf] CR to TS 38.133: Corrections to RedCap test cases (Rel 18)	18.4.0
2023-12	RAN#102	RP-233349	3783		A	[NR_NTN_solutions-Perf] CR to TS 38.133: Corrections to NR NTN test cases (Rel 18)	18.4.0
2023-12	RAN#102	RP-233371	3784		F	Big CR to specify RRM requirements on enhanced NR support for Rel-18 FR2 HST	18.4.0
2023-12	RAN#102	RP-233351	3789		A	[NR_UE_pow_sav_enh-Core]CR on maintaining RLM/BFD relaxation requirements R18	18.4.0
2023-12	RAN#102	RP-233346	3791		A	[NR_FeMIMO-Core]CR on maintaining L1-RSRP requirements for inter-cell BM R18	18.4.0
2023-12	RAN#102	RP-233346	3793		A	[NR_FeMIMO-Perf] Corrections to unified TCI states switching test cases R18	18.4.0

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2023-12	RAN#102	RP-233347	3796		A	[NR_MG_enh-Core] CR on Rel-17 MGE requirements R18	18.4.0
2023-12	RAN#102	RP-233347	3798		A	[NR_IIOT_URLLC_enh-Perf] CR on performance requirements for PDC measurement R18	18.4.0
2023-12	RAN#102	RP-233350	3800		A	[NR_redcap-Core] CR on INACTIVE requirements R18	18.4.0
2023-12	RAN#102	RP-233361	3803	1	B	Big CR to TS 38.133 on Enhanced support of reduced capability NR devices	18.4.0
2023-12	RAN#102	RP-233341	3806		A	Correction of measurement gap parameters for additional rel-16 mandatory gap patterns test case	18.4.0
2023-12	RAN#102	RP-233350	3808		A	DraftCR: L1-RSRP measurement for beam reporting accuracy	18.4.0
2023-12	RAN#102	RP-233350	3811		A	Correction of requirements and parameters for RedCap testing	18.4.0
2023-12	RAN#102	RP-233341	3821		A	[NR_RRM_Enh-Perf] CR on TCs for UE specific CBW change R18	18.4.0
2023-12	RAN#102	RP-233365	3822	1	B	Big CR to TS 38.133 on Completion of specification support for bandwidth part operation without restriction in NR	18.4.0
2023-12	RAN#102	RP-233334	3826		A	NR_newRAT-Perf CR clarification on MAC-CE based TCI state switch delay	18.4.0
2023-12	RAN#102	RP-233344	3832		A	LTE_NR_DC_enh2-Core CR for correting removing Tidentify_inter_without_index	18.4.0
2023-12	RAN#102	RP-233347	3833		A	CR on ConMGs	18.4.0
2023-12	RAN#102	RP-233349	3835		A	CR to 38.133 on PRS-RSRPP accuracy requirement	18.4.0
2023-12	RAN#102	RP-233349	3836	1	F	CR to 38.133 correction of PRS-RSRP measurement period requirement	18.4.0
2023-12	RAN#102	RP-233341	3844		A	[NR_RRM_enh-Core] CR on the SCell activation	18.4.0
2023-12	RAN#102	RP-233342	3853		A	[NR_unlic-Perf] HO test cases under CCA update	18.4.0
2023-12	RAN#102	RP-233350	3855		A	[NR_redcap-Perf] redCap HO test cases update	18.4.0
2023-12	RAN#102	RP-233349	3861		A	[NR_NTN_solutions -Core]: Modify the condition for NTN gradual timing adjustment.	18.4.0
2023-12	RAN#102	RP-233349	3863		A	[NR_pos_enh-Core]:Modify positioning measurements related in RRC_INACTIVE and RRC_CONNECTED state.	18.4.0
2023-12	RAN#102	RP-233351	3866		A	[NR_UE_pow_sav_enh-Core]: Modify the IE for RLM	18.4.0
2023-12	RAN#102	RP-233342	3870		A	[NR_unlic-Core]: Modify the condition for gradual timing adjustment.	18.4.0
2023-12	RAN#102	RP-233361	3878	1	B	Big CR on RRM Core Requirements for Positioning Enhancement in Rel-18	18.4.0
2023-12	RAN#102	RP-233349	3890		A	[NR_NTN_solutions-Core] CR to 38.133 on Measurement Req. For NTN	18.4.0
2023-12	RAN#102	RP-233350	3893		A	Corrections of SDT Test Case Parameters for RedCap	18.4.0
2023-12	RAN#102	RP-233341	3898		A	Corrections to NR Measurements with Autonomous Gaps	18.4.0
2023-12	RAN#102	RP-233350	3901		F	Editorial corrections to rel-17 RedCap test cases	18.4.0
2023-12	RAN#102	RP-233364	3907	1	B	Big CR to TS 38.133 on Further enhancements on NR and MR-DC measurement gaps and measurements without gaps	18.4.0
2023-12	RAN#102	RP-233350	3909	1	A	NR_redcap-Perf Formal CR to Rel-18 TS 38.133: on RedCap Perf maintenance in TS 38.133	18.4.0
2023-12	RAN#102	RP-233342	3932		A	[NR_unlic] EN-DC intra-frequency measurement test cases for NR-U – R18	18.4.0
2023-12	RAN#102	RP-233350	3934		A	[NR_redcap] RLM and BFD test cases in FR2 RedCap – R18	18.4.0
2023-12	RAN#102	RP-233350	3936		A	[NR_redcap] High priority search with eDRX in IDLE mode – R18	18.4.0
2023-12	RAN#102	RP-233350	3938		A	[NR_redcap] Correction CR for eDRX operation in IDLE mode – RedCap clauses (R18)	18.4.0
2023-12	RAN#102	RP-233350	3940		A	[NR_redcap] Correction CR for eDRX operation in IDLE mode – Non-RedCap clauses (R18)	18.4.0
2023-12	RAN#102	RP-233351	3947		A	[NR_SmallData_INACTIVE-Perf] Formal CR to Rel-18 TS 38.133 on SDT test cases (Mirror)	18.4.0
2023-12	RAN#102	RP-233366	3950	1	B	Introduction of the NTN L-/S-band to TS 38.133	18.4.0
2023-12	RAN#102	RP-233364	3951		B	Big CR to TS 38.133 on intra-band non-collocated EN-DC/NR-CA deployment	18.4.0
2023-12	RAN#102	RP-233971	3952	1	B	Big CR to TS 38.133 on Further NR mobility enhancements	18.4.0
2023-12	RAN#102	RP-233361	3953		B	Big CR to TS 38.133 on NR MIMO evolution for downlink and uplink	18.4.0
2024-03	RAN#103	RP-240571	3967		A	(NR_pos-Perf) CR on positioning test cases in R18 - Cat A	18.5.0
2024-03	RAN#103	RP-240571	3969		A	(NR_pos_enh-Perf) CR on R17 positioning test cases in connected mode - Cat A	18.5.0
2024-03	RAN#103	RP-240561	3972		F	[NR_MG_enh-Core] CR 38.133 Correction of normative text in requirements	18.5.0
2024-03	RAN#103	RP-240552	3975		A	[TEI17] CR 38.133 Correction of normative text in requirements	18.5.0
2024-03	RAN#103	RP-240566	3983		A	(NR_newRAT-Perf) CR to A.6.3.2.1.3 Intra-freq RRC re-establishment	18.5.0

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2024-03	RAN#103	RP-240569	3985		A	(NR_newRAT-Perf, NR_UE_pow_sav_enh-Perf, NR_redcap-Perf) CR to EPRE ratio of PDCCH and PDCCH DMRS for RLM tests	18.5.0
2024-03	RAN#103	RP-240569	3989		A	(NR_newRAT-Perf,NR_redcap-Perf) CR to FR1 SA intra-frequency SS-RSRQ measurement accuracy	18.5.0
2024-03	RAN#103	RP-240566	3993		A	(NR_newRAT-Perf) CR to CORESET and PDSCH RMCs of A.5.6.1.3, A.5.3.1.4 SSB SCS 240 kHz config	18.5.0
2024-03	RAN#103	RP-240573	3995		A	(NR_redcap-Perf) CR to A.16.4.1.2 UE transmit timing test and A.16.5.2.2 BFD and LR for RedCap	18.5.0
2024-03	RAN#103	RP-240561	4001		A	(NR_MG_enh-Core) CR on Rel-17 MGE requirements – R18	18.5.0
2024-03	RAN#103	RP-240555	4003		A	(LTE_NR_DC_enh2) CR for missing test case of E-UTRAN – NR FR2 interruptions during measurements on deactivated NR PSCell - R18	18.5.0
2024-03	RAN#103	RP-240555	4005	1	A	(LTE_NR_DC_enh2) Maintenance CR for test caes - A.4.5.2.10 - R18	18.5.0
2024-03	RAN#103	RP-240559	4008	1	F	CR on combination of HST and RRM relaxation - R18	18.5.0
2024-03	RAN#103	RP-240607	4009	1	B	Interruption test case for intra-band non-collcoated NR CA	18.5.0
2024-03	RAN#103	RP-240559	4015		F	(NR_feMIMO-Core) CR for active state list switching delay requirements for UTCI state -R18	18.5.0
2024-03	RAN#103	RP-240562	4021		A	(NR_newRAT) CR on NR-E-UTRAN HO requirement maintenance R18	18.5.0
2024-03	RAN#103	RP-240575	4024		A	(NR_unlic-Core)CR on max function for cell detection in NR-U R18	18.5.0
2024-03	RAN#103	RP-240570	4028	1	A	(NR_NTN_solutions-Core) CR on RSRP/RSRQ/SINR Requirements for NR-NTN-Rel18	18.5.0
2024-03	RAN#103	RP-240589	4039		F	CR to TS 38.133 on RRM core requirements for enhanced NR sidelink relay	18.5.0
2024-03	RAN#103	RP-240573	4041		A	(NR_redcap-Perf) CR to TS 38.133: Corrections to RedCap RRM test cases (Rel 18)	18.5.0
2024-03	RAN#103	RP-240571	4043		A	(NR_NTN_solutions-Perf) CR to TS 38.133: Corrections to NR NTN test cases (Rel 18)	18.5.0
2024-03	RAN#103	RP-240567	4052		A	(NR_newRAT-Perf) 38.133 CR on corrections for SMTC configuration – R18	18.5.0
2024-03	RAN#103	RP-240592	4056		B	(NR_ATG-Perf) BigCR to TS 38.133 Correction of core requirements for NR ATG	18.5.0
2024-03	RAN#103	RP-240575	4089		A	(NR_RRM_Enh-Perf) Maintenance perf part CR on event triggered reporting tests with additional mandatory gap pattern (Rel-18)	18.5.0
2024-03	RAN#103	RP-240575	4098		A	(NR_RRM_Enh-Perf) Correction to CGI measurement test cases_R18	18.5.0
2024-03	RAN#103	RP-240572	4102		A	(NR_redcap-Core) Correction to RedCap core requirements_R18	18.5.0
2024-03	RAN#103	RP-240573	4104		A	(NR_redcap-Perf) Correction to RedCap measurement test cases_R18	18.5.0
2024-03	RAN#103	RP-240573	4106		A	(NR_redcap-Perf) Correction to RedCap inactive and connected state test cases_R18	18.5.0
2024-03	RAN#103	RP-240575	4109		F	(NR_RRM_enh2-Perf) CR on location of SCell activation test cases R18 (Cat F)	18.5.0
2024-03	RAN#103	RP-240603	4110		F	Big CR on requirements maintenance for R18 NES	18.5.0
2024-03	RAN#103	RP-240603	4111		F	Modification on DL interruption for Tx switching across 3/4 bands	18.5.0
2024-03	RAN#103	RP-240572	4113		A	(NR_redcap-Core) Correction on relaxation measurement requirements for RedCap inactive UE with idle eDRX>10.24 s	18.5.0
2024-03	RAN#103	RP-240567	4117		A	(NR_newRAT-Perf) Corrections to TCI states switching test cases R18	18.5.0
2024-03	RAN#103	RP-240568	4121		A	(NR_newRAT-Perf) Correcting propagation condition of test cases not configuring Noc Rel-18	18.5.0
2024-03	RAN#103	RP-240591	4122		B	CR on introducing antenna connections for 8Rx capable UEs	18.5.0
2024-03	RAN#103	RP-240559	4127		A	(NR_HST_FR1_enh-Core) Maintenance CR on IDLE mode HST UE mobility R18	18.5.0
2024-03	RAN#103	RP-240563	4132		A	(NR_newRAT-Core) CR to correct PSCell addition delay requirements	18.5.0
2024-03	RAN#103	RP-240555	4135		A	(LTE_NR_DC_CA_enh-Core) CR to correct Inactive mode CA/DC measurement requirements	18.5.0
2024-03	RAN#103	RP-240575	4137		A	(NR_RRM_enh2-Core) CR to correct HO with PSCell delay requirements	18.5.0
2024-03	RAN#103	RP-240563	4141		A	(NR_newRAT-Core) CR to correct and clarify Rel-15 TCI state switching delay requirements	18.5.0
2024-03	RAN#103	RP-240575	4146		A	(NR_RRM_enh-Perf) corrections for FR2 inter-band SCell activation TC – R18	18.5.0
2024-03	RAN#103	RP-240561	4148		A	[NR_MG_enh-Perf] Maintenance CR for MGE perf part R18	18.5.0

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2024-03	RAN#103	RP-240569	4150		A	(NR_NTN_solutions-Core) CR on condtional handover delay for NTN	18.5.0
2024-03	RAN#103	RP-240603	4153		F	Big CR for RRM requirements for NR sidelink evolution maintenance	18.5.0
2024-03	RAN#103	RP-240606	4154		F	Big CR to TS 38.133 for RRM requirements for NR FR2 multi-Rx chain DL reception	18.5.0
2024-03	RAN#103	RP-240572	4156		A	(NR_redcap-Core) CR on handover requirements for RedCap	18.5.0
2024-03	RAN#103	RP-240606	4162		A	[NR_HST_FR2_enh-Core] CR on the scheduling restriction of R17 FR2 HST	18.5.0
2024-03	RAN#103	RP-240561	4163		A	[NR_MG_enh-Core] CR on the scheduling restriction of R17 NCSG	18.5.0
2024-03	RAN#103	RP-240575	4165		A	[NR_RRM_enh2-Perf] CR on Test case of PUCCH SCell and fast SCell activation of R17 enhancement	18.5.0
2024-03	RAN#103	RP-240555	4175		A	(LTE_NR_DC_enh2-Core) CR corrections for SCG Activation and Deactivation Delay	18.5.0
2024-03	RAN#103	RP-240572	4182		A	Corrections in RRC_INACTIVE for RedCap	18.5.0
2024-03	RAN#103	RP-240568	4193		A	(NR_newRAT-Perf)CR on test cases for SCell activation delay reduction in R18	18.5.0
2024-03	RAN#103	RP-240573	4197		A	(NR_redcap-Perf) Correction of requirements and parameters for RedCap testing	18.5.0
2024-03	RAN#103	RP-240559	4210		A	(NR_FeMIMO) CR correcting unified TCI state switching requirements	18.5.0
2024-03	RAN#103	RP-240559	4212		A	(NR_ext_to_71 GHz) CR corrections RRM core requirements	18.5.0
2024-03	RAN#103	RP-240564	4220		A	(NR_newRAT-Core) CR on MG related requirements R18	18.5.0
2024-03	RAN#103	RP-240575	4223		A	(NR_RRM_enh-Core) CR on multiple SCell activation requirements R18	18.5.0
2024-03	RAN#103	RP-240570	4225		A	(NR_NTN_solutions-Core) CR on Rel-17 NTN RRM requirements R18	18.5.0
2024-03	RAN#103	RP-240603	4236		F	Big CR to TS 38.133 on NR MIMO evolution for downlink and uplink	18.5.0
2024-03	RAN#103	RP-240606	4237		F	bigCR to TS 38.133 on Enhanced HST FR2 Core Requirements Maintenance	18.5.0
2024-03	RAN#103	RP-240552	4242		A	CR to 38.133 CatA R18 on PC1,5,6 RRM Parameters for RAN5	18.5.0
2024-03	RAN#103	RP-240607	4243		F	Big CR to TS 38.133 on R18 SCell activation enhancement maintenance	18.5.0
2024-03	RAN#103	RP-240606	4244		F	BigCR for 38.133 on RRM core requirements for NR support for dedicated spectrum less than 5 MHz for FR1	18.5.0
2024-03	RAN#103	RP-240571	4246		A	(NR_pos_enh-Perf) CR to 38.133 Corrections to PRS-RSRPP accuracy requirement	18.5.0
2024-03	RAN#103	RP-240570	4248		A	(NTN_Solutions) CR on 38.133 for applicability of time-based measurement initiation in Idle Mode (Rel. 18)	18.5.0
2024-03	RAN#103	RP-240571	4255		A	(NR_pos_enh-Perf) CR on R17 positioning test cases in inactive mode- Cat A	18.5.0
2024-03	RAN#103	RP-240571	4257		A	(NR_pos_enh-Core) CR on positioning core requirements in RRC_INACTIVE state in R18 - Cat A	18.5.0
2024-03	RAN#103	RP-240568	4261		A	(NR_newRAT-Perf) Inter-frequency measurement for UE capable of independentGapConfig (Cat-A Rel-18)	18.5.0
2024-03	RAN#103	RP-240607	4263		F	Big CR to TS 38.133 on Further enhancements on NR and MR-DC measurement gaps and measurements without gaps	18.5.0
2024-03	RAN#103	RP-240573	4265		A	(NR_redcap-Perf) Formal CR to Rel-18 TS 38.133: on RedCap Perf maintenance in TS 38.133	18.5.0
2024-03	RAN#103	RP-240575	4267		A	(NR_SmallData_INACTIVE-Perf) Formal CR to Rel-18 TS 38.133 on SDT test cases (Mirror)	18.5.0
2024-03	RAN#103	RP-240576	4269		A	(NR_unlic-Perf) UL CCA model (R18)	18.5.0
2024-03	RAN#103	RP-240576	4272		A	(NR_unlic-Perf) CR for NR-U TC correction (R18)	18.5.0
2024-03	RAN#103	RP-240573	4276		A	(NR_redcap-Perf) Correction CR for RRC re-establishment TCs for RedCap (R18)	18.5.0
2024-03	RAN#103	RP-240608	4280		F	Big CR to TS 38.133 on core maintenance for Completion of specification support for BWP without restriction in NR	18.5.0
2024-03	RAN#103	RP-240607	4281		F	Big CR for core maintenance on intra-band non-collocated EN-DC/NR-CA deployment	18.5.0
2024-03	RAN#103	RP-240588	4282		F	Big CR on RRM Core Maintenance for Positioning Enhancement	18.5.0
2024-03	RAN#103	RP-240587	4283		B	Big CR on RRM performance requirements for NR Multi-carrier enhancements	18.5.0
2024-03	RAN#103	RP-240589	4284		F	Big CR on Core maintenance for Further NR mobility enhancements	18.5.0
2024-03	RAN#103	RP-240604	4285		F	Big CR on Core maintenance for NR Dual TxRx Multi-SIM	18.5.0
2024-03	RAN#103	RP-240603	4287		F	Big CR on Core maintenance for Enhanced support of reduced capability NR devices	18.5.0

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2024-03	RAN#103	RP-240607	4289		F	BigCR to TS 38.133 Correction of core requirements for NR ATG	18.5.0
2024-06	RAN#104	RP-241401	4318		A	(NR_redcap-Perf) CR to A.16.6.2.9 and A.16.6.2.10 SMTC settings	18.6.0
2024-06	RAN#104	RP-241399	4320		A	(NR_MG_enh-Perf) Correction to A.7.6.15.3 Event triggered reporting test for FR2 concurrent gap	18.6.0
2024-06	RAN#104	RP-241399	4322		A	(NR_MG_enh-Perf) Correction to A.7.6.16.2 Event triggered reporting test with NCSG for FR2	18.6.0
2024-06	RAN#104	RP-241384	4326		A	CR on test for scheduling availability during BFD/CBD in FR2	18.6.0
2024-06	RAN#104	RP-241384	4330		A	(NR_newRAT-Perf) CR on test for SCell activation	18.6.0
2024-06	RAN#104	RP-241488	4336	1	F	Big CR to TS 38.133 on core requirement maintenance for Completion of specification support for BWP without restriction in NR	18.6.0
2024-06	RAN#104	RP-241442	4337	1	B	Big CR to TS 38.133 on performance requirements for Completion of specification support for BWP without restriction in NR	18.6.0
2024-06	RAN#104	RP-241481	4343	1	F	Big CR to TS 38.133 on core requirement maintenance for Even Further RRM enhancemen for NR and MR-DC	18.6.0
2024-06	RAN#104	RP-241437	4344	1	B	Big CR to TS 38.133 on performance requirements for Even Further RRM enhancement for NR and MR-DC	18.6.0
2024-06	RAN#104	RP-241465	4345		F	Addition of the FR1 DPC reporting mapping table.	18.6.0
2024-06	RAN#104	RP-241428	4346		B	Big CR to TS38.133 on Sidelink relay enhancement RRM performance	18.6.0
2024-06	RAN#104	RP-241397	4348	1	A	(NR_HST_FR1_enh) Deactivated Scell measurement for NR FR1 HST R18 mirror	18.6.0
2024-06	RAN#104	RP-241385	4352	1	A	(NR_newRAT-Perf) R15 SUL test setup correction R18 mirror	18.6.0
2024-06	RAN#104	RP-241384	4359		A	(NR_newRAT_Perf) CR for test case of intra-frequency handover from FR2 to FR2 R18	18.6.0
2024-06	RAN#104	RP-241404	4362		A	(NR_unlic-Perf) CR to TS 38.133: Corrections to NR-U test cases (Rel 18)	18.6.0
2024-06	RAN#104	RP-241401	4368		A	[NR_redcap-Perf] Correction to Cell specific test parameters for E-UTRAN inter-RAT NR handover affecting to A.18.2.1.1 (Rel-18)	18.6.0
2024-06	RAN#104	RP-241384	4372		A	(NR_newRAT-Perf) Inter-RAT measurement for UE capable of independentGapConfig (Cat-A Rel-18)	18.6.0
2024-06	RAN#104	RP-241404	4379		A	(NR_unlic-Perf) CR for NR-U TC correction (R18)	18.6.0
2024-06	RAN#104	RP-241404	4382		A	(NR_unlic-Perf) Removal of Interruption during SCell operations and RSSI and CO Measurement reporting TCs for NR-U (R18)	18.6.0
2024-06	RAN#104	RP-241404	4385		A	(NR_unlic-Perf) OCNG modeling for NR-U (R18)	18.6.0
2024-06	RAN#104	RP-241401	4387		A	(NR_redcap-Perf) Correction CR for RRC re-establishment TCs for RedCap (R18)	18.6.0
2024-06	RAN#104	RP-241401	4389		A	(NR_redcap-Perf) Correction CR for inter-RAT measurement TCs for RedCap clause A.18.3.1(R18)	18.6.0
2024-06	RAN#104	RP-241420	4393		B	Big CR on performance part of NR_MIMO_evo_DL_UL	18.6.0
2024-06	RAN#104	RP-241399	4395		A	(NR_MG_enh-Perf) Maintenance CR for MGE perf part R18	18.6.0
2024-06	RAN#104	RP-241388	4404		A	(TEI17) 38.133 CR addressing pervious conditions	18.6.0
2024-06	RAN#104	RP-241473	4406		F	(NR_Mob_enh2-Core) 38.133 CR addressing pervious conditions	18.6.0
2024-06	RAN#104	RP-241388	4408		A	(TEI17) 38.133 CR addressing the use of expected to in normative text	18.6.0
2024-06	RAN#104	RP-241396	4415		A	(NR_ext_to_71 GHz-Core) 38.133 CR addressing duplication of clause number	18.6.0
2024-06	RAN#104	RP-241399	4420		A	CR on Rel-17 NCSG requirements (Rel-18 spec)	18.6.0
2024-06	RAN#104	RP-241483	4421	1	F	Big CR to TS 38.133 Correction of core requirements for NR ATG	18.6.0
2024-06	RAN#104	RP-241483	4422	1	F	Big CR to TS 38.133 Correction of performance requirements for NR ATG	18.6.0
2024-06	RAN#104	RP-241421	4423	1	B	Big CR for RRM performance requirements for NR sidelink evolution	18.6.0
2024-06	RAN#104	RP-241403	4433		A	[NR_UE_pow_sav-Core] Corrections and clarifications	18.6.0
2024-06	RAN#104	RP-241404	4436		A	[NR_unlic-Perf] Correction for NR-U test case	18.6.0
2024-06	RAN#104	RP-241400	4438		A	[NR_Redcap-Core] Corrections and clarifications	18.6.0
2024-06	RAN#104	RP-241477	4446	1	F	BigCR for NR_FR1_lessthan_5 MHz_BW	18.6.0
2024-06	RAN#104	RP-241397	4449		F	CR on combination of HST and RRM relaxation	18.6.0
2024-06	RAN#104	RP-241403	4452		A	CR on applicability conditions for SDT	18.6.0
2024-06	RAN#104	RP-241386	4459		A	[NR_NTN_solutions-Core] CR for the TCI state indication of R17 NTN	18.6.0
2024-06	RAN#104	RP-241400	4460		A	[NR_redcap-Core] CR for the TCI state indication of R17 RedCap	18.6.0
2024-06	RAN#104	RP-241392	4461		A	[NR_RRM_enh2-Perf] CR on R17 test cases of unknown PUCCH SCell and fast SCell activation in FR1	18.6.0

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2024-06	RAN#104	RP-241385	4464		A	[NR_newRAT-Perf] CR for R15 test case of L1-RSRP measurement	18.6.0
2024-06	RAN#104	RP-241435	4465		B	Big CR to TS 38.133 on performance requirements for NR FR2 multi-Rx chain DL reception	18.6.0
2024-06	RAN#104	RP-241400	4468	1	A	(NR_redcap-Core) CR on handover requirements for RedCap	18.6.0
2024-06	RAN#104	RP-241402	4485		A	(NR_RF_FR1-Perf) Correction to Rel-16 Tx switching RRM test cases_R18	18.6.0
2024-06	RAN#104	RP-241402	4487		A	(NR_RF_FR1_enh-Perf) Correction to Rel-17 Tx switching RRM test cases_R18	18.6.0
2024-06	RAN#104	RP-241401	4491		A	(NR_redcap-Perf) Correction to RedCap RRM test cases_R18	18.6.0
2024-06	RAN#104	RP-241418	4492		F	(NR_MC_enh-Perf) Correction to multi-carrier enhancement RRM test cases_R18	18.6.0
2024-06	RAN#104	RP-241392	4500		A	CR Correcting propagation condition Rel-17 (Cat F)	18.6.0
2024-06	RAN#104	RP-241400	4517		F	(NR_redcap-Core) Correction to RedCap relaxed measurement requirements_R18	18.6.0
2024-06	RAN#104	RP-241397	4522	1	F	CR to 38.133 on HST FR2 Enhanced RRM Core Maintenance	18.6.0
2024-06	RAN#104	RP-241388	4526		A	CR to 38.133 Rel-18 CatA on Missing PC1 Test Parameters for RAN5	18.6.0
2024-06	RAN#104	RP-241388	4528		A	CR to 38.133 Rel-18 CatA on PC5,6 RRM Test Configuration Parameters for RAN5	18.6.0
2024-06	RAN#104	RP-241383	4532	1	F	(NR_newRAT-Core) CR for Rel-15 TCI state switching requirements - Rel-18	18.6.0
2024-06	RAN#104	RP-241387	4540		A	(NR_NTN_solutions-Perf) CR on modification on the filed name with LEO in NTN related features in Rel-18 perf requirements	18.6.0
2024-06	RAN#104	RP-241436	4541	1	B	Big CR to TS 38.133 on Rel-18 HST FR2 RRM performance requirements	18.6.0
2024-06	RAN#104	RP-241400	4544		A	(NR_redcap-Core)Correction on measurement requirements for RedCap UE	18.6.0
2024-06	RAN#104	RP-241403	4550		A	(NR_SmallData_INACTIVE) CR correcting SDT test cases	18.6.0
2024-06	RAN#104	RP-241401	4552	1	A	(NR_redcap-Perf) CR correcting SDT test cases for RedCap	18.6.0
2024-06	RAN#104	RP-241400	4555		A	(NR_redcap-Core) eDRX requirements for CG-SDT for non-RedCap UE	18.6.0
2024-06	RAN#104	RP-241403	4558		A	Correction of parameters for FR2 SA event triggered without gap tests	18.6.0
2024-06	RAN#104	RP-241399	4561		A	(NR_pos-Core) CR on measurement requirements for R16 positioning R18	18.6.0
2024-06	RAN#104	RP-241399	4563		A	(NR_MG_enh-Core) CR on Rel-17 MGE core requirements R18	18.6.0
2024-06	RAN#104	RP-241386	4565		A	(NR_NTN_solutions-Core) CR on Rel-17 NTN RRM requirements R18	18.6.0
2024-06	RAN#104	RP-241473	4566	1	F	Big CR to TS 38.133 on core requirement maintenance for Further NR mobility enhancements	18.6.0
2024-06	RAN#104	RP-241426	4567	1	B	Big CR to TS 38.133 on performance requirements for Further NR mobility enhancements	18.6.0
2024-06	RAN#104	RP-241397	4569		A	(NR_HST_FR1_enh-Perf) CR on Test cases for NR FR1 HST R18	18.6.0
2024-06	RAN#104	RP-241396	4584		F	[NR_ext_to_71 GHz-Core] Removal of square brackets	18.6.0
2024-06	RAN#104	RP-241386	4589		A	(NR_NTN_solutions –Core) Modify the S criteria for NTN measurements of intra-frequency NR cell in RRC IDLEINACTIVE state	18.6.0
2024-06	RAN#104	RP-241480	4593	1	F	Big CR to TS 38.133 on core requirement maintenance for NR FR2 multi-Rx chain DL reception	18.6.0
2024-06	RAN#104	RP-241401	4595		A	(NR_redcap-Perf) Formal CR to Rel-18 TS 38.133 on RedCap SDT test cases (Mirror)	18.6.0
2024-06	RAN#104	RP-241438	4597	1	B	Big CR to TS 38.133 on performance requirements for R18 NR and MR-DC measurement gaps and measurements without gaps	18.6.0
2024-06	RAN#104	RP-241400	4599		A	(NR_redcap-Core) Formal CR to Rel-18 TS 38.133: on RedCap Handover	18.6.0
2024-06	RAN#104	RP-241400	4601		A	(NR_redcap-Core) Formal CR to Rel-18 TS 38.133: on eDRX non-RedCap for INACTIVE mode	18.6.0
2024-06	RAN#104	RP-241401	4603		A	(NR_redcap-Perf) Formal CR to Rel-18 TS 38.133: on RedCap Perf maintenance	18.6.0
2024-06	RAN#104	RP-241466	4604	1	F	Big CR on core maintenance of NR_MIMO_evo_DL_UL	18.6.0
2024-06	RAN#104	RP-241482	4607	1	F	Big CR to TS 38.133 on core requirement maintenance for R18 NR and MR-DC measurement gaps and measurements without gaps	18.6.0
2024-06	RAN#104	RP-241472	4612		F	Big CR on Core maintenance for NR Dual TxRx Multi-SIM	18.6.0

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2024-06	RAN#104	RP-241472	4613		B	Big CR on performance requirements for NR Dual TxRx Multi-SIM	18.6.0
2024-06	RAN#104	RP-241471	4614		F	Big CR to 38.133 on RRM core requirements for Positioning Enhancements	18.6.0
2024-06	RAN#104	RP-241432	4615		B	BigCr Introducing agreed test cases and common parameters for NR_FR1_lessthan_5 MHz_BW	18.6.0
2024-06	RAN#104	RP-241470	4616		F	Big CR to TS 38.133 on core requirement maintenance for NR Network energy saving	18.6.0
2024-06	RAN#104	RP-241424	4617		B	Big CR to TS 38.133 on performance requirements for NR Network energy saving	18.6.0
2024-06	RAN#104	RP-241469	4618		F	Big CR on Core maintenance for Enhanced support of reduced capability NR devices	18.6.0
2024-06	RAN#104	RP-241429	4619		F	Big CR to TS 38.133 on RRM core requirements for NR NTN enhancement	18.6.0
2024-06	RAN#104	RP-241429	4620		B	Big CR to TS 38.133 on RRM performance requirements for NR NTN enhancement	18.6.0
2024-06	RAN#104	RP-241385	4623		A	(NR_newRAT-Perf) Correction to intra-frequency re-establishment test case_R18	18.6.0
2024-06	RAN#104	RP-241387	4624		A	(NR_NTN_solutions-Perf) CR on 14.2.1.6 (Cat-A Rel-18)	18.6.0
2024-09	RAN#105	RP-242175	4628		A	(NR_newRAT-Perf) CR to A.6.7.1.2.2 config 3 duplex mode	18.7.0
2024-09	RAN#105	RP-242185	4630		A	(NR_redcap-Perf) CR to A.16.7.1.3 and A.16.7.1.4 for typo correction	18.7.0
2024-09	RAN#105	RP-242185	4632		A	(NR_redcap-Perf) CR to 1x1 antenna configuration in FR1	18.7.0
2024-09	RAN#105	RP-242185	4633		F	(NR_redcap-Perf) CR to A.16.6.2.9 Table A.16.6.2.9.1-2 T2	18.7.0
2024-09	RAN#105	RP-242184	4635	1	A	(NR_redcap-Core) CR to 38.133 on eDRX requirements in IDLE mode for RedCap UE	18.7.0
2024-09	RAN#105	RP-242156	4636		F	(NR_ATG-Perf) CR on test case for R18 ATG performance	18.7.0
2024-09	RAN#105	RP-242170	4638	1	F	CR to TS 38.133 on performance requirements for further NR mobility enhancements	18.7.0
2024-09	RAN#105	RP-242184	4639	1	F	CR to 38.133 on eDRX requirements in INACTIVE mode for eRedCap UE	18.7.0
2024-09	RAN#105	RP-242152	4642		A	(LTE_NR_DC_CA_enh-Core) CR on IDLE mode CA/DC measurements	18.7.0
2024-09	RAN#105	RP-242170	4645		A	(NR_Mob_enh-Core) CR on abbreviation of DAPS	18.7.0
2024-09	RAN#105	RP-242168	4647		A	(NR_MG_enh-Core) CR on Rel-17 gap enhancements	18.7.0
2024-09	RAN#105	RP-242182	4649		A	(NR_NTN_solutions-Perf) CR on Rel-17 NTN core and accuracy requirements	18.7.0
2024-09	RAN#105	RP-242183	4651		A	(NR_pos_enh-Perf) CR on R17 positioning test cases in RRC_INACTIVE state	18.7.0
2024-09	RAN#105	RP-242168	4652	1	F	CR on Rel-18 gap enhancements	18.7.0
2024-09	RAN#105	RP-242178	4653	1	F	CR on Rel-18 NR NTN core requirements	18.7.0
2024-09	RAN#105	RP-242169	4656	1	F	CR for eUTCI state switching requirements	18.7.0
2024-09	RAN#105	RP-242169	4657		F	CR for correcting sDCI mTRP based test cases	18.7.0
2024-09	RAN#105	RP-242165	4662	1	F	CR on multi-RX core performance maintenance	18.7.0
2024-09	RAN#105	RP-242160	4666		A	CR on RSRP Measurement Report Mapping - R18	18.7.0
2024-09	RAN#105	RP-242168	4668		A	CR for minimum requirement at transitions - R18	18.7.0
2024-09	RAN#105	RP-242168	4669		F	CR for R18 gap core requirements maintenance	18.7.0
2024-09	RAN#105	RP-242157	4670	2	F	CR for BWP wor maintenance	18.7.0
2024-09	RAN#105	RP-242170	4673		F	CR for testability for eEMR FR1-FR2 test cases	18.7.0
2024-09	RAN#105	RP-242163	4674		F	(NR_FR1_lessthan_5 MHz_BW-Perf) test case of FR1 intra-frequency handover for less than 5 MHz	18.7.0
2024-09	RAN#105	RP-242181	4676		A	(NR_NTN_solutions-Core) CR on update field name of NTN features for NGSO	18.7.0
2024-09	RAN#105	RP-242166	4677		F	CR on clean up TC for TRP specific BFD for multi-Rx	18.7.0
2024-09	RAN#105	RP-242162	4684		A	CR 38.133 Addressing incomplete Rel-17 requirements in section 8	18.7.0
2024-09	RAN#105	RP-242168	4686		A	(NR_MG_enh-Core) CR on Rel-17 NCSG pattern (Rel-18 spec)	18.7.0
2024-09	RAN#105	RP-242189	4688		A	(NR_UE_pow_sav_enh-Core) Clarification to RLM/BFD relaxation with short DRX R18 Cat.A	18.7.0
2024-09	RAN#105	RP-242187	4689	2	F	38.133 CR on multilple SCell activation with L3 reporting	18.7.0
2024-09	RAN#105	RP-242187	4690		F	CR on FR2 unknown SCell activation with FG31-1 in FR1+FR2 and FR2+FR2 scenarios	18.7.0
2024-09	RAN#105	RP-242155	4692	1	F	Correction CR on NES based CHO HO delay TCs	18.7.0
2024-09	RAN#105	RP-242175	4696		A	(NR_newRAT-Perf) CR to TS 38.133: Corrections to RRM FR2 test cases (Rel 18)	18.7.0
2024-09	RAN#105	RP-242175	4700		A	(NR_newRAT-Perf) CR to TS 38.133: Corrections to RRM FR2 conditions for PC1 (Rel 18)	18.7.0
2024-09	RAN#105	RP-242182	4702	1	A	CR on maintenance of RRM performance requirements in NR_NTN_solutions WI_R18	18.7.0

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2024-09	RAN#105	RP-242170	4705	1	F	(NR_Mob_enh2-Perf) CR on performance maintenance for R18 mobility	18.7.0
2024-09	RAN#105	RP-242181	4708		A	(NR_NTN_solutions-Core) CR to TS 38.133 specification corrections for NR NTN	18.7.0
2024-09	RAN#105	RP-242181	4710		A	(NR_NTN_solutions-Core) CR to TS 38.133 measurement procedure related corrections for NR NTN	18.7.0
2024-09	RAN#105	RP-242182	4712		A	(NR_NTN_solutions-Perf) CR to TS 38.133 measurement accuracy related corrections for NR NTN	18.7.0
2024-09	RAN#105	RP-242184	4714		A	(NR_redcap-Core) CR to TS 38.133 specification corrections for NR Redcap	18.7.0
2024-09	RAN#105	RP-242156	4715		F	(NR_ATG-Core) CR to TS 38.133 corrections of measurement requirement for ATG	18.7.0
2024-09	RAN#105	RP-242178	4716	1	F	(NR_NTN_enh-Core) CR to TS 38.133 specification corrections of for NR NTN enh	18.7.0
2024-09	RAN#105	RP-242168	4718		A	(NR_MG_enh-Perf) Maintenance CR for MGE perf part	18.7.0
2024-09	RAN#105	RP-242165	4719		F	Remove CBD RRM requirement for scheduling and measurement restriction relaxation	18.7.0
2024-09	RAN#105	RP-242166	4720		F	Applicability for the test case of L1-RSRP group-based beam reporting	18.7.0
2024-09	RAN#105	RP-242173	4724		A	(NR_newRAT) NR-E-UTRAN HO requirement maintenance	18.7.0
2024-09	RAN#105	RP-242184	4726		A	(NR_Redcap-Core) CR correcting and clarifying the handover interruption time requirements	18.7.0
2024-09	RAN#105	RP-242157	4732	1	F	CR clarifying and correcting the handover interruption time requirements	18.7.0
2024-09	RAN#105	RP-242165	4734	1	F	CR on BFD and CBD for multi-RX operation	18.7.0
2024-09	RAN#105	RP-242168	4735	1	F	CR on concurrent gap with Pre-MG and network-controlled activation/deactivation (A.6.6.22.2)	18.7.0
2024-09	RAN#105	RP-242170	4736	2	F	CR on fast CA/DC	18.7.0
2024-09	RAN#105	RP-242170	4737	1	F	CR on L1-RSRP measurement for LTM	18.7.0
2024-09	RAN#105	RP-242163	4739		A	(NR_feMIMO-Perf)Correction of test configurations for Rel-17 FeMIMO	18.7.0
2024-09	RAN#105	RP-242167	4740	1	F	(NR_HST_FR2) CR to 38.133 on HST FR2 RRM Performance Corrections	18.7.0
2024-09	RAN#105	RP-242167	4742		A	(NR_HST_FR2) CR to 38.133 with corrections and missing RRM parameters	18.7.0
2024-09	RAN#105	RP-242168	4743	1	F	CR correction of interruption requirements for needForInterruptions-R18	18.7.0
2024-09	RAN#105	RP-242168	4744	2	F	CR correction of requirements for measurements without gaps with interruptions	18.7.0
2024-09	RAN#105	RP-242169	4746		F	CR corrections of RRM performance requirements for NR MIMO Evo FR2 UE transmit timing	18.7.0
2024-09	RAN#105	RP-242169	4747		F	CR corrections of RRM performance requirements for NR MIMO Evo sDCI mTRP FR2 separate UL TCI state switching	18.7.0
2024-09	RAN#105	RP-242186	4750		A	(NR_RRM_enh2-Core) Correction CR to multiple SCell activation with PUCCH SCell Cat.A	18.7.0
2024-09	RAN#105	RP-242155	4751		F	Correction CR to intra-band non-collocated NRCA	18.7.0
2024-09	RAN#105	RP-242175	4755		A	(NR_newRAT-Perf) Correction to FR1 BFR test cases_R18	18.7.0
2024-09	RAN#105	RP-242175	4759		A	(NR_newRAT-Perf) Correction to PRACH RMCs_R18	18.7.0
2024-09	RAN#105	RP-242186	4762		A	(NR_RF_FR1-Perf) Correction to Rel-16 UL Tx switching test cases_R18	18.7.0
2024-09	RAN#105	RP-242160	4765		A	(NR_CSIRS_L3meas-Perf) Correction to CSI-RS L3 measurement test cases_R18	18.7.0
2024-09	RAN#105	RP-242186	4767		A	(NR_RF_FR1_enh-Perf) Correction to Rel-17 UL Tx switching test cases_R18	18.7.0
2024-09	RAN#105	RP-242185	4769		A	(NR_redcap-Perf) Correction to FR1 RedCap BFR test cases_R18	18.7.0
2024-09	RAN#105	RP-242185	4771		A	(NR_redcap-Perf) Correction to FR2 RedCap RLM test cases_R18	18.7.0
2024-09	RAN#105	RP-242167	4772	1	F	(NR_MC_enh-Perf) Correction to Rel-18 UL Tx switching test cases_R18	18.7.0
2024-09	RAN#105	RP-242186	4774		A	(NR_RRM_enh2-Core) CR on PUCCH SCell activation with multiple SCells R18 (Cat A)	18.7.0
2024-09	RAN#105	RP-242187	4776		A	(NR_RRM_enh2-Perf) CR on TC maintenance for PUCCH Scell activation R18 (Cat A)	18.7.0
2024-09	RAN#105	RP-242176	4781		A	(NR_newRAT-Perf) CR on TC for BWP switching R18 (Cat A)	18.7.0
2024-09	RAN#105	RP-242165	4782		F	CR on TCI state switching requirements maintenance for R18 FR2 multi-RX	18.7.0
2024-09	RAN#105	RP-242165	4783	1	F	CR on measurement restriction requirements maintenance for R18 FR2 multi-RX	18.7.0
2024-09	RAN#105	RP-242166	4784		F	CR on TC maintenance for Rel-18 Multi-Rx	18.7.0
2024-09	RAN#105	RP-242187	4786		F	CR on TC maintenance for R18 eFeRRM SCell activation	18.7.0
2024-09	RAN#105	RP-242170	4789	1	F	Corrections on LTM TCI state activation	18.7.0

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2024-09	RAN#105	RP-242170	4792	1	F	Correction on LTM test cases	18.7.0
2024-09	RAN#105	RP-242170	4793	2	F	Correction on validity check test cases	18.7.0
2024-09	RAN#105	RP-242167	4794		F	Update DCI based BWP switch delay on multiple CCs in multi-carrier enhancement	18.7.0
2024-09	RAN#105	RP-242167	4795		F	Correction on test case of Cell reselection to FR2 inter-frequency NR case	18.7.0
2024-09	RAN#105	RP-242184	4796		F	Correction to measurement requirements with inactive eDRX	18.7.0
2024-09	RAN#105	RP-242155	4797	2	F	Update on SSB-less based SCell activation	18.7.0
2024-09	RAN#105	RP-242173	4801		A	(NR_newRAT-Core) Corrections on measurement restriction for RLM, BFD and CBD R18	18.7.0
2024-09	RAN#105	RP-242156	4802	1	F	CR on core requirements maintenance for R18 ATG	18.7.0
2024-09	RAN#105	RP-242177	4803		F	(NR_NTN_enh-Core) Formal CR on interruption time in handover delay for NR SAN FR2-NTN – NR SAN FR2-NTN Handover	18.7.0
2024-09	RAN#105	RP-242157	4806	1	F	CR on test cases for BWP operation without restriction	18.7.0
2024-09	RAN#105	RP-242165	4807	1	F	CR on measurement restriction requirements for multi-Rx	18.7.0
2024-09	RAN#105	RP-242166	4808	1	F	CR on test cases for m-DCI based TCI dual states switch for multi-Rx	18.7.0
2024-09	RAN#105	RP-242187	4810	1	D	CR to TS 38.133 on RRM SCG activation deactivation test case for FR1-FR1 inter-band NR-DC with target Pscell in FR1	18.7.0
2024-09	RAN#105	RP-242162	4812	1	F	CR on FR1 Type-1 gap + periodic MUSIM gap for SSB-based measurements in inter-frequency layers	18.7.0
2024-09	RAN#105	RP-242184	4817		A	CR to 38.133: Correction to priority level of relaxed inter-RAT measurements	18.7.0
2024-09	RAN#105	RP-242169	4821		F	CR on test cases of UE transmit timing from two TRPs in FR1	18.7.0
2024-09	RAN#105	RP-242179	4822	1	F	Correction on test cases for Rel-18 NTN	18.7.0
2024-09	RAN#105	RP-242170	4826	1	F	CR for Rel-18 LTM maintenance	18.7.0
2024-09	RAN#105	RP-242170	4827	2	F	CR for Rel-18 eEMR test cases	18.7.0
2024-09	RAN#105	RP-242166	4829	1	F	CR for Rel-18 multi-Rx performance part maintenance	18.7.0
2024-09	RAN#105	RP-242157	4833	2	F	(NR_BWP_wor-Core) CR on 38.133 BWP operation without restriction Core	18.7.0
2024-09	RAN#105	RP-242157	4834	1	F	(NR_BWP_wor-Perf) CR to 38.133 Test case of L1-RSRP for Option C	18.7.0
2024-09	RAN#105	RP-242186	4837		A	(NR_RRM_enh2-Core)CR on SRS antenna switching interruption requirements(R18 mirror)	18.7.0
2024-09	RAN#105	RP-242170	4839	1	F	CR on R18 LTM RRM core requirements	18.7.0
2024-09	RAN#105	RP-242155	4841	1	F	CR on test cases for Cell DTX	18.7.0
2024-09	RAN#105	RP-242168	4842		A	(NR_MG_enh-Core) CR on 38.133 MG enh on NCSG-r18	18.7.0
2024-09	RAN#105	RP-242181	4849		A	(NR_NTN_solutions-Core) CR on Rel-17 NTN measurement requirements R18	18.7.0
2024-09	RAN#105	RP-242168	4852		F	CR on requirements for inter-RAT LTE measurement without gap	18.7.0
2024-09	RAN#105	RP-242168	4853	1	F	CR on TCs for Case 1	18.7.0
2024-09	RAN#105	RP-242168	4854		F	CR on TCs for NFG	18.7.0
2024-09	RAN#105	RP-242163	4855	1	F	CR on RRM core requirements for less than 5 MHz BW	18.7.0
2024-09	RAN#105	RP-242163	4856		F	CR on TCs for less than 5 MHz operation	18.7.0
2024-09	RAN#105	RP-242157	4857		F	CR on HO TCs for option C	18.7.0
2024-09	RAN#105	RP-242177	4858		F	CR on Rx-Tx measurement requirements for NTN	18.7.0
2024-09	RAN#105	RP-242178	4859	1	F	CR on requirements for satellite switch with re-sync	18.7.0
2024-09	RAN#105	RP-242179	4860	1	F	CR on measurement accuracy requirements for FR2-NTN	18.7.0
2024-09	RAN#105	RP-242179	4861		F	CR on AoA setup for FR2-NTN test	18.7.0
2024-09	RAN#105	RP-242163	4862		F	CR introducing test case for Radio Link Monitoring In-sync Test for FR1 PCell with 3 MHz Channel Bandwidth configured with SSB-based RLM RS in DRX mode NOTE: The was not implemented due to CR choversheet issue	18.7.0
2024-09	RAN#105	RP-242162	4864		A	CR to 38.133 on Gradual timing adjustment	18.7.0
2024-09	RAN#105	RP-242179	4867		F	CR to 38.133 on test cases for L3-RSRP Measurement Accuracy in FR2-NTN NOTE: This CR introduce new test case with TBD for some test parameters in tables	18.7.0
2024-09	RAN#105	RP-242179	4868		F	CR to 38.133 on test case for L1-RSRP measurement procedures on FR2-NTN NOTE: This change includes TBD for AoA setup clause.	18.7.0
2024-09	RAN#105	RP-242179	4870	1	F	CR to 38.133 on Derivation of Side conditions for NTN measurement performance on FR2-NTN	18.7.0
2024-09	RAN#105	RP-242178	4872	1	F	CR to 38.133 on Measurement Procedures Requirements	18.7.0
2024-09	RAN#105	RP-242170	4874		F	Correction the chapter number on subsequent conditional PSCell addition/change	18.7.0

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2024-09	RAN#105	RP-242165	4878	1	F	CR to TS 38.133 on core requirement maintenance for NR FR2 multi-Rx	18.7.0
2024-09	RAN#105	RP-242166	4879	1	F	CR to TS 38.133 on maintenance of multi-rx TC	18.7.0
2024-09	RAN#105	RP-242169	4883	1	F	CR to TS 38.133 on UL Transmit timing for MIMO Evolution.	18.7.0
2024-09	RAN#105	RP-242169	4884		F	CR to TS 38.133: TC for TDCP measurements	18.7.0
2024-09	RAN#105	RP-242155	4886	1	F	CR on TC for A-TRS based inter-band SSB-less SCell activation delay for EN-DC	18.7.0
2024-09	RAN#105	RP-242178	4887	2	F	Modify NR NTN cell re-selection measurement in RRC CONNECTED state	18.7.0
2024-09	RAN#105	RP-242178	4888	1	F	Modify NR NTN cell re-selection measurement in RRC IDLEINACTIVE state	18.7.0
2024-09	RAN#105	RP-242178	4889	1	F	Supplement the NR NTN cell re-selection requirements in RRC IDLE state	18.7.0
2024-09	RAN#105	RP-242178	4890	1	F	Supplement the NR NTN cell re-selection requirements in RRC INACTIVE state	18.7.0
2024-09	RAN#105	RP-242177	4892		A	(NR_NTN_enh–Core) Modify the NR NTN RRC Re-establishment requirements . NOTE: CR changes in clause 6.2C.1.2.1 related to annex B as it conflicts with another CR that provides a difference reference clause.	18.7.0
2024-09	RAN#105	RP-242156	4894	1	F	CR on R18 ATG measurement	18.7.0
2024-09	RAN#105	RP-242165	4895	1	F	CR on R18 multi-Rx L1 measurement	18.7.0
2024-09	RAN#105	RP-242165	4896	1	F	CR on R18 multi-Rx link recovery procedures	18.7.0
2024-09	RAN#105	RP-242155	4897	3	F	(NonCol_intraB_ENDC_NR_CA-Core) CR on SCell addition interruption_R18	18.7.0
2024-09	RAN#105	RP-242174	4905		A	(NR_newRAT-Core) CR on SCell activation in FR2_R18	18.7.0
2024-09	RAN#105	RP-242162	4907		A	(NR_eMIMO-Core) CR on candidate beam detection_R18	18.7.0
2024-09	RAN#105	RP-242187	4909		A	(NR_RRM_enh-Core) CR on multiple SCell activation in FR2_R18	18.7.0
2024-09	RAN#105	RP-242163	4910		A	(NR_FeMIMO-Core) CR on TRP specific candidate beam detection_R18	18.7.0
2024-09	RAN#105	RP-242152	4911		A	(LTE_NR_DC_enh2-Core) CR on fast SCell activation in FR2_R18	18.7.0
2024-09	RAN#105	RP-242170	4912		F	CR for missing test case of enhanced CHO	18.7.0
2024-09	RAN#105	RP-242166	4916		F	CR on L1-RSRP measurement accuracy requirements for multi-Rx	18.7.0
2024-09	RAN#105	RP-242185	4920		A	(NR_redcap-Perf) Formal CR to Rel-18 TS 38.133: on RedCap Perf maintenance	18.7.0
2024-09	RAN#105	RP-242188	4924		A	(NR_RRM_enh-Perf) CR to 38.133: Correction to NR SRS carrier based switching test cases	18.7.0
2024-09	RAN#105	RP-242168	4927		A	(NR_MG_enh-Core) CR 38.133 Corrections to Pre-MG activation/deactivation	18.7.0
2024-09	RAN#105	RP-242168	4928	1	F	CR 38.133 Corrections to Case 1 requirements for NR_MG_enh2	18.7.0
2024-09	RAN#105	RP-242190	4932		A	(NR_unlic-Perf) CR for NR-U TC correction – clause A.10 (R18) NOTE: CR changes in clause A.10.1.2 was not implemented as the test case already exist.	18.7.0
2024-09	RAN#105	RP-242190	4935		A	(NR_unlic-Perf) CR for NR-U TC correction – clause A.11 (R18)	18.7.0
2024-09	RAN#105	RP-242190	4938		A	(NR_unlic-Perf) CR for NR-U TC correction – clause A.12 (R18)	18.7.0
2024-09	RAN#105	RP-242190	4941		A	(NR_unlic-Perf) CR for NR-U TC correction – clause A.13 (R18)	18.7.0
2024-09	RAN#105	RP-242185	4943		A	(NR_redcap-Perf) Correction CR for RedCap TCs (R18)	18.7.0
2024-09	RAN#105	RP-242188	4946	1	F	(NR_SL_enh2-Core) CR 38.133 Clarification on V2X and SL bands	18.7.0
2024-09	RAN#105	RP-242170	4949	1	F	CR to 38.133 on LTM test case maintenance	18.7.0
2024-09	RAN#105	RP-242166	4950		F	CR on multi-RX performance requirement maintenance	18.7.0
2024-09	RAN#105	RP-242168	4951	1	F	CR on concurrent Pre-MG dynamic collision	18.7.0
2024-09	RAN#105	RP-242195	4953		F	Big CR to 38133 for RRM core part for expanded and improved NR positioning	18.7.0
2024-12	RAN#106	RP-243045	4961		A	Corrections of the propagation conditions for cell reselection with highSpeedMeasInterFreq-r17	18.8.0
2024-12	RAN#106	RP-243055	4965		A	(NR_newRAT-Perf) CR to A.6.6.3.1 to A.6.6.3.3 on duplex mode and LTE RF channel number	18.8.0
2024-12	RAN#106	RP-243062	4967		A	(NR_redcap-Perf) CR to A.16.5.3 on PDCCH and PDSCH max HARQ transmission	18.8.0
2024-12	RAN#106	RP-243062	4969		A	(NR_redcap-Perf) CR to CORESET RMC for RLM 1Rx RedCap	18.8.0
2024-12	RAN#106	RP-243062	4971		A	(NR_redcap-Perf) CR to A.16.6.1.7 Dedicated CORESET RMC	18.8.0

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2024-12	RAN#106	RP-243062	4973		A	(NR_redcap-Perf) CR to A.16.6.2.9 redundant T2 parameter value	18.8.0
2024-12	RAN#106	RP-243062	4976		A	(NR_redcap-Perf) CR to A.16.3.1.7 to A.16.3.1.10 for Handover	18.8.0
2024-12	RAN#106	RP-243062	4978		A	(NR_redcap-Perf) CR to A.16.1.2.4 on missing configuration number	18.8.0
2024-12	RAN#106	RP-243062	4980		A	(NR_redcap-Perf) CR to A.16.6.1.10 SMTC configuration for CD-SSB	18.8.0
2024-12	RAN#106	RP-243062	4982		A	(NR_redcap-Perf) CR to A.18.1.1.1 E-UTRA cell re-selection to NR cell	18.8.0
2024-12	RAN#106	RP-243051	4985		A	(NR_Mob_enh-Core) Correction CR for Rel-16 CHO delay requirements	18.8.0
2024-12	RAN#106	RP-243051	4986	1	F	CR for Rel-18 LTM core requirements	18.8.0
2024-12	RAN#106	RP-243051	4987		F	Correction CR for Rel-18 CHO enhancements	18.8.0
2024-12	RAN#106	RP-243044	4988		F	CR for Rel-18 multi-Rx AoA setup	18.8.0
2024-12	RAN#106	RP-243062	4991		A	(NR_redcap-Perf) CR to TS 38.133 on test cases for RedCap UE	18.8.0
2024-12	RAN#106	RP-243041	4993		A	(NR_ext_to_71GHz-Perf) CR to TS 38.133 on test cases in FR2-2 with CCA	18.8.0
2024-12	RAN#106	RP-243034	4994	2	F	(NR_ATG-Core) CR to TS 38.133 on core maintenance for R18 ATG	18.8.0
2024-12	RAN#106	RP-243051	4995	2	F	CR to TS 38.133 on core maintenance for R18 NR mobility enhancements	18.8.0
2024-12	RAN#106	RP-243051	4996		F	CR to TS 38.133 on performance requirements for R18 NR mobility enhancements	18.8.0
2024-12	RAN#106	RP-243048	4998	2	F	(NR_MG_enh2-Core) CR on core requirements of Rel-18 gap enhancements	18.8.0
2024-12	RAN#106	RP-243056	4999	1	F	(NR_NTN_enh-Core) CR on core requirements of Rel-18 NR NTN enhancements	18.8.0
2024-12	RAN#106	RP-243033	5000		F	(NonCol_intraB_ENDC_NR_CA-Core) CR on interruption requirements for intra-band CADC	18.8.0
2024-12	RAN#106	RP-243063	5002		A	(NR_RRM_enh2-Perf) CR on test cases of PUCCH SCell activation and deactivation delay requirements	18.8.0
2024-12	RAN#106	RP-243063	5004		A	(NR_RRM_enh2-Core) CR on PUCCH SCell activation and deactivation delay requirements with Multiple SCells	18.8.0
2024-12	RAN#106	RP-243051	5007	1	F	CR on core requirements for R18 mobility	18.8.0
2024-12	RAN#106	RP-243051	5008	1	F	CR on performance maintenance for R18 mobility	18.8.0
2024-12	RAN#106	RP-243064	5010		D	Editorial corrections to sections 7 and 8	18.8.0
2024-12	RAN#106	RP-243039	5012		F	Removal of brackets for MUSIM capability	18.8.0
2024-12	RAN#106	RP-243051	5013		F	Removal of unnecessary conditions for LTM	18.8.0
2024-12	RAN#106	RP-243054	5017		A	(NR_newRAT) Restoring SCell interruption requirement	18.8.0
2024-12	RAN#106	RP-243028	5020		A	(LTE_NR_DC_CA_enh) Removal of brackets for R16 SCell activation improvements	18.8.0
2024-12	RAN#106	RP-243028	5022		A	(LTE_NR_DC_enh2-Core) Removal of brackets for R17 SCell activation improvements	18.8.0
2024-12	RAN#106	RP-243056	5023	1	F	(NR_NTN_enh-Core) CR on NTN CHO requirements TEI18	18.8.0
2024-12	RAN#106	RP-243048	5024	1	F	(NR_MG_enh2-Core) CR on Rel18 MG RRM requirements	18.8.0
2024-12	RAN#106	RP-243055	5028		A	(NR_newRAT-Perf) CR to TS 38.133: Corrections to RRM FR2 test cases for high power classes (Rel 18)	18.8.0
2024-12	RAN#106	RP-243059	5030		A	(NR_NTN_solutions-Perf) CR to TS 38.133: Corrections to NR NTN RRM test cases (Rel 18)	18.8.0
2024-12	RAN#106	RP-243032	5033	1	F	Corrections for inter-band SSB-less SCell activation TCs	18.8.0
2024-12	RAN#106	RP-243033	5034		F	38.133 CR on intra-band non-collocated EN-DC and NRCA	18.8.0
2024-12	RAN#106	RP-243060	5037		A	(NR_unlic-Perf) CR for NR-U TC correction (R18)	18.8.0
2024-12	RAN#106	RP-243060	5040		A	(NR_unlic-Perf) Missing idle-mode conditions for NR-U in 38.133 annex B (R18)	18.8.0
2024-12	RAN#106	RP-243055	5046		A	CR on MGTA 0.25ms for per-UE MG (Cat-A Rel-18)	18.8.0
2024-12	RAN#106	RP-243059	5048		A	CR on Fading for RLM and BFD-LR test cases (Cat-A Rel-18)	18.8.0
2024-12	RAN#106	RP-243028	5057		A	(LTE_NR_DC_enh2-Core) CR on alignment of RAN4 requirements with RAN2 procedures	18.8.0
2024-12	RAN#106	RP-243035	5062	1	F	Clarification for HO within NR_BWP_wor-Core	18.8.0
2024-12	RAN#106	RP-243064	5063	1	F	CR Section 9 specification quality improvement	18.8.0
2024-12	RAN#106	RP-243064	5066		A	(NR_UE_pow_sav-Core) CR on relaxed measurement in IDLE/INACTIVe mode	18.8.0
2024-12	RAN#106	RP-243064	5069		A	(NR_RRM_Enh-Perf) CR on adding Note in test parameter tables for multiple unknown SCells activation test case	18.8.0
2024-12	RAN#106	RP-243064	5070		F	(NR_RRM_enh3-Perf) CR on adding Note in test parameter tables for SCell activation test cases	18.8.0
2024-12	RAN#106	RP-243064	5071		F	CR on specification quality improvement for clause A.4 in TS 38.133	18.8.0

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2024-12	RAN#106	RP-243059	5073		A	(NR_NTN_solutions-Perf) CR on correction of test parameters and requirements for TCs for inter-frequency cell reselection on FR1 NR NTN	18.8.0
2024-12	RAN#106	RP-243056	5074		F	CR to TS 38.133 paging interruption requirement correction for NR NTN enh	18.8.0
2024-12	RAN#106	RP-243059	5080		A	(NR_NTN_solutions-Core) Modify NR NTN cell re-selection measurement in RRC IDLE state.	18.8.0
2024-12	RAN#106	RP-243063	5083		A	(NR_redcap-Core) Modify CG-SDT requirements for RedCap.	18.8.0
2024-12	RAN#106	RP-243063	5092		A	(NR_redcap-Core)Correction on RedCap UE	18.8.0
2024-12	RAN#106	RP-243063	5094		A	(NR_RRM_enh2) Correction on HO with PSCell	18.8.0
2024-12	RAN#106	RP-243055	5107		A	(NR_newRAT-Perf) Correction to RLM scheduling restriction test cases_R18	18.8.0
2024-12	RAN#106	RP-243034	5110		A	(NR_2step_RACH-Perf) Correction to 2-step RACH RRM RMCs and test cases_R18	18.8.0
2024-12	RAN#106	RP-243039	5113		A	(NR_CSIRS_L3meas-Perf) Correction to CSI-RS based mobility measurement test cases_R18	18.8.0
2024-12	RAN#106	RP-243062	5115		A	(NR_redcap-Perf) Correction to RedCap 2-step RACH RRM test cases_R18	18.8.0
2024-12	RAN#106	RP-243062	5117		A	(NR_redcap-Perf) Correction to RedCap measurement and radio link monitoring test cases_R18	18.8.0
2024-12	RAN#106	RP-243033	5123		F	Correction on SCell activation delay for UE supporting intra-band non-collocated	18.8.0
2024-12	RAN#106	RP-243051	5124	1	F	Corrections on LTM core requirements	18.8.0
2024-12	RAN#106	RP-243051	5125		F	Corrections on TC for NR conditional handover including target MCG and candidate SCG	18.8.0
2024-12	RAN#106	RP-243045	5127	1	F	Correction on IE for UE capability for PC6 UE	18.8.0
2024-12	RAN#106	RP-243057	5129	1	F	CR on performance requirements maintenance for R18 NTN	18.8.0
2024-12	RAN#106	RP-243044	5131	1	F	CR on core part requirements maintenance for multi-Rx	18.8.0
2024-12	RAN#106	RP-243044	5132	1	F	CR on AoA setup for multi-Rx	18.8.0
2024-12	RAN#106	RP-243061	5139		A	(NR_pos_enh-Core) CR on Rel-17 positioning requirements	18.8.0
2024-12	RAN#106	RP-243054	5142	1	F	(NR_newRAT-Core) Correction on SCell activation delay	18.8.0
2024-12	RAN#106	RP-243056	5143	1	F	(NR_NTN_enh-Core) Modify NR NTN core requirements in RRC Connected state	18.8.0
2024-12	RAN#106	RP-243049	5146	1	F	CR corrections of RRM core requirements for NR MIMO Evo	18.8.0
2024-12	RAN#106	RP-243049	5147	2	F	CR corrections of RRM performance requirements for NR MIMO Evo	18.8.0
2024-12	RAN#106	RP-243039	5151	1	F	(NR_DualTxRx_MUSIM-Core) CR on 38.133 MUSIM Core	18.8.0
2024-12	RAN#106	RP-243048	5153	1	F	(NR_MG_enh2-Core) CR on 38.133 MG enh2 on NeedForGaps	18.8.0
2024-12	RAN#106	RP-243056	5154	1	F	CR for updating the note for NTN frequency range definition in RLM requirements	18.8.0
2024-12	RAN#106	RP-243064	5156	1	F	CR on R18 FR2 SCell activation delay reduction	18.8.0
2024-12	RAN#106	RP-243049	5159	1	F	CR on R18 MIMO RRM requirements	18.8.0
2024-12	RAN#106	RP-243059	5161		A	(NR_NTN_solutions-Core) CR on measurement requirements for NTN R18	18.8.0
2024-12	RAN#106	RP-243048	5163		A	(NR_MG_enh-Core) CR on measurement requirements for con-MG R18	18.8.0
2024-12	RAN#106	RP-243042	5164		F	CR on RRM core requirements for less than 5MHz BW	18.8.0
2024-12	RAN#106	RP-243042	5165		F	CR on test configurations for less than 5MHz BW	18.8.0
2024-12	RAN#106	RP-243048	5166	1	F	CR on NFG requirements	18.8.0
2024-12	RAN#106	RP-243048	5167		F	CR on TCs for R18 MGE	18.8.0
2024-12	RAN#106	RP-243035	5168	1	F	CR on TCs for option C for BWP without restriction	18.8.0
2024-12	RAN#106	RP-243056	5169	1	F	CR on Rx-Tx measurement requirements for NTN	18.8.0
2024-12	RAN#106	RP-243056	5170		F	CR on RLM requriements for FR2-NTN	18.8.0
2024-12	RAN#106	RP-243057	5175	1	F	CR to TS 38.133 Satellite switching with re-synchronization test case correction for NR NTN enh	18.8.0
2024-12	RAN#106	RP-243064	5177	1	F	CR on RRM requirements for eFeRRM	18.8.0
2024-12	RAN#106	RP-243032	5178		F	CR on core part of R18 NES	18.8.0
2024-12	RAN#106	RP-243032	5179	1	F	CR on perf part of R18 NES	18.8.0
2024-12	RAN#106	RP-243034	5180	2	F	CR on core part of R18 ATG	18.8.0
2024-12	RAN#106	RP-243034	5181		F	CR on perf part of R18 ATG	18.8.0
2024-12	RAN#106	RP-243033	5183		F	CR on core part of R18 NonCol_intraB_ENDC_NR_CA	18.8.0
2024-12	RAN#106	RP-243064	5184	1	F	CR on core part of R18 SCell activation enhancement	18.8.0
2024-12	RAN#106	RP-243048	5185	1	F	CR on CSSF of R18 Concurrent MGs	18.8.0
2024-12	RAN#106	RP-243048	5186	1	F	CR on test case of R18 NFG enhancement	18.8.0
2024-12	RAN#106	RP-243044	5188	1	F	maintenance CR for test cases for multi-rx	18.8.0
2024-12	RAN#106	RP-243061	5194		A	(NR_pos-Perf) CAT-A CR to 38.133 (Release 18) on corrections to accuracy requirement for UE Rx-Tx measurement	18.8.0
2024-12	RAN#106	RP-243032	5199	1	F	38.133 CR on handover delays for NES-based CHO	18.8.0

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2024-12	RAN#106	RP-243056	5208	1	F	(NR_NTN_enh-Core) Formal CR on Interruption time for hard satellite switch	18.8.0
2024-12	RAN#106	RP-243059	5210		A	[NR_NTN_solutions-Perf] Correction in derive parameters in A.14.4.2.4 and A.14.4.2.6 (Rel-18)	18.8.0
2024-12	RAN#106	RP-243064	5211	1	F	CR on NR standalone tests with all NR cells in FR1 for RedCap	18.8.0
2024-12	RAN#106	RP-243064	5219		F	CR 38.133 RRM specification improvement for clauses 10 to A_3	18.8.0
2024-12	RAN#106	RP-243064	5220		F	CR 38.133 RRM specification improvement for clause A_6	18.8.0
2024-12	RAN#106	RP-243069	5227		B	Big CR to 38133 for RRM performance part for expanded and improved NR positioning	18.8.0
2024-12	RAN#106	RP-243070	5228		F	Big CR to 38133 for RRM core part for expanded and improved NR positioning	18.8.0
2024-12	RAN#106	RP-243064	5229		F	CR for RRM Spec Improvement (section 1~6)	18.8.0
2025-03	RAN#107	RP-250608	5237	1	F	(NR_RRM_enh3-Core) CR for RRM Spec Improvement (section A.7)	18.9.0
2025-03	RAN#107	RP-250579	5241		A	(NR_newRAT-Core) CR for RRM measurement on deactivated SCC - R18	18.9.0
2025-03	RAN#107	RP-250587	5245		A	(NR_RRM_Enh-Perf) CR on A.4.6.6.1 for EN-DC intra-frequency CGI identification - R18	18.9.0
2025-03	RAN#107	RP-250591	5247		A	(NR_MG_enh-Core) CR on RRM requirements for NCSG - R18	18.9.0
2025-03	RAN#107	RP-250605	5249		F	CR on core requirements for R18 mobility	18.9.0
2025-03	RAN#107	RP-250605	5251		F	(NR_Mob_enh2-Pref) Correction on test cases for Idle mode fast CA/DC measurement	18.9.0
2025-03	RAN#107	RP-250608	5252		F	(NR_redcap_enh-Core) Correction on eRedCap UE	18.9.0
2025-03	RAN#107	RP-250597	5254		A	(NR_RRM_enh2) Correction on NR PSCell Addition Delay requirements	18.9.0
2025-03	RAN#107	RP-250597	5261		A	(NR_SL_enh-Core) CR on correction of wrong indentation for Selection / Reselection of V2X Synchronization Reference Source	18.9.0
2025-03	RAN#107	RP-250608	5262		F	(NR_SL_enh2-Core) CR on correction of wrong indentation for Selection / Reselection of Sidelink Synchronization Reference Source with CCA	18.9.0
2025-03	RAN#107	RP-250605	5267	1	F	CR on maintenance for R18 mobility	18.9.0
2025-03	RAN#107	RP-250606	5268	1	F	(NR_NTN_enh-Core) CR on adding FR2 term in the requirement tables in cell re-selection for NTN	18.9.0
2025-03	RAN#107	RP-250582	5275		A	(LTE_NR_DC_CA_enh-Core) CR on R16 EMR	18.9.0
2025-03	RAN#107	RP-250585	5278		A	(NR_UE_pow_sav-Core) CR on R16 measurement relaxation for low mobility	18.9.0
2025-03	RAN#107	RP-250588	5281		A	(NR_unlic-Core) CR on R16 CSSF_outside gap for SA scenario	18.9.0
2025-03	RAN#107	RP-250591	5283		A	(NR_MG_enh-Core) CR on the interruption of deactivated SCell measurement when NCSG is configured	18.9.0
2025-03	RAN#107	RP-250597	5287		A	(NR_RRM_enh2-Core) CR on R17 handover with PSCell change	18.9.0
2025-03	RAN#107	RP-250601	5288		F	(NR_ATG-Core) CR on location-based CHO of R18 ATG	18.9.0
2025-03	RAN#107	RP-250603	5289		F	(NR_MG_enh2-Core) CR on Case 2 of R18 Concurrent MGs	18.9.0
2025-03	RAN#107	RP-250605	5290		F	(NR_Mob_enh2-Core) CR on R18 CHO with PSCell change	18.9.0
2025-03	RAN#107	RP-250590	5292		A	(NR_ext_to_71GHz-Perf) CR to TS 38.133 on test cases in FR2-2 with CCA	18.9.0
2025-03	RAN#107	RP-250601	5293		F	(NR_ATG-Core) CR to TS 38.133 on core maintenance for R18 ATG	18.9.0
2025-03	RAN#107	RP-250606	5294		F	(NR_NTN_enh-Core) CR on core requirements of Rel-18 NR NTN enhancements	18.9.0
2025-03	RAN#107	RP-250607	5296	1	F	CR on correction on interruption requirements for SRS BW aggregation	18.9.0
2025-03	RAN#107	RP-250605	5298	1	F	(NR_Mob_enh2-Core) CR on Rel-18 LTM	18.9.0
2025-03	RAN#107	RP-250601	5302	1	F	CR on handover requirements for BWP without restriction	18.9.0
2025-03	RAN#107	RP-250601	5303		F	CR on Pre-MG requirements for ATG	18.9.0
2025-03	RAN#107	RP-250607	5305	1	F	CR on core requirements of positioning enhancements	18.9.0
2025-03	RAN#107	RP-250606	5308		F	(NR_NTN_enh-Core) Correction IE for NR NTN in RRC connected state	18.9.0
2025-03	RAN#107	RP-250606	5309	1	F	(NR_NTN_enh-Core) Correction on NR NTN handover delay	18.9.0
2025-03	RAN#107	RP-250606	5310	1	F	(NR_NTN_enh-Core) Modify NR NTN cell re-selection measurement in RRC IDLE state.	18.9.0
2025-03	RAN#107	RP-250593	5312		A	(NR_NTN_solutions-Core) Correction on NR NTN in RRC connected state_R18	18.9.0
2025-03	RAN#107	RP-250587	5315		A	(NR_RF_FR1-Perf) Correction to Rel-16 Tx switching RRM test cases_R18	18.9.0
2025-03	RAN#107	RP-250592	5317		A	(NR_RF_FR1_enh-Perf) Correction to Rel-17 Tx switching RRM test cases_R18	18.9.0

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2025-03	RAN#107	RP-250603	5318		F	(NR_MC_enh-Perf) Correction to multi-carrier enhancement RRM test cases_R18	18.9.0
2025-03	RAN#107	RP-250605	5323	1	F	(NR_MIMO_evo_DL_UL-Core) CR on core requirements maintenance for R18 MIMO	18.9.0
2025-03	RAN#107	RP-250608	5325		F	(NR_RRM_enh3-Perf) CR on TC maintenance for Rel-18 eFeRRM	18.9.0
2025-03	RAN#107	RP-250600	5326	1	F	(Netw_Energy_NR-Perf) CR on TC maintenance for Rel-18 NES SSB-less	18.9.0
2025-03	RAN#107	RP-250600	5327		F	(Netw_Energy_NR-Perf) CR on TC maintenance for Rel-18 NES CHO	18.9.0
2025-03	RAN#107	RP-250608	5328		F	CR on specification improvement for 38.133 A.5	18.9.0
2025-03	RAN#107	RP-250605	5330		F	(NR_Mob_enh2-Perf) Corrections on TC for LTM PDCCH-order Random Access	18.9.0
2025-03	RAN#107	RP-250608	5332	1	F	(NR_redcap_enh-Core) Correction to TA validation requirements for RedCap R18	18.9.0
2025-03	RAN#107	RP-250602	5333	1	F	(NR_HST_FR2_enh-Core) Correction on inter-frequency cell identification without gap requirements for FR2 HST	18.9.0
2025-03	RAN#107	RP-250597	5339	1	F	(NR_SmallData_INACTIVE-Core) CR on CG-SDT requirements R18	18.9.0
2025-03	RAN#107	RP-250595	5341		A	(NR_pos_enh-Core) CR on requirements for PRS measurement outside MG R18	18.9.0
2025-03	RAN#107	RP-250606	5343		F	CR on measurement requirements for FR2-NTN	18.9.0
2025-03	RAN#107	RP-250606	5344		F	CR on UL timing TC for FR2-NTN	18.9.0
2025-03	RAN#107	RP-250607	5345	1	F	CR on RRM requirements for SL positioning	18.9.0
2025-03	RAN#107	RP-250607	5347		F	CR on accuracy requirements for RedCap positioning	18.9.0
2025-03	RAN#107	RP-250580	5351		F	(NR_newRAT-Perf) CR on the correction of band group notations in the SSB_RP and SSB conditions tables R18	18.9.0
2025-03	RAN#107	RP-250585	5354		F	(NR_newRAT-Perf)CR on the correction of band group notations in the accuracy requirements tables R18	18.9.0
2025-03	RAN#107	RP-250606	5356	1	F	(NR_NTN_enh-Core) Formal CR for TS 38.133 on positioning measurement for NTN	18.9.0
2025-03	RAN#107	RP-250603	5357	1	F	(NR_MG_enh2-Core) CR on 38.133 MG enh2 on NCSGs	18.9.0
2025-03	RAN#107	RP-250605	5358	1	F	CR for LTM core part maintenance	18.9.0
2025-03	RAN#107	RP-250587	5361		A	(NR_RRM_enh-Core)Correction on RRC based BWP switch delay for multiple CCs	18.9.0
2025-03	RAN#107	RP-250608	5363	1	F	CR on R18 RRM_enh3 core requirements	18.9.0
2025-03	RAN#107	RP-250607	5367	1	F	CR 38.133 remaining core issues for SL positioning	18.9.0
2025-03	RAN#107	RP-250580	5373		A	(NR_newRAT-Perf) CR to TS 38.133: Corrections to NR RRM test cases (Rel 18)	18.9.0
2025-03	RAN#107	RP-250588	5376		A	(NR_unlic-Perf) CR to TS 38.133: Corrections to NR-U RRM test cases (Rel 18)	18.9.0
2025-03	RAN#107	RP-250585	5379		A	(NR_pos-Perf) CR to TS 38.133: Corrections to NR Positioning test cases (Rel 18)	18.9.0
2025-03	RAN#107	RP-250595	5381		A	(NR_pos_enh-Perf) CR to TS 38.133: Corrections to NR Enhanced Positioning test cases (Rel 18)	18.9.0
2025-03	RAN#107	RP-250594	5383		A	(NR_NTN_solutions-Perf) CR to TS 38.133: Corrections to NR NTN RRM test cases (Rel 18)	18.9.0
2025-03	RAN#107	RP-250596	5385		A	(NR_redcap-Perf) CR to TS 38.133: Corrections to RedCap RRM test cases (Rel 18)	18.9.0
2025-03	RAN#107	RP-250605	5387		F	CR on PL1_sharing for L1-RSRP intra-frequency and inter-frequency neighbour cells	18.9.0
2025-03	RAN#107	RP-250595	5389		A	(NR_pos_enh-Perf) CAT-A CR to 38.133 on performance requirement for PRS-RSRP and UE Rx-Tx measurements	18.9.0
2025-03	RAN#107	RP-250607	5390	1	F	CR to 38.133 on core requirements for CPP	18.9.0
2025-03	RAN#107	RP-250607	5391		F	CR to 38.133 on core requirements for LPHAP	18.9.0
2025-03	RAN#107	RP-250607	5392	1	F	CR to 38.133 on test case for LPHAP	18.9.0
2025-03	RAN#107	RP-250607	5393		F	CR to 38.133 on performance requirements for carrier phase measurement for NR positioning	18.9.0
2025-03	RAN#107	RP-250606	5394		F	(NR_NTN_enh-Core) Formal CR for TS 38.133 on positioning measurement accuracy requirements for NTN	18.9.0
2025-03	RAN#107	RP-250599	5401		F	(LTE_NR_DC_enh2) CR for correcting interruptions during measurements on deactivated NR PSCell	18.9.0
2025-03	RAN#107	RP-250596	5403		A	(NR_redcap-Perf) Corrections in A.16.7.1.3 and A.16.7.1.4 on derived parameters (Rel 18)	18.9.0
2025-03	RAN#107	RP-250594	5405		A	(NR_NTN_solutions-Perf) Remove NR NTN testing scenarios for BFR in SCell (Rel 18)	18.9.0
2025-03	RAN#107	RP-250580	5409		A	(NR_newRAT-Perf) Corrections in A.4.7.1.2 and A.6.7.1.2 on derived parameters (Rel 18)	18.9.0
2025-03	RAN#107	RP-250605	5410	1	F	CR on R18 LTM RRM core requirements	18.9.0
2025-03	RAN#107	RP-250606	5415	2	F	Corrections to UE transmit timing for Satellite Access	18.9.0
2025-03	RAN#107	RP-250608	5417		F	CR to 38.133: Addition of sub test using SR for SCell action with valid L3 results	18.9.0

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2025-03	RAN#107	RP-250600	5419	1	F	CR to TS 38.133 on core requirement maintenance for NES	18.9.0
2025-03	RAN#107	RP-250608	5420	1	F	38.133 CR on PUCCH SCell activation with L3 report	18.9.0
2025-03	RAN#107	RP-250604	5421	1	F	CR for Rel-18 Less Than 5MHz Performance part NOTE: This CR was partially implemented as Table A.6.5.1.13.1-3 and Table A.6.5.1.14.1-3 was not based on latest specification and was not implementable.	18.9.0
2025-03	RAN#107	RP-250603	5423	1	F	(NR_MG_enh2-Perf) CR on MGE2 R18 performance	18.9.0
2025-03	RAN#107	RP-250603	5426	1	F	CR to TS 38133 on NeedForInterruption	18.9.0
2025-03	RAN#107	RP-250602	5427		F	CR for Rel-18 multi-Rx test case maintenance	18.9.0
2025-03	RAN#107	RP-250605	5428		F	CR corrections of RRM performance requirements for NR MIMO Evo	18.9.0
2025-03	RAN#107	RP-250587	5432		A	(NR_RF_FR1) CR on TC for DL interruptions at switching between two uplink carriers in FDD-TDD CA (R18)	18.9.0
2025-03	RAN#107	RP-250611	5434		F	CR to TS 38.133 on Inter-frequency measurements reporting requirements [NR_inter-freq_report]	18.9.0
2025-03	RAN#107	RP-250594	5439		A	(NR_NTN_solutions-Perf) CR on L1-RSRP accuracy requirements for FR1 SAN (Cat-A Rel-18)	18.9.0
2025-03	RAN#107	RP-250605	5440	1	F	(NR_Mob_enh2-Core) CR on PDCCH order PRACH timeline (Cat-F Rel-18)	18.9.0
2025-03	RAN#107	RP-250603	5442	1	F	CR38.133 Corrections to CSSF requirements	18.9.0
2025-03	RAN#107	RP-250588	5445		A	(NR_unlic-Perf) Correction CR for A.12.5.1.1	18.9.0

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2025-03	RAN#107	RP-250621	5231		B	CR to 38.133 - Introduction of bands n87-n88	19.0.0
2025-03	RAN#107	RP-250627	5232		B	CR to TS38.133 on introduction of NR band n110	19.0.0
2025-03	RAN#107	RP-250622	5297		B	CR to TS 38.133- Introduction of NR band n68	19.0.0
2025-03	RAN#107	RP-250626	5307	1	B	Big CR for less than 5MHz RRM requirements in Rel-19	19.0.0
2025-06	RAN#108	RP-250915	5453		A	(NR_pos-Perf) CR to TS 38.133: Corrections to NR Positioning test cases (Rel 19)	19.1.0
2025-06	RAN#108	RP-250919	5454		A	(NR_pos_enh-Perf) CR to TS 38.133: Corrections to NR Enhanced Positioning test cases (Rel 19)	19.1.0
2025-06	RAN#108	RP-250920	5457	1	A	CR on Link Recovery Procedures for NTN	19.1.0
2025-06	RAN#108	RP-250926	5459		A	CR on TRP specific Beam Failure Detection and Link Recovery for FR2 Pcell	19.1.0
2025-06	RAN#108	RP-250926	5461		A	CR for Multi-Rx test case maintenance	19.1.0
2025-06	RAN#108	RP-250928	5463		A	CR for LTM L1 measurement requirement maintenance	19.1.0
2025-06	RAN#108	RP-250915	5468		A	(NR_RRM_Enh-Perf)Correction to CGI measurement test case	19.1.0
2025-06	RAN#108	RP-250915	5474		A	(NR_RRM_Enh-Perf) CR for SA intra-frequency CGI identification of NR neighbor cell in FR1 - R19	19.1.0
2025-06	RAN#108	RP-250911	5484		A	CR for RRC based BWP switching for R19	19.1.0
2025-06	RAN#108	RP-250932	5493	1	A	CR for TS 38.133 to add UL RSCP reporting mapping requirement (Rel-19)	19.1.0
2025-06	RAN#108	RP-250934	5498		A	CR to TS 38.133 on RMSI CORESET Reference Channel for FDD with SCS=15KHz for Less than 5MHz UEs	19.1.0
2025-06	RAN#108	RP-250928	5500		A	CR to 38.133 on Rel-18 LTM PDCCH ordered RACH core requirements	19.1.0
2025-06	RAN#108	RP-250929	5507		A	CR on Correction for 38.133: clauses 6.1.4.2.2	19.1.0
2025-06	RAN#108	RP-250921	5510		A	(NR_redcap-Core) CR to TS 38.133 Correction of scheduling availability for HD-FDD Redcap UE	19.1.0
2025-06	RAN#108	RP-250924	5512		A	(NR_ATG-Core) CR to TS 38.133 Correction of L1 sharing factor for Inter-frequency measurements without measurement gaps for ATG UE	19.1.0
2025-06	RAN#108	RP-250930	5514		A	(NR_NTN_enh-Core) CR to TS 38.133 Correction of inter-RAT E-UTRAN cells with TN carrier measurement for NTN UE	19.1.0
2025-06	RAN#108	RP-250928	5516		A	CR on R18 LTM RRM performance requirements	19.1.0
2025-06	RAN#108	RP-250927	5518		A	CR on BWP switching requirements for multi-carrier enhancements	19.1.0
2025-06	RAN#108	RP-250928	5520		A	CR on R18 LTM Test Cases	19.1.0
2025-06	RAN#108	RP-250928	5525		A	CR for correction on test cases on CHO with PSCell change and CHO with CPC	19.1.0

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2025-06	RAN#108	RP-250921	5528		A	CR for correction on test cases on Handover with PSCell change	19.1.0
2025-06	RAN#108	RP-250928	5530		A	(NR_Mob_enh2-Perf) Correction on Principle of Testing in NR-DC	19.1.0
2025-06	RAN#108	RP-250933	5533		A	CR to TS 38.133: NR channel BW less than 5MHz for FR1	19.1.0
2025-06	RAN#108	RP-250928	5535		A	(NR_Mob_enh2-Core) Measurement restrictions for CSI-RS based measurement	19.1.0
2025-06	RAN#108	RP-250929	5537		A	(NR_redcap_enh-Core) Correction on eRedCap UE	19.1.0
2025-06	RAN#108	RP-250960	5538		F	CR to TS 38.133: NR channel BW less than 5MHz for FR1	19.1.0
2025-06	RAN#108	RP-250916	5542		A	CR on measurement period for CCA	19.1.0
2025-06	RAN#108	RP-250913	5546		A	(NR_2step_RACH-Perf) Correction to 2-step RACH RMCs_R19	19.1.0
2025-06	RAN#108	RP-250916	5550		A	(NR_unlic-Perf) Correction to NR-U 2-step RACH RMCs_R19	19.1.0
2025-06	RAN#108	RP-250926	5552		A	(NR_DualTxRx_MUSIM-Perf) Correction to MUSIM gap test cases_R19	19.1.0
2025-06	RAN#108	RP-250927	5554		A	(NR_MG_enh2-Perf) Correction to inter-RAT NR measurement without gap test cases_R19	19.1.0
2025-06	RAN#108	RP-250927	5556		A	(NR_MG_enh2-Perf) Correction to Rel-18 concurrent gap with NCSG test cases_R19	19.1.0
2025-06	RAN#108	RP-250927	5558		A	(NR_MG_enh2-Perf) Correction to Rel-18 concurrent gap with Pre-MG test cases_R19	19.1.0
2025-06	RAN#108	RP-250921	5561		A	(NR_RRM_enh2-Core) CR on core maintenance for PUCCH Scell activation R19 (cat A)	19.1.0
2025-06	RAN#108	RP-250921	5564		A	(NR_RRM_enh2-Perf) CR on TC maintenance for PUCCH Scell activation R19 (cat A)	19.1.0
2025-06	RAN#108	RP-250926	5566		A	CR on TC maintenance for R18 multi-Rx TCI R19 (cat A)	19.1.0
2025-06	RAN#108	RP-250943	5569	1	B	CR on introducing antenna connections for 6Rx capable UEs	19.1.0
2025-06	RAN#108	RP-250928	5571		A	(NR_Mob_enh2-Core) Corrections on LTM core requirements	19.1.0
2025-06	RAN#108	RP-250929	5573		A	(NR_redcap_enh-Core) Correction to TA validation requirements for RedCap R19	19.1.0
2025-06	RAN#108	RP-250921	5576		A	(NR_redcap-Core) Correction on requirements for HD-FDD RedCap UE R19	19.1.0
2025-06	RAN#108	RP-250913	5580		A	(NR_eMIMO-Perf) CR on L1-SINR performance requirements R19	19.1.0
2025-06	RAN#108	RP-250926	5582		A	(NR_SmallData_INACTIVE-Core) CR on CG-SDT requirements R19	19.1.0
2025-06	RAN#108	RP-250920	5585		A	(NR_NTN_solutions-Core) CR on measurement requirements for NTN R19	19.1.0
2025-06	RAN#108	RP-250919	5588		A	(NR_MG_enh-Core) CR on gap sharing for NCSG R19	19.1.0
2025-06	RAN#108	RP-250927	5592		A	CR on CSSF for R18 MG enhancement R19	19.1.0
2025-06	RAN#108	RP-250923	5594		A	CR on core requirements for BWP operation without restriction R19	19.1.0
2025-06	RAN#108	RP-250930	5596		A	CR on measurement requirements for FR2-NTN R19	19.1.0
2025-06	RAN#108	RP-250930	5598		A	CR on measurement accuracy requirements for FR2-NTN R19	19.1.0
2025-06	RAN#108	RP-250932	5600		A	CR on RRM requirements for SL positioning R19	19.1.0
2025-06	RAN#108	RP-250932	5602		A	CR on accuracy requirements for RedCap positioning R19	19.1.0
2025-06	RAN#108	RP-250960	5605	1	F	CR on RRM requirements for less than 5MHz Ph2	19.1.0
2025-06	RAN#108	RP-250924	5608		A	(NR_ATG-Perf) CR on TC maintenance for Rel-19 ATG	19.1.0
2025-06	RAN#108	RP-250912	5613		A	(NR_newRAT-Perf, NR_eMIMO-Perf, NR_CSIRS_L3meas-Perf) CR on maintenance for measurement procedure tests R19	19.1.0
2025-06	RAN#108	RP-250921	5616		A	(NR_redcap-Perf) CR on maintenance for SA event triggered reporting with SSB time index detection R19	19.1.0
2025-06	RAN#108	RP-250945	5621	1	B	Big CR on RRM performance requirements of NR channel BW less than 5MHz for FR1 phase 2	19.1.0

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2025-06	RAN#108	RP-250960	5624	1	F	Core maintenance CR on less than 5MHz RRM requirements	19.1.0
2025-06	RAN#108	RP-250926	5626		A	CR on maximum receive timing difference requirement for UE supporting multi-RX	19.1.0
2025-06	RAN#108	RP-250920	5644	1	A	(NR_NTN_solutions-Core) CR on NR NTN core requirements of (Rel-19)	19.1.0
2025-06	RAN#108	RP-250924	5645		A	(NR_ATG-Core) CR to TS 38.133 on ATG core requirements (Rel-19)	19.1.0
2025-06	RAN#108	RP-250923	5647		A	(NR_BWP_wor-Core) CR for correcting logical errors related to HO requirements	19.1.0
2025-06	RAN#108	RP-250934	5649		A	CR for Rel-18 Less Than 5MHz Performance part	19.1.0
2025-06	RAN#108	RP-250911	5652		A	(NR_newRAT-Core) CR on NR-E-UTRAN HO delay requirement maintenance	19.1.0
2025-06	RAN#108	RP-250922	5659		A	(Netw_Energy_NR-Core) CR on NES CHO_R19	19.1.0
2025-06	RAN#108	RP-250929	5661		A	(NR_RRM_enh3-Core) Correction to the SCell activation with L3 report_R19	19.1.0
2025-06	RAN#108	RP-250912	5668		A	(NR_newRAT-Perf) Correction to CSI-RS based L1-RSRP test case_R19	19.1.0
2025-06	RAN#108	RP-250934	5670		A	CR on PDSCH Reference Measurement Channels with NR FR1 less than 5MHz BW	19.1.0
2025-06	RAN#108	RP-250926	5677		A	CR corrections of RRM core requirements for NR MIMO Evo	19.1.0
2025-06	RAN#108	RP-250927	5684		A	(NR_MG_enh2-Core) CR on MGE2 R18 Core CAT A	19.1.0
2025-06	RAN#108	RP-250927	5686		A	(NR_MG_enh2-Perf) CR on MGE2 R18 Perf CAT A	19.1.0
2025-06	RAN#108	RP-250932	5692		A	CR to 38.133 on corrections to general aspects of gapless positioning measurements and core requirements for RedCap positioning	19.1.0
2025-06	RAN#108	RP-250932	5694		A	CR to 38.133 on corrections to core requirements for carrier phase measurement for positioning	19.1.0
2025-06	RAN#108	RP-250932	5696		A	CR to 38.133 on corrections to performance requirement for UE Rx-Tx time difference measurements	19.1.0
2025-06	RAN#108	RP-250932	5698		A	CR to 38.133 on corrections to performance requirement for carrier phase measurements for positioning	19.1.0
2025-06	RAN#108	RP-250920	5706		A	(NR_NTN_solutions-Core) CR on L1-RSRP accuracy requirements for FR1 SAN (Cat-A Rel-19)	19.1.0
2025-06	RAN#108	RP-250920	5709		A	(NR_NTN_solutions-Perf) CR on NTN test cases for FR1 SAN (Cat-A Rel-19)	19.1.0
2025-06	RAN#108	RP-250930	5711		A	(NR_NTN_enh-Perf) CR on NR NTN test cases (Cat-A Rel-19)	19.1.0
2025-06	RAN#108	RP-250927	5714		A	(NR_MC_enh-Perf) CR on TC for DL interruptions at switching between uplink carriers in FDD-TDD CA (R19)	19.1.0
2025-06	RAN#108	RP-250949	5717		B	CR to TS 38.133: Introduction of a new NTN S-band n252	19.1.0
2025-06	RAN#108	RP-250920	5718		A	(NR_NTN_solutions-Perf) Correction to NR SA SS-RSRP measurement accuracy for Satellite Access (Rel19)	19.1.0
2025-09	RAN#109	RP-252387	5722		A	(NR_NTN_solutions-Perf) CR on SSB based L1-RSRP measurement for SAN	19.2.0
2025-09	RAN#109	RP-252390	5724		A	CR for m-DCI DL TCI state switch delay	19.2.0
2025-09	RAN#109	RP-252392	5726		A	CR for adding AoA setup for s-DCI test case	19.2.0
2025-09	RAN#109	RP-252387	5729		A	CR on test case for SAN distance-based conditional Handover	19.2.0
2025-09	RAN#109	RP-252425	5731		B	Big CR for RRM requirements of NR MIMO Phase 5	19.2.0
2025-09	RAN#109	RP-252387	5734		A	(NR_NTN_solutions-Perf) CR on perf requirements of Rel-19 NR NTN	19.2.0
2025-09	RAN#109	RP-252388	5737		A	(NR_redcap-Perf) CR to TS 38.133 Correction of test cases for Rel-19 RedCap UE	19.2.0
2025-09	RAN#109	RP-252430	5738		B	Big CR for RRM requirements of NR NTN Phase 3	19.2.0
2025-09	RAN#109	RP-252383	5742		A	(NR_RRM_Enh-Perf) CR on EN-DC inter-frequency CGI identification of NR neighbor cell in FR2 – R16	19.2.0
2025-09	RAN#109	RP-252380	5757		A	CR for UE timing requirement for first Tx after quitting dormant BWP for R19	19.2.0
2025-09	RAN#109	RP-252423	5760		B	Big CR for R19 NR_LBCA_Sw RRM	19.2.0

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2025-09	RAN#109	RP-252379	5765		A	(NR_CLI_RIM-Perf) 38.133 CR on R16 CLI measurement accuracy requirement – R19 Cat A	19.2.0
2025-09	RAN#109	RP-252389	5772		A	(Netw_Energy_NR-Core) 38133CR on inter-band SSB-less SCell activation - R19 CatA	19.2.0
2025-09	RAN#109	RP-252389	5774		A	(Netw_Energy_NR-Perf) Correction of SSB-less SCell activation TC - R19 CatA	19.2.0
2025-09	RAN#109	RP-252399	5775		B	CR 38.133 on interruption of Tx switching for 3Tx UEs [TxSwitch_R19]	19.2.0
2025-09	RAN#109	RP-252384	5781		A	(NR_unlic-Perf) CR to TS 38.133: Corrections to NR-U RRM test cases (Rel 19)	19.2.0
2025-09	RAN#109	RP-252388	5784		A	(NR_redcap-Perf) CR to TS 38.133: Corrections to RedCap RRM test cases (Rel 19)	19.2.0
2025-09	RAN#109	RP-252387	5787		A	(NR_NTN_solutions-Perf) CR to TS 38.133: Corrections to NR-NTN RRM test cases (Rel 19)	19.2.0
2025-09	RAN#109	RP-252378	5792		A	(NR_newRAT-Core) Correction of typos in clause 9 of TS38.133	19.2.0
2025-09	RAN#109	RP-252422	5797		B	Big CR on RRM requirements for NTN less than 5MHz in Rel-19	19.2.0
2025-09	RAN#109	RP-252394	5798		A	(NR_NTN_enh-Perf) CR on NTN test cases for FR2 SAN (Cat-A Rel-19)	19.2.0
2025-09	RAN#109	RP-252387	5801		A	(NR_NTN_solutions-Perf) Update on RRC Connection Release with Redirection for Satellite Access (Rel19)	19.2.0
2025-09	RAN#109	RP-252379	5806		A	(NR_newRAT-Perf) Update on SUL test scenario (Rel19)	19.2.0
2025-09	RAN#109	RP-252392	5811		A	(NR_MG_enh2-Perf) CR on Performance maintenance for EMW	19.2.0
2025-09	RAN#109	RP-252413	5813		B	Big CR on TS 38.133 for NR ATG enhancement	19.2.0
2025-09	RAN#109	RP-252393	5815		A	CR on Test Cases for R18 subsequent conditional PSCell addition/change	19.2.0
2025-09	RAN#109	RP-252380	5818		A	(LTE_NR_DC_enh2-Core) CR on Scell activation delay requirements with TCI-ActivatedConfig	19.2.0
2025-09	RAN#109	RP-252421	5823		F	Correction on test cases for NR channel BW less than 5MHz	19.2.0
2025-09	RAN#109	RP-252421	5824		F	CR to TS 38.133: NR channel BW less than 5MHz for FR1	19.2.0
2025-09	RAN#109	RP-252393	5826		A	(NR_Mob_enh2-Pref) Correction on test cases for Idle mode fast CA/DC measurement	19.2.0
2025-09	RAN#109	RP-252393	5828		A	(NR_Mob_enh2-Core) Correction on conditional handover with PSCell	19.2.0
2025-09	RAN#109	RP-252388	5831		A	(NR_redcap-Core) Handover for unknown inter-frequency cell	19.2.0
2025-09	RAN#109	RP-252386	5835		A	(NR_NTN_solutions-Core) CR on requirements for Minimization of Drive Tests (MDT) for Satellite Access (R19 Cat A)	19.2.0
2025-09	RAN#109	RP-252379	5844		A	(NR_CSIRS_L3meas-Perf) Correction to CSI-RS based measurement accuracy test cases_R19	19.2.0
2025-09	RAN#109	RP-252384	5848		A	(NR_RF_FR1-Perf) Correction to Rel-16 Tx switch test cases_R19	19.2.0
2025-09	RAN#109	RP-252388	5851		A	(NR_RF_FR1_enh-Perf) Correction to Rel-17 Tx switch test cases_R19	19.2.0
2025-09	RAN#109	RP-252391	5853		A	(NR_ATG-Perf) Correction to ATG test cases_R19	19.2.0
2025-09	RAN#109	RP-252392	5855		A	(NR_MC_enh-Perf) Correction to Rel-18 Tx switch test cases_R19	19.2.0
2025-09	RAN#109	RP-252378	5860		A	(NR_newRAT-Core) CR on correction to CSSF SA mode requirements for outside gaps for R19	19.2.0
2025-09	RAN#109	RP-252379	5864		A	(NR_newRAT-Perf) CR on miantenance for NR Cell test paramaters in measurement performance tests for R19	19.2.0
2025-09	RAN#109	RP-252393	5870		A	(NR_Mob_enh2-Core) Modification on measurement restriction and schedudling availability for R18 mobility	19.2.0
2025-09	RAN#109	RP-252393	5872		A	(NR_Mob_enh2-Core) CSSF within gap due to SSB based L1 measurement on neighbor cell	19.2.0
2025-09	RAN#109	RP-252390	5877		A	(NR_MIMO_evo_DL_UL-Perf) CR on TC maintenance for R18 MIMO uTCI R19	19.2.0
2025-09	RAN#109	RP-252378	5882		A	(NR_newRAT-Core)CR on maintenance for intra-frequency measurement Rel-19	19.2.0
2025-09	RAN#109	RP-252385	5885		A	(NR_eMIMO-Core) CR on L1-SINR core requirements R19	19.2.0
2025-09	RAN#109	RP-252386	5892		A	(NR_NTN_solutions-Core) CR on core requirements for R17 NTN R19	19.2.0
2025-09	RAN#109	RP-252385	5895		A	(NR_MG_enh-Core) CR on core requirements for R17 MGE R19	19.2.0
2025-09	RAN#109	RP-252392	5897		A	(NR_FR1_lessthan_5MHz_BW-Core) CR on core requirements for less than 5MHz BW R19	19.2.0
2025-09	RAN#109	RP-252392	5899		A	(NR_MG_enh2-Core) CR on core requirements for R18 MG enhancement R19	19.2.0
2025-09	RAN#109	RP-252391	5901		A	(NR_BWP_wor-Core) CR on core requirements for BWP operation without restriction R19	19.2.0

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2025-09	RAN#109	RP-252394	5903		A	(NR_NTN_enh-Core) CR on core requirements for Rel-18 NTN R19	19.2.0
2025-09	RAN#109	RP-252394	5905		A	(NR_NTN_enh-Perf) CR on RRM test cases for Rel-18 NTN R19	19.2.0
2025-09	RAN#109	RP-252393	5907		A	(NR_pos_enh2-Core) CR on requirements for PRS/SRS BWA R19	19.2.0
2025-09	RAN#109	RP-252393	5909		A	(NR_pos_enh2-Perf) CR on test cases for PRS BWA R19	19.2.0
2025-09	RAN#109	RP-252389	5911		A	(NR_DualTxRx_MUSIM-Core) CR on MUSIM gaps without priority R19	19.2.0
2025-09	RAN#109	RP-252421	5912		F	CR on test case for less than 5MHz Ph2	19.2.0
2025-09	RAN#109	RP-252378	5917		A	(NR_newRAT-Core) CR on SFTD of NR SA_R19	19.2.0
2025-09	RAN#109	RP-252385	5925		A	(NR_MG_enh-Core) CR on the inter-RAT measurement_R19	19.2.0
2025-09	RAN#109	RP-252383	5928		A	(NR_RRM_enh2-Core) CR on the requirements of SCG activation_R19	19.2.0
2025-09	RAN#109	RP-252391	5930		A	(NR_ATG-Core) CR on CSI-RS based L3 measurements of ATG_R19	19.2.0
2025-09	RAN#109	RP-252388	5934		A	(NR_pos-Core) (NR_pos-Perf) CR to 38.133 correction for UE Rx-Tx time difference measurement requirement (Rel. 19)	19.2.0
2025-09	RAN#109	RP-252393	5936		A	CR to 38.133 corrections to core requirement for NR positioning (Rel. 19)	19.2.0
2025-09	RAN#109	RP-252393	5938		A	CR to 38.133 corrections to performance requirement for NR positioning (Rel. 19)	19.2.0
2025-09	RAN#109	RP-252385	5944		A	(NR_HST_FR2-Perf) CR to amend missing SSB_RP for PC6 with 240kHz SCS	19.2.0
2025-09	RAN#109	RP-252411	5945		B	Big CR for RRM requirements of Enhancements of network energy savings	19.2.0
2025-09	RAN#109	RP-252386	5956		A	Modification on NR NTN MDT requirements	19.2.0
2025-09	RAN#109	RP-252394	5959		A	Change FR1 to FR1 NTN in NTN clause	19.2.0
2025-09	RAN#109	RP-252395	5961		A	Modification on measurement of inter-EUTRAN cells [Meas_inter-RAT_cells]	19.2.0
2025-09	RAN#109	RP-252394	5964		A	Modification on NR NTN measurement requirements in IDLE state	19.2.0
2025-09	RAN#109	RP-252380	5973		A	(LTE_NR_DC_enh2-Core) CR on SCG activation	19.2.0
2025-09	RAN#109	RP-252392	5975		A	(NR_FR1_lessthan_5MHz_BW-Core) CR correcting the SSB reference for a 3MHz	19.2.0
2025-09	RAN#109	RP-252392	5993		A	CR on PDSCH RMC Corrections on TCs with NR_FR1_lessthan_5MHz_BW	19.2.0
2025-09	RAN#109	RP-252421	5994		F	CR on RRM performance requirements of NR channel BW less than 5MHz for FR1 phase 2	19.2.0
2025-09	RAN#109	RP-252428	6013		B	CR to TS 38.133: Introduction of new NTN Combined L-bands n253, n251, n250	19.2.0
2025-09	RAN#109	RP-252391	6015		A	Corrections to ATG test cases	19.2.0
2025-09	RAN#109	RP-252399	6012	1	F	(TEI19) CR on TCs with testability issues [TC with testability issue]	19.2.0
2025-09	RAN#109	RP-252421	6002	1	F	Rel-19 CR on less than 5 MHz RRM Core requirement maintenance	19.2.0
2025-09	RAN#109	RP-252432	5761	2	B	Draft big CR for NR Radio Resource Management (RRM) Phase 5	19.2.0
2025-09	RAN#109	RP-252412	6017		B	Big CR on RRM requirements for Support of intra-band non-collocated EN-DC/NR-CA deployment Phase 2	19.2.0
2025-09	RAN#109	RP-252429	6018		B	Big CR on RRM requirements of Ku band for NR NTN	19.2.0
2025-09	RAN#109	RP-252418	6019		B	Big CR for RRM requirements of Sub-band full duplex	19.2.0
2025-09	RAN#109	RP-252424	6020		B	Big CR on RRM requirements for LP-WUS/WUR	19.2.0
2025-09	RAN#109	RP-252433	6021		B	Big CR on RRM requirements for NR XR Phase 3	19.2.0
2025-09	RAN#109	RP-252845	5743	1	B	BigCR for R19 mobility RRM	19.2.0
2025-12	RAN#110	RP-253631	6049		F	CR on Ku-band NTN RRM	19.3.0
2025-12	RAN#110	RP-253631	6157		F	CR on RRM core requirements of Ku band for NR NTN	19.3.0
2025-12	RAN#110	RP-253631	6194		F	CR on core requirements for Ku band NTN	19.3.0
2025-12	RAN#110	RP-253634	6282		B	Big CR for R19 AI/ML Positioning	19.3.0
2025-12	RAN#110	RP-253634	6097	3	B	CR on RRM core requirements for support of AI/ML for NR Air Interface for beam management	19.3.0
2025-12	RAN#110	RP-253637	6060		B	Big CR on RRM test cases for NTN less than 5MHz in Rel-19	19.3.0
2025-12	RAN#110	RP-253646	6093		F	CR 38.133 Maintenance for interruption of Tx switching for 3Tx UEs [TxSwitch_R19]	19.3.0
2025-12	RAN#110	RP-253649	6285	1	F	Big CR for RRM core requirements of NR MIMO Phase 5	19.3.0
2025-12	RAN#110	RP-253650	6195		F	CR on measurement delay requirements with SBFD	19.3.0
2025-12	RAN#110	RP-253650	6233		F	(NR_duplex_evo-Core)CR on RACH impact of SBFD	19.3.0
2025-12	RAN#110	RP-253650	6036	1	F	CR to update RRM core requirements of SBFD	19.3.0
2025-12	RAN#110	RP-253650	6234	1	F	(NR_duplex_evo-Core)CR on Scheduling restriction of L1 CLI for SBFD	19.3.0
2025-12	RAN#110	RP-253651	6286		F	Big CR on core maintenance for NR_LPWUS_RRM	19.3.0

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2025-12	RAN#110	RP-253653	6087		F	Correction on NES requirements	19.3.0
2025-12	RAN#110	RP-253653	6210		F	Draft big CR on core maintenance for Netw_Energy_NR_enh_RRM	19.3.0
2025-12	RAN#110	RP-253653	6082	1	F	Core maintenance for minimum requirement at transitions	19.3.0
2025-12	RAN#110	RP-253653	6209	1	F	CR for network energy savings enhancements	19.3.0
2025-12	RAN#110	RP-253655	6059		F	CR for LTM event-triggered L1 reporting	19.3.0
2025-12	RAN#110	RP-253655	6252		F	Clearn up for CSI-RS based Intra-frequency L1-RSRP measurements for neighbour cell	19.3.0
2025-12	RAN#110	RP-253655	6162	1	F	CR for Conditional Intra-CU LTM	19.3.0
2025-12	RAN#110	RP-253656	6167		F	(NR_NTN_Ph3-Core)_Modification on radio link monitoring for HD-FDD UE with SAN	19.3.0
2025-12	RAN#110	RP-253656	6197		F	CR on RRM requirements for RedCap UE in NTN	19.3.0
2025-12	RAN#110	RP-253656	6168	1	F	(NR_NTN_Ph3-Core)_Modification on applicability rule for SDT	19.3.0
2025-12	RAN#110	RP-253656	6169	1	F	(NR_NTN_Ph3-Core)_Modification on RedCap UE in NTN scenario requirements in RRC IDLE state	19.3.0
2025-12	RAN#110	RP-253656	6198	1	F	CR on DL coverage enhancement in NTN	19.3.0
2025-12	RAN#110	RP-253656	6032	1	F	(NR_NTN_Ph3-Core) CR on RRM core maintenance for NTN Phase 3	19.3.0
2025-12	RAN#110	RP-253656	6061	1	F	(NR_NTN_Ph3-Core) CR on RRM core maintenance for NTN Phase 3 part 2	19.3.0
2025-12	RAN#110	RP-253657	6147		F	CR 38.133 Big CR on core maintenance for NR_XR_Ph3_RRM	19.3.0
2025-12	RAN#110	RP-253657	6251	1	F	CR38.133 Measurement requirements with XR	19.3.0
2025-12	RAN#110	RP-253657	6148	2	F	CR 38.133 Maintenance of XR core requirements	19.3.0
2025-12	RAN#110	RP-253658	6192	1	F	CR on test case for less than 5MHz Ph2	19.3.0
2025-12	RAN#110	RP-253660	6284		F	Big CR on core maintenance for NR_RRM_Ph5	19.3.0
2025-12	RAN#110	RP-253661	6085	1	F	BigCR on core maintenance for NonCol_intraB_ENDC_NR_CA_Ph2_RRM	19.3.0
2025-12	RAN#110	RP-253662	6094	1	F	Big CR on core maintenance for NR_ATG_enh_RRM	19.3.0
2025-12	RAN#110	RP-253664	6193		F	CR on requirments for less than 5MHz for NTN	19.3.0
2025-12	RAN#110	RP-253666	6235		F	(NR_LBCA_Sw-Core)CR on R19 LB CA via switching	19.3.0
2025-12	RAN#110	RP-253666	6057	1	F	CR for LBCA SCell activation and other requirements	19.3.0
2025-12	RAN#110	RP-253669	6185		A	(LTE_NR_MUSIM-Core) CR on Rel-17 MUSIM core requirements R19	19.3.0
2025-12	RAN#110	RP-253670	6111		A	(NonCol_intraB_ENDC_NR_CA-Core) Correction CR on interruptions – R19 Cat.A	19.3.0
2025-12	RAN#110	RP-253670	6124		A	(Netw_Energy_NR-Perf) Correction on the test case for NES triggering intra-frequency target CHO delay	19.3.0
2025-12	RAN#110	RP-253670	6212		A	CR to 38.133 on Rel-19 NR ATG Performance Corrections	19.3.0
2025-12	RAN#110	RP-253670	6214		A	CR to 38.133: Rel-19 NR ATG Core Correction	19.3.0
2025-12	RAN#110	RP-253670	6250		A	(NR_ATG-Core)CR on maintenance for intra-frequency measurement in ATG_R19	19.3.0
2025-12	RAN#110	RP-253670	6274		A	(NR_ATG-Perf) Io value correction in Table A.19.4.5.1.1-3	19.3.0
2025-12	RAN#110	RP-253672	6120		A	(NR_FR2_multiRX_DL-Core) CR on requirements maintenance for Rel-18 Multi-Rx (Cat-A)	19.3.0
2025-12	RAN#110	RP-253672	6187		A	(NR_FR1_lessthan_5MHz_BW-Core) CR on core requirements for less than 5MHz BW R19	19.3.0
2025-12	RAN#110	RP-253672	6100	1	A	(NR_CSIRS_L3meas-Perf) Correction to side conditions for CSI-RS measurements_R19	19.3.0
2025-12	RAN#110	RP-253672	6103	1	A	(NR_CSIRS_L3meas-Perf) Correction to CSI-RS measurement accuracy test cases_R19	19.3.0
2025-12	RAN#110	RP-253673	6153		A	(NR_MG_enh2-Core) CR to correct SSB measurement without gap definition with NFI R19	19.3.0
2025-12	RAN#110	RP-253673	6156		A	(NR_MG_enh-Core) CR on the scaling factor Kp for measurement without gap	19.3.0
2025-12	RAN#110	RP-253673	6189		A	(NR_MG_enh2-Core) CR on core requirements for R18 MG enhancement R19	19.3.0
2025-12	RAN#110	RP-253673	6255		A	(NR_MG_enh2-Core)CR on intra-frequency measurement_R19	19.3.0
2025-12	RAN#110	RP-253673	6263		A	(NR_MC_enh-Perf) CR on TC correction for DL interruptions at switching between uplink carriers in FDD-TDD CA (R19)	19.3.0
2025-12	RAN#110	RP-253673	6270	1	A	(NR_HST) CR correction of EUTRA requirements	19.3.0
2025-12	RAN#110	RP-253674	6051		A	(NR_Mob_enh2-Perf) CR on test case for R18 Subsequent CPC	19.3.0
2025-12	RAN#110	RP-253674	6064		A	CR to correct Unified TCI state switching requirements for mTRP- R19	19.3.0
2025-12	RAN#110	RP-253674	6070		A	(NR_Mob_enh2-Perf)CR on LTM TCs for R19	19.3.0
2025-12	RAN#110	RP-253674	6118		A	(NR_MIMO_evo_DL_UL-Core) CR on requirements maintenance for Rel-18 MIMO (Cat-A)	19.3.0
2025-12	RAN#110	RP-253674	6128		A	(NR_Mob_enh-Perf) Correction on the test case for CHO	19.3.0

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2025-12	RAN#110	RP-253674	6135		A	(NR_Mob_enh2-Core) Correction on Subsequent Conditional PSCell Addition Delay	19.3.0
2025-12	RAN#110	RP-253674	6229	1	A	Maintenance CR on PDCCH order-based RACH requirements for LTM	19.3.0
2025-12	RAN#110	RP-253675	6027		A	(NR_newRAT-Core) Correction on serving cell evaluation	19.3.0
2025-12	RAN#110	RP-253676	6079		A	(NR_newRAT-Perf) Adding SSB index configuration in FR2 RLM CSI-RS based test scenarios (Rel19)	19.3.0
2025-12	RAN#110	RP-253676	6139		A	(NR_newRAT-perf, TEI16) Correction on SCell Activation and deactivation of unknown SCell	19.3.0
2025-12	RAN#110	RP-253676	6244		A	(NR_newRAT-Perf)CR on test case of interruptions during measurements on deactivated NR SCC_R19	19.3.0
2025-12	RAN#110	RP-253677	6191		A	(NR_NTN_enh-Core) CR on core requirements for Rel-18 NTN R19	19.3.0
2025-12	RAN#110	RP-253677	6287		A	(NR_NTN_enh-Core) CR on satellite switching with resync	19.3.0
2025-12	RAN#110	RP-253678	6043		A	(NR_NTN_enh-Perf) CR on the representation of UE position	19.3.0
2025-12	RAN#110	RP-253678	6166		A	Test case on transmit timing with SAN	19.3.0
2025-12	RAN#110	RP-253679	6030		A	(NR_NTN_solutions-Perf) CR on RRM maintenance for NR NTN test cases	19.3.0
2025-12	RAN#110	RP-253679	6035		A	(NR_NTN_solutions-Perf) CR on test principle for Rel-19 NR NTN	19.3.0
2025-12	RAN#110	RP-253679	6106		A	(NR_NTN_solutions-Perf) Correction to NTN measurement test cases_R19	19.3.0
2025-12	RAN#110	RP-253679	6179		A	(NR_NTN_solutions-Core) CR on core requirements for R17 NTN R19	19.3.0
2025-12	RAN#110	RP-253679	6206		A	(NR_NTN_Solutions) Correction on misaligment of clauses for intra frequency measurements for NTN (Rel. 19 Cat-A)	19.3.0
2025-12	RAN#110	RP-253679	6266		A	(NR_NTN_solutions-Perf) CR on TCs for Time-based measurement initiation and Idle mod enhanced requirements (Cat-A Rel-19)	19.3.0
2025-12	RAN#110	RP-253680	6041		A	CR to 38.133 to correct test cases for positioning (Rel-19)	19.3.0
2025-12	RAN#110	RP-253680	6217		A	(NR_pos_enh2-Core) CR to 38.133 on correction to RSTD measurement requirement in RRC_IDLE mode for RedCap positioning	19.3.0
2025-12	RAN#110	RP-253680	6281		A	CR 38.133 Correction to interruption requirements for PRS BWA	19.3.0
2025-12	RAN#110	RP-253681	6276		A	(NR_redcap_enh-Perf) Applicability of RedCap tests for eRedcap	19.3.0
2025-12	RAN#110	RP-253681	6279		A	(NR_redcap-Perf) Antenna config in RedCap test cases	19.3.0
2025-12	RAN#110	RP-253682	6092		A	(NR_unlic-Perf) CR on maintenance for NR SCell with CCA performance tests for R19	19.3.0
2025-12	RAN#110	RP-253682	6247		A	(NR_unlic-Core)CR on maintenance for intra-frequency measurement with CCA_R19	19.3.0
2025-12	RAN#110	RP-253683	6039		A	CR to 38.133 to correct test cases for sidelink relay (Rel-19)	19.3.0
2025-12	RAN#110	RP-253683	6068		A	(NR_RRM_enh-Perf)CR on RRM enhancement TCs for R19	19.3.0
2025-12	RAN#110	RP-253683	6109		A	(NR_RRM_enh2-Perf) Correction CR for SCell activation test case – R19 Cat.A	19.3.0
2025-12	RAN#110	RP-253683	6116		A	(NR_RRM_enh2-Core) CR on PUCCH SCell activation requirements Rel-19 (cat-A)	19.3.0
2025-12	RAN#110	RP-253683	6176		A	(NR_UE_pow_sav-Core) CR on relaxed measurement requirements R19	19.3.0

History

Version	Date	Status
V19.2.0	October 2025	Publication
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